

The Perfect Machine

Lorenz Böhler's Rationalized Fracture Treatment in World War I

*By Thomas Schlich**

ABSTRACT

This essay examines Lorenz Böhler's modernist system of rationalized fracture care as a particular case of medical rationalization and standardization. Böhler's locally created culture of standardized practices is analyzed in the context of its concrete work environment but also situated in relation to aspects of its wider cultural environment. It will be described as part of a more general trend of body-based rationalization efforts in industry and health care, in which the machine metaphor was used to characterize both the body and the work process. The project's origins in World War I will be discussed, as well as its subsequent migration to a civilian setting and its resonance with postwar Viennese modernism, to which it contributed. The essay aims at contributing to a historically informed discussion of medical rationalization and standardization as a heterogeneous, value-laden, and historically contingent phenomenon.

WHEN, IN THE EARLY TWENTIETH CENTURY, innovative fracture surgeons organized their work according to the ideals of rationality and efficiency, the idea of the machine served as a model both for understanding the human body and for organizing work processes. One of the most influential fracture specialists of that period was Lorenz Böhler (1885–1973). Böhler was widely admired for his thoroughly rationalized and standardized treatment regime for restoring his patients' injured bodies to their original functionality. His system of fracture care was associated with the world-famous accident hospital in Vienna, which the Austrian National Accident Insurance Company (AUVA) had set up for him in 1925. Its roots, however, go back to World War I. In this essay I will look at the origins of Böhler's treatment system in the Great War. I will examine his locally created culture of rationalization and standardization in detail and analyze the

* Department of Social Studies of Medicine, McGill University, 3647 Peel Street, Montreal, Quebec H3A 1X1, Canada.

For their valuable advice on this essay I wish to thank Cornelius Borck, Tatjana Buklijas, Hans-Georg Hofer, Martin Lengwiler, and George Weisz.

practical, cultural, and political conditions of its emergence and its eventual migration to its new setting.

Böhler's system of fracture care is a specific example of the more general phenomenon of rationalization and standardization, which Susan Leigh Star and Martha Lampland have recently characterized as a hidden but central feature of modern social and cultural life. Standardization is usually seen not as a historical phenomenon but simply as a "necessary technique designed to facilitate other tasks," these authors claim, with the consequence that "the quintessentially sociocultural and ethical aspects of standards" are overlooked. This is also true for rationalization and standardization in the medical domain.¹ As a result of the relative lack of studies of the material and intellectual dimensions of their history, rationalization and standardization in medicine still appear as uniform, more or less intentional, and almost historically necessary developments. A more historically informed approach can reveal that these developments actually consisted of a multifaceted group of historically specific and local projects, which, depending on the circumstances, converged into greater historical trends or remained isolated. By paying special attention to the diverse factors and contingencies that shape different kinds of medical standardization in particular ways, this essay aims at contributing to such a historically informed view.

In my historical account, I will look at the material and practical conditions of Lorenz Böhler's rationalization and standardization project and its links to the sociocultural and political circumstances of its time and place. This approach will lead me to address a number of relevant historical themes. One of them is the history of the mutual relationship between body concepts and the organization of work processes in the context of modernist attempts at rationalization, which, as we will see, were often expressed through the machine metaphor. This focus will simultaneously draw our attention to the neglected history of mechanical ideas in surgical thinking and practice, which shows that the modernist body was not always conceived in terms of energy as a motor but in some contexts, rather, as a functional machine. Another central theme of my case history is the impact of World War I on rationalization and standardization in bone surgery and, in fact, on medical innovation more generally. This discussion includes an account of how Böhler was eventually able to move his local culture of standardized practices into a civilian context. Here, it will be important to look closely at the links between the efficiency-driven view of the body and economic concerns, especially in the modernist culture of accident insurance. I will then broaden the focus and raise the question of how Böhler's rationalized fracture care fit into the broader environment of his time and place—in other words, how it related to Vienna modernism, of which, as I claim, Böhler was a surgical proponent.

¹ Susan Leigh Star and Martha Lampland, "Reckoning with Standards," in *Standards and Their Stories: How Quantifying, Classifying, and Formalizing Practices Shape Everyday Life*, ed. Lampland and Star (Ithaca, N.Y.: Cornell Univ. Press, 2009), pp. 3–34, on p. 10 (I thank the authors for giving me access to a prepublication version of this essay). For studies that treat rationalization and standardization in the medical domain see, e.g., Harry Marks, *The Progress of Experiment: Science and Therapeutic Reform in the United States, 1900–1990* (Cambridge: Cambridge Univ. Press, 1997); Stefan Timmermans and Marc Berg, *The Gold Standard: The Challenge of Evidence-Based Medicine and Standardization in Health Care* (Philadelphia: Temple Univ. Press, 2003); Alberto Cambrosio, Peter Keating, Thomas Schlich, and George Weisz, "Regulatory Objectivity and the Generation and Management of Evidence in Medicine," *Social Science and Medicine*, 2006, 62:189–199; and Weisz, Cambrosio, Keating, Loes Knaapen, Schlich, and Virginie Tournay, "The Emergence of Clinical Practice Guidelines," *Milbank Quarterly*, 2007, 85:691–727.

BODY AND MACHINE

Historians have described how rationalization efforts in industry were linked in particular ways to specific body concepts. Thus, the metaphor of the “human motor” connected physiology with technology, as Anson Rabinbach has shown. In his book with that title, he discusses how body concepts and innovative ideas about the organization of industrial labor converged, so that the “protean force of nature, the productive power of industrial machines, and the body in motion” were all seen as “instances of the same dynamic laws, subject to measurement.”²

The most influential of these body-based rationalization concepts was introduced in the 1890s by the American engineer Frederick W. Taylor. Taylor applied his engineering skills to reorganizing labor processes according to rigorously scientific principles. “Using a stopwatch to analyze the movement of workers at the Midvale Steel Company, in Philadelphia,” he “claimed that he could determine the one best way for each of the workers to do his specific task.”³ All shop-floor tasks were to be divided into their fundamental parts; each task was analyzed and designed to achieve maximum efficiency and ease of imitation; tools and machines were redesigned as standardized models; wages were to be linked to output; and the administration of production was to be subjected to rational coordination. “Taylor’s factory was to be one big machine,” as his biographer Samuel Haber puts it.⁴

Despite the importance of Taylorism, the use of physiological ideas in industry was by no means an exclusively American phenomenon. In the first decades of the twentieth century, similar concepts of rationalization enjoyed increasing popularity in Europe. In Germany, for example, science-based labor rationalization schemes, such as the Fordist assembly line, were adopted on a large scale after World War I. They all formed part of a profoundly modernist discourse of labor power, in which the methods of science and business were opposed to the older values of faith in tradition and community.⁵

With its special association with science, health care seemed “a likely candidate for improvement through efficiency.” Between 1900 and 1920, scientific management ideas were applied to a variety of health care services in the United States.⁶ It was a time when the vocabulary pertaining to a hospital’s purpose and structure was switching from metaphors of charity to metaphors of enterprise. Hospitals were now seen as “workshops for physicians” or “health factories.” As the number of surgical operations soared, methods and tools from the world of business were imported into the hospital environment, which, according to Joel Howell, started to resemble a factory. Surgery played a

² Anson Rabinbach, *The Human Motor: Energy, Fatigue, and the Origins of Modernity* (Berkeley/Los Angeles: Univ. California Press, 1992), p. 1.

³ Joel D. Howell, *Technology in the Hospital: Transforming Patient Care in the Early Twentieth Century* (Baltimore/London: Johns Hopkins Univ. Press, 1995), p. 31. On Taylor’s application of engineering principles to reorganize labor processes see Samuel Haber, *Efficiency and Uplift: Scientific Management in the Progressive Era, 1890–1920* (Chicago/London: Univ. Chicago Press, 1964); and Charles S. Maier, “Between Taylorism and Technocracy: European Ideologies and the Vision of Industrial Productivity in the 1920s,” *Journal of Contemporary History*, 1970, 5:27–61.

⁴ Haber, *Efficiency and Uplift*, p. x. For the outline of the rationalization process see Rabinbach, *Human Motor* (cit. n. 2), p. 239.

⁵ For the developments in Germany see Maier, “Between Taylorism and Technocracy” (cit. n. 3); and Rabinbach, *Human Motor*, pp. 271–288. Regarding the modernist discourse of labor power see Edward T. Morman, “Introduction,” in *Efficiency, Scientific Management, and Hospital Standardization*, ed. Morman (New York/London: Garland, 1989), pp. i–xxvii, esp. p. i.

⁶ Morman, “Introduction,” p. i; and George Rosen, “The Efficiency Criterion in Medical Care, 1900–1920: An Early Approach to an Evaluation of Health Service,” *Bulletin of the History of Medicine*, 1976, 50:28–44.

special role in these reform movements. As a form of manual labor, the surgeon's work could itself be subjected to efficiency-enhancing time-motion analysis.⁷ The engineer Frank Gilbreth, for example, used film analyses of surgical operations and concluded "that between 10 and 30 percent of the time spent under anesthesia could be saved with proper training in Tayloristic methods." Others suggested simplification and standardization of surgical instruments to increase the optimum performance of operators.⁸ A radical reformer and one of "a larger group of physicians, surgeons, nurses and administrators who tried to weld scientific management or, as in his case, industrial efficiency techniques, to medicine" was the Boston surgeon Ernest Amory Codman.⁹ Codman demanded the systematic documentation and analysis of the outcomes of surgical interventions. He listed not only all the results of his operations but also possible sources of failure. Applied on a larger scale, his "end-result system" would make it possible to compare the results of various surgeons and to improve medical practice. This system would replace traditional parameters of a surgeon's evaluation such as reputation, social standing, bedside manner, and technical skill. Codman made the link to industrial management explicit by stating that hospitals, just like factories, had the duty to ensure that they delivered only high-quality products to the public. As we will see, Böhler's rationalized fracture care was a European example of such efforts.

Another contemporary example can be found in Britain. According to Roger Cooter, in British orthopedic surgery ideas about what came to be called "rationalization" arose in the 1880s. Their main proponent was Robert Jones, who was said to have "never wasted a motion," his organization being "so perfect that there was not a moment's delay between cases." Jones reorganized orthopedic care by segregating patients according to their injury and introducing new modes of division of labor, standardization of supplies and clinical procedures, and continuity in patient care and aftercare. Jones became a leading figure for a whole cohort of British surgeons who were committed to technical expertise and who wanted to be judged on the grounds of the new standards of efficiency and productivity rather than according to more traditional criteria such as the quality of the doctor-patient relationship. Cooter links Jones's initiatives to the new ways of viewing the human body and the organization of labor: "Taylor's ideas and the new 'physiological' orthopaedics emerged together in a socioeconomic context in which economic metaphors were drawn into physiology as much as physiological metaphors were drawn into economics." "At a time," he writes, "when the whole idea of labor was being transformed, when the notion of the efficient 'human motor' was high on the intellectual agenda of the Western world, . . . the organization of Jones's orthopedic clinics embodied and exemplified modernity in medicine." If, as Joel Howell notes, "Taylor thought that one could apply the same principles of efficiency to human hands and muscles which others had applied to the gears and ratchets of machines," it was plausible that surgeons could do the same.¹⁰ Thus, the

⁷ Susan Reverby, "Stealing the Golden Eggs: Ernest Amory Codman and the Science and Management of Medicine," *Bull. Hist. Med.*, 1981, 55:156-171, on p. 157; Howell, *Technology in the Hospital* (cit. n. 3), pp. 65-66; and Morman, "Introduction," p. i.

⁸ Howell, *Technology in the Hospital*, p. 67. On Gilbreth and his relationship to Taylorism see Haber, *Efficiency and Uplift* (cit. n. 3), pp. 37-43. On simplifying and standardizing surgical instruments see Howell, *Technology in the Hospital*, p. 67; and Morman, "Introduction," pp. vi-viii.

⁹ Reverby, "Stealing the Golden Eggs" (cit. n. 7), pp. 161-162. On Codman see also Howell, *Technology in the Hospital*, pp. 66-67; and Morman, "Introduction," pp. iii-vi.

¹⁰ Roger Cooter, *Surgery and Society in Peace and War: Orthopaedics and the Organization of Modern Medicine, 1880-1948* (Houndmills, Basingstoke: Macmillan, 1993) (hereafter cited as *Cooter, Surgery and Society in Peace and War*), pp. 93, 32, 47, 113-114, 121, 122, 33; and Howell, *Technology in the Hospital*, pp. 30-31.

medical culture described here was built around mechanical practices and concepts and drew on the machine metaphor rather than the idea of the human motor. This “biomechanical” view stressed movement, mechanical function, and efficiency rather than energy. With its emphasis on gestures and processes, it related in a different way to ongoing rationalization efforts in industry.

These modernist concepts resulted in a reciprocal relationship between the organization of orthopedists’ work and their vision of the body.¹¹ Orthopedists interpreted the body as an integrated dynamic system, optimized in its efficiency and economy. Their goal was to enable the injured body’s maximum use-efficiency by restoring the locomotor system as a whole. At the same time, functional efficiency was an integral constituent of their new way of managing patients. This ideal was, remarkably, based on management strategies that had themselves been inspired by physiological idealizations of organization and function. Body perception and work organization were thus both based on a mutually dependent set of ideas about function and efficiency.

By the time of World War I, these principles had achieved a certain currency, to the extent that, as Roger Cooter and Steve Sturdy claim for Britain, “both the military and the civilian spheres were reorganized and disciplined according to the same notions of socio-economic efficiency.” The war itself seemed to embody these kinds of principles with particular clarity. Contemporary proponents of scientific management in the United States, for example, referred to “the War Machine” that had to be optimized in its efficiency. On a more general level, Daniel Pick has tracked the idea of modern war as a machine-like process—an idea that culminated in World War I, where “the killing of enemy soldiers had become an efficiency driven mechanized industrial process, perhaps best symbolized in and realized through the new technology of the machine-gun.”¹²

This context also provided the occasion for introducing modern management techniques into military health care in a comprehensive way. In British military medicine, as Mark Harrison has determined, “principles of ‘scientific management’—such as time and motion studies and specialization—were introduced in an attempt to make the best use of scarce material and human ‘resources.’”¹³ Harrison characterizes the British Army’s medical arrangements on the western front as resembling “a large machine which processed the human wreckage of war.”¹⁴ However, the machine metaphor has not been used only in retrospect, by historians. The machine aspect was made explicit by contemporaries, too—for example, in the demands for standardization and strict guidelines for wound

¹¹ I am following Cooter, *Surgery and Society in Peace and War*, p. 48.

