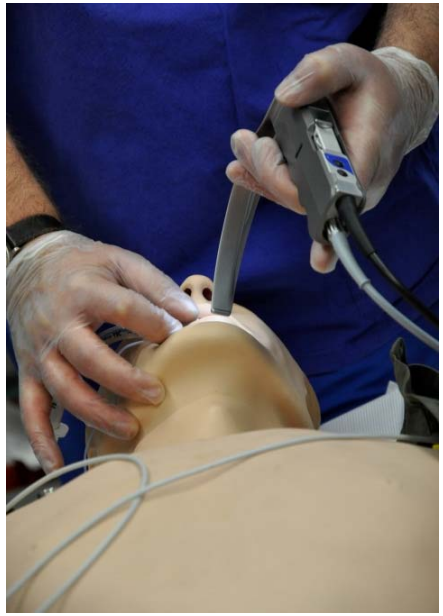
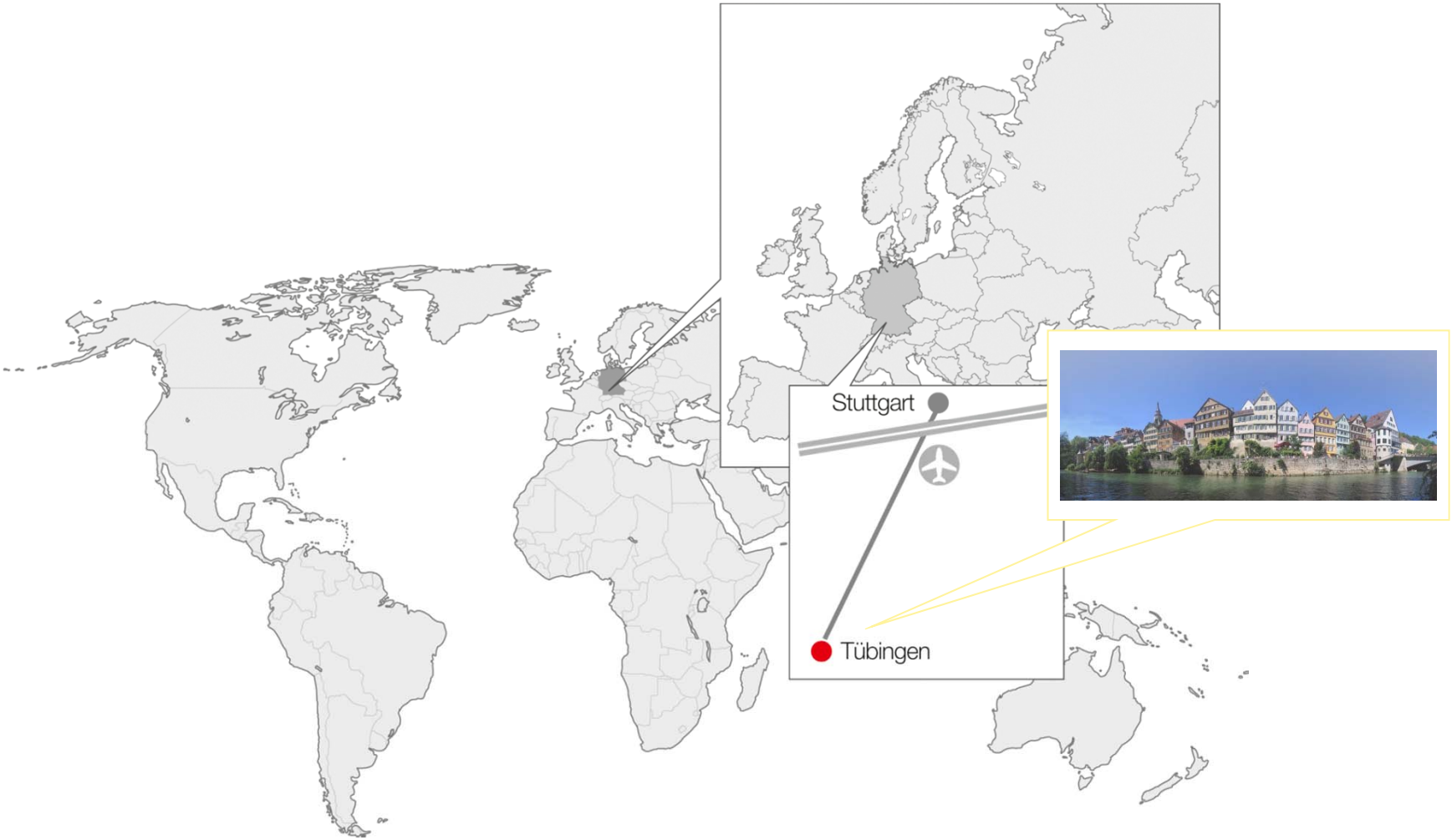
Eric Stricker , M.Sc.
Tüpass, Center for Patientsafety & Simulation

# Technology of modern simulation centers



# World – Europe – Germany – Tübingen



# Tübingen

# Tüpass

Center for Patientsafety & Simulation

Department of Anesthesiology and Intensive Care Medicine

University Hospital Tübingen

UNIVERSITÄTS KLINIKUM TÜBINGEN

tüpass
Patientensicherheit und Simulation

# Simulation in Healthcare

10 years ago I started with the question:

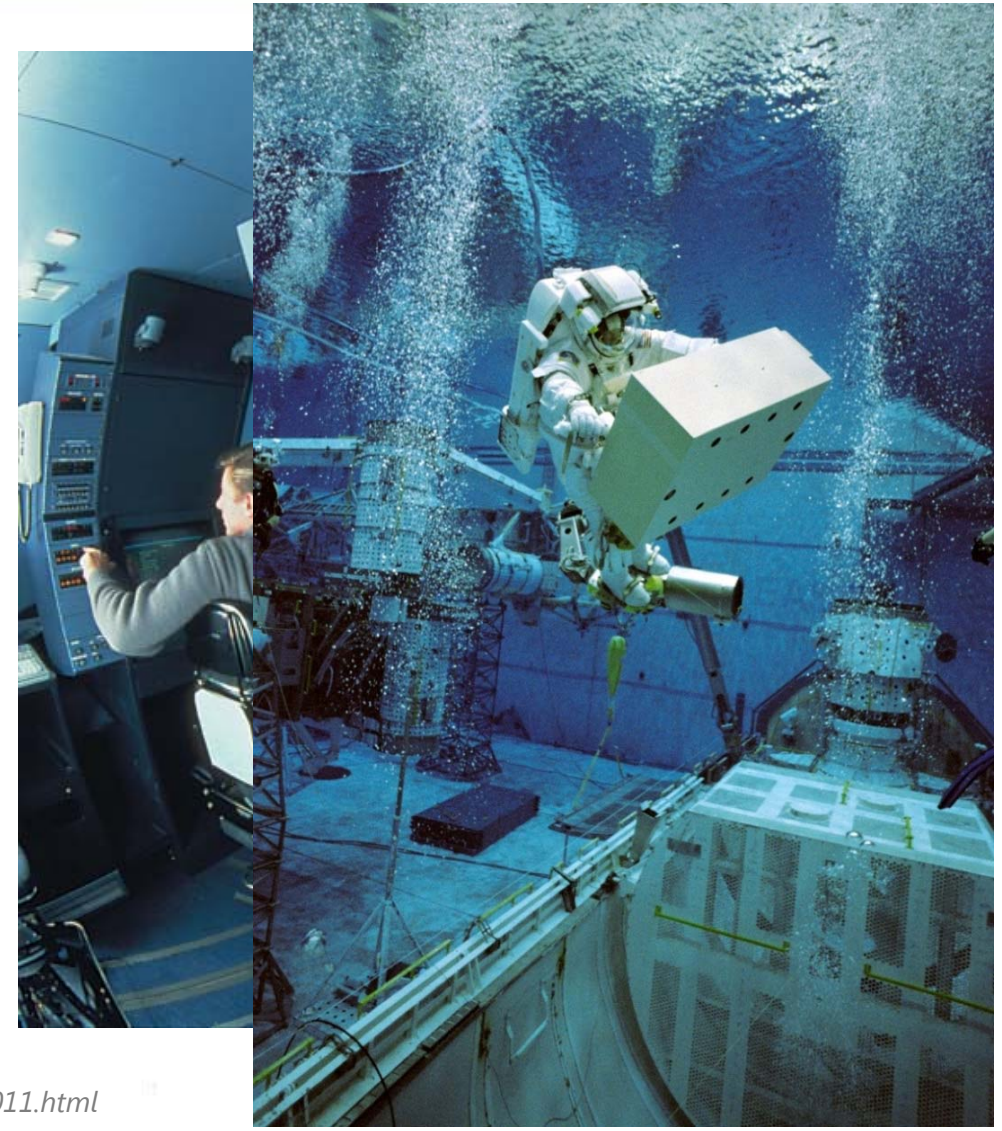
- How can simulation be improved?
  - better models?
  - better manikins with better features?
  - better environment?

# Definition

Simulation refers to the artificial replication of sufficient elements of a real-world domain to achieve a stated goal and it can help users understand and model real life systems.

# Human-In-The-Loop Simulation

- Flight Simulators
- Space Flight
- Power-Plant
- Airtraffic Control
- Oil-Platform
- Other HROs
- **Medicine**



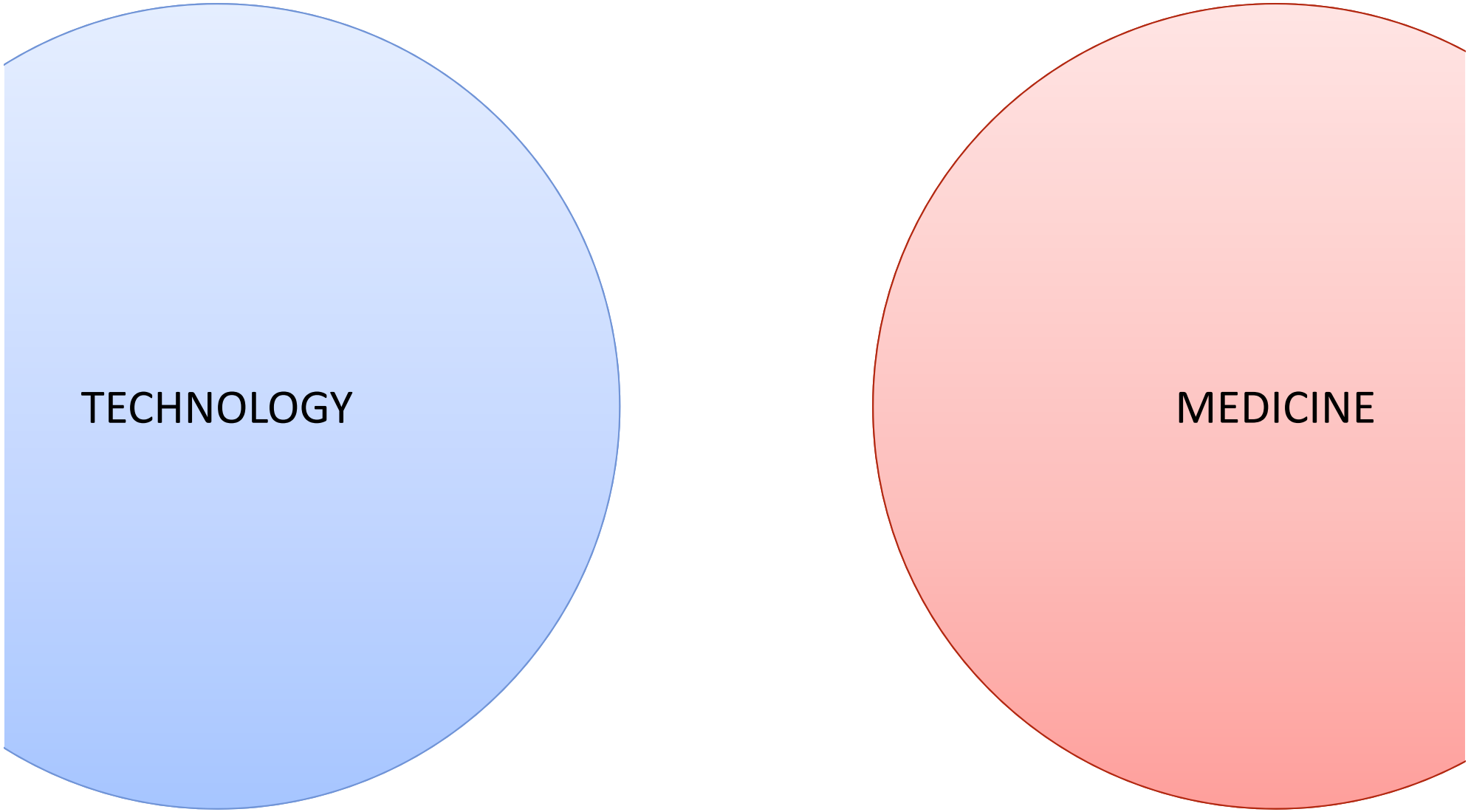
*http://en.wikipedia.org/wiki/Simulation*

*http://spaceflight.nasa.gov/gallery/images/shuttle/sts-116/html/jsc2003-00011.html*

# Different views

- Engineers view
- (medical) Educators view
- Psychologists view

1st: should be clear about your goals


TECHNOLOGY
MEDICINE

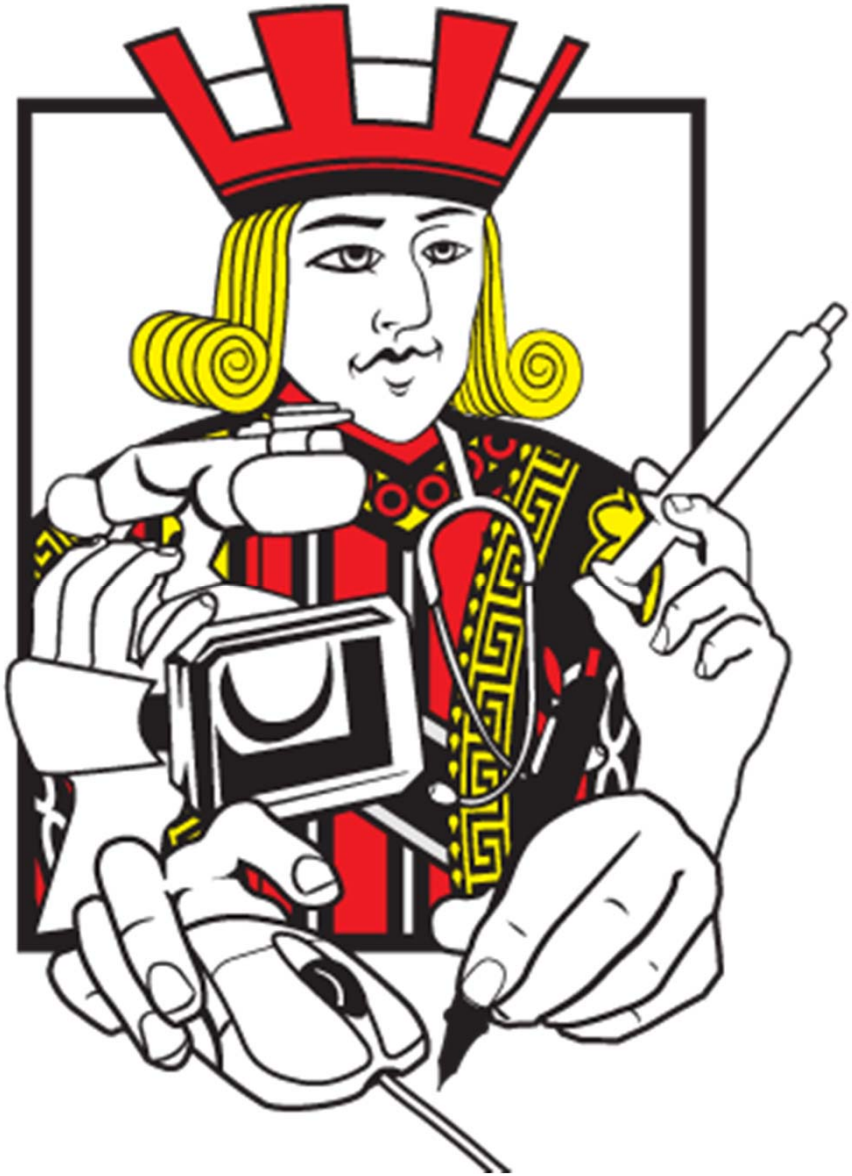
# Program 1st part

- Planning a simCenter
- Audio
  - Usage, terminomogy, definitions, basics …
- Video
  - Usage, terminomogy, definitions, basics …

