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Canadian Civil Engineers Pre-1850: Professionals Before Professionalization

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Article abstract

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Canadian Civil Engineers Pre-1850 : Professionals Before Professionalization

RICHARD WHITE*

Abstract

This article argues for a thorough re-thinking of the origins of the civil engineering profession in Canada. Working from a variety of sources, the richest being the public works papers in the National Archives of Canada, the author has assembled a list of forty-three men who practised as civil engineers in Canada before the railway boom of the 1850s and for whom biographical details are known. They are overwhelmingly men of the upper middle class who received good academic educations before their professional apprenticeships in engineering. Almost none were tradesmen. The civil engineering profession thus appears of much higher status, and much closer to the other traditional gentlemanly professions of the early nineteenth century, than others have recognized. The author goes on to explore to what extent this first generation of civil engineers might be considered true professionals, and what their existence suggests about the society in which they lived and practised.

Résumé

Cet article plaide en faveur d'une révision profonde des origines de la profession d'ingénieur civil au Canada. Appuyé par de nombreuses sources, dont les plus riches sont les documents des travaux publics aux Archives nationales du Canada, l'auteur a dressé la liste de quarante-trois hommes qui pratiquaient le génie civil au Canada avant la forte progression du chemin de fer dans les années 1850 et pour lesquels des informations biographiques sont disponibles. Ils sont pour la majorité des hommes de la classe moyenne supérieure qui reçurent une bonne éducation scolaire avant l'apprentissage de la profession d'ingénieur. Aucun d'entre eux n'était marchand. Contrairement à ce que d'autres ont pu penser, la profession d'ingénieur civil apparaît ainsi relever d'un statut de beaucoup supérieur et plus près des autres professions de gentleman du début du XIX^{e} siècle. L'auteur se donne pour tâche d'évaluer dans quelle mesure les ingénieurs civils de la première génération peuvent être considérés comme de véritables professionnels et comment leur existence nous renseigne sur la société dans laquelle ils vivaient et pratiquaient le génie.

The social history of engineering is not a field of active scholarship in Canada. Rarely, if ever, does one see or hear a Canadian historian expressing an opinion on the subject.[1] So in making an argument on the topic one might be accused of arguing against nothing, or of taking issue with a set of ideas that nobody holds. It is my belief, however, that notwithstanding the lack of current scholarship Canadian historians do have a mental picture of the engineering profession's origins, in Canada and to a degree elsewhere, and that this picture badly needs to be redrawn. The history of engineering is not an insignificant field. Who engineers are and what they value can deeply affect the evolution of technology under their charge, and the history of engineering, like that of other professions, can reveal something of the social and cultural matrix from which the profession emerged. The subject, in other words, deserves more attention than it has received, and its misconceptions warrant being set right.

The engineering profession is customarily seen as a product of industrialization, or more specifically of industrial capitalism. Thus "engineers" of a sort began to appear in Canada through the mid-nineteenth century, but a true profession did not take form until the final decade or two of the century—by which time the consequences of Canada's industrial revolution were manifest. This fits well with the chronology of the engineering professionalization movement in Canada, which arose in the 1870s and culminated in 1887 with the formation of the Canadian Society of Civil Engineers (CSCE), Canada's first professional engineering society. Socially, in this view, early pre-professional "engineers" were basically tradesmen, or mechanics—men with little formal education who learned their practical skills on the job—but as industrialization progressed, and greater numbers of technically skilled men were needed at higher levels of management, these tradesmen were able to establish themselves as professionals. Thus professionalization for engineers brought with it upward social mobility. Historians generally recognize that by the time the professionalization movement proper began in the 1880s the connection between engineer and tradesman no longer held true in all cases—some engineers were by this time graduates of new university engineering schools—but at the same time will note that the aspiring engineer had an uphill climb trying to escape his artisanal past and gain proper professional status, presuming, in other words, that the profession did emerge from an artisanal past.

These ideas are presumed rather than argued, so one is hard-pressed to identify their source or active proponents, but they are, nevertheless, quite widely held. R. D. Gidney and W. P. J. Millar, for example, write in their recent book about the professions in nineteenth-

century Ontario that engineers in the third quarter of the nineteenth century had an "equivocal and uncertain status" because of their "links to manual labour."[2] Rodney Millard, a historian of the early CSCE, notes that engineers at the time of the Society's formation were still "stigmatized by negative nineteenth century British aristocratic attitudes to manual labour."[3] And A. B. McKillop, in his book on Ontario universities, writes of how the process of professionalization was impeded for engineers by the "traditional association of the engineer with the mechanic, the building tradesman, and the architect." McKillop goes on to make the related point that not only had engineers not differentiated themselves *socially* from their traditional associates, neither had they clearly differentiated their *work* from that of mechanics and tradesmen—they had no "functionally homogeneous area of the social division of labour," he states, quoting from the seminal work of sociologist Magali Sarfadi Larson.[4]

I first began to question these assumptions while studying two Canadian civil engineers, Frank and Walter Shanly, who began their careers in the 1840s.[5] Here were two brothers from an old Irish gentry family, who had received a solid classical education from private tutors before emigrating to Upper Canada with their family in 1836, and who found the profession of civil engineering quite compatible with their social origins. On my being repeatedly told, and readily admitting, that two was not enough of a sample on which to base a conclusion, I have extended research into as many engineers from before 1850 as could be found.

Further investigation has not led to new conclusions. The Shanly brothers were not unique. It seems clearer than ever that a group of well-established and reasonably high-status civil engineers already existed in Canada in the 1840s, well before Canada's industrial revolution. This early "profession" was not the domain of tradesmen but of the prosperous merchant and the well-educated gentleman. It was, in fact, a surprisingly close kin to the traditional, learned professions of the pre-industrial world—medicine, the law, and the church.

