Alvar Aalto, Ernst Neufert, and Architectural Standardization in Germany and Finland, 1933–45

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Not long ago, many historians believed that the first great era of German modern architecture ended abruptly with Hitler's rise to power.[1] According to this narrative, the demise coincided with the closure of the Bauhaus in 1933 and the subsequent emigration of leading architects such as Walter Gropius and Ludwig Mies van der Rohe, the former in 1934, the latter in 1937. Today, we know that the story is far more complicated. In her 1968 book *Architecture and Politics in Germany, 1918–1945*, Barbara Miller Lane showed that Nazi views of modernism were more nuanced than was once believed, and that Hitler's cultural policies must be seen in relation to the politics and history of the Weimar Republic.[2] Historian Winfried Nerdinger has similarly shown that Hitler's election and the eventual expulsion of Jews, homosexuals, and political dissidents from the architectural profession did not prevent German modernist designers from courting government patronage. Mies, for instance, was a signatory to an infamous pro-Nazi manifesto published in the National Socialist newspaper *Völkischer Beobachter*; Gropius participated in an exhibition organized by the Deutsche Arbeitsfront, a Nazi-led labor organization.[3] We know further from Jean-Louis Cohen's recent writings that numerous modernists enjoyed support from the Nazi regime.[4] Fritz Ertl, for instance, a graduate of the Dessau Bauhaus, was an overseer of the SS construction office at Auschwitz.

However, we still know little about the transnational architectural networks that sustained the National Socialists during World War II—the focus of this article. Researchers have documented Philip Johnson's support for National Socialist causes during the 1930s, as well as Le Corbusier's well-known efforts to court the Vichy government in France.[5] Here, I concentrate on the case of the Finnish architect Alvar Aalto and his relationship with the German industrial builder Ernst Neufert.[6]

Aalto gained international acclaim in the 1930s for his Paimio tuberculosis sanatorium in southwest Finland, and for projects such as his Villa Mairea and Viipuri Library. Neufert, meanwhile, belonged to the first class of students to enroll at the Bauhaus in Weimar. In 1936, he published the *Bauentwurfslehre* (also known as *Architects' Data*), which is still in print today. Together with *Architectural Graphic Standards* (first published in 1932), it remains the most widely used architectural standards handbook in the world. In 1938, Neufert joined the office of Albert Speer, where he headed the eponymous Neufert Department. In 1941, he became a senior adviser to the Organisation Todt, which executed major Reich-sponsored infrastructure projects such as the building of the autobahn. Neufert's job was to rationalize the design and construction of prefabricated buildings in Germany and its occupied territories. He was tasked with offering consultation advice and design support vis-à-vis the standardization and typification of various industrial buildings, from barracks to factories. He also participated in discussions surrounding the rebuilding of destroyed German cities.[7]

Göran Schildt's 1989 Aalto biography was the first English-language publication to discuss the architect's wartime relationship with Neufert. According to Schildt, Finland "was invited to send a delegation to Germany to inspect, under Neufert's guidance, the progress of standardization throughout the country."[8] Aalto was a key figure of this

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delegation, and he and his compatriots were "received with great cordiality by their official host Albert Speer, who had just been appointed Reichsminister for armament."[9] More recently, architectural historian Susanne Müller has shed light on the larger economic and political circumstances that precipitated this invitation. "The invitation was politically motivated," she writes. "There were 200 thousand men from the German mountain army stationed in [northern] Finland to protect against Soviet occupation. Coupled with that was the enormous economic dependency of Finnish trade exports on Germany, which imported foodstuffs and armaments."[10] Müller observes that Finland's military was minuscule compared to the Soviet Union's and suggests that Germany's presence in Finland served to deter Soviet aggression.

Historian Ákos Moravánszky has analyzed the theoretical assumptions underpinning Neufert's and Aalto's views on standardization. Neither rejected standardization per se, he notes, but the two men did understand it in distinctly different ways.[11] For Neufert, standardization was related to the dimensional coordination of prefabricated building components, whereas for Aalto, it was tied to the organic expression of biological needs. As Moravánszky puts it, Aalto criticized "the practice in the United States of basing standardization in architecture on car-manufacturing models, despite the fundamental difference in the way the objects relate to their environment and to nature. He stressed that standardization in architecture should be based on biological models."[12]

Moravánszky does not specify what he means by "biological models," and, indeed, his account of Aalto's views on standardization is not entirely convincing. Still, the larger question here is how circumstances brought Neufert and Aalto together. Scholars have not fleshed out the significance of Aalto's understanding of standardization as related to the political situation in wartime Europe. The full scope of Aalto's collaboration with Neufert, Speer, and the Nazis has not been documented. Further, Schildt's description of Aalto as a "reluctant" Nazi collaborator is unconvincing.[13] Even if we accept his argument that Aalto detested Hitler personally, we cannot ignore the fact that many individuals—including Aalto—chose to work with the Nazis despite objecting to the Führer's virulent racism and fanatical anti-Semitism.[14] Aalto's involvement in creating the Finnish Standardization Office, and in facilitating the goals of prefabrication conglomerates such as Puutalo Oy (Timber Houses Ltd.), is presented here as a case in point.

Finland and Nazi Germany

To understand Aalto's ties to Nazi Germany, we need to remember that Germany and Finland were cobelligerents from 1940 to 1944, sharing a common enemy in the Soviet Union.[15] Finland had recently endured two brutal conflicts with the Soviets: the first in 1939, during the so-called Winter War; the second in 1941, in what became known as the Continuation War. Yet Finland's Russian problems went back much further. During much of the nineteenth century, Finland had been subject to czarist colonial rule, and beginning in 1809, it was known officially as the Autonomous Grand Duchy of the Holy Russian Empire. Germany assisted Finland in gaining independence during World War I, secretly training Finnish soldiers in what became known as the *Jäger* movement. In 1942, the Germans provided reconstruction assistance, building *Waffenbrüderhäuser*, or "comrades-in-arms homes," for displaced Finns.[16] Hitler viewed Finland's proximity to the Soviet Union as strategically important, and in 1941 he launched his invasion of the Soviet Union, Operation Barbarossa, with Finnish assistance and from Finnish soil. He visited Finland in an official capacity in 1942, to celebrate the birthday of General Carl Gustav Mannerheim, commander in chief of Finnish defense forces and marshal of Finland (and later, its president), and to solidify Germany's military footing in the north (Figure 1). Germany and Finland maintained close economic and political ties until 1944, when the Soviets finally pressured Finland to expel German troops from Lapland. The two countries were never fully aligned, however, and the Allied powers maintained a consular presence in Finland for much of World War II. Neither England nor the United States ever declared war on Finland, and, unlike France, Finland never surrendered its Jewish citizens to the Germans.[17]

Figure 1 Adolf Hitler at Immola Airfield, near Lappeenranta, Finland, 4 June 1942, with Field Marshal Carl Gustav Mannerheim (left) and President Risto Ryti (right) (SA-Kuva, Wikimedia Commons).