# Program 2nd part

- Simulators
  - Networksettings …

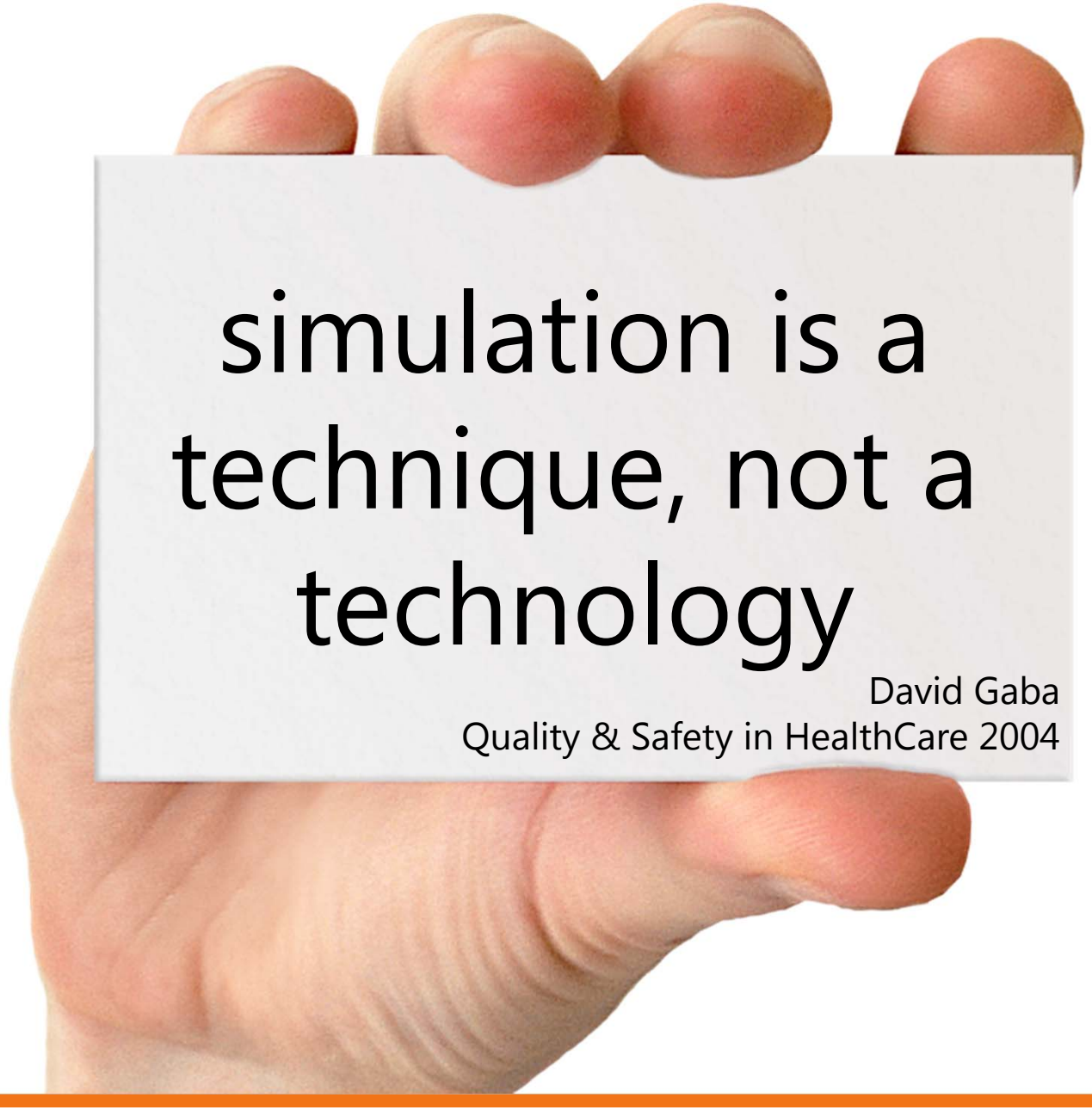
- How to troubleshoot my Manikin



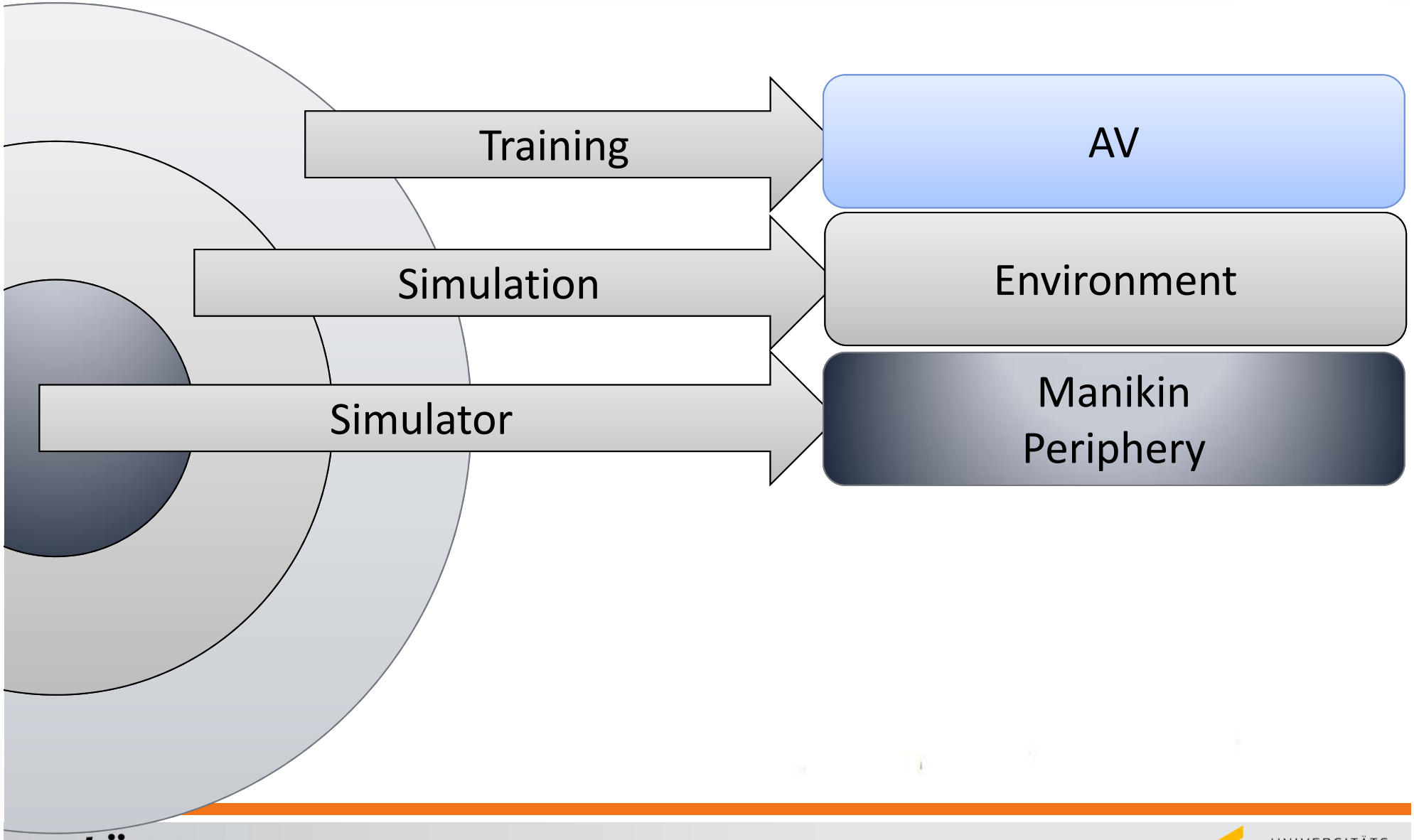
http://www.simghosts.org/

Planning a Simulation Center

SIMULATION


simulation is a technique, not a technology
David Gaba
Quality & Safety in HealthCare 2004

# Simulationtraining



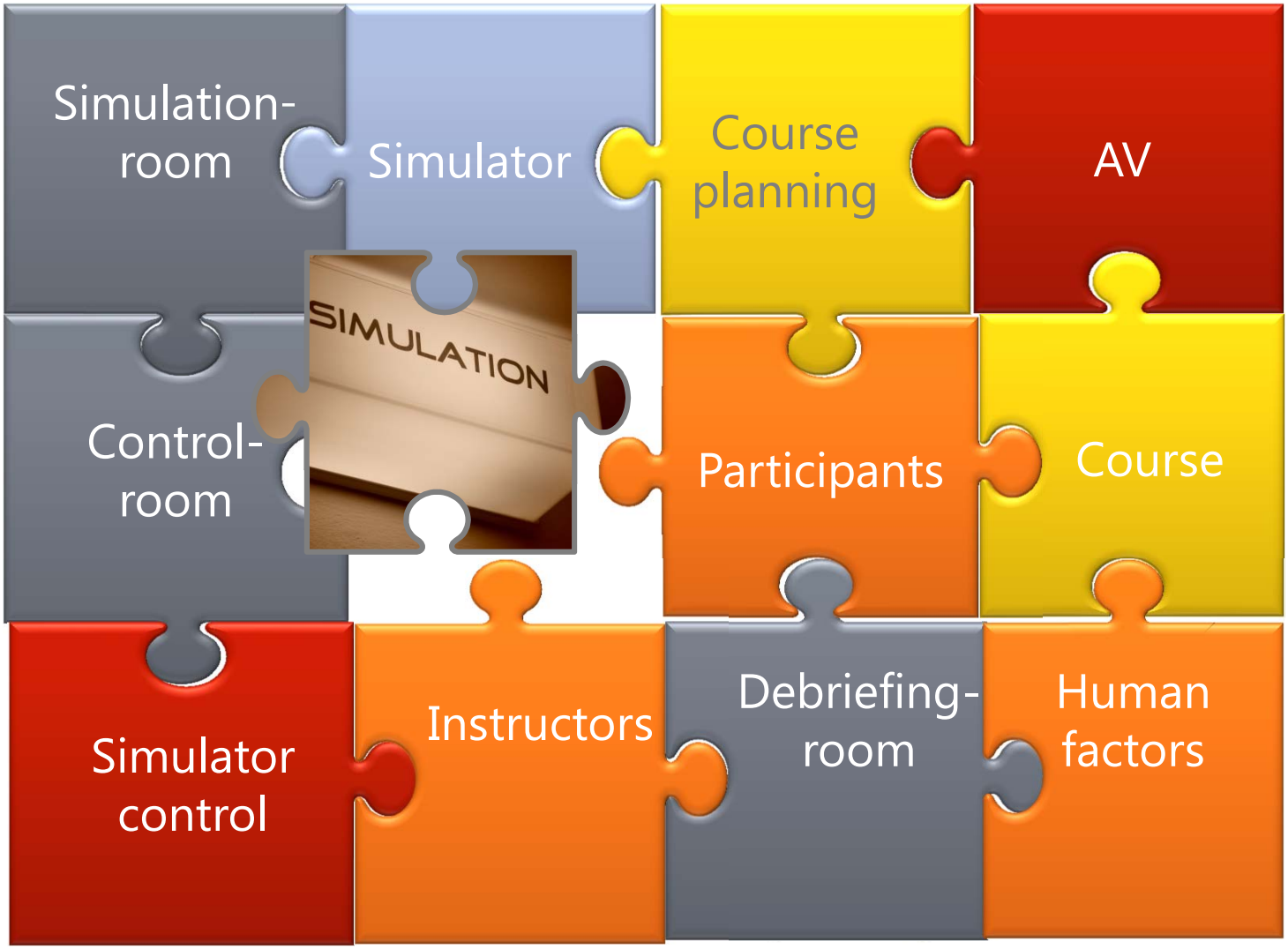
# Planning How do I start?

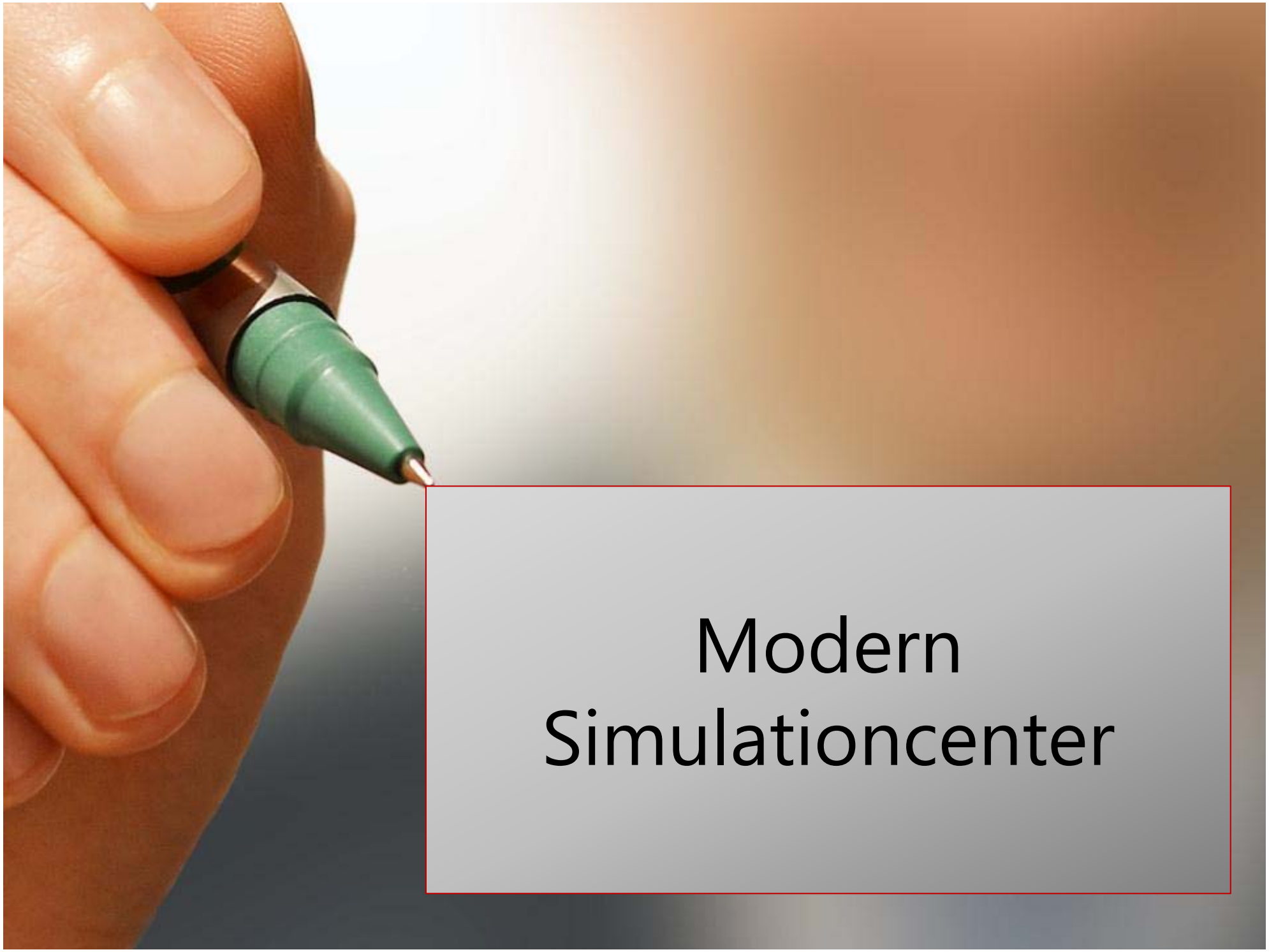
# mySimulationCenter

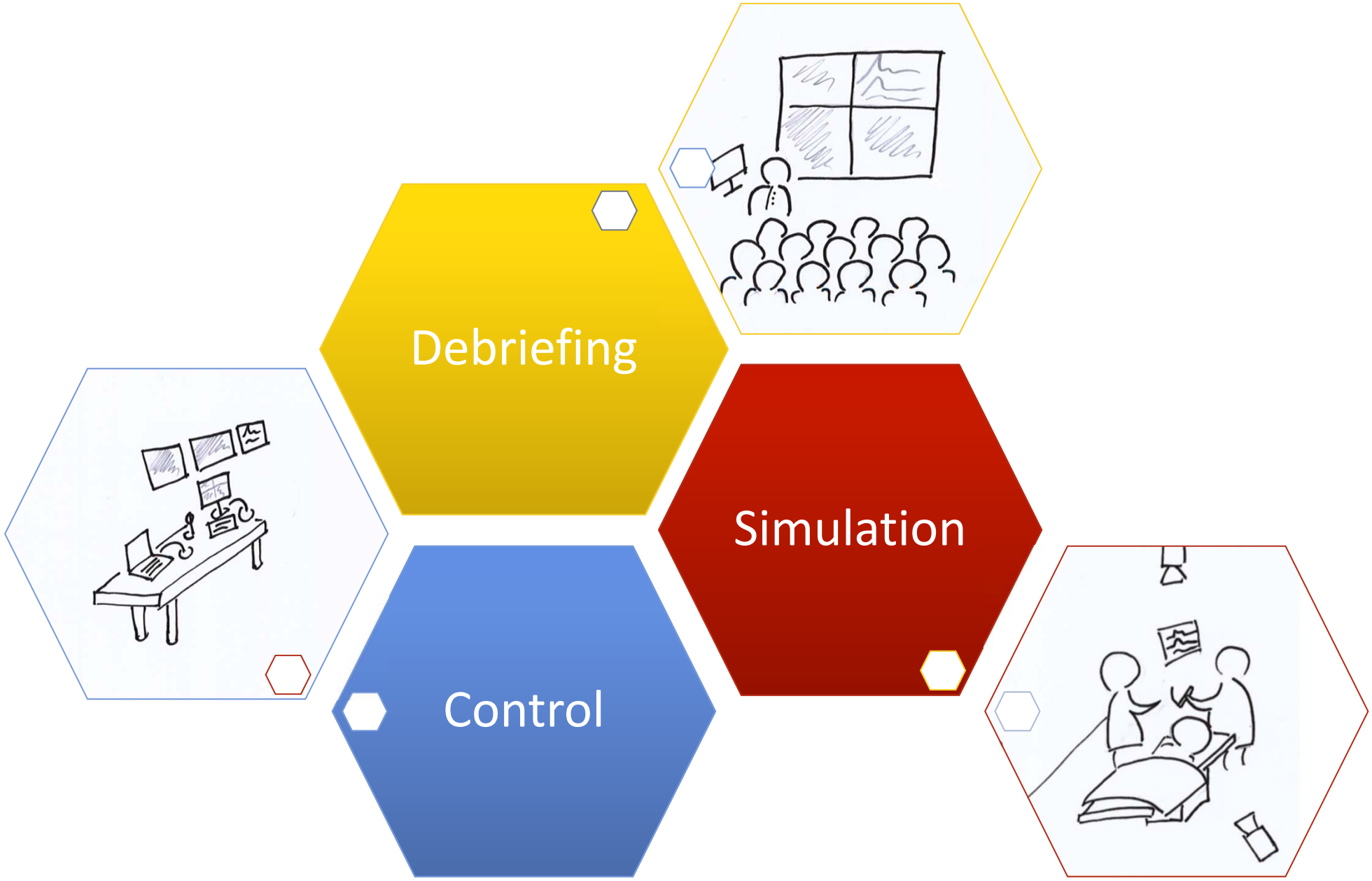
- **Do not plan a replication of a clinical setting**
- **Plan a learning environment**
  - Meet specific needs of you participants
- Which AV Setting is needed?
- What IT++ is needed

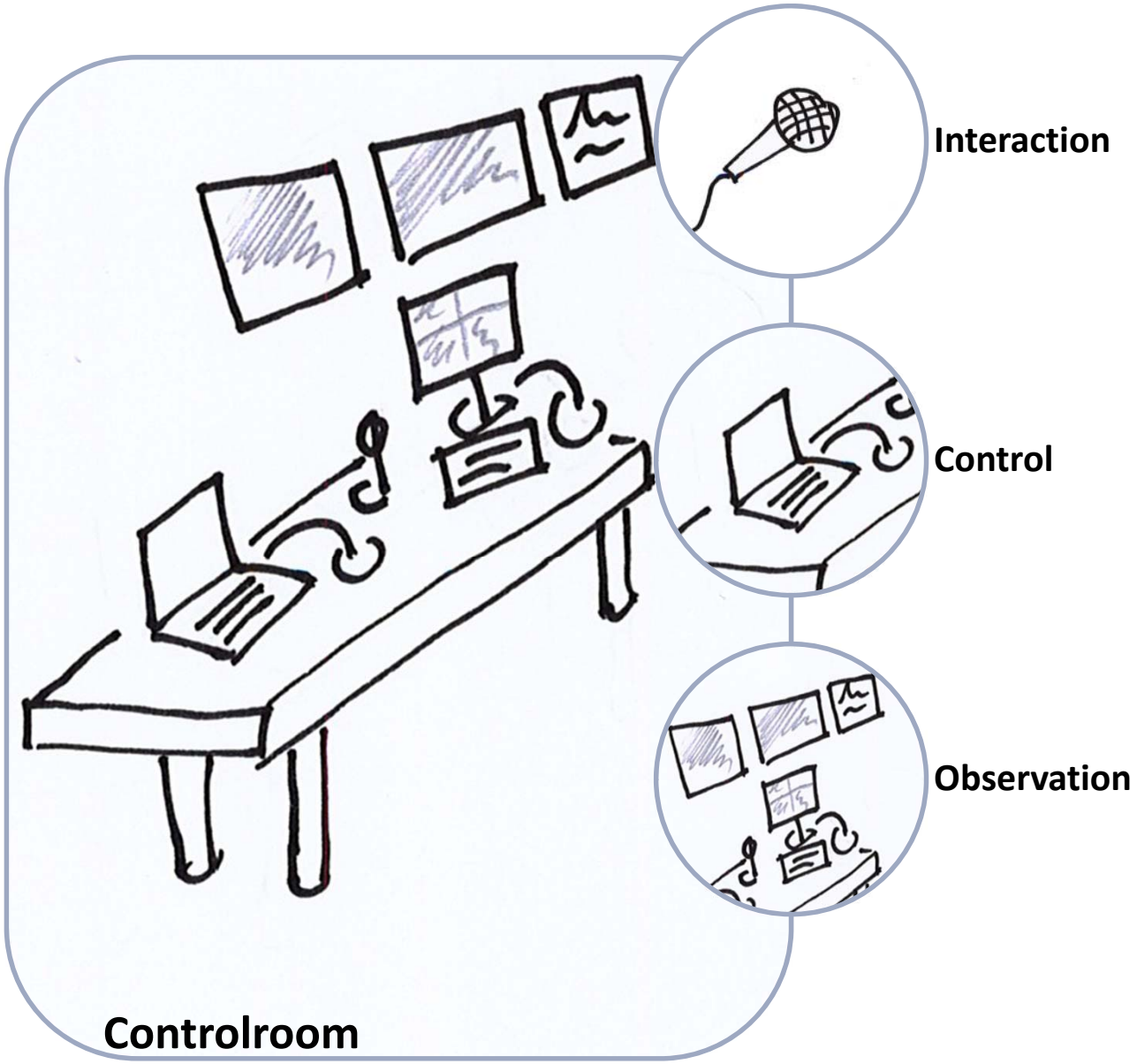
Avoid [...] confuse
glamorous
technology [...]
Alice L. Acker
In R. Kyle & B. W. Murray (Eds.), Clinical Simulation (2008)