¹² Roger Cooter and Steve Sturdy, “Of War, Medicine, and Modernity: Introduction,” in *War, Medicine, and Modernity*, ed. Cooter, Mark Harrison, and Sturdy (Stroud: Sutton, 1998), pp. 1–21, on p. 3 (both quotations); Haber, *Efficiency and Uplift* (cit. n. 3), pp. 117–133; and Daniel Pick, *War Machine: The Rationalization of Slaughter in the Modern Age* (New Haven, Conn./London: Yale Univ. Press, 1993).

¹³ Mark Harrison, “Medicine and the Management of Modern Warfare,” *History of Science*, 1996, 34:379–410, on p. 380; and Harrison, *The Medical War: British Military Medicine in the First World War* (Oxford: Oxford Univ. Press, forthcoming) (I thank Harrison for giving me access to a preliminary manuscript version; I draw here on pp. 180–181 of that version). For a French example see Perrin Selcer, “Standardizing Wounds: Alexis Carrel and the Scientific Management of Life in the First World War,” *British Journal for the History of Science*, 2007, 41:73–107.

¹⁴ Harrison, “Medicine and the Management of Modern Warfare,” p. 392. When studies were conducted in 1916–1917 into the management of casualty clearing stations, the “enquiries bore some resemblance to the ‘time and motion’ studies that had recently been developed in industry. Some recorded numbers of wounded admitted to CCSs and the proportion of each type of case, and then timed how long it took to perform each type of operation”: Harrison, *Medical War* (the quotation is from p. 185 of the manuscript version). Taylorism and other scientific management approaches were employed without explicit references to their managerial ideology, however (*ibid.*).

treatment brought forward by the renowned medical scientist and doctor Almroth Wright, at that time a consultant physician to the British Army in France. Even though these guidelines would conflict with the “cherished professional tradition that every medical man must be quite unfettered in his choice of treatment,” Wright demanded that doctors too should follow the “very foundation principle of the army that every man shall work, not as he individually thinks best but as part and parcel of a great machine.”¹⁵

The same machine metaphor can be found in the context of rationalization attempts on the Austrian side of the front as well. Confronted with dismal rates of death and disability, the Austrian Army began to put more emphasis on health issues in 1915, according to Hans-Georg Hofer. The War Office initiated intense efforts to mobilize medical resources and introduced a whole range of organizational innovations to economize manpower. These measures included the acceleration and standardization of the transport of wounded soldiers and the introduction of mobile clinics, as well as mobile surgery units with automobiles and the use of laboratories. Within the context of these rationalization efforts, the army was seen as a hierarchically organized large enterprise that required efficient systematization and perfect coordination to function properly. In this enterprise, the individual doctor was assigned the role of a skilled worker, who, as the Austrian military physician Karl Kassowitz phrased it, “received the order to see in the individual soldier just one tool among many, a means to a particular goal, namely the successful execution of military actions, a machine which, under conditions of extreme usage, needs to be monitored by the medical mechanic and in case of damage to be repaired quickly rather than permanently.”¹⁶ As we will see, Böhler contributed to Austrian rationalization efforts on his own initiative and in his own idiosyncratic way.

LORENZ BÖHLER

Lorenz Böhler was born in 1885, the son of a carpenter in the rural region of Vorarlberg in Austria. From 1905 to 1911 he studied medicine in Vienna. To what extent he was exposed to contemporary modernist ideas during that time is unknown. His only close contact with the world of academic surgery came during an internship of a couple of months at the Second Surgical Clinic at the University of Vienna, before he moved on to work as a ship’s surgeon in 1912 and then, from March 1913, as an intern in a small hospital in Decin in the Austrian-Hungarian province of Bohemia.¹⁷ Böhler was thus on

¹⁵ A. E. Wright, “An Address on Wound Infections,” *British Medical Journal*, 1915, 1:762–764, on p. 764. See also Harrison, *Medical War* (I am drawing here on pp. 186–187 of the manuscript version).

¹⁶ Hans-Georg Hofer, “Beyond ‘Freud and Wagner-Jauregg’: War, Psychiatry, and the Habsburg Army,” in *War, Violence, and German Medicine, 1914–1936*, ed. Cay-Rüdiger Prüll, Hofer, and Wolfgang U. Eckart (Freiburg: Centaurus, forthcoming) (I thank Hofer for giving me access to a preliminary version of his essay; it should be noted that the volume title is still preliminary); and Hofer, “Effizienzsteigerung und Affektdisziplin: Zum Verhältnis von Kriegspsychiatrie, Medizin und Moderne,” in *Aggression und Katharsis: Der Erste Weltkrieg im Diskurs der Moderne*, ed. Petra Ernst, Sabine Haring, and Werner Suppanz (Vienna: Passagen, 2004), pp. 219–242, on p. 228 (quoting Kassowitz). Here and throughout this essay, translations into English are mine unless otherwise indicated.

¹⁷ Biographical information in this essay is based on Otto Wichtl, *Alphabetisch gereichte Biographien aller aufgefundenen, während des Ersten Weltkriegs für das Militär bzw. Rote Kreuz röntgenologisch tätigen Ärzte, Mediziner und Zivilpersonen samt einschlägigen Beilagen*, Vol. 1 (Vienna, 1994); I consulted a typograph held in the Library of the Institute for the History of Medicine of the University of Vienna (hereafter **IGM Vienna**), signature I 64869/5. Other biographical accounts include Friedrich Lorenz, *Lorenz Böhler: Der Vater der Unfallchirurgie: Eine Festgabe des Verlages Wilhelm Maudrich zum 70. Geburtstag* (Vienna: Maudrich, 1955); and Inge Lehne, *Lorenz Böhler: Die Geschichte eines Erfolges* (Vienna: Maudrich, 1991).

the margins of the professional establishment of his time. However, in March 1914 his professional contacts made it possible for him to join a delegation of the German Society of Surgery and the International Society of Surgery on a trip to the United States. The last stop on his journey was a visit to the Mayo Clinic in Rochester, Minnesota, where, according to his biographer Inge Lehne, he studied that well-organized institution, with its culture of teamwork among different specialists. In light of Böhler's subsequent projects, it is interesting to note that the Mayo Clinic had just been reorganized according to the principles of specialization and teamwork. Among other things, record keeping and administration had been rationalized and standardized. Surgery at the Mayo Clinic was in the middle of an exponential growth spurt, with regard to both the number and the range of operations being performed. One of the developing specialties in which the clinic would gain international prestige was orthopedic surgery. To that end, the Mayos had sent general surgeon Melvin S. Henderson to train in the departments of two prominent proponents of rationalized fracture care in Britain, Robert Jones in Liverpool and Harold Stiles in Edinburgh. After his return in 1912, Henderson was placed in charge of organizing and directing the clinic's Section on Orthopedic Surgery in the Division of Surgery.¹⁸

It was apparently here that Böhler became interested in bone surgery. He later related that he had picked up his techniques of fracture treatment in the United States and attributed a particularly economical suture technique to his time in Rochester. Having heard from Charles Mayo about centers for fracture care in London and Liverpool, Böhler planned an extended visit to see them. Mayo had already equipped him with a letter of recommendation to Arbuthnot Lane in London, for the purpose of studying his methods of operative fracture care, when World War I broke out and he had to return to Austria.¹⁹

WARTIME SURGERY

At the end of August 1914 Böhler found himself in the position of military surgeon in charge of field hospital 4/14 on the Galician front. It was the first time that the twenty-nine-year-old doctor was responsible for a unit of his own. Here the seeds of the system for which he later became famous become discernible. Böhler tried to create islands of order and rationality within what he saw as the general turmoil of war. He began by subjecting his unit to a detailed reorganization, separating the wounded soldiers according to the site of their injuries—skull, thorax, abdomen, and arms and legs. Nurses were trained to handle specific injuries and the specific dressings for each—a division of labor that was probably inspired by what he had seen in Rochester. He rationalized and optimized all procedures, so that splinting a thigh fracture, for example, took him only ten

¹⁸ On Böhler's Mayo visit see Lehne, *Lorenz Böhler*, pp. 37–42. On the reorganization of the clinic itself see William F. Braasch, *Early Days in the Mayo Clinic* (Springfield, Ill.: Thomas, 1969), pp. 34–36 (record keeping and administration), 38 (orthopedic surgery); and Mayo Clinic, Division of Public Relations, *Sketch of the History of the Mayo Clinic and the Mayo Foundation* (Philadelphia/London: Saunders, 1926), pp. 100–103. Regarding Henderson see *ibid.*, pp. 17–50.

¹⁹ Daniela Claudia Angetter, *Dem Tode geweiht und doch gerettet: Die Sanitätsversorgung am Isonzo und in den Dolomiten 1915–18* (Frankfurt on Main: Lang, 1995), p. 136 (origin of techniques of fracture treatment); Lorenz Böhler, "Über Catgut sparende Unterbindungen," *Zentralblatt für Chirurgie*, 1918, 45:21–22 (suture technique); and Lehne, *Lorenz Böhler*, p. 42 (recommendation to Lane).

minutes, as he later proudly remarked.²⁰ According to his own account, during his two years at the front Böhler treated thirty thousand injured soldiers.

Böhler was promoted to the rank of *Oberarzt* in January 1915 and to *Regimentsarzt* in September 1915 and moved to the Italian front at the Isonzo and the Dolomites.²¹ After a bout with health problems that took him away from the front, on 1 August 1916 he was made head of the Second Surgical Section (*zweite chirurgische Abteilung*) of the reserve hospital in Bolzano, South Tyrol, located about 30 kilometers behind the front. The reserve hospital was housed in what had been a trade school and was dedicated to convalescent and lightly injured soldiers.²² But Böhler had other plans. He asked for official approval to extend his activities to the treatment of bone fractures and joint injuries in order, as he would later write, to test and demonstrate the usefulness of his newly devised treatment methods for preventing long-term damage after bone fractures. The request was turned down for reasons of expense. But Böhler was not so easily deterred.

He used his own money and improvisational skills to set up his specialized field hospital. Despite these contributions, the project bore the marks of material scarcity. The patients were put in military camp beds with mattresses filled with wood wool, for lack of straw. For more than a year there was no bathtub. The floors were made of soft wood, without the usual linoleum covering. Initially there were 240 beds, later only 200. The number of female nurses varied between eight and fourteen. There were also two male nurses, an x-ray technician, three office workers, and six to eight cleaning women. The supply situation in the Austrian Army was poor, and the military medical service suffered from shortages of even the most basic materials. Böhler encountered great difficulties in procuring materials, such as metal rods and bands, steel for springs, screws, nails, and rollers for his treatment devices. He therefore used his vacations to search out these items in the little country towns of the region. In June 1917 he had assembled the equipment required to treat two hundred patients with bone fractures, the typical case load of an Austrian field hospital.²³

²⁰ Lorenz Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" *Zeitschrift für Orthopädische Chirurgie*, 1924, 45:244–281 (hereafter cited as **Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?"**), esp. pp. 257–258. See also Angetter, *Dem Tode geweiht und doch gerettet*, pp. 136–142; Angetter had access to Böhler's war diaries. On the situation at the Galician front more generally see Brigitte Biwald, *Von Helden und Krüppeln: Das österreichisch-ungarische Militärsanitätswesen im Ersten Weltkrieg* (Vienna: Öbv&Htp, 2002), Vol. 2, pp. 342–346. On the underestimation of the medical war requirements and the chaotic conditions resulting from it see Hans-Georg Hofer, *Nervenschwäche und Krieg: Modernitätskritik und Krisenbewältigung in der österreichischen Psychiatrie (1880–1920)* (Vienna: Böhlau, 2004), pp. 202–208.

²¹ Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" p. 246. Böhler's career is documented in the *Vormerkblatt für die Qualifikationsbeschreibung*, 1 June 1916–31 Oct. 1917, War Archives Vienna; photocopies of the original documents are at IGM Vienna, signature I 64869/5. On the military medical hierarchy in the Austrian Army in World War I see Biwald, *Von Helden und Krüppeln*, Vol. 2, pp. 94–115. On the organization of military medicine in the region, including the military ranks and the different types of units, see Angetter, *Dem Tode geweiht und doch gerettet*.

²² On the establishment of the hospital see 20. Korpskommando 1917 No. 66865, San. Feldpost 514, 12 Oct. 1917, Gegenstand Improv. Felspital des XX. Korps dessen Etablierung in Bozen, War Archives Vienna; and *Teilung des Reservespitals in Bozen mit Stadtplan Bozen-Gries*, War Archives Vienna: in both cases photocopies of the original documents are at IGM Vienna, signature I 64869/5. "Bozen" is the German version of "Bolzano." It was typical for military hospitals to be housed in public buildings; see Angetter, *Dem Tode geweiht und doch gerettet*, p. 125.

²³ Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" pp. 257–266. On the equipment of Austrian field hospitals and material shortages during the war generally see Biwald, *Von Helden*

A SYSTEM OF FRACTURE CARE

It was in Bolzano that Böhler first published the principles of fracture treatment for which he would later become world famous. They consisted in, first, the early adjustment of the bone fragments, followed, second, by the complete and uninterrupted immobilization of the fracture site by means of plaster casts, splints, or traction. The third and equally important principle was the restoration of the limb's function by active exercise of its joints and muscles. The focus of Böhler's treatment efforts was not just the broken bone itself but the whole locomotor system, for which, as he emphasized, the bones were just the support. Active exercise would help to restore function by stimulating local blood circulation (which reduced swelling and cyanosis), preventing adhesions of skin, muscles, and bones, averting muscle atrophy, and restoring the whole range of joint movement. In line with his emphasis on function (as opposed to structure), Böhler strongly advised against any disturbance of the wound through surgical operations. Bone splinters should not be removed, and the wound should not be cleaned extensively, in particular not with antiseptics. Even the initial realignment of the fragments had to be done as gently as possible, without causing any pain.²⁴

Böhler set a high value on simplicity. He resolutely rejected the use of the various sophisticated and complex technologies for promoting wound and bone healing that were under discussion at the time, such as massage, deep antiseptics, vaccination, electric and x-ray stimulation, and phototherapy. Although this attitude might initially have been shaped by war-related conditions of scarcity, Böhler would maintain his skeptical stance toward technical innovation: all the potential technical progress in surgery would not change the basic and simple laws of fracture treatment, he declared in 1924. For him, the best protection against infection was not chemical antiseptics but "those protective bodies that circulate in the body." The basic principle of healing was rest—rest for the wounds and rest for the wounded—combined with exercise of the noninjured parts of the body. His anti-interventionist stance and trust in the body's power of self-healing place him in the tradition of conservative surgery and in the company of British proponents of rationalization, whose innovations embodied simplification and robustness rather than sophistication.²⁵ They represented an alternative to the dominant trend toward invasive, high-tech surgery, which was geared more toward restoring anatomical structures than regaining function. This alternative approach was more common in those specialties that dealt with the locomotor system, where function was actually equivalent to mechanical function (as opposed to the functioning of an organ), and that typically had close ties to industrial environments—

und Krüppeln (cit. n. 20), Vol. 1, pp. 80–84; on conditions in that part of the front more specifically see Angetter, *Dem Tode geweiht und doch gerettet*, pp. 127–130.

