



Open Research Online

Citation

Bissell, Christopher (2014). Interpreting the information age: can we avoid anglocentrism? In: Interpreting the Information Age: New Avenues for Research and Display, 3-5 Nov 2014, Science Museum, London.

URL

<https://oro.open.ac.uk/41309/>

License

None Specified

Policy

This document has been downloaded from Open Research Online, The Open University's repository of research publications. This version is being made available in accordance with Open Research Online policies available from [Open Research Online \(ORO\) Policies](#)

Versions

If this document is identified as the Author Accepted Manuscript it is the version after peer review but before type setting, copy editing or publisher branding

Interpreting the information age: can we avoid anglocentrism?

Chris Bissell

Department of Computing and Communications
Faculty of Mathematics, Computing and Technology
The Open University, UK

chris.bissell@open.ac.uk

Interpreting the Information Age. Science Museum, London, 3-5 Nov. 2014

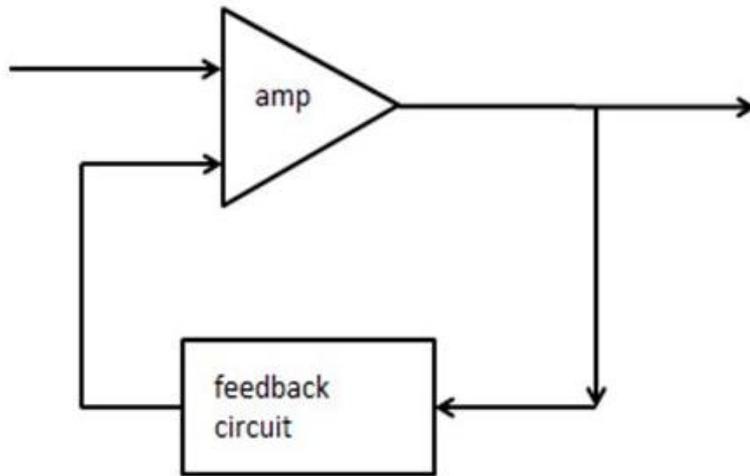
What this talk is (not) about

- *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



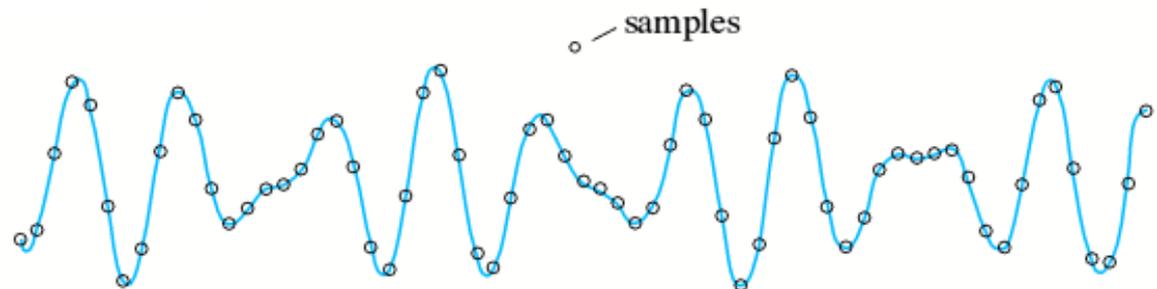
How do we characterise the 'black box'?



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

How fast must we sample to preserve all the information?

Is the feedback loop stable?



