

State-Controlled Multimedia Education for All? Science Programs in Early German Radio

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Abstract While science education and popularization by means of print media developed in quite similar forms in many nations, the advent of radio resulted in initiatives to bring science on the air that were rather heterogeneous from country to country. The German case stands out with respect to quantity, variety and ambition, and also for its special mechanism of planning and controlling educational programs on science and technology. Hence it is argued that a closer look at how the chances of the new medium were discussed and implemented in Weimar Germany can provide a scale of reference for the development of science communication on the radio in other countries. For this reason a brief summary of the the respective developments in the United States and Europe is presented, before discussing in some detail Germany's particular institutional organization, program structures, combination of radio broadcasts and print material into a kind of multimedia, and various formats and genres.

1 Introduction

When radio was established in many countries as a new medium for news, entertainment and education in the early 1920s, visionary speeches on the great educational impact of the wireless communication were abundant. Particularly strong was the claim that radio would revolutionize education. Workers could go to school at night, farmers in remote areas could have access to education, and even the nation's universities would be opened to the whole people. Controversial content, however, which was connected in any way to political issues like discussions of current living conditions or economic judgments on local initiatives, was often excluded from the airwaves. In contrast it was rather unproblematic to agree on broadcasts on science and technology; unlike selecting people from the arts or literature, recognition as a scientist was both simple to evaluate for the program makers and easy to present to the listeners. Having a professor, an Academy president or a Nobel laureate on the program was always a good choice and could easily be presented as (further) education.

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Furthermore, scientific visions of a bright future were a good environment for commercials and a respectable currency to pay for private and state sponsorship of radio.

For all these reasons it comes as no surprise that science programs can be identified on almost all stations right from the very beginnings of radio. This is even less surprising if one takes into account that early listeners of radio required a certain technical aptitude to be able to receive the program, given the shortcomings of unstable reception and equipment that had to be put together by the listener. Moreover, for many people the advent of radio meant the beginning of an interest in science and technology; tinkering around with radio kits may have superseded battle play with tin soldiers.

Apart from this general outlook, however, radio developed very different forms and opportunities for science programs in the various early radio countries. Germany's self-understanding as a *Kulturnation* (cultural nation) and America's "unrestrained commercialism" (LaFollette 2002a, p. 5) probably mark two of the most influential contexts within which a system of radio with entertainment and education had to find its working scheme in the 1920s and 1930s. In any case, radio was a "medium"; but between which groups and interests did it actually communicate? A look into the rich historical literature on radio does not give a general answer, particularly where science is concerned.¹ Surprisingly, despite the fact that the history of radio has received such a great deal of attention in recent decades, studies of science communication on the air are still scarce.² What is more, the available comprehensive studies of program history do not always help to elucidate the quantity and quality of science popularization on the radio since the typical categories in which science would be subsumed consist simply of radio talks in general, educational programs or courses, broadcasts for schools or teachers more particularly, or special target group broadcasts and highbrow entertainment.³

In this article I try to contribute to a clearer picture of the quantity and quality of science programs in early radio and attempt to show through a case study on Weimar Germany the extent to which radio makers planned to create a new means of education directed toward schools and businesses as well as a general public interested in further education. The case of early German radio was by far the most ambitious attempt to use the ether to educate a whole people.

To this aim I proceed in four steps: First of all, I discuss what (media) changes radio brought forth, when print encountered radio not only in competition for the interested reader or listener, but rather opened the opportunity for alliances like models for integrating print material and broadcasts into a kind of multimedia. This includes the question of whether radio and print adapted to one another with respect to formats and presentation, or whether they instead became specialized, for example due to different attainable speeds of communication. Then (in Sect. 3) I present a comparative sketch of the different modes of instituting science communication on the radio that shows how differently nations such as the United States, Germany, France or even the Netherlands or Portugal set up the organization and control of radio programs, thereby providing rather different degrees of room for educational content. This comparison elucidates the special case of science-rich

¹ On Germany see Dussel (2004) and Führer (1997), on the US Douglas (2001), on Britain Crisell (2002), on France Brochand (1994), on Italy Monteleone (1999), and on Spain Díaz (1997).

² With the exception of LaFollette, who in recent years has produced seminal studies for the US case, in particular (LaFollette 2002a, b, 2006) and her recent book-length account (LaFollette 2008).

³ In Leonhard (1997, 352) the definition of talks was: "a speech or speech-music transmission of arbitrary content denoted as talk and potentially for all listeners; a spoken transmission of other kind like a discussion or series, that is primarily educational."

radio in Weimar Germany. The formats and genres of science communication that emerged in the German example are presented next (Sect. 4). Here the particularly strong and diverse programming on science also included special programs for schools and for vocational training. Finally, the question is raised as to the impact early radio had on establishing science—or rather special topics thereof—within broader cultural discourses, and to what extent certain ways of treating science in the media became persistent, at least as far as they were represented on the air and in radio magazines (Sect. 5). I conclude that in all of these ways radio educated a broad public, not only on curricular knowledge but in a more general sense on the cultural meanings of scientific knowledge.

2 The Many Prospects for a New Medium

The history of early radio appears as a rather contingent development that was strongly influenced by the political and economical conditions after the Great War. While at least in principle radio opened many opportunities, ranging from fostering democracy by easily making many voices heard, or even by giving everybody the opportunity to send out his or her views, to simply making money by selling consumer products and media content to a unprecedentedly vast clientele, in reality stations were not set up so easily and did not simply pick their content from readily available sources. In the United States, for example, two major networks quickly dominated the scene. One can try to analyze radio by looking at the main actors—program makers, radio stations and equipment suppliers—and how they pushed their issues in a triangle of content, commerce and control. For each national case apparently a different configuration emerged. Program makers in Germany, for example, were not only concerned with content but had also to deal with political control, while the electro-technical industry could generally not expect much commercial success without attractive content.

For science communication it is important to notice that the beginnings of radio fell into a period when the old models of science popularization were already transformed into new forms that reflected, roughly speaking, a shift from presenting neat accounts of the wonders of science to explaining how science works and to what extent a general scientific outlook may determine modern life (Schirmacher 2008). As the British Science Guild put it in a notice to *Nature* in 1904 (Turner 1980, p. 601):

[The] purpose is to stimulate, not so much the acquisition of scientific knowledge, as the appreciation of its value, and the advantage of employing the methods of scientific inquiry, the study of cause and effect, in affairs of every kind.