* * *

It is important to set straight at the outset that the civil engineering profession is not as new as many non-specialists tend to think. It emerged in continental Europe and Britain late in the eighteenth century, taking somewhat different forms in different countries. In France, for instance, the profession was born with close ties to the state and to the already highly-respected tradition of military engineering, whereas in Britain it began with close connections to development-minded landowners and early capitalists. In both countries,

however, the profession was legitimate and carried a certain degree of social status by the start of the nineteenth century.[6] In the United States (US), the profession came into its own only in the canal-building era after the War of 1812. The notion of an engineer as an independent professional was slow to develop there; for some time the distinction between the engineer and the proprietor of works being built, and between the engineer and the contractor engaged to build them, remained less strictly defined in the US than overseas. Nevertheless, by 1830 there were plenty of well-paid, well-educated, and well-connected "engineers" in the US.[7]

In Canada, civil engineers from abroad began to appear in small numbers after about 1820.[8] Construction of the Rideau Canal was planned and supervised in the 1820s by the British military, and thus most of the engineers on it were technically not civil engineers, but the first Welland Canal, begun shortly after the Rideau in the 1820s, drew several (mostly American) civil engineers into Canada. So too did the Burlington Bay and the early Lachine canals, and the Shubenacadie Canal in Nova Scotia, a little later. Engineers were still very few however—perhaps no more than ten or twenty—until 1840 when the newly-formed Board of Works of the Province of Canada suddenly required several dozen engineers to supervise its road, canal, and bridge-building projects. The flurry of work did not last. Employment for civil engineers in Canada fell off in the mid-1840s when the Board's money ran out. But the profession survived, becoming still more established in the railway boom of the early 1850s.

"Civil engineers" of some sort, then, were active in Canada before 1850. But who were these men, and were they, in fact, the tradesmen that early engineers are presumed to be? If so, what trade were they in? Did they lack social position in the colony because of their origins in the trades? To what extent, if at all, were they formally educated? Might they be considered true professionals?

To provide answers to those questions, sources of information were few and limited. The largest by far turned out to be the papers of the Board of Works. The Board (later the Department) issued annual reports throughout the period, which usually listed all engineers employed, their positions, and often their salaries. The Board also occasionally printed retrospectives describing past projects, which sometimes included references to engineers.[9] There were also files of correspondence between the Board and its engineers. There were a few other useful documentary sources, most notably obituaries in the CSCE Transactions and T. C. Keefer's valuable outgoing presidential address to the CSCE in 1888 in which he briefly recalled several early engineers he had known personally.[10] The main useful secondary

source was the *Dictionary of Canadian Biography*, both for full biographies of the better known and for passing references to lesser known engineers. Altogether in these sources a total of sixty-eight men could be identified as having worked as civil engineers before 1850. Personal details about them were not easy to come by, and for twenty-six, unfortunately, not enough biographical information could be found for any meaningful observations. They had to be discarded from the study.[11] This still left a group of forty-three whose personal and professional lives were well enough documented for them to be included, and they and their careers were subsequently analyzed.[12]

A few words must be said about the limits of the study sample. It is quite clearly rooted in Board of Works sources, and thus might not represent the full range of civil engineers in the colony. It is hard to imagine anyone with a legitimate claim to being a civil engineer in Canada in the 1840s not, at some point, passing through the Board's papers, for there were very few other places a civil engineer could work. Nevertheless, the sample could well exclude some lesser known and more poorly connected engineers, a fact that can not be entirely disregarded.

* * *

Of the forty-three, six had connections to military engineering. That is not to say there were only six military engineers in the province of Canada during this time, but that of all the engineers mentioned as civil engineers in the sources referred to above only six were military men. There were other military engineers attached to the British garrisons in Canada, which were well manned in the 1840s, but if they did not do civil work they were not counted here. The six are far from a seminal group. Two—Caddy and Peebles—were never truly active as civil engineers; they retired in Canada on military half-pay and worked only occasionally. William Roebuck states himself to be a trained engineer, but the only record of his work is as a Superintendent of Pilots and Salvage Agent (it is not clear whether the two duties comprised a single job) for the St Lawrence Inland Marine in the early 1840s. The well known Colonel John By of Rideau Canal fame—not strictly speaking a civil engineer—is included here because of his and his work's importance, but he did not remain in the colony for long and his connection with the early civil profession is questionable.[13] The only two who can be said to have truly worked as civil engineers are a Colonel Philpotts, who was consulted on the early Beauharnois Canal about 1842 and who supervised construction of the Cornwall Canal for a time in 1844, and Captain William Robinson, who in 1848

laid out an early route for a Quebec to Halifax (later the Intercolonial) Railway.

Six men combined architecture and engineering. Most were fairly well known—John Howard and Frederic Cumberland in English Canada, and Charles Baillairgé in French Canada—and their fame may have led us to conclude that blending the two professions was common, or even typical, in the period. But the numbers here do not bear this out. It is worth noting too that, apart from Cumberland, the reputations of these men are based more on their work as architects than as engineers. Most of their work as "engineers" was actually nothing more than surveying, suggesting that they were architects at heart who occasionally found it useful to be able to make a living as an "engineer." This appears to be the case with the English-born John Howard, who although identified as a civil engineer, did little serious engineering work. Such can not be said of Cumberland; but he was in a class by himself—a truly unique man who did excellent work as both an architect and an engineer, and even better work, some might say, as a railway manager.

There is a further notable detail about the men in this architect/engineer category; it is the only one with a significant French Canadian presence—two of the six. In fact only one other French Canadian is found among the entire group of forty-three. Furthermore, both Pierre Gauvreau and Baillairgé are from the artisanal building tradition, in fact from *families* with a tradition in the skilled building trades. Such an origin is not to be found among the English-Canadian engineers.

Beyond Gauvreau and Baillairgé, there were just two in the sample whose backgrounds might be considered the trades—an American cabinet-maker and an English entrepreneur with a technical bent. There was also one man, the Scotsman Simon James Dawson, whose career was confined primarily to surveying, but who called himself a civil engineer often enough to be labelled as such. None of these three men had notable or influential careers.

This left a total of twenty-eight men for whom no other descriptive classification fits but "civil engineer." It is true that some of these men later dabbled in contracting—for railways, primarily—and some moved from engineering work into other forms of engineering-related businesses, or into politics, but they clearly trained and practised as civil engineers at the start of their careers. This alone is a point worth noting, for engineering specialties are sometimes assumed not to have developed until later in the nineteenth century. Because of the centrality of engineering in their careers, these twenty-eight were analysed more closely, and several important points emerged.

