Weimar Culture and Futuristic Technology: The Rocketry and Spaceflight Fad in Germany, 1923–1933

MICHAEL J. NEUFELD

In 1923 the Transylvanian German Hermann Oberth published in Munich a slim theoretical volume on rocketry and spaceflight, Die Rakete zu den Planetenräumen (The rocket into interplanetary space).1 (See fig. 1.) Over the next few years Oberth's book was followed in the German-speaking lands by a number of other works, both popular and technical, which attempted to demonstrate the feasibility and desirability of spaceflight—at the time a rather utopian and bizarre concept. One of the world's first spaceflight societies and the world's first journal devoted exclusively to rocketry and space exploration were also founded, and a significant popular fad was unleashed, peaking in 1928–29 with a number of spectacular rocket stunts and a major science-fiction movie, directed by Fritz Lang, about a moon-flight. Rocket experiments extended the life of this fad into the early 1930s, but the political and economic troubles of the Great Depression gradually overwhelmed it, and public experimentation with and discussion of rocketry were largely eliminated by the Nazis in 1933–34.

Dr. Neufeld is a curator in the Department of Aeronautics of the National Air and Space Museum, Smithsonian Institution. He is the author of The Skilled Metalworkers of Nuremberg and is currently working on an institutional history of the German army rocket center at Peenemünde during the Third Reich. This article was originally presented at the 1988 Society for the History of Technology annual meeting in Wilmington, Delaware. The research was made possible by the generous support of the Verville Fellowship of the National Air and Space Museum and a Smithsonian Postdoctoral Fellowship. The author wishes to express his appreciation for the many helpful comments made by colleagues currently or formerly at the Smithsonian, especially Frank Winter and Paul Forman, but also Gary Kulik, Robert Smith, John Maurer, Michael Dennis, David DeVorkin, Paul Ceruzzi, Allan Needell, and Cathy Lewis. Adam Green of the NASA Space Station History Project also deserves thanks.

1Hermann Oberth, Die Rakete zu den Planetenräumen (1923; reprint, Nuremberg, 1960). Oberth outlived virtually all of his contemporaries, dying in late December 1989 at the age of ninety-five.

© 1990 by the Society for the History of Technology. All rights reserved.

0040-165X/90/3104-0004$01.00
Oberth was not, of course, the first to discuss the feasibility of spaceflight through rocket propulsion. The priority of Konstantin Tsioolkovsky in Russia and Robert Goddard in the United States has long been recognized. Germany was also not the only location where rocketry and spaceflight were energetically discussed in the 1920s and 1930s—German-speakers were involved in a larger international movement that included Russians, Frenchmen, Americans, and Britons. What was unique about Germany in this era was the spectacular nature of the rocket stunts, the extent of the theoretical discussion, and the level of response in the news media and popular culture to the spaceflight idea. While this fact has often been noted, no one has offered an adequate explanation that takes into account the character of Weimar culture and society. In large part this is due to the scholarly neglect of the history of technology in German popular culture as well as the inadequacy of the literature in space history—a field that has only recently become respectable among academic historians. Not only do we lack comparable treatments of, say, the zeppelins or aviation in Weimar culture; there is little scholarly literature on the Weimar spaceflight fad itself. Popular histories aside, only Frank Winter's very useful books and articles on the early rocket societies have covered this ground, and they do not focus on the cultural factors that might explain Weimar Germany's openness to radical technological ideas.

Such explanations as have been offered in the popular literature have emphasized nationalism and escapism among the German populace, which was burdened by the defeat in World War I, and the ensuing

\*In this article the adjective “German” will be used loosely to include Austrians and other German-speakers like Oberth, a Romanian citizen in the 1920s, who were heavily involved in the German movement. A peculiar footnote to Oberth’s role in the German-speaking world is that even there he was not first. The well-known eccentric inventor Hermann Contrasiedt gave a public lecture in May 1891 proposing a form of reaction propulsion for spaceflight based on a faulty understanding of physics. His idea was fairly rapidly discredited and forgotten, however, and was remembered only as a result of the fad unleashed by Oberth’s book. Frank H. Winter, Prelude to the Space Age: The Rocket Societies: 1924–1940 (Washington, D.C., 1983), p. 24.

postwar chaos of revolution, inflation, and foreign occupation. Frank Winter has placed more weight on the influence of individuals, in particular on how Oberth’s book provoked a strong reaction because it opened whole new vistas for manned spaceflights through its many ingenious technical proposals. One might add that, since Oberth’s book was available only in German for some years, this may help explain the strong reaction in Germany and Austria. But Winter has also suggested that “the space travel movement had a special appeal to the Germans as an extension of the romantic Lebensphilosophie (Philosophy of Life) which pervaded the Weimar Republic. The Lebensphilosophie, at its height, glorified technology in reaction to Germany’s defeat in World War I and its subsequent economic woes.” In Winter’s view, the romantic aspects of the German spaceflight movement and Fritz Lang’s movie Frau im Mond (The woman in the moon, 1929) are examples of the influence of Lebensphilosophie.

