# Image Communication I

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# Why English?

- Electrical engineering literature is mostly in English
- Companies have branches in several countries
- Customers often do not speak German

> Electrical engineers read, write and speak English on a daily basis.

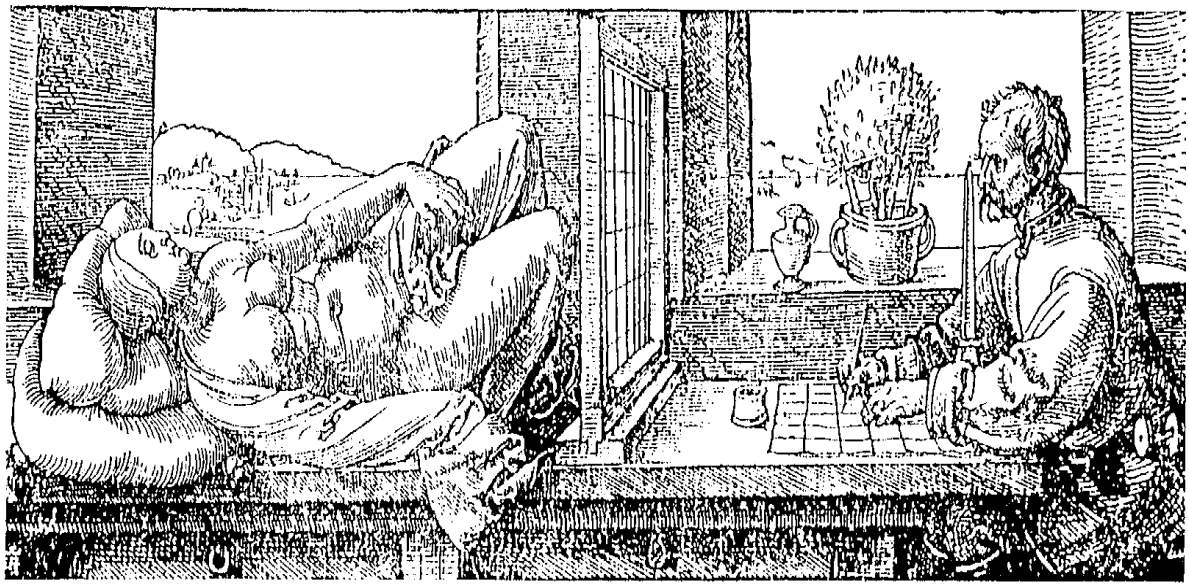
# Ground Rules

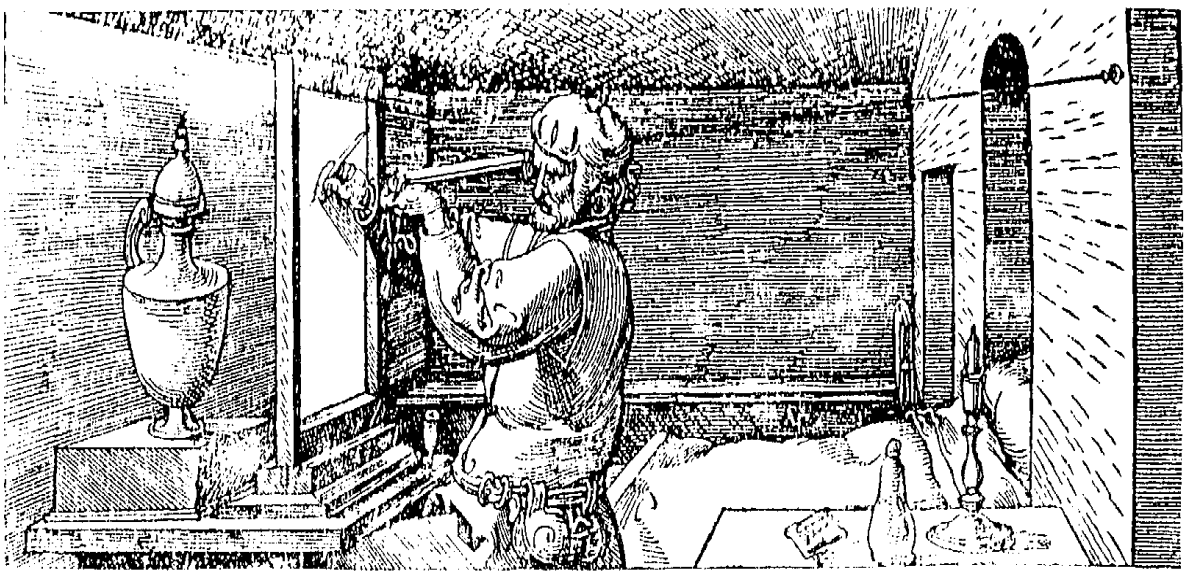
- During class, we will exclusively speak English.
- German copies of the overhead transparencies are available for those who need them.
- Oral exams will be conducted either in English or German, as preferred by the individual student.

