Aesthetics and the Professional Identity of the Modern German Engineer

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INTRODUCTION

One could argue that German civil engineering became an established profession in 1856, when the first national society of engineers - the *Verein Deutscher Ingenieure* - was established. The development of engineering into a specialized vocation is hardly well represented by a single year, however, throughout the nineteenth and twentieth centuries the field followed a gradual trajectory of increasing specialization. Originally part of the responsibility of the *Baumeister*, who combined structural know-how with artistic reflection, construction became progressively distinguished from artistic matters as the use of industrial materials demanded greater scientific knowledge and experience. Both the educational curriculum and the occupational practice of the engineer became increasingly concerned with the mathematical formulas, geometric analysis, and objective thought required to create structures in iron and concrete.

And yet beginning in the late nineteenth century and continuing for decades thereafter, the artistic nature of engineered construction served as a topic of interest for German engineers. Discussions of the artistic nature of construction were published in engineering manuals and journals and voiced at professional meetings. In these discussions, a theoretical discourse developed regarding the aesthetic principles underlying the engineers' practice - a discourse somewhat distinct from the practical artistic advice and building reviews that engineers also authored. Contrary to conventional architectural thought at the time regarding the built environment, in which applied ornament was considered the site of aesthetic experience, engineers contended that the forms of construction themselves possessed aesthetic worth. The authors discussed the creative talent and aesthetic feeling of the engineer and analyzed the beauty of engineered monuments like the Kaiser Bridge near Mainz and France's Eiffel Tower in Paris **(Figs. 1 and 2)**. This body of aesthetic theory was initiated in 1890 by Franz Reuleaux's essay "Können eiserne Brücken nicht schön sein?" (Cannot iron bridges be beautiful?). Most examples that followed came from the twentieth century, with publications such as Otto Schulz's essay "Schönheit und Zweckmäßigkeit von Maschinen und Bauwerken" (Beauty and purposefulness of machines and buildings) from 1909, Franz Czech's essay "Ästhetik der Raumumschliessenden Eisenkonstruktionen" (Aesthetic of the space-enclosing iron construction) from 1912, Karl Bernhard's lecture "Die Aesthetik der Eisenbauten" (The aesthetic of iron construction), Hermann Jordan's and Eugen Michel's treatises entitled jointly *Die künstlerische Gestaltung von Eisenkonstruktionen* (The artistic form of iron construction), and Georg Chr. Mehrtens' essay "Aesthetische Fragen der Ingenieurkunst, besonders des Eisenbaues"

(Aesthetic questions regarding the engineer-art, especially iron construction), all from 1913, and Hermann Jordan's essay "Vorschläge zur künstlerischen Gestaltung von Brückenbauten" (Proposals regarding the artistic form of bridge construction) from 1916. What binds these theories is their focus on defining—often in painstaking detail—the abstract principles that underlay the beauty of engineered design. In fact, in comparison to perspectives on engineering's aesthetic offered by visionary architects like Hermann Muthesius and Hans Poelzig, engineers were more conventionally philosophical about the principles behind engineered form -often, in fact, informing architectural thought on the matter.

Abb. 73. Kaiserbrücke über den Rhein bei Mainz. 1902—03.
Nach Abb. der Maschinenfabrik Augsburg-Nürnberg, A.-G., Werk Gustavsburg.

Figure 1. Kaiser Bridge near Mainz

The artistic dimension of modern German engineering has received little attention from historians. This is due in part to the divisions within the historical field: historians of German art and architecture are often unfamiliar with the theory and practice of related scientific occupations, such as engineering; and historians of German engineering, construction, and technology tend to shy away from the subjective, artistic dimension of their subject. Even German political history that has examined the ideological basis of engineering theory and the impact of cultural ideals on its claims has disregarded the role played by aesthetics (Ludwig 1974, Herf 1984). My study combines elements from these three bodies of scholarship—the histories of art, engineering, and ideology. I contend that to understand German engineering's aesthetic theory, one must examine it in light of

the social and professional structure in place at the time. In truth, I do not discount the notion that the purely personal convictions of engineers may have shaped this theory, and that in turn this theory may have shaped the standards of their practice. Nonetheless, examining this aesthetic theory from 1890, when it began, to 1918 - a somewhat socially and politically cohesive period - I argue that this theory was developed by the engineers primarily to provide the profession with a particular class distinction. The incredible importance of social class for professions of the German civil service prompted engineers not only to change the standards of their education and certification but also to cultivate a professional discourse that reflected particular class values. In this way the aesthetic theory of engineers may tell us less about the engineers' actual practice of construction and more about the institution of the profession itself.