# mySimCenter

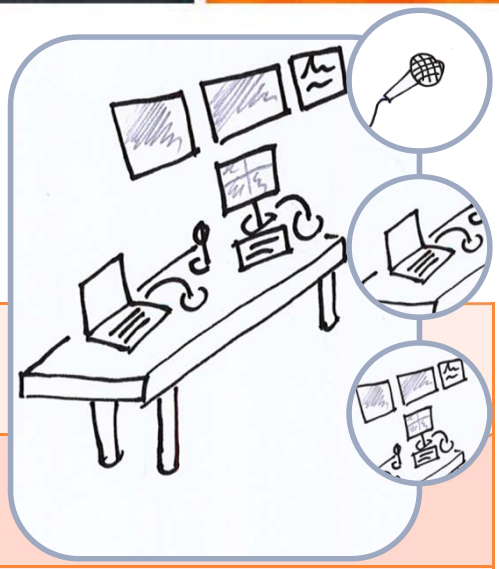



Modern
Simulationcenter


Debriefing
Simulation
Control


Interaction
Control
Observation
Controlroom

# Controlroom

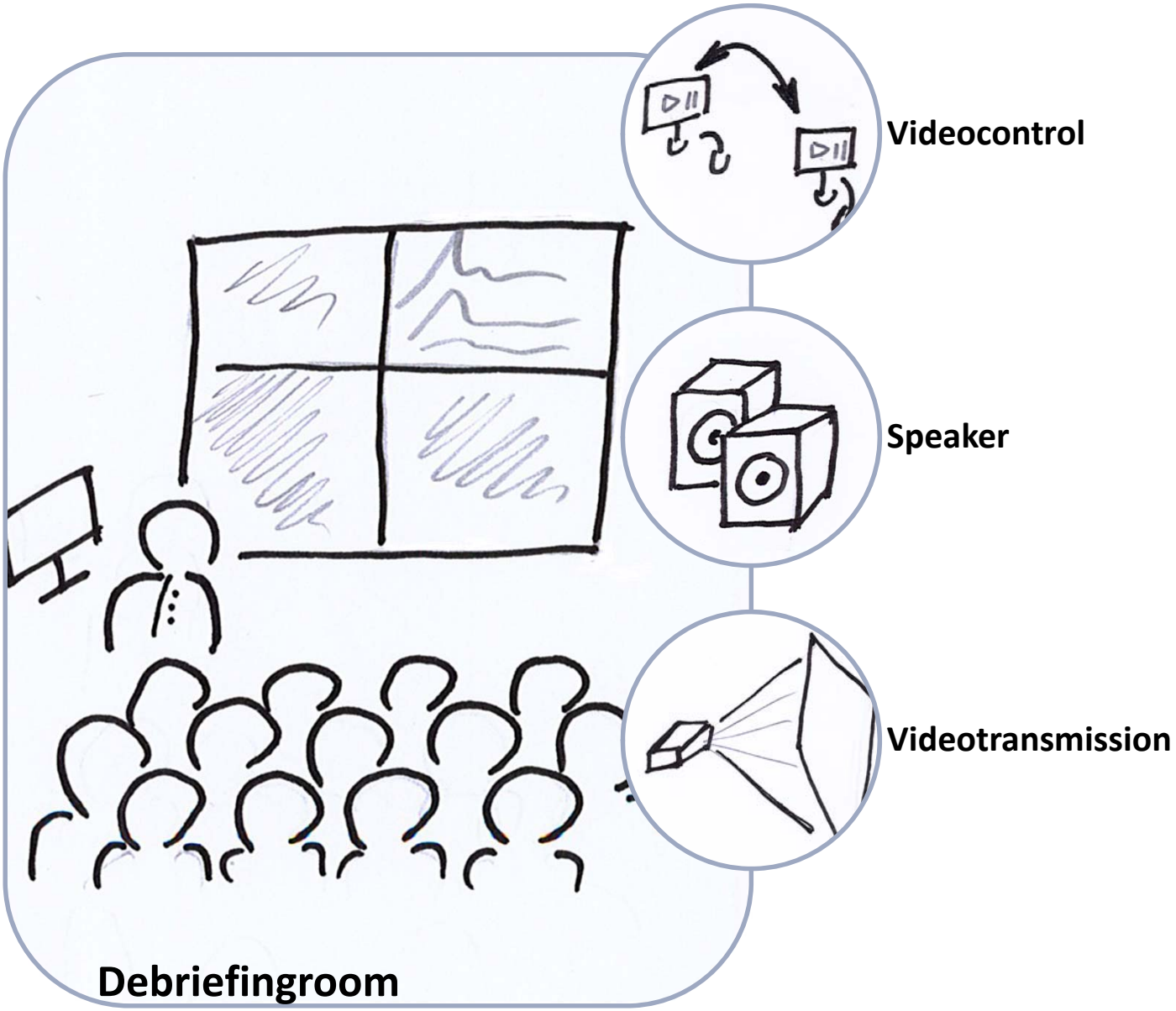


| | |
|---|---|
| **Microphone** | **Patient-Voice** |
| **Microphone** | **Voice of God** |
| **Wireless headsets** | **Communication with Sim-Nurse (if necessary)** |
| **Computer** | **Control of Manikin and Vitaldata** |
| **Computer or Remote Access** | **control Audio-Video-System** |
| **Observation** | **Displays** |

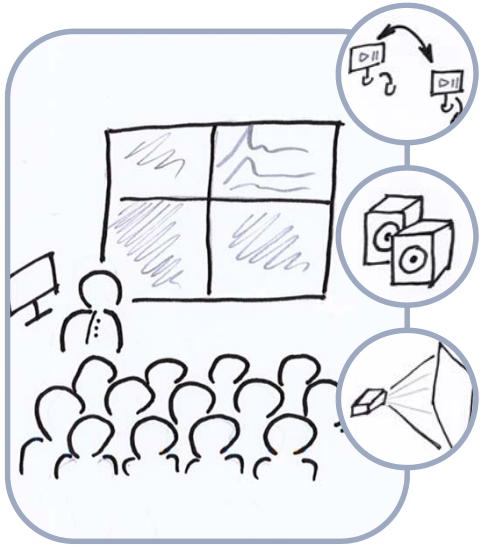
Microphones
Cameras
Simulator
Simulationroom

# Simulationsraum

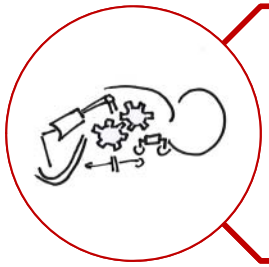
| | |
|---|---|
| **Simulator** | **Manikin with periphery** |
| **Microphone** | **Room-Mic** |
| **Cameras** | **3 Cameras** |
| **Vitaldata** | **VGA to Video Converter** |
| **FX** | **X-Ray, US, …** |
| **Speaker** | **Voice of God** |
| **Wireless headsets** | **Communication with Sim-Nurse (if necessary)** |


Videocontrol
Speaker
Videotransmission
Debriefingroom

# Debriefingraum



| | |
|---|---|
| **Projector** | **Student‘s view** |
| **Speaker** | **Transmission of Audio** |
| **Computer or Remote Access** | **control Audio-Video-System** |



**S** imulator is ready

**T** ransmission of AV is ok

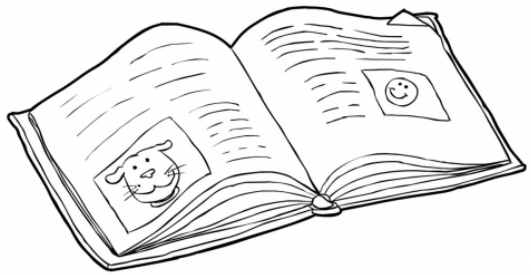
**O** perator and Team have situational awareness

**P** articipants are briefed

# Ideal implementation of simulation in a curriculum

**Theory**

Theory: Theoretical knowledge

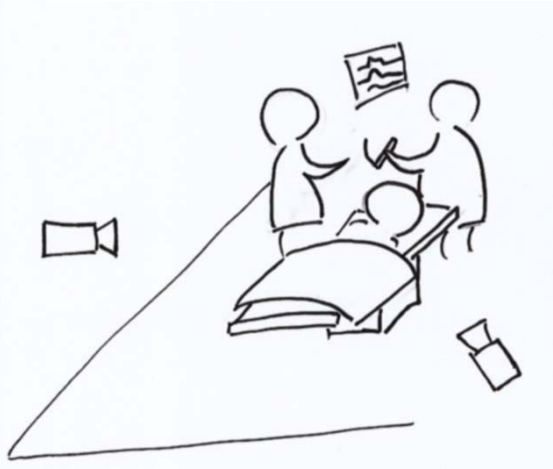


**Skills**

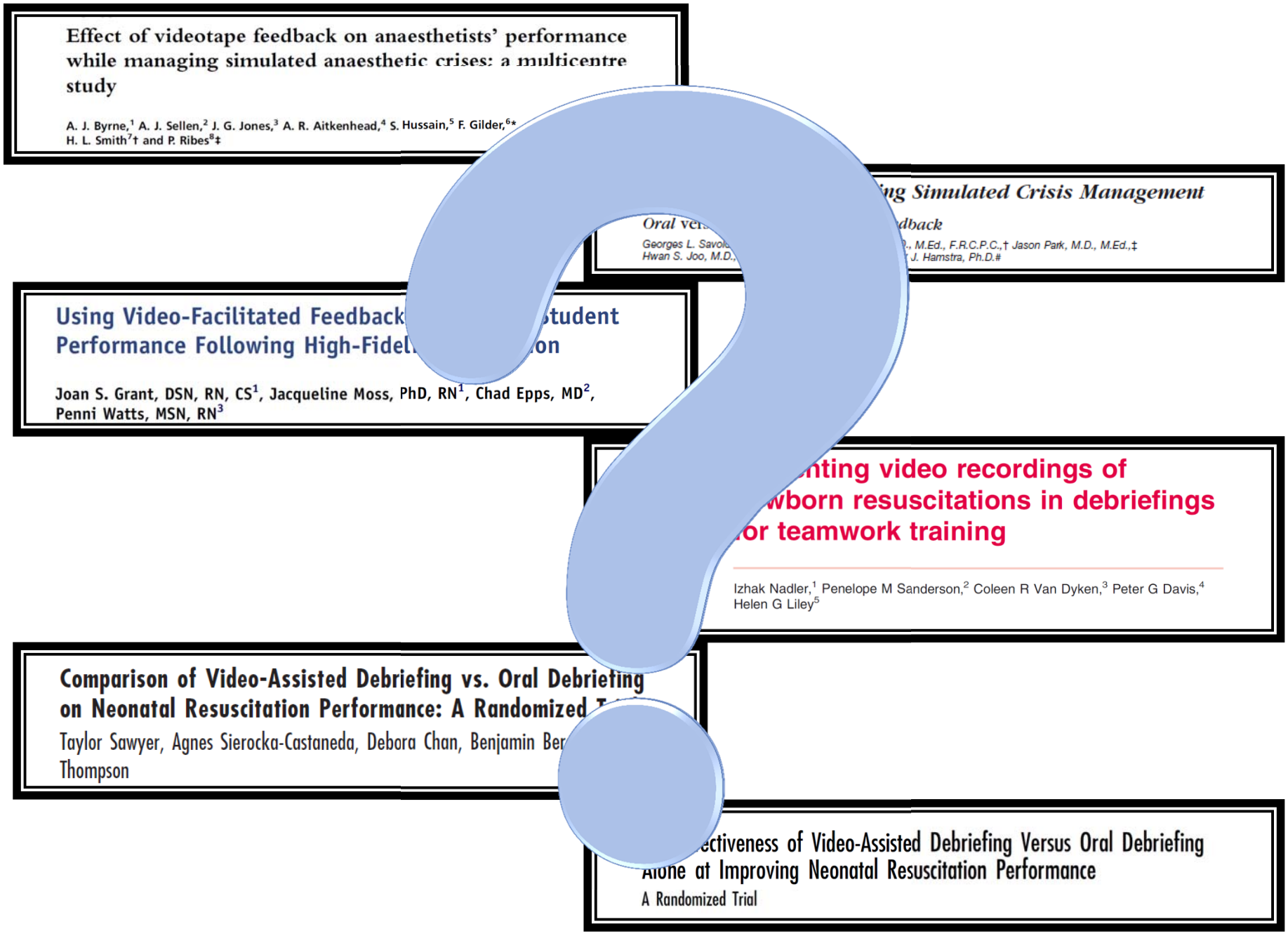
Skills: Medical skills

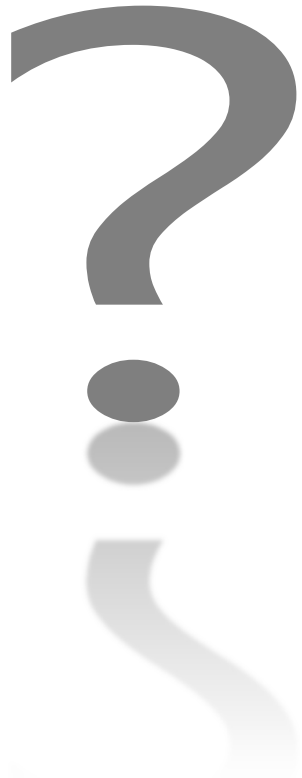
**Simulation**

Simulation: Application of medical skills



Video

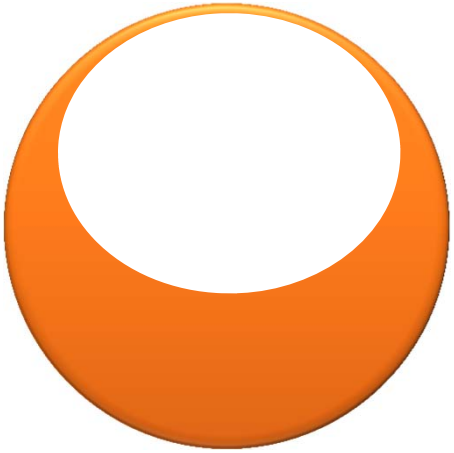

Effect of videotape feedback on anaesthetists' performance while managing simulated anaesthetic crises: a multicentre study
A. J. Byrne,[1] A. J. Sellen,[2] J. G. Jones,[3] A. R. Aitkenhead,[4] S. Hussain,[5] F. Gilder,[6]* H. L. Smith[7]† and P. Ribes[8]‡
ng Simulated Crisis Management
Oral ver
dback
Georges L. Savol
Hwan S. Joo, M.D.,
., M.Ed., F.R.C.P.C.,† Jason Park, M.D., M.Ed.,‡
J. Hamstra, Ph.D.#
Using Video-Facilitated Feedback
tudent
Performance Following High-Fidel
on
Joan S. Grant, DSN, RN, CS[1], Jacqueline Moss, PhD, RN[1], Chad Epps, MD[2], Penni Watts, MSN, RN[3]
nting video recordings of
wborn resuscitations in debriefings
or teamwork training
Izhak Nadler,[1] Penelope M Sanderson,[2] Coleen R Van Dyken,[3] Peter G Davis,[4] Helen G Liley[5]
Comparison of Video-Assisted Debriefing vs. Oral Debriefing on Neonatal Resuscitation Performance: A Randomized T
Taylor Sawyer, Agnes Sierocka-Castaneda, Debora Chan, Benjamin Ber
Thompson
ectiveness of Video-Assisted Debriefing Versus Oral Debriefing
Alone at Improving Neonatal Resuscitation Performance
A Randomized Trial



Purpose / Aim of Video

Influencing factors on effective video usage

Features Videosystem

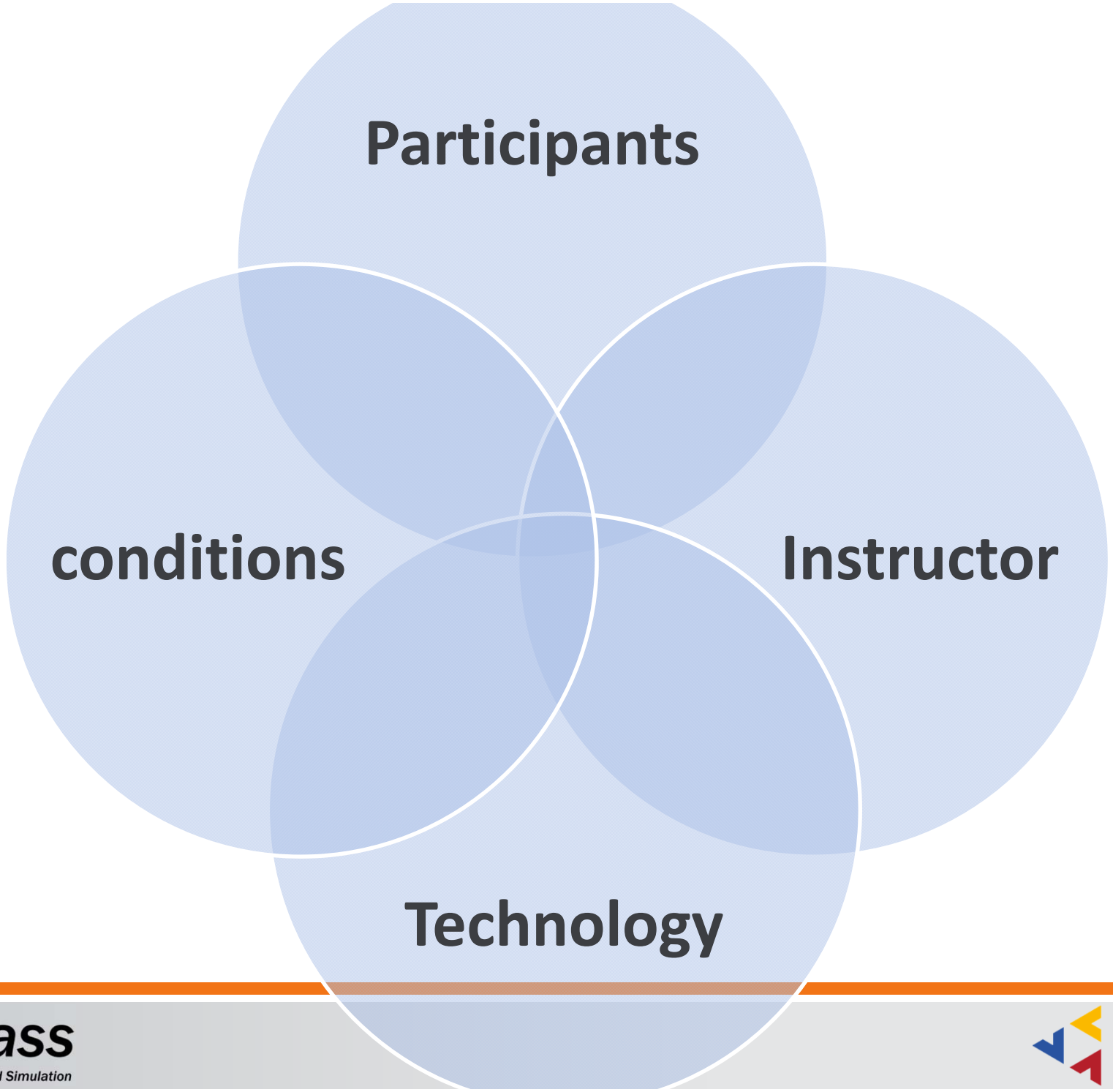


# STIMULATE SELF-REFLECTION

Only for teamtraining?

# Enhancing skill training with video

http://www.tilak.at/media/data0463/bild_2.jpg

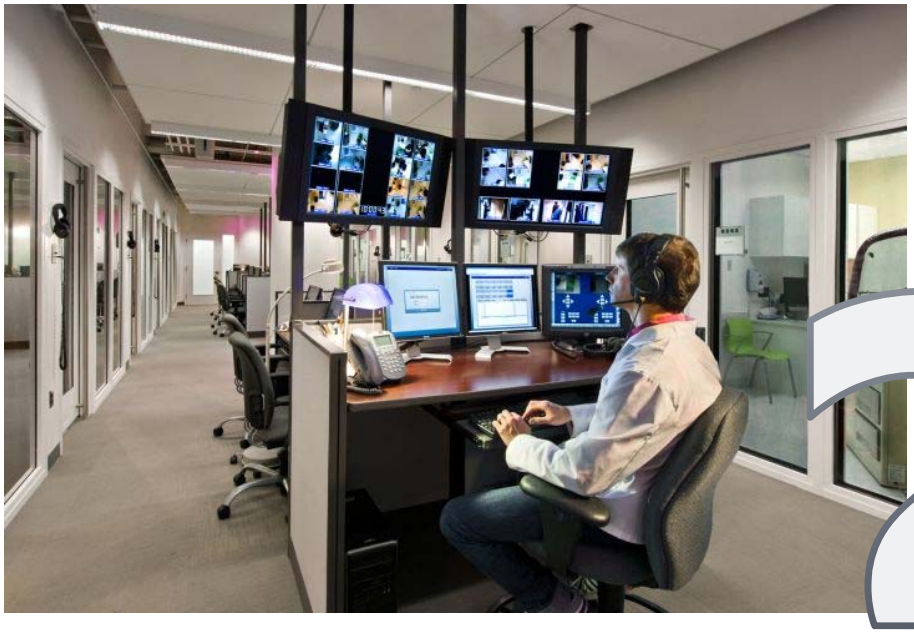

Participants
conditions
Instructor
Technology

purposelessness
?!

# Focus on good views and visibility

http://1.bp.blogspot.com/-8k6v6U_3mdw/TwsQJO3R9JI/AAAAAAAAAAU/U1yyM6HVxQ0/s320/traumasims2.jpg

# Focus on good usability for your instructors



http://humancircuit.com/vision-delivered/the-johns-hopkins-hospital-clinical-skills-and-simulation-center/

# Usability ????

http://humancircuit.com/vision-delivered/weill-cornell-medical-college/

http://www.healthysimulation.com/wp-content/uploads/2011/12/EMS_IT_Role.jpeg

Export?