Around the same time we find in France “the extinction of the ideology of an *instruction amusante*,” due to the exit of the first generation of science writers that had espoused a “militancy of popularizers in the 1850s to the 1890s” (Beguet 1994, p. 19). In Germany, too, a decisive turn occurred, which replaced the old model of popularizing science that was established, authorized and validated, with new interest in the ways science and technology work and perform. In this vein, for example, the Teubner publishing house advertised a book series called *Aus Natur und Geisteswelt* (On Nature and the World of Ideas), that was to be a “collection of scientific-popular accounts of all areas of knowledge.” It sold over 400 titles between its launch in 1898 and the beginning of the Great War. In advertisements it was promulgated that the collection intended “to impart to the readers an understanding of how modern science has managed to shed light on important questions of general interest” (Schirmacher 2007, p. 53).

Fig. 1 1926 Title page of *Kosmos* with a typical cover depicting a rather traditional view of nature and science writing



These examples of early signs of a new attitude to science, or even a “scientification” of society, now met a science-based medium of communication, such that few of the early adopters of radio and its technology were able to enjoy its value without some interest in science (which might have excused the shortcomings of reception). With this context in mind, I would like consider three avenues that early radio *could* have taken in order to establish itself as a medium to educate vast audiences on science, before moving on to sketch the actual developments in Germany.

2.1 Adapting from Print

If we look at Süddeutscher Rundfunk AG, the southern German radio station in Stuttgart during the year 1925, we find an example of seamless adaption. In the same city the Franck publishing house was printing the journal *Kosmos*, which was founded in 1904 and persisted on the market for the whole century, becoming the best-selling popular science publication in Germany for many decades, for example selling 200,000 copies per month in the 1920s (Fig. 1). Science writer Kurt Floericke, who had studied science in the 1890s and then undertook extended expeditions on many continents before joining the editorial staff of *Kosmos*, thus had a been writing articles in the journal for 20 years, mainly on botany and zoology, before taking to the airwaves.⁴

Floericke participated in the weekly lecture series the Kosmos society organized for its members who subscribed to the journal.⁵ In 1925 the Süddeutsche Rundfunk AG broadcast

⁴ On Floericke (1869–1934) see *Kosmos*, 26 (1929), p. 19.

⁵ For a discussion of *Kosmos* in German culture cp. (Schirmmacher 2011).

the Kosmos lectures every Monday at 7:30 p.m., thus for a prime time listening audience. Floericke alone spoke eight times that year on topics like animal hibernation, polar animals, and the love life of birds, while others covered the miracles of coal, the history of paper, gravitational deviations in the Earth's crust, or the German forest.⁶

Interestingly, this practice of extending authors and content from print to radio became rather the exception than the rule. And even in this exceptional case radio programs did not correspond directly with the printed articles; nor did the journal directly reference any related broadcasts. From my analysis of roughly 1200 popular science programs in German radio during the Weimar period almost no other clear pattern of a simple adaption of format and personnel from print to radio can be identified, so that we must assume that the new medium was also run mainly by new people looking for new formats. There was a probably strong tendency for authors who had established themselves in one medium to resist changing to another later.

2.2 The Chance of Multimedia

The first German station on air was the Berlin Funkstunde AG, which began regular broadcasts on October 29, 1923. In its third month of operation Hugh Iwan Gramatzki (who had studied science at Karlsruhe, was an engineer before the Great War and naval officer in combat before turning to astronomy and popularization) presented his first program on astronomy—at least according to available program listings, which were very sporadic in the first month. He realized immediately that he could not compensate for the lack of visual presentation by auditive means alone. Gramatzki, however, when speaking about the moon a couple of months later, solved the problem in a multimedia fashion. His listeners were now prepared—or at least those who read the radio magazine *Der Deutsche Rundfunk* (Fig. 2), a very affordable illustrated magazine. In some ways the magazines resembled teaching materials, including illustrations, introductory texts and summaries. In a later contribution to *Der Deutsche Rundfunk* Gramatzki explained the “simplest solution, at least for the time” he had found to the “plight,” i.e., having the illustrations published beforehand in the radio magazine. In addition, this was a welcome means to direct the listeners' full attention to the broadcast, with ears and eyes well provided for. Finally, the immaterial voice was complemented by a material reminder that kept the message alive (Gramatzki 1924).

In this way the pedagogical advantage of the combination of media is obvious and the reciprocal reference between print and broadcast might have been favorable for both media. However, the problem of non-simultaneity remained, as the pictures in the radio magazine could not convey too much of the scientific content of the radio broadcast (without rendering the broadcast unnecessary), nor could the radio speaker presuppose that the listener actually had the illustrations at hand.

2.3 Radio: The Faster Medium?

The speed of reporting should be at least one definite advantage of radio over print. But if we look at the reporting of the spectacular balloon flight by Auguste Piccard into the stratosphere on May 27, 1931, German radio does not seem to have been prepared. Otto Willi Gail of the Munich Funkstunde was present at the start in nearby Augsburg, as were

⁶ According to the program listings in *Der Deutsche Rundfunk. Rundschau und Programm für alle Funk-Teilnehmer*, 3 (1925).



Fig. 2 The radio magazine *Der Deutsche Rundfunk*, providing visuals for a science program on Berliner Funk-Stunde by chief engineer H. I. Gramatzki, broadcast on March 31, 1924, about the surface of the moon (journal dated March 30, 1924)

many newspaper reporters, who—in contrast to Gail—tried to locate Piccard after his flight by plane. Gail had studied physics and electrical engineering at the Munich Technical University right after the war; he first became a business clerk and writer on space travel as both fiction and popular science before entering radio in 1928.⁷ His broadcast on Piccard's flight was excellent, a critic wrote, but 24 hours late (Fig. 3). Instead of taking a chance on reporting Piccard's unknown fate—had he survived the flight?—late at night, this was left to the morning editions of the newspapers. Later Gail tried to make good on this missed opportunity by bringing Piccard into the radio station for a special broadcast.⁸

Interestingly, the example of radio in Weimar Germany does not mirror the development often described as medialization (Weingart 1998, 2001). A supposedly widespread pattern, according to which news values generally would quickly dominate content and quality once the media revolution of the mass media had started, does not apply here (or at least needs substantial differentiation). In the German example, control and cultural values still determined a medium for which it was apparently not so vital to beat the press in speed—instead, radio followed its own rules. Before delving more deeply into the emerging opportunities of science communication between medialization and (scientific) autonomy in Weimar Germany, I should first put into context the particular development of German radio more generally. In this way the mechanisms can be exhibited that in the German case produced an unprecedented amount of educational programming.

3 National Modes of Instituting Science Communication on the Radio

The history of radio is a unique story for every single country, as each gave different weights to the main actors: program makers, radio stations, equipment suppliers and politicians. In the triangle of content, commerce and control I will try to briefly sketch their respective positions. However, this portrayal is limited to the different beginnings of radio in Western countries, in order to exhibit the rather special German development.