Figure 2. Eiffel Tower in Paris

GERMAN CIVIL PROFESSIONS

The status of social class, specifically the educated class (or *Bildungsbürgertum*), had particular importance for professionalization in Germany. Class distinctions throughout the nineteenth century and into the twentieth were based less and less on birth and property and increasingly on education. This was in part a result of the educational reforms initiated in the early nineteenth century by Wilhelm von Humboldt, who espoused the notion that an education in the humanist tradition should serve as the foundation of Prussian nationalism. All Prussian citizens should, like the citizens of classical Greece, be educated in a range of academic subjects, which would give them the cultivation (*Bildung*) needed to serve their state. Humboldt created a school system of secondary and post-secondary education based on an assembly of classical subjects, including languages (with an emphasis on Greek and Latin), literature, philosophy (including aesthetics), and the pure and natural sciences. According to the Humboldtian ideal, a general degree from a university should precede any specialized professional instruction. It was those citizens who graduated from university who were considered the core of the German educated class, an elite stratum of the middle class. While this educated class was originally a social construction of the Prussian empire, it became after 1871 part of the class structure of unified Germany (Jarausch 1982, pp. 6-10, 82-3; Ringer 1969, pp. 25-42).

As the modern phenomenon of professionalization developed in Germany, this educated class became the ideal for the professional community. Unlike the apprenticeship-based occupations that predated and then later coexisted with professionalization, professions developed from fields of academic learning. A popular designation for "profession" in Germany in the nineteenth century, *akademischer Berufstand*, or "academic occupation" lays bare its denotation of academic learning. The professional norm, which one finds established already with the first professions of law and medicine, was a university degree and employment with the state, where one's learned background was well regarded.

As several historians have pointed out, engineers held an ambiguous social status. (McClelland 1991, Jarausch 1990, Gispen 1989, Cocks and Jarausch 1990). Following the professional norm, engineers worked for the civil service. They did not however receive a university education. The Humboldtian ideal of a university education preceding specialized instruction ran counter to the pragmatic need for engineering training to keep pace with Germany's rapid industrialization. To provide engineers with the specialized knowledge needed for construction in industrial materials, the state created an assortment of engineering programs, which ranged from the more practical and workshop-oriented trade schools to the more academic polytechnic institutions (*technische Hochschulen* and *Polytechniken*). Not surprisingly, the unique trajectory of the engineer's education compromised the profession's social standing. Education had become a prime indicator of class distinctions, and the engineer's specialized curriculum, different schools, and alternative certification signaled that its profession was part of the middle - but not university-educated - class.

Academically educated yet not broadly learned, engineers occupied a subordinate place in the structure of the civil service. As historian Kees Gispen has outlined, the engineers' occupational mobility, advancement, authority, and salary were all compromised (1989). As civil professionals, engineers were at an obvious disadvantage.

The issue of class became a major concern for engineers, who developed a range of strategies for the reform of their profession in line with humanist ideals. Although some engineers anticipated a change in the social order that would better reflect the reality of Germany's modernization and allow for greater recognition of technical, specialized knowledge, many engineers attempted to make their profession better suited to the traditional social order. Since it was one's education and professional certification that were the most patent indicators of affiliation with the educated class, it was these things that became the focus of reform. Efforts began as early as the 1860s and 70s, and focused on the strengthening of school admission standards and curriculum in the *technische Hochschulen* (Gispen 1989, p. 38). For some engineers, the ideals to be pursued were those guiding the teaching at the Berlin *Bauakademie* (1799-1879), where students were groomed for work in the Prussian state according to a curriculum that included the natural and mathematical sciences as well as the building arts. Instruction there was considered to have achieved such a high level of pure, academic knowledge that graduates "took great pride in their civil-service standing, paraded as 'classically educated' men belonging to the cultured classes" (Gispen 1989, p. 73). Although the general trend in the education of the engineer was towards greater specialization, some engineers still favored a less practical yet more ideologically auspicious focus on the pure sciences and broad cultivation over the applied sciences and workshop experience. For example, by the turn of the century in the *Technische Hochschule* in Berlin, literature and additional languages were introduced into the department of general academics (*Abtheilung für allgemeine Wissenschaften*), a division of the school that offered general interest courses to all engineering and architecture majors. In the academic year 1884-85, this department offered courses in botany, French, English, hygiene, mathematics, and national economy; by 1899, it had expanded its offerings on topics of scientific specialization while introducing courses on Goethe's *Faust* and the tragedies of Shakespeare (*Dobbert* 1899, pp. 235, 239-40). It was in 1899 that one of the most important academic changes was realized by proponents of educational reform: all the *technische Hochschulen* in the Prussian state were given the right to confer doctoral degrees, as was already offered by universities, a measure that was adopted soon after by the rest of Germany (Clark 1990, p. 150). For a class system based on indicators of academic advancement, such a sign of accreditation must have been deemed one of the most critical steps for advancing the profession's social standing. The engineers' class stigma proved to be tenacious, however. In 1909, as inequities were still experienced by the profession, a new society, called the *Verband Deutscher Diplom-Ingenieure* (Society for German accredited engineers), was established specially to promote the interests of those engineers considering themselves to be part of a classically learned profession. The degree of this stigma is indicated by the comments of Wilhelm Franz, a professor at the *Technische Hochschule* in Berlin and the first editor of the journal for the *Verband Deutscher Diplom-Ingenieure*. In an essay from