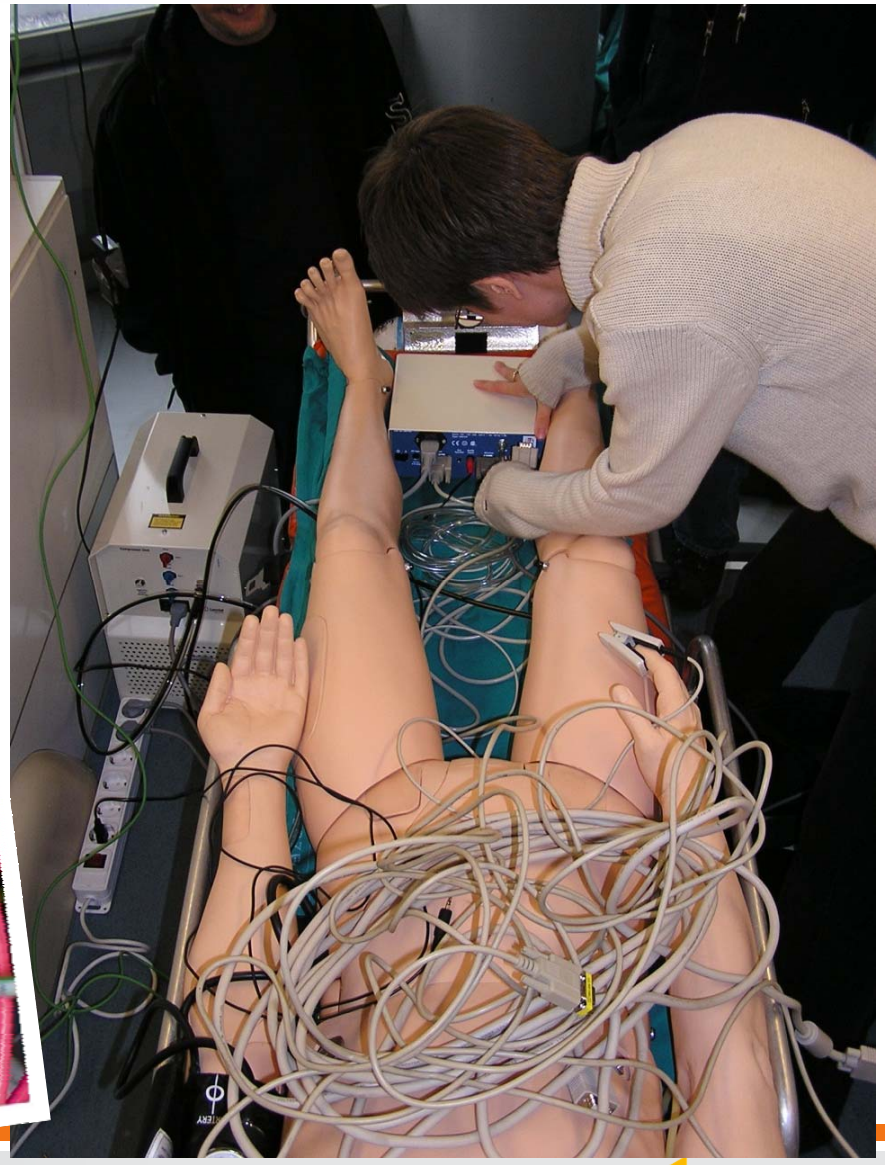
THINK ABOUT!!!!

# Analog vs. Digital

Hummer 1

NASA Mars Rover Curiosity

# Wires or not?

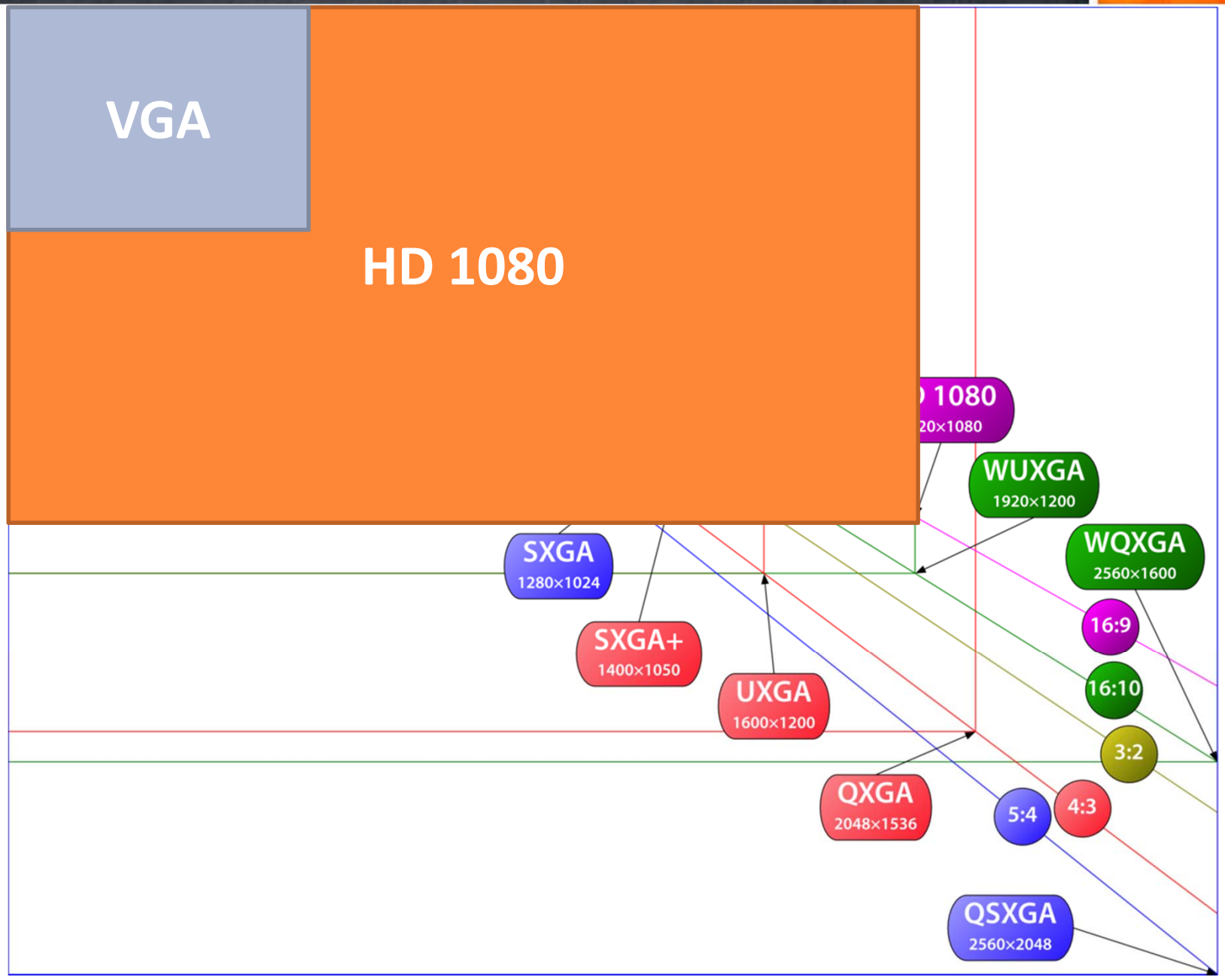


Video
fundamentals

# Video

- Analog vs. Digital
- Resolution
- Transmission
- Participants-View
- …

# Resolutions



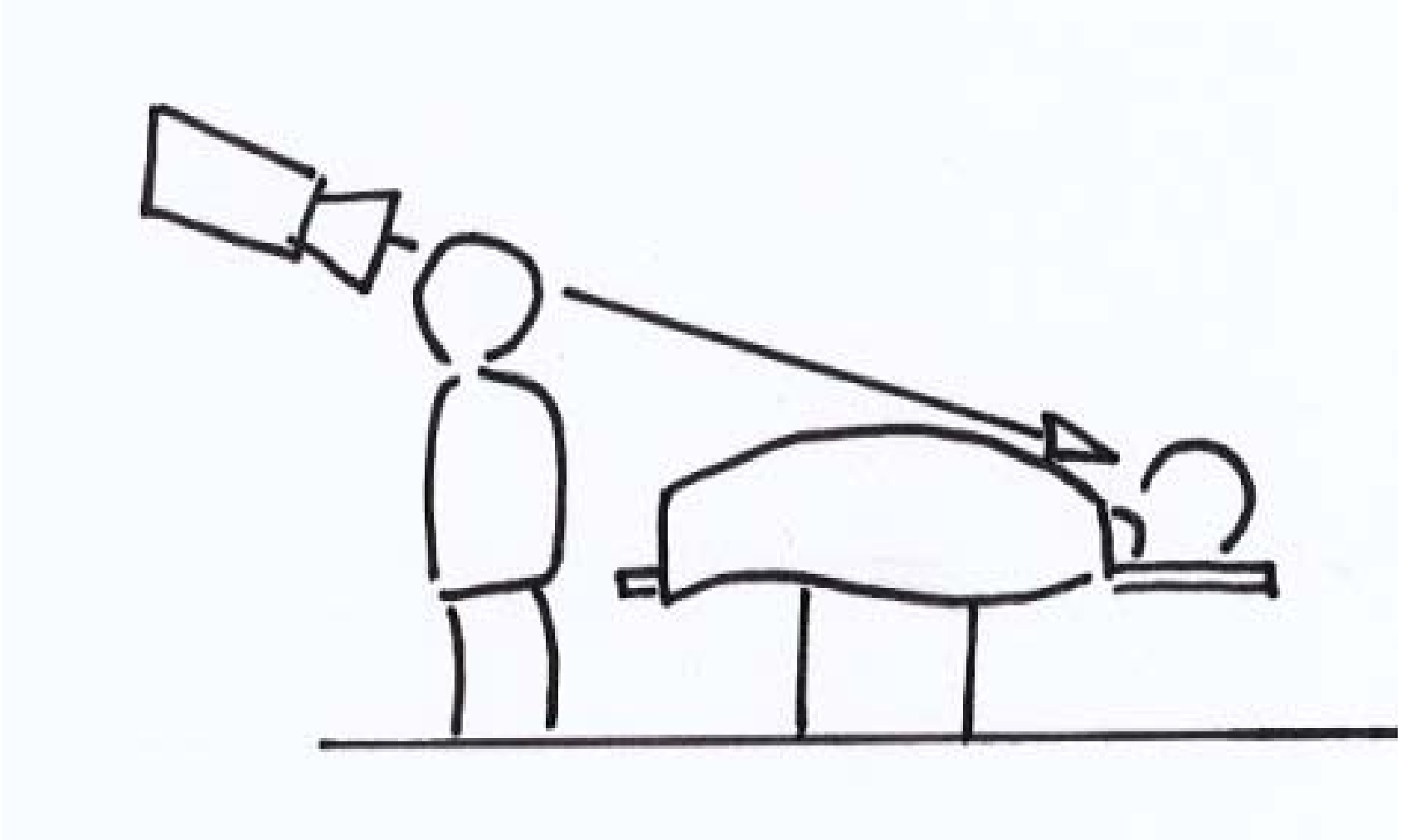
# Resolutioons

| Bildformat | Beispiel | Bildauflösung | Seitenverhältnis |
|---|---|---|---|
| VGA | Webcams | 640 x 480 | 4:3 |
| SVGA | Webcams | 800 x 600 | 4:3 |
| PAL | Old TV (central Europe), Analoge Cameras | 768 x 576 | 4:3 |
| PAL Widescreen | DVD | 1024 × 576 | 16:9 |
| NTSC | Old TV (USA…) | 720 × 480 | 4:3 |
| „HDready“ 720p | LED or TFT TV, Projector, Webcams (2011), digital Cameras | 1280 x 720 | 16:9 |
| „FullHD“ 1080p | LED or TFT TV, Projector, some few Webcams (2011), digital Cameras | 1920 x 1080 | 16:9 |
| MORE TO COME! | | | |

# HD?

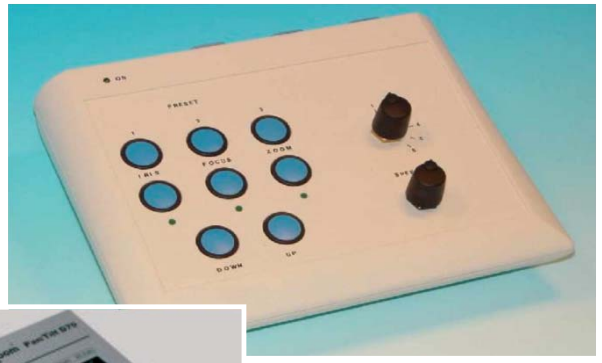
| Name | x (px) | y (px) | x:y | x·y (Mpx) |
|---|---|---|---|---|
| **nHD** | **640** | **360** | 16:09 | 0.230 |
| **qHD** | **960** | **540** | 16:09 | 0.518 |
| **HD** | **1280** | **720** | 16:09 | 0.921 |
| **HD+** | **1600** | **900** | 16:09 | 1.44 |
| **FHD** | **1920** | **1080** | 16:09 | 2.073 |
| **QHD** | **2560** | **1440** | 16:09 | 3.686 |
| **4K UHD** | **3840** | **2160** | 16:09 | 8.294 |
| **8K UHD** | **7680** | **4320** | 16:09 | 33.178 |

# Camerapositions



# PTZ Cameras

- Pan
- Tilt
- Zoom

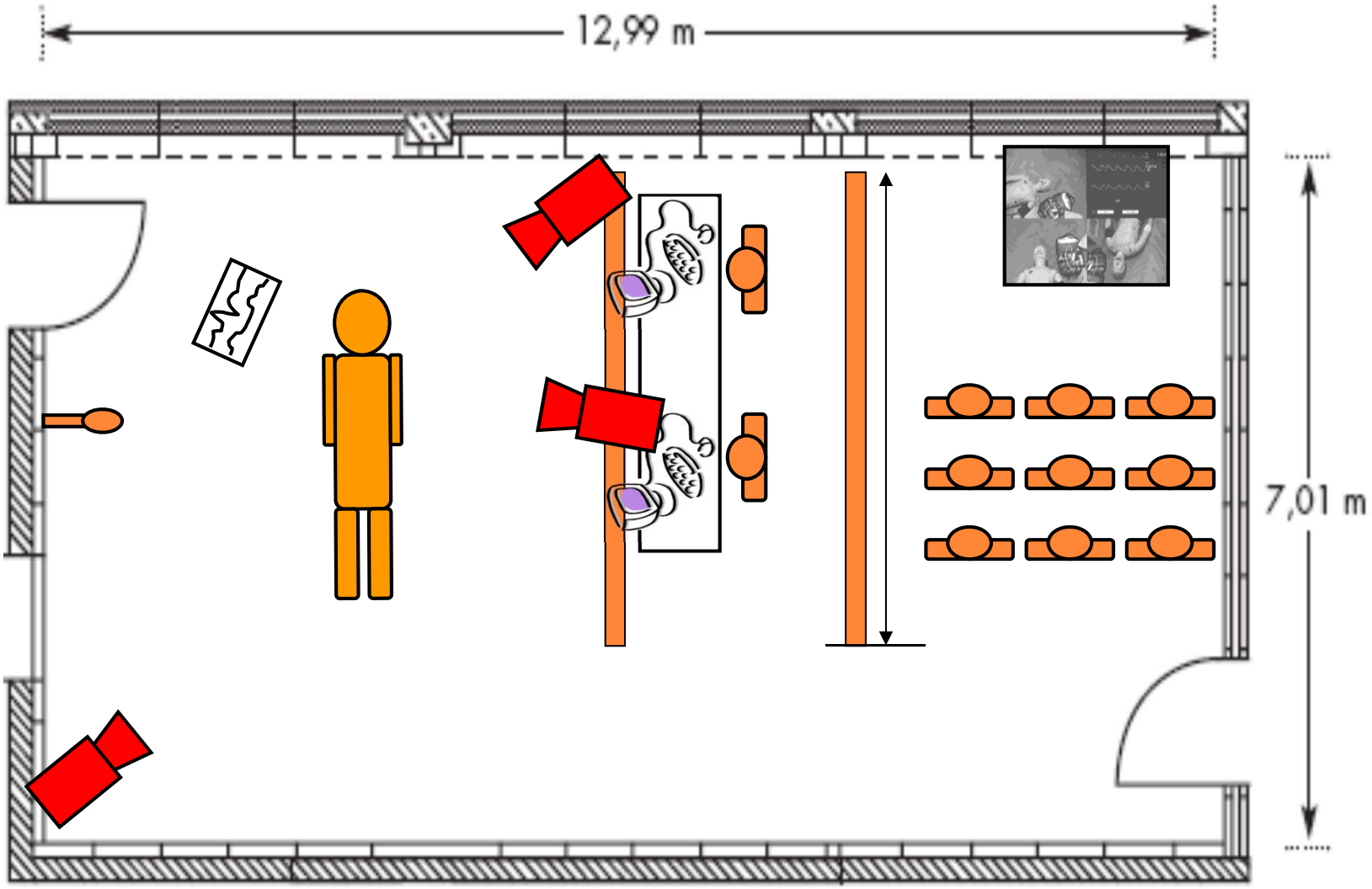


- Position Presets
- Controle your view “on the fly”