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

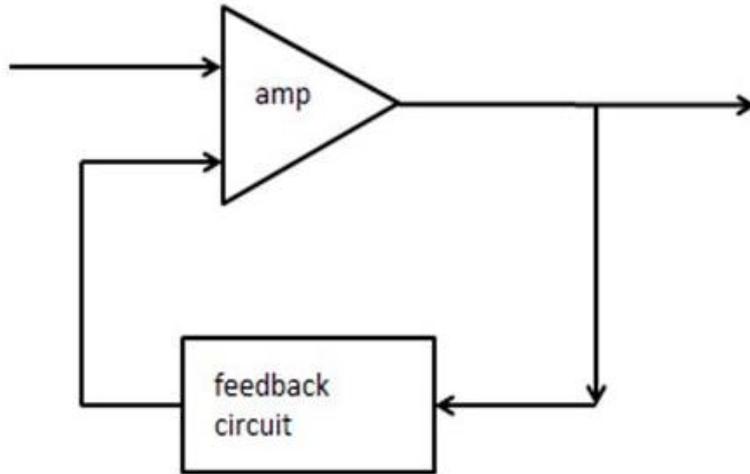
Küpfmüller

- 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



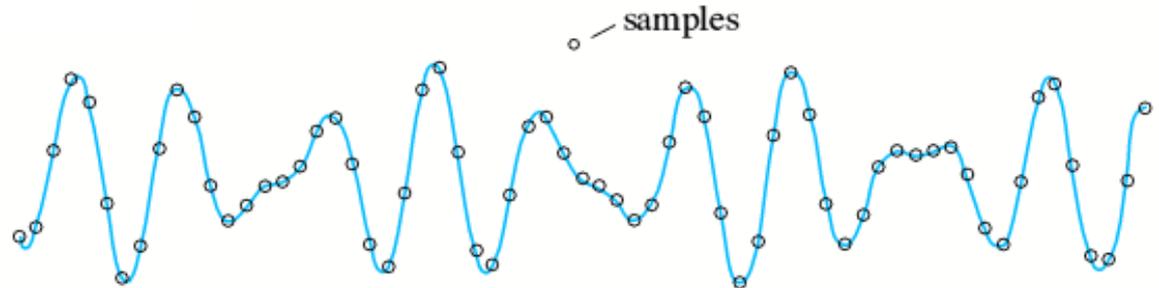
How do we characterise the 'box'?



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

How fast must we sample?

Is the feedback loop stable?



Vladimir Aleksandrovich Kotelnikov



Kotelnikov as a young man

- 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

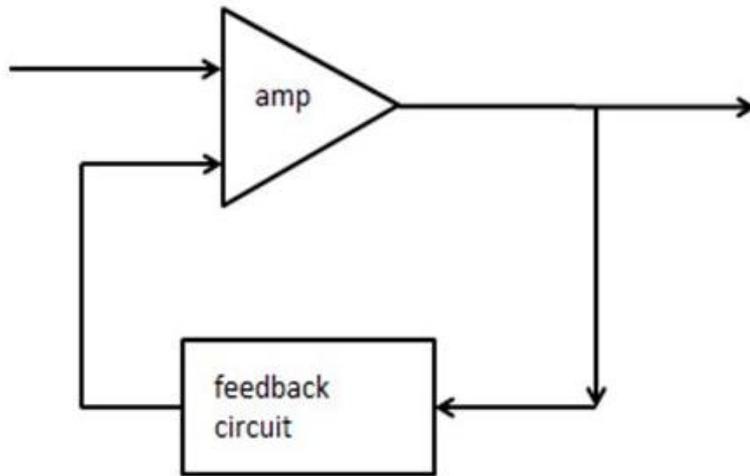


- PhD thesis on pulse amplitude modulation and multiplexing, results published in 1939
- Full treatment of sampling, including bandpass signal
- Practical systems designed and built
- Work rediscovered only in late '70s, 80s

Kotelnikov and Raabe – bottom right issue



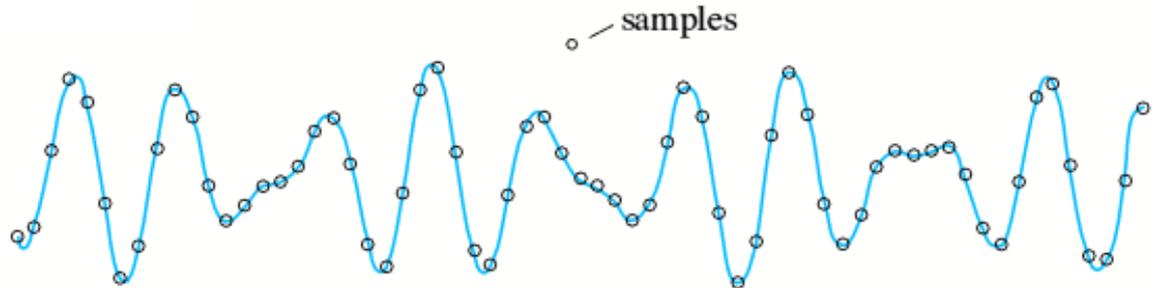
How do we characterise the 'box'?