⁷ His early works on science fiction and popular science include (Gail 1925, 1928).

⁸ Reports in the *Bayrischer Radiozeitung*, 8:24 (1931), 8–12, Fig. 3 on p. 8, critique on p. 12.



Zeichnung H. u. B. v. Döner

Der Flug in die Stratosphäre

Sowohl im Freiballon als auch im Flugzeug sind schon über 13 Kilometer Höhe erreicht worden, doch ist beabsichtigt, die großen Flugrouten in noch höhere Luftschichten, in die sog. "Stratosphäre" zu verlegen, um noch größere Reisefertigkeiten zu erzielen.

Die Stratosphäre, welche von etwa 15 bis 25 Kilometer Höhe angenommen wird, bietet den für die sicheren Luftwege sehr bedeutenden Vorteil, daß sie von Witterungseinflüssen, wie Stürme, Regen, Schnee oder Nebel ständig frei ist und infolge der viel geringeren Luftdichte dem Flugzeug einen geringeren Widerstand entgegenstellt, als die Luftschichten in Erdnähe.

Die zu überwindenden Nachteile sind jedoch die in diesen Regionen herrschende große Kälte (?) und der Mangel an Sauerstoff, welcher für die Injizien und für den Betrieb der Motoren unbedingt notwendig ist. Diese Schwierigkeiten sind jedoch nicht so groß, als daß sie nicht durch technische Hilfsmittel überwunden werden könnten. Alle führenden Fachleute sind sich darüber einig, daß das Fliegen in 15-25 Kilometer Höhe ohne Gefährdung der Injizien möglich ist.

Das Stratosphärenflugzeug wird in seiner äußeren Form den bisher gebräuchlichen Flugzeugtypen ähnlich sein, jedoch in seinem Innern eine Reihe neuer, sehr wichtiger Apparate und Maschinen erhalten müssen.

Der Führerraum sowie die Kabine für die Flügelleiter müssen von außen hermetisch abgeschlossen sein. Durch künstliche Lüftung und Temperaturregler müssen der Luftdruck sowie die Luftzusammensetzung und die Temperatur stets in normalen Grenzen gehalten werden. Besondere Sauerstoffgeneratoren werden die Innenräume ständig mit Frischluft versetzen, während die verbrauchte kohlensäurehaltige Luft von Luftreinigern angefangen und aufgereinigt wird. Die Motoren, deren Leistungen bekanntlich in großer Flughöhe stark abnehmen, werden Spezialkompressoren erhalten, durch welche den Zylinder ein druckvermehrtes und verdichtetes Gasfrischgemisch zugeführt wird, so daß die Motoren auch in großer Höhe mit ihrer Normalleistung arbeiten können. Schließlich muß der Propeller durch automatische Verstellung seiner Schaufeln eine veränderliche Örtigkeit erhalten, damit sein Wirkungsgrad den jeweiligen Verhältnissen angepaßt werden kann.

Der Rundfunk allen voran? Oder: 24 Stunden zu spät!

Am Mittwoch, den 27. Mai 1931, in den ersten Morgenstunden war Prof. Piccard mit seinem Assistenten Dr. Kipfer zu dem denkwürdigen Flug gefahren, der uns alle eine Nacht voll langer Erwartung und Sorge verbringen ließ.

Otto Willi Oel, der den Start in Augsburg miterlebte, hatte ihn nur wenige Stunden später den Hörern des Bayerischen Rundfunks schildern können. Als dann in den Abendstunden die weiteren Meldungen über den Verlauf der abenteuerlich anmutenden Fahrt kamen, als man nicht mehr wußte, ob Piccard

in seiner Metallkugel überhaupt noch am Leben war und der Ballon von einem fiesigen Wind immer weiter nach Süden getrieben wurde, da raffte im Junthaus ununter-

Rechts: Der Ballon Piccards

1. Ventil.
2. Reklörne, doppelt gesichert.
3. Reißbahn.
4. Lichtabsehgurt.
5. Hülle aus einlichem selben Ballonstoff, einseitig gummiert.
6. Parabelbogenstange.
7. Füllansatz.
8. Ansatztrommel.
9. Stützstützen für Reißgurt.
10. Stützstützen für Ventiltrieb.
11. Füllansatz mit Aufschraubvorrichtung.
12. Anschlagseile.
13. Korbbirgeln mit Kasten.
14. Korbriegel.
15. Kugelförmige Aluminiumgondel.

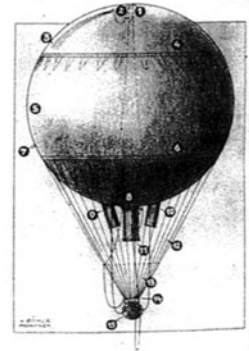


Fig. 3 *Bayrische Radiozeitung* reporting on Piccard's stratosphere flight (top) and discussing the missed opportunity of radio reporting it (below); also note the many details on atmospheric structure and balloon technology. Issue of June 7, 1931

3.1 The Liberal Model with Some State Intervention: US Radio

The main example of how a liberal system of radio developed in Western countries is the American one. Thanks to the seminal work of Marcel C. LaFollette we already have a rather clear picture of the development of science communication in early radio under the liberal and commercial conditions provided by this democratic society.⁹ In the US, too, it took until the 1920s for radio to become a medium of mass communication with many

⁹ Here I follow mainly (LaFollette 2002a); for more details and a stronger emphasis on individual actors, see (LaFollette 2008).

stations on the air. Receivers improved steadily and became affordable for broad sectors of the population. Broadcasting was in the hands of privately organized corporations and hence we should assume that, as in print, commercial aims must also have had their influence on science programs. At that time, however, many observers expressed the hope that the public good and commercial interests could be reconciled.

As in many other countries, in the US as well, it was believed that radio was destined to become a national institution for education that allowed experts to inform an interested and willing audience in talks. Workers could “go to night school” (LaFollette 2002a, p. 8) in this way and scientists would demonstrate their “latest discoveries,” or at least this was the vision NBC founder Davis Sarnoff entertained in a newspaper article in 1926. Radio stations that specialized in education did not fare well in the US, however, and financing turned out to be the biggest problem for stations like the University of Pittsburgh station that broadcast radio talks by university professors from 1924 to 1930 on topics ranging from modern physics and chemical catalysis to science in the kitchen. Interestingly, commercial reasons were what made it possible to print some of the lectures and distribute them to listeners, as advertisers discovered this audience as a particularly interesting group of prospective customers for various goods (LaFollette 2002a, p. 9).