²⁴ For the principles see, e.g., Lorenz Böhler, "Ueber die Einheitsbehandlung der Unterschenkelbrüche," *Münchener Medizinische Wochenschrift*, 1918, 65:68–78; the benefits of active exercise are detailed on p. 73. Regarding the focus on the whole locomotor system see Böhler, "Einfacher Apparat für Bewegungen während der Behandlung der Oberschenkel-schußbrüche," *Wiener Klinische Wochenschrift*, 1917, 30:723–728. On the importance of gentle realignment see Böhler, "Hat der Arzt das Recht, bei Knochen-schussbrüchen die Wunde radikal auszuschneiden?" *Münchener Med. Wochenschr.*, 1918, 65:817–822.

²⁵ Böhler, "Einfacher Apparat für Bewegungen während der Behandlung der Oberschenkel-schußbrüche," p. 728 (rejection of sophisticated techniques); Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" p. 255 (quotation); Böhler, "Ueber die Einheitsbehandlung der Unterschenkelbrüche," pp. 68–78 (importance of rest); and Cooter, *Surgery and Society in Peace and War*, pp. 20–21 (on the British proponents of rationalization).

for example, in accident services or accident insurance companies. Accordingly, it often went along with an interest in efficiency. Its proponents thus favored low-risk, low-tech, economical, robust, and reliable technologies over the glamorous “big surgery” of the day—an attitude that, as we will see, was fully compatible with contemporary modernist sensibilities in art, music, philosophy, and science, which also championed simplicity, clarity, and functionality.

It is consistent with this attitude that the principles Böhler championed were by no means new. The knowledge on which they were based was well established, as he always pointed out; but, as he deplored, they were rarely applied correctly.²⁶ The reason for this neglect was the fact that these principles were so hard to implement in a consistent way. It was technically extremely difficult to ensure the complete immobilization of the fracture site while simultaneously enabling exercise of the neighboring joints and muscles. Böhler frequently reported on how much damage he had seen resulting from imperfect immobilization. As early as 1916, he stated that among the 350 pretreated upper-leg fractures he had seen so far, only two had come with an adequate dressing. Even very small flaws in the immobilization technique could lead to disastrous long-term consequences, such as infections and extensive limb damage. On the other hand, excessive immobilization would damage muscles and joints.²⁷ The crux of the problem was that the simultaneous immobilization of the fracture site and exercise of the remaining body required an enormous amount of control. Böhler responded to this challenge by employing both technical means of control—special devices—and organizational means of control for regulating and standardizing practices.

MACHINES

Böhler’s treatment devices were built to immobilize the fracture itself but simultaneously to allow for very specific and well-controlled movements of the patient’s body. In 1917 he reported for the first time on an apparatus he designed for the treatment of thigh fractures. It was a contraption of reels, strings, and weights that permitted the patient to move his knee joint—either actively or passively, with the help of his arms—while guaranteeing a good fixation of the fracture (see Figure 1).²⁸

For constructing his treatment machines, Böhler was able to take advantage of the workshop facilities at the trade school that housed the hospital and of technical assistance from one of the school’s former teachers. In 1921 he wrote that his devices in their present simplicity were the fruit of five years of constant optimizing for efficient and reliable

²⁶ See, e.g., Böhler, “Ueber die Einheitsbehandlung der Unterschenkelbrüche,” p. 68; and Böhler, “Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?” p. 249. For an authoritative survey of the techniques of fracture treatment at the time see B. Bardenheuer and R. Graessner, “Die Behandlung der Frakturen,” *Ergebnisse der Chirurgie und Orthopädie*, 1910, 1:173–240. It shows the similarity of existing techniques to those suggested by Böhler.

²⁷ Lorenz Böhler, “Lagerungs- und Streckapparate für die funktionelle Bewegungsbehandlung von Knochenbrüchen und Gelenkverletzungen der unteren Gliedmassen,” *Münchener Med. Wochenschr.*, 1921, 68:881–888, esp. p. 883 (technical difficulties of proper immobilization); Böhler, “Zur Behandlung von Knochenbrüchen im Felde und im Hinterlande mittels Schienen,” *Wiener Klin. Wochenschr.*, 1916, 29, no. 23 (unpaginated offprint) (consequences of imperfect immobilization); and Böhler, “Transportverbände für Schussfrakturen und Gelenkschüsse in der vordersten Linie,” *Medizinische Klinik*, 1916, 12:733–739 (consequences of excessive immobilization).

²⁸ Lorenz Böhler, “Zur Behandlung der Oberschenkelchussbrüche,” *Zentralbl. Chirurg.*, 1917, 44 (unpaginated offprint).

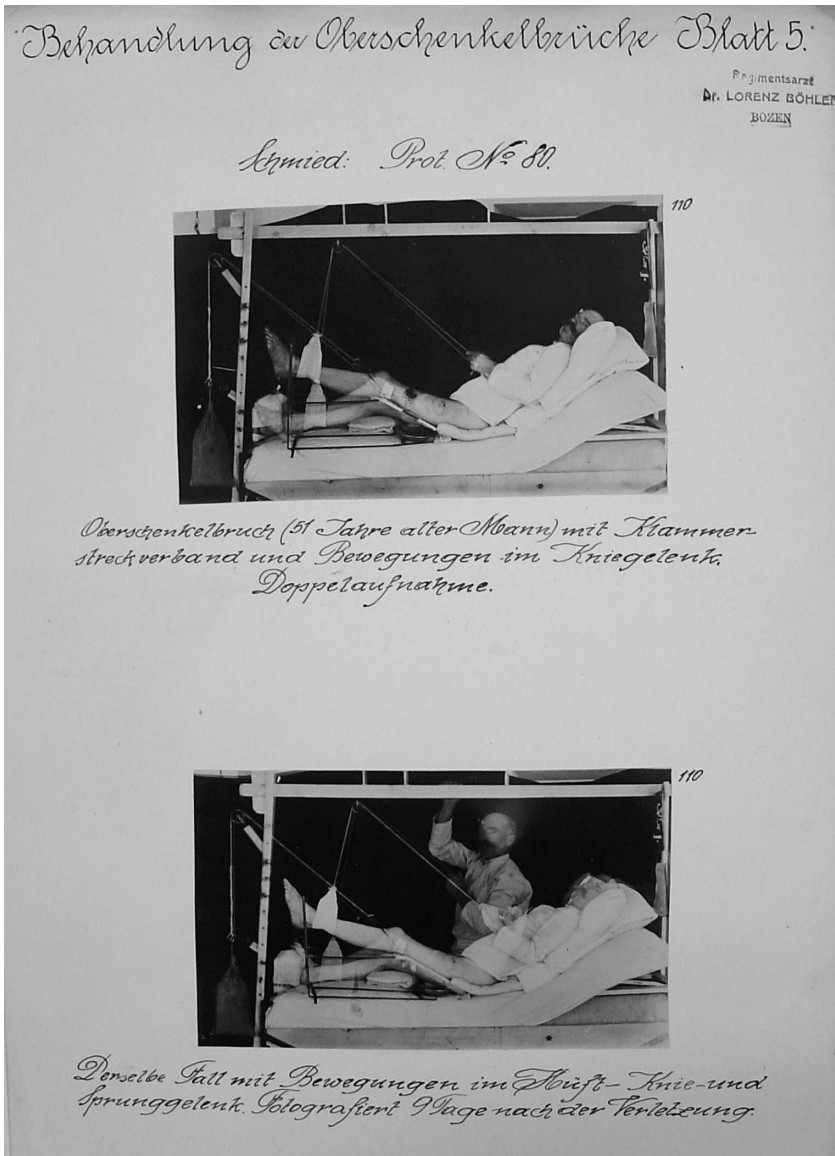


Figure 1. Device for treating thigh fractures. Images in double exposure, with a somewhat fuzzy Lorenz Böhler checking the strings below. The knee joint can be moved within defined parameters, either actively or passively with the help of a string pulled by the patient. (Böhler Papers, Institute for the History of Medicine, University of Vienna.)

function. They were built in such a way that their various cords would not interfere with each other and unnecessary friction was avoided. The cords always had to run along the correct axis and should not derail. Böhler's machines were variations of existing appliances. As he emphasized time and again, he did not aim at revolutionary inventions; all he wanted was to simplify and standardize existing machines to make them cheaper and more reliable. Simplicity, at first born out of the necessities of war, became one of Böhler's main technological principles. However, even in their simplified form the

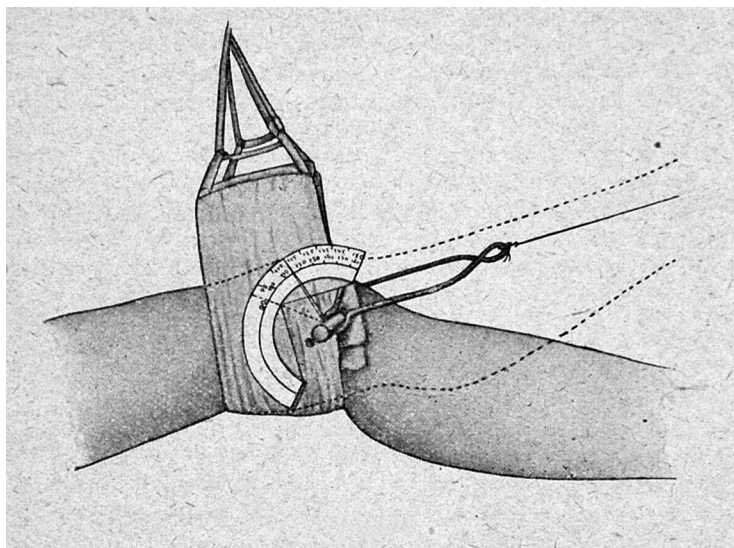


Figure 2. Machine–body interface: flexion measuring device. (Lorenz Böhler, “Einfacher Apparat für Bewegungen während der Behandlung der Oberschenkelbrüche,” *Wiener Klinische Wochenschrift*, 1917, 30:723–728, Figure 3.)

machines required rigorous, ongoing control. Since every detail was important, the treatment devices had to be checked constantly to ensure that they allowed the proper degree of movement and afforded the necessary immobilization. Every day, the rolls, strings, and weights had to be tested and regulated to ensure their smooth operation. The same thing applied to their mirror images—the bodies of the injured soldiers—whose function also had to be checked on a daily basis.²⁹

Another, related issue was the tight coupling of machine and body. For thigh fractures Böhler used a Steinmann nail, driven through the tibia, in combination with a bracket to allow for controlled flexion of the knee. He even equipped this new link with a fixed device for measuring the degree of flexion on a numerical scale (see Figure 2).³⁰ Adding a measuring tool to the body in this way is emblematic of Böhler’s control technology, enacted at the interface of body and machine.

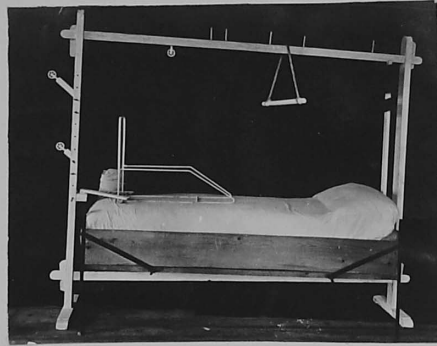
What makes Böhler’s approach particularly remarkable is that he went beyond the individual level and conceived his treatment for potential mass application, on a quasi-industrial scale. The multiplication of treatment machines and procedures raised further challenges in terms of control (see Figure 3). Böhler met them through the thorough standardization of materials and practices. According to his own account, “everything” in his hospital was “normalized and typified”—“every splint, every bandage, every gesture,

²⁹ Böhler, “Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?” p. 261 (workshop facilities and technical assistance); Böhler, “Lagerungs- und Streckapparate” (cit. n. 27), p. 888 (optimization over time); Böhler, “Einfacher Apparat für Bewegungen während der Behandlung der Oberschenkelbruße” (cit. n. 25), p. 723 (simplify and standardize); Lorenz Böhler, “Anatomische Bemerkungen über die Versorgung der Oberarmschußbrüche,” *Wiener Klin. Wochenschr.*, 1916, 30, no. 4 (unpaginated offprint) (checking device function); and Böhler, “Lagerungs- und Streckapparate,” p. 888 (checking patient function).

³⁰ Böhler, “Einfacher Apparat für Bewegungen während der Behandlung der Oberschenkelbruße,” pp. 724–725.

Behandlung der Oberschenkelbrüche Blatt 10.

Regimentsarzt
Dr. LORENZ BÖHLER
BOZEN



Fortiges Bett für Oberschenkelbrüche: Holz-wolle fest gestopfter Strohsack.
Galgeln mit Spreize und Schiene und Fußstütze aus einem Holz-woll-
polster für das gesunde Bein.



Fortiges Zimmer für - Oberschenkelbrüche.

Figure 3. Multiplication and standardization of treatment devices. The top image shows one treatment unit, the image at the bottom a room with several such units. (Böhler Papers, Institute for the History of Medicine, University of Vienna.)

every knot." All the elements of his devices had the same measures so that they could be exchanged at any time. When Böhler decided to change an individual device, all the other devices of that type had to be altered too, so that there was always only one standard version. Böhler emphasized the reliability of his devices. They were in constant use over a period of three years in eighty to a hundred beds. The braces that connected the machines to the patients' heels, he wrote, had been in use for nine thousand days, those for the thigh

and the flexible nail he used for the tibia for three thousand days.³¹ This, of course, was the language of industrial mass production, not of traditional, individualized medicine. We will see that he talked about his patients in a similar way.