The most obvious is a chronological division. Those whose Canadian careers endured were those who began practising after about 1840—usually in connection with the Board of Works. There are exceptions. Samuel Keefer began his long and influential career on the Welland Canal in the 1820s. But overall the pattern does hold. It is in the 1840s that the best known names of the profession appear—Killaly, Gzowski, Keefer, Fleming—while in the 1820s and 1830s one finds men not nearly so well known—Francis Hall, Alfred Barrett, Nicol H. Baird. These earlier men were skilled engineers. Hall was a university-trained pupil of Thomas Telford's in England, who began working on the Burlington Bay Canal in Upper Canada in 1824;[14] Barrett, an American, was an experienced divisional engineer on the Erie Canal who came to take charge of the Welland while it was still in private hands; and Baird was a Scottish engineer who came to Canada in 1828 with enough experience and connections to be admitted in 1831, while in Canada, to the Institution of Civil Engineers in England. They were thus no less legitimate than the later engineers, and probably could have had longer careers had they persisted, but they either left, fell out of favour, or died before the profession took hold. The year 1840, with the *government* now a large employer, thus appears to mark the start of a continuous tradition of civil engineering in Canada.

Regarding the national origins of the group, there is a striking absence of Americans. Only four came from the US, and all of them were among the early, pre-1840, arrivals who did not stay.[15] Fourteen were from the British Isles—about equally divided among England, Scotland, and Ireland. Eight were from Canada (six from Upper, and two from Lower). The final two were from Poland.

The almost complete absence of French Canadians is equally striking. Only one, Fréderic Baillairgé, is to be found in this pure civil engineer category. Baillairgé apprenticed in law for a year before taking a job as an assistant draftsman with the Board (Department) of Works in 1844, where he stayed for his entire career, rising to Assistant Chief Engineer in 1871 and Deputy Minister in 1879. (Fréderic's brother Charles is counted among the architect/engineers.) A likely explanation for this absence of French Canadians, not just in this sub-group but also in the sample overall, is the absence of French, or other French-speaking, immigrants to the province. One must realize that nearly all the so-called "English-Canadian" engineers in the group were, in fact, the sons of British or US immigrants whose families knew and respected the profession, and they were thus the products of an outside culture where engineering was more developed than in Canada. English Canada was much more of an immigrant

society than French Canada in the early nineteenth century and, without such an influx, French Canada was less likely to have civil engineers.

Regarding the social position and educational level of these men—returning to the entire group of forty-three—the evidence is unmistakable that most were from the middle class or higher, and had been the recipients of an academic secondary education before they undertook professional apprenticeships or studies. Unambiguous details about education are available for only twenty-four, of whom twenty-three had good educations; the only one who was clearly of humble origins was Horace Merrill, a trained cabinet-maker from New Hampshire who came to Ottawa as a millwright in 1826 and established himself as a supervising engineer with the Board of Works in the late 1840s. Of the nineteen for whom educational details are not known, however, fifteen show strong signs of academic education (writing reports early in their careers, holding military officer rank) and social position (friendships with other engineers whose status is known).[16] The remaining four were the early-arriving American engineers noted above who did not stay in the colonies and about whom little is known. Taking evidence and inference together suggests that, overall, this group of early civil engineers was born into respectability and educated to a fairly advanced level for the time. The particulars of their social origins differ: some were the sons of military officers, some of successful merchants or builders, some of landowners and office-holders. So too do their academic institutions vary—the Quebec Seminary, the Edinburgh Academy, or Upper Canada College. But overall their social positions are remarkably similar, and uniformly good.

How far one can generalize from this sample is difficult to say. On the one hand, these were surely not the only men who called themselves civil engineers in Canada before 1850. As noted above, a number of names were excluded from this study because of insufficient information, and they might represent a different type of lower status engineer. And there were building tradesmen and surveyors who referred to themselves as "civil engineers" in classified advertisements or commercial directories; they might not have been as well educated or as well connected as the men in this sample.[17] But at the same time, the men studied here would have been the core of the developing profession; it is they who set the professional standards and shaped the profession's development. They can not, therefore, be dismissed as unrepresentative of the early *profession*. And on this basis, some general conclusions do seem defensible.

First, in view of the large proportion of men for whom civil engineering was a prime occupation, it appears that civil engineering was already a fairly distinct form of work. Overlap with architecture or with the trades, or even with military engineering, while evident, was not typical; nor is there much evidence of civil engineering being combined with mechanical engineering. Civil engineering, by this date at least, was not "emerging" from any other more general type of work. Having already become established in Britain and the United States, the profession had migrated to early Canada in a fairly mature form.

Second, early Canadian civil engineering was not a profession of untutored tradesmen. Particularly striking in this regard is the prevalence of academic education prior to professional apprenticeship, something which is often noted as the essential defining element of "learned" professions.[18] In fact, these early engineers look, socially, much like the men of the old traditional professions. With such close personal and professional connections to the colonial elite, they could be painted into Gidney and Millar's portrait of Ontario's nineteenth-century professionals not as upwardly mobile working men but as one of their "professional gentlemen," whose cultural roots lie in eighteenth-century Georgian culture.[19]

Third, this nascent "Canadian" profession was made up almost entirely of immigrants or sons of immigrants, nearly all of whom were of British origin. A few American engineers had been present in the pre-1840 period, and some stayed on for a few years to work for the Board of Works, but they were never in the heart of the developing Canadian profession. This should not be surprising, for it is well known that British influence in Canada peaked in these years. The big loan to pay for Canada's public works came from the British government. Lord Sydenham, who was the conduit for the loan and who appointed Killaly to the Chief Engineership of the Board, was well connected to British commercial circles and was no doubt familiar with the British profession. Here then is an institutional example of J. M. S. Careless's old notion of metropolitanism, and, like the ideas of mid-Victorian liberalism that led him to his conclusions, it is closely connected to British immigration.[20]

* * *

Were these civil engineers true professionals? Even if their social origins are as claimed, that would not on its own define them as professionals. This poses another quite different historical problem, and to answer it properly requires first a solid definition of the word "professional."