Beyond military and political considerations, Germany and Finland needed each other economically. Hitler needed access to Finnish minerals and lumber to build his global empire. Many Nazis believed that an economically integrated Europe would serve the national interest and that international trade would strengthen Nazi influence in occupied and nonaligned countries. Finland, meanwhile, had lost England as its main export partner and was eager to build new relationships abroad. As one Finnish official observed: "The Finnish timber-processing industry has fallen on hard times as a result of the limited consumption capacities of its domestic markets. The Finnish coast was blocked and the export of precut timber was almost entirely suspended."[18] Finnish timber and housing manufacturers such as the Ahlstrom Corporation and Puutalo Oy wanted to expand their commercial presence in Central Europe. They also had powerful Nazi sympathizers within their ranks. Maire Gullichsen—heiress to the Ahlstrom fortune, owner of a famous Aalto-designed house (the Villa Mairea, 1938), and founder, with Alvar and Aino Aalto, of the furniture company Artek—was not a Nazi sympathizer, but she was well aware that many Ahlstrom executives did support Hitler. As she wrote in a letter to Alvar Aalto:

> So we are now definitely on the wrong side, and all we can do is make the best of a bad job. I just think everything, the whole future we must build, seems pretty hopeless, whichever way the war ends. Stuck here in the country like in a sack, with nothing but the scarce and biased news on the radio, and no menfolk to talk to except Jonas Gylphe [one of Ahlstrom's directors], but he is living in higher spheres with a portrait of Hitler on his desk.[19]

Aalto was well positioned to serve the needs of the Finnish and German governments because he spoke German and shared the Nazis' anticommunist and anti-Bolshevik views, as architectural historian Eeva-Liisa Pelkonen has noted.[20] He was an occasional contributor to *Nordlicht*, a pro-Nazi journal of culture and economics. He was also a lieutenant in the Finnish military and was more knowledgeable about trends in prefabricated building systems than all but a handful of individuals anywhere in Europe.

This last qualification proved especially important to Finland's relations with Germany because industrialization of the construction industry had been one of Germany's top commercial priorities since 1935. When Hitler was elected chancellor in 1933, he was quickly made aware of Germany's lack of affordable housing and the potential for political unrest this posed. As economic historian Adam Tooze notes, "The minimum monthly rent even allowing for subsidy was 40 Reichsmarks per month, greatly in excess of the sums that working-class families considered affordable."[21] Hitler was eager to use technology to bring Germany's living standards in line with those of the United States, where automobiles and other consumer goods were far more widely available than in Germany. He also believed that modernizing Germany's infrastructure would improve the nation's preparedness for war and stimulate its productivity. In 1933, Hitler outlawed collective bargaining and named the engineer Fritz Todt to head up the building of Germany's autobahn network. He appointed Hermann Göring his plenipotentiary for the Four-Year Plan in 1936, and in 1937 he named Albert Speer general building inspector of the imperial capital of Berlin. These individuals used their powers to enforce the widespread adoption of Fordist and Taylorist managerial principles. They also aggressively lobbied the building industry for prefabrication and standardization measures.

Standardization was central to Speer's efficiency efforts. Partnering closely with SS-owned companies such as the Deutsche Erde- und Steinwerke, Speer was keen on maximizing worker productivity while minimizing labor costs. Architectural historian Paul Jaskot has shown how Speer used his logistical expertise to expedite the excavation of stone quarries across Germany and Austria.[22] (Speer also appropriated thousands of Jewish-owned homes for the purpose of enriching himself personally and realizing "Hauptstadt Germania.")[23] In 1942, he standardized the pricing of goods and materials in an effort to strengthen his oversight of the war economy.[24] He believed that time and money could be saved through the commodification of the entire building industry.

Speer believed that a unified *Bauordnung*, or "construction regulation," could concentrate German power by bringing discipline and hierarchy to the construction industry. He instructed his associate Neufert to develop just such a system. As Speer explained in his brief preface to Neufert's resulting *Bauordnungslehre* (*Theory of Construction Regulation*, 1943):

> War requires the concentration of all powers in the construction industry as well. Thoroughgoing centralization, for the purpose of economizing technical powers and building mass-production systems, is the prerequisite for improving productivity, which is necessary for the purpose of conquering our current construction tasks. . . . With this new order, one can hardly rely on arbitrary measurements of building components and on the parliamentary deliberations of participating manufacturing organizations. Rather, one must establish a building regulation [*Bauordnung*] in the broadest sense of the word, with a firm hand and with the collaboration of industry, in order to ease the work of the manufacturer, the planner, and the builder in equal measure, and to achieve the appropriate integration of building components.[25]

Aalto understood the economic opportunities that Speer's views on standardization presented and was uniquely positioned to address the Nazis' needs. Through the Congrès

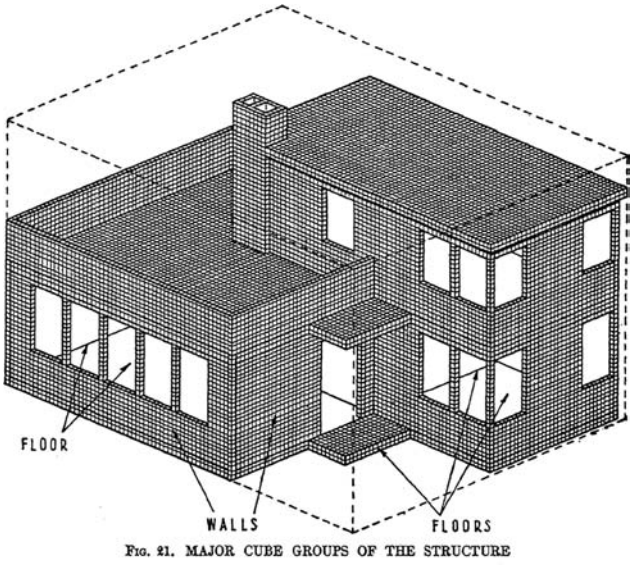

FIG. 21. MAJOR CUBE GROUPS OF THE STRUCTURE

Figure 2 Diagram explaining Albert Farwell Bemis's 4-inch system of dimensional coordination (Albert Farwell Bemis, *The Evolving House: Rational Design*, vol. 3 [Cambridge, Mass.: Technology Press, 1936], 73).