There are many problems with this. If right-wing idealist philosophy was very prominent in the universities and among some intellectuals, it hardly “pervaded” the ideologically diverse and divided Weimar Republic, and the advocates of this amorphous philosophy were far from uniformly protechnology. In any case, Lebensphilosophie was almost absent in the mainstream media’s treatment of the rocket fad, as I will show, and a vague romanticism in the movement or in the movie hardly demonstrates the influence of reactionary idealist philosophers. Winter is certainly correct in emphasizing the role of personalities as the most important cause of Germany’s prominence in the early space travel movement, but I will examine in more depth the cultural factors leading to this prominence. These include nationalism, a widespread belief in technological progress, and the growth of a very modern “consumer culture” that was indeed in some aspects escapist.

section on the renewed enthusiasm for these airships that followed the transatlantic crossing of the LZ 126 (taken over by the United States as the Los Angeles) in October 1924.

4For a particularly sensationalistic version of this argument see Helen B. Walters, Hermann Oberth (New York, 1962), p. 60. The more competent popularizations of Willy Ley and Wernher von Braun do not appear to address the question at all. Willy Ley, Rockets, Missiles, and Space Travel, rev. and enlarged ed. (New York, 1957); Wernher von Braun, Frederick I. Ordway III, and Dave Dooling, Space Travel: A History (New York, 1985).

5This argument is more implicit than explicit in Winter, Prelude (n. 2 above), p. 15, but more clearly stated in his forthcoming The Rocket into Space (Cambridge, Mass., 1990), chap. 1.

6Winter, Prelude (n. 2 above), p. 15.


8Before examining these factors in more detail, however, it is useful to look at the trajectory and nature of the Weimar rocket fad, in order to gauge its extent, the personalities involved, and the forces at work. This fad went through three phases: the preliminary period from the publication of Oberth’s book in mid-1923 to the first rocket stunt in April 1928; the fad proper from the spring of 1928 to the premiere of Frau im Mond in late 1929; and the declining phase from 1930 to the Nazi seizure of power in 1933.

Oberth’s work was indeed crucial in the first phase, in part because his heavily mathematical treatise forthrightly discussed not just rocketry but also manned spaceflight. The little book opened with four startling propositions: (1) “With the present state of science and technology it is possible to construct machines that can climb higher than the Earth’s atmosphere”; (2) “With further development” it would be feasible to reach escape velocity; (3) These machines could carry humans, probably without unhealthy side effects; and (4) “Under certain economic conditions the construction of such machines would pay for itself” and this could happen “within a few decades.” Oberth then proceeded not only to derive the theories of rocket engines and trajectories mathematically but also to make many constructive suggestions for the design of liquid oxygen/alcohol and liquid oxygen/hydrogen multistage vehicles, and showed how the hazards of manned spaceflight, such as acceleration and weightlessness, could be overcome. Although many of these ideas had been developed independently by others, they were nowhere accessible to the public. Tsiolkovsky’s work remained buried in very obscure Russian journals until Oberth’s book appeared, and Goddard was quite circumspect in his 1919 paper “A Method of Reaching Extreme Altitudes.” After the paper’s publication by the Smithsonian in January 1920, the shy American became completely secretive when newspapers sensationalized and distorted his discussion of a simple staged powder rocket to hit the moon.

Fueled by this secrecy, wild rumors about Goddard’s plans circulated in the German popular press in the 1920s, especially in 1924–25, when the American scientist was allegedly going to launch himself to the moon. But only the reaction to Oberth produced any...

9Oberth, Die Rakete (n. 1 above), p. 7. All translations are mine.


long-lasting movement in Germany. At first scarcely anyone noticed Oberth’s book, which appeared in a very small edition at the author’s cost and in the middle of the disastrous hyperinflation/Ruhr-occupation crisis of 1923. Oberth’s initial problem was academic opposition. The book was rejected as a Heidelberg doctoral thesis in 1922 because it was too unorthodox, and in early 1924 it was attacked by a Prof. Dr. Riem in a popular science magazine with the old and oft-repeated canard that a rocket cannot work in a vacuum because its exhaust had nothing to push against. While others with academic titles wrote to defend Oberth, the German-Rumanian pioneer was often to suffer from narrow-minded and sometimes silly attacks by members of the university establishment.

The whole discussion might have remained obscure at this point but for the intervention of Max Valier, a popular writer of Austrian birth resident in Munich. Valier lived by his wits and writing talent, churning out books on a bizarre heterodox cosmology and on the occult, among other topics. He devoted his inexhaustible energies to a crusade for Oberth’s ideas, beginning with a popular book, Der Vorstoß in den Weltraum (The advance into outer space) in 1924. This book was sold well enough to go into a second printing by 1925 and greatly aided the sales of Oberth’s book, which sold out and was reprinted in 1925 as well. Valier also published a number of illustrated articles on spaceflight in popular newspapers and magazines, some with very large circulations. Although it may be significant that German editors were already open-minded enough to publish articles on such a futuristic and often ridiculed topic, perhaps they were motivated only by a desire to increase their readership. Valier also set out on endless lecture tours in Germany and Austria; some were well received, others drew ridicule and cost him money.