1910, he advised engineers to fight the misconception that the engineer was merely a brutish muscleman (*Kraftmeier*) who destroyed natural beauty with his work (Franz 1910, pp. 326-7).

AESTHETICS AND THE ENGINEERING PROFESSION

Historians have largely focused on understanding the engineering profession's social predicament by examining the kinds of factual evidence discussed above - curriculum standards, certification requirements, and the roles of professional societies (Gispen 1989, Gispen 1990, McClelland 1991). And yet the profession adopted other, less direct strategies for its social advancement, a prime example being the discourse on the philosophy of aesthetics. Admittedly, an important indicator of inclusion into the educated class was the level of one's formal education, but signs of education that were less quantifiably expressed could also signify class status. As the historian Konrad Jarausch has pointed out, the signs of the educated class were often expressed through such things as "common habits, forms of communication, and sociability" (Jarausch 1990, p. 5). To be sure, as engineers graduated with increasing specialization - even with the equivalent of a university diploma in hand - manners of discourse may have been considered the most advantageous way in which to establish the profession's social identity. By discussing subjects considered to be evocative of cultivation, engineers could initiate a form of communication that might overshadow the details of schooling and curriculum.

Aesthetics provided such an opportunity; it was a topic relevant to the engineers' work and, as a division of philosophy taught at universities, it was a field that displayed one's broad cultivation. Engineers could demonstrate a learned character by showing a command of aesthetic principles and an ability to reach intellectually beyond the circumscribed concerns of mathematical calculation and technical expertise. And while this sort of learned discourse may not have altered the facts of the engineer's education, it did indicate that engineers were nonetheless reading the literature of the educated class. The message sent was that the values of their profession demanded a conversance with this literature. The aesthetic theory of engineers suggested that they had stocked their libraries with books on aesthetics, such as Immanuel Kant's *Kritik der Urteilskraft* (Critique of Judgment) and Friedrich Theodor Vischer's *Aesthetik*, and that they regularly perused journals on German culture, such as *Die Zukunft*, or Ferdinand Avenarius's *Kunstwart*, and, starting in 1906, the first journal on aesthetic theory, *Zeitschrift für Ästhetik und allgemeine Kunstwissenschaft*.

Some engineers left no ambiguity regarding the pedigree of their aesthetic theory, stating directly the sources that informed their discussion. Otto Schulz, for instance, is his essay "Schönheit und Zweckmäßigkeit von Maschinen und Bauwerken" (Beauty and purposefulness of machines and buildings) from 1909, detailed the ways in which Arthur Schopenhauer's ideas informed his own. It was Schopenhauer's notion of the metaphysical component of aesthetic contemplation that provided the basis for his own theory on the engineer's aesthetic. In *Die künstlerische Gestaltung von Eisenkonstruktionen* (The artistic form of iron construction) from 1913, Hermann Jordan indicated

the theory that had guided his own thought, identifying Karl Groos's treatise *Einleitung in die Ästhetik* (Introduction to aesthetics) as the source informing his treatment of the concepts of feeling, imagination, and beauty. Jordan, moreover, underscored in no uncertain terms the fact that his theoretical discussion extended beyond the specialized field of engineering into the realm of philosophy. Confronting the question of what role aesthetics would play in iron construction, he contended: "If one wants to get to the bottom of this question, then one must understand above all that it is not so much a technical than a philosophical question" (Jordan 1913, p. 67). He concluded that it was in the "philosophy of aesthetics" that the answer lay.