Internationaux d'Architecture Moderne, he gained familiarity with Taylorism and Fordism, two of the ideologies that heavily influenced Speer and his counterparts in the Organisation Todt. As Moravánszky notes: "The large number of [Aalto's] prototype drawings shown at the 'Minimum Apartment' Exhibition in Helsinki in November 1930 reflected the CIAM conviction that technological standards are responses to standard biological needs. The minimum apartment is based on standardization, industrialization, and Taylorization."[26] Aalto also enjoyed considerable and widespread esteem within the architectural profession and was familiar with some of the most influential and up-to-date theories of standardization. One of these was developed by Albert Farwell Bemis, an American businessman who was interested in questions of affordable housing; a second was developed by Neufert.

In volume 3 of his 1936 book *The Evolving House*, Bemis argued that the construction of timber-framed homes should be based on a 4-inch system of dimensional coordination, with a uniform grid governing relations among fabricators, architects, and builders (Figure 2).[27] A few years later, Neufert similarly argued that the use of interchangeable building parts by architects and manufacturers would enhance quality in construction. His thesis in the *Bauordnungslehre* was that a unit measuring one-eighth of a meter—an "octameter," he called it—should serve as the basis for the modular coordination of all prefabricated, mass-produced building materials and building systems around the world. This module should govern the standardization of the masonry industry, Neufert reasoned.[28] It should be tied to the standardization of timber and steel products as well. Neufert's objective was to coordinate the dimensions of machinery and buildings, overhead cranes, and airplane factories, and to enforce the use of automated construction solutions.

Aalto likely gained familiarity with Bemis's writings in 1940, while he was lecturing and teaching at the Massachusetts Institute of Technology.[29] He first encountered Neufert in October 1933 through *Bauwelt*, one of Germany's leading building trade magazines, to which Neufert was a regular contributor.[30] At the time, *Bauwelt* had a reputation for being practically oriented, addressing the economic and technical aspects of construction along with questions of design. Its ties to government ran deep during the Weimar Republic and Nazi eras. Its editor, Friedrich Paulsen, was a fierce anti-Semite and fervent Hitler supporter, and *Bauwelt* purged its ranks of Jews soon after Hitler became chancellor.[31] Through his affiliation with the magazine, Neufert developed a keen interest in Scandinavian architecture and took a particular liking to Aalto's recently completed tuberculosis sanatorium in Paimio. As he wrote to Aalto in 1933:

> I just arrived back the day before yesterday, after a hasty crossing, only to discover that there was great interest in your tuberculosis sanatorium among the *Bauwelt* editors. We would like therefore to feature this sanatorium in *Bauwelt* and in the *Monatsheften für Baukunst und Städtebau*, with all its important details, because they will interest architects in Germany.[32]

In 1935, Neufert introduced Aalto to the Swiss architect Paul Bernoulli, who later became one of Aalto's most valued employees and disciples.[33] Neufert mailed Aalto excerpts from his *Bauentwurfslehre*, which went on to become a best seller among architects.[34] In 1941, Aalto visited Neufert in Berlin. At that time, he was probably returning from a trip to Switzerland, where he had presented a series of lectures on standardization. Aalto later shared with Neufert an essay he had written on prefabrication and rapid building systems. "I enclose to you herewith a copy of a study concerning the reconstruction of my country," Aalto wrote, "which also relates to my activities in the United States. I would be very pleased if you would offer your personal opinion about the questions it raises."[35] In 1942, soon after being elected head of the Finnish Association of Architects (SAFA), Aalto invited Neufert to lecture in Helsinki.[36] In 1943 and again in 1944, Neufert's ideas about standardization were discussed in the Finnish journal *Arkitekten*, the mouthpiece of SAFA. A photograph of Neufert and a description of his visit were featured in one issue. Illustrations from his *Bauordnungslehre* appeared on the magazine's cover in 1944; they showed cutaway and sectional views of Neufert's "House Building Machine," a mobile shed that expedited the construction of poured-concrete apartment buildings (Figures 3).

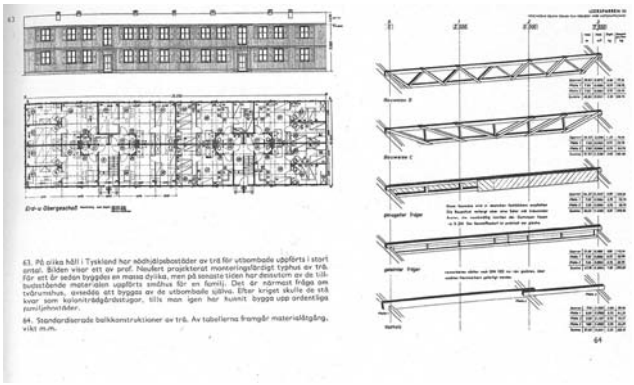

Figure 3 Review of Ernst Neufert's *Bauordnungslehre* in the Finnish journal *Arkitekten* (*Arkitekten*, nos. 5–6 [1944], 57).

In the summer of 1943, Speer invited Aalto and a group of colleagues—Jussi Paatela, Esko Suhonen, Viljo Rewell, and Aarne Ervi—to visit Germany. During their stay, they toured Berlin, Hamburg, Nuremberg, Munich, and Braunschweig.[37] Their journey lasted from 19 June to 7 July, and during that time they learned about Hitler's *Führerstädte* and the large-scale urban renovation and infrastructural plans then under way. The Finns heard about Speer's plans for Hauptstadt Germania and inspected the famous scale model for the project.[38] They were shown a massive reinforced concrete U-boat facility that was designed to withstand aerial bombings—a formidable achievement in terms of size and logistical complexity, one that projected Nazi confidence, technological know-how, and self-assurance at a time when Germany was suffering militarily.[39] In Braunschweig, they inspected a large steel factory and gained familiarity with Germany's most advanced prefabricated building systems. We know from photographs and written testimony that Aalto and his colleagues also toured the studio of sculptor Arno Breker—a favorite of Speer and Hitler, named "official state sculptor" in 1937—in the city of Wriezen (Figure 4).[40] Neufert further offered his guests an intimate, firsthand look at how his ideas about dimensional coordination were playing out in practice. The visit culminated with a banquet hosted by the Reichskammer der Bildenden Künste (Reich Chamber of Fine Arts). As SAFA's unpublished report on the Finns' trip indicates, "The Reichskammer der Bildenden Künste organized a celebration that lasted a couple of nights and was attended by several Berlin architects and artists."[41]

The presence in Germany of Aalto and his delegation cemented an already close economic alliance between Finland and Germany. Beyond this, an intimate friendship between Neufert and Aalto grew out of their contact during this time. The two men began addressing each other using the informal *Du*, or "you," in written correspondence, and they continued to share the fruits of their research with each other. In 1944, Neufert wrote to Aalto: "I learned from Major Eroi about your Finnish standardization efforts, which I will share with Speer as soon as the opportunity presents itself. . . . I unfortunately only just recently gained the opportunity to send to you a copy of the *Bauordnungslehre*."[42]