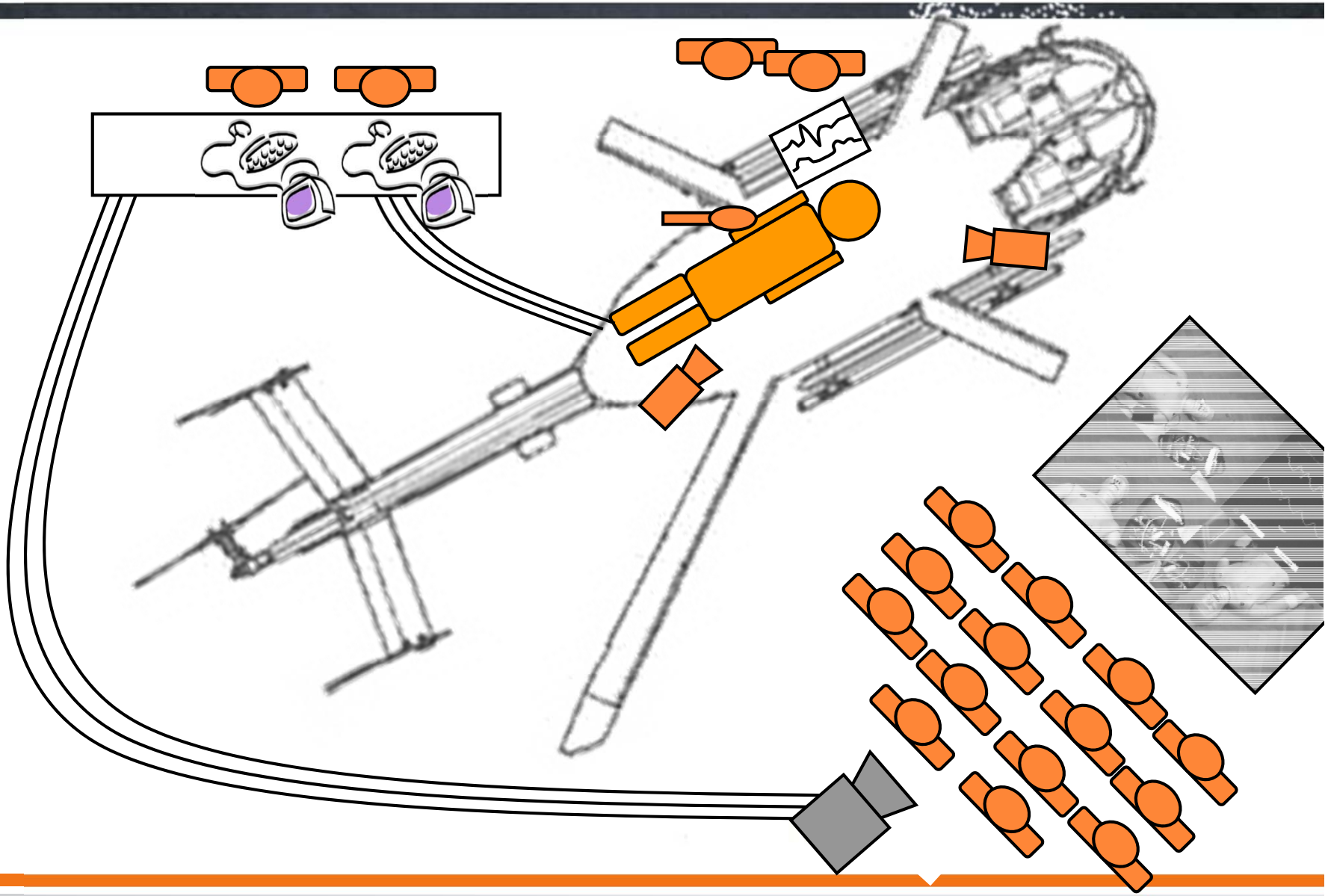
# Problems with camera positions

# Camera Positions

# Training in ONE Room (Hotel or Conference)



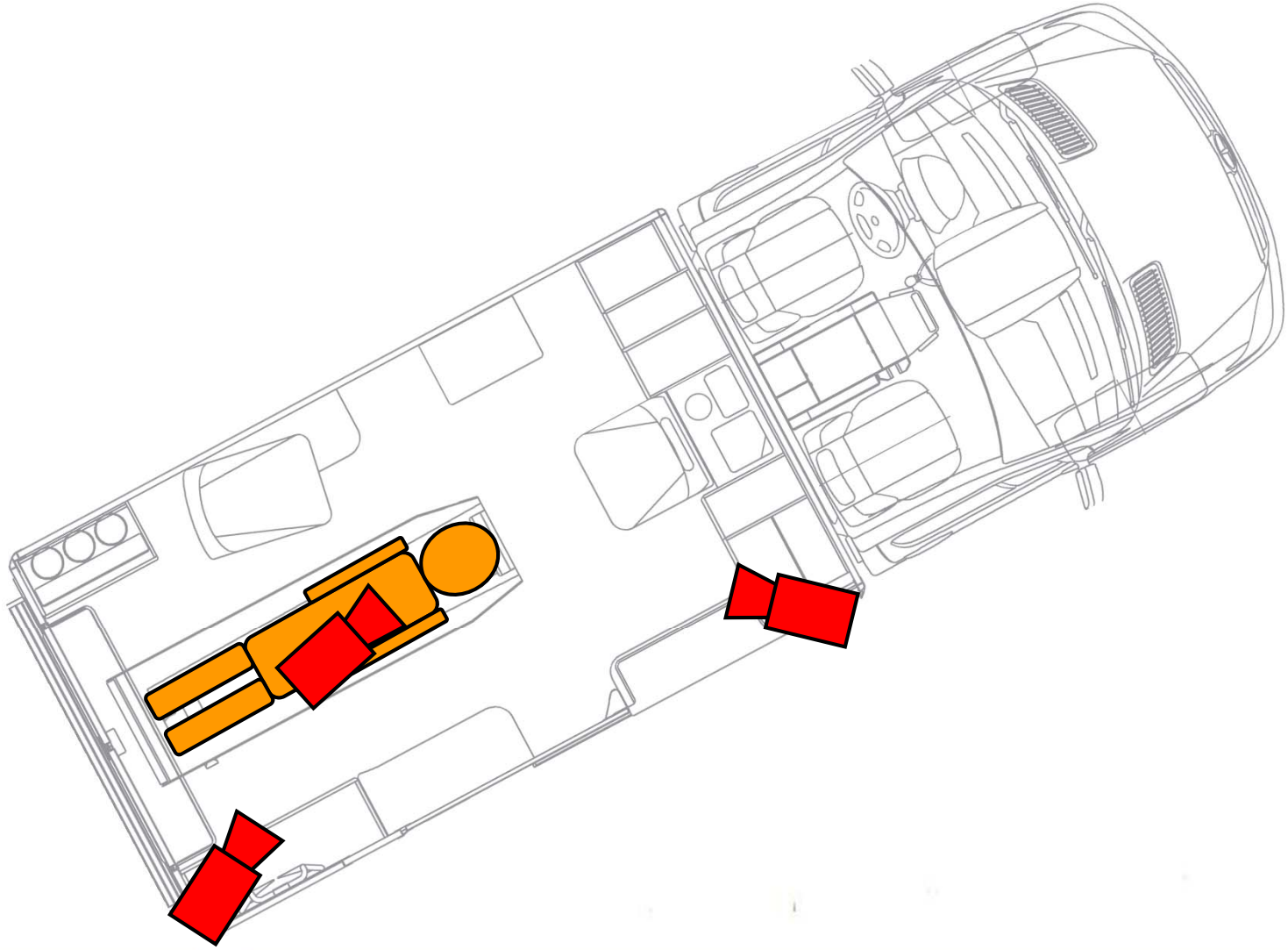
# Training in a Helicopter



# Why multiple Views?

***… Because …***

# Where to place cameras in an Ambulance car? Example ...



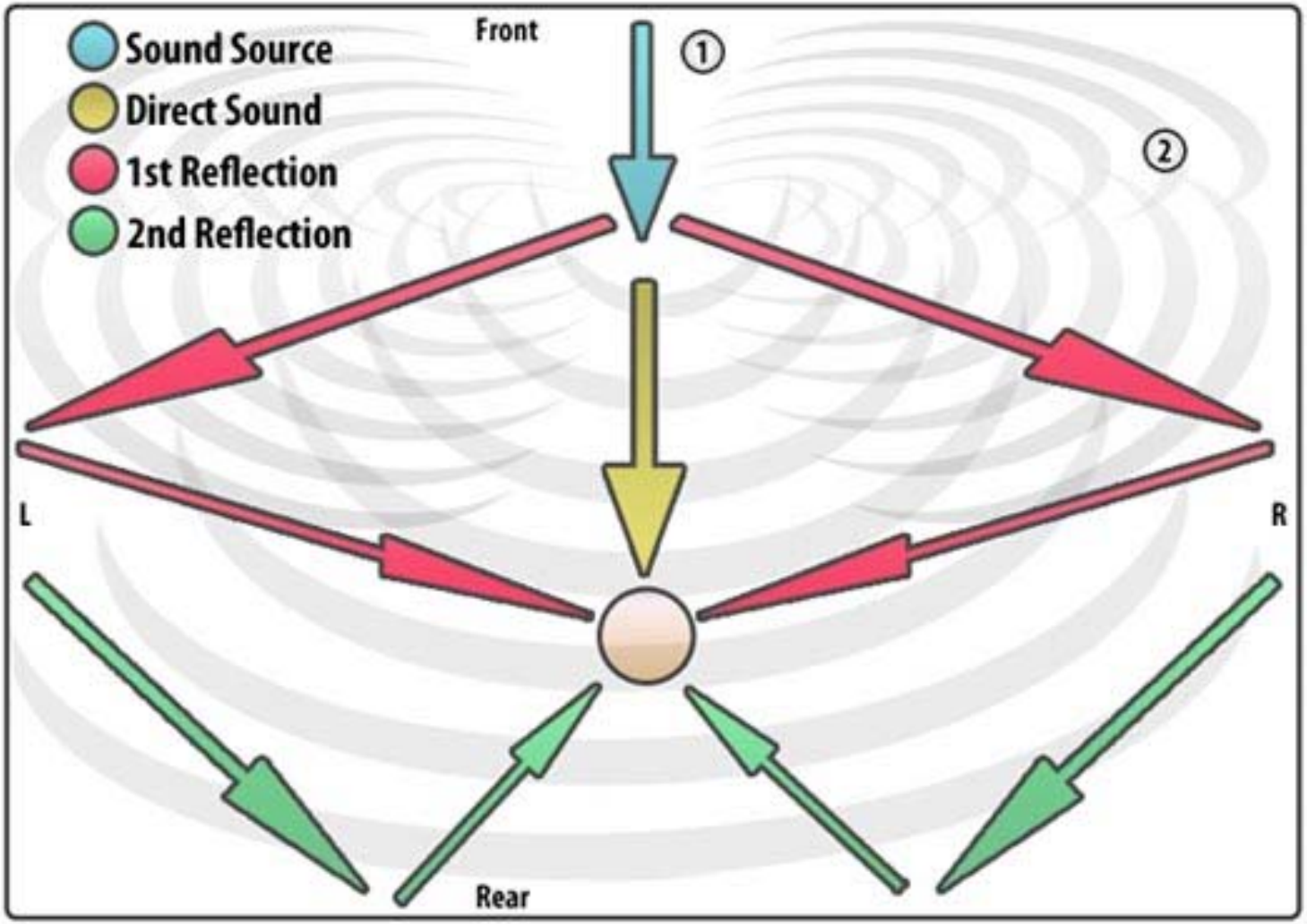
# Result

# Video

- 3 Cameras
  - Simulator room
- Patient Monitor
  - VGA to Video Converter
- Transmission
  - Debriefing room
- Recording
  - Control room
- Playback / Projector
  - Debriefing room

Audio
fundamentals

# Sound reflection




http://www.themusicespionage.co.uk/wp-content/uploads/2012/06/Ambience.jpg

# Microphone basics

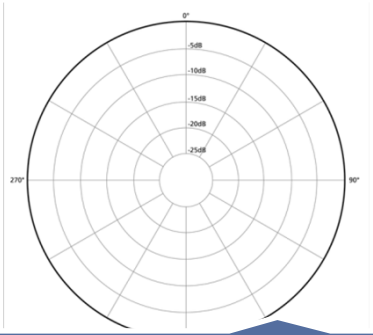
- A microphone is an acoustic-to-electric transducer or sensor that converts sound into an electrical signal.
- Most microphones today use electromagnetic induction (**dynamic microphone**), capacitance change (**condenser microphone**), piezoelectric generation, or light modulation to produce an electrical voltage signal from mechanical vibration.

http://en.wikipedia.org/wiki/Microphone

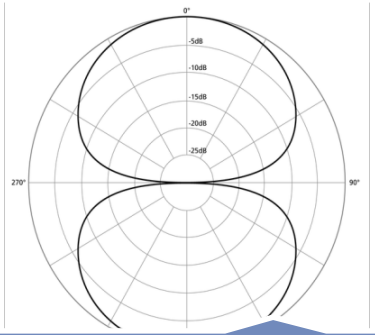
# Application specific microphone designs

- Boundary microphones
- Lavalier microphones
- Wireless microphones
- Contact microphones
  - Throat microphones

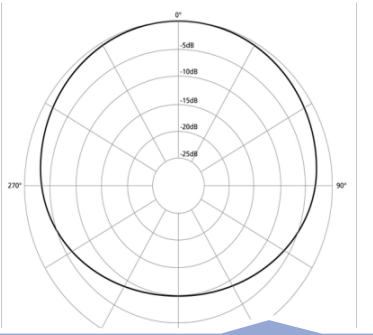
# Microphone’s directionalities



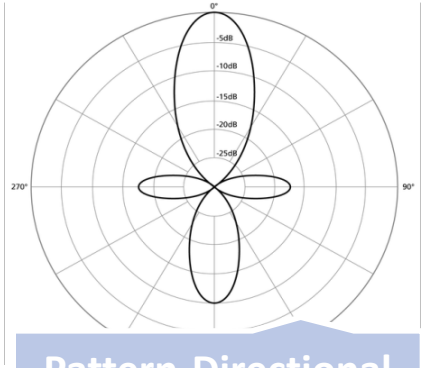

**Omnidirectional**



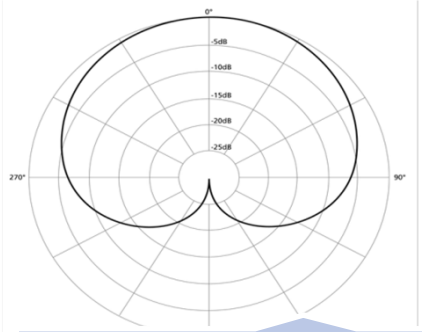

**Bi-directional (Figure 8)**



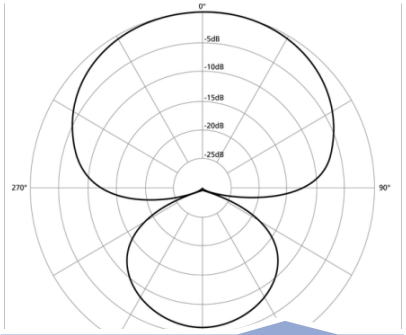

**Sub-cardioid**



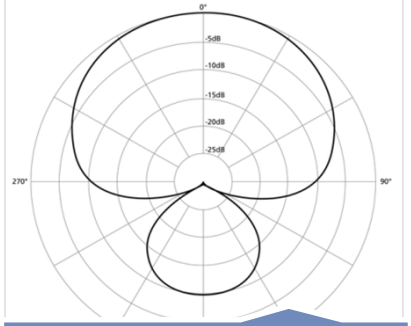

**Pattern-Directional (Shotgun)**




**Cardioid**



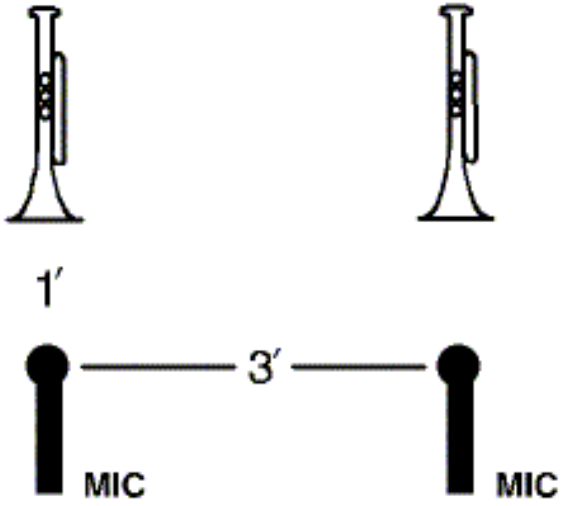

**Hyper-cardioid**



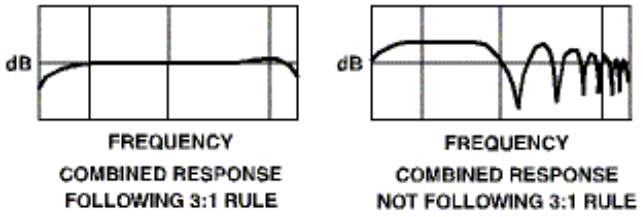

**Super-cardioid**

# The 3:1 rule

The distance from any given microphone to the next closest microphone must be 3x as far as that microphone is from the nearest sound source.



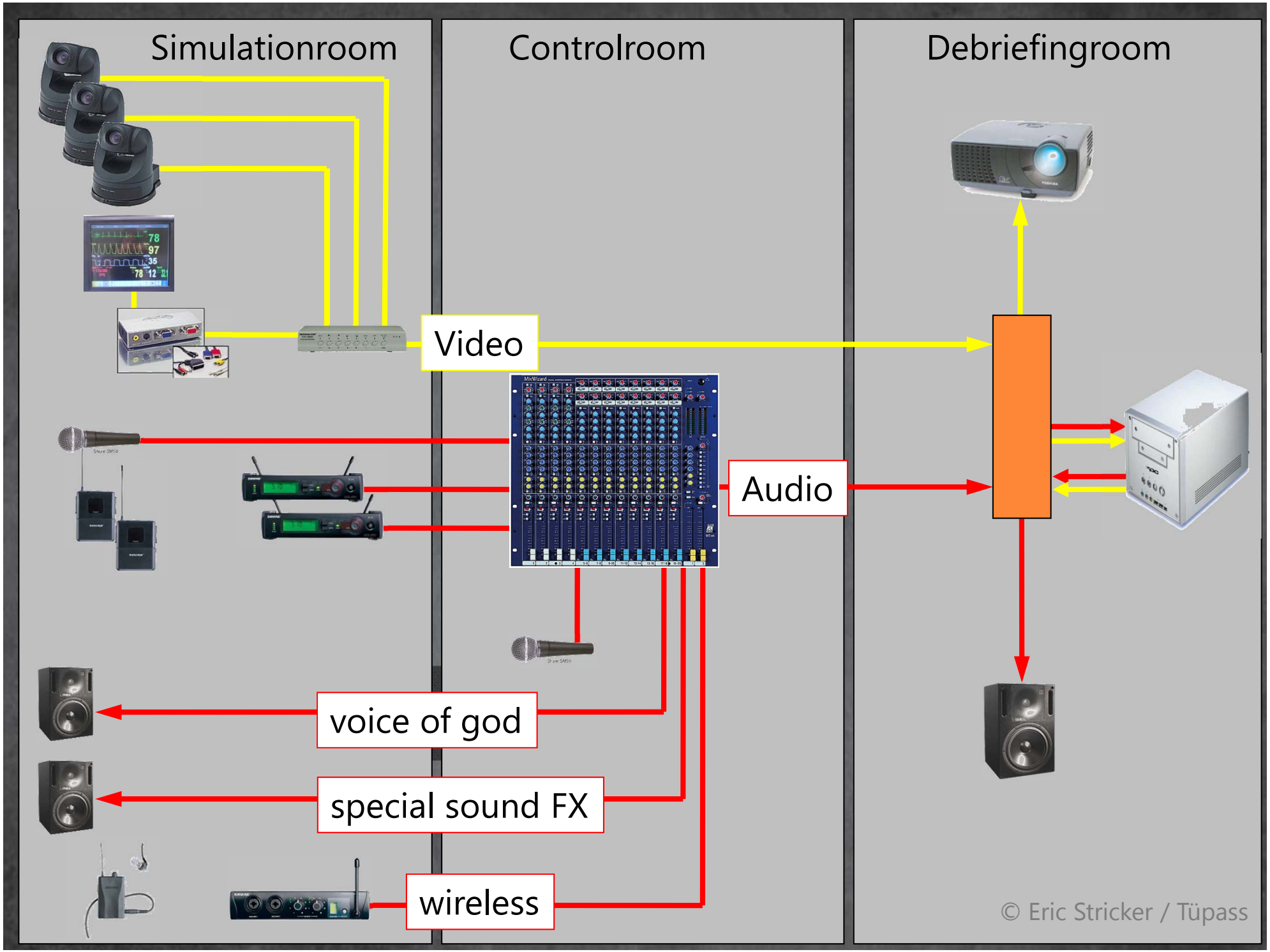

*Less is more*




http://en.wikiaudio.org/3:1_rule

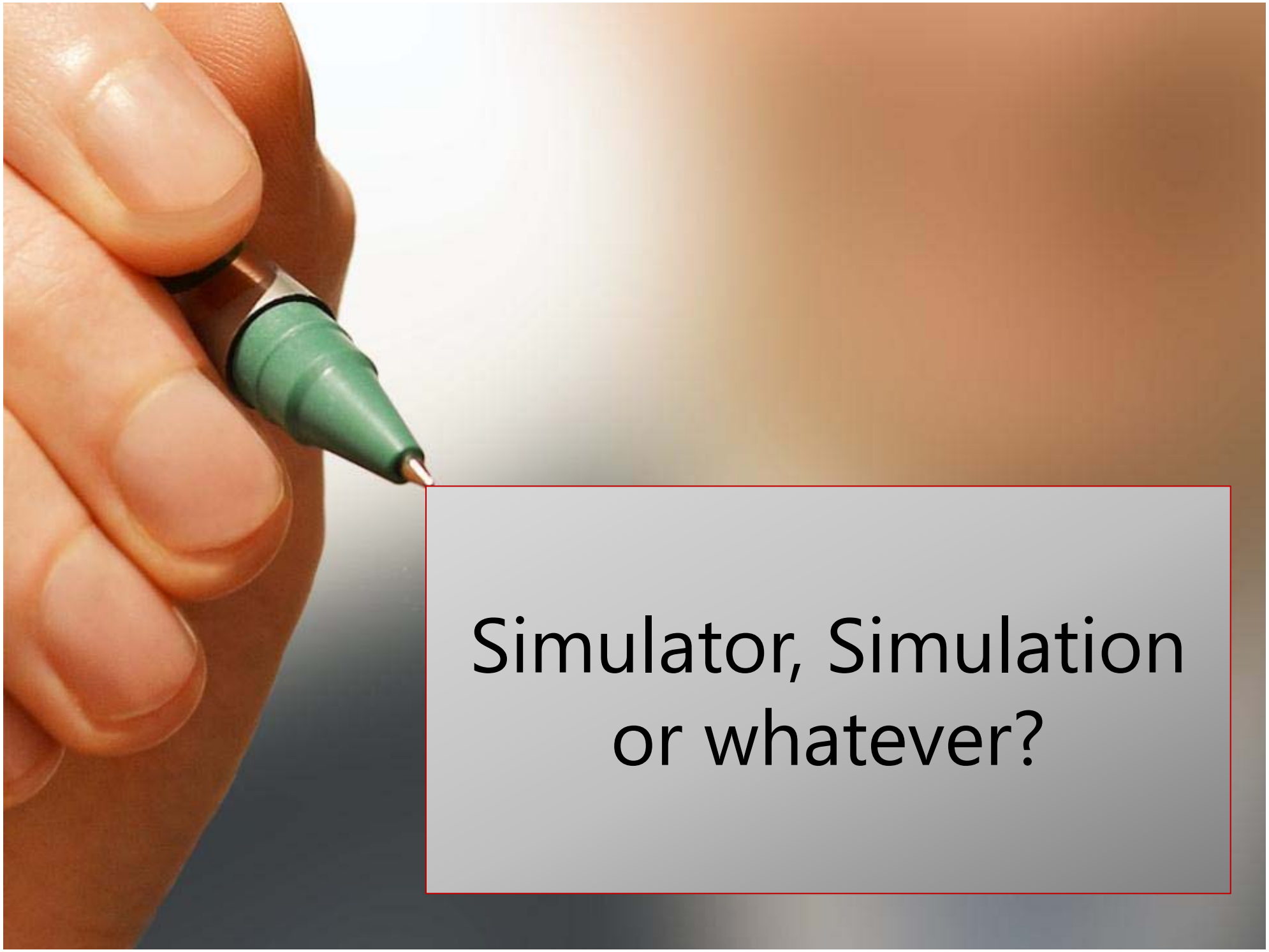
# Audio

- Patient voice & Voice of God
  - microphone control room
- Participants
  - microphones in the simulator room
  - wireless microphones
- Recording & Transmission
  - audio- & video-recording / control room
- Transmission & Playback
  - debriefing room
- Special FX
  - simulation room


Simulationroom
Controlroom
Debriefingroom
Video
Audio
voice of god
special sound FX
wireless
© Eric Stricker / Tüpass

# do not reinvent the wheel

| Company | URL |
|---|---|
| AQAI | www.aqai.eu |
| BDC | www.bdc-mindt.de |
| Biobsereve GmbH | www.defence.biobserve.com |
| B-Line Medical, LLC | www.blinemedical.com |
| Education Management Solutions EMS | www.ems-works.com |
| Kb Port LLC | www.kbport.com |
| Laerdal Medical | www.laerdal.com |
| Mangold Interact | www.mangold-international.com |
| METIVision | www.caehealthcare.com |
| Smots | www. scotiauk.com/smots/ |
| Studiocode | www.studiocodegroup.com |
| SIMstudio | www.simstudio.at |
| ZYOS | www.zyos.de |


Simulator, Simulation
or whatever?