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

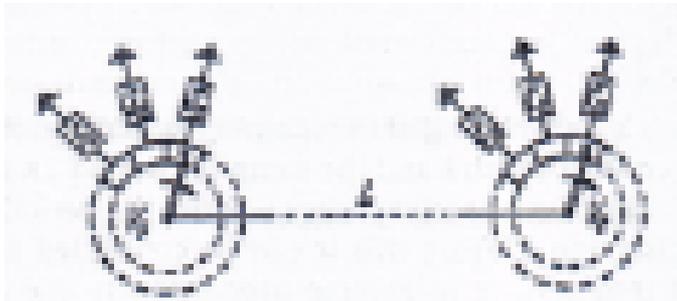
How fast must we sample?

Is the feedback loop stable?

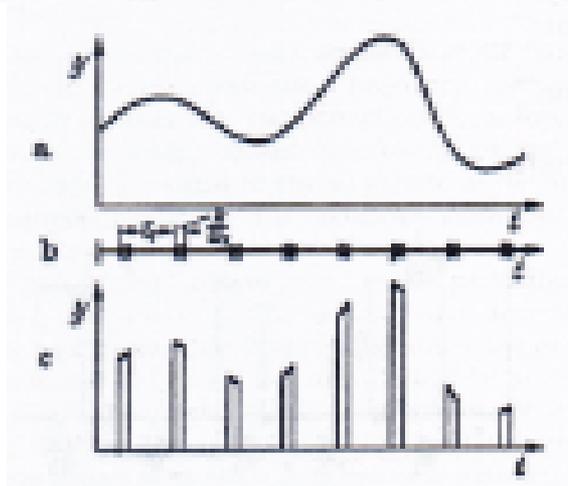
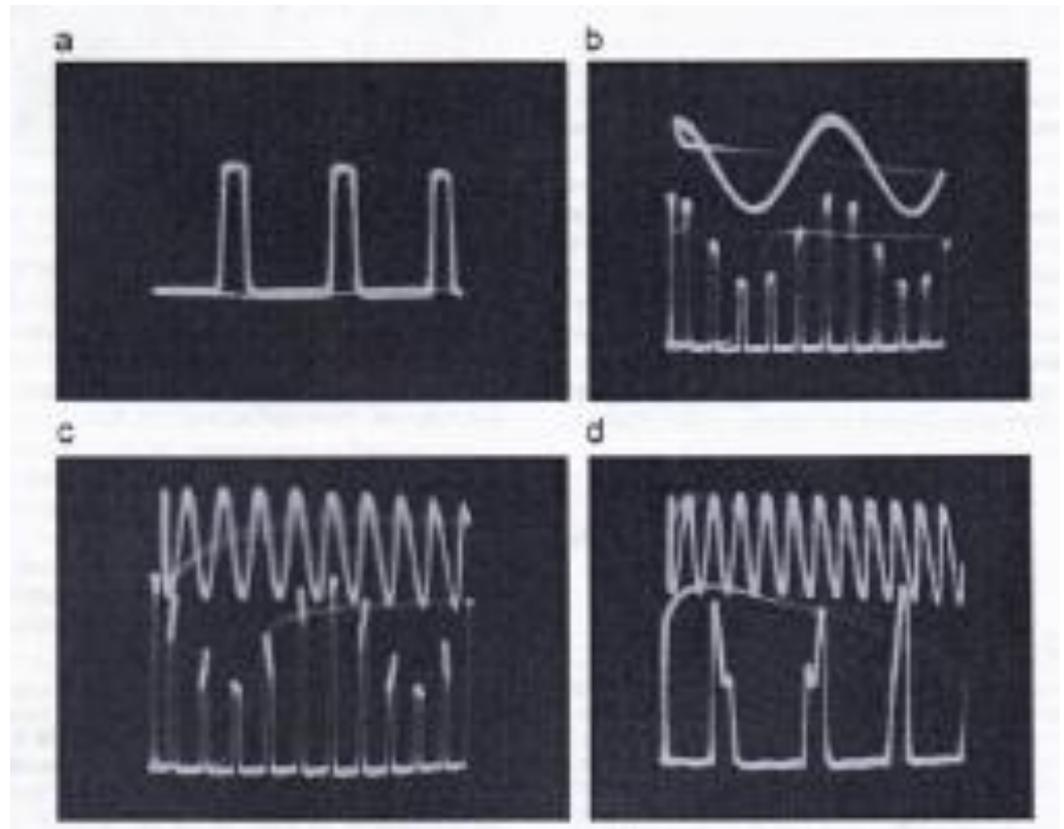