Aalto, however, made it clear that he had misgivings about Neufert's notions of dimensional coordination. He rejected the idea of using a single module to regulate the entire building industry, because he believed this would conflate architecture with engineering and rob it of its artful and humanistic potential:

> There are many among us who think that architecture is a branch of technology. It is not. The architect is a person who makes use of technology, among other things, when doing his work. He is like a painter with a palette in which technology may represent the blue color, or perhaps even black, but that which contains many other ingredients that must be included in the result. The goal is to make the little man a little happier by offering him a setting which suits him exactly, and does not make him a slave to standardization. In other words, I am advocating unbridled individualism. The password is flexible standardization, the adaptability of details to innumerable different human needs. The difference between technological and architectural standardization is that the technological path leads to one single type, whereas sensible standardization leads to millions of different types.[43]

Aalto asserted that Neufert's octametric system would be untenable in a place such as Finland, where centuries of colonial occupation had bred resentment and resistance to imposed foreign standards and technical practices. He maintained that subordinating the building industry to a single module would be neither practical nor feasible in a small country such as Finland, which depended heavily on exports. Further, he found the idea of imposing such a module offensive to his autonomy as both a Finn and an artist. Referring to a czarist bid to impose uniform room heights throughout the Russian Empire, Aalto noted:

> It is not likely that we could ever convince all people that they want rooms of the same height. There are many reasons for favoring diversity. Even if we are satisfied with a certain standard room height, but wish to use a thinner construction for intermediate floors, we must vary the floor height. Moreover, the floor height can be dictated to a certain extent by the terrain. If we compare the Hottentots with the Nordic race—and every nation has its Hottentots—we find that they need rooms of different height. I have no use for the kind of standardization that puts its foot down and commands things should be done exactly thus and no other way. That is a banal way of doing things.[44]

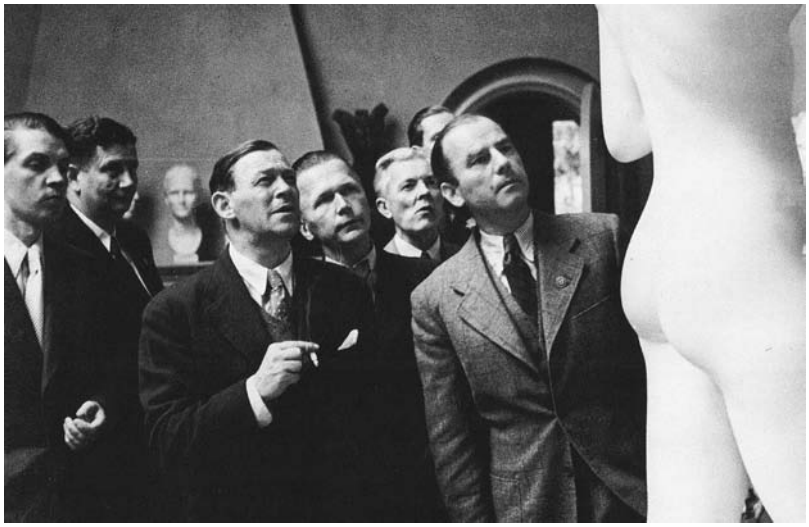

Figure 4 Alvar Aalto (center, with cigarette) and Finnish colleagues visiting German sculptor Arno Breker (far right) at his studio, Wriezen, 1943 (Göran Schildt, *Alvar Aalto: The Mature Years* [New York: Rizzoli, 1989], 71).

Finnish Standardization Efforts

What lessons, then, did Aalto derive from Neufert's ideas? On a theoretical level, he gained an awareness of how corporations, contract negotiations, and state bureaucracies were transforming architectural practice. In the 1930s, the volume of paperwork that architects had to handle was burgeoning. New technologies and building systems were reaching the marketplace, contract negotiations were becoming increasingly complex, and new and more sophisticated risk management tools were becoming available to builders and investors. Standards organizations were revolutionizing the architectural profession.[45] In the *Bauordnungslehre*, Neufert observed that the strategic use of specification sheets and the attendant standardization of contracts, pricing schedules, construction documents, and shipping infrastructures could improve the architect's ability to manage information, minimize paperwork, and deal with complexity. Such efforts at standardization were especially useful in times of war, Neufert argued. "Total war," he wrote, "compels us to eliminate all unnecessary work, to minimize the war of paper as much as possible, and most of all to simplify calculations associated with prefabricated structures."[46]

Aalto agreed with Neufert that management of information needed to become a greater priority within the architectural profession. To that end, in 1942 he created the Finnish Standardization Office. Modeled on the German Institute for Standardization's Construction Standards Committee, which Neufert oversaw during the last eighteen months of the war, the Finnish Standardization Office was founded as an independent, nongovernmental body that brought together stakeholders from industry and commerce, the government, academia, and the architectural profession. Its aims were to foster higher levels of efficiency, productivity, and quality within the Finnish construction industry and to establish a building information directory that architects, contractors, engineers, and fabricators could use to reduce errors in design and construction, increase precision, and assure compliance with specifications issued by both domestic and foreign actors (Figure 5).

The Finnish Standardization Office's main products were Building Information Cards (RT-kartoteket), which, as described by Finnish architect Viljo Rewell, were "collection[s] of universal drawings, methods, and definitions, put in a useful system."[47] Information Cards were printed on standard-format, A4-sized sheets of paper so that users could quickly browse the data they contained. The cards were ordered numerically and stored in spiral binders, so that they could be accessed easily for revisions and updates as needed (Figure 6). The intention, Rewell wrote, was to "rationalize building design and the preparation of drawings, and on that path create the basic conditions for the rationalization of construction and building materials."[48] The Building Information Cards furnished government officials and manufacturers with precise specifications that expedited the ratification of complex and large-scale contracts and requests for proposals. Through systematization and codification, the cards enabled the transmission of highly technical information. The Finnish Standardization Office would eventually catalogue the data contained in all relevant "manuals, laws and regulations, catalogues, advertising brochures, and more." The intent was to update the data on an ongoing basis, "to keep the catalogue in line with the requirements of the time."[49]

Many of the earliest Building Information Cards were geared toward the rationalization of the timber industry. Puutalo Oy was a leading beneficiary of the services of the Finnish Standardization Office, and the company's case

Figure 5 Cover of the journal *Arkitekten* highlighting the efforts of the Finnish Standardization Office (*Arkitekten,* nos. 5–6 [1943]).