Although he had drawn some attention to the spaceflight idea, by 1926 Valier was disillusioned by the lack of a broader response, partly

because he and Oberth had a naive view of the technological and financial difficulties involved in building a space vehicle. With the theoretical problems largely solved, they both felt that some millionaire or corporation would come along to finance rocket experiments leading to spaceflight in a few years. In retrospect this seems ludicrous, but their image of the lone inventor creating a great breakthrough was typical of this era and appears to derive from the examples of the electrical and aviation pioneers, among others. It also shows that, like all the spaceflight pioneers, they failed to anticipate that advanced rocketry would be an enormously expensive technology that could only be developed by large state-financed military-industrial complexes.

Departing from Oberth’s concept of vertically launched rockets, Valier set out to popularize his own approach, which postulated a gradual transition from rocket planes to spaceships, with the aim of attracting money to solve an important contemporary technological challenge: transatlantic air transport. The weather-plagued attempts to cross the ocean in these years gave Valier’s advocacy of travel at stratospheric altitudes a certain currency. The Austrian pioneer even dimly perceived the possibility of some kind of air-breathing reaction propulsion, but the turbojet concept had not yet been clearly perceived by him or virtually anyone else. To launch his campaign, Valier enlisted the support of two well-known technical illustrators in Munich, the von Römer twins, and published a whole series of articles with sensationalistic drawings of rocket planes beginning in 1926 (fig. 2). In part because these drawings and proposals were often technically absurd, Oberth broke with him. Meanwhile, other spaceflight theorists

For an influential interpretation of the relationship between rocketry and the military-industrial complex, see Walter A. McDougall, . . . the Heavenly and the Earth: A Political History of the Space Age (New York, 1985). On Valier’s and Oberth’s expectations, and Valier’s disillusionment, see their correspondence, and Oberth’s correspondence with C. Barthel, a wealthy banker, in Hans Barth, ed., Hermann Oberth: Briefwechsel (Bucharest, 1979), 1:20–41, 75–77; Hermann Oberth, “Ist die Weltraumfahrt möglich?” pt. 2, Die Rakete (December 1927), 165–66, and the anonymous article, probably by Winkler, “Was kostet das Weltraumschiff?” pp. 170–71 of the same issue, offer extremely unrealistic cost estimates for constructing a spaceship. There is no adequate social history of the image of inventors and scientists in Germany in this period. My impressions were gathered in part from reading the press and the spaceflight pioneers’ publications. Some useful impressions of the image of engineers in German popular novels are to be found in Harro Segeberg, Literaturische Technik-Bilder: Studien zum Verhältnis von Technik und Literaturgeschichte im 19. und frühen 20. Jahrhundert (Tübingen, 1987).


Essers, Max Valier (n. 12 above), pp. 125–26, 237, 244–45; Oberth to Valier, January 8, 1927, in Barth, Oberth: Briefwechsel (n. 14 above), pp. 89–92; Max Valier,
came forward in Germany and Austria in 1925–26, a number of influential science-fiction novels about spaceflight were published, such as Otto Willi Gail's *Der Schuss ins All* (The shot into space), and a society was formed in Vienna in late 1926. Johannes Winkler, a church administrator in Breslau, Silesia, started the first spaceflight journal, *Die Rakete* (The rocket), in the spring of 1927, and partly because of Valier's intervention, the Verein für Raumschiffahrt (Society for space travel or VfR) was founded in Breslau in July 1927, with *Die Rakete* as its organ.  

Although the years 1923 to 1927 had generated a level of activity in Germany and Austria that rivaled or exceeded that of the lively but internationally isolated spaceflight movement in the USSR, the popular fad began in earnest with the first rocket car stunts in April–May 1928. In his search for financial support, the restless Valier had finally succeeded in enlisting the cooperation of the media-conscious playboy and heir to the Opel car manufacturing fortune, Fritz von Opel. Jettisoning the scientific approach of Oberth, who advocated the development of liquid-fuel rocket engines, Valier and Opel chose to use traditional black powder: lifesaving rockets to popularize the often misunderstood principle of reaction propulsion and to win adherents for the rocket plane. In this they succeeded. The first rocket car experiments at the Opel headquarters of Rüsselsheim on April 11–12, 1928, were followed by Opel's spectacular run at the Avus racetrack in Berlin on May 23 before 2,000 invited guests from the pinnacle of Weimar government and society (figs. 4 and 5). Before the run, Opel's speech and that of the head of the Scientific Society for Aviation were carried live on Berlin radio, and the newspapers gave considerably more space to the rocket car than they had in April.

---


*Winter, Prelude* (n. 2 above), pp. 27–30.

Fig. 3.—The cover of one of the early issues of Die Rakete also shows Max Valier's influence: the conventional propeller aircraft with rocket assistance is reaching for the edge of space.