STANDARDIZATION AND DIVISION OF LABOR

Not only did Böhler use machines for treatment; he also organized his hospital like a well-functioning machine, following the principles of efficiency and productivity. If the Taylorist engineer was, as the historian Charles Maier has put it, a “master of machines” as well as “a potential manipulator of all industrial relationships,” so too was Böhler. The basic principle of Böhler’s system was what he called *Einheitsbehandlung*, unified or standardized treatment. This meant that all patients with a particular type of fracture—for example, thigh fractures—were treated in exactly the same way, using exactly the same devices. Furthermore, *Einheitsbehandlung* included a specific division of labor, in which every nurse was trained to deal with only one kind of injury, just as in his little sanitary unit in 1914–1915. In addition, Böhler’s *Einheitsbehandlung* included a particular division of space. Unlike in most hospitals, where, he claimed, patients with various kinds of injuries were mixed in together, in Böhler’s hospital all patients with one type of fracture were moved into the same room and treated identically.³² As a consequence, the rooms in which the unified treatment was carried out looked like healing factories. They were filled with a series of identical machines, treating supposedly identical injuries, ideally producing identical results (see Figure 4). The spatial division was the physical equivalent of fracture classification. The fact that the latter was very schematic and rough—with broad categories such as “lower-leg fractures”—underscores Böhler’s strategy of de-emphasizing the individual character of each injury and each patient.

We can see how segregation was used as a typically modern strategy of enhancing control by taking phenomena out of their original context and putting them in new, artificial, and systematically constructed contexts. Böhler’s serialization of treatment sites formed a permanent grid that eliminated confusion and enabled comparison and assessment—as described by Michel Foucault for the modern factory. This arrangement made it possible to carry out a type of supervision that was both general and individual just by walking up and down the central aisle—another feature of the factory Foucault points to. “Distribution and supervision and intelligibility” were indeed “inextricably bound up.”³³

Another element of Böhler’s reorganization scheme was continuity of treatment. Normally, he claimed, military surgeons were so busy performing operations that they had no time or opportunity to find out what had become of the patients they had operated on. They also had to delegate crucial parts of the treatment process to others—for example, putting on the dressing and conducting the aftercare. Böhler, by contrast, made a point of keeping all stages of the treatment process in his own hands. Combining spatial segregation with

³¹ Böhler, “Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?” p. 260 (quotation); and Böhler, “Lagerungs- und Streckapparate” (cit. n. 27), p. 888 (reliability data).

³² Maier, “Between Taylorism and Technocracy” (cit. n. 3), p. 28; Böhler, “Ueber die Einheitsbehandlung der Unterschenkelbrüche” (cit. n. 24); and Böhler, “Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?” pp. 260–261 (segregation according to injury).

³³ Michel Foucault, *Discipline and Punish: The Birth of the Prison* (New York: Vintage, 1995), pp. 141–149, on p. 149. Böhler’s example also corresponds to Foucault’s claim that the medical supervision of diseases through rigorous distribution and partitioning of space is inseparable “from a whole series of other controls” (p. 144) such as military, fiscal, and administrative controls—all three of which apply to the strategy Böhler pursued in his military hospital.

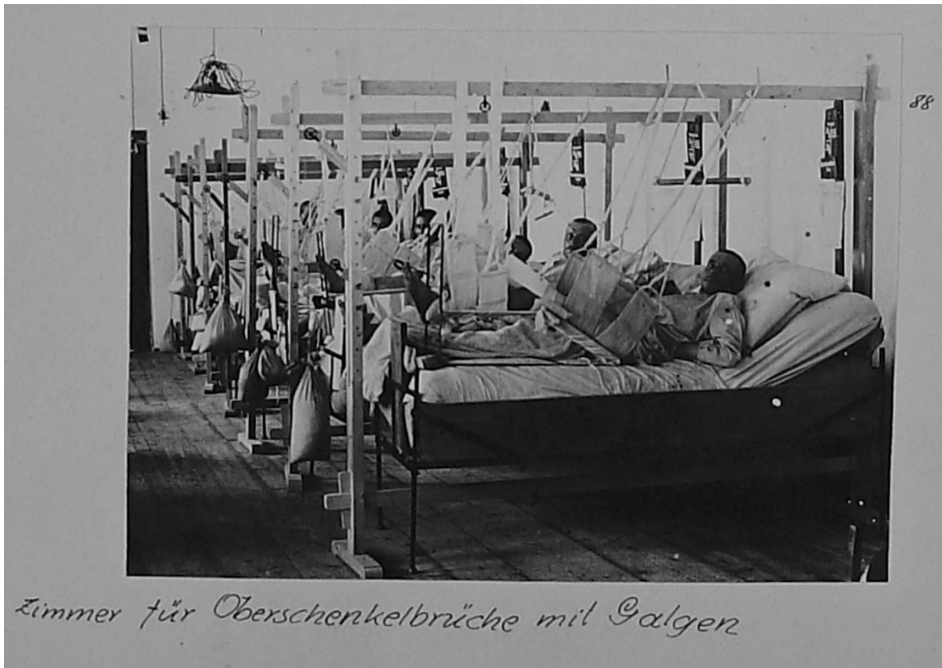


Figure 4. Einheitbehandlung in a room filled with patients who all have thigh fractures and are all treated in the same way. (Böhler Papers, Institute for the History of Medicine, University of Vienna.)

temporal continuity of surveillance gave him a new degree of control and enabled him to determine the causes of bad outcomes, something that, he claimed, had in fact been physically impossible before.³⁴

RATIONALIZATION

Life at Böhler's field hospital was strictly organized. All the necessary information about the patients—date of injury and of admission, body temperature, last change of dressing, operative interventions, and so forth—was noted down on little tables at their heads (see Figure 4). A picture of the fracture as indicated by an x-ray was drawn onto the healthy leg. Patient rounds took three hours in the morning and ninety minutes in the afternoon. Böhler saw every patient twice a day and checked both bodies and devices. And, like Taylor, he measured the time this supervision took: each lower-leg fracture took thirty seconds, each thigh fracture two minutes. Whenever a new batch of injured soldiers was expected, he prepared everything in a way that enabled him to give definitive treatment to ten lower-leg fractures or six upper-leg fractures within one hour.³⁵

Böhler saved time and personnel wherever he could. "In order to save man-power," he designed a special device that enabled him to make plaster casts without the usual assistance by one or two helpers. To make up for the lack of personnel in the unit, patients had to help out. Soldiers with lower-leg fractures and walking casts carried wash bowls.

³⁴ Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" p. 273.

³⁵ *Ibid.*, p. 263.

Patients with one fractured arm had to use the healthy arm to carry food from the kitchen. Those who were bedridden prepared dressing materials and threads. Böhler's integration of patients' work power is reminiscent of Robert Jones's curative workshop, where, "in the name of occupational therapy, not only did [patients] manufacture all the splints, surgical boots, and other appliances required for the hospitals to which they were attached . . . , those assigned to the workshops also performed all the maintenance work for the hospital, and carried out the wiring and plumbing for the installation of the electrotherapeutic and hydrotherapeutic departments."³⁶

Böhler claimed that this strategy of strict standardization and rationalization had made it possible for him to achieve good treatment results under conditions of wartime scarcity; in other words, he claimed a high degree of efficiency for his system. Like a factory under the Fordist system, Böhler's ward thus resembled a "kind of super-machine in its own right, with both human and mechanical parts." It was conceived as the same kind of "hierarchy of standardized, segmented and subsegmented parts, all of which were interchangeable, . . . with a Taylorised workforce, contentedly learning and developing their skills, . . . but also performing standardized repeated actions"; and it would be "managed by an elite of engineers, supervisors and designers."³⁷

DOCUMENTATION

Another important element of Böhler's system concerned the output of his "treatment machine," which he subjected to meticulous documentation and accounting. Like Codman, Böhler concentrated explicitly on finding, exposing, and correcting mistakes in surgical technique. Given his functional orientation, Böhler's standard for evaluating his treatment outcomes was the restored function of the patient's musculoskeletal system. In his publications Böhler gave accounts of all his cases. But he insisted on a particular format: trying to avoid the subjectivity of language, Böhler rejected all verbal descriptions, admitting only numerical data and photographs. In his overall account of his Bolzano experience he listed the numbers of each type of injury treated, the numbers and percentages of amputations and deaths that occurred with each type of injury, the duration of treatment, and the outcome.³⁸

In this context, Böhler employed a whole range of measuring and visualizing technologies. He kept file sheets that combined different visual media—photographs of injuries, treatments, and range of mobility, x-rays, and sketches—with written material (see Figure 5). These sheets seem to represent a stage between the individual patient's clinical record and a scientific

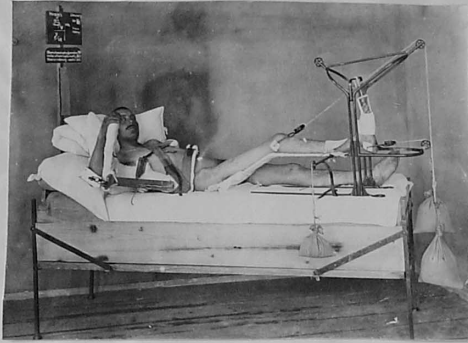
³⁶ Böhler, "Ueber die Einheitsbehandlung der Unterschenkelbrüche" (cit. n. 24), p. 74 ("to save manpower"); Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" p. 264 (patients' contributions); and Cooter, *Surgery and Society in Peace and War*, p. 118 (Jones's curative workshop).

³⁷ Pick, *War Machine* (cit. n. 12), p. 175. For Böhler's claims about efficiency see Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" p. 260. For the parallels to the scientific management strategy and its emphasis on efficiency see Maier, "Between Taylorism and Technocracy" (cit. n. 3), p. 30. On the "efficient machine" that responded to the new demands from industrialization and "whose effect will be maximized by the concerted articulation of the elementary parts of which it is composed" see Foucault, *Discipline and Punish* (cit. n. 33), p. 164.

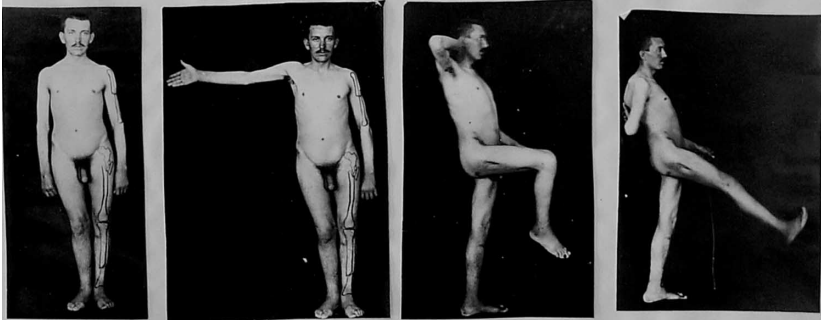
³⁸ Lorenz Böhler, *Technik der Knochenbruchbehandlung* (Vienna: Maudrich, 1929), p. v (insistence on uncovering and correcting mistakes); Böhler, "Der Begriff 'Heilung' und die Darstellung der Funktion bei der blutigen Behandlung von Knochenbrüchen und bei anderen Verletzungen," *Archiv für Klinische Chirurgie*, 1924, 133 (unpaginated offprint) (rejection of verbal descriptions and reliance on numerical data and photographs); and Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" pp. 267–272 (numerical results from Bolzano).

Oberschenkelblatt 41

Frajci: 147. Granate 23. 7. 1918. 22. III. 1918. Dr. LORENZ BÖHLER
Regimentsarzt
6. Dem. Kav. 392.
213.



Mann mit Oberschenkelschußbruch (Einschuß des Granat-splitters am Hüfter, aus-
schuß unter dem Trochantor). Offenem Unterschenkelbruch und Oberarm splitter-
bruch in Behandlung.



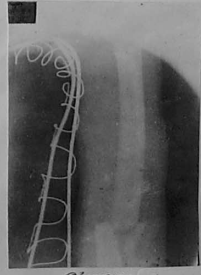
Funktion 3 Monate nach der Verletzung. Alle Knochen sind ohne Verkürzung,
und in guter Stellung geheilt. Die Muskeln sind kräftig - die Rente frei. Der
Mann kann schon ohne Stock gehen.



Oberschenkel



Unterschenkel



Oberarm

Röntgenbilder vor der Behandlung.

55185/41

Figure 5. Documentation: a case of thigh fracture. Top: The treatment. Middle: The treatment result, in the form of a photographic demonstration of the patient's locomotor function; note the sketch of the x-ray image of the fracture on the healthy leg. Bottom: The pretreatment x-rays of the broken thigh bone. (Böhler Papers, Institute for the History of Medicine, University of Vienna.)

paper. Half of the field hospital's budget went to x-rays and photographs, of which he took more than 1,250 in total.³⁹ For Böhler, photography created a new degree of objectivity. Photographs, he wrote, provided much better information about a limb's usability than even the most detailed descriptions could: "They encourage self-criticism and exact observation and show many details the importance of which often becomes obvious only later on." Böhler used the photographs from his file sheets extensively as evidence in his publications and his correspondence with the military bureaucracy. He started publishing the photos from Bolzano in 1917, alongside sketches of his traction treatment techniques.⁴⁰ In a 1918 paper on the standardized treatment of lower-leg fractures, he made extensive use of photos for the first time. In the text that went with his published pictures, he informed the reader that he had not selected examples of particularly good results; rather, every single one of the men he treated was able to stretch his injured leg actively, "as the [patients in] figure 10 and 11 show."⁴¹ He frequently used phrases like "as we can see from the pictures," thus rhetorically casting the viewer as a witness and taking advantage of what was held to be the mechanical objectivity of photography.⁴² In 1929, in the introduction to the first edition of his textbook (which had 234 illustrations on 176 pages), he emphasized the value of visualization: "Since one can learn more from images than from lengthy words, the whole book is equipped with numerous photos and sketches."⁴³

As the treatment was not just about bones growing together, the photographs had to provide comprehensive evidence of musculoskeletal function. The whole limb and all its joints must be assessed. In the case of shoulder injuries, for example, the function of the fingers had to be examined too. The position and posture of the whole body had to be taken into account in order to exclude the influence of compensation by nonaffected joints and muscles. Therefore, most images show the entire, unclothed body in different postures (see Figure 5). For the hip joint, for example, nine different pictures were needed. In order to document joint function objectively, the movements are broken down into their discrete components. To demonstrate that a patient was able to support his injured limb without the help of the therapeutic device, Böhler used long exposure times (e.g., 5 seconds). To show the range of active movement, he used double exposure.⁴⁴

This use of double exposure and its effect of decomposing movements into their elementary constituents is reminiscent of Etienne-Jules Marey's studies of bodies in motion a couple of decades earlier, but at Böhler's time the technique was frequently employed for the documentation of orthopedic treatment results. Various other components of Böhler's imagery had also been used by other surgeons.⁴⁵ Before-and-after

³⁹ Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" p. 266. On the introduction of x-rays and photographs as evidence of the effectiveness of treatment techniques in orthopedic surgery see Andrew Warwick, "X-Rays as Evidence in German Orthopedic Surgery, 1895–1900," *Isis*, 2005, 96:1–24.

