Interpreting the information age: can we avoid anglocentrism?

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Interpreting the information age: can we avoid anglocentrism?

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What this talk is (not) about

• *Not* the history of computers
  – Although there is still much to be said about computer development beyond the UK / USA

• Rather, some German and Russian contributors to
  – Signal and systems theory (Karl Küpfmüller)
  – Sampling theorem (in addition to Shannon)
  – Cybernetics (in addition to Norbert Wiener)
  – These are all topics that are fundamental constituents of *information engineering*
Some information engineering issues of the mid 20th century

How fast must we sample to preserve all the information?

Is the feedback loop stable?

USA: Shannon, Nyquist, Carson, Foster, Bode, Black, ...

How do we characterise the ‘black box’?

How fast must we sample to preserve all the information?
Dramatis Personae

• Karl Küpfmüller
  – Communications engineer, Nazi and SA/SS member from 1930s (rising to Obersturmbannführer by 1944), advisor to Doenitz (so very much part of the Nazi establishment)

• Vladimir Kotelnikov
  – first engineering account of the sampling theorem in 1933
  – went on to make major advances in cryptography

• Herbert Raabe
  – Version of sampling theorem in 1939; construction of practical devices

• Hermann Schmidt
  – Physicist by training, probably first ever Chair of Control Engineering (Berlin, 1944), trapped in Soviet zone post WW2 for a time

• Winfried Oppelt
  – Physicist by training, worked on flight control including V1 rockets, later a major force in German control engineering
Karl Küpfmüller

- Distinguished communications engineer, responsible for groundbreaking work in 1920s
- 1946-7 interned for denazification
- Met Hermann Druckrey, cancer researcher, in the camp
- Joint publication *Dosis und Wirkung* appeared 1949
- Küpfmüller applied electrical analogue modelling to cancer treatment; ideas successfully tested at Rhode & Schwarz after their release
- Prime mover in founding of German Society for Cybernetics
Küpfmüller

• Understood “time x bandwidth product”
• Developed a closed-loop stability criterion
• [one of] the first to use block diagrams
• Applied a systems (black box) approach to electronic and communications circuits and components
• Important contributor to the establishment of the concept of “information” alongside “matter” and “energy”
Küpfmüller – top and left issues

How fast must we sample?

How do we characterise the ‘box’?

USA: Shannon, Nyquist, Carson, Foster, Bode, Black, ...

Is the feedback loop stable?
Vladimir Aleksandrovich Kotelnikov

• Sampling theorem (1933) independent of earlier (and later) work
• Scrambling and cryptography (early ‘40s)
• Optimal detection (1947)
• Escaped work in a sharashka
• Planetary telemetry and geodesy
The elderly Kotelnikov in full Soviet glory!
Herbert Raabe

- PhD thesis on pulse amplitude modulation and multiplexing, results published in 1939
- Full treatment of sampling, including bandpass signal
- Practical systems designed and built
- Work rediscovered only in late ‘70s, 80s
Kotelnikov and Raabe – bottom right issue

How do we characterise the ‘box’?

USA: Shannon, Nyquist, Carson, Foster, Bode, Black, ...

How fast must we sample?

Is the feedback loop stable?
From Raabe’s 1939 thesis

Switches for time-division multiplexing

Oscilloscope photos

Pulse-amplitude sampling
Hermann Schmidt

- Nazi Party member 1938-1945 (probably opportunistic, rather than ideological)
- Asked to chair VDI committee on control engineering 1939
- Workshop in October 1940
- Included presentations on blood circulation and human motion
Allgemeine Regelungskunde

• Overarching concept, applicable to
  – Engineering
  – Biology
  – Physiology
  – Economics

• Closed-loop models

• Some have argued this is a pre-Wiener German ‘cybernetics’
Denkschrift 1941

• Called for the establishment of an Institute of Control Engineering

• Application areas in:
  – Industry
  – Military
  – Biology
  – Society

• “to control everything that is controllable, and to render controllable that which cannot yet be controlled”
The Wiener myth

• “… Wiener’s consistent failure to acknowledge the multiple traditions of feedback engineering that preceded him”
  – David Mindell, Between Human and Machine, 2002

• Wiener’s origin stories have made their way into historical accounts

• Mindell has redressed the balance, but only for the USA
Winfried Oppelt

- Colleague of Schmidt in VDI committee
- Became interested in economic and biological applications after WW2
- Published on the application of control ideas to economics, 1957
- Continued interest in cybernetic areas until his death, including the study of hypnosis
Oppelt’s selected later publications

- *Der Mensch als Regler: eine Sammlung von Aufsätzen*, 1970
- *Über das Menschenbild des Ingenieurs: eine Bestandsaufnahme und offene Fragen bei der kybernetischen Modellbildung menschlichen Verhaltens*, 1984
- *Eine Schichtenanordnung zur Darstellung der hypnotische Trancezustände*, 1990
So what?

- I have presented a number of figures who are / were highly significant in Germany and Russia: there are others.
- English-language histories of control engineering, telecommunications and other aspects of information engineering largely ignore such figures.
- Contributions in German and Russian to history and historiography of information engineering are largely untranslated.
Two examples of important, untranslated monographs
Cybernetics in East and West Germany – contrasting stories!
Is the charge of anglocentrism true?

- Priority in the history of science and technology is not particularly important, but all the researchers presented here have significant claims.
- 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 the German past.
- Language and translation issues must not be underestimated.