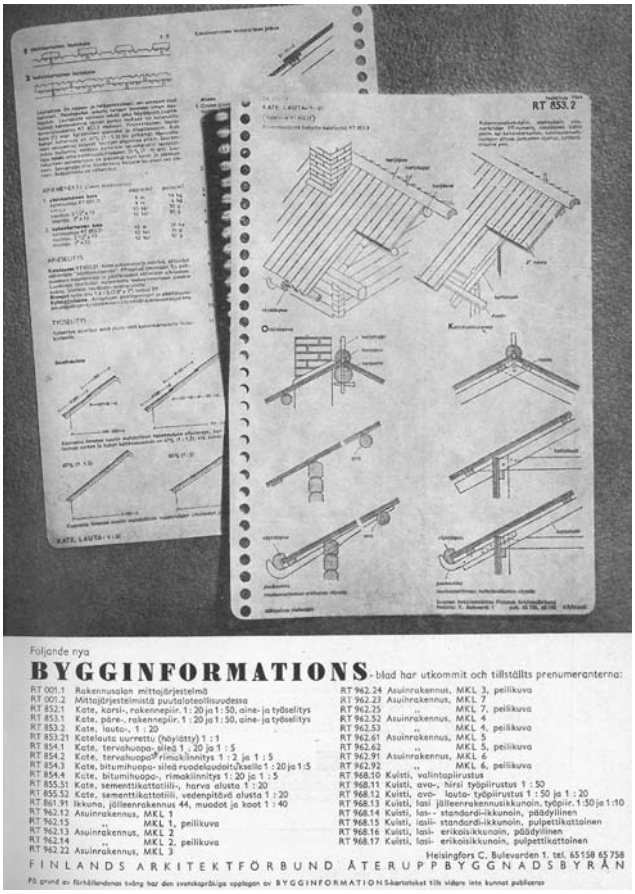

Figure 6 Advertisement for Building Information Cards from the Finnish Standardization Office (*Arkitekten,* nos. 5–6 [1944]).

provides evidence of the sorts of commercial arrangements that Neufert and Aalto helped to broker. A 1949 company publication described Puutalo Oy as "manag[ing] the output of some thirty factories" and operating "both a planning and sales organization. Its central office in the national capital consists of sales, delivery, shipping and freight, planning, supervisory, rationalization (scientific management), price and other departments."[50] Puutalo Oy used the Finnish Standardization Office's Building Information Cards to avoid costly mistakes that could slow the manufacturing process, reduce speed and precision, and increase the company's exposure to risk.

During World War II, Nazi Germany was Puutalo Oy's primary client. Recognition of German standards was often a precondition for doing business with the Nazis. Puutalo Oy built "troop barracks, camp barracks, [and] horse stalls"—that is, the RAD-Baracke, OKH 260/9, and the BfH-Type—which found their way into military bases and concentration camps (Figure 7).[51] The company advertised in the pages of the pro-Nazi periodical *Nordlicht*, which was published in Finland, and both during and after World War II it relied on German standards for prefabricating temporary dwellings, not just for Finland's own population of displaced citizens but for the SS and the Wehrmacht as well. It maintained fabrication facilities and shipping ports throughout Finland, partly to serve the tremendous demand for prefabricated timber building components and partly to secure supply lines against enemy attack (Figure 8).

Aalto was well aware of Puutalo Oy's efforts and, along with colleagues such as Viljo Rewell, was instrumental in adding German standards to the Finnish Standardization Office's catalogue of standards. He alluded to Puutalo Oy's activities in an essay he wrote for *Nordlicht* in 1941, in which he emphasized the highly decentralized nature of the company's operations and noted that it was equipped to prefabricate literally thousands of timber structures in short order. By consolidating a number of Finnish housing manufacturers under a single roof, Puutalo Oy was able to exploit economies of scale. According to Aalto, this consolidation also enabled the company to keep pace with demand:

> As is well known, Finland is an exporter of timber products. A part of our timber-processing infrastructure is the sawmill industry. The excess lumber that is domestically produced in various forms and the large sawmills themselves build this

Figure 7 Advertisement for detached housing, squad barracks, storage barracks, horse stall barracks, garages, and tents from Finnish timber manufacturer Puutalo Oy (*Nordlicht*, no. 1 [1944], back cover).

Figure 8 Advertisement for timber housing manufacturer Puutalo Oy showing the company's fabrication facilities and shipping ports throughout Finland, 1943 (*Arkitekten*, nos. 1–2 [1943]).

> machinery. In short order, a large number of specialized factories for standardized timber homes were created, using our raw materials as their basis. In order to minimize unnecessarily large shipping requirements, the factories were distributed throughout the country. The majority of such factories began their work with primitive machinery and were expanded and improved upon in the second half of 1940. At the start of the winter, the country presided over 20 specialized factories that produced roughly 1,500 dwellings each. The production focused on two areas: rapidly assembled barracks for emergency assistance and fully furnished, prefabricated modern dwellings.[52]

Even after World War II, Puutalo Oy continued to rely on German specifications in manufacturing prefabricated barracks. A German standard known as DIN 4171 dictated the bay widths of the company's PS Hut, which was a variant of a barrack design used at the Mauthausen concentration camp during the war (Figure 9).[53] Developed around 1945, the PS Hut was almost identical to the Nazis' BfH-Type, which was based on Neufert's so-called *Unterkunftsbaumaß*, or "temporary shelter module," with bay widths set at 1.25 meters (Figure 10). As Neufert put it, "The first victory was the typification of Finnish timber panel barracks using the module 1.25 meters or, alternatively, 6.25 meters."[54] The PS Hut remained in production through around 1950 and was used in the reconstruction efforts in places like Poland and the Soviet Union. The building, which could be ordered in a variety of sizes, consisted of modular panels suitable for handling by a single individual; it could be constructed using mostly unskilled labor. In 1949, Puutalo Oy's marketing literature described it this way:

> Let us take, for example, the Puutalo Oy's removable PS-construction, a light construction. . . . The basic modulus of the construction is 125 cm. All the wall panels, for instance, have been measured according to this basic modulus, in such a way that all walls following this 125 cm division into squares in the plan can be assembled from standard parts. The spaces between the roof trusses and joists have also been adapted to this 125 cm