As anyone who has ventured into the field will know, the word has an elusive meaning. Sociologists have been grappling with it since early in the twentieth century, and in doing so have built up a vast literature on the subject. The question, interestingly enough, remains open, since each suggestion of what defines the concept has generally been discredited by subsequent authors.[21] There seems always to be one profession or other that does not fit even the most basic criteria, whether the requirement be the existence of a professional organization (which divinity usually does not meet) or the holding of social power and authority (which nursing usually does not meet). For historians, the elusiveness of the term is magnified by the fact that some elements deemed essential to a professional designation now (such as university education) can not always be applied to the past.[22] The fruitlessness of the definitional pursuit has led a recent analyst to retreat to the position that professions are "nothing more than a series of rather random occupations that have historically been called that in our culture."[23]

Such nihilism is unnecessarily extreme. While the perfect definition might be beyond reach, there do appear to be several elements of a "profession" around which there is a fair consensus. Although there is no point in arguing that all or any of them must be present for a profession to exist, five of them might be as follows:[24] an advanced education (both of a general academic and a specialized technical nature), a specific realm of work which only the profession is capable of performing (Larson's "functionally homogeneous area"), a predominance of what engineering historian Monte Calvert calls "colleague orientation" over "client orientation" in professional work (satisfying your peers rather than your customers), some form of self-regulation or licensing usually connected to a professional association, and a certain degree of social status.

The first of these has already been established for the early Canadian civil engineers under study here. They were unmistakably a well-educated group. Their professional training, done after the completion of their academic education, was in the form of an apprenticeship, but acquiring practical knowledge and skill in this manner was not "unprofessional" in the 1840s. Lawyers learned by apprenticeship well into the twentieth century.

The last element—social status—has also been established insofar as it followed from the social positions of their families and from their own educational attainments. Further evidence of status can be found in their salaries. Civil engineers with the Board of Works were very well paid. The Board's Chief Engineer in 1843 received £500 per annum, while assistant engineers in charge of specific work-sites

made from £200 to £300.[25] This was at a time when ordinary Anglican and Presbyterian clergymen (the established churches) made about £150 per year, while Anglican clergymen with the wealthiest urban parishes might make to £300 to £400. Doctors' annual incomes in the 1850s ranged from £200 to £500. University of Toronto professors of the 1850s, of which there were very few, made from £200 to £500.[26] Engineers, then, were at or perhaps even above the salary levels of other professionals at the time. As well, engineers' pay was always in the form of an annual salary—a "living" rather than an hourly wage—and in this they were similar to the other professions.

The middle three elements are not so easily dealt with. What is needed to establish the presence of such professional working principles is more information on the working lives of these early civil engineers. Unfortunately, little research has been done. Only a few bits of evidence are available, some of it from the author's earlier work.

It appears that civil engineers on construction projects undertaken by the early Board of Works were distinct from the contractors who hired the labourers and tradesmen who did the work. Not only were they distinct; they were in charge, and had full authority to tell contractors what to do. This was an article of faith that Walter Shanly learned at the very outset of his career from engineers such as Hamilton Killaly, Nicol H. Baird, John B. Mills, and others.[27] Peter Baskerville's study of early railway promotion and management in Upper Canada led him to a similar observation; the Board of Works engineers, he noted, had "a strong collective unity," and "their relations to contractors tended to be that of inspector to worker."[28] T. C. Keefer's "Extracts from Lectures on Civil Engineering," given at McGill University in 1855-56 but based on his experience working in the 1840s, also expresses this sentiment; Keefer claimed that when an engineer "becomes a party to contracts he should cease to practise as an engineer."[29]

So there is some evidence that these civil engineers did have a fairly distinct realm of work, separate from the other occupations involved in their construction projects. The very same evidence, admittedly, shows that the integrity of the profession was not always easy to maintain—Keefer's exhortation that engineers keep their contracting separate from their engineering must mean that at times the spheres were not kept separate. But it would be going too far to claim that what we have is evidence that the profession *lacked* a distinct realm of work. Perhaps it does show that the engineers' professional ideals were hard to maintain, but it also shows that such professional ideals existed—a relevant fact when considering professional identity.

The extent to which colleague orientation existed among these early engineers can not be firmly established without more research. The fact that they strove to work independently of contractors and clients provides some evidence, for it suggests that their own professional standards were a better guide than the interests of those whom they served. So too does their practice of recommending each other for jobs. More concrete evidence might be the indignation Killaly and his confreres felt at being impugned, and ultimately deposed, by the Assembly in 1846 when the exorbitant costs of the St Lawrence canals began to emerge. This conflict has been seen by one historian as due to naive "management by enthusiasm" and by another as the product of political corruption, but it could also be seen as a proud professional brotherhood being challenged and undermined by laymen.[30]

The one element of professionalism that clearly was absent was a professional association. No such organization existed in Canada in the 1840s to certify professional competence (some were members of the British Institution of Civil Engineers, but one could practise in Canada without being a member). This lack of formal control has led some to imagine something of a professional free-for-all; "anyone could practise," states one historian. Others have taken it to mean minimal control over how self-proclaimed engineers carried out their work—"the market and their conscience were their only regulators," states the biographer of William Kingsford.[31] But in fact there was a surprisingly effective, if informal, system of self-regulation within the profession. Young engineers were tutored along through their professional apprenticeships rather carefully, and principles of both workmanship and professional conduct were strictly enforced by supervising engineers.[32] Evidently this system worked. One need only note how few *engineering* errors were made in the early railways and canals to realize that, informal though such regulations were, they kept incompetent practitioners out of positions of authority. So although no professional engineering association existed in Canada at this time, this absence does not, on its own, preclude all professional self-regulation.

Taken altogether, these aspects of Canadian civil engineering work in the 1840s bring its practitioners somewhere close to professional status. While the small numbers (certainly no more than one hundred at any time in this period), and probably the impermanence of most engineering employment, prevented the establishment of the usual accoutrements of a formally organized profession, there was a set of professional ideals that defined and bound together the few men who did practise. While this might not meet the most rigorous definition of "profession," it does suggest that the principal civil

engineers in Canada at the time worked as and believed themselves to be "professionals."

* * *

By combining the professional nature of early civil engineering work, qualified though this claim must be, with the social and educational portrait of the practitioners presented earlier, one comes to see the civil engineers of pre-1850 Canada as something quite other than tradesmen or mechanics. This asks for a fairly radical revision in thinking, and it might be useful to consider briefly why the other view of early engineering has had such a hold on our understanding. There are some very good reasons, most of which are connected to a simple lack of knowledge about the general history of the engineering profession.

First, there prevails a rather uncritical acceptance that the engineering profession was created by industrialization. But this is not entirely true, especially in North America. Construction of the canals, harbours, roads, and bridges in Upper Canada and the early United States was more closely connected to an expanding *commercial* economy than to early industry.[33] The primary purpose of early Canadian engineering works was to facilitate the movement of raw materials like wheat and lumber out to market, rather than to move industrial materials or products about. In Britain, the civil engineering works of the eighteenth century had closer connections to early industry—the tie between coal and canals is well recognized—but even there it was increases in Imperial trade that necessitated major harbour reconstruction, an important but often overlooked source of work for early civil engineers. If one breaks this connection between the engineering profession and industrialization, it becomes easier to see early civil engineers for what they were.