Engineers also embellished their aesthetic discussions with allusions to the broader realm of classical learning. Classical languages and classical literature had in reality no direct relevance for the science of modern engineering, but this did not stop engineers from incorporating such things into their writings as though they spoke directly to the essence of their work. Much like the direct mention of particular philosophers and their theories, references to the knowledge of antiquity signalled that the author was familiar with a body of knowledge reserved for the discourse of an educated elite. Such would have been the case when engineer Eugen Michel originally titled his treatise on aesthetics *Magna est res architectura* (the work was ultimately published officially under the German title *Die künstlerische Gestaltung von Eisenkonstruktionen*). By using Latin, Michel presented himself as someone with a classical education, someone who was familiar with the architectural essays from an earlier humanist era, such as the *De re aedificatoria* of Alberti - the consummate humanist architect. Similarly, in the published lecture *Ueber innere Anschauung und bildliches Denken* (On inner vision and graphic thought), Guido Hauck displayed his own classical background when he made explicit the link between modern engineers and classical authors when he compared the engineer's graphic imagination to the imaginative talents of Homer, Pythagoras, Phidias, Perikles, Xenophon, and Archimedes.

Many engineers refrained from explicitly endorsing a particular humanist figure or theory, however. The decision to do so, interestingly, could be considered just as strategic as the decision to highlight one's sources. The discourse of a particular class often operates with a number of assumptions regarding the knowledge and background that the participants bring to it. Engineers may have understood that a lack of direct references could in fact be the hallmark of a dialogue that excluded the uninformed and the uninitiated. When, for instance, key terms were employed as shorthand references to larger bodies of theoretical thought, the writer implicitly signaled to the reader their shared background. Such would have been the case when engineers referred to the beauty of their construction's *Zweckmäßigkeit* (purposefulness) - as Franz Reuleaux did in "Können eiserne Brücken nicht schön sein?" (Cannot iron bridges be beautiful?) and Karl Bernhard did in "Die Aesthetik der Eisenbauten" (The aesthetic of iron construction). *Zweckmäßigkeit* was an important theoretical term found in the work of Kant and Schopenhauer, who both expounded on the relationship between purposefulness and beauty, and would have been familiar to anyone with a background in aesthetics. Additionally, when Bernhard discussed the engineer's inner feeling for

aesthetic form, he was using a concept from the popular aesthetic theory of empathy (*Einfühlungstheorie*), which had appeared not only in the specialized literature of aesthetics but also in the general cultural journals of the educated class.

But just as concept- and name-dropping could serve as signs of the engineers' familiarity with theories of aesthetics, display of original analytical thought - how deftly one could apply these theoretical concepts to the realm of engineering - could also communicate the engineer's engagement with this learned discourse. Indeed, by exposing one's ability to think independently and critically, one achieved one of the ideals of the university-educated citizen. Since the time of Humboldt, the educated social stratum championed original, discursive thought over encyclopedism, which was considered characteristic of the French Enlightenment (McClelland 1980, pp. 124-5).

Engineers exhibited this spirit of intellectual inquiry when they showed that they could stretch the implications of conventional philosophical principles to include the new kind of beauty found in engineered structure. By applying aesthetic principles normally reserved for architectural ornament to the forms of construction, engineers engaged in the sort of thoughtful speculation associated with university learning. Otto Schulz, for instance, displayed (in 15 attentively argued pages) the ability to confront an intellectual problem and expand the reach of received ideas. He did this by tapping the theoretical potential in engineering's association with purposeful form. Schulz explained that according to Schopenhauer, by knowing oneself, one could achieve a metaphysical connection to the purposefulness of the world. He described further how one, having achieved this metaphysical bond, could express this connection in the things one created, which included the forms of modern technology and industry. When the formal compositions of engineered structures conveyed their purposeful nature, they reflected the meaning of the universe and achieved a supreme kind of beauty. Like the skeleton of a sea organism, engineered structures, like a railroad overpass near Mainz and the Kaiser Wilhelm Brücke near Müngsten **(fig. 3),** satisfied the universal principle that beautiful design contains no extraneous parts, only a combination of elements forming a harmonious whole.