⁴⁰ Böhler, "Der Begriff 'Heilung' und die Darstellung der Funktion" (cit. n. 38) (quotation); and Böhler, "Einfacher Apparat für Bewegungen während der Behandlung der Oberschenkelbruchbrüche" (cit. n. 24), pp. 724–727.

⁴¹ Böhler, "Ueber die Einheitsbehandlung der Unterschenkelbrüche" (cit. n. 24), p. 75. This is also the first of Böhler's publications that shows pictures of lined-up patients (pp. 72–76).

⁴² See, e.g., Lorenz Böhler, "Die Ausbildung der Ärzte in der Unfallchirurgie," *Monatsschrift für Unfallheilkunde und Versicherungsmedizin*, 1924, 31:241–247. On the mechanical objectivity of photography see Lorraine Daston and Peter Galison, "The Image of Objectivity," *Representations*, 1992, 40:81–128.

⁴³ Böhler, *Technik der Knochenbruchbehandlung* (cit. n. 38), p. vi.

⁴⁴ Böhler, "Der Begriff 'Heilung' und die Darstellung der Funktion" (cit. n. 38).

⁴⁵ Böhler adopted the idea of using an orientation line drawn on the lower body in photographs of naked patients in different poses from the Budapest orthopedist Julius Dollinger; see Dollinger, "Die veralteten



Figure 6. Lined-up patients in synchronous movement. The x-ray of the broken bone drawn on the healthy leg is particularly clearly visible in the first patient. (Böhler Papers, Institute for the History of Medicine, University of Vienna.)

pictures, for example, were quite common. However, Böhler's use of photography was special in the way it transcended the individual case. He lined up groups of patients with the same fracture and took photographs as they performed specified movements simultaneously (see Figure 6). These images function as a kind of visual account of his treatment results; as the number of patients photographed increases, they take on the character of visual statistics. Böhler emphasized that he was not interested in showcasing particularly successful cases but sought to present a random sample of the totality of patients he had treated.⁴⁶

Böhler's photographs embody his general approach. As we have seen, his treatment looked like it was being performed on an assembly line. The outcome pictures now show the restored bodies as the "output" of this factory-like process (see Figures 7 and 8). Böhler thus presented his patients as though they were industrial mass products. In their nakedness, they bear the imprint of medical discipline. In the simultaneity of their movements, they embody military discipline. Getting a group of naked men to line up and perform the same movements simultaneously was possible only under the special circumstances of the war. In his later publications Böhler had to resort to photomontage to achieve the same effect.⁴⁷

traumatischen Verrenkungen der Schulter, des Ellenbogens und der Hüfte," *Ergebn. Chirurg. Orthop.*, 1911, 3:83–194. On Marey's studies see, e.g., Rabinbach, *Human Motor* (cit. n. 2), pp. 84–119.

⁴⁶ Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" p. 278.

⁴⁷ See, e.g., Lorenz Böhler, "Unfallkrankenhäuser, Unfallabteilungen, Unfallkliniken," *Archiv für Orthopädische und Unfallchirurgie*, 1942, 42:5–23; for a photomontage see p. 13.

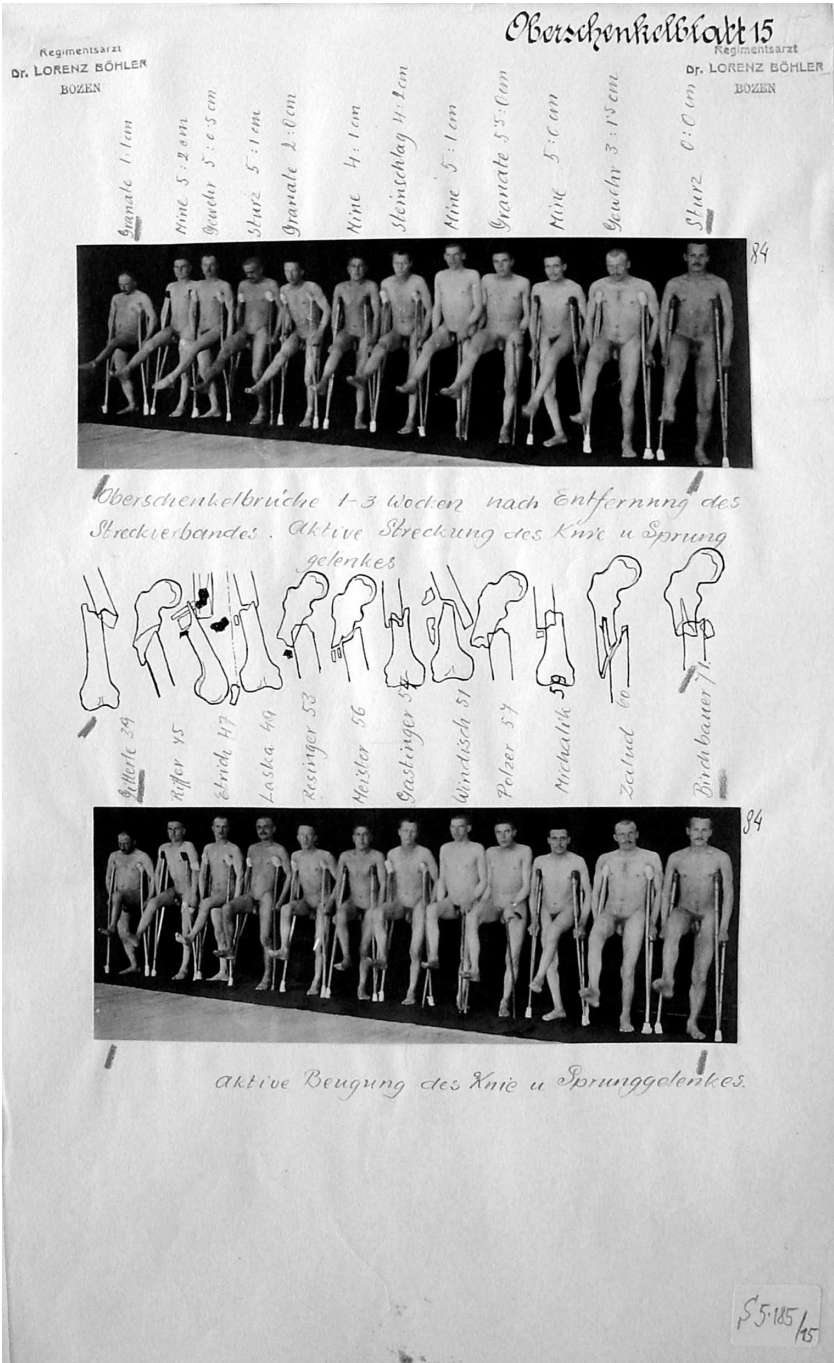


Figure 7. Visual statistics: patients with thigh fractures, demonstrating active movement of the hip and knee joints. Middle: Sketches of the respective x-ray images. (Böhler Papers, Institute for the History of Medicine, University of Vienna.)

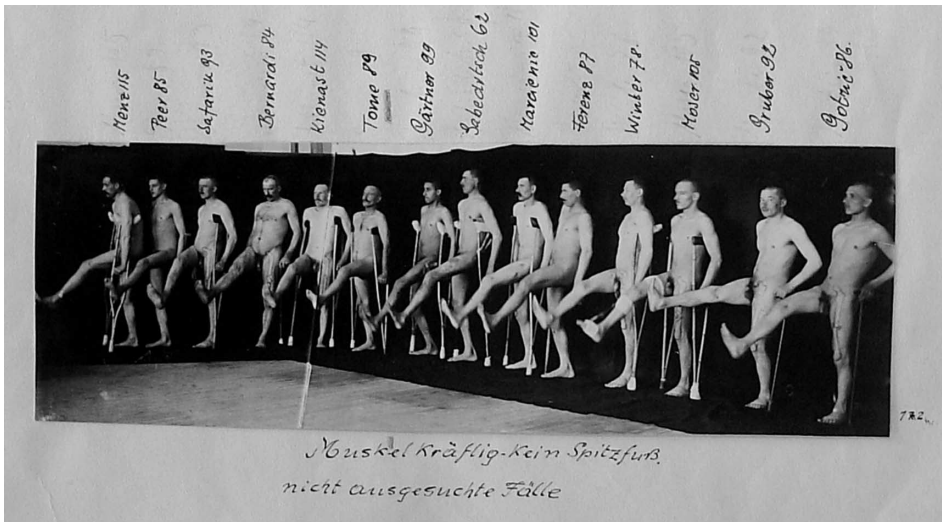


Figure 8. Handwritten comment: “muscles strong—no pes equines—non-selected cases.” (Böhler Papers, Institute for the History of Medicine, University of Vienna.)

ECONOMY

In evaluating his surgical outcomes, Böhler put them in a larger economic perspective. Here his concern with mechanical efficiency explicitly converged with ideas about economic efficiency.⁴⁸ The ultimate parameter for judging the effectiveness of his fracture treatment went beyond the purely physical aspects: it was the functioning of the injured person’s body in the work process. There was a quantifiable indicator of the effects of treatment: the calculation of compensation owed for the purpose of accident insurance payments. In this context, loss of function was expressed as a percentage reflecting the limitation of an individual’s earning power. Böhler used the numbers that had been published by the AUVA in 1917.

He had come across these statistics in the summer of 1917 in a bookstore in Vienna, on the way back to his hospital after a leave of absence. In his autobiographical writings he claimed that it was then that he decided to extend the specialization of fracture care to peacetime conditions.⁴⁹ He started referring to the AUVA statistics in his publications of the same year. Böhler even claimed that it was only the insurance statistics that had revealed to him the poor long-term results of earlier treatment arrangements. The AUVA figures showed an average loss of earning capacity per individual of 27.6 percent for upper-arm fractures and 12.6 percent for lower-arm fractures. Another significant numerical indicator was the percentage of patients who never regained their full earning capacity. In the AUVA statistics, these numbers were 90.4 percent for upper-leg fractures

⁴⁸ For the parallel in Taylorism see Haber, *Efficiency and Uplift* (cit. n. 3), pp. ix–x.

⁴⁹ Lorenz Böhler, “Das Unfallkrankenhaus in Wien,” in *25 Jahre Unfallkrankenhaus Wien* (Vienna: Allgemeine Unfallversicherungsanstalt, 1952), pp. 30–66, esp. p. 30; and Böhler, *Ein Leben für die Unfallchirurgie* (Klagenfurt: Geschichtsverein für Kärnten, 1965), p. 7. The vacation is documented in the *Vormerkblatt für die Qualifikationsbeschreibung*, 1 June 1916–2 Oct. 1917, War Archives Vienna; photocopies of the original documents are at IGM Vienna, signature I 64869/5.

and 62 percent for lower-arm fractures. Böhler promised to bring these figures down to 10–15 percent and less than 5 percent, respectively.⁵⁰

And he would accomplish those reductions at a low cost. From his first publications during the war, Böhler always emphasized that treatment procedures must be not only simple, robust, and flexible but also cheap. All his publications provide information on the cost of devices and bandages and suggest ways of saving cotton wool or metal or some other material resource. He carefully documented and published his modest expenditures on dressing materials and his parsimonious use of drugs. All in all, Böhler claimed to have treated 1,214 bone fractures and a thousand additional injuries in his field hospital at a cost of 25,000 Kronen, which amounts to an average cost per patient of around 10 Kronen.⁵¹

However, in his main line of argument he emphasized the efficiency of his treatment on a more general level—namely, its long-term effects on patients' reintegration into the work process. In this context, Böhler actually translated the functional restoration of the patient's locomotor system directly into measurable economic benefit. In his petition of July 1917 he offered the example of a young soldier with an upper-leg fracture:

Normally, as numerous statistics showed, the treatment would take between 1.2 and 3 years and would still result in shortening of the leg, stiff joints and atrophied muscles, leaving the injured a handicapped man. Suppose this soldier lives another 30 years, and given an annual disability pension of 400 K, the state will have to spend 12,000 K on this man. If we also consider that this man would have earned 1,000 K per year, his invalidity would mean a loss of 30,000 K to the national economy, not even mentioning that this man could be married and that his wife and children would also suffer.

In 1918 he calculated the sum of the pensions that would have to be paid for a hundred thousand invalids over thirty years to be 1.2 billion Kronen and promised to reduce that figure by 70 percent.⁵²

Obviously Böhler's declared target was not only the individual patient's well-being but the aggregate economic benefit. This represents a clear departure from the way doctors traditionally understood their work, but it was completely consistent with Böhler's strategy of conceptually and visually de-individualizing his patients. This emphasis situates Böhler in the utilitarian tradition of seeing medical and scientific questions as intimately connected to economic problems.⁵³

⁵⁰ Böhler, "Einfacher Apparat für Bewegungen während der Behandlung der Oberschenkelbruhe" (cit. n. 24), p. 723 (first reference to the AUYA statistics); Lorenz Böhler, [no title], in *Zur Eröffnung des Unfallkrankenhauses der Arbeiter-Unfallversicherungsanstalt für Wien, Niederösterreich und das Burgenland in Wien XX, Webergasse 2–6, 17. Jänner 1926* (Vienna: Verlag der Arbeiter-Unfallversicherungsanstalt in Wien, 1926), pp. 6–7 (revelation regarding poor long-term outcomes); and Böhler, "Die Ausbildung der Ärzte in der Unfallchirurgie" (cit. n. 42), p. 241 (promised reductions).

⁵¹ Böhler, "Ueber die Einheitsbehandlung der Unterschenkelbruhe" (cit. n. 24), p. 76 (emphasis on cost); Böhler, "Transportverbände für Schussfrakturen und Gelenkschüsse in der vordersten Linie" (cit. n. 27) (details on costs and suggestions for savings); and Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" p. 266 (cost per patient). For parallels to the hospital rationalization movement see Howell, *Technology in the Hospital* (cit. n. 3), pp. 32–40.

⁵² R.A. Dr. Lorenz Böhler, Bozen, "Zur Errichtung von Spezialabteilungen für Knochenschussbruhe und Gelenkschüsse," typescript, 12 July 1917, IGM Vienna, S 5.180/1–66, p. 2. See also Böhler, "Die Spezialisierung der Frakturenbehandlung für die Kriegezeit, eine Frage von größter volkswirtschaftlicher Bedeutung," *Zentralbl. Chirurg.*, 1918, 46:793–795, esp. p. 795 (for the promised 70 percent reduction); and Böhler, "Kniegelenksteckschuss mit Fraktur des Oberschenkels in vier Wochen mit guter Funktion geheilt (Zugleich ein Beitrag zur Spezialisierung der Frakturenbehandlung)," *Med. Klin.*, 1918, 14 (unpaginated offprint).