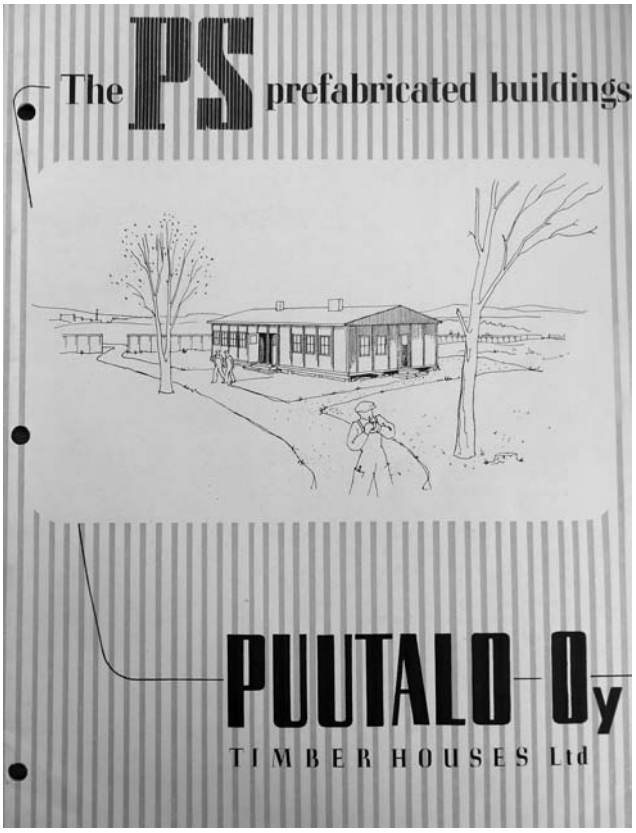

Figure 9 Cover of a Puutalo Oy company catalogue featuring the PS Hut, 1946 (AC 302, box 23, Finland—Puutalo Oy, Papers of the Albert Farwell Bemis Foundation, Institute Archives and Special Collections, Massachusetts Institute of Technology Libraries).

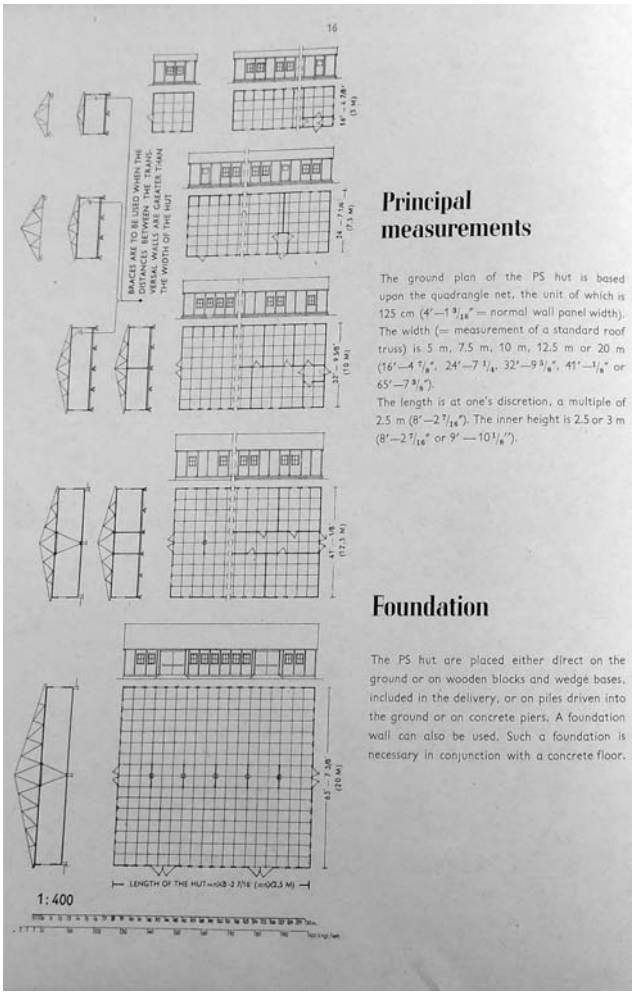

Figure 10 Explanation of the modular principles underpinning Puutalo Oy's PS Hut, 1946 ("The PS Prefabricated Building" [1946], AC 302, box 23, Finland—Puutalo Oy, Papers of the Albert Farwell Bemis Foundation, Institute Archives and Special Collections, Massachusetts Institute of Technology Libraries).

> measuring unit in such a way that out of the parts can be assembled all building lengths divisible by 125 cm. The length of the floor and ceiling panels is two moduli, and the building widths used accordingly are 5, 7½, 10, 12½ and 20 m.[55]

Neufert provided substantial advisory and logistical support to the Finnish Standardization Office, but the flow of information and influence was hardly unilateral. Neufert became an enthusiastic supporter of Aalto's theory of flexible standardization, and he strongly endorsed Aalto's views on prefabrication in the pages of the *Bauordnungslehre*. He was particularly taken by a Building Information Card detailing the "Flexible Stair," which codified Aalto's view that building systems should never be based on standard modules.[56] The Flexible Stair may be understood today as a forerunner to parametric design, because it showed how architects could use algorithms to standardize construction and yet still customize their designs. Neufert described it thus:

> The Finnish architects, who built an active construction standards office under the direction of Alvar Aalto, arrived at the conclusion that the rise of a step needed to be built diagonally, in accordance with the formula 2 treads + 1 riser = 63 cm. . . . In this way we can achieve proportions for steps that are suited to one another and are appropriate for every kind of floor height. At the basis of the stair form selected by the Finns lie tread proportions of roughly 145 × 330 mm and 160 × 290 mm. For every 1 mm higher stair, the rise declines by 2 mm, in accordance with the next series.[57]

For Aalto, the Flexible Stair offered proof that one need not adopt any single unit or module in establishing a system of standardization. This was indeed a partial repudiation of Bemis's and Neufert's writings, making the case for a more nuanced and fine-grained approach to the standardization of buildings. "If you cannot fix a certain floor height," Aalto wrote, "neither can you standardize the staircase. . . . Despite this, we have made an effort in this direction, and have even had a stair approved as our definitive standard: this is a stair

that does not have a dictatorially imposed form, but is based on freedom rather than compulsion."[58]

After World War II, Neufert and Aalto remained friends, but they followed divergent paths. Neufert built a successful practice, although his Nazi past hampered his efforts to gain commissions outside Germany. Aalto, meanwhile, became an international architectural celebrity and was invited to participate in major exhibitions and building projects across Europe and the United States. Few held him to account for his involvement with the Nazis, despite the fact that his Finnish Standardization Office was part of a machine that sustained the Nazi hold on power.

The Finnish Standardization Office was a vehicle through which Nazi Germany cemented its commercial ties to Finland during World War II. It deserves close scrutiny today, for Aalto's ties to fascism have not received sufficient attention. According to Sigfried Giedion, Aalto was a strident humanitarian despite his wartime relationship with the National Socialists. He "is interested in every human being," Giedion wrote in 1949.[59] More recent scholars have similarly cast him as a guardian of the humanist tradition.[60] Still, much of what we know about Aalto's political and social commitments remains shrouded in myth. It is my hope that this essay will invite scholars to question these commitments anew, for we cannot divorce his financial and professional dealings from his political commitments.