In terms of philosophical and discursive thought, Schulz's essay could not match the display of rigor and expertise that Guido Hauck provided in his speech given at the *Technische Hochschule* in Berlin in 1897. Entitling his speech "Ueber innere Anschauung und bildliches Denken," Hauck argued with reason and care that all successful engineers possessed the capacity for "innere Anschauung" (inner vision) and "bildliches Denken" (graphic thought), as well as for "Phantasie" (fantasy). These abilities stemmed from one's soul, and were in contrast to one's abstract thought, which was conceptual and verbal rather than graphic in nature. Hauck explained that both abstract and graphic thought were components of the engineer's work: abstract thought gave engineers the ability to analyze the interaction of static and dynamic forces - a critical initial step in construction design - but that it was graphic thought that allowed them to translate this analysis into visual form.

It was this engagement with graphic thought that made engineers similar to artists, whose work was based on an “unchecked capacity for fantasy". While Hauck conceded that both graphic and abstract thought were important for the engineer, he stressed the philosophical import of graphic thought, explaining that “a so-called further or higher thought process is only possible with graphic thought".

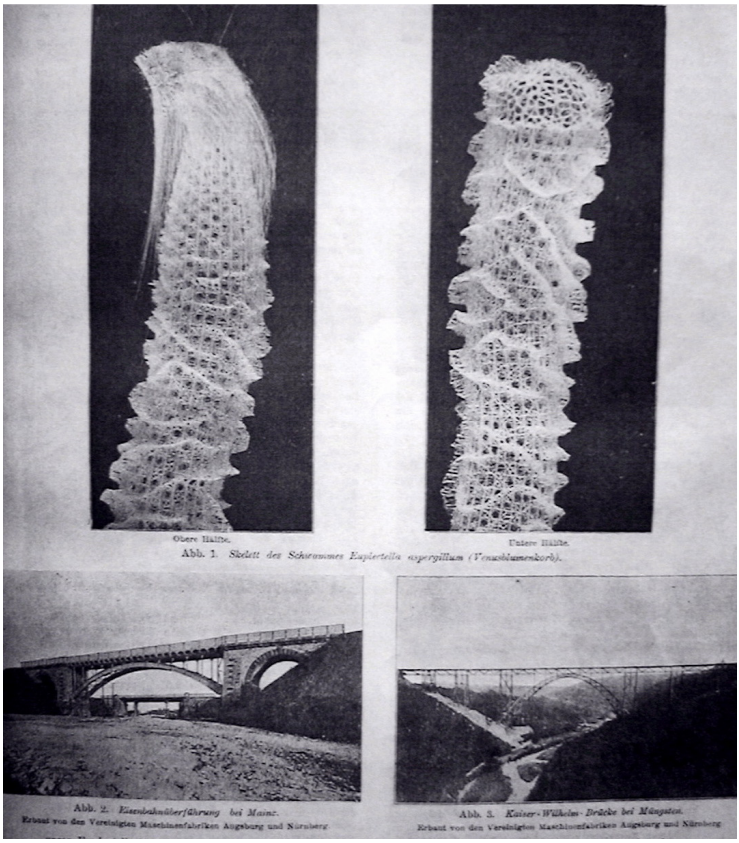

Figure 3. Railroad overpass near Mainz and the Kaiser Wilhelm Brücke near Müngsten

Other engineers painstakingly explicated the manner in which empathy, which originally served as a basis for discussing the aesthetics of classical, stone architecture, could be applied to the thin, standardized beams of iron skeletal construction. Empathy theory’s general premise was that aesthetic experience stemmed from the ability of the viewer to empathize with the system of forces expressed in the forms of structure. The problem with transposing this aesthetic theory to another material and construction method was that the traditional site of empathic perception - the sculptural contours of structural form - was no longer expedient. Iron’s uniform beams did not indicate signs of load and support as did the apparent swelling and contraction of classical forms. Franz Reuleaux, perhaps the first to introduce the tenets of empathy theory to iron construction, confronted this

problem by proposing that it was the overall contour of a structure that conveyed the beauty of engineered construction. He described how the gently arched bridge effected a sense of rest and calm in the viewer, while the bridge crossing straight across two banks produced a feeling of restlessness (Reuleaux 1890, p. 435).

Eugen Michel also tackled this aesthetic problem. Like Reuleaux, Michel found that it was often the entire profile of iron construction that yielded the greatest empathic experience. He explained, for example, that it was the "beautiful, glorious striving upward contour line of the Eiffel Tower in Paris" - and not its internal, criss-crossing beams - that provided an uplifting impression (Michel 1913, p. 163). For Michel, however, some individual iron forms in fact offered the sculptural volume conducive to an empathic connection with its forces, such as in the tapered pillars of certain bridges.

