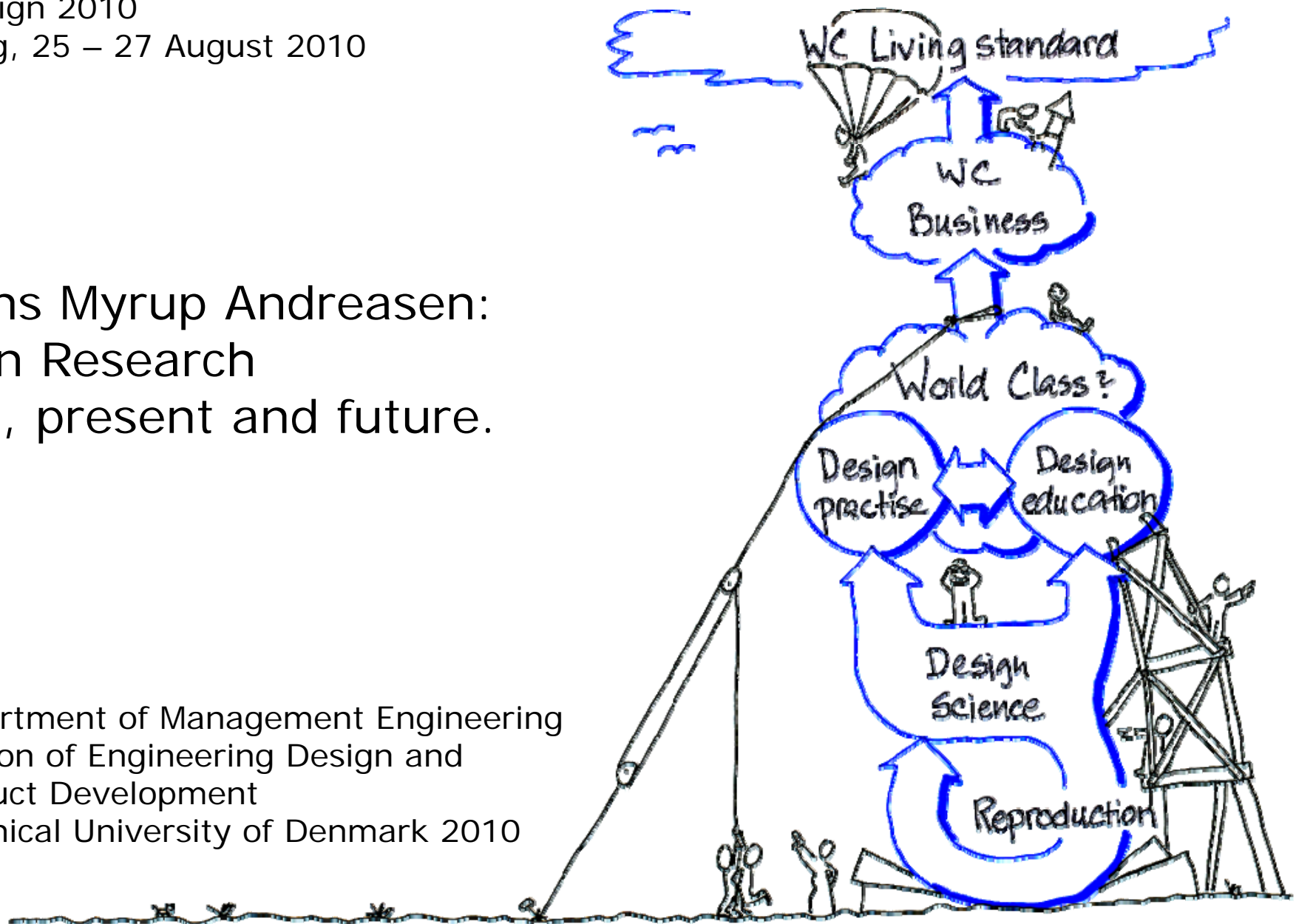


NordDesign 2010  
Göteborg, 25 – 27 August 2010

Mogens Myrup Andreassen:  
Design Research  
- past, present and future.



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Section of Engineering Design and  
Product Development  
Technical University of Denmark 2010



## My scope

- An explosive development observed over 45 years
- Design research now explicitly defined, learnable, with game rules
- ...but still in infancy and showing need for consolidation by means like:
  - Identify key books and publications.
  - Ensure research directed at industrial practice.
  - Create 'schools of designing'.
  - Establish a clear overall structure of design research.
  - Set a research agenda.
- Will consolidation solve everything?

