New ways for interactive product design

Matthias Rauterberg
Technical University Eindhoven
The Netherlands
The Digital Desk (1991)
Perception Space and Action Space

- **Perception Space**
  - The physical space where the user’s attention is.

- **Action Space**
  - The physical space where the user acts in.

- **Design Principle**:
  - Perception space and action space must coincide! \( \delta = 0 \)
  - “Interlacing the display and manipulation space” (Djajadiningrat, 1998, TU Delft)
Tic-Tac-Toe with four interaction styles (1996)
Empirical Results: game playing time per dialog technique

Cell Line Chart for "playing time"
Grouping Variable(s): Interface type
Error Bars: ± 1 Standard Deviation(s)

Sample size (number of games with a total of 96'739 moves):
CI=1128   MI=3645   TI=2881   TUI=1352
Empirical Results: winning chance per dialog technique

Cell Line Chart for "winning chance"
Grouping Variable(s): Interface type
Error Bars: ± 1 Standard Deviation(s)

- User win
- Remis
- Computer win

- CI
- MI
- TI
- TUI

- P < .020
- P < .001
- P < .007
- P < .802
- P < .008
- P < .001
- P < .001
The BUILD-IT system (1996)
M. Fjeld, M. Bichsel & M. Rauterberg

- design team with different domain knowledge
- unconstrained social interaction
- interlacing perception and action spaces
- intuitive interaction style

Winner of the Swiss Technology Award '98
Top-Five-List of Zurich Technopark Award '98
Top-Ten-List at CeBIT’98
Estimated Trend in Interface Design

Past: 1 2 3 4 5 6          Present: 1 2 3 4 5       Future: 1 2 3 4 5 6 7 8 9
The Chameleon Table can recognize the RFID-tagged device. Every object placed on top of the Chameleon Table would initiate its associated photos to be shown on the corresponding Digital Photo Browser.
Interaction Props with Active Form

unloaded state  Nitinol tubes  loaded state
Design Metaphors

Tool

Channel

Active Form

long time ago

2000

time

Past: 1 2 3 4 5
Present: 1 2 3 4 5
Future: 1 2 3 4 5 6 7 8 9
Design Forms

- Mechanical style
  - Dedicated form
    (e.g., typewriter, etc)
  - Active forms
    (e.g., smart memory alloys)
- Electronic style
  - Channel forms
    (e.g., PC, TV, Radio, etc)
  - Connected forms
    (e.g., ambient intelligence)
- Mechatronic style
  - Given forms
    (e.g., augmented reality)

Past: 1 2 3 4 5 6  
Present: 1 2 3 4 5  
Future: 1 2 3 4 5 6 7 8 9
Shortly after publication of *Dialogue Concerning the Two Chief Systems of the World - Ptolemaic and Copernican* in 1632 the Inquisition banned its sale and ordered **Galileo Galilei** to appear in Rome before them. The truth of the Copernican theory from 1514-1543 was not an issue therefore; it was taken as a fact at the trial that this theory was false. This was logical, of course, since the judgement of 1616 had declared it totally false.
Despite several mechanical difficulties, Richard Trevithick had proved publicly that rail transportation was viable. In South Wales on 21st February 1804 history records that the Penydarren locomotive hauled five wagons containing ten tons of iron and seventy passengers between the ironworks and the canal at a maximum speed of four mph (6 km/h). Despite the claims of some of his contemporaries, it cannot be disputed that Richard Trevithick should be recognized as the true Father of the Railways for introducing the technology that changed the world.

Richard Trevithick spent his lifetime at trying to get a government pension to fund his developments and experiments, while a more clever James Watt was successful in imposing his view that Richard Trevithick should not get support from the government, because his high steam pressure machines would endanger the life of citizens. At that time the British Academy of Sciences took the position to oppose the development of railways on the ground that people would not stand a greater speed than 25km/h and would die of suffocation and heart attack.
In 1932 the discoveries of Sigmund Freud about the unconscious in particular were revolutionary. His treatment of neuroses allowed inspection of a “hidden” part of the mind. Freud divided the mind into two parts: the preconscious (ideas and memories capable of becoming conscious), and the unconscious (desires, impulses, and wishes of a mostly sexual and sometimes destructive nature). All human thought is partly a conflict between the preconscious and unconscious, and partly a compromise to pursue pleasure whilst avoiding danger and dealing with the realities of life.
During 1936 to 1938

**Konrad Zuse**

developed and built the first binary digital computer in the world (Z1).
The first fully functional program-controlled electromechanical digital computer in the world (the Z3) was completed by Zuse in 1941. In fact it wasn’t until 1998 (three year’s after Konrad Zuse’s death) that Raul Rojas formulated the proof that the Z3 was a truly universal computer in the sense of a Turing machine.

In 1967 a final decision of rejection was made by the German patent court and Konrad Zuse lost his 26 year fight about the invention of the Z3 with all its new features. The main argument of the German patent court for this negative decision was a ‘lack of sufficient innovation’.
Most notably, the experiments of Benjamin Libet in 1979 reveal a substantial delay--the "mind time"--before any awareness affects how we view our mental activities. If all conscious awarenesses are preceded by unconscious processes, as Libet observes, we are forced to conclude that unconscious processes initiate our conscious experiences. Freely voluntary acts are found to be initiated unconsciously before an awareness of wanting to act--a discovery with profound ramifications for our understanding of free will.

What made these people so special?

They took the risk to attack Dogmas and Taboos!

*Dogma:*
1. a: something held as an established opinion; *especially:* a definite authoritative tenet,
2. b: a code of such tenets *<pedagogical dogma>,*
3. c: a point of view or tenet put forth as authoritative without adequate grounds;
4. 2: a doctrine or body of doctrines concerning faith or morals formally stated and
   authoritatively proclaimed by a church.

*Taboo:*
1. a prohibition against touching, saying, or doing something for fear of immediate harm
   from a supernatural force;
2. 2: a prohibition imposed by social custom or as a protective measure;
3. 3: belief in taboos.

[definitions taken from © 2004 Merriam-Webster online]
Power, Love and Death

Peter Brook's film adaptation of the "Mahabharata"

The Mahabharata is an ancient religious epic of India
(composed between about 300 BC and 300 AD).

Scene from "Mahabharata"
© Classica (KirchMedia) 2000
This is what we have

This is what we want to have
Common Features of Technological Revolutions

1. Existence of General Purpose Technologies
2. Developed in a ‘Knowledge Society’
3. Market expansion beyond previously known demands
4. Entrepreneurship & proper business models
5. Adequate supply of skills & inventiveness
6. Complementarities across technologies, networks and institutions
7. Growth of GDP & of wealth, with new social patterns
8. An environment that provides incentives for innovation
Designing new interactive products beyond established dogmas and taboos in our society is challenging and risky, but possible!

Thank you for your attention.