As the historian Fritz Ringer has pointed out, cultivation in the German context meant not simply developing one's mental capacity but also improving one's inner spirit (Ringer 1969, p. 104). The educated class had cultivated the mind *and* the soul. This too was expressed by the engineers. The notion that engineers had indeed an elevated spirit was perhaps most effectively expressed in the way they characterized their role in the aesthetic process. Their inner cultivation was portrayed by Karl Bernard when, recalling the tenets of empathy theory, he claimed that it was the engineer's feeling for form that dictated his aesthetic choices (Bernhard 1913, p. 172). Hardly a brutish, insensitive scientist, the engineer sensed beauty through his empathy with the world. Fritz Ringer has further claimed that empathy theory was particularly valuable in the display of humanist cultivation, for when one demonstrated a capacity for empathy, one demonstrated a high level of inner cultivation rather than a superficial aggregation of facts (Ringer 1969, p. 104). Certainly when Otto Schulz elaborated on the engineer's transcendence to universal truths through an empathetic "sympathy," he, like Bernard, conveyed just such a message. He depicted an individual of a delicate inner character when he stated of the engineer, "An inner voice tells him whether something is purposeful or not in the deepest sense; this is the same voice that tells him what is beautiful" (Schulz 1909, col. 35-6).

The notion that the aim of this aesthetic theory was to shape the profession's identity is supported by the biographical backgrounds of its authors. Although the biographical details that can be found on these engineers are often meager, they do provide some evidence of the engineers' sympathy toward and even involvement in the reform of the profession along humanist lines. The most thoroughly sketched biography exists for Franz Reuleaux, the most famous contributor to this discourse. His education suggests an attempt at the Humboldtian ideal, as he attended the universities of Berlin and Bonn between 1852 and 1854, studying the natural sciences and philosophy, following his education in a technical program at the *Polytechnik* in Karlsruhe (www.tu-berlin.de/presse/125jahre/festschrift/reuleaux_e.htm). During the time that he served as a professor in Berlin at the *Königliches Gewerbeinstitut* and later at the *Technische Hochschule*, he

associated himself with the segment of the faculty that favored the teaching of the pure sciences and their theoretical principles over the running of workshops for applied training (Gispen 1989, pp. 74, 152). Although Reuleaux's specialization was in fact mechanical rather than structural engineering, one can find in Reuleaux a general concern to elevate all specializations of engineering to a learned profession. Indeed in 1890, when his essay on the beauty of bridges was published, Reuleaux was serving as rector of the *Technische Hochschule* in Berlin, where all departments were in his care.

To be sure, it was in Berlin, the former capital of the Prussian empire, where concerns about cultivation were strongest, and such was the academic home of not only Reuleaux but also three other engineers discussed here: Guido Hauck, Karl Bernhard, and Wilhelm Franz. Guido Hauck, like Reuleaux, served as a rector for the *Technische Hochschule* in Berlin, filling the post twice (1884-85, 1896-97), and like Reuleaux showed an interest in placing the school on a conservative, humanist course. Hauck was technically considered a professor of mathematics, specializing in "descriptive geometry and graphostatics," but he taught structural engineers and wrote engineering theory. During his second term as rector, Hauck presented *Ueber innere Anschauung und bildliches Denken* as a ceremonial address (*Festrede*), a kind of speech introduced into the *technische Hochschulen* in emulation of the ceremonial addresses delivered at universities, in which the underlying values of the institution were expressed. In Hauck's speech, as discussed above, intellectual rigor and inner cultivation certainly must be considered as ideals. The significance of such qualities for the engineer was also the message of Hauck's first rector's speech from 1885, in which he spoke on "Die Grenzen zwischen Malerei und Plastik und die Gesetze Reliefs" (The boundaries between painting and sculpture and the principles of reliefs). Already in 1879, Hauck had indicated that aesthetics were to be at the ideological if not theoretical heart of the engineer's education, writing a *Festschrift* (commemorative written work) on "Die subjektive Perspektive und die horizontalen Curvaturen des dorischen Styls. Eine Perspektivisch-Ästhetische Studie" (The subjective perspective and the horizontal curvature of the Doric style. A study in perspective aesthetics) for the 50th anniversary of the *Technische Hochschule* in Stuttgart. And by 1891, Hauck had shown an even broader range of humanist expertise with the publication of his literary exposition on the technological ideals to be found in Goethe's *Faust*, called "Technikers Faust-Erklärung" (The engineer's guide to *Faust*).