# Introduction

- Historic break-throughs in image communication:
  - ✗ Invention of photography and cinema
  - ✗ Invention of television
  - ✗ Introduction of television broadcasting
- Current technological challenges
- Technological key problems
- What will be covered in this course?
- Organisation

# Perspective Projection

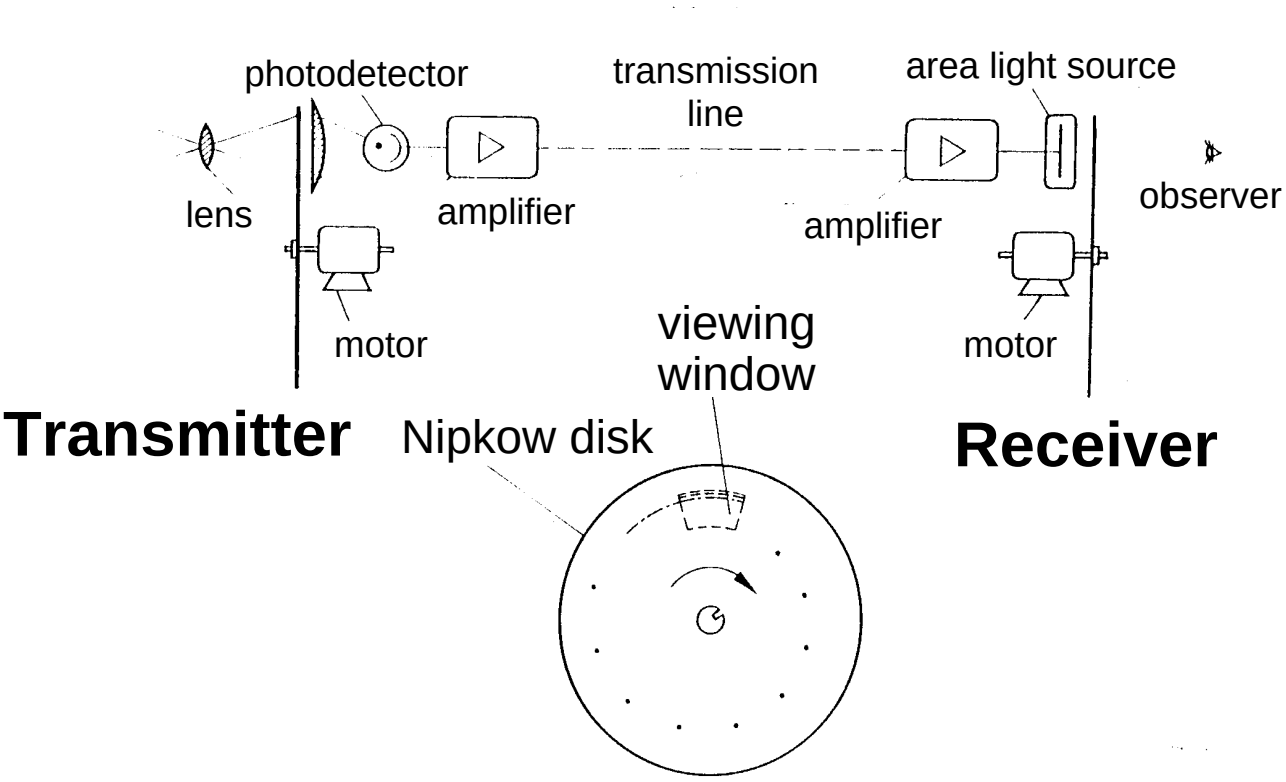