Since broadcasting stations were private—and in principle anyone could run one, as in the print business—revenues could be made only by advertising. In practice, however, only two big players emerged in the US: the networks NBC and CBS. NBC grew out of the industrial sector, while CBS had its roots in artist agencies. For programs other than entertainment, that is, educational programs in general, the funding question was paramount—thus hopes that the new medium would allow workers to go to night school by listening to the radio were disappointed. For science content, therefore, a sponsor was always needed, be it the National Advisory Council on Radio in Education or the Science Service, both of which relied on donations, or be it General Electric, General Motors or the US Rubber Company. Public radio did not arrive until half a century later in 1970.

As a consequence, rhetoric and reality were not always in sync in the early decades of US radio. Nobel Prize winner Robert Millikan, speaking in 1931 for the National Advisory Council on Radio in Education (NACRE) funded by the Rockefeller and Carnegie Foundations, pointed out that “radio seems to be already showing that it contains within it the possibility of exerting an influence toward introducing more rational, less emotional thinking and acting into American life.” At the same time some of the most widely heard science broadcasts were the intermission talks on “dramatic stories of science.” Was the New York Philharmonic really necessary to lure an audience into listening to a few minutes of popularized science? (LaFollette 2002a, pp. 10–11, 25–26).

3.2 Western Europe

In France the first broadcasts, which came from the Eiffel tower, were the weather forecasts introduced during its military use in the Great War, together with some music presented by a soldier. In 1922, however, the main enterprises of the electro-technical industry jointly founded a private radio station named *Radiola*, which would later become Radio Paris and Radio France. *Radiola* stood for a close connection of the electro-technical industry and the radio program, as both the receivers produced by the company Société française radioélectrique (SFR) and the radio station that served to promote the purchase of these receivers were called *Radiola*—the renowned presenter Marcel Laporte, however, was known as “Radiolo” (Laporte 1925). In the beginning advertising was not allowed, but programs sponsoring was widespread. In contrast to the Radiola-Radiolo system, which

Table 1 Chart of some different models of early radio organization

Country	Organized by	System features	Characteristics
United States	Networks	Commercials, industry sponsors, foundations, donations	Entertainment \Rightarrow science as "intermission talks"
Britain	BBC Company, later BBC Corporation	Fees (no commercials)	Independence
France	Electro-technical industry	RADIOLA System Postal university etc.	Program = promotion for equipment
Netherlands	Listeners' associations	Proportional air time	Participation, plurality
Germany	State	Fees (subsidized by the state) no market, no participation	(high) culture, education \Rightarrow science as an integral part
Portugal	Amateurs	A number of independent individuals	Diverse agendas
...			

hardly emphasized educational content, the university of the postal service (École supérieure de postes, télégraphes et téléphones) took up this brief when it set up a station in 1923. However, it transmitted on the medium wave band rather than long wave and hence required receivers that were not manufactured in France, but available from Western Electric in the US (Brochand 1994, p. 318). These and other projects would later lead to the three major radio stations Radio Paris, Paris PTT and Tour Eiffel, all of which approached science programs in rather different ways (Raichvarg 2009).

In Britain the slightly earlier developments in the US had prompted a decision for a different private approach. Basically six larger companies formed the British Broadcasting *Company*, which was awarded the license under the condition that it adopted a rather high-quality program with no advertising, following a public service philosophy and a cooperative scheme for broadcasting. Money was earned from listeners' license fees as well as from selling receivers, at least initially. As early as 1927, however, the state bought the stations and formed the BBC under a Royal Charter, now registered as the British Broadcasting *Corporation*, which was meant to be free from commercial pressures as well as from political intervention (Crisell 2002). And many more national ways of institutionalizing radio and its programs could be added (Table 1).¹⁰

3.3 The Atypical State-Controlled System: German Radio

While it seems that everywhere else radio started by private initiative and was market driven at least in part, in Germany there was no connection between industry and programming, and nor could any private person or association go on the air. Although after the Great War a democratic order was established, the radio that started in 1923 did not show anything democratic or liberating. The fragile republic with frequent changes of the politicians in charge accustomed itself to a law-and-order attitude, meaning strict supervision

¹⁰ In the Netherlands, which also started with company stations promoting their product, again a remarkably different model can be found. The radio program was organized and produced by listeners' associations. And when more and more associations, often aligned with some religion, ideology, etc., demanded broadcasting time, a typically Dutch proportional system was introduced (Häusermann 2004, pp. 38–40). In Portugal it was instead a small number of amateurs starting in 1924 that determined the first 10 years of radio broadcasting before state radio was introduced in 1935 (Silva 2011).

Fig. 4 Hans Bredow (1879–1957) in a broadcasting studio



of all radio organization and content. Industrialist Hans Bredow (Fig. 4) became Director for Telegraphy at the National Postal Service and a constant promoter of radio with a high cultural profile.¹¹ Censorship was banned by the new constitution, which made for a rather free and diverse press, but there was the exception of film and, one might have guessed, later of radio as well. Control boards were set up to keep political controversy off the air; concerning cultural or scientific content, the authorities tried to arrange for balanced coverage. Strictly enforced listeners' fees not only financed the program and infrastructure, they actually substantially subsidized state finance. The only unknown missing in this equation seems to have been the audience.

In *Der Deutsche Rundfunk* Hans Bredow explained in January 1925:

Only a well thought-out series of lectures, that treat scientific questions with utmost care and explain step by step, can raise general understanding in the audience. It is not impossible that some day we will have the lectures of our professors broadcast directly from the their lecterns and in this way open our universities to the whole nation.¹²

And like universities, schools and all general educational institutions, radio and science communication by means of radio was also a matter of the state. Market forces only affected the equipment, so that unlike in France, the radio industry and programming were completely separate and content did not have to compete. Furthermore, amateur radio was also blocked; local radio clubs would meet only to listen to radio, but not to make it. It was characteristic for the German case that there was no public participation in the founding of radio. Although the German stations that reflected the federal structure were stock corporations, 51% of the shares were always held by the German state through the postal

¹¹ On Bredow's own view, see (Bredow 1949, 1956). Although the simplification of the German development to a single actor distorts the whole picture and is usually instrumentalized to create founding myths (Häusermann 2004, p. 47), here it might be sufficient to show the extent to which Bredow instilled the idea of a German nation of culture into his work.

¹² Paraphrase of Bredow's address in a report, *Der deutsche Rundfunk*, 3 (1925), 20–21, on p. 21. My translation as in all following cases.