Certainly there were German technological feats that produced much more media attention in the Weimar Republic—notably the construction and flights of the passenger zeppelins and the first east-to-west, nonstop transatlantic flight, carried out by a German crew in April 1928. The Opel-Valier experiments nonetheless unleashed what one journal disparagingly called the Raketenrumpel ("rocket row" or "rocket racket"—the term Rumpel was often applied...
to public controversies or fads in this period. Powder rocket experiments multiplied: the first flight of an aircraft with rocket power on June 11; separate experiments by Opel and Valier with unmanned rocket railcars the same season (the two split up owing to Opel’s desire to keep all the credit); even rocket bicycles and a Valier rocket ice sled in 1929 (fig. 6). Other rocket car imitators followed. In addition to the print media, radio and newsreels often popularized these exploits, and space launches appeared in a Berlin cigarette advertisement (fig. 7), a Munich fireworks display, and other events for the “Raketen-Camouflage” (Rocket Smear).

Flight March). (See fig. 8.) German children played with model rocket cars and planes, and a number of future engineers at Peenemünde, notably Wernher von Braun, had their interest in rocketry sparked or increased by the publicity. On a more serious level, the number of books and articles about rocketry and spaceflight markedly increased after 1928. Commercial publishers brought out both quick popularizations and new theoretical works.22

This fact was showing signs of petering out in 1929 when two events gave it new impetus. On September 30, 1929, Fritz von Opel flew in a rocket-powered glider, which he dishonestly advertised as the first-ever such flight, and about two weeks later Fritz Lang staged the spectacular Berlin premiere of his film Frau im Mond. Lang had first conceived of a moonflight movie while working on the futuristic drama Metropolis. But it was the Raketenrumpel that really impelled him and his novelist-screenwriter wife, Thea von Harbou, to publish a novel and turn it into a film. Oberth was brought on board as scientific adviser, and then financed to build a liquid fuel rocket to be launched for publicity at the time of the premiere. This latter project turned into a comic disaster when the technologically inexperienced professor from Rumania tried to build a rocket together with a con-artist engineer, Rudolf Nebel, and a fugitive Bolshevik aviation writer, Alexander Scherchevsky (described by Oberth as “the second laziest man I ever met”). The rocket never flew, but the film company

22Advertisement for Josetti Juno cigarettes in Die Rote Fahne (Berlin), June 23, 1928; advertisement in the Volkscher Beobachter (Munich), Bayernausgabe, July 12, 1928; photograph “Das Weltraumrauschen auf Volksfesten,” Die Rakete 3 (February 1929): 30; and sheet music of the “Raketenflug-Marsch” by Johann Schädel (Zurich, ca. late 1920s) in the Bella Landauer Collection, Ramsey Room, NASM Library. Rocket pioneer and von Braun team member Arthur Rudolph also remembers a photograph of Goddard on a pack of cigarettes about 1928. Rudolph oral history interview by Michael Neufeld, August 4, 1989, available in the Department of Space History, NASM, Smithsonian Institution.

Among the important theoretical or serious semipopular works published in this period were Hermann Oberth, Wege zur Raumschiffahrt (Munich, 1929); Hermann Noordung (pseud. of Hermann Potočnik), Das Problem der Befahrung des Weltraums (Berlin, 1928); Willy Ley, ed., Die Möglichkeit der Weltraumfahrt (Leipzig, 1928); and numerous articles in Die Rakete. One cheap popularization was Felix Linke, Das Raketen-Weltraumfahrt: Wanderung zum Mond und zu anderen Planeten (Hamburg, 1928). A later imitator was Gerrit Biermann, Weltraumfahrt? Eine kurze Studie des Problems (Bremen, 1931). For German rocket toys, see the pictures in Reinhold Ohe, “Die Schnellfahrversuche des Opel-Raketenwagens auf der Reichshauptstrasse Burgwedel-Celle. Bericht eines Augenzeugen,” Der Raum (August 1928): 65–68, and in Science and Invention 16 (November 1928): 602. They were also shown in a newsreel available in the Bundesarchiv Koblenz. Erik Bergaust, Wunder von Braun (Washington, D.C., 1970), pp. 34–35, and Dieter Huzel, Peenemünde to Canaveral (Englewood Cliffs, N.J., 1962), pp. 18–19, testify to the influence of this period on future Peenemünders.

Fig. 7.—A cigarette advertisement from Die Rote Fahne in June 1928 reflects the Raketenrumpel. The text reads: “What does the bear (the symbol of Berlin) say? Our age is marked by high-flying plans. If new goals in outer space entice researchers, to the smoker only one thing is worth striving for: Josetti Juno, Berlin’s most-smoked 4 Pf. cigarette.”
exploited its anticipated launch for free advertising. *Frau im Mond* was not the first spaceflight movie, but it was certainly the first significant and technologically plausible one. It turned out to be only a moderate success, however, in part because the excellent special effects were diminished by Thea von Harbou’s melodramatic and unoriginal plot, and in part because it was one of the last major silent films made in Germany and was overshadowed by the first talkies.