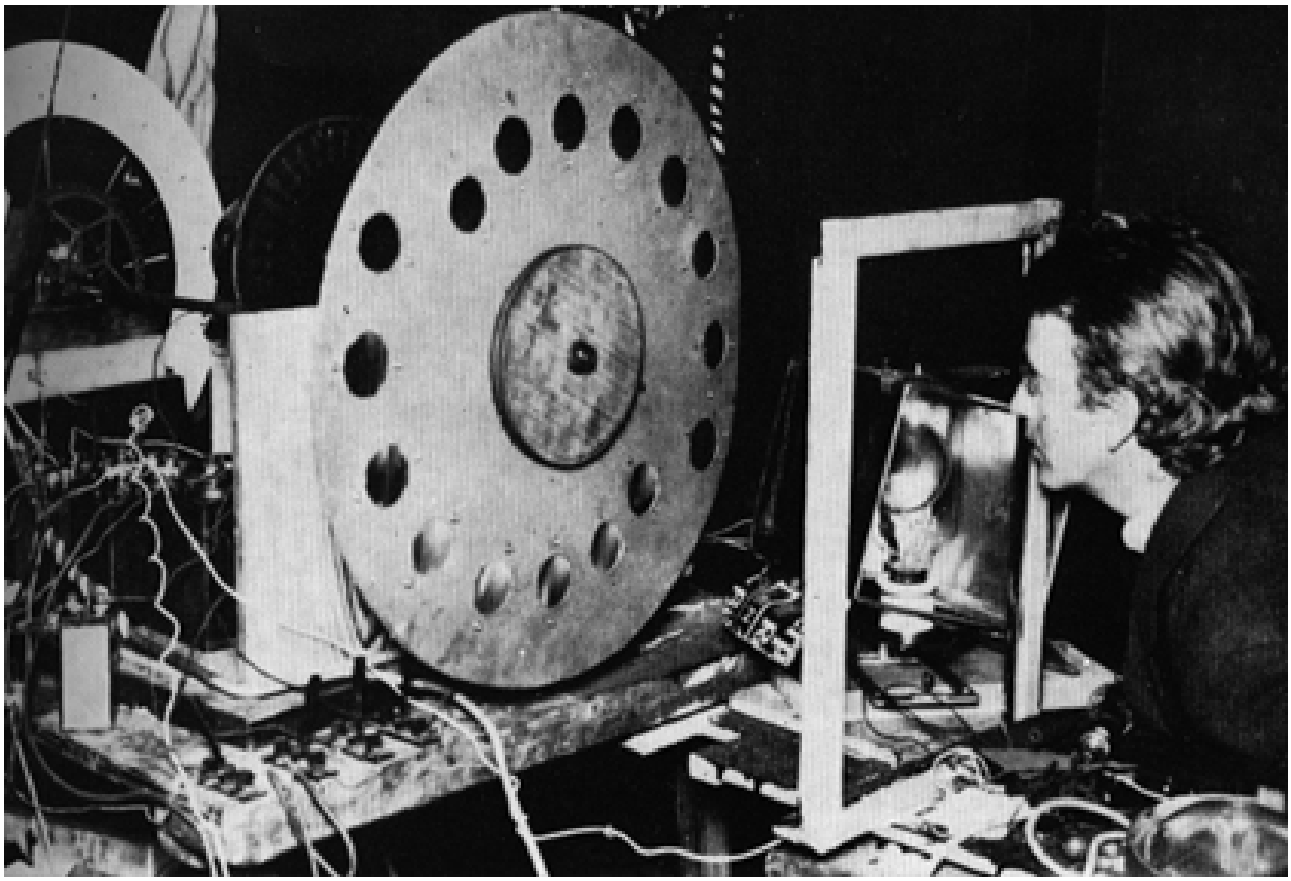
# Photograpy and Cinema

| | |
|---|---|
| 1840 | Louis J. M. Daguerre, France<br>William Henry Fox Talbot, USA<br>photographic film |
| 1895 | First public motion picture presentation<br>(Lumière brothers, France) |
| End 1920s | sound motion pictures: „talkies“ |
| 1930s | color movies |