Fig. 5 Distribution of science programs on days of the week for Munich's "Deutsche Stunde in Bayern" in 1925 (total of 81 broadcasts)

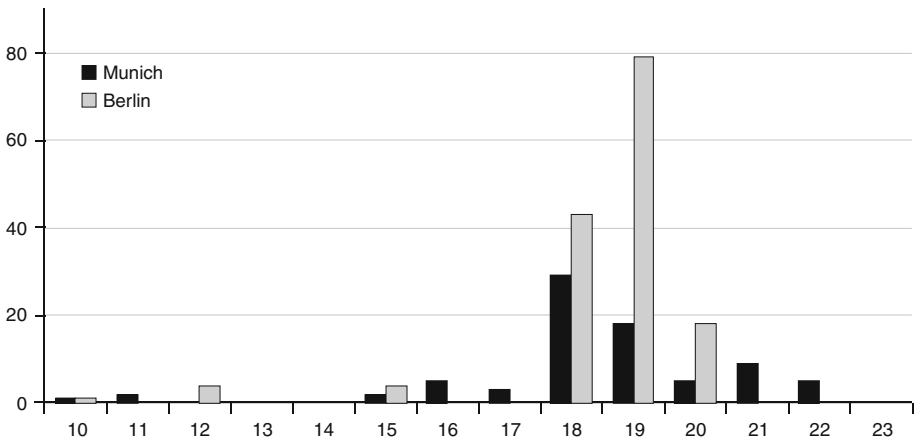
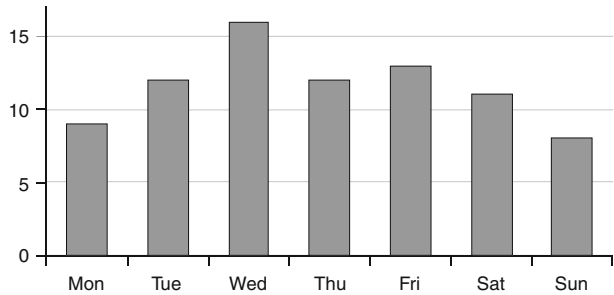


Fig. 6 Distribution of science programs over the day for Munich's "Deutsche Stunde in Bayern" and Berlin's "Funkstunde" in 1925 (total number of broadcasts: 81 for Munich and 149 for Berlin)

service; after 1932 German radio became fully nationalized (Häusermann 2004, pp. 49–55).

How did this state-controlled program look? Although it was quite different from station to station, the quantity of science programs was high everywhere. While the Stuttgart station had its weekly Kosmos lectures, the Munich Funkstunde AG in 1925 spread the programs over the whole week (Fig. 5). It is also telling that science programs were generally broadcast in prime time, as in Berlin and Munich (Fig. 6).

This was not due to the listeners' demand—there were many complaints about the evening program and workers and employees requested "light" entertaining music—but it was the radio policy of the *Kulturnation* to provide "higher things."¹³ The rather general reason also had a particular motive. It was no accident that the new head of the Central Institute for Training and Education of the German Radio (*Zentralinstitut für Erziehung und Unterricht*) Hermann Schubotz, who came from the ministry of culture, spoke on "Broadcasting and Knowledge Communication" at a conference that was organized to fight "trash and dirt literature and the rampage of the cinema."¹⁴ It was in particular the

¹³ For a lucid analysis of "higher things" and entertainment in Weimar radio see (Führer 1997, pp. 742–753).

¹⁴ The conference was titled "Tagung des Berliner Ausschusses zur Bekämpfung der Schund- und Schmutzliteratur und des Unwesens im Kino" and took place on Oct. 15, 1926 (Schubotz 1926).

new medium of cinema that did not perform to the liking of officials. Hence, cheap diversion was to be avoided at all cost on German radio. Schubotz, who was a convinced democrat, was responsible for the *Deutsche Welle*,¹⁵ a nationwide radio station with the task of promoting its program, in the words of Ernst Voss, “to a level that is the highest conceivable in cultural respects,” clearly echoing Bredow’s words (Leonhard 1997, p. 124).

4 Genres of Science Communication on German Radio

While the quote from Hans Bredow, stating that radio would eventually let the whole nation attend university, reflected a widespread rhetoric of the educational potential of radio that can be found in many nations, the Germans probably came closest. First of all, this meant clearly renouncing the growing group of journalists and professional popularizers (like Floericke and others from *Kosmos* etc.), and those journalists who had founded a technical-literary association (TELI) of science writers to establish themselves in the growing print media and newspaper sections on popular science (Förster 2007). On the air the authentic scientists or engineers were supposed to speak for themselves, with the program listings duly reporting not only the name of the speaker, but also his—and it was mostly a he—qualification and affiliation. Secondly, it must be taken into consideration that early radio did not mean that every household had a receiver with a loudspeaker. Besides the many amateurs with their headphones, constantly adjusting their receivers for good reception, public community listening was organized, which made the radio experience in the early years rather similar to going to a concert or a talk (or to night school). Consequently, the most ambitious efforts for educational radio were exerted with the aim of providing schools and communities with “Volksbildungsmitteln” with means to educate the people.

4.1 Pedagogical, Vocational and General Educational Programming

The German effort of radio education materialized most visibly in 1926 in a special nationwide station *Deutsche Welle*. Every listener in Germany would now, in principle at least, have the choice between two programs at the same time, which meant in the words of one of the managers of the *Deutsche Welle*: “Then the radio listener has the opportunity—according to his respective needs or present mood—either to be entertained, or to listen to a talk communicating science, or to work on his extended vocational training.” (Roeseler 1926, p. 1). This triad of pedagogical, vocational, and general educational programs was to occupy correspondingly earlier or later hours in the timetable of *Deutsche Welle* (Table 2).

From noon into the afternoon pedagogical programs aimed at teachers, parents and schoolchildren dealing with foreign languages, stenography, elocution etc. In the later hours of the afternoon vocational programs were aired. Clerks were lectured on the basics of economics, small businessmen on accounting, one country gentleman explained to farmers the necessity of processing seeds, another the essentials of grape harvesting. A young inventor and radio pioneer (Manfred von Ardenne) introduced the listener to putting together and fixing high-frequency amplifiers, and an engineering professor discussed electrical technology for small businesses and the home. There were also programs for lawyers, physicians and civil servants as well as career portraits and prospects of various

¹⁵ There is no direct link to today’s foreign radio service of Germany with the same name.