The phase of declining public and media attention began immediately after the publicity surrounding the movie subsided. The fad had run its natural course, and unrealistic expectations of imminent spaceflights fostered by the popular press led to disillusionment even among members of the Society for Space Travel. *Die Rakete* folded in late 1929 because of the failure of many members to pay their dues, and because of the decision of the VFR leadership to concentrate its resources on rocket experiments. The onset of the Great Depression and the gathering political storm were other distractions and problems. A further blow came with the death of Valier in May 1930 during experiments with his first liquid fuel rocket engine, which led to calls to outlaw private rocket research. What kept rocketry and spaceflight alive after that were the private rocket experimenters, most notably the VFR group, which was more or less captured by Rudolf Nebel. It carried the grandiose title of *Raketenflugplatz* (Rocketport) Berlin and included the aristocratic university student Wernher von Braun (fig. 9). Accounts of rocket launches by them and by others appeared episodically in newspapers and magazines from 1931 to 1933, sometimes with great sensationalism. Wild rumors about rocket experiments elsewhere, especially about Goddard and the fraudulent claims of another American, *Dr.* Darwin O. Lyon, continued to circulate. The disastrous final crisis of the Weimar Republic in 1932–33 overshadowed any further activities, however, and when the Nazis came to power they discouraged public experimentation.

---


Oberth had not published in German and had not so forthrightly discussed manned spaceflight, if Max Valier had not popularized the idea and had not persuaded Fritz von Opel to finance rocket stunts, and if Opel had not exploited these stunts for all the publicity they were worth, it is difficult to conceive the Weimar fad taking on the scope that it did. Valier’s role was particularly crucial as a popularizer and as the link between Oberth’s theory and Opel’s money.

It is extremely difficult, however, to apply the traditional tools of the intellectual historian and give a cultural, social, or political explanation (as opposed to a psychological one) for why isolated individuals like Oberth came to the idea of spaceflight, or why people like Valier picked up on it. Nothing in their writings shows Weimar culture, or a specific school of social and political thought, to be a factor, except perhaps the amorphously nationalist belief that Germany must be first in rocketry. When searching for the cultural roots of the spaceflight fad, then, the question becomes: Why was there such a strong reaction to Oberth and Valier? Or, to put it another way, what cultural or social resonance was there that made other people take up the cause; why did publishers and the media latch onto the idea of rocketry and spaceflight; and why did individuals like Opel (or Lang) obviously calculate that much attention (and money) could be won by exploiting the spaceflight fad?

In order to answer these questions, it is necessary to go beyond the literature of the spaceflight movement. In addition to reading all available citations to spaceflight articles in the press and magazines, I

---

2Examples of the spaceflight pioneers’ nationalism may be found in the Valier lecture program (ca. 1927) in NASA file “Max Valier,” Valier to Oberth, June 17, 1925, in Barth, Oberth: Briefwechsel (n. 14 above), 1-60, 75; Gail, Mit Raketenfertigkeit (n. 10 above), p. 106; Ley, Möglichkeiten (n. 22 above), pp. iv, 282; Rudolf Nebel’s handbill (ca. 1931) “RAKETENFLUG Aufruf!” found in NASA file “German Federal Republic, 1920–1930;” and pictured in Winter, The Rocket, n. 2 above, p. 174. The one clear intellectual reason Valier had to become a spaceflight enthusiast was to prove the bizarre “glacial cosmology” of Viennese engineer Hanns Hörbiger, which asserted that most of the universe was made of ice. On the question of the links between culture and the origins of the idea of spaceflight, Walter McDougall makes the interesting speculation that in the case of Tsiolkovsky and the tarant assassin Kibalchich (also a dreamer of rocketry), it was not coincidental that “the most ‘backward’ of the Great Powers...was the one that fostered violent rebellion against the chains of human authority and the chains of nature.” See Houson (n. 14 above), p. 19. But this is extremely difficult to prove—and may not even be accurate. An Austrian historian has claimed that one-third of the spaceflight pioneers came from the old Austro-Hungarian Empire, which would include, of course, Oberth and Valier. I leave this to someone else to explain. Fritz Sykora, “Guido von Pirquet: Austrian Pioneer of Astronautics,” in R. Carrell Hall, ed., Essays on the History of Rocketry and Astronautics (NASA Conference Publication 2014) (Washington, D.C., 1977), 1:140.
have surveyed five Berlin newspapers, ranging politically from the moderate Right to the Communists, plus the Nazi daily issued in Munich, during the two peaks of the fad: April–June 1928, and October 1929. I have also consulted the popular science journals Die Umschau and Kosmos for 1923 to 1933, and Wissen und Fortschritt from its beginning in 1927 to 1933. This survey shows three social and cultural factors to be paramount: nationalism, a widespread faith in technological progress (especially in the late 1920s), and the growth of a very modern consumer culture.

Of the three, nationalism is the most obvious. One of the first reviews of Oberth’s Die Rakete zu den Planetenräumen appeared in a right-wing Berlin newspaper, and it celebrated the Germanness of the author “in these years of the deepest distress of Germany” (i.e., the crises of 1918–23). The Weimar rocketry fad took place primarily, however, in the illusory golden years of the republic: the years of “stabilization” from 1924 to 1929. The right-wing press in particular celebrated the Opel-Valier rocket stunts as the latest accomplishments of German technology, much as they did the zeppelins, with the implicit message of pride in the recovery from the war and postwar humiliation. It is impossible to measure the mind of the general public of that day, but it is hard to believe that many Germans did not react the same way in a culture soaked with nationalism.