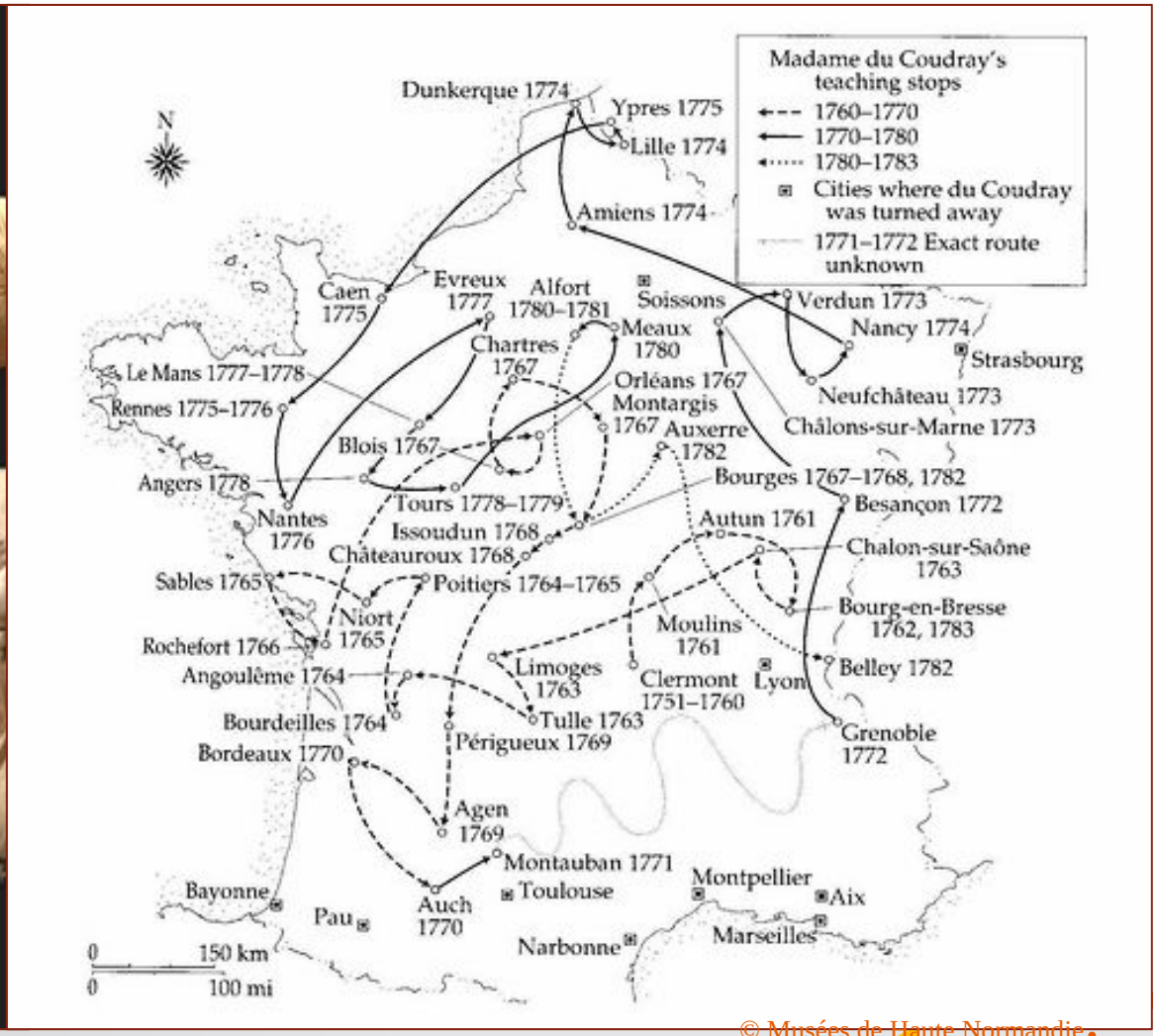
# fidelity? Low to high

- What fidelity does my Simulator need?
- Do I really need a high fidelity (full-scale) Simulator?
- What periphery do I need? AV?

***Depends on your type of training and your learning goals!***

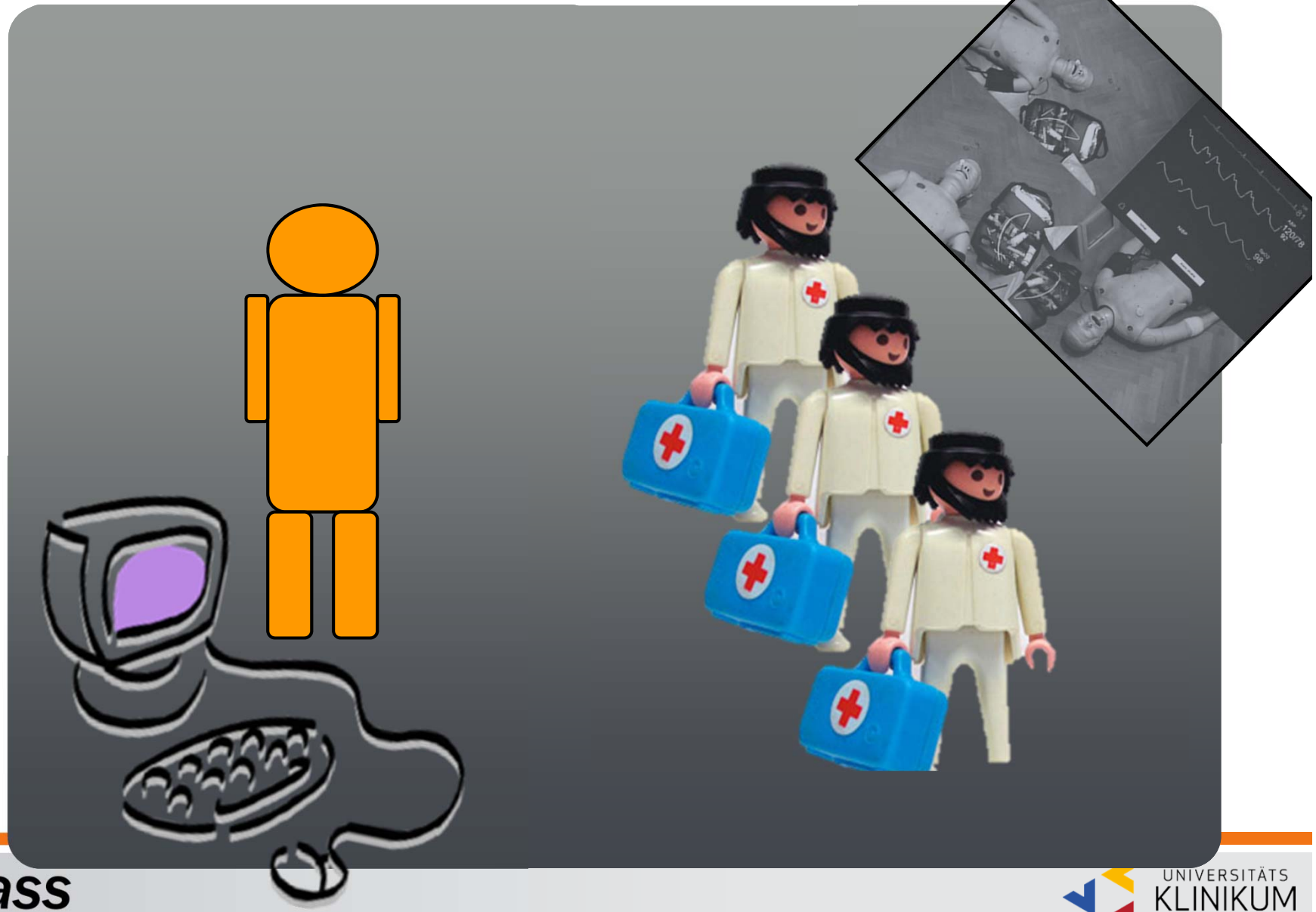
# Simulation in Healthcare

- Madame DuCoudray 1700's




© Musées de Haute Normandie.

# Simulator vs. Simulation vs. SimTraining



# Fidelity?

http://article.wn.com/view/2011/03/30/HealthStream_Acquires_50_Stake_in_Laerdal_Medical_s_Advanced/#

# Skilltrainer Definition Limbs & Things

## Physical Examination Skills

Products to aid in the development of clinical examination skills

- Ophthalmology
- Otology
- Auscultation & Cardiology
- Abdominal Ultrasound
- Female Examination
- Male Examination

## Procedural Skills

Products designed for staged training in clinical procedures

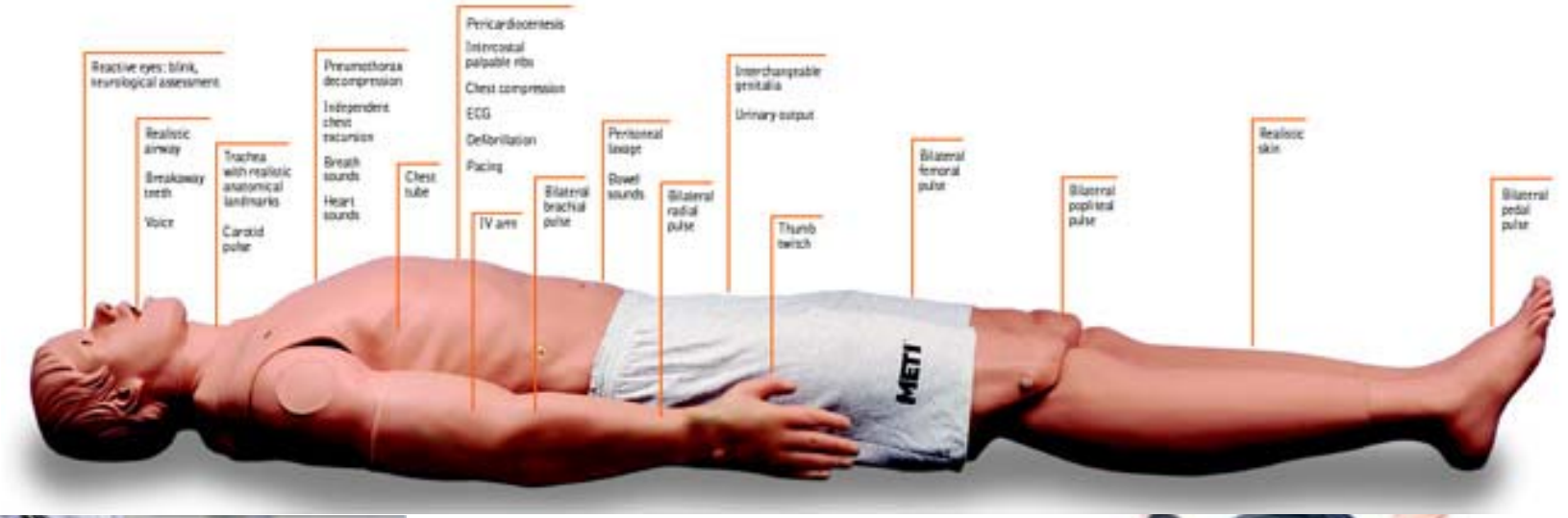
- Airway Management
- Chest Trauma - ATLS
- Venepuncture
- Injection Technique
- Central Line Management
- Patient Care
- Diagnostic Procedures
- Urinary Catheterisation

## Specialist Skills

Products for specialist and surgical skills training

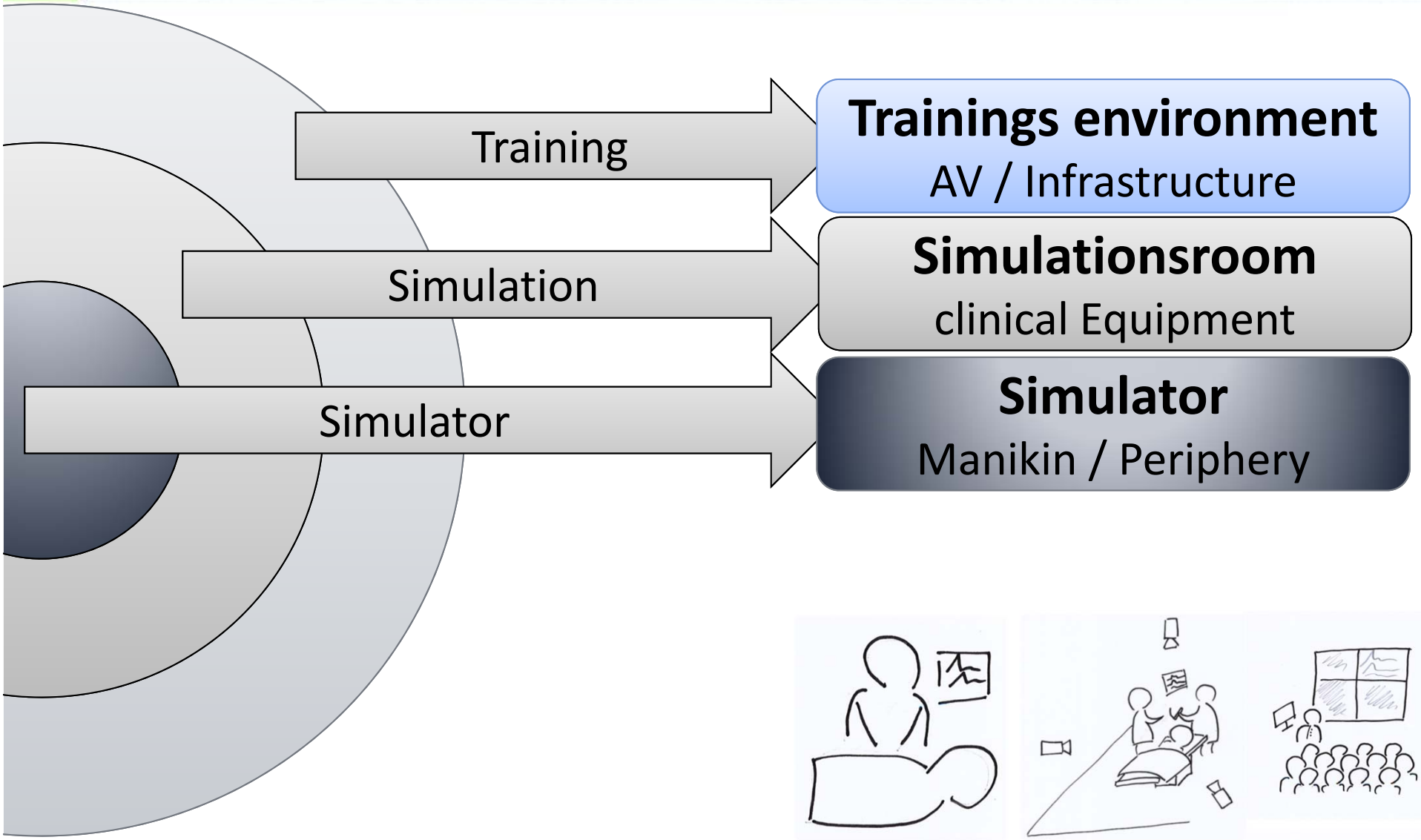
- Basic Surgical Skills
- Minor Surgery
- Joint Injection
- General Surgery
- Laparoscopic Surgery
- Gynaecology
- Obstetrics & Midwifery
- Paediatrics
- Urology
- Podiatry
- Vascular
- Wound Care
- Radiology
- E-learning
- OSCEs

# Modern Simulators

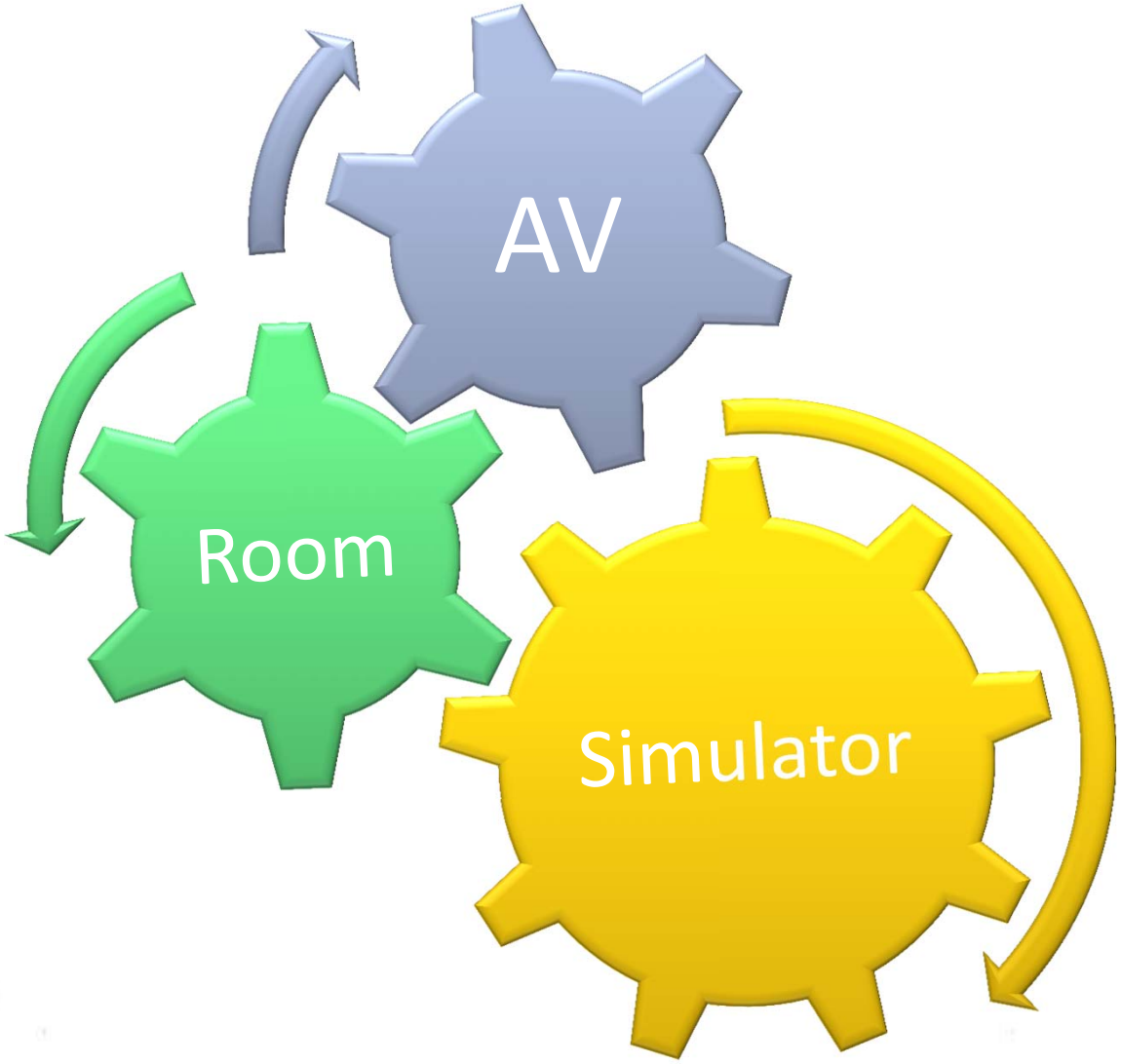


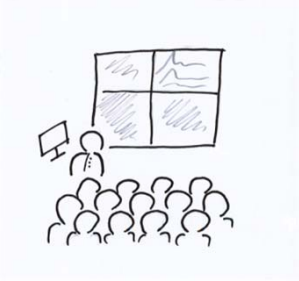
| Type of Training | Type of Simulator | AV |
|---|---|---|
| **Skilltraining** | Part-Task-Trainer | 1x Camera (Webcam)<br>PiP additional information<br>1x Microphon (Webcam)<br>1x Recording (PC) |
| **Basic Simulations-training** | Basic-Simulation-manikin<br>z.B. CPR | 1x Camera (Webcam)<br>PiP additional information<br>1x Microphone (Webcam)<br>1x Recording (PC) |
| **Simulationstraining for one profession** | Simulation-manikin | 3x Cameras<br>1x Microphone<br>1x Recording (PC) |
| **Simulationtraining for multiprofessional teams** | Simulation-mainikin<br>+ add Simulatoren<br>(Ultrasound etc)<br>Simulatormainikin | Min.<br>3x Cameras<br>1x Cameraswitch ?<br>1x Microphone<br>1x Recording (PC) |