# Époques of design research

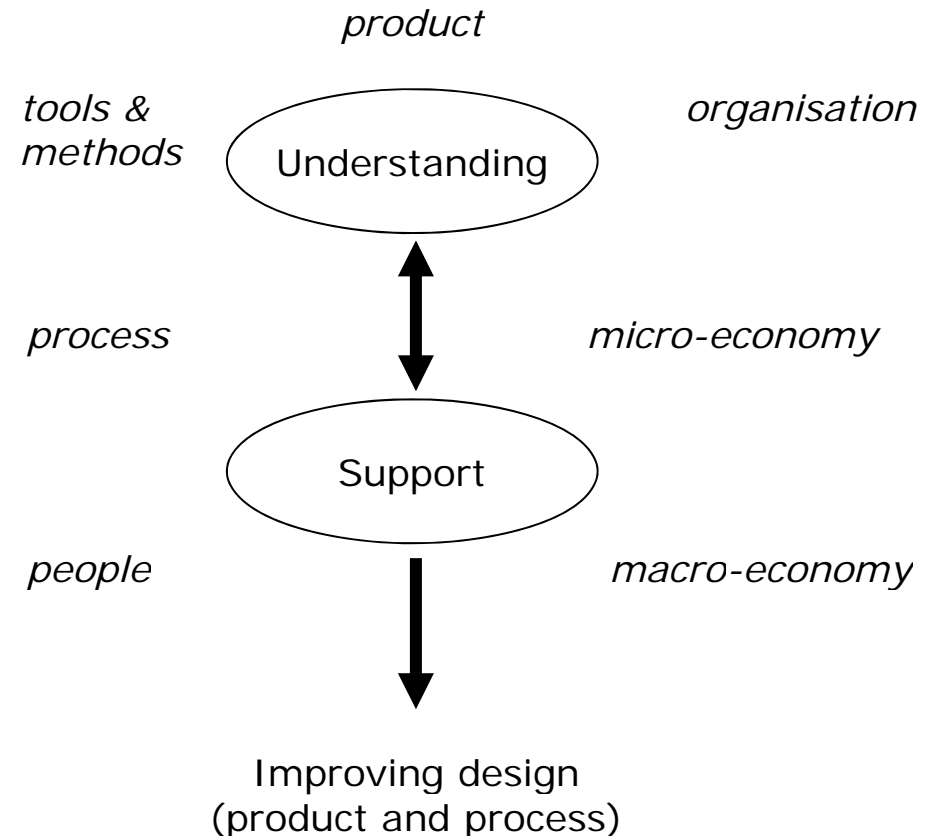
- Swann
  - 1. phase: **Intuitive, operational and applied** mode that grew more commercial (truthfulness, rightness).
  - 2. phase: **Rational methods**, founded in scientific objectivity and positivist formulas (truth claim)
  - 3. phase: **Post modernistic philosophy**, more pluralistic approach to design research and social schemes offer several alternative ways of investigating and validating research (claim to rightness)
  
- Wallace
  - **Experiential stage** (up to 1950s): Reflections on practice, guidelines.
  - **Intellectual stage** (1960-1980s): Understanding and modeling processes and products, leading to theories and prescriptive methods.
  - **Experimental stage** (1980s): Experimental set-up, influences of human elements, descriptive.
  
- **What époque do the researchers and reviewers belong to?**
- **What do they believe in?**

[Swann: Action Research and the Practice of Design. Design Issues, 18 (2), 2002]

[Wallace: Product Development and Design Research, ICED 1997, Tampere]

# Design research today

- Design research involves:
  - The formulation and validation of **models and theories** about the phenomenon of design, as well as
  - The development and validation of **knowledge, methods and tools**, founded on these models and theories.
- Important questions:
  - What do we mean by a successful product?
  - How is a successful product created?
  - How do we improve the chances of being successful?

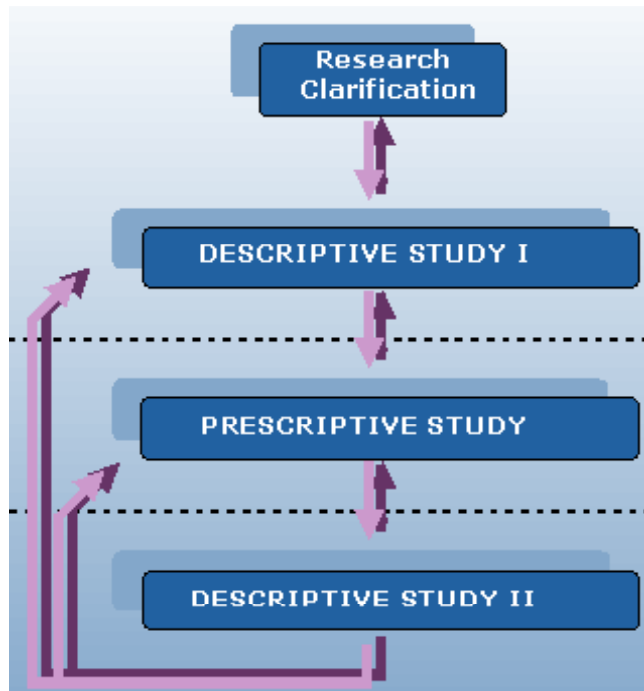


[Blessing: What is this thing called Design Research?, CIRP 2002, Hong Kong]

# Design research methodology and our contributions



- Blessing & Chakrabarti's design research methodology:



What is work practice?

67% of papers:  
no industrial motivation

The new model,  
theory, method

How is the work  
practice with the  
new method?

90% of papers:  
implementation  
issues ignored

[Blessing & Chakrabarti: DRM, a Design Research Methodology 2004]  
[Cantamessa: Design Research in Perspective, ICED 2001, Glasgow]



## We fight with unsharp research approaches

- Cantamessa:
  - It is no simple matter to define the contents, the research approach or the community behind research in engineering design.
  - Analysis of 718 ICED papers:
    - 111 describe empirical studies
      - 10%: no statement on research approach
      - 22%: unit of analysis not defined
      - 41%: no statement on sample size
      - 25%: implications of findings not stated.
    - 311 describe tools and methods
      - 47%: motivation absent
      - 63%: no statement on industrial settings
      - 68%: relation to commercially available tools not stated.