Table 2 Broadcasting schedule of Deutsche Welle for the week of Oct. 25–30, 1926 (simplified)

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
12:00			French for schoolchildren		Elocution	
12:30	Slaughtering for country household		From the lab of domestic science			
3:00	English for beginners	Spanish for beginners	English for beginners	Stenography	Spanish	Stenography
3:30	English, advanced		English, advanced	On free will and crime	Elocution: deep breathing	On work in public welfare
4:00	On vocational teaching in high schools	Classic drama on stage: Schiller	Work in speech therapy	On the metaphysical meaning of the free will	The vocational structure of the German people	Engineering and technology in the metal industry
4:30	Child has stolen money from mother...	From the pedagogical world	From the Central Institute ... Notices	From the Central Institute for Training and Education: Reports	Excursions in pedagogy (by a sociologist)	From the pedagogical journal literature
5:00	Chess for beginners	The physical investigation of the microcosm	The physical investigation of the microcosm		The physical investigation of the microcosm	Romantic buildings in Berlin and Potsdam
5:30						
6:00	Animal nutrition	German technology	Basic law	Pig breeding and keeping	Electrical heating	Small electrical engines
6:30	Accounting for small business		National economy	Economy for business people	Economy research in practice	Pernicious tumors in the mouth
7:00	Music of Japan	Bird protection	Poetry hour	Beethoven's early sonatas	The working class artist	German opera Mozart, Schreker
7:30	Art in Germany	The hour with books		On Chinese militarism		On modern German literature
8:00						Ancient comedy

Pedagogical, vocational and general educational programs occupy different time slots. Even general educational programs were often organized in series of talks, e.g. the talks on "The physical investigations of the microcosm" (Tue, Wed, Fri 5–6). (Source: D. W. Funk, *J.*, 1926, p. 47)

fields. Finally, from around 5:00 p.m. (sometimes even earlier, especially on Saturdays) until 8:00 p.m. general educational broadcasting occupied prime time. Here programs on science and technology appeared side by side with those on music, arts, history, literature, politics and philosophy. Many topics were dealt with in series of talks, often extending over several weeks with up to three broadcasts per week. Table 2 shows, for example, the first three programs on “The physical investigation of the microcosm” on Tuesday, Wednesday and Friday at 5:00 p.m., a series that continued on Fridays for four more weeks. The timing, topic and title indicate that this series was neither for schools nor for vocational training but rather meant to reach a general audience. Another example can be taken from the very first week after Deutsche Welle had started its regular service: three talks on the origins, problems and crisis of human races were broadcast at the same times. The author was eugenicist Hermann Muckermann of the Kaiser Wilhelm Institute for Anthropology. Further series were on the literary qualities of the Old Testament or the reasons for the decline of the Ancient empires. Typically, the journal of the Deutsche Welle “D. W. Funk” would complement the lecture series with some introductory pages that sometimes reproduced pictures and diagrams taken from textbooks. For the programs of vocational training a special series of *Rundfunktexthefte* (radio booklets) appeared in print.¹⁶

Although one might think that the *Deutsche Welle* would monopolize and unify science communication on Weimar radio, it is a remarkable fact that, despite this national educational station in place, the nine federal broadcasting stations did not reduce their air time on science. The Berlin *Funkstunde* kept its science content of an average of two or three broadcasts every week. Thus we find instead many innovative approaches for formats of science communication within the strict state-controlled framework. Plurality, not uniformity, reigned radio science (as was also the case for science in German popular print, see Schirmmacher 2011). In this way commercial competition was replaced in part by a contest among the various regional stations, which actually had to compete more and more for listeners as the reception quality for distant stations steadily improved. To some extent, however, this may also explain why radio did not compete openly with print media. Furthermore, the question of speed of publication, as exemplified in the Piccard example, was not a central issue for German radio makers.

4.2 New Formats for Broadcasts: Plauderei, Hörbericht, Mikrophonstreifzug

While *Deutsche Welle* stuck mainly to the format of talks or series of talks, the federal stations often tried to find more innovative formats for science programs. A typical and widespread format—which was actually adapted from newspaper writing¹⁷—was the “Plauderei”, something between chat, causerie and gossip. Since it was not a formal lecture, but rather *about* science and scientists, the journalists and popularizers found a way back in. Interestingly, these “Plaudereien” were not necessarily superficial. One series by the engineer Joachim Böhmer at the Berlin station was even called “the critical engineer,” although the content was not “critical” in the sense of questioning the autonomy of science in a radical sense, but in its in-depth investigations of what science was able to do. Apart

¹⁶ The examples and topics mentioned are taken from a sample of the broadcasts of the first 6 weeks of *Deutsche Welle* after the official launch of its regular program on September 20, 1926, as reported in *D. W. Funk*, 1 (1926), 1–66.

¹⁷ German science and science fiction writer Hans Dominik wrote many *Plaudereien* for newspapers, cf. the collection (Dominik 1903).

Table 3 Selection of program called “Plaudereien” in German radio (source: radio magazines *Der Deutsche Rundfunk* 3 (1925) to 5 (1927), 13 (1935) and *Hör Zu!* 1956)

Author	Year	Title	Station and Date
Joachim Boehmer, Ingenieur	1925	Der kritische Ingenieur (Technische <i>Wochenplauderei</i>)	Berlin, Mon, Feb 1, 18:40
Prof. F. Schmidt (TH Karlsruhe)	1926	Photographische <i>Plaudereien</i> , II. Vortrag	Frankfurt, Wed, May 5, 20:00
Georg Zimmermann, Dipl.-Ing.	1926	Technische <i>Plauderstunde</i> : Flüssige Kohle. Ein großer Erfolg deutscher Forscherarbeit	Munich, Sun, Dec. 19, 16:20
Paul Frank, San. Rat Dr.	1926	Medizinisch-hygienische <i>Plauderei</i>	Berlin, Sat, Feb 13, 18.45
Max Mengerinhausen	1927	Technische <i>Plauderstunde</i> : Die Reise nach dem Mond	Munich, Mon, Jun 6, 15:15
Heinz Gelhar	1935	Die Geburtsstunde des Fernsehens. <i>Plauderei</i> über Paul Ripkow	Munich, Fri, Jul 19, 18:55
Hans Gerhard Meyer	1956	So sehe ich meine Zeit: Eine technische <i>Plauderei</i>	Berlin (RIAS I), Wed, Feb 15, 16:40

from the typical topics of the natural sciences, issues of hygiene and medical questions were also presented as “Plaudereien” (Table 3).