Certainly the range of studies produced by Hauck suggests that the aesthetics of engineering was not the only type of theory employed by engineers in their attempt to generate a learned discourse. And if one looks at the survey of works written by engineers, one finds further proof that the discourse on aesthetics was not an isolated attempt to communicate the learned character of engineers. The discourse on aesthetics could in fact be considered an offshoot from a larger philosophical discourse that occupied engineers during the last quarter of the nineteenth century, called *Technikphilosophie*, the philosophy of technology. The purpose of this body of theory, as was often expressly stated by its authors, was to comprehend the relationship of modern technology to human culture. Reuleaux had spurred this type of philosophical investigation in 1875 with his

book on the principles of motion in mechanics, entitled *Theoretische Kinematik*. In it, he attempted to situate machine engineering within a larger *Weltanschauung* (philosophy of the world), summoning the wisdom of Goethe and Schopenhauer to advance his position. Many works on *Technikphilosophie* followed, some of the most renowned being Ernst Kapp's *Grundlinien einer Philosophie der Technik* (Foundation of a philosophy of technology) (1877), Reuleaux's "Cultur und Technik" (Culture and technology) (1885), Adolf Ernst's "Kultur und Technik" (1888), Eduard von Mayer's *Technik und Kultur* (1906), and Carl Weihe's "Der Kulturwert der Technik" (The cultural value of technology) (1918). Historian Jeffrey Herf has in fact linked this body of theory to the engineers' class ambitions, claiming that it speaks to their desire for "prestige and status equal to that of the older professions, especially law" (Herf 1984, p. 152). Clearly, one can establish a parallel between the role of this theory and that of the engineers' aesthetic theory. To be sure, this discourse, like aesthetic theory, created an impression of intellectual sagacity as well as refinement of spirit.

Both types of theory - aesthetics and *Technikphilosophie* - achieved a substantial presence in the literature of the engineering profession. By 1908, the *Verein Deutscher Ingenieure* had even dedicated an entire department within their journal *Technik und Wirtschaft* (Technology and industry) to philosophy, art, and culture. These types of discussions could serve to create ideological cohesion among the profession's members and groom them according to its particular ideals. Yet engineers did not confine their conversance in philosophical thought to their own professional literature; they also displayed it for the educated readership across Germany. The appearance of their learned discussions in the more general literature of the educated class had the equally significant role of articulating this identity to the broader social community. For example, in *Die Zukunft*, a journal of a broad cultural purview, one finds an engineer displaying an engagement with the larger educated community when the *Diplom-Ing*. (diploma-engineer) Wichard von Moellendorff authored an essay in 1912 on the notion of "Der Ingenieur." In this essay he engaged in a theoretical discussion of the engineer's role in modern society and culture, and his learned references, cultural themes, and analytical language suit the rest of the journal well. Using the writings of sociologist Werner Sombart and cultural historian Karl Lamprecht as a launching point, he discussed the engineer's role through a theoretical exploration of the notion of *Technik* (technology). In 1913 Moellendorff followed this essay with another learned exposition in *Die Zukunft*, this one exploring the notion of "Das technische Motiv" (the technical motive) in modern culture. With such publications, he communicated to his educated readers that engineers shared their same language, ideals, problems, and values.

CONCLUSION

An important point regarding nineteenth and early twentieth-century German professions is that their identities, while generally serving to distinguish one profession from another, also affirmed the social ideals that were to transcend individual specializations and provide the nation's

professionalization with a cohesive foundation. For engineers, this meant confronting a vexing contradiction, for it was precisely their background in technological specialization which belied the social values of the civil service. And yet the paradoxical nature of modern German professionalization affected not only engineers. The reality of modernization was that most fields found greater specialization necessary, which then compromised the ideals of broad cultivation. Even the faculties of universities began to express apprehension for the changing direction of academic instruction as Germany's institutions became increasingly transformed by industrial capitalism. Confronting this distressing situation, in 1923 in *Die Idee der Universität* (The idea of the university), philosopher Karl Jaspers articulated his concern regarding the greater specialization of academic professions in general:

> The vitality of academics depends on the *relationship to the whole*. On the one hand, each individual discipline is one such whole and from that point of view has a philosophical character; on the other hand, each discipline also has a connection to academic knowledge in its entirety. […] The training for […] professions is spiritless and makes us inhuman if it does not lead us back to the whole, develop our perceptiveness, or show the wider horizon—in short, if it does not give us the "philosophical" perspective.
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> (Jaspers 1923, p. 46)