We have no reason to doubt Aalto's personal animosity toward Hitler. At the same time, we should not overlook the fact that he collaborated actively and systematically with the Nazis despite any personal misgivings he may have had. The Finnish Standardization Office was nothing if not a mechanism through which to normalize trade relations between Finland and Germany. It was dangerous precisely because it was part of an intricate and, at times, imperceptible global infrastructure that furthered the Nazis' destructive aims.

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Notes

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2. Barbara Miller Lane, *Architecture and Politics in Germany, 1918–1945* (1968; repr., Cambridge, Mass.: Harvard University Press, 1985).

3. Winfried Nerdinger, ed., *Bauhaus-Moderne im Nationalsozialismus: Zwischen Anbiederung und Verfolgung* (Munich: Prestel, 1993), see esp. the chapters by Nerdinger. See also Michael Tymkiw, *Nazi Exhibition Design and Modernism* (Minneapolis: University of Minnesota Press, 2018), esp. 41–58.

4. Jean-Louis Cohen, *Architecture in Uniform: Designing and Building for the Second World War* (New Haven, Conn.: Yale University Press, 2011).

5. For a discussion of Johnson's ties to the Nazis, see Franz Schulze, *Philip Johnson: Life and Work* (Chicago: University of Chicago Press, 1994), 104–46. For an overview of the debate surrounding Le Corbusier and fascism, see Simone Brott, "The Le Corbusier Scandal, or, Was Le Corbusier a Fascist?," *Fascism: Journal of Comparative Fascist Studies* 6 (2017), 196–227.

6. On Neufert, see Patricia Merkel, *Das Wirken Ernst Neuferts in den Jahren von 1920 bis 1940* (Wiesbaden: Springer, 2017); Gernot Weckherlin, *BEL: Zur Systematik des architektonischen Wissens am Beispiel von Ernst Neuferts "Bauentwurfslehre"* (Tübingen: Wasmuth, 2017).

7. Werner Durth and Niels Gutschow, *Träume in Trümmern: Planungen zum Wiederaufbau zerstörter Städte im Westen Deutschlands, 1940–1950*, 2 vols. (Braunschweig: Vieweg & Sohn, 1988).

8. Göran Schildt, *Alvar Aalto: The Mature Years* (New York: Rizzoli, 1989), 67.

9. Schildt, 70.

10. Susanne Müller, *Aalto und Wolfsburg: Ein skandinavischer Beitrag zur deutschen Architektur der Nachkriegszeit* (Weimar: Verlag und Datenbank für Geisteswissenschaften, 2008), 42. Unless otherwise noted, all translations are my own.

11. Ákos Moravánszky, "Baker House and Brick: Aalto's Construction of a Building Material," in *Aalto and America*, ed. Stanford Anderson, Gail Fenske, and David Fixler (New Haven, Conn.: Yale University Press, 2012), 210.

12. Moravánszky, 211.

13. Schildt, *Alvar Aalto*, 67.

14. Schildt, 66. An extreme example of an individual who opposed the Nazis' fanatical racism and yet still collaborated with them is Ernst Wolfgang Topf. His company, Topf & Söhne, harbored communists and Jewish so-called *Mischlinge* during World War II while also manufacturing crematoria for the concentration camps. See Annegret Schüle, *Industrie und Holocaust: Topf und Söhne—Die Ofenbauer von Auschwitz* (Göttingen: Wallstein, 2017).

15. In 1939, there had been great anger in Finland over Germany's entering into a nonaggression pact with the Soviet Union. Finns were elated when the pact collapsed. For background on the history of Finland's Winter and Continuation Wars, see Vesa Nenye et al., *Finland at War: The Winter War 1939–1940* (Oxford: Osprey, 2015); Vesa Nenye et al., *Finland at War: The Continuation and Lapland Wars 1941–1945* (Oxford: Osprey, 2016). See also Olli Vehviläinen, *Finland and the Second World War*, trans. Gerard McAlester (New York: Palgrave, 2002).

16. "In order to assist with the housing crisis that took place in the region of Karelia, in 1942 a comprehensive, voluntary construction effort was called into existence. The soldiers on the front began in their free time to build fortified dwellings for families of fallen or war-injured soldiers." Letter titled "Die Waffenbrüderhäuser," 1940s, Archive of the Finnish Association of Architects, Archives of Salaried Employees, Helsinki.

17. In fact, some Jewish Finns fought alongside Nazi soldiers during World War II. See "The Jews Who Fought for Hitler: 'We Did Not Help the Germans. We Had a Common Enemy,'" *Telegraph*, 9 Mar. 2014, https://www.telegraph.co.uk/culture/museums/10682975/The-Jews-who-fought-for-Hitler-We-did-not-help-the-Germans.-We-had-a-common-enemy.html (accessed 5 Apr. 2019).

18. J. O. Söderhjelm, "Die finnische Holzverarbeitungsindustrie," *Nordlicht: Organ der Ostseegesellschaft in Finnland* 1, no. 3 (1941), 21.