Another genre of radio science was the format “Hörbericht Wissenschaft,” audible reports on science which were meant to be a “brief and relaxed comprehensible form” of topical science communication. It was introduced in 1929 by the *Deutsche Stunde* from Munich. The radio magazine *Bayrische Radiozeitung* criticized the first couple of broadcasts as “a bit sluggish and unpleasant;” only after the presenter had reduced the scope of his exposition in the later editions did it become comprehensible and enjoyable.¹⁸ When Otto Willi Gail later took over the presentation things improved. Gail, a physicist and engineer who also wrote a number of science fiction novels, can be seen as one of the early radio reporters, who left the studio to speak from authentic places of science and technology but also from the living room. In 1934 he began staging his reports as debates with colleagues; in 1935 he began his “microphone excursions through the research scene of science,” visiting scientific workers in the lab (Table 4). Gail thus became one of the most prominent science reporters in the 1930s; his way of presenting science, it seems, did not only thrive in the first years of National Socialism. Many others, however, were no longer heard after 1933.¹⁹ The apparently seamless incorporation of radio into the propaganda system of National Socialist Germany was largely facilitated by the structures of state control built into the system from the beginning. And, interestingly, the amount and breadth of science programs in German radio remained on a high level.²⁰

¹⁸ Anon. [hws] (1930), Was wir hörten: Wissenschaft im Hörbericht, *Bayrische Radiozeitung*, 7:2 (1930), p. 8.

¹⁹ Although radio in Nazi Germany is a strongly researched field of German history, information on popular science is almost absent (Zimmermann 2007, MarBolek/von Saldern 1998). Research is especially needed to exhibit the changes in the personnel of science communication in all media as the limited changes in the formal structures hardly reflect this.

²⁰ Both lines of argument can be found: either that the National Socialism had a certain link to scientific and technological topics, or that besides the omnipresent propaganda, rather unideological reports on nature and science might have provided a “break room” (“Pausenraum”) within the system (Herf 1984, Würmann/Warner 2008).

Table 4 Some examples of “Hörberichte” etc. by Otto Willi Gail on the Munich station Deutsche Stunde in Bayern (with the descriptions of topics as given in the program listings)

Year	Title	List of topics	Date, time
1929	Hörbericht Technik	Droll patents/a thousandth of a second/ airplanes landing on moving ships/ skidding motorcars	Fri, Nov 8 19:30
1932	Technische Zeitfragen:	Zigzag ways of technology/windmills become modern again/ice as building material/television with light rays/ magnetic street cleaning	Mon, Apr 11 18:45
1934	Arbeiter im Laboratorium: Ein Streifzug durch die Forschungsstätten der Wissenschaft. I. Teil	The royal couple in the glass bottle/in the interior of a crankshaft/steel is torn to pieces/a ten thousandth of a millimeter/the man who makes elephants	Thu, Nov 15 19:35
1936	Der Physiker geistert durch den Haushalt. Ein Gespräch mit Otto Willi Gail		Thu, Jul. 16 19:45

5 Radio and Scientific Culture in Germany

In the first years the number of listeners rose to many millions, thus making radio a new cultural factor that found a place and played a role within a wider national culture. Although evidence of the direct impact of scientific and educational programs is scarce, we can nevertheless relate the presentation and reception of science described so far with general accounts of science in Weimar culture.²¹

Much has been written on the crisis years of Weimar Germany; historians of science, particularly in the field of physics, have discussed the interaction of science and society. Special attention was paid to the so-called Forman thesis, that theoretical and atomic physicists in Weimar Germany were confronted with a “hostile intellectual environment.” And scientists then, it is stipulated, tried to adapt to this “cultural milieu” that was marked by a philosophy of life, the dismissal of causality and a questioning of determinism (Forman 1971, Carson et al. 2011). Interestingly, on the radio we do not find such a confrontation of science and culture; instead we find a perfect immersion of science into culture in general. The Munich program of April 28, 1931 serves as a good example, when a concert, a women’s program and a program for farmers were followed seamlessly by a talk on “The Constitution and Decay of Atoms” by the Munich professor Kasimir Fajans. This talk on atomic physics was aired between 6:30 and 7:15, and was followed by a language course in Italian, after which an opera performance was broadcast. The radio magazine devoted much room for illustrations for both the talk—multimedia again—and exactly the same amount covering the transmission later that evening of Cimara’s opera *The Secret Marriage*. Here the stage photos and text occupy precisely the same amount of space as the α - and β -ray track photos, the radium letters and explanatory texts (Fig. 7).²²

²¹ The first surveys including the public’s views about science can be found in Britain in the 1940 s, (Broks 2006, pp. 71–72).

²² *Bayrische Radiozeitung*, 13/1931 (Mar. 29, 1929), pp. 437–438, modified title taken from program listing.



Fig. 7 *Bayrische Radiozeitung*, covering topics as diverse as opera and atomic physics side by side with illustrations of the same size

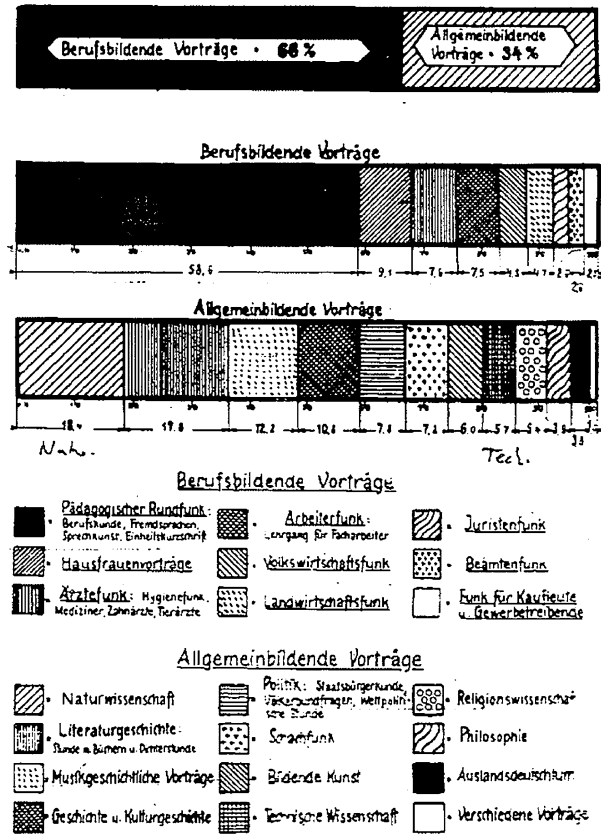
This result should not be misinterpreted, however. The variety of subjects and multiple types of broadcasts that can be found did not mean that there were no choices made, nor political and cultural influences acting on the program. Even the *Deutsche Welle*, with its sophisticated structure, oversight and control, created a program that was balanced only on a superficial level. When after 2 years of operation the station analyzed its program, it was easy to show how well the general educational talks had covered all areas of importance, ranging from science and technology over music, arts and literature to political education and religion (Fig. 8). However, 1 year earlier the *Deutsche Welle* had already confessed that there was a kind of “hidden systematics” for its science programs, so that it comes as no surprise that, despite the lack of listeners’ democratic participation, some of the most widely discussed topics of the time are mirrored in the programming:

Intentionally we confined ourselves to a certain hidden systematics [...] which became only apparent in the course of the events: Just recall the lectures on “race research,” “cell and heredity,” “theory of descent,” “the race elements of the German people” [...] (Roeseler 1927, 2)

In this way Weimar radio probably played an important role in amplifying the otherwise already present discourse on race and heredity that would be exploited for political reasons a few years later.²³

The German airwaves in the interwar period saw not only much science that was closely integrated into the prevailing ideas of high culture. In general, German science underwent a difficult, yet very successful period after the lost World War. It hence appears tempting to

²³ For a discussion of the programs with eugenic topics cf. (Rolfes 1992, pp. 137–146).