In spite of the concerns and caveats of the university-educated, the educated class gradually yielded to an increasingly powerful class of industrialists and entrepreneurs. But at least until World War I, for a certain segment of engineers, perceptions of the social class structure remained ensconced within a traditional order, and the aspirations of these engineers remained the goal of receiving the benefits of its privileged class. For them, aesthetics provided one strategy for improving their lot in the civil service. Although writing specifically about the creative thought of the engineer, Guido Hauck expressed well the general perspective of this group of engineers and the message of their aesthetic theories when he announced, "So we see, that if you think about it, the thought of the engineer proceeds completely according to the same laws that guide the members of other professions" (1897, p. 18). Like other professionals, the engineer was guided by cultivation.

REFERENCES

Bernhard, Karl, 1913. "Die Aesthetik der Eisebauten", *Deutsche Bauzeitung*, vol. 47, pp. 171-2.

Clark, Vincent, 1990. *A Struggle for Existence: The Professionalization of German Architects*, in Cocks, Geoffrey, and Jarausch, Konrad H., eds., *German Professions, 1800-1950*, New York and Oxford: Oxford University Press.

Cocks, Geoffrey, and Jarausch, Konrad H., eds., 1990. *German Professions, 1800-1950*, New York and Oxford: Oxford University Press.

Dobbert, Eduard, and Meyer, Alfred G., 1899. *Chronik der königlichen technischen Hochschule zu Berlin 1799-1899*, Berlin: Wilhelm Ernst und Sohn.

Franz, Wilhelm, 1910. "Ingenieurarchitekturen", *Technik und Wirtschaft*, v. 3, no. 6, pp. 321-6.

Gispen, Kees, 1989. *New Profession, Old Order: Engineers and German Society, 1815-1914*, Cambridge: Cambridge University Press.

Gispen, Kees, 1990. "Engineers in Wilhelmian Germany: Professionalization, Deprofessionalization, and the Development of Nonacademic Technical Education" in Cocks, Geoffrey, and Jarausch, Konrad H., eds., *German Professions, 1800-1950*, New York and Oxford: Oxford University Press.

Hauck, Guido, 1897. *Ueber innere Anschauung und bildliches Denken*, Berlin.

Herf, Jeffrey, 1984. *Reactionary Modernism: Technology, Culture, and Politics in Weimar and the Third Reich*, Cambridge: Cambridge University Press.

Jarausch, Konrad H., 1982. *Students, Society, and Politics in Imperial Germany: The Rise of Academic Illiberalism*, Princeton: Princeton University Press.

Jarausch, Konrad H., 1990. *The Unfree Professions: German Lawyers, Teachers, and Engineers, 1900-1950*, New York and Oxford: Oxford University Press.

Jaspers, Karl, 1923. *Die Idee der Universität*, Berlin: Julius Springer.

Jordan, Hermann, and Michel, Eugen, 1913. *Die künstlerische Gestaltung von Eisenkonstruktionen*, Berlin: Carl Heymanns Verlag.

Ludwig, Karl-Heinz, 1974. *Technik und Ingenieure im Dritten Reich*, Düsseldorf: Droste Verlag.

McClelland, Charles E., 1980. *State, Society, and University in Germany, 1700-1914*, Cambridge: Cambridge University Press.

McClelland, Charles E., 1991. *The German Experience of Professionalization: Modern Learned Professions and Their Organizations from the Early Nineteenth Century to the Hitler Era*, Cambridge: Cambridge University Press.

Moellendorff, Wichard von, 1912. "Der Ingenieur", *Die Zukunft*, vol. 80, pp. 425-32.

Moellendorff, Wichard von, 1913. “Das technische Motiv”, *Die Zukunft*, vol. 85, pp. 415-20.

Reuleaux, Franz, 1890. “Können eiserne Brücken nicht schön sein?” *Prometheus: Illustrirte Wochenschrift über die Fortschritte der Angewandten Naturwissenschaften*, vol. 1, no. 28, pp. 433-438.

Ringer, Fritz K., 1969. *The Decline of the German Mandarins: The German Academic Community, 1890-1933*, Cambridge, Mass.: Harvard University Press.

Schulz, Otto, 1909. “Schönheit und Zweckmäßigkeit von Maschinen und Bauwerken”, *Zeitschrift für Architektur und Ingenieurwesen*, vol. 55, pp. 15-45.

Websites

www.tu-berlin.de/presse/125jahre/festschrift/reuleaux_e.htm