A second, and related, point is that few historians seem to have given much thought to what civil engineers actually did in their work. Civil engineers never worked in shops. They worked in offices and on construction sites. Their job was to set and enforce standards of construction and to tell other men what to do.[34] They were always managers more than anything else. Their day to day work involved writing reports, monitoring expenditures, and issuing instructions, and to do this required rhetorical skill, social authority, and the trust of investors (public and private). So the social and educational levels of these men should be of no surprise. True, civil engineers had to be familiar with construction trades like carpentry and masonry, as well as with surveying and earthmoving—all of which they gained in their apprenticeships—but they needed this knowledge in order to under-

stand the work they supervised. They did not do the work themselves. One might note, as well, that these were the trades of the pre-modern world, not of the industrial revolution.

Third, the difference between the early civil engineer and the early mechanical engineer is not always given its due. These two branches of the profession have quite different origins; they are not the progeny of a common ancestor.[35] The roots of the mechanical engineer do lie, at least partly, in the artisanal shop—blended with a good measure of entrepreneurship—so the model of tradesmen seeking recognition as professionals might fit better for mechanical than civil engineering. And the growth of mechanical engineering is more closely connected to industrialization. But few of the civil engineers in this study's sample had any connection with mechanical engineering.

Fourth, and last, the late nineteenth-century phenomenon of professionalization, in which various occupational groups established themselves as "professions" and worked to establish the legal and institutional structures to sustain their claim, has attracted so much attention that one is apt to equate the process with the creation of the professions. But this is not so. There were what are usually called "traditional" professions in the early-modern world.[36] These professions had plenty of status and authority, and were every bit as exclusive as professions would become after the late-nineteenth-century professionalization movement—one might even say more exclusive. There is nothing impossible or unlikely about professionals before professionalization.

* * *

It is my contention, to sum up, that the Canadian civil engineering profession is both older and of a higher-status parentage than has heretofore been recognized. Its origins lie not industrialization or the trades but in the well-educated bourgeois-gentry class in the second quarter of the nineteenth century, before both full-scale industrialization and the railway age. While the claim that these early engineers constituted a true profession is admittedly questionable, their social position and level of education are much less so. They fit surprisingly well, in fact, into Gidney and Millar's world of "professional gentlemen."[37]

Looking for the broader significance of this claim, it is hard to see these early engineers having had much direct effect on the development of technology in Canada. They were a fairly conservative bunch—socially and politically conservative in the sense of being tied to the old colonial elite, and professionally conservative in the sense of eschewing overt entrepreneurialism and rarely counselling drastic

change. (Some were still advocating canals rather than railways at mid-century.[38]) Yet one will look in vain for a Canadian technological style tainted with conservative values as their legacy. They simply did not have such influence. The international forces behind the railway revolution were stronger than these few men, and Canada, like everybody else, adopted railways.[39]

Where these men might have left their mark is on the values of the Canadian civil engineering profession. The connection between them and the 'professionalized' civil engineers of the 1880s remains a missing piece of the puzzle for now; the research necessary to find it is beyond the scope of this study. What is clear, even at this point, is that the connection is not as direct as one might think. Many of these men lost influence in the railway age—the Great Western Railway and the Northern Railway were both built without any significant involvement from the Canadian engineers in this study's sample[40]—while those who did make the transition to railways, such as Gzowski, Cumberland, Samuel Keefer, and the Shanly brothers, tended to move away from true professional practice into railway or construction management. And one finds none of them much involved in the development of university-based engineering programs in the 1860s and 1870s, or in the initial agitation for a professional association in the 1880s.[41] Nevertheless, the names Keefer, Gzowski, and Shanly do later appear among the founding members of the CSCE in 1887. They led and influenced the Society for most of its first generation, and their long-distant flourishing served as something of a Golden Age to the younger, formally educated, and far more numerous engineers of the late-nineteenth century.[42] So their gentlemanly style and status seems to have lived on in the professional ideals of the Canadian civil engineering.

For the more general historical significance—what the profession says about the social matrix in which it took form—one point is so obvious that it barely deserves mention. Should one be surprised to find an exclusive set of development-minded but Tory-friendly Anglo-Canadians, with English roots nourished by American experiences, hard at work building the commercial infrastructure of the United Province of Canada? Could there be a better metaphor for the period? What might be more illuminating in this context, but must await further research, is not the predominance of this group of gentlemanly engineers in the 1840s but their decline in the early railway age of the 1850s. Their loss of influence would offer another piece of evidence that the transition from the 1840s to the 1850s was a critical time in the bourgeois democratisation of Canadian institutions. It was after all, as one political commentator has put it, not until the

middle 1850s that "the last vestiges of the old 1791 constitutional system had disappeared."[43] The dissipation of this well-heeled cadre of civil engineers could thus be added to the passing of the Guarantee Act,[44] the ascendancy of temperance ideology,[45] the movement towards modernizing Lower Canadian law and land tenure,[46] the challenges to traditional professional prerogatives,[47] the secularisation of the University of Toronto,[48] and numerous other phenomena of the time often presented under the rubric "bourgeois politics."[49]

NOTES

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1 Two Canadian works about the profession are Norman R. Ball, *"Mind Heart and Vision": Professional Engineering in Canada 1887 to 1987* (Ottawa: National Museums of Canada, 1987) which as the title suggests has little on the formative years in the nineteenth century, and J. Rodney Millard, *The Master Spirit of the Age: Canadian Engineers and the Politics of Professionalism* (Toronto: University of Toronto Press, 1988).

2 R. D. Gidney and W. P. J. Millar, *Professional Gentlemen: The Professions in Nineteenth Century Ontario* (Toronto: University of Toronto Press, 1994), 228.

3 Millard, *op. cit.* (note 1), 9.

4 A. B. McKillop, *Matters of Mind: The University in Ontario 1791–1951* (Toronto: University of Toronto Press, 1994), 169. Magali Sarfadi Larson, *The Rise of Professionalism: A Sociological Analysis* (Berkeley: University of California Press, 1977), 26. McKillop states that this association with tradesmen was "in the public mind," but does not actually consider whether or not it was also a fact.