# SimulationTraining



# SimulationTraining





# SimCenters have to be a safe place

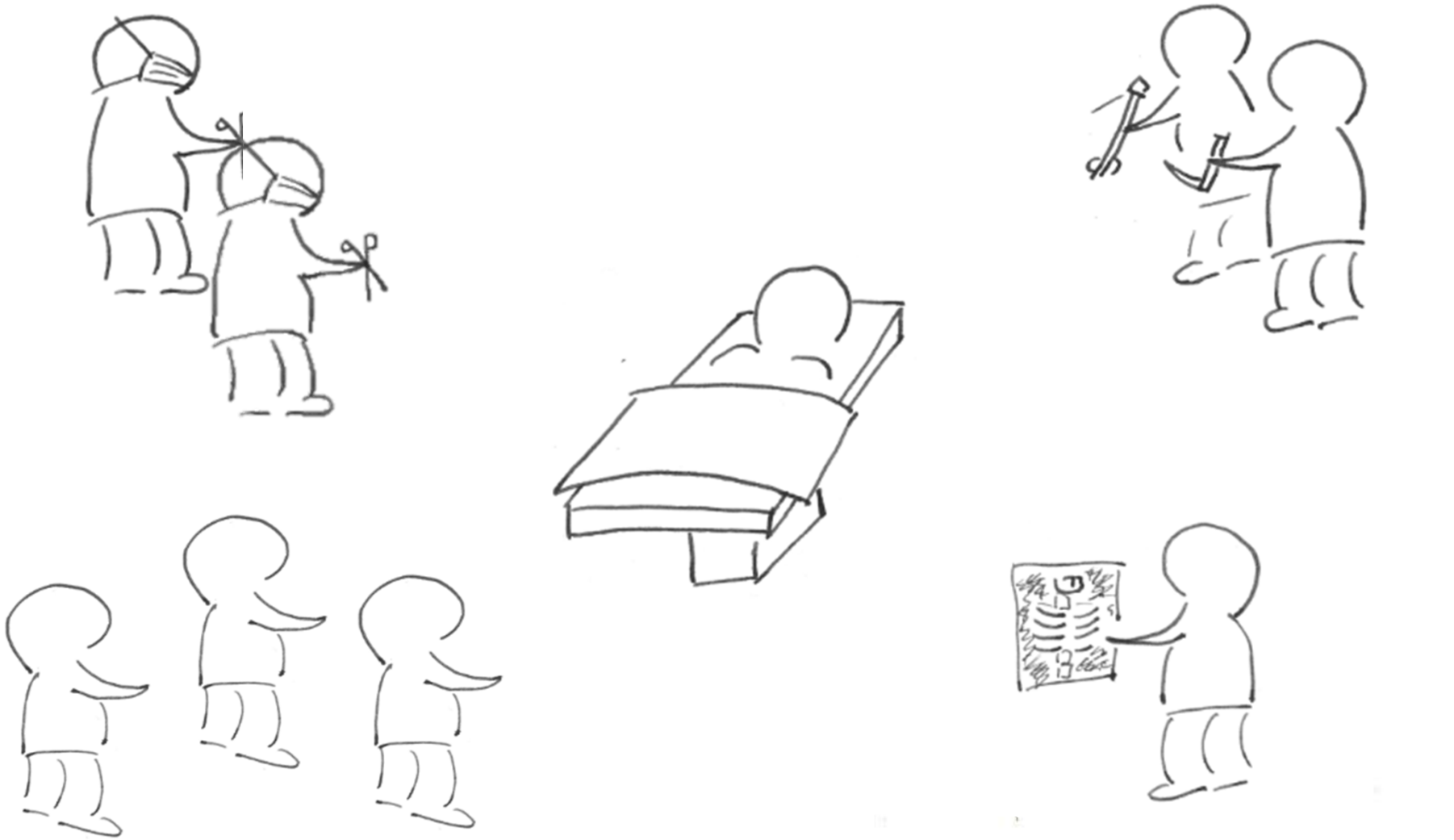
Psychological
safety

# leaving them alone

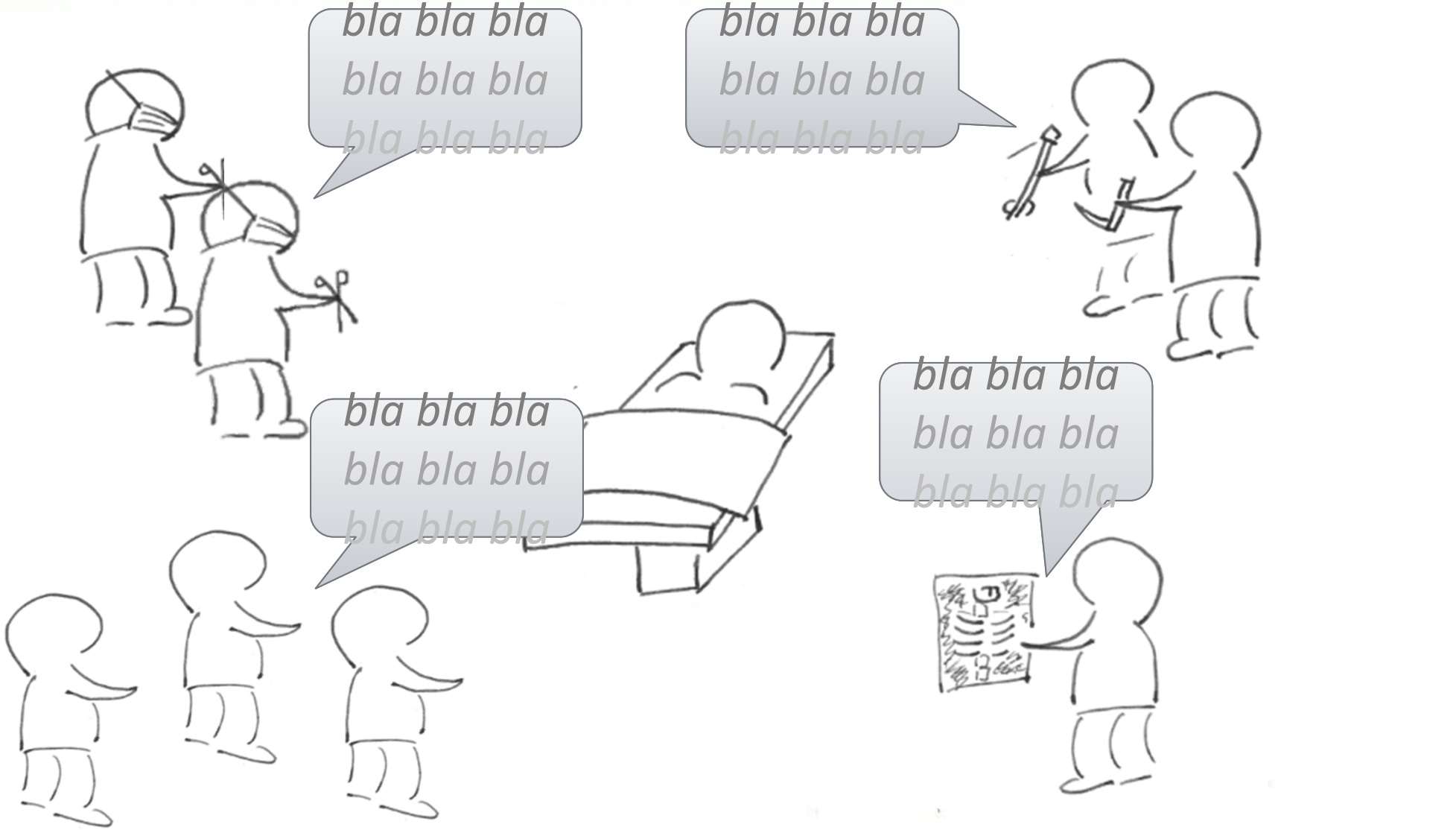
# Planning a course

- Course design
- Participants
- Learning Goals
- Simulator
- AV Technology
- Add-on technology?

# Participants

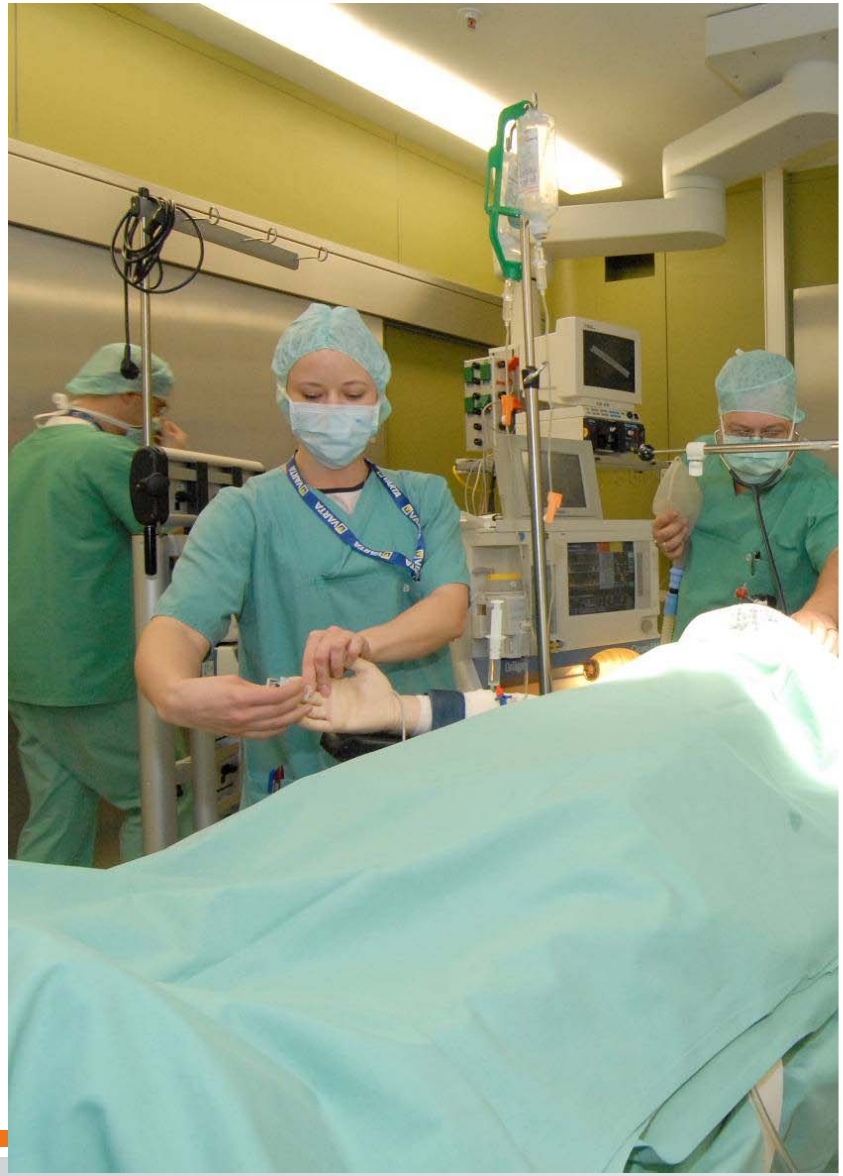


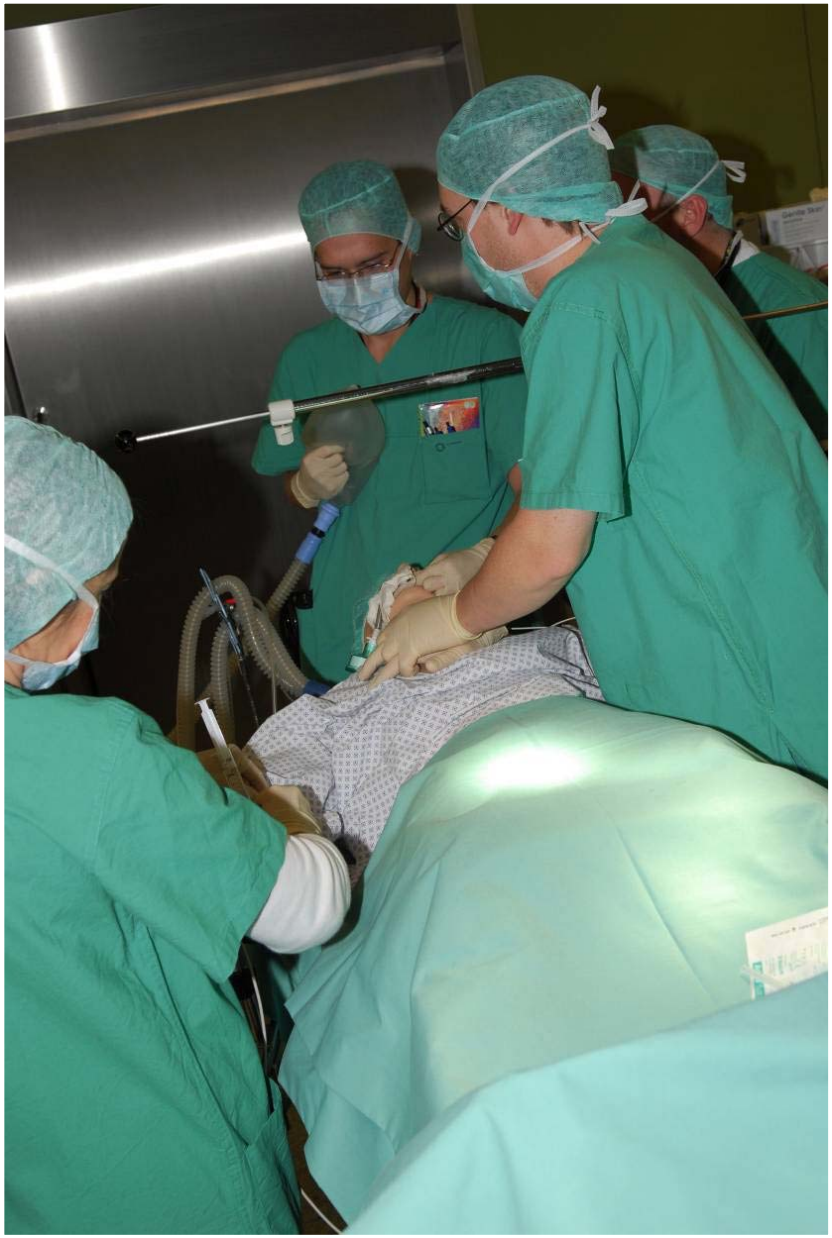
# Technical challanges



# Some possible „in-situ“ trainings

# Training in an OR





# Training inside a LearJet

# Ambulance Team training

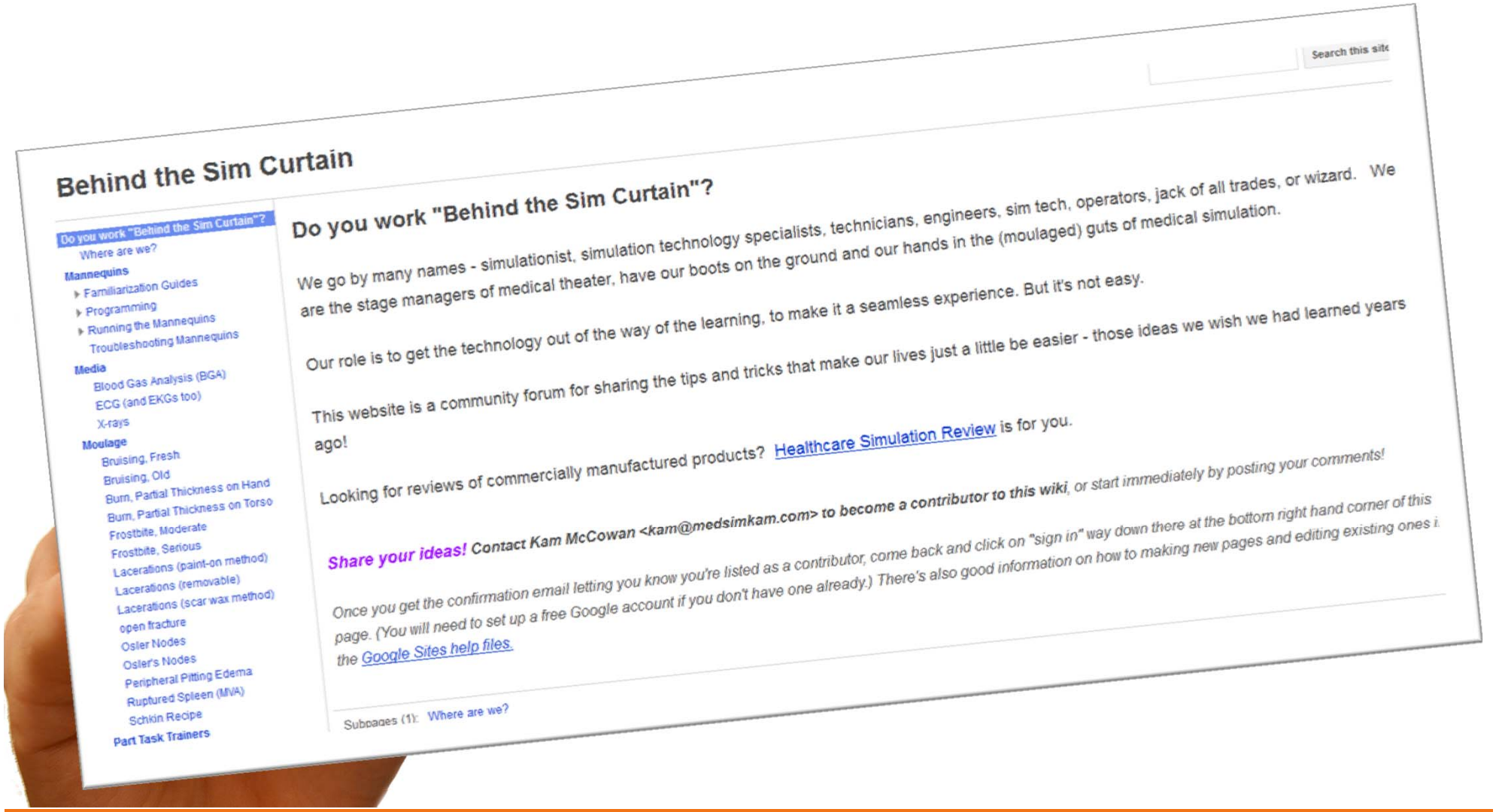
Links &
Information on
the web

# http://thesimtech.com/

# http://healthysimulation.com/

# http://www.simghosts.org/

# http://www.behindthesimcurtain.com/



# more useful pages

- Simulation User Network (SUN) Laerdal http://simulation.laerdal.com
- isimtech.org
- isiulate.com.au
- www.medworldlive.com

http://sourceforge.net/projects/vitalsignsim/

more Information on

http://healthysimulation.com

## Free Downloadable Vital Sign Simulator & Patient Monitor

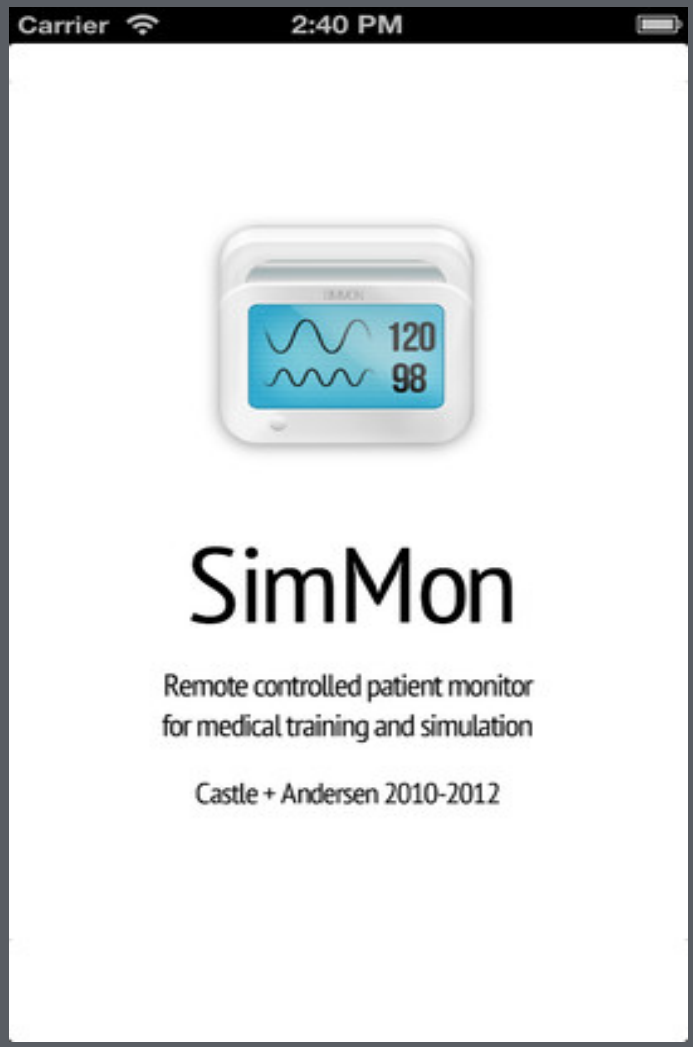
Florian Schwander, ER-nurse and mega-code instructor from Switzerland wrote to HealthySimulation.com to share his new software for emergency medicine simulations: The Vital Sign Simulator. This downloadable program is an open-source project, free to use and modify!

