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The anglocentric tendency in the history of information engineering

Abstract: This paper examines the anglocentric nature of much writing on the history of technology, taking as an example important research results from the first half of the last century published in German and Russian in the field of information engineering. By 'information engineering' is meant such disciplines as electronics, telecommunications, control engineering and signal processing. The seminal German and Russian results discussed here, untranslated at the time into English, remained largely unknown in the English-speaking world.

1 Introduction

Unusually for this journal, this paper is a case study of the significant *absence* of translation. The (unspoken) general assumption by many technologists and engineers is that most, if not all, important developments in computing and information technologies have taken place in the anglophone world. Currently, many research papers are written in English by authors with a different native language. This was not, of course, always the case (Gordin, 2015) – and even today, important publications appear in languages other than English. This short paper examines some of the contributions, mainly from the first half of the last century, of a number of Germans and Russians to the development of telecommunications, control engineering and systems thinking, contributions that never became widely known in the contemporary English-speaking world. Following brief descriptions of the *personae dramatis* and some of their work, I shall consider some general issues of anglocentrism and translation in information technology in its broadest sense. However, it is necessary first to give an indication of the scope of the contributions discussed here.

The major technical topics considered are:

- signal and systems theory
- control engineering
- the sampling theorem
- cybernetics

These are all topics that are fundamental constituents of *information engineering*, and some aspects of the important issues of the period 1920 to 1950 are illustrated in Figure 1, which should not require any specialist knowledge to follow. All these aspects are still vital to current developments in ICT, from mobile phones to smart cars and homes

At the top is what is called a ‘black box’, and the question is: how can we understand the functioning of the system without taking it apart? In the centre is a feedback loop, in which the output is fed back to the input for some purpose; a simple central heating thermostat is an example, with the output being the actual temperature and the input the required one. The feedback ‘forces’ the output towards the required value, but such systems can become unstable and stop functioning correctly: how do we design such a system so that this does not happen? The bottom part of the Figure shows the conversion of a continuous signal (such as an audio source) into a digital representation – in other words, a set of numbers for computer processing. The question here is: how do we know how often we must take samples to preserve the sound quality?

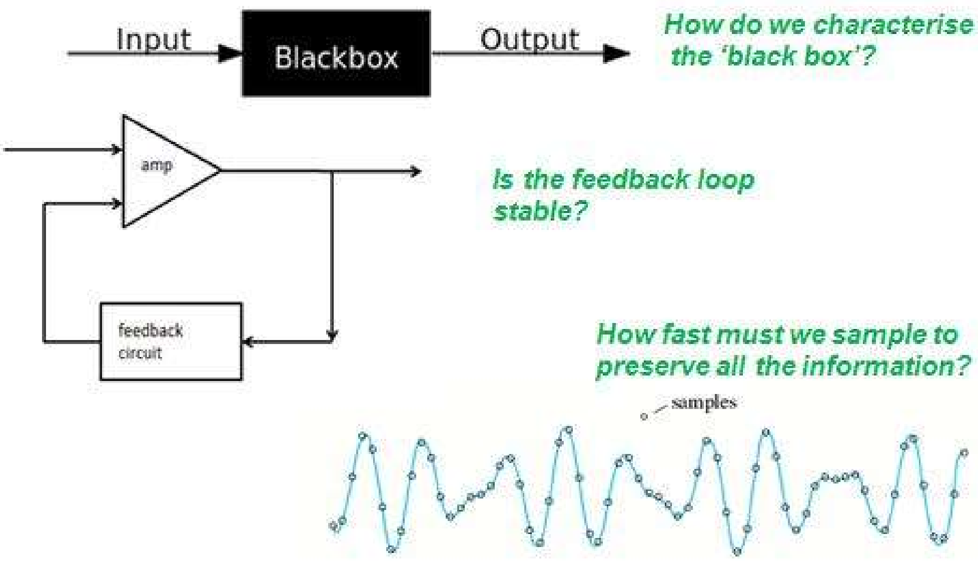

Figure 1: Some important information engineering issues of the early 20th century

2 The engineers

It must be admitted that the historical figures presented here are all, unfortunately, white, European / US males. This partly reflects the history of the subject area, but also the limits of the author's knowledge. It is to be hoped that others will examine lesser-known contributions by women, Asian researchers, and so on.

The contributions of some female engineers in this general area (again, predominantly white and anglophone) have been recognised: Irmgard Flugge-Lotz (relay control), Edith Clarke (power transmission modelling), Grace Brewster Murray (programming), for example (see http://www.engineergirl.org/4356.aspx). Nevertheless, a great deal of work remains to be done.

