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Towards a European Engineering Doctorate

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Agenda

1. Role of 3e Cycle Engineering Programmes
   - Differences between PhD and industrially-driven, third cycle engineering programmes
2. The Dutch Programmes
   - History
   - Value propositions
   - Programmes Today
   - Quality Control
3. European Quality Standard

1. Role of 3e Cycle Engineering Programmes

- 1e and 2e cycle of Bologna focus on learning
- 3e focus on contribution to the 'body of knowledge'
- PhD: the contribution is the *scientific result*
- Industrially-driven, third cycle engineering programmes (IDTCEP): contribution is an *innovative artefact*
- Artefact is a product, process or system. Either tangible or intangible
- Artefact is the 'solution' to a 'problem'
- The artefact should be designed using scientifical methods

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Differences between PhD and IDTCEP

	Research	Design
Questions	*Why?*	*What ?*
Starts from	*Empirical Data*	*Requirements*
Leads to	*Theory*	*Artifact*
Thinks in	*Invariants*	*Variants/Choices*
Approach	*Abstraction*	*Concretization*
Aim	*Knowledge*	*Value*

2. History of Dutch Programmes

- Started in 1986, because BSc+MSc became 4 years
- In 1997 again BSc=3 and MSc=2
- Students obtain a Professional Doctorate in Engineering Degree (PDEng). Title used since 2004.
- Up to now: 3000 graduates delivered!

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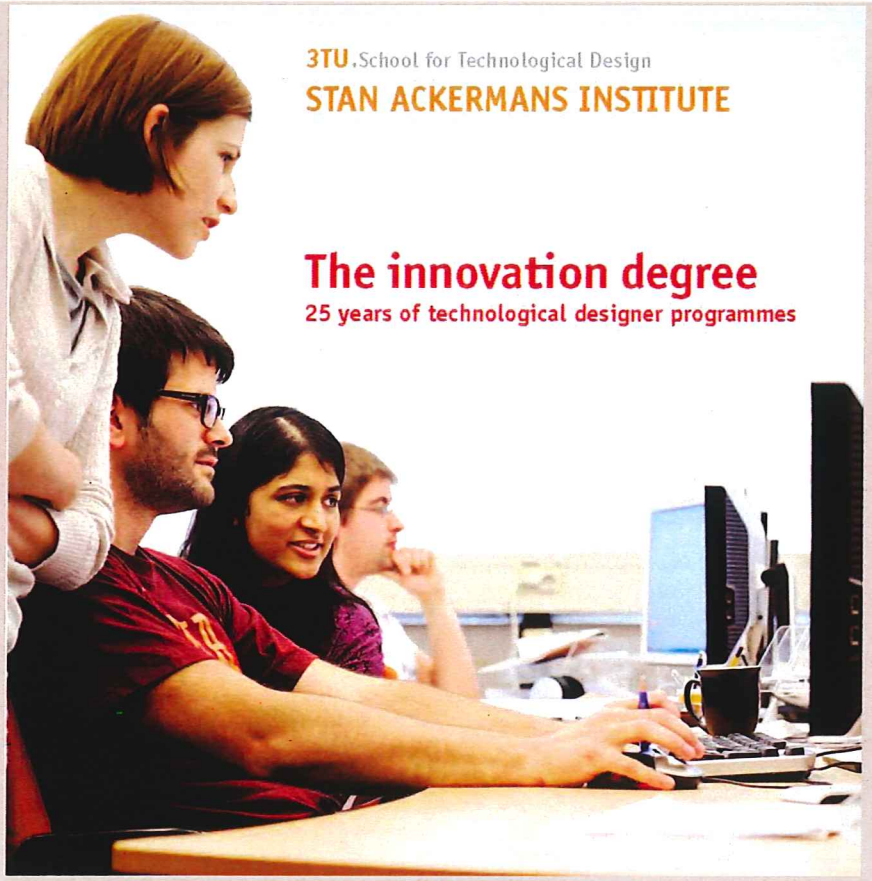

http://www.3tu.nl/en/education/sai/the_innovation_degree/

The PDEng formula

- Strongly selected master students
- PDEng students are called trainees
- PDEng trainees receive a scholarship
- Two year program:
  - year 1: training in engineering methods and skills
  - year 2: design project in industry supervised by University staff
- Companies are paying for the innovation project (€ 5.000 per month)
- We train top-level engineers to perform an excellent *innovation project* using state-of-the-art knowledge of the university

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Value Proposition for Companies

- If you need a new *product, process or system*, let it be designed by a EngD-trainee under supervision of a professor!
- Top-design trainees are selected from the best graduates with a masters in engineering.
- Design projects are selected carefully: they must really *make a difference* to the company and they should be sufficiently *innovative* for the University.