⁵³ Rabinbach, *Human Motor* (cit. n. 2), p. 104.

SPECIALIZATION

Böhler meant his hospital to be a small-scale model for the larger scheme he envisaged for the Austrian Army. In numerous publications and petitions he demanded the establishment of specialized field hospitals for fracture care, which were to take on the entire course of treatment of the musculoskeletal system.⁵⁴ The specialization pattern Böhler envisaged ran against usual military practice, in which, as he complained, one person was responsible for the operation, another for the wound treatment, and a third for the treatment of the bone fracture—all of which was followed by orthopedic aftercare, by which point in most cases irreversible damage had already occurred.

This old form of specialization was detrimental. Instead, Böhler insisted, the distribution of labor should be reorganized according to rational, science-based principles, even if that would cut across the geography of existing disciplinary categories and consequently provoke resistance from “dyed-in-the wool opponents of specialization.”⁵⁵ As a model for the type of specialization he had in mind, Böhler referred to internal medicine, with its subspecialties. Translating this model into surgical terms, he indicated that separate departments would have to be created for injuries of the brain, the thorax, the abdomen, the genital organs, and the limbs. He also mentioned other specialties that had been established during the war, pointing to the very successful specialized military hospitals for treating jaw injuries, ear injuries, and larynx injuries and the exemplary institutions for orthopedic aftercare.⁵⁶

Böhler claimed that his war experience had shown him the fundamental importance of specialization. He had seen the negative consequences of the lack of proper instruction and of the constant movement of doctors between different areas, which impeded the development of any expert knowledge in fracture care. Böhler’s complaints are, in fact, consistent with some historians’ views of a more widespread deficit in consistent wound treatment on the Austrian side of the front, a deficit that was also the background of the rationalization efforts of the Austrian Army noted earlier. Moreover, neglect of long-term care and inattention to individual patients’ needs have been identified as typical shortcomings of wartime medicine more generally—and increased specialization has been seen as a typical response to those problems.⁵⁷

⁵⁴ See Böhler, “Zur Errichtung von Spezialabteilungen für Knochenschussbrüche und Gelenkschüsse” (cit. n. 52); R.A. Dr. Böhler, Bozen, “Spezialabteilungen für Knochenschussbrüche und Gelenkschüsse nahe an der Front und die in denselben erzielten Erfolge,” typescript, Apr. 1917 [added in handwriting], IGM Vienna, S 5.180/1–66; AOK-Q.-Abteilung, San.-Chef 1917, Nr. 503, box 2300, War Archives Vienna; and Poldi Böhler to Countess Schönborn, Hofdame Ihrer Majestät, Gries near Bozen, 7 May 1917, and Dienstkämmerer Ihrer Majestät der Kaiserin und Königin Graf . . . to Generalstabsarzt Kuntze, Laxenburg, 11 May 1917, Mittelbeherden, Chef des ärztl. Offizierskorps 1894–1918, Res. Nr. 660, War Archives Vienna.

⁵⁵ For objections to the old form of specialization see Böhler, “Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?” pp. 273–274. For his recommendations see Böhler, “Die Spezialisierung der Frakturenbehandlung für die Kriegszeit” (cit. n. 52); and Böhler, “Kniegelenksteckschuss mit Fraktur des Oberschenkels in vier Wochen mit guter Funktion geheilt” (cit. n. 52). For similar difficulties in organizing the treatment of trauma across the geography of other medical and surgical specialties see Cooter, *Surgery and Society in Peace and War*, p. 181.

⁵⁶ Böhler, “Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?” p. 275; and Böhler, “Zur Errichtung von Spezialabteilungen für Knochenschussbrüche und Gelenkschüsse” (cit. n. 52), p. 1. The establishment of special hospitals, such as those for head and facial injuries, neurasthenia (mainly shellshock), epilepsy, cardiac disorders, and tuberculosis, was a major organizational innovation in medicine during the war in Britain; see Cooter, *Surgery and Society in Peace and War*, p. 112.

⁵⁷ On the negative consequences see Böhler, “Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?” pp. 255–256; see also Biwald, *Von Helden und Krüppeln* (cit. n. 20), Vol. 2, pp. 469–473. For historians’ views of Austrian deficiencies in wound treatment see *ibid.*, pp. 482–488; and Hofer, “Effizien-

Establishing special institutions for fracture treatment would entail great savings in terms of material and personnel, Böhler argued. The personnel could be trained in a standardized way. Surgeons could be educated about the social dimensions of their job and the importance of proper treatment for the social reintegration of injured soldiers. He combined these recommendations with a typical modernist demand for aptitude tests, which would help to identify those candidates for training in surgical fracture care that were able to handle hammer and pincers, drill and file, saw and ax.⁵⁸ No additional expenses would result from this—only savings. Given that about 10 percent of all war injuries were gunshot wounds to the bones and joints, one could expect there to be about a hundred thousand cases of this type per year. With his system, it would take about three months to treat each case, so twenty-five thousand beds would be needed. These could be distributed among 125 military hospitals with two hundred beds each. Each hospital required one surgeon and three assistants, which meant a need for about five hundred doctors. Under the old system, Böhler claimed, about ten times as many doctors would be required to do the same job, because of the length of the treatment. In addition, the good treatment results his system made possible would dramatically reduce the need for orthopedic aftercare institutions.⁵⁹

For a long time, Böhler proposed this kind of specialization for times of war only. After World War I ended he gradually widened his scope, but wartime needs and expectations still figured large in his demands. His detailed description of special schools for fracture treatment in 1924 still referred to times of war.⁶⁰

THE RESPONSE OF THE MILITARY

Böhler's ambitions to reform the Army's surgical service go back to 1916, when he suggested the establishment of special dressing courses for military doctors as a first step toward specialization and standardization. His repeated petitions to his military superiors were accompanied by detailed reports about his Bolzano hospital; in 1917, for example, he submitted a twenty-five-page report with sixty-three photographs. In such reports he appealed to the military rationale, declaring that, according to the Imperial and Royal Ministry of War, only 78 percent of injured soldiers could be returned to active service. Most of the remaining 22 percent had bone and joint injuries. If the ministry adopted his system, he insisted, the majority of those could be made fit for service too. With their detailed descriptions and photographic depictions of his treatment system, complete, detailed, and up-to-date statistics on outcomes, and exact calculations of the expenses involved, these reports contained the same elements as his later publications.⁶¹

zsteigerung und Affektdisziplin" (cit. n. 16), p. 228. On the "typical" shortcomings of wartime medicine and increased specialization as a response to them see Joanna Bourke, "Wartime," in *Companion to Medicine in the Twentieth Century*, ed. Roger Cooter and John Pickstone (London/New York: Routledge, 2000), pp. 589–600, esp. p. 592.

⁵⁸ Böhler, "Die Spezialisierung der Frakturenbehandlung für die Kriegszeit" (cit. n. 52), pp. 794–795; and Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" pp. 259, 275–276. On aptitude tests see, e.g., Rabinbach, *Human Motor* (cit. n. 2), pp. 263–266, 278–280; and Maier, "Between Taylorism and Technocracy" (cit. n. 3), p. 48.

⁵⁹ Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" p. 275.

⁶⁰ *Ibid.*, pp. 259, 275–276. This is also how his readers interpreted his suggestions; see, e.g., Blencke-Magdeburg's summary of Böhler, "Die Spezialisierung der Frakturenbehandlung für die Kriegszeit" (cit. n. 52), *Z. Orthopäd. Chirurg.*, 1920, 39:354.

⁶¹ On the suggestions about special dressing courses see Böhler, "Zur Behandlung der Oberschenkelschussbrüche" (cit. n. 28); Böhler, "Kniegelenksteckschuss mit Fraktur des Oberschenkels in vier Wochen mit guter

In retrospect, Böhler complained bitterly about his superiors' resistance to his ideas. Coming from a young assistant surgeon, his proposals advanced no further than his *Divisions-* and *Korps sanitätschef*, he wrote. He kept making the same suggestions to different levels of the military hierarchy, but whenever one institution accepted his ideas another declared that they were not viable. In the summer of 1916 Böhler wrote directly to the Army headquarters (*Armeoberkommando*), ignoring official channels, but to no avail. In 1917 he went so far as to have his wife, Poldi, send a letter with his usual illustrated report directly to the imperial household—namely, to the Countess Schönborn, a lady of the court who had previously visited Bolzano and seen Böhler's hospital. The countess showed Böhler's documents to the empress, who was duly impressed and recommended that Major General of the Medical Corps (*Generalstabsarzt*) Dr. Kuntze look into the issue and report back to her.⁶² All Böhler achieved through these efforts was the visit of another commission.

In a 1924 paper Böhler described how numerous commissions came to check and evaluate his hospital. Many were benevolent, he wrote, but some came with the express intention of dissolving his unit, which was seen as a trouble spot. The reports of two of the consulting surgeons on Böhler's hospital are preserved in the Austrian war archives and provide an interesting glimpse of the rationale behind the official reaction to his ideas. In the spring of 1917 Chief Staff Surgeon (*Oberstabsarzt*) Professor Hans von Haberer conducted an inspection tour of Böhler's hospital. In his subsequent report he praised Böhler's treatment results in terms of infection and death rates. But he attributed them largely to the fact that the hospital was not sent the worst cases. Böhler's good results, he judged, could be achieved anywhere under similarly favorable conditions. Böhler's treatment principles, he held, were not new, though it was praiseworthy how much energy he put into applying them. For von Haberer, Böhler was above all an autodidactic talent with a highly developed understanding of functional aspects of fracture treatment. He did not support Böhler's demands for specialized fracture care institutions, the claims for which he thought exaggerated. The strict supervision of fracture care by consulting surgeons at existing institutions would be a sufficient warrant of its high quality.⁶³

Another report came from Anton von Eiselsberg on 6 June 1918. Von Eiselsberg emphasized Böhler's strict immobilization regime and abstinence from surgical interventions and mentioned the fact that he had his patients do active exercise early on. Like von Haberer, he explained Böhler's strikingly good statistics by inadvertent case selection. His response to Böhler's specialization initiative is illuminating. Von Eiselsberg focused completely on scientific and technical innovations for the treatment of the individual patient. As long as no new technical methods or scientific discoveries created a new

Funktion geheilt" (cit. n. 52); and Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" pp. 258–259. For the 1917 report see AOK-Q.-Abteilung, San.-Chef 1917, Nr. 503, box 2300, War Archives Vienna. For reports addressing the Ministry of War statistics and offering improvements see Böhler, "Spezialabteilungen für Knochenschussbrüche und Gelenkschüsse nahe and der Front und die in denselben erzielten Erfolge" (cit. n. 54); and Böhler, "Zur Errichtung von Spezialabteilungen für Knochenschussbrüche und Gelenkschüsse" (cit. n. 52).

⁶² Regarding the 1916 suggestions see Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" p. 259. For the letters see P. Böhler to Countess Schönborn, 7 May 1917, and Dienstkämmerer Ihrer Majestät der Kaiserin und Königin Graf . . . to Kuntze, 11 May 1917, Mittelbehörden, Chef des ärztl. Offizierskorps 1894–1918, Res. Nr. 660, War Archives Vienna.

⁶³ Regarding the many commission visits see Böhler, "Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?" p. 264. For von Haberer's report see Prof. Dr. H. v. Haberer Heeresgruppenkommando F.M. Frh. von Conrad, Vienna, 4 June 1917, 12 June 1917, Ministry of War 14. A. 43–54/2, box 2260, War Archives Vienna.

situation, he wrote, specialized fracture care was not needed. Böhler's methods did not represent anything fundamentally new; they consisted mainly in traction treatment, and the devices he used were so simple that any surgical ward could provide them.⁶⁴

Significantly, neither report even mentioned Böhler's core emphasis on standardization and efficiency. Both referees were thinking in terms of individual patients with individual fractures and correspondingly individualized treatment. They were both leading proponents of contemporary high-tech surgery, and they were looking for scientific discoveries or technological innovations that would improve individual treatment results, not for new ways of organizing fracture care at the level of the entire population. It is also interesting that, socially, both men came from the upper echelon of the surgical establishment and in many ways represented the antithesis of the brash parvenu Böhler. At that time Anton von Eiselsberg was arguably the last important representative of the German-language tradition of general surgery. After a stellar career as Theodor Billroth's prize student, he had become world famous for his surgical skills as well as his scientific achievements. Furthermore, von Eiselsberg came from an aristocratic family and embodied the "born gentleman," with subtle and discreet manners and a clear consciousness of his class-based superiority. Hans von Haberer, at the time of World War I a full professor in Innsbruck, belonged to the exclusive club of von Eiselsberg's students and shared his master's cultural background and professional profile.⁶⁵

Despite the Austrian efforts to rationalize medical services in World War I mentioned above, Böhler's suggestions were not taken up by his superiors. A comparison of his difficulties with a more successful wartime attempt by an orthopedist in another country will help to clarify the reasons for his failure. Böhler's negative experience with his superiors stands in marked contrast to the wartime fortunes of the most important British proponent of rationalized fracture care, Robert Jones. In Britain, as in the United States, World War I increased general awareness of the importance of orthopedic surgery. The war-related transformation of orthopedics in the English-speaking world has even been taken as paradigmatic of the positive relationship between war and specialization more generally. However, as Roger Cooter argues, this process "depended on certain fortuitous political and economic circumstances in which the worth of Jones's expertise was able successfully to be demonstrated. More broadly, it relied on the emergence of a context in which the managerial skills that were fundamentally a part of that expertise could be effectively exercised." These circumstances included "the aggregation of larger numbers of patients suffering from the same types of problems; the authoritarian structures in which the supply and maintenance of specialist facilities could be prioritized; and the salaried employment of doctors that eliminated the peacetime financial constraints on full-time specialty work." But even all this was not enough: "Crucial to the wartime making of modern orthopedics was the negotiation and occupation of a political space in medicine for reorganizing medical work and power relations generally—in effect, the opening of the space that had been a part of the agenda of the 'modernists' in surgery since

⁶⁴ Prof. A. Frh. v. Eiselsberg to the XIV Dept. of the War Ministry, 6 June 1918, IGM Vienna, 2.715. On the relationship between technological innovation and organizational change in military medicine in World War I see Harrison, "Medicine and the Management of Modern Warfare" (cit. n. 13), p. 393.