2.1 Küpfmüller

Figure 2: Karl Küpfmüller (1897 - 1977)

Karl Küpfmüller was born in Nuremberg. There, at a technical college (*Polytechnicum*), he studied electrical engineering from 1913 to 1915 and 1918 to 1919. After his graduation, he joined a research laboratory of the German postal and telegraph authority, and in 1921 moved to the *Siemens & Halske* Company in Berlin. Küpfmüller was a distinguished communications engineer, and one of the first to use block diagrams such as those in Figure 1 – including a black box approach to electronic and communications systems. Only one of his early papers has been translated – by the current author and published on line in 2006. In 1928, Küpfmüller was appointed full professor of general and theoretical electrical engineering at the University of Technology in Danzig (even though he did not possess a doctorate!). In Germany he is recognised as an important contributor to the establishment of the concept of "information" alongside "matter" and "energy" as three building blocks of the universe.

Küpfmüller was a member of the Nazi party and the SS from 1937, rising to the rank of *Obersturmbannführer* in 1944, and becoming scientific advisor to Admiral Doenitz. His wartime activities have been little reported, however, even in the German literature. In 1946-7 he was interned for denazification, when he met Hermann Druckrey, a cancer researcher. A joint publication *Dosis und Wirkung* [Dose and Effect] followed in 1949, in which Küpfmüller showed how to simulate electronically the action of carcinogens; the approach was later successfully verified in practice at Rhode & Schwarz.

2.2 Andronov

Figure 3 Aleksandr Andronov (1901 – 1951)

Aleksandr Aleksandrovich Andronov was one of a number of young Soviet physicists who began their academic careers studying advanced mathematics as research students under Mandelstam in Moscow. One of Andronov's first great achievements was to recognize the commonality of a whole range of practical oscillatory processes in chemistry, biology and engineering which, he predicted correctly as early as the 1920s, would be amenable to similar mathematical analyses.

Unlike his Western contemporaries, Andronov was *au fait* early on with the international state-of-the-art, as demonstrated in his publications and presentations. Only well after the Second World War, and in the context of the Cold War, did cover-to-cover translations of public-domain Russian scientific and engineering research become widely available. Because of this (and also because of the tendency under Stalin for spurious claims to be made for Russian priority in science and technology) English-language histories of 20th century engineering and technology do not always recognise the significance of Russian contributions.

In 1947 Andronov became a deputy and member of the Presidium of the RSFSR (Russian Soviet Federative Socialist Republic) and in 1950 a deputy of the Supreme Soviet of the USSR.

2.3 Oppelt

Figure 4: Winfried Oppelt (1912 – 1999)

Winfried Oppelt came from a physics and aeronautical engineering background, and worked on flight control systems as early as the 1930s. But the truly remarkable aspect of his early career is that he recognised the commonality of the dynamics of many different engineered systems, and the fact that a uniform approach could be taken to controlling them.

Oppelt was one of a group of eminent control engineers from Germany, the United Kingdom and the United States, who emerged from the Second World War with a burning desire both to disseminate the novel ideas about automation and control that had been forged during the conflict, and to apply them in areas other than technical systems – and a belief that automatic control could be a benefit to post-war society. In all these countries, engineers were coming to terms with what they had done, within or without the armed forces, as part of the war effort.

2.4 Sartorius

Figure 5: Hans Sartorius (1913 – 2005)

Hans Sartorius was born near Nuremberg. He studied mathematics and electrical engineering at the Munich University of Technology. Immediately after graduation, he joined the Siemens & Halske Company in Berlin, where he met Rudolf Oldenbourg, the head of the laboratory in which Sartorius worked. Soon, the cooperation between the two led to a famous early text on control engineering. The book, *Dynamics of Automatic Control*, was completed in 1942, but because of the exigences of war did not appear until 1944. An unofficial, and hence not well-known, English translation was published in 1948, the original having been uncovered by the Allied armed forces during the invasion of Germany; it was followed by versions in Russian, French and Japanese. The book is particularly noteworthy as it includes one of the earliest treatments (possibly *the* earliest) of sampled data systems, later to become the basis of computer control.