[Cantamessa: Design Research in Perspective, ICED 2001, Glasgow]

## Reasons for lack of consolidation

- Engineering design is **complex** and therefore many contributions are needed to cover the field
- Most contributions are based on **speculations**, **concepts** and **models** that create a pattern of support for explanation of and support for synthesis – there is an almost **endless number** of such proposals
- Design researchers do not feel the pressure to consolidate because:
  - there are **no barriers** for creating new speculations
  - there is **little tradition** for building on previous contributions
  - **reviewing practices** do not discourage the growth of speculations.
- Researchers **seldom apply** the results of research in practice and so:
  - do not **acquire direct insights** into best practice
  - do not **appreciate a designer's mindset**, range of tasks and tools
  - fail to **convince designers** of the value of their ideas.

## More detailed questions

### Why, What, How, Who, Where, When?

#### Why do we need to consolidate?

- Because designing is so important!
- Cope with expanding complexity and conflict
- Build on known results
- Avoid 'reinventing the wheel'
- Reduce wasted and superfluous efforts
- Set a research agenda
- Contribute to establishing research practice
- Create 'schools of designing'
- Support design researchers and students
- Identify 'best practice'
- Make results available to practitioners

#### What do we mean by consolidation?

- Clear overall structure
- Potential for mapping research areas and topics
- Model to guide funding
- Long-lasting set of topics and keywords
- Consistency
- Respect of other research communities
- Ensure research directed at industrial practice

#### How do we consolidate?

- Identify key books and publications
- Papers reflecting scope, range, contribution, etc
- Identify key contributors
- Identify theories, principles
- Set out current 'best practice'

#### Who should consolidate?

#### Where and when should we consolidate?

- The Design Society
- Here and now!

## Let me focus on some of these questions

- Identify **key books** and publications.
- Ensure research directed at **industrial practice**.
- Create '**schools of designing**'.
- Establish a clear overall **structure** of design research.
- Set a **research agenda**.

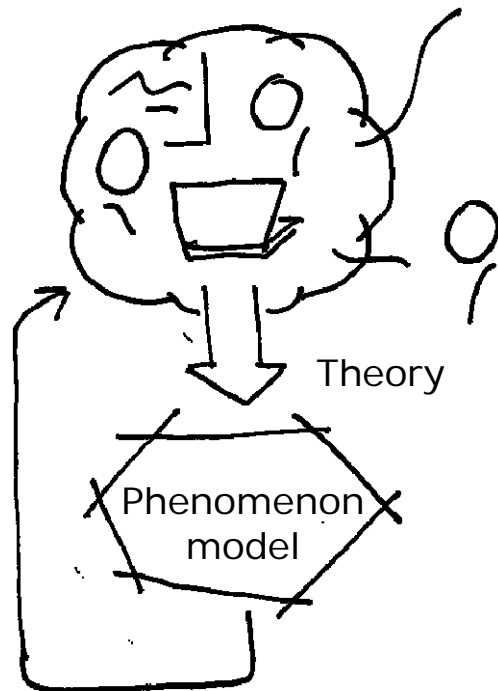
## Consolidation: Identify key books and publications

- **DS's experiment** with BM/AB, 20 individuals: "Mention important books": List of 90 books, but not more than 10 known by all.
- **Wild growth:**
  - many strands, loosely coupled
  - strands not clearly defined
  - 'referencing islands' common.
- **Horváth:** "It is not easy to see the trends of evolution, to identify landmarks of the development, to judge the scientific significance of the various approaches and to decide on the target fields for investments."
- We have no tradition for comparing, evaluating and scoring research.
- **NordDesign experiment:** Write one A4-page: "What impressed me?"
  - only by evaluating, sorting out and aggregating we come to consolidation.

[Horváth: Contemporary Survey of Scientific Research in Engineering, ICED 2001, Glasgow]

## Consolidation: Ensure research directed at industrial practice?

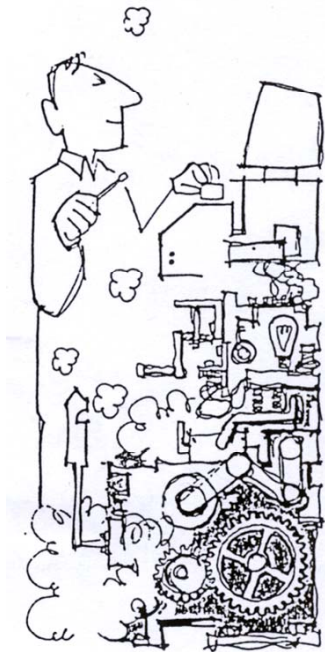
- Object of study: Work practice or design phenomena?



- The designer performs “**work practice**” and is a part of a “**community of practice**”.
  - The researcher study work practice:
    - Based upon **theories**
    - Based upon **hypotheses and research questions**.
  - The researcher creates insight into certain **design phenomena** hold in the practice.
  - The researcher create **contributions** to theory and design knowledge related to the phenomenon
  - - and **new insight** into practice!
- 
- Our complexity problem shows, that **we label contributions as practice** and do not share **a structure of basic phenomena**.