⁶⁵ On von Eiselsberg see Burghard Breitner, "Anton von Eiselsberg," in *Neue österreichische Biographie ab 1815: Grosse österreichischer*, Vol. 9 (Nendeln/Liechtenstein: Kraus, 1970), pp. 107–113; and Anton von Eiselsberg, *Lebensweg eines Chirurgen* (Innsbruck: Deutscher Alpenverlag, 1939). On von Haberer see Marlene Jantsch, "Haberer v. Kremshohenstein, Hans," in *Neue deutsche Biographie*, ed. Historische Kommission bei der Bayerischen Akademie der Wissenschaften, Vol. 7 (Berlin: Duncker & Humblot, 1966), pp. 389–390.

the 1880s.”⁶⁶ It is obvious that Böhler was not in a position to negotiate and occupy such a political space, even in the context of an army where rationalization efforts were already under way. While Jones was at the height of his career, Böhler was just starting out. He was a young, unknown military surgeon, from a humble background, who had a reputation for trying to circumvent established hierarchies; his medical credentials were relatively unimpressive, and his prior experience was minimal. In addition, 1917 was probably not the best time for reform proposals like Böhler’s. Unlike in 1915, when the Austrian Army did in fact introduce rationalization measures for its medical services, the war had now definitively turned against Austria. A new emperor had taken the throne in November 1916, only to abdicate in October 1918. Existing nationalist movements were turning separatist, and the empire was beginning to disintegrate. In November 1918 the Republic of German Austria (Deutschösterreich) was declared.⁶⁷

Böhler’s example shows that the circumstances of war did not automatically serve to bring about a modernist reorganization of medical services. The impact was more complicated and contingent on local conditions. On a more general level, his case supports a more revisionist account of war and social change that sees “developments in medicine during the two World Wars as part of a much larger and long-term international process, whereby health care became collectivized as part of the State’s response to the problems of mass society.”⁶⁸ From this perspective, we can recognize that Böhler had already been on a rationalization trajectory, which was modified by the war experience. The war might have enhanced particular elements of his rationalization plan, such as the preference for simplicity. But it did not help Böhler to spread his ideas in the way he intended. Nonetheless, even though Böhler’s ambitious plans were thwarted, the war had provided him with some opportunities and benefits. His field hospital was a protected space in which to develop and test his innovations. He was far enough away from the chaos of the front to be able to build up a viable infrastructure. At the same time, the distance from central control gave him a degree of autonomy that he would not have had in peacetime. The war also supplied him with a large number of patients with similar injuries in a hierarchically subordinate position—a conjuncture that allowed him to establish a machine-like treatment routine and take photographs of naked men lined up to perform simultaneous movements.

Transferring war-related innovations into civilian practice is a different matter, of course. Another brief comparison shows the contingent character of the influence of war on civilian practice. For British orthopedists, things did not work out as well as expected once the war ended. Even though “it was widely believed when the war was over that the experience of orthopaedic surgeons with the war-wounded would be transferred to the wounded ‘soldiers of industry,’” and “despite the encouraging rhetoric and the apparent opportunities, Jones and his colleagues were unable to transfer military orthopedics to industry,” as Cooter has found. He lists a number of reasons, most importantly economic circumstances that determined the limits of the possible. Contributing to this situation was the crucial fact that Britain enacted no rehabilitation legislation. “Between 1917 and 1924, state intervention was out of fashion, and in the worsening economic climate and falling

⁶⁶ Cooter, *Surgery and Society in Peace and War*, pp. 105–107, 108 (quotations).

⁶⁷ Ernst Hanisch, *Der lange Schatten des Staates: österreichische Gesellschaftsgeschichte im 20. Jahrhundert* (Vienna: Ueberreuter, 1994), pp. 263–270.

⁶⁸ Mark Harrison, “The Medicalization of War—The Militarization of Medicine,” *Social History of Medicine*, 1996, 9:267–276, on p. 270.

employment after 1921, government had little reason to accept calls for legislation which would enable the disabled to regain their former earning capacity.” Under these conditions, British insurance companies, which “were not interested in arguments grounded in efficiency and economy,” provided funds for fracture and rehabilitation services “only in a few isolated cases.” “The insurance companies, like employers and trade unions, had little economic incentive to medicalize workmen’s compensation. Industry feared greater costs, labor feared monetary loss.”⁶⁹

ACCIDENT INSURANCE

Böhler, by contrast, was able to use his wartime work as a starting point for a successful hospital project in interwar Austria. By war’s end, Austria had become a different country. The Austrian-Hungarian Empire had been split up into a number of individual nation-states. One of them was the new Republic of Austria, which geographically encompassed only a fragment of the old empire. After a couple of turbulent postwar years of revolutionary upheaval and economic crisis, conditions started to stabilize in the early 1920s under a political system that was more or less dominated by the Social Democrats. In the First Republic the Social Democrats finally tackled the long-neglected consequences of industrialization in the metropolis. Their experiments with new forms of social policy, education, and housing earned their city the epithet “Red Vienna.” The new political landscape provided a favorable environment for upgrading and extending social security structures and services, including accident care. In 1919 Böhler himself took an active role in extending the legally regulated responsibilities of accident insurance to include the acute treatment of accident victims.⁷⁰ Even before the war, workmen’s compensation insurance had been a state monopoly in the hands of the Austrian National Accident Insurance Company, the same company whose statistics Böhler had used in framing his wartime projects.⁷¹ The type of rationalization and standardization he stood for resonated with the AUVA’s bureaucratic rationality. The company had a vital interest in providing high-quality fracture care for the simple reason that in the long run it was much cheaper to invest in such care than to pay pensions to the victims of a sloppy treatment regime. In addition, Böhler’s approach had a lot in common with the insurance regime of his time, which Greg Eghigian has characterized as “a hybrid of natural scientific, medical, statistical, legal, and bureaucratic rationalities and values.” Insurance management was all about balancing revenues and expenditures and calculating risks. In order to be economically viable, companies had to keep extensive and detailed records. Accident insurers, in particular, were constantly involved in controversies about insurance claims.⁷² For dealing

⁶⁹ Cooter, *Surgery and Society in Peace and War*, pp. 137, 138, 145, 149. On the organization of fracture treatment in Britain between the wars see *ibid.*, pp. 180–198.

⁷⁰ Lehne, *Lorenz Böhler* (cit. n. 17), p. 67–68. More generally, see Helmut Gruber, *Red Vienna: Experiment in Working-Class Culture, 1919–1934* (New York/Oxford: Oxford Univ. Press, 1991); and Hanisich, *Der lange Schatten des Staates* (cit. n. 67), pp. 263–284.

⁷¹ For a survey of the AUVA’s history see *25 Jahre Unfallkrankenhaus Wien* (cit. n. 49), pp. 7–21. On the history of accident insurance in Austria see Wolfgang Rohrbach, “Entstehung und Entwicklung der Unfallversicherung,” in *Die Ära des klassischen Versicherungswesens*, ed. Rohrbach (Vienna: Holzhausen, 1988), pp. 647–702; and Herbert Hofmeister, “Austria,” in *The Evolution of Social Insurance, 1881–1981*, ed. Peter A. Köhler and Hans F. Zacher (London: Pinter, 1982), pp. 265–383. See also Fritz Povacz, *Geschichte der Unfallchirurgie* (Berlin: Springer, 2000), pp. 407–415.

⁷² Greg Eghigian, *Making Security Social: Disability, Insurance, and the Birth of the Social Entitlement State in Germany* (Ann Arbor: Univ. Michigan Press, 2000), p. 66. On disability compensation in Germany up to 1914 see *ibid.*, pp. 67–116. On the AUVA’s interest in providing high-quality fracture care see *Zur Eröffnung des*

with this situation, they created a type of knowledge that could be “used to integrate different parties on a seemingly disinterested and objective point of view.”⁷³ Like Böhler, they privileged quantified information, because it offered a universalistic and generally acknowledged language. Along these lines, accident insurance companies in the German-speaking world cultivated “an epistemology of disability that privileged the visible, the observable, and the scientifically verifiable.” Rigorous documentation and the extensive use of technologies of objectivity such as the measurement of body data and photographic images were part and parcel of that epistemology.⁷⁴ In the insurance context, body function was quantified in terms of percentages of earning power, thus connecting body functionality with economy. This meant, for example, that pension payments would be cut when rehabilitation measures had been successful in restoring an injured person’s working capability—an example that illustrates how the notion of body function in trauma surgery became part of an explicit economization of human labor.⁷⁵

Considering the important role the AUVA’s approach had played in leading Böhler to develop his specific line of argument, it is not surprising that the insurance company was very receptive to his ideas. The AUVA allotted 500,000 Kronen to set up a special hospital for him, though because of postwar hyperinflation it was not until 1923 that the insurance company went ahead with the plan. On 1 December 1925 Böhler’s accident hospital was finally inaugurated. It was accommodated in two stories of a larger administrative building owned by the AUVA in the Webergasse in Vienna.⁷⁶ Böhler’s rationalized fracture care provides an example of a locally created culture of standards and its subsequent migration to another context where it found a new environment with which it could engage.

Later publications show how Böhler transferred his principles of standardization and documentation to the new setting.⁷⁷ The transition from a military to a civilian insurance context was not difficult to accomplish. Instead of returning to military duty, restored injury victims were now sent back to their workplace. Böhler himself conflated the two achievements in prospect as early as 1917, when he promised in one of his petitions that “thousands of limbs could be saved and tens of thousands of wounded be returned to

Unfallkrankenhauses der Arbeiter-Unfallversicherungsanstalt für Wien, Niederösterreich und das Burgenland (cit. n. 50), pp. 3–5.

⁷³ Martin Lengwiler, “Technologies of Trust: Actuarial Theory, Insurance Sciences, and the Establishment of the Welfare State in Germany and Switzerland around 1900,” *Information and Organization*, 2003, 13:131–150, on p. 147; see also Lengwiler, *Risikopolitik im Sozialstaat: Die schweizerische Unfallversicherung 1870–1970* (Cologne: Böhlau, 2006), p. 70.

⁷⁴ Eghigian, *Making Security Social* (cit. n. 72), p. 83. Regarding documentation and technologies of objectivity see, e.g., the chapter on accident insurance in a contemporary German textbook on insurance medicine: F. Gumprecht and G. Pfarrius, eds., *Lehrbuch der Arbeiter-Versicherungsmedizin* (Leipzig: Barth, 1913), pp. 34–46; on the importance of photography for the documentation of accident-related injuries in that context see C. Thieme, “Über die Bedeutung physikalischer Mittel bei der Untersuchung und Behandlung Unfallverletzter,” *Monatsschrift für Unfallheilkunde und Invalidenwesen*, 1907, 14:293–319, esp. p. 295.

⁷⁵ Lengwiler, *Risikopolitik im Sozialstaat* (cit. n. 73), pp. 114–127.

⁷⁶ *Zur Eröffnung des Unfallkrankenhauses der Arbeiter-Unfallversicherungsanstalt für Wien, Niederösterreich und das Burgenland* (cit. n. 50); Böhler, “Das Unfallkrankenhaus in Wien” (cit. n. 49); and Böhler, *Ein Leben für die Unfallchirurgie* (cit. n. 49), pp. 7–10. The interesting process of negotiation between Böhler and the AUVA is subject to further research. So far, I have not been able to locate the written correspondence between the parties, so the account here is based on oral history (see Lehne, *Lorenz Böhler* [cit. n. 17], pp. 65–72) and autobiographical material (e.g., *Zur Eröffnung des Unfallkrankenhauses der Arbeiter-Unfallversicherungsanstalt für Wien, Niederösterreich und das Burgenland*, pp. 3–4).

⁷⁷ See, e.g., Lorenz Böhler, “Die volkswirtschaftliche Bedeutung der Unfallkrankenhäuser,” *Monatsschrift Ungarischer Mediziner*, 1928, Heft 7–9, Festnummer anlässlich des V. internationalen Kongresses für Unfallheilkunde und Berufskrankheiten in Budapest; and Böhler, “Die Behandlung der Knochenbrüche mit Ruhe und Bewegung erläutert durch einen Lauffilm von 1400 m Länge und zahlreiche Diapositive,” typescript, 17 Feb. 1928, IGM Vienna, 42.434/1.

military service and later to gainful employment.” This is an instance of the convergence of the welfare and the warfare state in the modern world, as described by Cooter and Sturdy. Here, medicine and war can be seen to participate in the “wider sociocultural, economic and medico-professional contexts that transcend the social boundaries of military life and the temporal boundaries of wartime itself,” demonstrating that war “is not separate or distinct from the constitution and processes of the society in which it is practiced, any more than is medicine.”⁷⁸

Böhler’s subsequent publications reflect his switch from the military to accident insurance. He acknowledged his new audience by starting to publish in journals of traumatology and insurance medicine. He no longer talked about a new specialty for fracture care, but about *Unfallchirurgie*—traumatology—instead. *Unfallchirurgie*—literally, “accident surgery”—is a specific phenomenon of the German-speaking countries, where the public accident insurance companies fostered the emergence of this subspecialty within general surgery. Traumatologists were in charge of treating acute bone fractures, as opposed to orthopedists, who were responsible for the treatment of chronic musculoskeletal disorders only.⁷⁹

MODERNISM IN “RED VIENNA”

Böhler’s ideas did not merely correspond well with the values of the AUVVA. They can also be seen as part of a more general historical phenomenon—namely, the specific version of modernism that emerged in Vienna before World War I and became an important cultural force in the new Austrian republic after the war. Böhler’s ideas shared some of the characteristic features of this so-called Vienna modernism. Vienna is generally considered an important hub of early twentieth-century modernism, though with its own particular flavor shaped by the radical changes after World War I and the striking contrasts between old and new that were so typical of the Austrian capital at the time. According to Allan Janik and Stephen Toulmin, the ideals of Vienna modernism demanded “that the struggle against moral and aesthetic corruption be carried on by a critique of that particular area of human experience in which the individual artist or writer was himself most at home.” Its prewar proponents—for example, the journalist Karl Kraus, the architect Adolf Loos, the composer Arnold Schoenberg, and the philosopher Ludwig Wittgenstein—favored authenticity over conventions and rejected what they saw as the old moral and aesthetic corruption in favor of radical simplicity. Like Böhler, many of these modernizers were, for example, deeply interested in the idea of functionality. Also like Böhler, literary modernists such as Robert Musil harbored a deep distrust toward language, which, they thought, could not express what was most real, and the philosopher Fritz Mauthner claimed that the metaphorical nature of language precluded all univocity and that knowledge of the world through language was impossible.⁸⁰

⁷⁸ Böhler, “Zur Errichtung von Spezialabteilungen für Knochenschussbrüche und Gelenkschüsse” (cit. n. 52), p. 7; and Cooter and Sturdy, “Of War, Medicine, and Modernity” (cit. n. 12), p. 7.