2.4 Kotelnikov

Figure 6: Vladimir Kotelnikov (1908 – 2005) as a student and as a grand old man in his Soviet finery

Vladimir Aleksandrovich Kotelnikov was born in Kazan. He studied radio engineering as an undergraduate at the Moscow Energy Institute (MEI). Following wartime research and development in Ufa (one of the temporary locations of scientific institutions evacuated from endangered cities) he returned to MEI in 1944, where he became professor and Dean of the Radioengineering Faculty. Kotelnikov derived the sampling theorem (1933) independent of earlier (and later) work. He then turned to cryptography and planetary applications. Unlike the novelist Aleksandr Solzhenitsyn and the aircraft designer Andrei Nikolayevich Tupolev, Kotelnikov narrowly managed to escape work in a *sharashka* (a scientific prison R&D facility). He ultimately became chairman of the Russian Supreme Soviet 1973-1980 (not to be confused with the Supreme Soviet of the USSR).

There is little doubt that Kotelnikov's 1933 paper was the first to address the engineering problem of sampling. As noted already, Russian work in the 1930s and 1940s was not known at the time in the West. Indeed, Kotelnikov's seminal paper was published only much later, in 2000, revised by the current author and the original translator nearly a decade later (see also Bissell, 2009).

2.5 Raabe

Herbert Raabe deduced the sampling theorem in his doctoral thesis, and published it in1939 in the journal *Elektrische Nachrichtentechnik*. He went beyond theory and actually built probably the first functioning system. Raabe's doctoral work was not widely known. His early papers and thesis were written in German and published just before World War II. After the war he moved to the USA, by which time equivalent work had appeared in the USA, and his achievements were unknown outside Germany for many years.

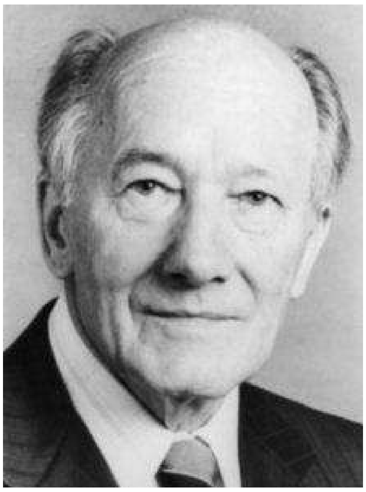

Figure 7: Herbert Raabe (1884 – 1968)

2.5 Schmidt

Hermann Schmidt was born in 1984 near Frankfurt. Soon after the completion of his academic education in mathematics and physics, he joined the German patent office in Berlin, where he was employed until 1945. Parallel to this position, he was appointed in 1935 to lecture on applied physics at the University of Technology of Berlin-Charlottenburg. Schmidt was Nazi Party member 1938 -1945 (probably opportunistic, rather than ideological, in sharp contrast to Küpfmüller).

Figure 9: Hermann (1984 – 1968)

Central to Schmidt's thinking was that control engineering ideas could be applied to biology, physiology, economics and other areas. Asked to chair a German Engineers Society (VDI) committee on control engineering in 1939 he organised a seminal workshop in October 1940, which included presentations on blood circulation and human motion as well as engineering topics. During the last period of his life, Hermann Schmidt was extremely active outside academia, giving many public talks on ethics and on technology's influence on society. Like the other researchers discussed above, his name is virtually unknown in English-speaking areas (but see Bissell, 2011)

3 Towards an analysis

If I have dealt at some length with these personalities, it is because of their eminence in German and Russian engineering, and the significance of their work is still largely unknown in the anglophone world. Priority in the history of science and technology is not particularly important, but all the researchers presented here have significant claims in their various specialisms. Post WW2 the US put huge resources into presenting itself as the major technological superpower. The Soviet Union turned inwards, and genuine claims were marred by a number of spurious ones. German historians of technology often concentrated elsewhere, rather than investigate certain aspects of the German past, for obvious reasons. Language, translation and socio-cultural issues must therefore not be underestimated. Another point to be borne in mind is political exigence: Andronov and Kotelnikov rose high in the Soviet political system, while Küpfmüller and Schmidt were Nazi party members. Yet all is not necessarily what it seems. While Küpfmüller bought into National Socialism, Schmidt appears to have joined the party simply in order to carry on his university career in peace, and when I expressed surprise at Andronov's participation in Russian politics, his son replied: "Someone came round one evening to speak to my father. You did not say no!"

A few words should be said about cybernetics; again most of the English language historical writing concentrates on anglophone contributions. In the websites in the Bibliography, the American Society of Cybernetics page is devoted entirely to English language contributions; and although the Collopy biography includes a number of papers (in English) on Soviet developments, Schmidt and his colleagues are barely mentioned. The best reference on work on the USSR is Gerovich (2002).