5 Richard White, *Gentlemen Engineers: The Working Lives of Frank and Walter Shanly* (Toronto: University of Toronto Press, 1999).

6 Two excellent books on the British profession are R. A. Buchanan, *The Engineers: A History of the Profession in Britain 1750–1914* (London: Jessica Kingsley, 1989), and Mike Chrimes, *Civil Engineering 1839–1889: A Photographic History* (Stroud, Gloucestershire: Alan Sutton, 1991). On the French, Charles Coulston Gillispie, *Science and Polity in France at the End of the Old Regime* (Princeton: Princeton University Press, 1980), and John H. Weiss, *The Making of Technological Man: The Social Origins of French Engineering Education* (Cambridge, Mass.: MIT Press, 1982). More general, and rather dated, works are W. H. G. Armytage, *A Social History of Engineering* (London: Faber and Faber, 1961), and George S. Emmerson, *Engineering Education: A Social History* (Newton Abbott: David & Charles, 1973).

7 For US engineering, a good recent overview is John Rae and Rudi Volti, *The Engineer in History* (New York: Peter Lang, 1993). Terry S. Reynolds, *The Engineer in America: A Historical Anthology from Technology and Culture* (Chicago: University of Chicago Press, 1991) has articles on the key topics in the field. The point about close ties to proprietorship is from the aging but still vital book Daniel Hovey Calhoun, *The American Civil Engineer: Origins and Conflict* (Cambridge, Mass.: Harvard University Press, 1960).

8 There is no published work that describes the early Canadian engineering profession. This description has been pieced together from a number of primary and secondary sources.

9 Canada, Public Works, "Report of the Commissioners of Public Works for the Year 1848, Appendix N, A Statement of the Public Works of the Province of Canada ... since the Union (10 February 1841) to the 31st December 1848..." Alphabetical Record of Engineers and Superintendents, etc., and the Principal Public Works on Which They Have Reported or Been Employed, 1779–1891, compiled by G. F. Baillairgé.

10 *Transactions of the Canadian Society of Civil Engineers*, 2 (1888), 40–42.

11 See Appendix 1.

12 See Appendix 2.

13 Norman Ball argues that in coming to terms with the North American environment, the military engineers who designed the Rideau Canal, especially Hog's Back Dam, laid the foundation for Canadian engineering. From a design perspective, this is an important observation, but there is surprisingly little continuity of personnel from the Rideau to subsequent civil works. Ball, *op. cit.* (note 1), 4–7.

14 Stephen A. Otto, unpublished biographical memorandum based on various primary sources, personally supplied to author.

15 Mills, Barrett, Casey, Power (?).

16 Officers: W. Robinson, Philpotts; reports: Cull, Dawson, John Tully, McTaggart, Baird, Peter Fleming, Roy; personal associations: A. G. Robinson, Stewart, Brunel, George Keefer (there is overlap between the last two categories).

17 The author is indebted to Stephen Otto for bringing this point to his attention.

18 Gidney and Millar, *op. cit.* (note 2), 3. Larson, *op. cit.* (note 4), 3–4.

19 Gidney and Millar, *op. cit.* (note 2), 207, do recognize T. C. Keefer as somewhat of a professional gentleman, but they see him as unique.

20 J. M. S. Careless, "Mid-Victorian Liberalism in Central Canadian Newspapers, 1850–67," *Canadian Historical Review*, 31 (1950), 221–236. Ian Radforth, "Sydenham and Utilitarian Reform," in Ian Radforth and Allan Greer, eds., *Colonial Leviathan: State Formation in Mid-Nineteenth Century Canada* (Toronto: University of Toronto Press, 1992).

21 Two excellent overviews of the literature that are accessible, with some effort, to the non-specialist, are the introductions to Bruce A. Kimball, *The "True Professional Ideal" in America: A History* (Cambridge, MA., and Oxford: Blackwell, 1992), 1–10, and Andrew Abbott, *The System of Professions: An Essay on the Expert Division of Labor* (Chicago: University of

Chicago Press, 1988), 3–20. Also valuable is the brief introduction to Gerald L. Geison, ed., *Professional Ideologies in America* (Chapel Hill: University of North Carolina Press, 1983). Randall Collins, *The Credential Society: An Historical Sociology of Education and Stratification* (New York: Academic Press, 1979) has a good brief treatment of engineering in this theoretical context on pages 160–71. Larson, *The Rise of Professionalism* is a central book in the literature, as is Burton J. Bledstein, *The Culture of Professionalism: The Middle Class and the Development of Higher Education in America* (New York: Norton, 1976), 86–92, where he explores the meaning of professionalism in a nineteenth-century context.

22 This point is made in Kimball, *op. cit.* (note 21), 3–4, and Gidney and Millar, *op. cit.* (note 2), xi–xii.

23 This is the conclusion that Laurence Veysey comes to after very cleverly showing, in just a few pages, how every definition seems to exclude something: Lawrence Veysey, "Higher Education as a Profession," in Nathan O. Hatch, ed., *The Professions in American History* (Notre Dame: Notre Dame University Press, 1988), 15–18, cited in Kimball, *op. cit.* (note 21), 1.

24 I draw these from the works cited above as well as Monte A. Calvert, *The Mechanical Engineer in America: Professional Cultures in Conflict* (Baltimore: Johns Hopkins Press, 1967), xv–xvi.

25 "Engineering Establishment of the Board of Works," in Report of the Board of Works, 13 October, 1843.

26 Gidney and Millar, *op. cit.* (note 2), 187. Jaclyn Duffin, *Langstaff: A Nineteenth-century Medical Life* (Toronto: University of Toronto Press, 1993), 46–47. J. E. Hodgetts, *Pioneer Public Service: An Administrative History of the United Canadas, 1841–1867* (Toronto: University of Toronto Press, 1955), 50. *Journals of the Legislative Assembly of the Province of Canada,* 14 (1856), Part 1, Appendix A.

27 White, *op. cit.* (note 5), Chapter 2.

28 Peter Baskerville, "Americans in Britain's Backyard: The Railway Era in Upper Canada, 1850–1880," *Business History Review,* 60 (1981), 316.

29 T. C. Keefer, *The Philosophy of Railways*, edited by H. V. Nelles (Toronto: University of Toronto Press, 1972), 96, and more generally 93–103.