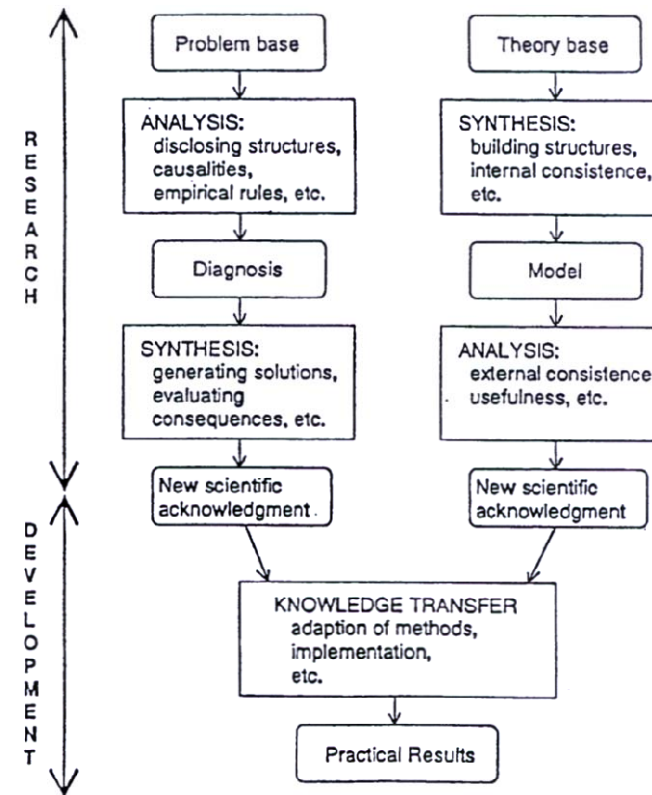
# The role of work practice

- Finger & Dixon:  
 “An ideal research institution should be based on a **solid basis** and **master research methods** and should **master ‘best practice’!**”

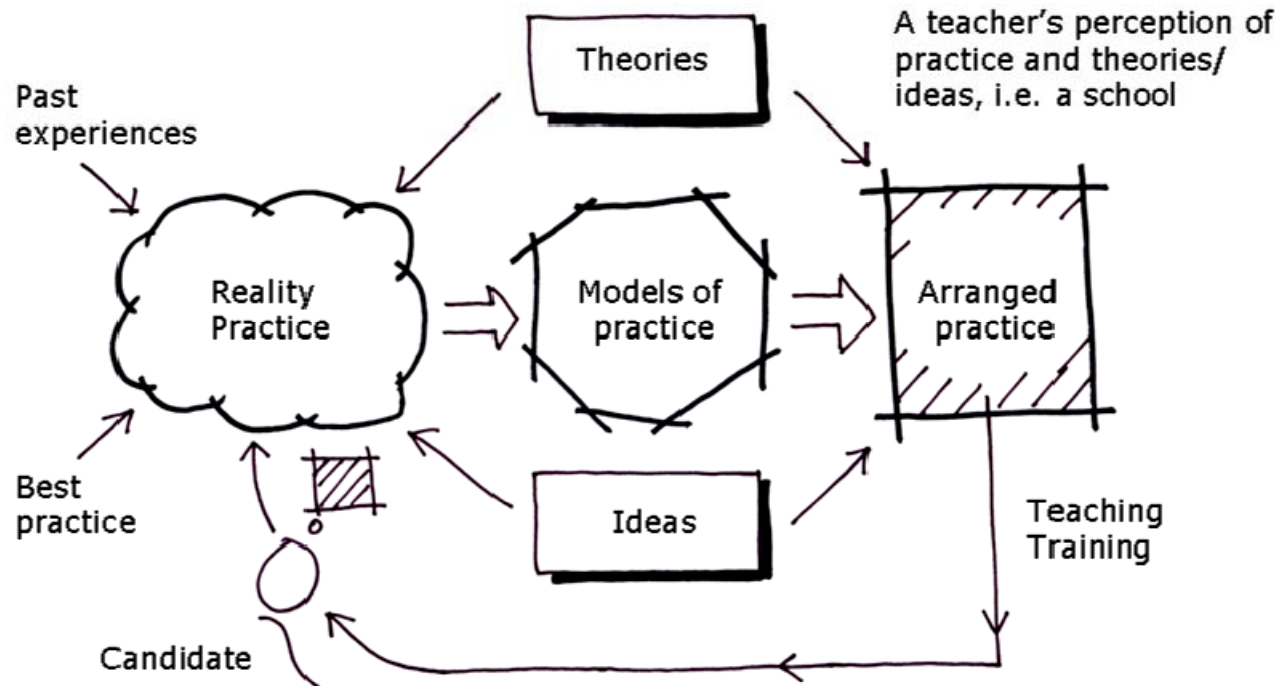


[Finger & Dixon: A review of research in mechanical engineering design, RED 1989]  
 [Jørgensen: Unpublished research model, 1992]

- Kaj Jørgensen’s model of relations between research of **practice** and **theory**:



# How is industrial practice created?



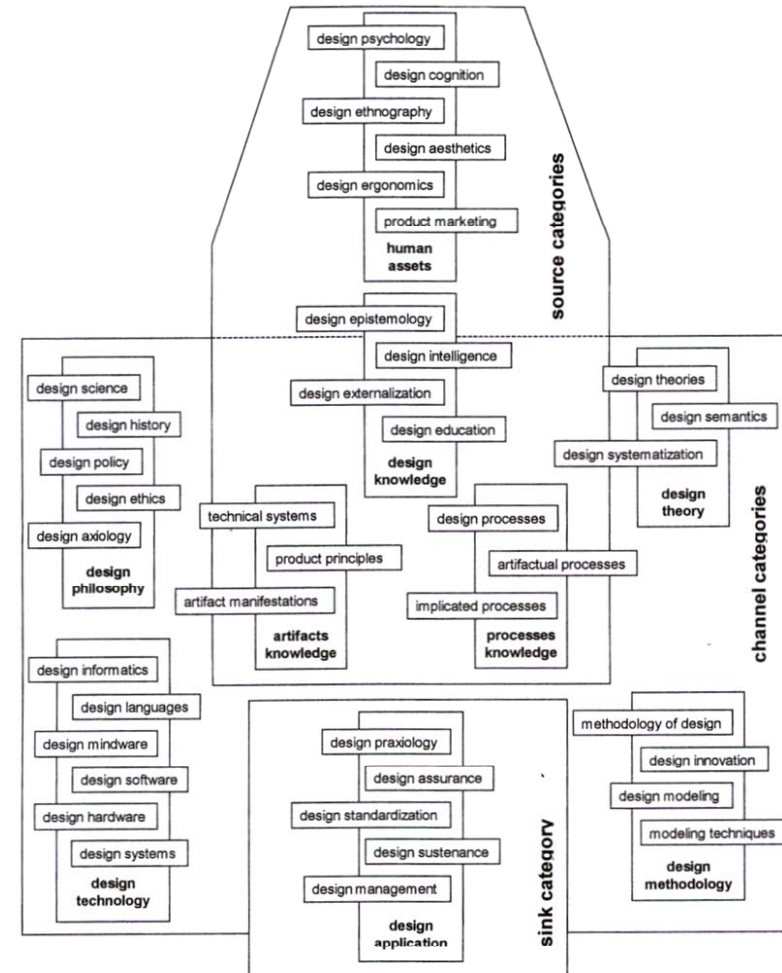
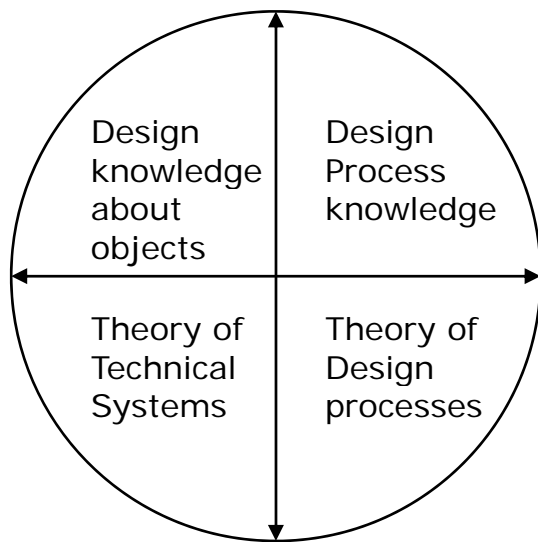
- How is industrial **practice** influenced?
  - Past experiences, industrial best practise, cross industrial influences
  - Industry's perception of theories and ideas, transferred by consultancies
  - Influence carried by staff member's training and education
- What does a candidate bring: A teacher's **"Arranged practice"**?
- Results: Commonality of practise judged by **trustworthiness and productivity**

## Consolidation: Create 'schools of designing'

- The problem is:
  - Design is still seen as a **non-scientific education topic** with a dubious research reputation.
  - Design education is left **little space** in science-dominated curricula.
- More powerful schools should be created:
  - With a **comprehensive set** of theories, models and research paradigms, able to support productive research.
  - A curriculum with focus on **designing in broad sense** for designers as planners, differentiators, executants and enablers.

# Consolidation: Clear overall structure

- **Hubka's model:**
  - Science seen as a knowledge structure.
- **Horváth's model:**
  - 9 contextual categories.
  - 39 topics, 127 sub topics.