# Nipkow Disk I



# Nipkow Disk II



*British TV pioneer J.L. Baird*
*with Nipkow disk (around 1926)*

# Cathode Ray Tube (Braun)

## 12. *Ueber ein Verfahren zur Demonstration und zum Studium des zeitlichen Verlaufes variabler Ströme; von Ferdinand Braun.*

1. Die im Folgenden beschriebene Methode benutzt die Ablenkbarkeit der Kathodenstrahlen durch magnetische Kräfte. Diese Strahlen wurden in Röhren erzeugt, von deren einer ich die Maasse angebe, da mir diese die im allgemeinen günstigsten zu sein scheinen (Fig. 1). *K* ist die Kathode aus Aluminiumblech, *A* Anode, *C* ein Aluminiumdiaphragma; Oeffnung des Loches = 2 mm. *D* ein mit phosphorescirender Farbe überzogener Glimmerschirm. Die Glaswand *E* muss möglichst gleichmässig und ohne Knoten, der phosphorescirende Schirm

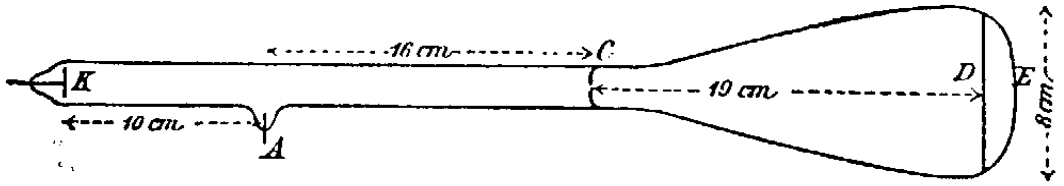
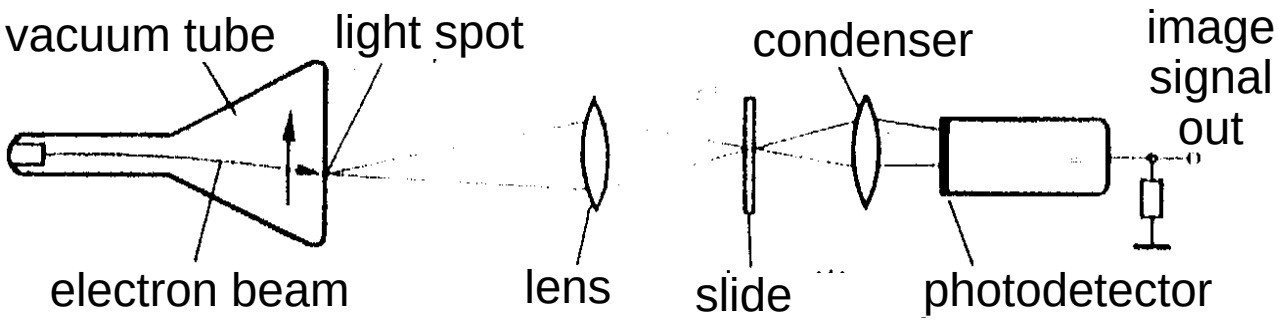
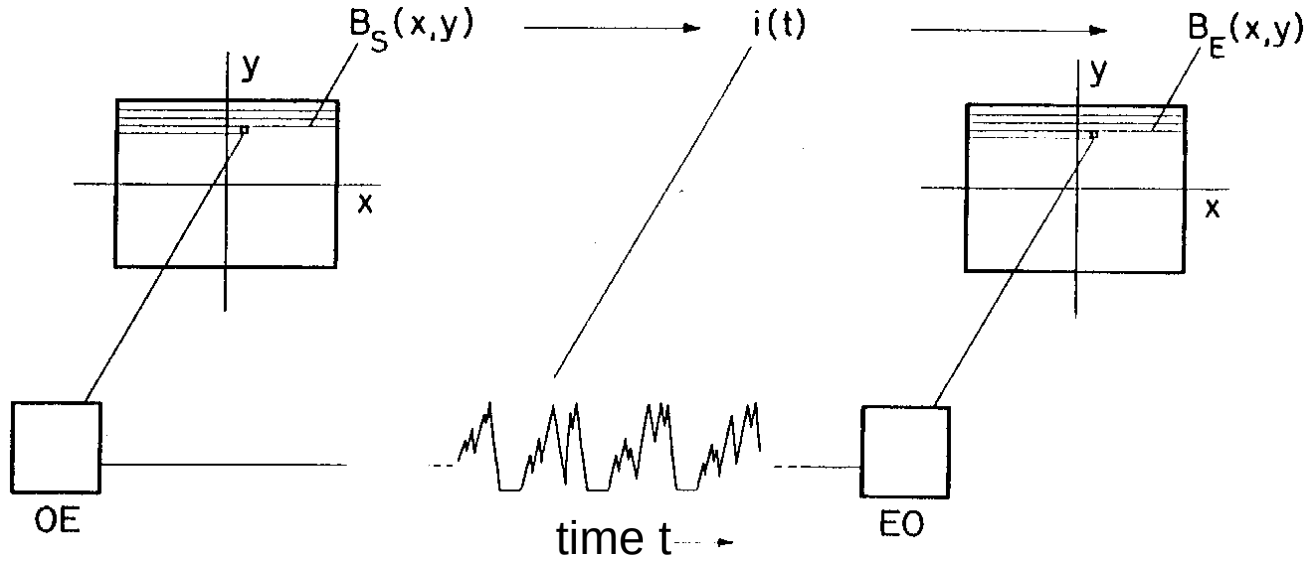