In fact, the development of cybernetics differed greatly between East and West, and within the Eastern Bloc there was great controversy. Work in the former DDR, in particular, has seen little analysis in English technological historiography.

Until comparatively recently graduate scientists – and, to some extent engineers, – were expected to be able to read a foreign language, mostly French and/or German. German was particularly important for physics and chemistry, and even after WWII, many university undergraduate curricula included compulsory language courses. When work from non-anglophone countries was disseminated in English, however, it occurred in a rather haphazard way. As far as the contributions in this article are concerned, Andronov's work was reported only decades later, mainly by two Americans of Russian background, Minorsky and Lefschetz; while the seminal work of German circuit theorists of the 1920s such as Küpfmüller was described only in the mid-1930s, particularly by the gifted engineering educator Ernst Guillemin, an American who had completed his PhD in Munich. Raabe's work was widely disseminated only in 2010!

Although the current state of reading knowledge of a foreign language by English native speakers is probably poorer than even half a century ago, the status of English as the major global language of science and technology means that the situation is very different from that of the period considered in this article. As Steven Shapin (2015) puts it in a review of Gordin (2015):

We now live in a scientific world as monoglot in English as medieval scholarship was in Latin. From 1880 to 2005, the fraction of the world's scientific literature published in English increased from 35% to more than 90%. […] the vast majority of Chinese, Japanese and Russian scientists write in English. Fewer and fewer international scientific conferences feel the need to provide simultaneous translation […] By 1960 English was used in just over 50% of science texts. Then it really took off: between 1980 and 1996 English usage rose from about 75% to 91%; Russian dropped from 11% to 2%; and German from 2.5% to 1.2%.

In spite of these remarks, however, is significant work still first published in Chinese, say, or Japanese? And how would engineers know?

4 Conclusion and further research

I have presented a number of figures who were highly significant in Germany and Russia in the first half of the 20th century: there are others. Authors of most English-language histories of information engineering tend to be unaware of such figures. Contributions in German and Russian to the history and historiography of information engineering are largely untranslated.

Let me conclude with the following quotation from Bellos (2011):

The reasons why English has made a clean sweep of the sciences are not straightforward. Among them we cannot possibly include the unfortunate but widespread idea that English is simpler than other languages. However, you can't explain the history and present state of the language of science as the direct result of economic and military might either. In three instances, languages became scientific vehicles because the work of a single individual made advances that could not be ignored anywhere else in the world (Liebig for German, Berzelius for Swedish, Mendeleev for Russian). One language lost its role because of the political folly of its users (German). What we seem to have experienced is not a process of language-imposition, but of language-elimination, in a context where the scientific community needs a means of global communication among its members. The survivor language, English, is not necessarily best suited to the job; it's just that nothing has happened yet to knock it out [p. 13].

As noted in the Introduction, major areas still to be investigated are contributions in languages other than German and Russian, and also the contributions of women and those not from a Western cultural background. The author has a knowledge of several other European languages; but publications that first appeared, say, in Asian languages – although an aspect that calls for further research – are, unfortunately, a closed book to him. Another area not examined in depth here is the question: to what extent were English-language researchers even aware of the existence of relevant work and/or literature from elsewhere, and what measures, if any, did they take to identify it.

5 Bibliography

Bellos, David (2011) *Is that a Fish in your Ear? Translation and the meaning of Everything.* London: Particular Books

Bissell, Chris (2009), "Vladimir Aleksandrovich Kotelnikov: Pioneer of the sampling theorem, cryptography, optimal detection, planetary mapping", *IEEE Communications Magazine,* vol. 47, no.10, pp. 24–32

Bissell, Christopher Charles (2011), "Hermann Schmidt and German 'proto-cybernetics", *Information, Communication & Society*, vol. 14, No.1, pp. 156–171

Gerovitch Slava (2002) *From Newspeak to Cyberspeak: A History of Soviet Cybernetics* Cambridge MA: MIT Press

Gordin KM (2015) *Scientific Babel: The Language of Science from the Fall of Latin to the Rise of English*. London: Profile Books

Shapin, Stephen (2015) Confusion of tongues. *London Review of Books*. 37(23): 23-24, 25

Websites (all accessed 6 March 2016):

http://www.engineergirl.org/4356.aspx

http://www.asccybernetics.org/foundations/history2.htm;

https://collopy.net/projects/bibliography.html;

Note: the full text of the articles by Bissell, which include many references to primary sources, can be found at http://oro.open.ac.uk/view/person/ccb2.html. Some relevant translations by the author are at http://ict.open.ac.uk/classics/