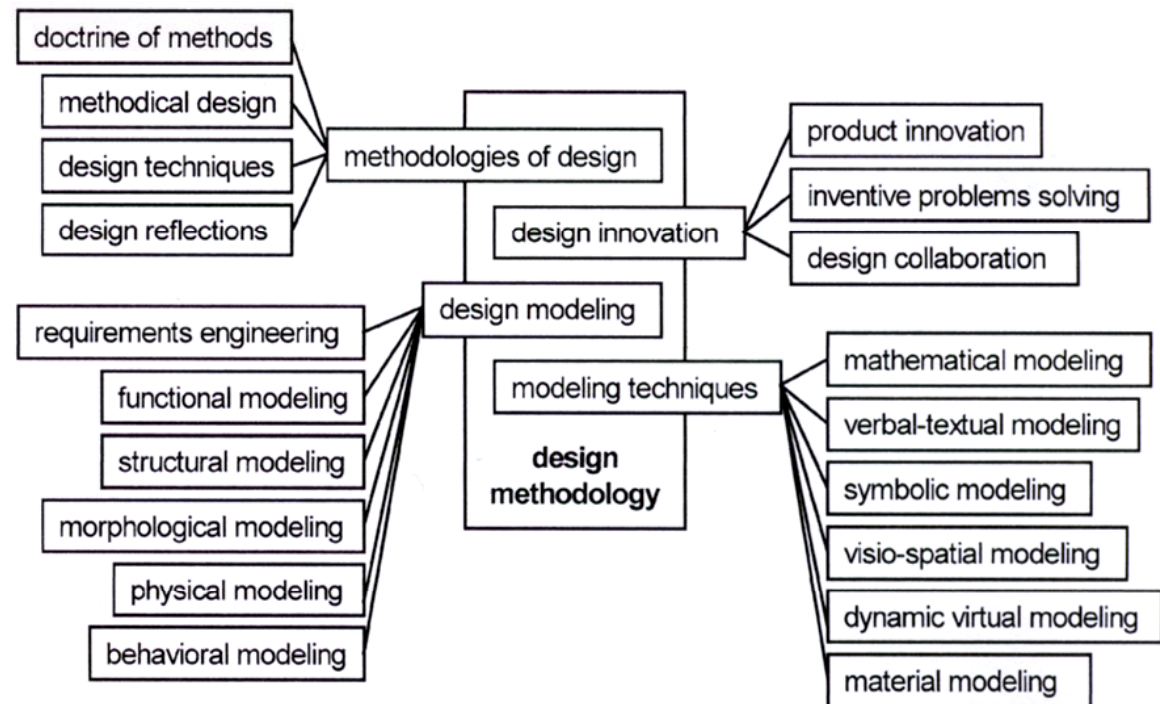


[Hubka & Eder: Design Science, 1996]

[Horváth: A treatise on order in engineering design research. RED, 15, 2004]

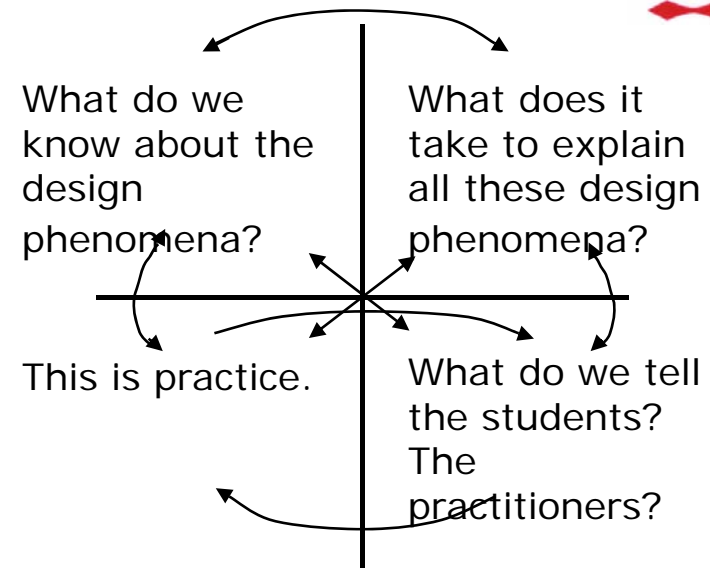
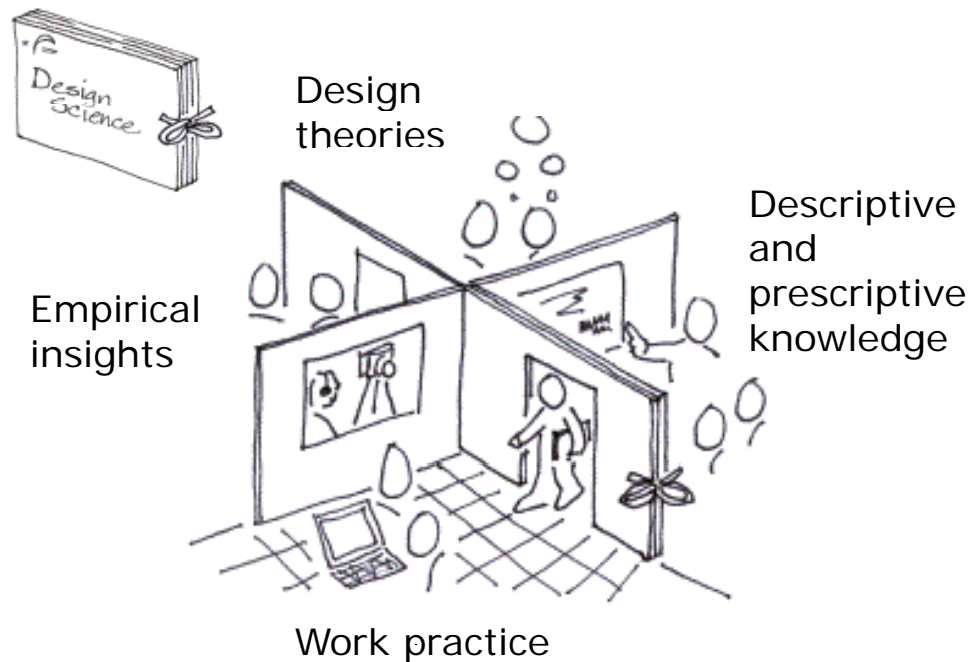
## Example of content in Horváth's classes

- **Related basic literature:**
  - Subrahmanian et al. 1993
  - Anderl 1997
  - Chakrabarti & Bligh 1994
  - Fujita 2000
  - Vergeest & Spanjaard 2002
  - Cartwright 1997
  - Breedveld et al. 1991 East  
et al. 1991
  - Cambell 2002.