Value Proposition for Students

- Become a top-designer by '*learning and earning*'
- After graduation trainees get many job offers and have better carreer opportunities
- PhD is for an academic career and PDEng for an industrial career (CTO is the aim)

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Value Proposition for Universities

- The perfect way for industrial *innovation*
- Knowledge *transfer* "on the job"
- *Inspiration* from actual industrial problems
- Source of income!

Dutch PDEng programmes

- **Eindhoven**
  - Architectural Design Management Systems
  - Automotive Systems Design
  - Design and Technology of Instrumentation
  - Information and Communication Technology
  - Logistics Management Systems
  - Mathematics for Industry
  - Process and Product Design
  - Software Technology
  - User System Interaction
  - Smart Energy Buildings and Cities
  - *In preparation:* ICT for Health
- **Delft**
  - BioProcess Engineering
  - BioProduct Design
  - Comprehensive Design in Civil Engineering
  - Process and Equipment Design
- **Twente**
  - Civil Engineering
  - Energy and Process Technology
  - Robotics

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Curriculum year 1

- Personal skills
- Entrepreneurship (also 'intrapreneurship')
- Generic design methods, including testing
- Advanced domain specific design techniques

Quality control

- Quality of the design *result*
  More difficult than evaluation of research!!
- Quality of the design *process*

- For both *criteria* grouped per aspect were defined
- For each criterion one or more *indicators* with an *ordinal* scale were defined
- No straight jacket, but a help for evaluation committees

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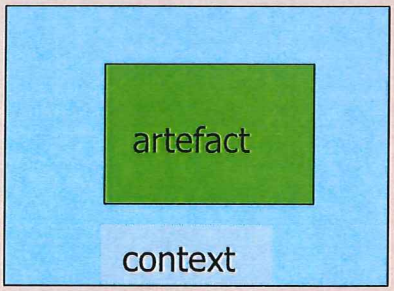
Aspects for Assessing Technological Design

Aspect

1. Functionality
2. Impact
3. Realizability
4. Inventivity
5. Complexity
6. Elegance
7. Genericity
8. Methodology
9. Presentation

greenfield



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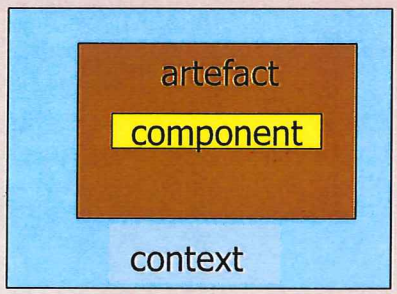

Aspects for assessing Design Process

1. Project planning
2. Time management
3. Meeting project goals
4. Problem formulation
5. Understanding of the context
6. Finding and incorporation of expert knowledge
7. Communication with stakeholders
8. Organizing meetings
9. Working in teams
10. Presentations
11. Creative thinking
12. Showing a critical attitude

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Criteria for assessing Design evaluated recently:

- Criteria system was too complex!
- Simplification:
  - Functionality (satisfaction, ease of use, reusablity)
  - Construction (structure, inventivity, convincingness)
  - Realizability (technical, economical)
  - Impact (social, risks)
  - Presentation (correctness, completeness)

3. European Quality Standard

- Set of common criteria
- Different programmes; avoid 'one-size-fits-all'
- Academic criteria:
  - Problem description
  - State-of-the-art
  - Evidence of scientific engagement (publications)
  - Detailed description of the outcome
  - Theoretical or empirical verification
- Industrial criteria:
  - Description of industrial context
  - Analysis of impact of the projected outcome
  - Description of embedding in context
  - Evidence that outcome is innovative
  - Demonstration that outcome is fit for purpose

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Accreditation

- We need a European label → European Engineering Doctorate (EEngD)!
- There should be a well-established organization that provides the label
- There should be an accreditation process; may be only a meta process to check the national processes

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EEngD's: THE Innovation Degrees