Fig. 1.

# Electronic Image Scanner („Flying Spot Scanner“)

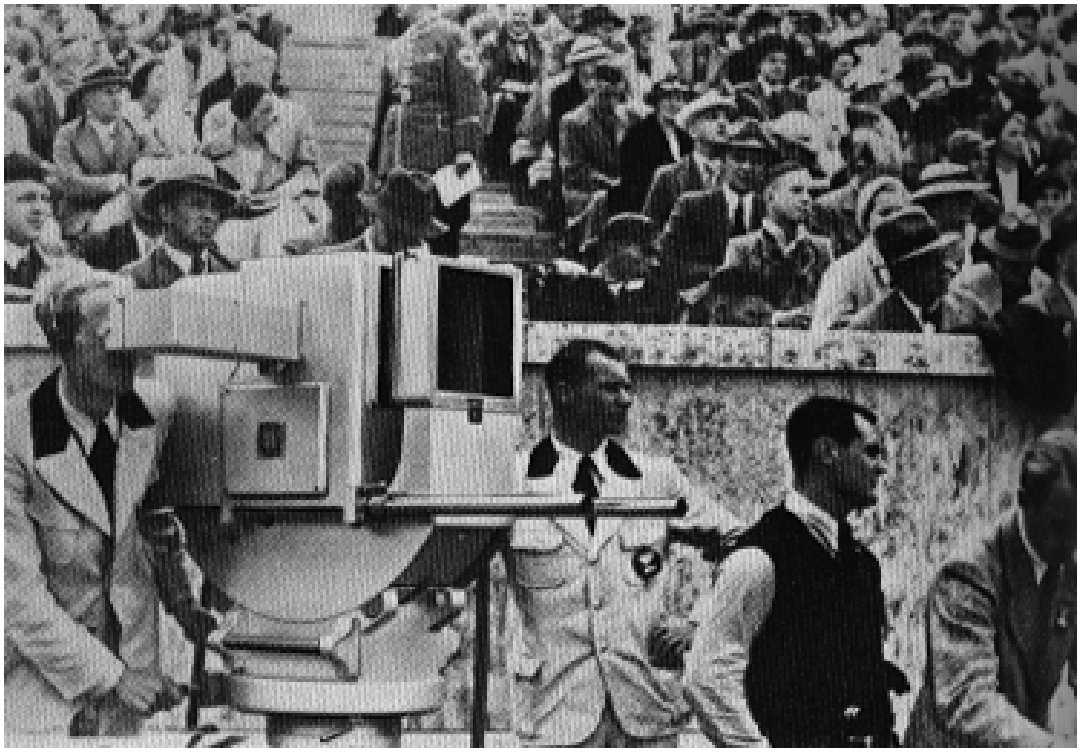


# Image Transmission by Line Scanning



# History of Electronic Image Communication I

| | |
|---|---|
| 1920s | First television experiments |
| 1930-32 | First experimental television broadcasting in New York City |
| 1935 | First German television broadcasting in Berlin |



*TV transmission during the Berlin summer olympics 1936 using an iconoscope camera*

# History of Electronic Image Communication II

1939 Regular monochrome TV service in the US

1952 Television service in Germany

1954 Introduction of NTSC color television in US

1967 Introduction of PAL color television in Germany

*Dr.-Ing. h.c. Walter Bruch,*
*inventor of the PAL system*

1970s Consumer video cassette recorder (VCR)

# Current Developments

- Digital TV studios
- Digital TV transmission
- Video conferencing, consumer videophone
- Integration of computers and video ("Multimedia")
- Content-based retrieval and interactivity

# What Drives Image Communication Technology?

- Accomodate more TV channels in limited bandwidth
- Provide better picture (and sound) quality
- Offer new services

# Key Questions of Image Communication Technology

- What are the requirements for cameras, displays and transmission systems ?
- How can the video signal be stored and transmitted most efficiently?
- What are the requirements on bandwidth and transmission bit-rate ?

# Image Communication I

Physics of Light

Human Visual Perception

Image capture / cameras

Displays

Linear multidimensional continuous systems

Scanning and sampling of images

Color television systems: PAL, NTSC

# Image Communication II

Redundancy reduction

Irrelevancy reduction and quantization

Predictive coding

Transform coding

Resolution pyramids and subband coding

Interframe coding

Motion estimation

Motion compensated coding

Image coding standard JPEG

Video coding standards H.261, H.263 and MPEG