When one reads the press reaction to the rocket stunts and Frau im Mond, one is also struck by the relative lack of criticism of either rocketry or of technological change in general. Certainly critiques of space travel as utopian did appear, but even then the authors almost always accepted Valier’s belief in the potential of the rocket for intercontinental transport. The Nazi Volkischer Beobachter praised the first Opel-Valier rocket car in April 1928 as a national achievement, but used the occasion to dismiss spaceflight and the theory of relativity as unscientific. Later articles were mostly pro-spaceflight, however, the exception being one in September 1929 that objected to Oberth’s ideas because Germany must concentrate on its immediate problems. The Deutsche Allgemeine Zeitung, a paper connected to the right-wing barons of heavy industry, expressed some doubts about the economic sense of the first rocket car and published a scientific attack on the concept of spaceflight just before Opel’s run in Berlin a month later. But the paper reacted to the actual run with considerable enthusiasm. The moderately conservative Catholic newspaper Germania ran a large article in favor of spaceflight in the aftermath of this event, while the left-liberal and socialist newspapers, which avoided the expression of much nationalism, also ran prorocketry articles or treated it as a straight news event. Only the Communist Rote Fahne ignored the whole rocket car and plane business. (There was, however, a famous Communist agitprop group called the Red Rockets formed in Dresden in 1927/28.) Press reaction to the Opel railroad experiment in June 1928 and his rocket plane stunt in September 1929 followed a similar pattern.

This evidence, plus the publication of prospaceflight articles in popular science journals throughout the 1924–33 period and the pervasive pride in German technological achievements displayed in the Weimar media, leads me to my second conclusion: a belief in, or at least an acceptance of, technological progress extended across the bitterly divided political and ideological spectrum of Weimar during the late 1920s, resulting in open-mindedness toward futuristic technologies. Socialism and liberalism, as heirs of the Enlightenment,

---

2Deutsche Allgemeine Zeitung (Berlin), December 2, 1923.
4The German pioneers, at least, were not subjected to the universal ridicule some space historians, based on the American experience, have asserted was the fate of these early advocates of spaceflight. See, e.g., Frederick G. Durant III’s “Foreword” to Walter, Prelude (n. 2 above), p. 9.
were by definition "progressive" on scientific and technological issues; the Right increasingly accepted the necessity of technological change for nationalist reasons even when it was worried about some of the implications of capitalist modernization, such as the decline of morality and the "German spirit" and the rise of class conflict and an anonymous mass society.

Fear of the social effects of technology was certainly present in all ideologies and among all classes. The enslavement of the workers by the machine in Fritz Lang's *Metropolis* symbolically expressed the vague but pervasive anxiety in Weimar (as elsewhere in the West) about the implications of Taylorism and Ford's assembly line—not to mention the "rationalization movement" in German industry, which became necessary after the stabilization of the mark in 1923-24. But even in the case of the Social Democratic labor movement, one of the groups one would most expect to have questioned the transformation of industrial work, a powerful ideological commitment to scientific progress prevented any thoroughgoing criticism of rationalization.³⁵

After 1923, with the decline of radical Expressionism in the arts, the only remaining bastion of antiscientific and antitechnological criticism was in the universities and among the intellectuals of the "conservative revolution"—the creators of Lebenphilosophie. Paul Forman has written persuasively of the influence of reactionary, neoromantic idealism on Weimar physicists, especially as a result of Oswald Spengler's best-selling *Decline of the West* (vol. 1, 1918). Many university physicists felt impelled by their institutional environment to reject strict causality in their theory.³⁶ Forman's article is a seminal contribution to the history of science, but it is based primarily on the period 1919–23, when the loss of the war and severe political and economic crises produced a corresponding sense of intellectual crisis inside and outside the universities. Because Forman looks toward the rise of probabilistic quantum mechanics in the later 1920s, he underrates the perceptible change in mood outside academia that came with the "stabilization" in 1924. The "New Objectivity" (die neue Sachlichkeit), a movement that began in painting, soon became a popular slogan among intellectuals; it meant a rejection of utopian hopes, an emphasis on realism and cold analysis, and an acceptance of seemingly inexorable technological change.³⁶

The stabilization era, it must be remembered, was one overshadowed by technological innovation. Commercial radio began broadcasting to 200 crystal sets in Berlin in October 1923; by 1930 there were 3 million radios and a national network. The hoopla surrounding the transatlantic flights by zeppelins and aircraft after 1924, the advent of neon lighting, the massive expansion in the production of German films and of gramophones and records, the new (if temporary) respectability of the Bauhaus's modernist architecture, and the fascination with Henry Ford and American skyscrapers—all these are indicators of the role technology played in high and popular Weimar culture in this period (fig. 10).³⁶ Of course, the mood of optimism inevitably declined with the new crisis at the end of Weimar, and the university professoriat maintained a stronghold of right-wing anti-Weimar ideas throughout the republic. Lebenphilosophie remained very much alive during the stabilization epoch, if very marginal to the mass media—as my survey of press reaction to the rocket fad demonstrates. But even on the intellectual radical Right, as Jeffrey Herf has shown, many writers tried to integrate irrationalism and technology in the 1920s and 1930s. Spengler was among them. These thinkers appreciated technology for aesthetic and nationalist reasons (not the least for its importance in modern warfare), while rejecting with horror many of the ultramodern and "American" aspects of the culture of the Weimar Republic.³⁶ In an anti-intellectual way, the Nazis embodied the same contradictory appreciation of technology.