19. Quoted in Schildt, *Alvar Aalto*, 63–64.
20. Eeva-Liisa Pelkonen, *Alvar Aalto: Architecture, Modernity, Geopolitics* (New Haven, Conn.: Yale University Press, 2009), 12.
21. Adam Tooze, *The Wages of Destruction: The Making and Breaking of the Nazi Economy* (New York: Penguin, 2007), 564–65.
22. Paul B. Jaskot, *The Architecture of Oppression: The SS, Forced Labor and the Nazi Monumental Building Economy* (London: Routledge, 2000).
23. Susanne Willems, *Der entsiedelte Jude: Albert Speers Wohnungsmarktpolitik für den Berliner Hauptstadtbau* (Berlin: Rudolf Otto, 2002). See also Magnus Brechtken, *Albert Speer: Eine deutsche Karriere* (Munich: Siedler, 2017).
24. Tooze, *Wages of Destruction*, 565.
25. Albert Speer, preface to Ernst Neufert, *Bauordnungslehre*, ed. Albert Speer (Berlin: Volk und Reich, 1943), 3. For a summary of the arguments contained in the *Bauordnungslehre*, see Nader Vossoughian, "Standardization Reconsidered: *Normierung* in and after Ernst Neufert's *Bauentwurfslehre*," *Grey Room*, no. 54 (Winter 2014), 34–55.
26. Moravánszky, "Baker House and Brick," 210–11.
27. See Albert Farwell Bemis, *The Evolving House: Rational Design*, vol. 3. (Cambridge, Mass.: Technology Press, 1936), 53–54. For an excellent discussion of Bemis's ideas, see Andrew L. Russell, "Modularity: An Interdisciplinary History of an Ordering Concept," *Information & Culture* 47, no. 3 (2012), 257–87.
28. Neufert's settling on 12.5 centimeters as a standard module in the *Bauordnungslehre* cannot be treated in depth here. Three points will have to suffice. First, one-eighth of a meter (or 12.5 centimeters) had the benefit of easily being halved twice. That is to say, it could be divided readily by anyone with rudimentary knowledge of arithmetic. Second, the octameter approximated the dimensions of the *Normalformat*, Prussia's existing standard brick size. Finally, the use of the octameter would ease the task of converting metric units into imperial units and vice versa. Multiplying 12.5 centimeters by ten results in a measure of roughly 4 feet.
29. Pekka Korvenmaa, "A Bridge of Wood: Aalto, American House Production, and Finland," in Anderson et al., *Aalto and America*, 102.
30. See Dörte Kuhlmann, "Alvar Aalto—The Magnus of the North in Germany," in *Alvar Aalto: Second Nature*, ed. Mateo Kries and Jochen Eisenbrand (Weil am Rhein: Vitra Design Museum, 2014).
31. For a discussion of the Bauwelt Verlag and its history, see Roland Jaeger, "Die Produktfamilie *Bauwelt*: Architektur im Programm des Ullstein-Konzerns," in *"Der ganze Verlag ist einfach eine Bonbonniere": Ullstein in der ersten Hälfte des 20. Jahrhunderts*, ed. David Oels and Ute Schneider (Munich: Walter de Gruyter, 2014).
32. Ernst Neufert to Alvar Aalto, 5 Oct. 1933, box 25, Alvar Aalto Museum, Jyväskylä.
33. Neufert gave Bernoulli a note of introduction to present to Aalto. It read, in part, "The bearer of this text is the architect Paul Bernoulli, the son of the architect Hans Bernoulli, whose spirited articles, written under the pen name Joshua Fensterriegel, you most certainly must have read." Ernst Neufert to Alvar Aalto, 18 May 1935, box 25, Alvar Aalto Museum, Jyväskylä.
34. "Through Mr. Bernoulli, I am enclosing to you 14 sample pages out of my *Entwurfslehre*, which will be appearing in book form with 300 pages and ca. 270 illustrated sheets. . . . I hope to be able to send you a desk copy, for you will surely have an opportunity to review it in a Finnish architectural magazine." Neufert to Aalto, 18 May 1935.
35. Alvar Aalto to Ernst Neufert, 9 Sept. 1941, box 49, Alvar Aalto Museum, Jyväskylä.
36. The talk was well received, at least according to Neufert's own account: "During the Second World War in Finland, a standardization association was founded by the Finnish architectural league. Around its opening, I spoke about 'The Preliminary Work and Reflections about a German System of Dimensional Coordination' at the invitation of Finnish colleagues at the Technical College of Helsinki. Drawing architects from all over Finland, the reception of the paper at this important architectural congress was unequivocally favorable." Ernst Neufert, *Das Maßgebende* (Wiesbaden: Bauverlag, 1965), 72.
37. See Müller, *Aalto und Wolfsburg*, 41.
38. One of the Finnish delegates observed: "This new monumental fairway is designed to be 7½ km long and 150 meters wide on average. At both ends there are giant railway stations that replace all other Berlin stations. . . . From the south, there is a magnificent triumphal arch at the beginning of the highway, which will be 90 meters high and through which a stranger to the city can admire Berlin in its full glory. The design of the triumphal arch has been drafted by the national leader himself, Hitler, who is known to be extremely interested in architecture." Finnish Association of Architects, travel report, 19 June–7 July 1943, Archive of the Finnish Association of Architects, Archives of Salaried Employees, Helsinki.
39. Architect Esko Suhonen recounted the visit years later: "Especially in industrial architecture and in certain building projects for the Army, the Germans had achieved technological standards that were completely new to us. We were also shown installations that were considered top secret: in Hamburg, for instance, we visited the Uboots Werke, a shipyard built into an artificial hill. We were shown how this hill was made by injecting concrete from two-foot thick pipes into gigantic formworks full of steel. None of us had ever even dreamed of technology like this. Another of the significant building projects we were shown was the new *Reichskanzlei*, the Chancellor's office in Berlin, which had just been completed and which no Finn, and precious few Germans, had seen." Quoted in Schildt, *Alvar Aalto*, 68.
40. Schildt, 71.
41. Finnish Association of Architects, travel report, 19 June–7 July 1943.
42. Ernst Neufert to Alvar Aalto, 19 June 1944, box 25, Alvar Aalto Museum, Jyväskylä.
43. Alvar Aalto, *Alvar Aalto in His Own Words*, ed. Göran Schildt, trans. Timothy Binham (New York: Rizzoli, 1997), 165.
44. Aalto, 166.
45. See Thomas Wölker, *Entstehung und Entwicklung des deutschen Normenausschusses 1917 bis 1925* (Cologne: Beuth, 1992); Günther Luxbacher, *DIN von 1917 bis 2017: Normung zwischen Konsens und Konkurrenz im Interesse der technisch-wirtschaftlichen Entwicklung* (Berlin: Beuth, 2017).
46. Neufert, *Bauordnungslehre*, 315.
47. Viljo Rewell, "Bygginformationskartoteket," *Arkitekten*, nos. 1–2 (1943), 42.
48. Rewell, 42.
49. Rewell, 42.
50. "The Timber House Production of Puutalo Oy," *Puutalo Oy Communications*, May 1949, p. 4, AC 302, box 23, Papers of the Albert Farwell Bemis Foundation, Institute Archives and Special Collections, Massachusetts Institute of Technology Libraries.
51. "Mannschaftsbaracken, Lagerbaracken, Pferdeställe." *Nordlicht*, no. 1 (1944), back cover.
52. Alvar Aalto, "Finland: Das Land im wechsel zwischen Krieg und Wiederaufbau," *Nordlicht: Organ der Ostseegesellschaft in Finnland* 1, no. 4 (Summer 1941), 34.
53. Examples of this barrack type can still be seen at the KZ-Gedenkstätte Mauthausen.
54. Neufert, *Das Maßgebende*, 73.
55. "Timber House Production of Puutalo Oy," 6.
56. The Flexible Stair was also the subject of a talk that Aalto gave in 1942. See Aalto, *Alvar Aalto*, 165–66.
57. Neufert, *Bauordnungslehre*, 434.
58. Aalto, *Alvar Aalto*, 166.
59. Sigfried Giedion, *Space, Time and Architecture: The Growth of a New Tradition*, 2nd ed. (Cambridge, Mass.: Harvard University Press, 1949), 490.
60. See Peter Reed, ed., *Alvar Aalto: Between Humanism and Materialism* (New York: Museum of Modern Art, 1998); Winfried Nerdinger, ed., *Alvar Aalto: Toward a Human Modernism* (New York: Prestel, 1999).