[Horváth: A treatise on order in engineering design research. RED, 15, 2004]

# Is design science composed?



- Four domains compose design research:
  - **Work practise**, i.e. knowledge about industrial practise
  - **Empirical insights**, i.e. results of studies of designing
  - **Design theories**, i.e. the body of theories and basic understanding
  - **Descriptive and prescriptive knowledge**, i.e. what is composed into 'schools' for education and training

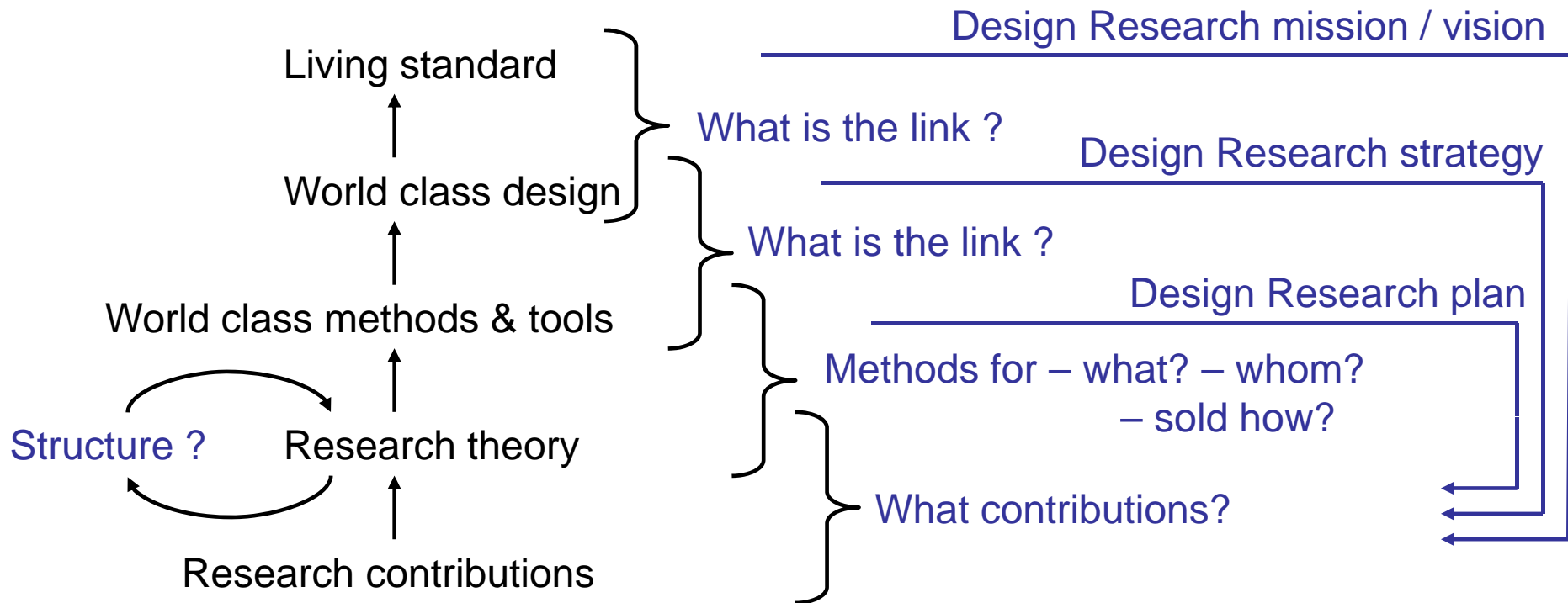
## Contributions in the four worlds



"World"	Types of contribution	Criteria	Examples
Industrial work practice	Need, problems, experiences and methods, originated from (participatory) work practice	Applicability, productivity	Reinertsen, Ward, Boothroyd
Empirical insights	Work practice obtained by empirical studies	Validity	Frankenberger, Ahmed
Design theories	Philosophies, theories, model based theories, conceptual frameworks	Productivity, a system, falsifiable	Hubka, Dorst, Buchiarelli
Teaching, Prescriptive knowledge	Schools, textbooks, with pragmatic structured insights for pedagogic and/or practical purposes	Learnability, applicability, in accordance with best practice	Pahl & Beitz, French, Andreasen & Hein