From Raabe's 1939 thesis

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

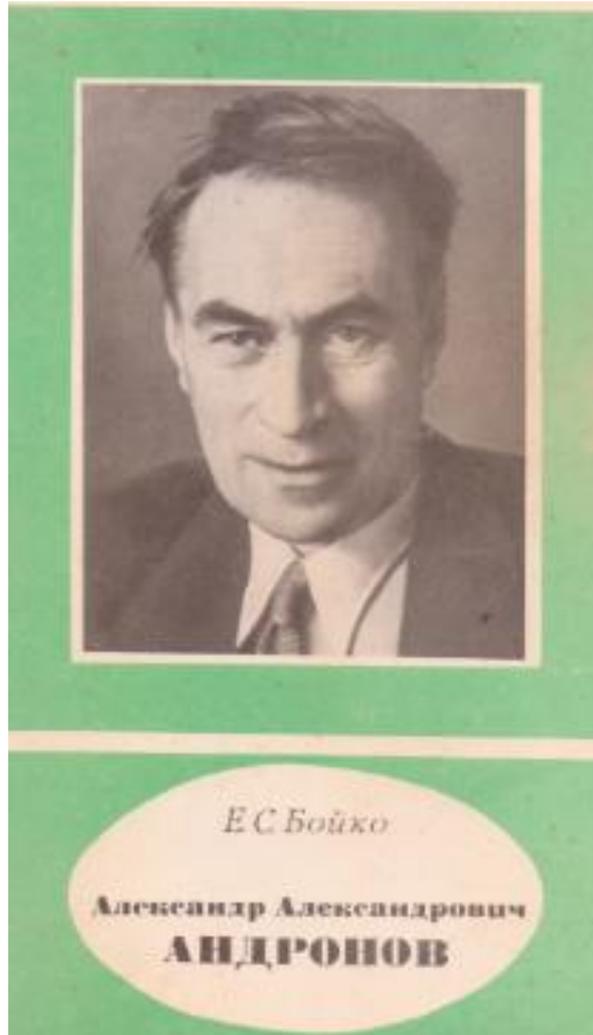
Oppelt's selected later publications

- *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*

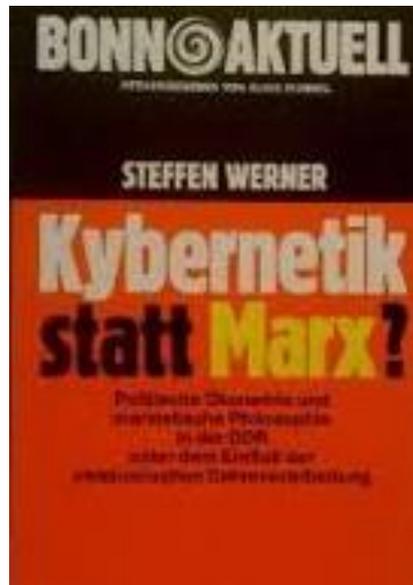
So what?

- 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