The vital sign simulator is intended for use in medical emergency training simulations. In combination with an affordable low-fidelity cpr-manikin, VSS offers a low-cost alternative to commercial high-fidelity patient simulation monitors. Vital Sign Simulator (VSS) acts as a vital sign monitor / defibrillation unit. The operator can change various values such as heartrate, blood pressure, ecg-rhythm etc; while the trainee can perform a defibrillation, pacing etc on a separate interface. VSS is used with a split-screen system, one monitor with controls for the operator and one providing the vital signs to the trainees. Heart rate, oxygen saturation, respiratory rate, blood pressure and various moving ecg-samples can be set and changed at any time by the operator. Scenario log files can be exported to an .rtf file for documentation debriefing.

# Apps @ itunes

## SimMonitor 2,69€
Med-eSim Apps

## SimMon 14,49 €
Castle Andersen ApS

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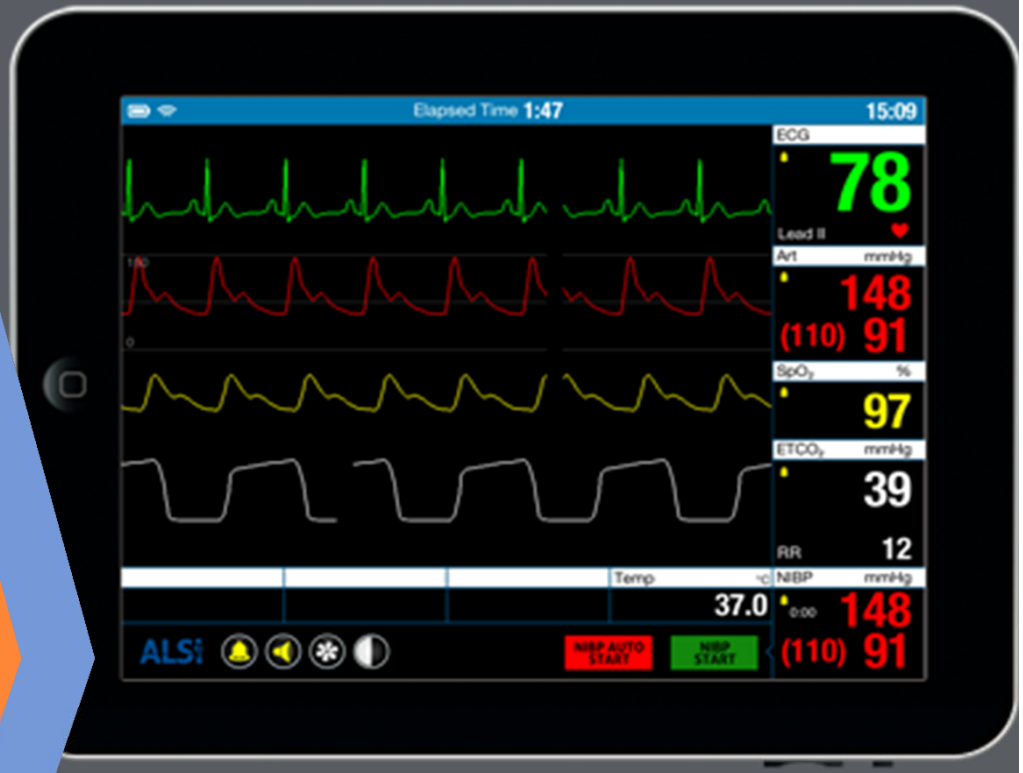
Patientensicherheit und Simulation

iSimulate

www.isimulatetechnologies.com

# ALSi
# CTGi

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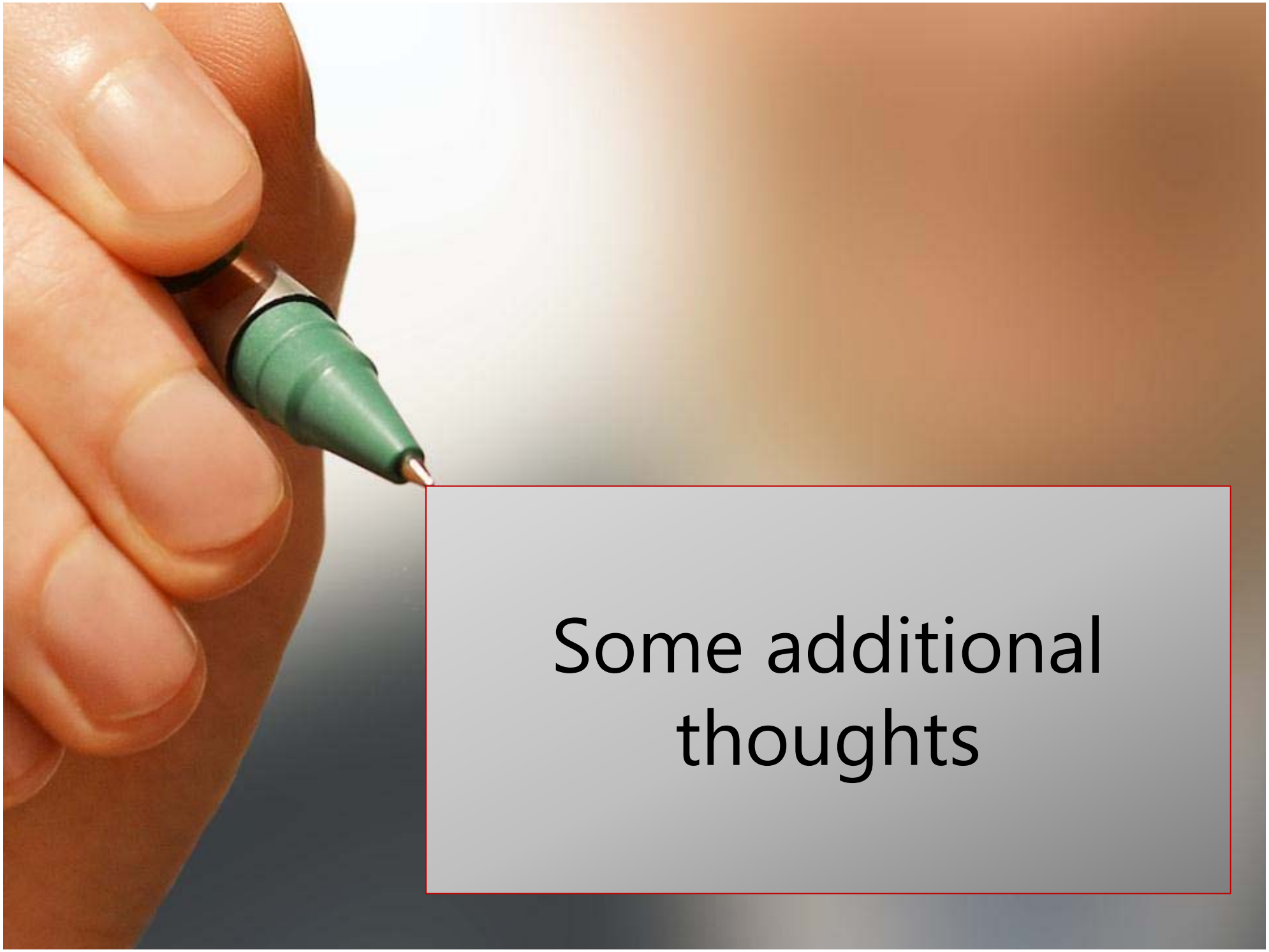
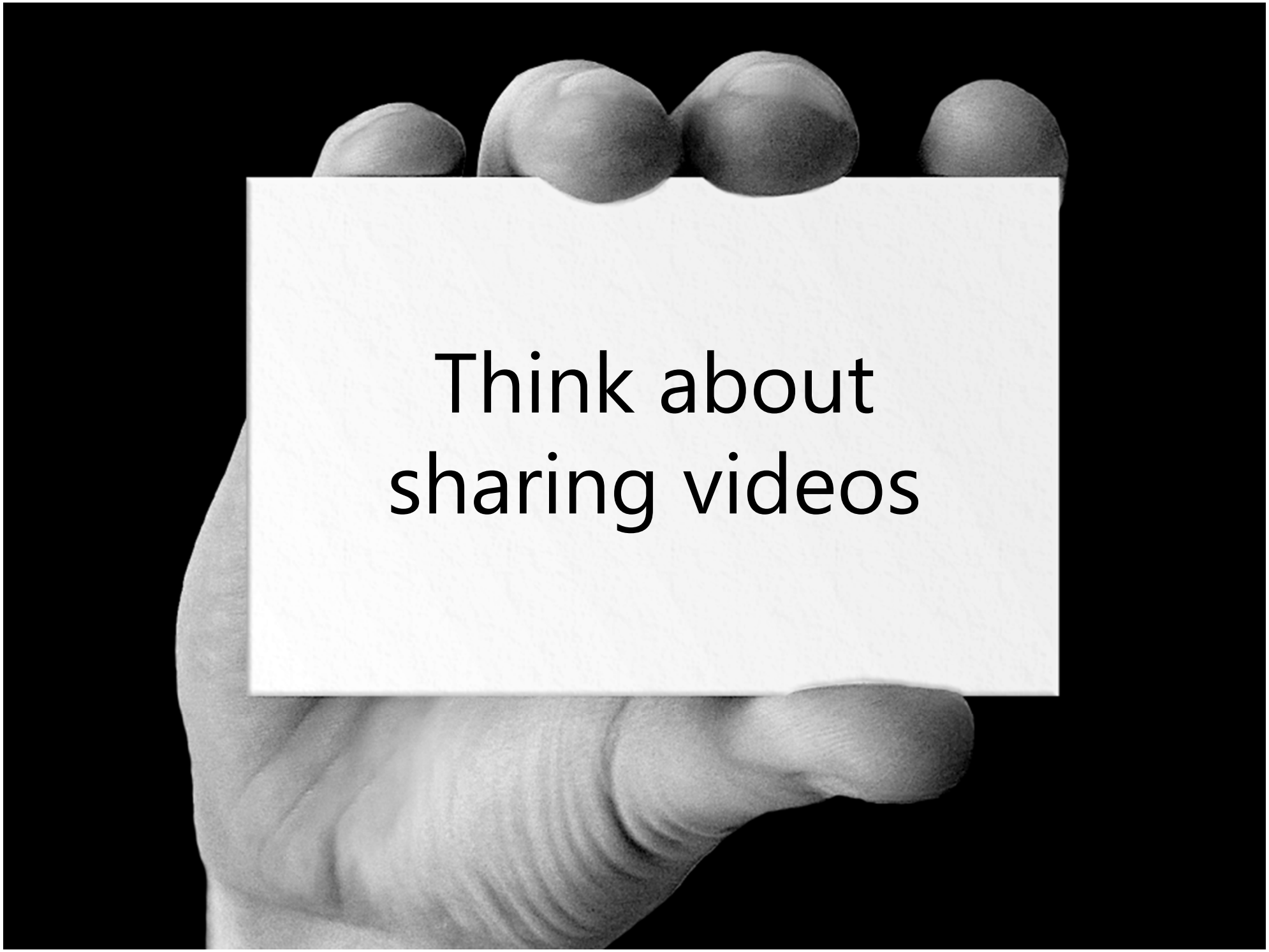
Patientensicherheit und Simulation

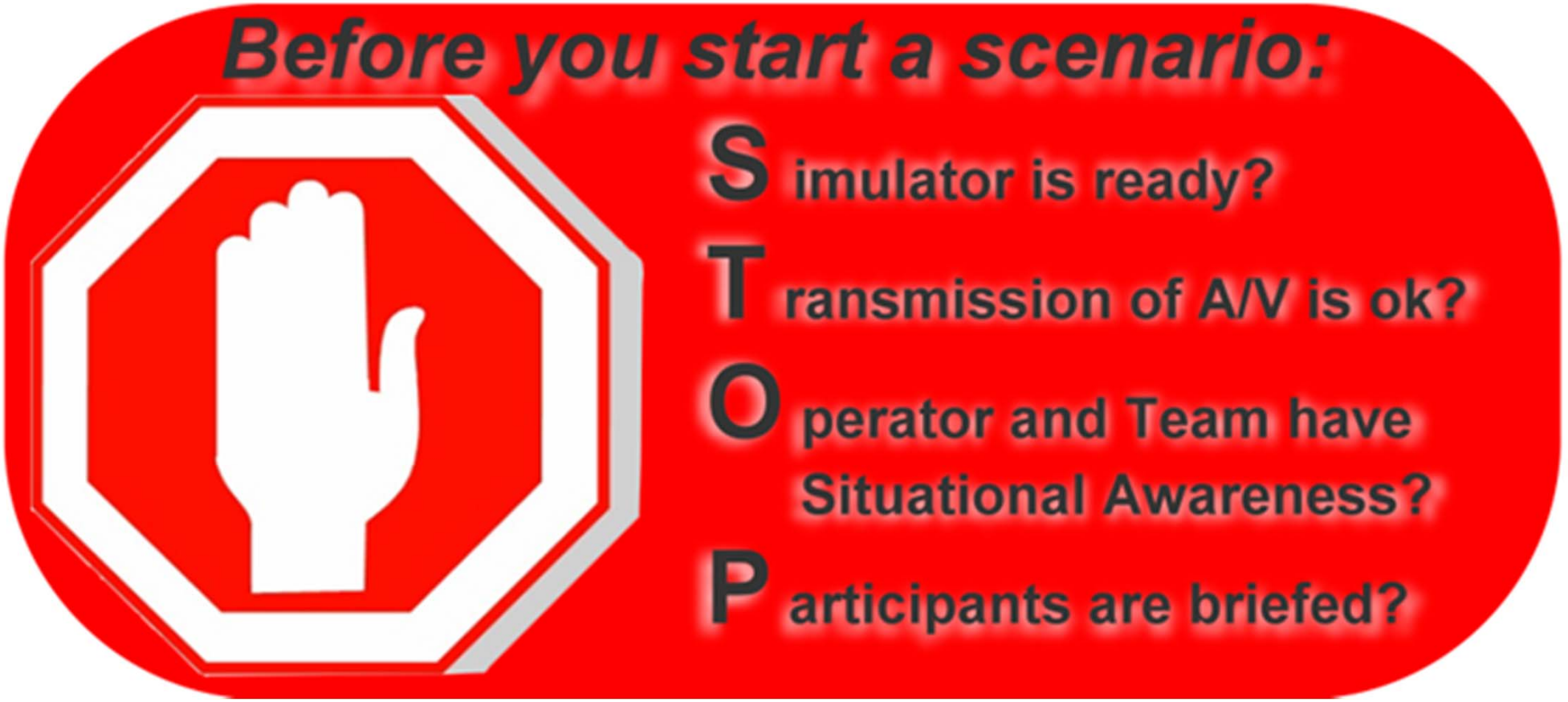
We've listened and we have a new price structure.
Standard membership is $2000 with an annual fee of $500.
Premium membership is $4900 with nothing more to pay.
Membership gets you all the app updates, and a chance to decide on the future of the apeps from iSimulate. What do you want ALSi to do? Tell us and we will listen.
We believe this is the most cost effective way to do simulation anywhere, anytime.
No more expensive manikins.

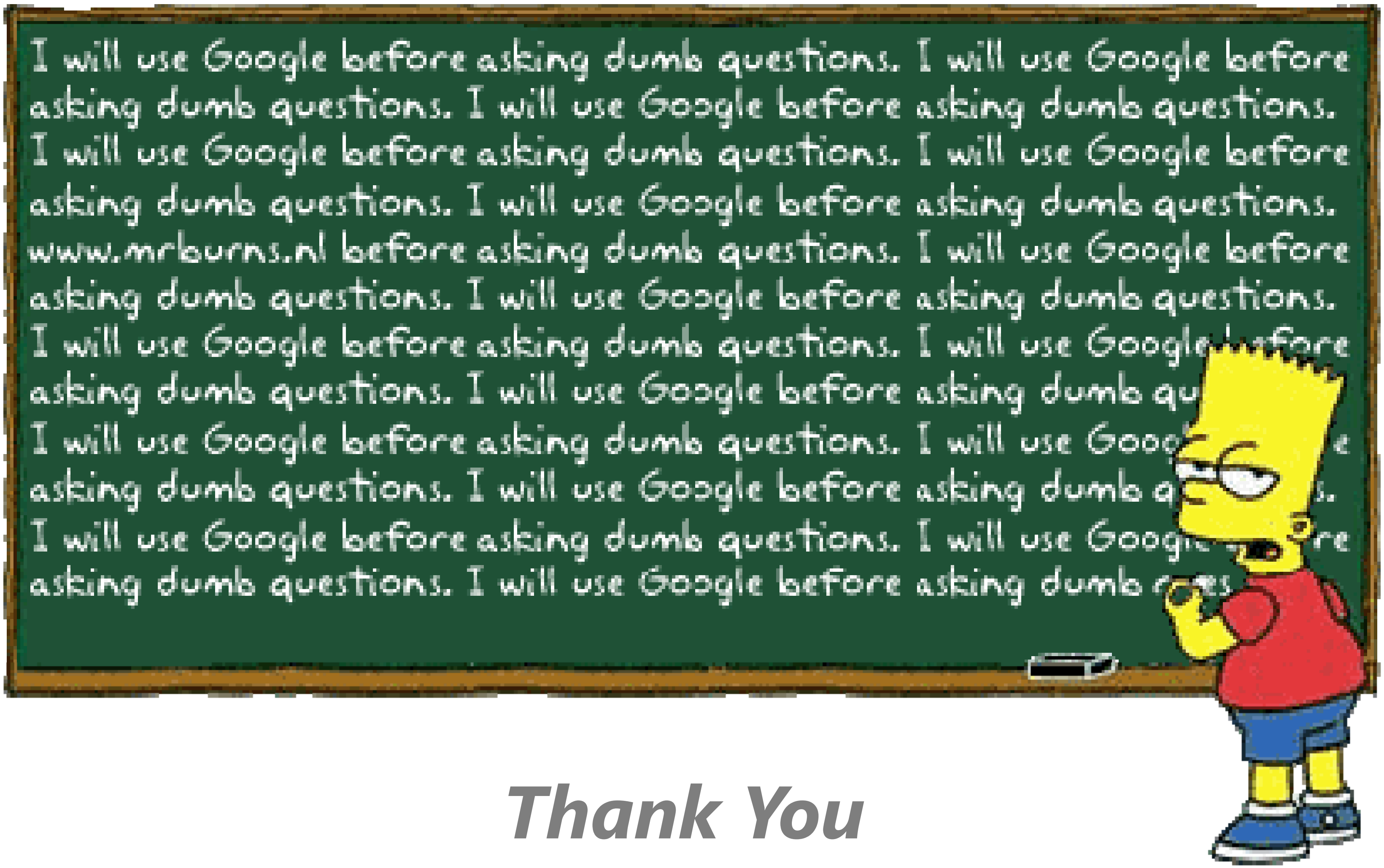

Some additional thoughts


Think about
sharing videos

Starting a
simulation
THE SCENARIO

# STOP Procedure






***Thank You***

***eric.stricker@tupass.de***