# Consolidation: Set a research agenda

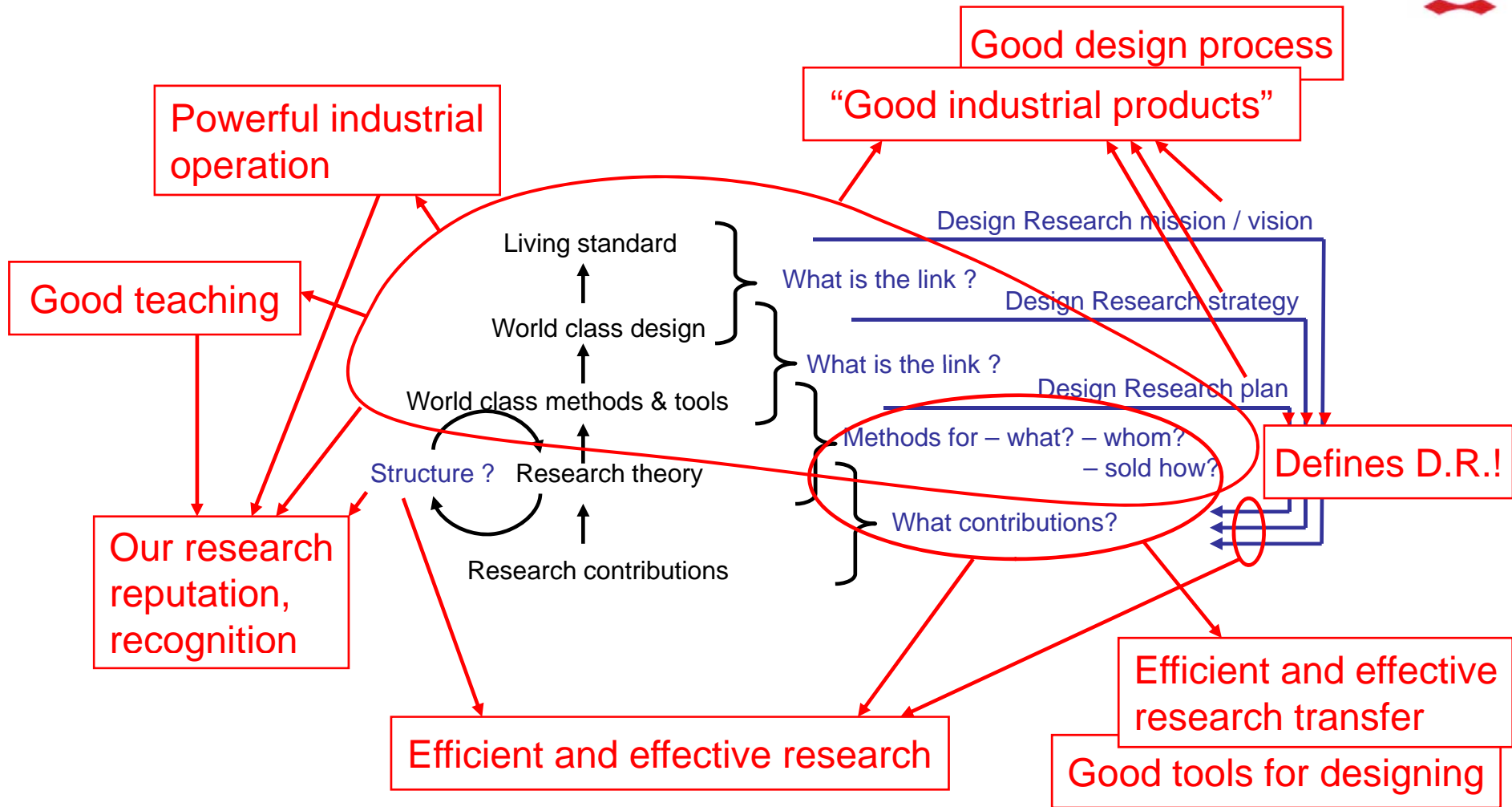
- Consolidation of **what?**



[Araujo inspiration]

[Andreasen & Ahmed: Thoughts on Design Research Consolidation. DS Rigi, Heraclion, 2006]

# Why consolidation?



[Andreasen & Ahmed: Thoughts on Design Research Consolidation. DS Rigi, Heraclion, 2006]

## Consolidation is not all: Product orientation?

- Design research seems focused upon **efficiency and tool making**.
- A parallel:
  - **Design Science of Information Systems Research** consist of two sciences: behavioral science and design science: Seeks to extend the boundaries of human and organizational capabilities by creating new and innovative artifacts.
- Several ICED's have tried to put "**innovative products**" on the program, - and receive no papers.
- "**In principle** someone should ask – each time a new research [technology] result is reached – how can this be utilized? Is there a commercial possibility?" [A venture manager]
- **In principle? This is our task in design community!**

[Hevner et al.: Design Science in Information System research. MIS Quarterly 2004]

## Consolidation is not all: Believes? Philosophy?

- Our credo: By better understanding of design we can create better support, leading to improved designing.
- **Brooks** has other viewpoints:
  - “I believe a ‘science of design’ to be an impossible and indeed misleading goal. This liberating skepticism gives license to speak from intuition and experience...”
  - “The desire for rigor and for a science of design perhaps discourages? publications of anything other than scientific studies”
  - “A formal design process is needed ‘but’ a product process  *fights the last war*”

[Brooks: Design of design, Addison Wesley, 2010]

## Consolidation is not all: Believes? Philosophy?

- Other viewpoints:
  - **Verganti** defines Design Driven Innovation: When *R&D* based upon *personal culture* is used for creating *meanings*.
    - “In presenting design as a codified, predictable and mandatory process...designers risk losing their ability to do such forward looking research”
    - Vagantis’ viewpoints: **Out** with creativity, user centered design and teamwork, **In** with interpreters!
- Other viewpoints:
  - **Reich**: “I do it may way”

[Verganti: Design Driven Innovation, Harvard Business Press, 2009]

[Reich: Design Religions, DESIGN 2010, Dubrovnik, Croatia]

## A balance

- We shall not mistake consolidation for ripening: **We are still in infancy!**
- We need plural approaches (*experience + systematic + speculations + empirical studies*) and plural research paradigms.
- **Research results** are found in:
  - textbooks for teaching
  - commercial tools for designing
  - changed practice in companies.Dynamics and visibility are very different in these areas!
- We (responsible in DS, supervisors, senior researchers, research program responsible) need badly to **rethink** the ups and downs of our research world.

## A piece of advice

- Design research should be “**Radical, Relevant, Rigorous**” – but research formalities do not create this.
- Designing is characterized by **curiosity, excitement, play, imagination, interpretations**. Making design research should have the same qualities.
- In design the problem is the problem. In design research the good **questions are the challenge!**

Thank you for listening carefully!