30 Doug Owram, " 'Management by Enthusiasm': The First Board of Works of the Province of Canada," *Ontario History,* 70 (1978), 171–88. Hodgetts, *op. cit.* (note 26), 189–204. Hodgetts's telling does in fact show considerable "peer orientation" among the engineers, although he does not present it in that light.

31 Millard, *op. cit.* (note 1), 9. "William Kingsford," *Dictionary of Canadian Biography* (Toronto: University of Toronto Press), XI, 493.

32 White, *op. cit.* (note 5), Chapter 2.

33 This point was first brought to my attention by Terry Reynolds in "The Education of Engineers in America before the Morrill Act of 1862," *History of Education Quarterly,* 32 (1992), 479, but I am taking it farther than he.

34 White, *op. cit.* (note 5), Chapter 3.

35 Calvert, *op. cit.* (note 25). Edwin T. Layton, Jr., *The Revolt of the Engineers: Social Responsibility and the American Engineering Profession* (Baltimore: Johns Hopkins University Press, 1986), 36.

36 Larson, *op. cit.* (note 4), 4. Gidney and Millar, *op. cit.* (note 2), Part One. The latter is an excellent discussion of the traditional professions in early Upper Canadian society.

37 Non-Canadian historians of engineering, and of the professions generally, have made similar observations about the engineering profession. Larson, *op. cit.* (note 4), 26–30. Collins, *op. cit.* (note 21), 159–71. But it does not seem to have become common knowledge. Gidney and Millar, *op. cit.* (note 2), clearly do not see engineers among the early professionals.

38 Hodgetts, *op. cit.* (note 26), 181–88.

39 It is well known that the first generation of Canadian railways was different from those in the United States, but that was because they were built to the standards of their British designers.

40 Baskerville, *op. cit.* (note 28). Baskerville, "Professional vs. Proprietor: Power Distribution in the Railroad World of Upper Canada/Ontario, 1850–1881," *Historical Papers*, Canadian Historical Association, (1978) 48–50. Great Western Railway, *Report of the Directors of the Great Western Railway of Canada* (London, 1854), 10–12. Silas Wright Burt, *An Engineer on the Great Western: A Selection from the Personal Reminiscences of Silas Wright Burt* (London, Ontario: Lawson Memorial Library, University of Western Ontario, 1952).

41 "Presidential Address," *Transactions of the Canadian Society of Civil Engineers*, 1 (1888), 9–14.

42 Millard, *op. cit.* (note 1), 26–40. Millard identifies them as the "Montreal Clique," describes them as "conservative," and narrates conflicts in the society between them and the professional rank and file.

43 Gordon T. Stewart, *The Origins of Canadian Politics: A Comparative Approach* (Vancouver: University of British Columbia Press, 1986), 57.

44 A. A. den Otter, *The Philosophy of Railways* (Toronto: University of Toronto Press, 1997), 32–64.

45 Jan Noel, *Canada Dry: Temperance Crusades Before Confederation* (Toronto: University of Toronto Press, 1995). It is only fair to Noel to add that she emphatically does not see temperance as a bourgeois class (strictly defined) movement, but as a cultural movement, which transcended conventional class divisions.

46 Brian Young, "Positive Law, Positive State: Class Realignment and the Transformation of Lower Canada, 1815–1866," in Greer and Radforth, *op. cit.* (note 20), 57–58.

47 Gidney and Millar, *op. cit.* (note 2), 49–69.

48 McKillop, *op. cit.* (note 4), 9–25.

49 A brief summary of general history written with this spin is the section "Bourgeois Politics in the 1850s" in the recent textbook edited by David J. Bercuson et al., *Colonies: Canada to 1867* (Toronto: McGraw-Hill Ryerson, 1992), 336–41.

Appendix 1 Civil Engineers Excluded from Study			
Name	Flourishing Dates*	Known Work (Date)	Sources
Atherton, Charles	n.a.	Lac St Pierre works (1840s)	PWPR
Brough, Alan	n.a.	Early survey of Toronto & Guelph Railway	White
Buchanan, W.O.	n.a.	Asst. Eng., Welland Canal (1843)	PWPR
Burnett, Thomas	1819–26	Lachine Canal (c.1819)	DCB VI, "Auldjo"
Clowes, Samuel	n.a.	Canal surveys (1823–26)	TCK
Cowley, J.G.	n.a.	Asst. Eng., Beauharnois Canal (1842)	PWPR
Gore, T.S.	n.a.	Asst. Eng., western roads (1840s)	PWPR
Guy, A.	n.a.	Asst. Eng., Beauharnois Canal (1842)	PWPR
Hale, W.D.	1842–49	Asst. Eng., Burlington Bay Canal (c.1842)	PWPR
Higham, Robert	n.a.	Wrote early report on Toronto & Lake Huron Railway (1830s)	Toronto Public Library, Baldwin Collection
Hopkins, W.R.	1831–35	Chambly Canal (1835)	TCK
Killaly, John S.	n.a.	St Lawrence Canals (1843)	PWPR
Larocque, A.B.	n.a.	Asst. Eng., Beauharnois Canal (1842)	PWPR
LaRue, Adolphe	1836–56	Testifies regarding Beauharnois Canal location (1842)	PWPR
Lawson, W.	n.a.	Asst. Eng., western roads (1840s)	PWPR
Livingstone, Robert R.	n.a.	Early survey of Laprairie to St Jean Railway	DCB X, "Killaly"
Maingy, Robert A.	1833–37	Reported on proposed Trent Canal (1833)	Otto
Rubidge, Frederick Preston	b. 1806	Assistant to N.H. Baird (1835)	DCB VII, "Baird"
Scott, W.R.	n.a.	Welland Canal (1843)	PWPR
Shaw, W.M.	n.a.	Burlington Bay Canal (c.1842)	PWPR
Slater, James Dyson	1842–72	Asst. Eng., Welland Canal (1843)	PWPR
Starke, D.	1842–88	Lachine Canal (c.1842)	PWPR
Stevenson, Alex	1830–42	Testified regarding Beauharnois Canal location (1842)	PWPR
Tate, C.M.	1842–72	n.a.	White
Tibbett, Hiram	n.a.	Early survey of Welland Canal (1823)	TCK
Turner, A.	n.a.	Port Stanley Road (c.1842)	PWPR
Willyard, W.	n.a.	Assistant Engineer on western roads (1840s)	PWPR

* "Flourishing" dates in this table have been supplied by Larry McNally, National Archives of Canada, through personal communication.