⁷⁹ For a publication addressed to his new audience see, e.g. Böhler, “Die Ausbildung der Ärzte in der Unfallchirurgie” (cit. n. 42). On the separation of traumatology and orthopedics see Povacz, *Geschichte der Unfallchirurgie* (cit. n. 71), pp. 407–415. On the history of traumatology in the German-speaking countries see Jürgen Probst, “Aus der Geschichte der Unfallchirurgie,” in *Unfallchirurgie in Deutschland: Bilanz und Perspektiven*, ed. Hans-Jörg Oestern and Probst (Berlin: Springer, 1997), pp. 3–62.

⁸⁰ Allan Janik and Stephen Toulmin, *Wittgenstein’s Vienna* (New York: Simon & Schuster, 1973), pp. 93 (quotation), 118 (Musil), 122–129 (Mauthner), 176, 207 (issue of function). On Vienna modernism see Hanisch, *Der lange Schatten des Staates* (cit. n. 67), pp. 244–261; and W. Boyd Rayward, “European Modernism and the

After the war, Böhler became a representative of a whole generation of the Viennese elite who adopted and elaborated these modernist ideas to build a new and more democratic society based on pragmatism. According to Janik and Toulmin, “Central European dynasties had left a new world waiting to be built—on the scientific and cultural, as much as on the social and political plane. . . . The important thing was to bring the most up-to-date, effective and scientific technique available to this great work of construction and reformation.” In philosophy, the Vienna Circle took up Ernst Mach’s historico-critical and constructive positivism and tried to apply it to different spheres of life. In the arts as well as in the natural sciences and other intellectual spheres, liberation from earlier tastes and conventions stimulated a great burst of technical innovation in the 1920s. The postwar modernist “form of life,” as Peter Galison calls it, was seen as a countermodel to the old authoritarian and inefficient system. Its values were rationality, functionality, simplicity, and elimination of the superfluous.⁸¹ Böhler participated in this form of life by sharing and promoting these values.

A particularly interesting contemporary parallel to Böhler’s modernist concepts, as well as to his visual language, can be seen in the case of the social critic, philosopher of science, and educationalist Otto Neurath, who worked in interwar Vienna. With his “pictorial statistics”—also called the “Vienna method” and later refined to become Isotype—Neurath developed an unusual visualization method that sought to unite the accuracy of scientific representations and the clarity of popular images. To indicate quantity, he represented a greater or smaller number of objects by a greater or smaller number of symbols rather than by using symbols of a different size. He adopted what he called “speaking signs,” often concrete symbols. For example, a picture of a house symbolized housing units, a coffin depicted deaths, and so on. In designing the pictures Neurath avoided individualistic, expressionistic, and naturalistic features that would have blurred the intended message. His system represents an attempt to reduce the surplus of meaning of the images as far as possible.⁸² As a symbol for humans, he used a standardized, strongly geometric figure, free of all gendered and other individualizing features. His symbols were to be mass-produced, like automobiles—which, as he pointed out, were also manufactured in series and not produced one by one in a smithy. Neurath’s images are shaped by the same interest in standardization and de-individualization we can see in Böhler’s photographs. Neurath, in fact, understood the process of making pictures as a tool similar to the use of photography in other fields. He created his novel method of visualization because, as he wrote, “we cannot photograph social objects even if we tried.”⁸³ Neurath’s picture statistics were simultaneously a tool for expressing social science knowledge in a way that conformed to the scientific criteria formulated in the Vienna Circle (of which he was an important member) as the *Wissenschaftliche Weltauffassung* (scientific conception of the world).

Information Society: Introduction,” in *European Modernism and the Information Society: Informing the Present, Understanding the Past*, ed. Rayward (Aldershot, Hampshire: Ashgate, 2008), pp. 1–25, esp. pp. 4–8.

⁸¹ Janik and Toulmin, *Wittgenstein’s Vienna*, pp. 246 (quotation), 239–242 (Vienna Circle), 247 (technical innovation); and Peter Galison, “Aufbau/Bauhaus: Logical Positivism and Architectural Modernism,” *Critical Inquiry*, 1990, 16:709–752.

⁸² Sybilla Nikolow, “Gesellschaft und Wirtschaft: An Encyclopedia in Otto Neurath’s Pictorial Statistics from 1930,” in *European Modernism and the Information Society*, ed. Rayward (cit. n. 80), pp. 257–278; and Nikolow, “Imaginäre Gemeinschaften: Statistische Bilder der Bevölkerung,” in *Konstruierte Sichtbarkeiten: Wissenschafts- und Technikbilder seit der Frühen Neuzeit*, ed. Martina Hessler (Munich: Fink, 2006), pp. 263–278, esp. p. 277. On Neurath’s crucial role in the Vienna Circle see, e.g., Galison, “Aufbau/Bauhaus,” pp. 713–716.

⁸³ Nikolow, “Gesellschaft und Wirtschaft,” pp. 268 (symbol for humans), 262 (mass production), 275 (tool similar to photography), 261 (quotation).

Neurath believed that his pictorial system, in its austerity and schematism, “would deliver pure observational statements without any reflection of hidden, nonrevisable causes.”⁸⁴ He hoped that the method might be used as a script within the political and scientific discourse of his time to express facts and information that were based on empirical observations and not on religious or ideological beliefs or metaphysical assumptions.

We do not know whether Böhler was in personal contact with any of the proponents of Vienna modernism. Nor do we have any statements of a personal credo that might shed light on his beliefs. Böhler did present a very pronounced modernist aesthetic judgment in one of his medical papers, where, in the context of occupational therapy, he condemned superfluous decorations in the strongest terms. We also know that he furnished his home with avant-garde modernist furniture.⁸⁵ But the point here is not to claim that Böhler was a card-carrying Vienna modernist, if such existed. It is about an attitude, about shared values and goals. These values and goals are reflected in Böhler’s work.

On a concrete level, for example, Böhler’s style of instruction in his famous trauma textbook is reminiscent of the Vienna Circle’s effort to base all knowledge on elementary protocol sentences. His *Einheitsbehandlung*, further, looks like a typical case of building up complex forms from standardized basic units. Working with fundamental units and creating new structures from them has been seen as an important characteristic of modernism. Loos proposed such an approach in his architecture, the Vienna Circle and Wittgenstein in their philosophy, and Schoenberg in his music.⁸⁶ Böhler’s work in its different facets can clearly be interpreted as part of “the same drive toward a ‘modern’ way of life, freed from ideology and grounded on a vision of the machine age,” that Galison has described as a common feature of Vienna modernism.⁸⁷

In Vienna, Böhler became the father figure for a whole generation of trauma surgeons worldwide. In the German-speaking world of the 1920s up to the 1960s he was one of the most influential people in the realm of traumatology. The first edition of his textbook *Technik der Knochenbruchbehandlung* was published in 1929. The book became the “bible of modern fracture care.” It came out in new editions up to 1963 and was translated into numerous languages.⁸⁸ Surgeons from all over the world came to visit Böhler’s hospital. British fracture surgeons started to look to his hospital as a model to emulate, the

⁸⁴ Sybilla Nikolow, “Kurven, Diagramme, Zahlen- und Mengenbilder: Die Wiener Methode der Bildstatistik als statistische Bildform,” *Bildwelten des Wissens: Kunsthistorisches Jahrbuch für Bildkritik*, 2005, 3:20–33, esp. p. 23; and Nikolow, “Gesellschaft und Wirtschaft,” p. 275 (quotation).

⁸⁵ For the condemnation of superfluous decoration see Böhler, “Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?” p. 268. Compare Galison, “Aufbau/Bauhaus” (cit. n. 81), p. 726; and Adolf Loos, *Ornament and Crime* (German ed., 1908; Riverside, Calif.: Ariadne, 1998). Regarding Böhler’s furniture see Lehne, *Lorenz Böhler* (cit. n. 17), pp. 119–120.

⁸⁶ For Böhler’s instructional style see Böhler, *Technik der Knochenbruchbehandlung* (cit. n. 38). See also Galison, “Aufbau/Bauhaus,” p. 738. On building new forms from standardized basic units see Rayward, “European Modernism and the Information Society” (cit. n. 80), p. 8. Regarding the approaches of Loos, Wittgenstein and the Vienna Circle, and Schoenberg see *ibid.*; and Galison, “Aufbau/Bauhaus,” pp. 725–726.

⁸⁷ Galison, “Aufbau/Bauhaus,” p. 750. Another interesting visual parallel with Böhler’s striking images is the contemporary chorus line of showgirls, such as the popular Tiller Girls. These featured lined-up dancers who were de-individualized by their identical dress (often military uniforms!) and their synchronous, machine-like movements. Chorus lines can be understood as a cultural reference to modern production methods in industry and are thus as much an expression of modernism as Böhler’s strikingly similar photographs. See Thomas Schlich, “Knochenbruchbehandlung und die Tiller Girls: Chirurgie, Tanztheater und Modernismus im frühen zwanzigsten Jahrhundert,” in *Concertino: Ensemble aus Kultur- und Medizingeschichte*, ed. Kornelia Grundmann and Irmtraut Sahmland (Marburg: Univ. Library Marburg, 2008), pp. 177–189.

⁸⁸ Regarding Böhler’s influence see Probst, “Aus der Geschichte der Unfallchirurgie” (cit. n. 79); and Povacz, *Geschichte der Unfallchirurgie* (cit. n. 71), pp. 159–171. On the editions and translations of his textbook see Böhler, *Ein Leben für die Unfallchirurgie* (cit. n. 49), pp. 14–15.

success of his specialized accident service serving as encouragement for similar efforts in Britain. Cooter found that in interwar Britain “a visit to Böhler’s mid-European fracture synod had become a badge of progressivism among orthopaedists.” “Like an earlier generation of visitors to Jones’s clinic in Liverpool, those who went to ‘Böhler’s clinic’ were impressed by his various surgical and manipulative techniques, . . . but they were even more astounded and delighted by his meticulous organization.”

Above all, it was the economic advantages deriving from this organization that gained Böhler his fame—his impressive accumulation of statistics to prove this point being unique for the time. As the *Lancet* hastened to comment in an editorial of 1926, not only had Böhler shown the clinical and social advantages of specialized fracture treatment in restoring patients to their full earning capacity, but he had also demonstrated to the insurance companies that surgical specialization could render enormous savings.

When the British fracture surgeon Ernest Hey-Groves translated Böhler’s textbook into English, he noted in his preface that Böhler had “demonstrated that the proper treatment of fractures is not only a scientific problem or a philanthropic duty, but also a business proposition. In other words, it pays to treat fractures well!”⁸⁹

CONCLUSION

The metaphor of the machine was a feature of many of the different environments in which we have located Böhler’s rationalized fracture care. We have seen how it figured prominently in Vienna modernism. In industry, it connected a specific modernist view of the body with particular kinds of workplace rationalization. Contemporary observers used it to characterize World War I—a characterization that Böhler himself took up in demanding that since special machines had been constructed in order to smash as many bones as possible, fracture care had to be reorganized too.⁹⁰ The machine view of the body appeared once more in the context of early twentieth-century accident insurance. In modernist orthopedic surgery, bodies and healing technologies were used as models for one another, both reflecting the contemporary ideal of the perfect machine. In this context, Böhler’s example also points to the specific tradition of the biomechanical body concept (as opposed to Rabinsach’s motor body), which, despite its importance in surgery, in orthopedics, and in industry, has been largely neglected by historians. However, as the history of the ambiguous reception of Böhler’s system shows, all of these ideas and images were highly specific to particular modernist environments. By no means did they represent a generally accepted concept of the time. Instead, they mark a very specific position in the diverse and often controversial discussions about medical practice and the human body.

Along the same lines, we see how in Böhler’s specific project of standardization and rationalization different strands of rationalization concepts were intersecting and converging with each other, each of them embedded in their wider cultural world. There is the medical tradition of industry-like rationalization, which Böhler seems to have picked up in the United States. There is also military culture, with its emphasis on hierarchy, discipline, control, and de-individualization, which allowed Böhler to establish and try out his system and which is so impressively embodied in his photographs—a culture that, in the Austrian case, was otherwise dominated by surgeons who adhered to an older ideal of

⁸⁹ Cooter, *Surgery and Society in Peace and War*, pp. 184–192, on pp. 191, 192.

⁹⁰ Böhler, “Wie schützen wir die Verwundeten vor Amputation und Krüppeltum?” p. 278–279.

medical science and technology and whose influence restricted the spread of Böhler's type of rationalization. We have also seen how Böhler was subsequently more successful with the insurance bureaucracy, which had developed its own rationalized view of the body in answer to its specific economic needs. Finally, Böhler's system formed part of the wider complex of early twentieth-century Vienna modernism, with its appreciation of rationality, simplicity, functionality, and mass applicability and its affinity to the world of machines. Böhler's case thus adds a new, surgical dimension to scholarship on Vienna modernism. Vice versa, situating Böhler's surgical practices within this wider cultural context adds a new dimension of cultural history to the history of surgery.

Furthermore, my examination of this concrete historical example demonstrates how ideas and practices of rationalization in medicine are deeply embedded in their cultural contexts—to which they in turn contribute. The ways in which standardization and therapy evaluation emerged and spread in this instance show that this development occurred by no means automatically, but was contingent on a particular constellation of various factors. On the other hand, it was also part of a larger trend that went well beyond medicine. This trend didn't stop in the early twentieth century. As part of a modern world with "millions of interlocking standards," the standardization of practices and the evaluation of treatment results have become commonplace in many fields of modern medicine.⁹¹ We can understand them better if we attend to both their technical contents and the cultural world in which they have emerged. Despite their aura of neutrality and inevitability they are, in fact, based on particular worldviews. They embody specific assumptions about how the world is and specific values about how it should be. As I have shown, this particularity includes not just the world of ideas, but also the world of social interactions and of material practices. Modernist body concepts manifested themselves not only in physiological theories; they shaped surgical work in concrete ways. Thus Böhler's ideas about optimized work organization, economic usefulness, and the healthy body were—on the intellectual level—all manifestations of his modernist approach to surgery, as were—on the practical level—his treatment devices, his segregation of space, his division of work, and his regulated body practices in which bodies figured as machine-like entities.

⁹¹ For the quotation see Star and Lampland, "Reckoning with Standards" (cit. n. 1).