


Novel annuloplasty ring solution for improved surgical quality and safety during minimally invasive mitral valve surgery



- ergonomic approaches for **safer** and **more efficient** minimally invasive cardiac surgery

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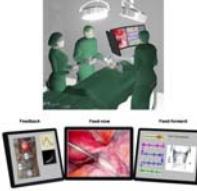
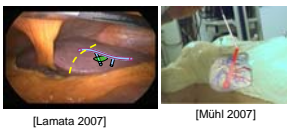
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ARIS ERNET
augmented reality in surgery

Thomas Stüdeli Ergonomist, Human Factors / Safety Engineering
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Medisign group – Research and Product development in healthcare, e.g. "Surgical cockpit"
www.io.tudelft.nl/medisign

Human Information Communication Design
- Intelligent products, ambient intelligence, perception, information processing and information design
"Augmented Reality in Surgery" (FP6, 2004-2008), AR/VR-Systems for surgery and intervention radiology
www.ariser.info

[Lamata 2007] [Mühl 2007]

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Minimally invasive cardiac surgery




Keywords: Team work, Complex operation, Cardio pulmonary bypass, Time-critical, Patients safety

Human factors: **Safety, Efficiency, Quality**

Annuloplasty ring solution



Catheter positioning system

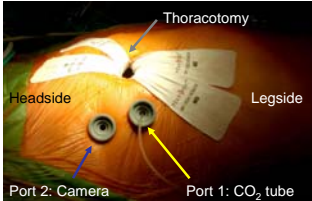


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Minimally invasive cardiac Surgery



Thoracotomy
Headside
Legside
Port 2: Camera
Port 1: CO₂ tube

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Interdisciplinary Design Methodology

Human factors

- Design
- Ergonomics
- ...

Technology

- Sensor technology
- Robotics control
- ...

Interdisciplinary medical team

- Medical expertise
- Medical needs -> innovative ideas

User-Centered Design
Common language
Focus groups
Co-Design
...

[adapted from Stüdeli, Freudenthal, Samset 2007 UITO]

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Moderated Workshops with Engineers and MD



Operation time

- Surgical team
- Technology
- Safety / Information / Workload

[Stüdeli, Freudenthal, de Ridder 2007 WWCS]

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Operation time

Surgical team

Technology

Safety / Information / Workload

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Mitral valve repair / replacement...

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Design work: Concepts, Simulation, Usability testing, Co-Design

Medisign graduation project at IDE-TUD

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Design by Felipe Moraes as Medisign graduation project at IDE-TUD

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Annuloplasty ring solution

- Pre-tied and pre-arranged knots - decreased suturing time and time on CPB
- C-shaped ring supports proper placement of the sutures
- Fine motor tasks drastically reduced outside the patients body without spatial limitations and restrictions

Design by Felipe Moraes as Medisign graduation project at IDE-TUD

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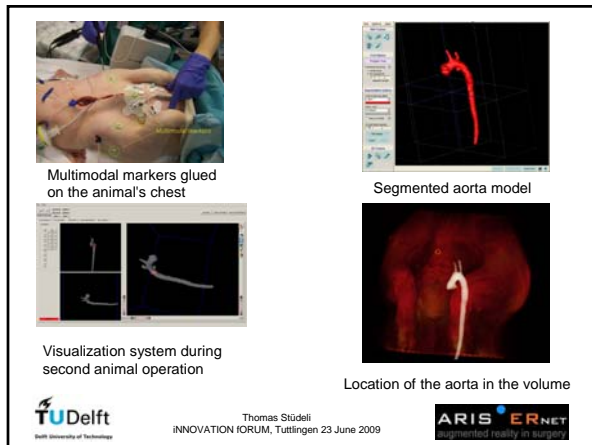
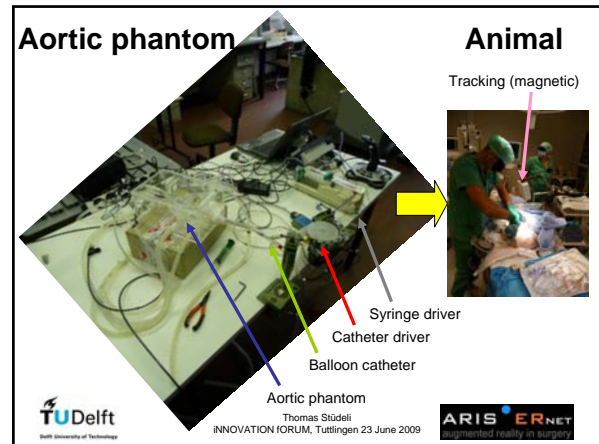
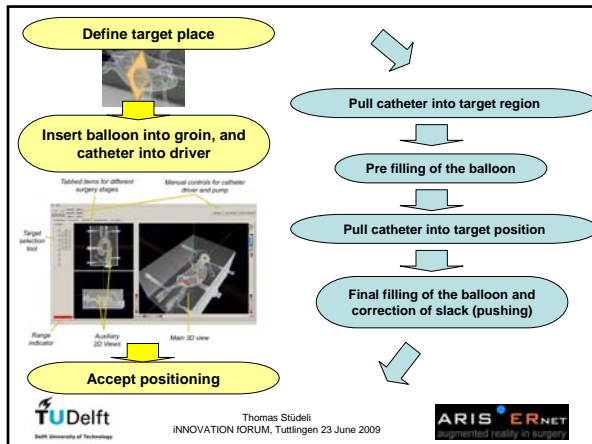
Catheter placements ...

... and monitoring of their positions...

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Catheter positioning system

- Visualization supports **safe and accurate placement** of the catheter
- Intelligent control secures an automatic **monitoring** of the catheter and **keeping it in place**
- No more **interruptions** of the surgeons during work at the valve due to **displacements of catheters**

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Outlook & Looking for ...

- Founding of start-up company in process
- Investigations on new application for solutions (pre-knotted knots and intra-operative visualizations of sensor data)
- **R&D collaboration with medical device industry that aim to improve safety and efficiency of their products**

Annuloplasty ring solution

- Functional prototype, successful proof of concept
- Proved compatibility in surgical workflow
- **R&D testing on tissue and manufacturing**
- **Partners for R&D and commercialization**

Catheter positioning system

- Successful proof of concept and first animal tests
- Patent of key technology is filed
- **R&D for the actuator part partners for acquiring public funding**
- **Licensing monitoring and visualization part for add-on to existing medical device (catheters, implants, surgical tools).**

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Thank you for your attention!

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