# Organisation

**Lectures:** **Monday 17:15-18:45, Thursdays 10:15-11:45**

**Supplements:** **Tuesdays 10:15-11:45**

Image Communication I+II taught in **one** semester.

Oral exam for „Vertiefungsspezialfach“ or „Wahlfach“ in English or in German.

Copies of overhead transparencies can be downloaded at URL

http://www-nt.e-technik.uni-erlangen.de/


Lectures: Prof. Dr.-Ing. Bernd Girod
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# References for Image Communication I


W. J. Smith, "Modern Optical Engineering," McGrawHill, 1990.
*Great book for optics and photometry*

W. F. Schreiber, "Fundamentals of Electronic Imaging Systems," Springer-Verlag, 1986.
*Well-written slim book with many useful insights from years of practical experience.*

D. E. Pearson, "Transmission and Display of Pictorial Information," Pentech Press, London, 1975.
*Another recommended lean volume, which is well-written and very readable. Interesting coverage of image sampling.*

W. K. Pratt, "Digital Image Processing", John Wiley, 1978.
*A classic of digital image processing fundamentals and algorithms.*

A. N. Netravali, B., G. Haskell, "Digital Pictures", Plenum Press, 1988.
*Comprehensive book covering digital image communications, including TV systems basics, facsimile compression, motion video coding. First edition (1988) somewhat obsolete, look for more current 2nd edition.*

B. Wendland, H. Schröder, “Fernsehtechnik“, Hüthig, Band 1:1988, Band 2: 1991
*Fairly comprehensive German book. Includes both fundamentals and details of analog TV systems.*

H. Schönfelder, “Bildkommunikation“, Springer-Verlag 1983.
*German, some parts are obsolete today.*

W. Dillenburger, "Einführung in die Fernsehtechnik", Schiele und Schön GmbH, Berlin, 1964.
*Good old-fashioned German television technology book.*

R. Theile, "Fernsehtechnik", Band 1, Springer-Verlag 1973.
*Another good old-fashioned German television technology book.*