Graphische Darstellung der Darbietungen der Deutschen Welle im Jahre 1927

Fig. 8 Deutsche Welle program analysis published in *D. W. Funk* 1928, 1–3, here p. 1. The *first bar* relates vocational and general educational talks, the *second and third bars* differentiate the vocational and general educational programs with respect to branches of the sciences or humanities, resp. In the case of general educational programs (“Allgemeinbildende Vorträge”) one sees a rather balanced coverage of science, political education, religion; literature, languages, philosophy; music, art, programs on German culture abroad; history, technology, and various other talks

consider the extent to which the phenomenon of radio, or rather the radio experience, exerted any influence back on science and thus gave rise to “science media couplings” (Weingart 2001). At the very least we have many examples of radio influencing scientists. Some of them were able to earn good money working for radio, which helped them in their research or early careers. Some of them—perhaps an entire generation—were drawn into science by putting together a radio kit. Scientist-philosopher Hans Reichenbach was initially quite interested in radio technology; then he lectured on science on the air and later transformed radio talks on quantum and relativity theory into books. Manfred von Ardenne, who was just 18 years old when he first presented a program on radio technology and

its deeper scientific basis in 1925, would later make important inventions in amplifier and electron optics technology.²⁴

In a different way the focus of the *Deutsche Welle* on heredity and eugenics may also have contributed to ideas, motivations and recognition of scientific research, as it amplified the perception of a crisis that spread from economic to biological fields. While the prominence of programs on race and heredity was the result of a free choice of the program makers, probably on the basis of a growing public discourse which these programs may have further fostered, it seems rather ironic that the *Deutsche Welle* was shut down as an educational station at the end of 1932, as a consequence of a controversial reorganization of German radio for the purpose of establishing a strong national station, the “Deutschlandsender.” This transformation came just in time to create opportunities for abuse for propaganda purposes when the Nazis took power in early 1933 (Rolfes 1992, pp. 52–55; Lerg 1980). As mentioned before, the new political rule did not reduce science broadcasts on the radio—indeed, their quantity remained constant. The experiment of a state-controlled multimedia education for all, however, sooner or later became deflected by political forces incorporating political propaganda.

6 Conclusion

The history of early German radio shows a unique approach to mass education by a new means of communication. Its great independence from most of the factors that were decisive for print media, first of all its market orientation and competitive character, allowed for a wealth of programs on science and technology aimed at many audiences, ranging from pupils, professionals and people interested in vocational training to an imagined broad audience that was assumed to be keen on further education. This clearly reflects the great value attributed to education and high culture in Germany, but at the same time shows a rather extreme case of what kinds and formats of (popular) science were possible. In this sense the German example may provide a scale of reference for assessing other national models of science communication on the radio. The most interesting feature of German radio was probably the models of multimedia education that the regional stations tried to establish with their radio magazines, as did the educational station *Deutsche Welle*, which was supported by a Central Institute for Training and Education of the German Radio. This organization actually ran a 1-year test phase before the program officially started, published a journal with introductions and illustrations for particular broadcasts, separate radio booklets and instruction manuals on using radio in schools and for community listening, as well as books on related pedagogical issues.²⁵ As this orchestrated combination of different media is obviously more than a plurimediality of different media coexisting side by side (Wilke 2000, p. 303), here it has been called multimedia.

²⁴ For example, (Reichenbach 1930) is a publication of radio talks broadcast by the Berlin station in winter 1929/1930. Ardenne’s program at the same station on April 30, 1925, at 18:40 was “Die Physik der Glühkathodenröhre” and was identified as part of the educational series “Hans-Bredow-Schule,” section “Bildungskurse der Funk-Stunde, Technik.”

²⁵ Cf. the journals *Z. I. Funk. Rundfunk-Mitteilungen des Zentralinstituts für Erziehung und Unterricht und der Deutschen Welle*, 1 (1925) and 2 (1926) and *Deutsche Welle. Offizielles Organ der Rundfunk-Gesellschaft Deutsche Welle Berlin*, 1 (1926) to 5 (1932), containing many advertisements for print material related to the educational program.

A direct impact of this initiative to educate a whole people by means of the new medium is difficult to assess, mainly due to a lack of appropriate sources.²⁶ Sometimes the radio magazines included a section reviewing the program of the preceding week, thus representing the listeners' voice to some extent.²⁷ A more general cultural influence of radio science, however, becomes visible when science was treated on the air on an equal footing with music, arts or literature. This is reflected by the side-by-side reports including pictures of such different cultural topics as opera and atomic physics in the radio magazines (Fig. 7), an attitude that persisted in Germany for a long time.²⁸ In the United States the tradition of industry-sponsored intermission talks for the live broadcasts of classical concerts exemplifies a rather different format of science communication, which clearly has to be explained by the very different ways of instituting radio and thus programs on popular science in this medium. As a consequence the differences in the public pictures and the public understanding of science found in various national cultures are at least to some extent the result of different national modes of educating people on the cultural meanings of scientific knowledge, which can be distinguished rather clearly in the case of radio.

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²⁶ Accounts on the impact of radio programs that can be found in individual biographies, letters and interviews, and listeners' responses, some of which were printed in radio magazines or even collected in archives tend to be unsystematic; more systematic surveys are not available for the period discussed, but see note 21.

²⁷ A section "What we listened to" can be found, for example, in *Bayrische Radiozeitung*, cf. note 18.

²⁸ Similar examples can be found for the postwar years in both German states, e.g. in the East German Radio magazine *Unser Rundfunk*, reported in its Feb. 29 issue of 1954 (p. 7) on broadcasts of a Slovak national opera and progress on antibiotics research side by side. On German postwar radio see (Dussel 2004, chaps. 4 and 5).

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