³⁷In fairness to Forman, it should be pointed out that the rise of the New Objectivity has only been emphasized more strongly in recent German scholarship. See Schrader and Schebera, _The "Golden" Twenties_ (n. 31 above), pp. 150-51; Eberhard Kolb, _The Weimar Republic_ (London, 1988), pp. 85-90. The effect of the change in mood on the Bauhaus's parent organization, the Werkbund, was earlier described by Joan Campbell in _The German Werkbund_ (Princeton, N.J., 1978), pp. 172-75, 201-3. The New Objectivity and the whole influence of American technology on Weimar culture has recently been illuminated by Thomas P. Hughes in _American Genesis: A Century of Invention and Technological Enthusiasm_ (New York, 1989), pp. 284-94, 309-19, 346-59.

³⁸Schrader and Schebera, _The "Golden" Twenties_ (n. 31 above), pp. 86-90, 117-29; Kolb, _Weimar Republic_ (n. 34 above), pp. 89-95; Barbara Miller Lane, _Architecture and Politics in Germany, 1918-1945_ (Cambridge, Mass., 1968); Hughes, _American Genesis_ (n. 34 above), pp. 284-94, 309-19.

³⁹Herf, _Reactivity Modernism_ (n. 7 above). On the alienation of right-wing intellectuals from Weimar Germany, see Walter Laqueur, _Weimar: A Cultural History_ (New York, 1970), chaps. 3 and 6.
A pervasive sense in Weimar of an onrushing technological world symbolized by the United States, to which Germany must somehow adapt, points us toward the third and final cultural factor that contributed to an acceptance of futuristic technologies like the rocket: the development of a very modern "consumer culture." With some exaggeration, Walter Laqueur has called Weimar "the first truly modern culture" and has pinpointed some of the reasons why that might be the case: personal and political freedom unprecedented in Central Europe, a palpable break in historical continuity caused by the collapse of the empire in 1918, many sources of ideological and social conflict, and a search for entertainment and escape provoked by those conflicts and the political and economic troubles that followed the war. To this list should be added the influence of technology itself, as we have seen.

In the United States, freedom and escapism in combination produced what Joseph Corn, in his history of aviation in American popular culture, has called "the zany exhibitionism of the Jazz Age." Corn continues: "In that period, many Americans went overboard, as it were, in a cultural climate that supported a new permissiveness regarding public and intimate behavior. The ballyhoo of the era also reflected new and more aggressive ways of merchandising and advertising products, including the use of public relations professionals and new forms of media, such as radio and billboards." Similar processes must have contributed to the success of the Weimar rocket stunts in 1928–29 and thus to the scope of the fad. In the most modern and Americanized culture in Europe, one in which the rise of the mass media was accompanied by a rapid growth in spectator sports and other forms of consumer culture, Germans must have had an appetite for spectacles that not only symbolized national triumphs and technological progress but also provided...

I have adopted the terms from Richard W. Fox and T. J. Jackson Lears, eds., The Culture of Consumption (New York, 1988), pp. x-xii, a book of essays concentrating exclusively on the United States.

Laqueur, Weimar (n. 36 above), pp. ix, 32, 182, 225.


Knip, Weimar Republic (n. 34 above), p. 91. The introduction to Linke's 1928 popularization, Das Raketen-Weihrumachff (n. 22 above), p. 5, comments explicitly on mass spectator sports as one form of entertainment competing for public attention. It must be kept in mind, however, that the "Americanization" of German popular culture was somewhat superficial, and that Weimar German society remained deeply divided along class lines and had a flourishing working-class socialist "alternative culture." On the latter, see Peter Lüdecke and Franz Valier, "Zur Organisationskultur der sozialdemokratischen Arbeiterbewegung in der Weimarer Republik: Niedergang der Klassenkultur oder solidargemeinschaftlicher Höhepunkt?" Geschichte und Gesellschaft 15 (1989): 311–36.
escapist entertainment. Radio certainly contributed to the popularization of rocketry, and the press, too, was freer and more able to exploit sensationalism in Weimar Germany than had been the case in the past. Finally, for Fritz von Opel the rocket stunts were free advertisement for his family’s cars, and it is unlikely that without this new mass culture and American-style forms of advertising he would have associated his respected firm with what amounted to “zany exhibitionism.”

In sum, there are convincing cultural and social historical reasons why Weimar Germany sustained the greatest rocketry and spaceflight fad of the interwar period and the most lively and productive movement for the same cause. There is indeed some truth to the statements of the popular space-history literature, which has emphasized nationalism and escapism. But it was not a nationalism or an escapism produced by the immediate postwar crisis, because the fad began and reached its apogee in the stable middle years of the republic, precisely when relative prosperity and the lack of distractions from pressing political and economic issues allowed the highest development of the Weimar spaceflight movement and the consumer culture. A widespread belief in the inevitability—and usually the desirability—of technological progress also encouraged an openness to futuristic technological concepts, but this did not spring from romantic Lebensphilosophie, which was in any case very divided on technological issues and very marginal to the mainstream media.