Appendix 2 Civil Engineers Included in the Study Group				
Name	Birthdate	Birthplace	Secondary Education	Sources
Military				
By, John	1783	England	Royal Military Academy (Woolwich)	1
Caddy, John Herbert	1801	Lower Canada	Royal Military Academy (Woolwich)	DCB XIII
Peebles, Adams John Laing	1812	England (of Scottish parents)	Royal Military College (Sandhurst)	DCB XIII
Philpotts, George (Colonel)	(f. 1811–58)	n.a.	n.a.	TCK, 2
Robinson, William (Capitain)	(f. 1826–63)	n.a.	n.a.	TCK, 3
Roebuck, William		n.a.	Royal Military Academy (Woolwich)	4
Architects				
Howard, John George	1803	England	n.a.	DCB XI
Gauvreau, Pierre	1813	Quebec City	Petit séminaire de Québec	DCB XI
Tully, John	1818	Ireland	n.a.	Otto
Cumberland, Frederic William	1820	London (England)	King's College School (London)	5
Tully, Kivas	1820	Ireland	Royal Naval School (London)	DCB XI
Baillargé, Charles	1826	Quebec City	Petit séminaire de Québec	DCB XIII
Trades				
Merrill, Horace	1809	New Hampshire	Apprenticed Tradesman	DCB XI
Cull, James	1789	England	n.a	TCK, DCB VII
Surveyors				
Dawson, Simon James	1818	Scotland	n.a.	DCB XIII
Civil Engineers				
MacTaggart, John	1791	Scotland	n.a.	DCB XIII
Hall, Francis	1792	Scotland	Edinburgh University	Otto
Baird, Nicol H.	1796	Scotland	n.a.	DCB VII
Keefer, George Jr.	c. 1800	Upper Canada	n.a.	TCK
Killaly, Hamilton Hartley	1800	Ireland	Trinity College (Dublin)	DCB XI
Mills, J.B.	1800	United States	n.a.	CEIB, TCK

Casey, William Redmond	1805	New York	n.a.	6 DCB VII
Keefer, Samuel	1811	Upper Canada	Upper Canada College	7 DCB XI
Gzowski, Casimir Stanislas	1813	Poland	Lyceum of Krzemieniec	DCB XII
Fleming, Peter	1815	Britain	n.a.	DCB VII, CEIB
Page, John	1815	Scotland	University of Glasgow	8
Kierzkowski, Alexandre-Edouard	1816	Poland	École centrale des arts et manufactures (Paris)	DCB IX
Shanly, Walter	1817	Ireland	Private tuition	White
Brunel, Alfred	1818	England	n.a.	DCB XI
Kingsford, William	1819	England	Private school (London)	DCB XII
Shanly, Frank	1820	Ireland	Private tuition	White
Keefer, Thomas C.	1821	Upper Canada	Upper Canada College	DCB XIV
Light, Alexander	1822	Durham (England)	Royal Grammar School (Kingston, UC)	DCB XII
Walsh, Aquila	1823	Upper Canada	London District Grammar School	DCB IX
Baillargé, Frédéric	1824	Lower Canada	Petit séminaire de Québec	DCB XIII
Fleming, Sandford	1827	Scotland	Local private schools	9
Legge, Charles	1829	Upper Canada	Queen's College	DCB XI
Henshaw, George H.	1831	Lower Canada	Montreal High School and private tuition	10
Robinson, Arthur G.	n.a.	Upper Canada	n.a.	White, CEIB
Stewart, James	n.a.	Scotland	n.a.	White, 11
Barrett, Alfred	n.a.	United States	n.a.	12, DCM VII
Power, Samuel	n.a.	United States (?)	n.a.	CEIB
Roy, Thomas	n.a.	Scotland	n.a.	12, Otto, DCB XII

Abbreviated Sources for Appendix 1 and 2

DCB = *Dictionary of Canadian Biography* (Toronto: University of Toronto Press, various dates).

CEIB = Civil Engineer Instruction Book, National Archives of Canada, RG 11, vol. 135.

PWPR = Public Works Papers and Reports, National Archives of Canada.

Otto = Stephen A. Otto, unpublished biographical memorandum based on various primary sources, personally supplied to author.

TCK = T.C. Keefer's outgoing presidential address, *Transactions of the Canadian Society of Civil Engineers* 2 (1888): 40–42.

White = Richard White, *Gentlemen Engineers: The Working Lives of Frank and Walter Shanly* (Toronto: University of Toronto Press, 1999).

1. Various published sources, e.g., Mark Andrews, *For King and Country: Lieutenant Colonel John By, R.E., Indefatigable Civil-Military Engineer* (Merrickville: Heritage Merrickville Foundation, 1998).
2. Public Works Papers and Reports (PWPR) "Report on the Beauharnois Canal" (1842).
3. PWPR "The Engineer's Report for the Halifax and Quebec Railroad," *Report of the Commissioners of Public Works* (1848), 7–30.
4. *Journals of the Legislative Assembly of the Province of Canada,* vol. 2 (1842), app. Z, Testimony of William Roebuck.
5. Various published sources, e.g., Geoffrey Simmins, *Fred Cumberland: Building the Victorian Dream* (Toronto: University of Toronto Press, 1997).
6. *Journals of the Legislative Assembly of the Province of Canada,* vol. 2 (1842), app. Z, Testimony of W.R. Casey.
7. *Transactions of the Canadian Society of Civil Engineers,* 4 (1890), 332–36.
8. *Transactions of the Canadian Society of Civil Engineers,* 4 (1890), 336–37.
9. Various published sources, e.g., Lorne Greene, *Chief Engineer: Life of a Nation Builder – Sandford Fleming* (Toronto: Dundurn Press, 1993).
10. *Transactions of the Canadian Society of Civil Engineers,* 5 (1891), 365–66.
11. PWPR "Report of the Commissioner for Public Works," 1848, app. N, 53-56, by James Stewart.
12. PWPR "Report of the Commissioner of Public Works," 1846, 2.
13. Robert Leggett, "Thomas Roy and his 'Remarks on Roadbuilding'," *Canadian Geotechnical Journal* 25 (1988): 1–12.