The most challenging historiographical questions arise in comparisons to other countries, especially the United States. One can see how the utopian and scientific culture of the early Soviet Union might contribute to a lively spaceflight movement, while the absence of a consumer culture, plus government control of most of the media and the industrial economy, could prevent the outbreak of a popular fad such as occurred in Germany. But a lively popular culture and faith in the beneficence of technology were even more developed in the United States than in the Germany of the 1920s, yet the American spaceflight fad was certainly weaker in spite of a number of imitators of the German rocket stunts. Persons must have played a crucial role: Goddard ran from publicity because of his shyness and his professional role as an academic physicist, whereas Oberth, and especially Valier, understood the need to build popular support.

Of the cultural factors, perhaps the rather pathetic nationalism of many Weimar Germans was crucial, since they seemed to seize on any technological accomplishment by a German as evidence of national recovery or superiority. It is also possible that the strong association between science fiction and rocketry in the United States put the idea of spaceflight in disrepute among academics and “respectable people” from the outset. Brian Horrigan has shown how American popular culture incorporated the spaceflight idea as a form of entertainment as early as 1901, when carnival rides appeared with this theme. In 1926 Hugo Gernsback created the pulp science-fiction magazine Amazing Stories with its sensational covers, and “Buck Rogers” became a regular comic strip in 1928. These were products of American consumer culture that had no German equivalents. In the 1930s and 1940s, the association between spaceflight and science fiction became so great that the American Interplanetary Society (founded in 1930 by science-fiction writers) became the American Rocket Society, while among scientists, according to the famous aerodynamicist Theodore von Kármán, “the word ‘rocket’ was in such bad repute that for practical reasons we decided to drop it from our early reports and even our vocabulary.” When dividing Army Air Corps contracts in 1938, another colleague let von Kármán “take the Buck Rogers job,” and thus arose at Caltech the Jet Propulsion Laboratory and the JATO (jet-assisted takeoff) rocket for aircraft.

If exploration of the origins of the Weimar spaceflight and rocketry fad are illuminating for the social history of technology, we must not forget finally that the fad itself had crucial historical importance: without it one can scarcely imagine the development of the German factor in the interest in spaceflight in the 1920s, which may indeed have been stronger in the United States than in Germany, was the debate over extraterrestrial life, in particular Mars and its supposed canals. See Ley, Möglichkeiten (n. 22 above), pp. 14–15, and Wilhelm Backhauscher (Munich), Bayernausgabe, October 24, 1929, for Germany. See Susan J. Douglas on the American fad for radio communication attempts with Mars in the early 1920s in Corn, Imagining Tomorrow, pp. 54–55.


High-Technology Calculation in the Early 20th Century: Punched Card Machinery in Business and Government

ARTHUR L. NORBERG

Information-handling techniques changed dramatically in the last quarter of the 19th century with the introduction of mechanical contrivances for counting and for analyzing data. Calculators could perform all four basic arithmetical functions; bookkeeping machines, similar in most respects to calculators, could generate various types of ledgers; and tabulating systems could analyze data stored on punched cards. The effect of the tabulating system was substantially different from that of other business machines, such as desk calculators.

Dr. Norberg is director of the Charles Babbage Institute and associate professor in the Program in History of Science and Technology at the University of Minnesota. He is grateful to William Aspray, Martin Campbell-Kelly, and I. Bernard Cohen for many helpful suggestions. Research for this article was part of a larger project supported by the National Endowment for the Humanities (RO-21098-85) and the National Science Foundation (SES-8420481), whose generosity is gratefully acknowledged.

The basic arithmetical functions were difficult to handle mechanically. Addition involved two distinct operations: the addition of digits and the carrying of figures. Various techniques were devised for these two operations. Multiplication was essentially repeated addition. Division was very cumbersome and was analogous to ordinary long division. Subtraction often involved a switch for reversing the motion of the main shaft but keeping the rotation of the handle constant. In business calculations, credits were entered as nine complements and debits as ordinary numbers, so that subtraction was not done directly. According to I. Bernard Cohen, at the beginning of the 20th century the scale with which mechanical calculators were used shifted. It was the introduction of the keyboard and the key-driven machines, plus the high level of reliability, that made them so generally acceptable. For details on the operation of calculators, see E. M. Horrocks, ed., Handbook of the Napier Tercentenary Celebration or Modern Instruments and Methods of Calculation (1914), Section D, vol. 3 of the Charles Babbage Institute Reprint Series for the History of Computing (Los Angeles, 1982). See also D. Buxandall, “Calculating Machines and Instruments,” in Catalogue of the Collections in the Science Museum (London, 1926); and “Instruments et machines à calculer,” Catalogue du Musée, Section A (Paris: Conservatoire National des Arts et Métiers, 1942).


© 1990 by the Society for the History of Technology. All rights reserved.

0040-165X/90/3104-0002$01.00