

Lessons Learned from Customizing and Applying ACTA to Design a Novel Device for Emergency Medical Care



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DER FORSCHUNG | DER LEHRE | DER BILDUNG

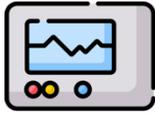
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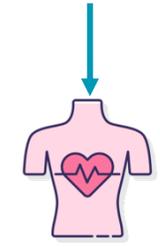
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Emergency Medical Care

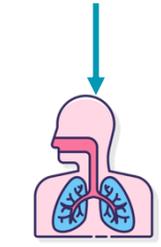
Current Situation:



Vital Signs



Resuscitation



Ventilation



Desired Situation:



Applied Cognitive Task Analysis (ACTA)



- Developed by Militello and Hutton (1998)
- Based on the Cognitive Task Analysis (CTA)



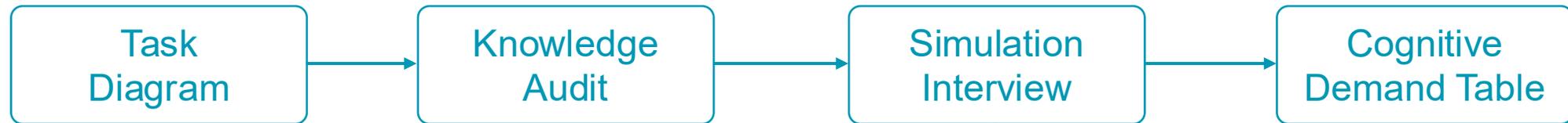
CTA

streamline

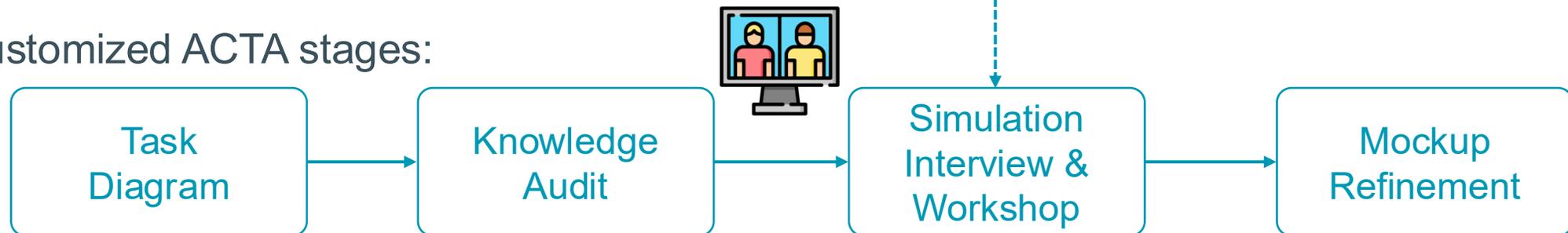
ACTA



Original ACTA stages:



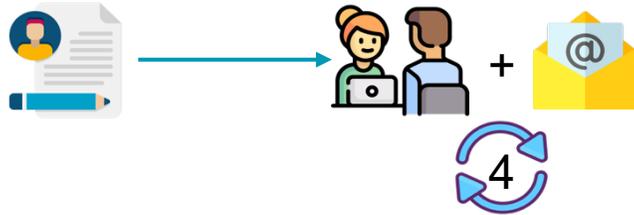
Customized ACTA stages:



Stage 1: Task Diagram

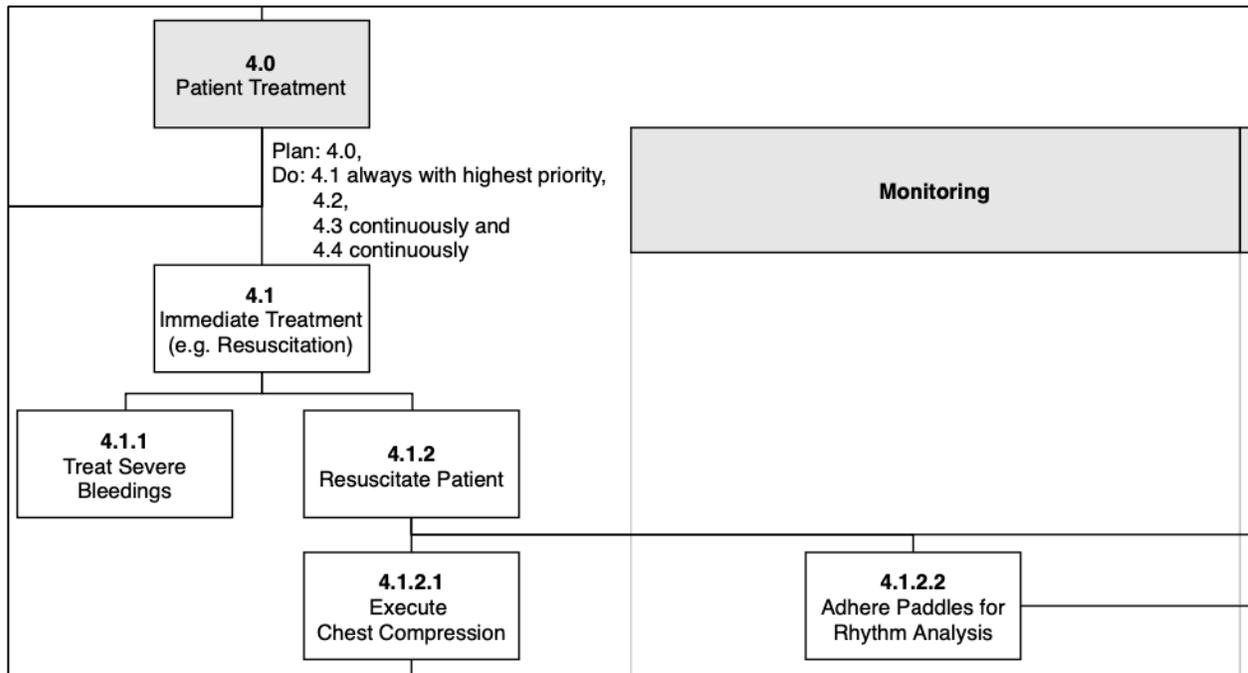


Get an overview of all emergency-related tasks



Conduct collaborative interviews in multiple iterations

synchronous
+
asynchronous



Hierarchical Task Analysis (HTA) diagram

Stage 2: Knowledge Audit



Document cognitive difficulties in a knowledge audit table

Transcribe and evaluate each interview during this stage



258 – 7000 emergencies

4 – 21 years experience

3x ♀ 8x ♂

ACTA guideline questions:

- Big Picture
- Past and Future
- Noticing
- Equipment Difficulties
- Job Smarts
- ...



>340 difficulties
(+ cues and mitigation strategies)

Example:
Measuring SpO2 in cold environments
can lead to inaccurate values.

Stage 3: Simulation Interview & Workshop



Understand the decisions of experts in difficult situations

+

Collect UI sketches of a combined medical device



- Two cross-functional teams
- 6 hours of digital sketching and discussions



1. Scenario presentation
2. Sketching
3. Presentation & feedback
4. Iterate
5. Repeat

Use Case 1 - Only Monitoring

Use Case Description

Iteration 1

This is a copy of the slide for the use case description.

You can create your sketches here.

M1 S1 - Monitor/Smartwatch/ Google G...

Anwendungsbeispiel 1 „nur Monitoring“

RTW (2 RettAss/NotSan [RTWler] und 1 Praktikant) und NEF (1 NotSan und 1 Notarzt)
Altbau, 3. Stock, kein Fahrstuhl

04:25 Uhr

Setting:
Patient im Sessel, gestresst, unruhig, (Sprech-)Dyspnoe, Todesangst, kaltschweißig, fahl-grau

Vorerkrankungen:
Z.n. Herzinfarkt vor ca. 10 Jahren, Z.n. Bypass-OP und Koronar-Stenting, art. Hypertonie, Diabetes mellitus

Befunde:

- SpO₂: 65 %
- HF: 120/min
- RR: 152/109 mmHg
- Tachypnoe
- grobblasige RG, Husten, Brustschmerz (drückend, eng)

Stage 3: Simulation Interview & Workshop

Results:

- 34 sketches of device screens (with increasing complexity)
- 2/3 of participants would have preferred an on-site workshop



Make the participants feel welcomed.



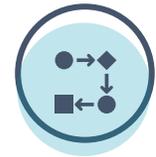
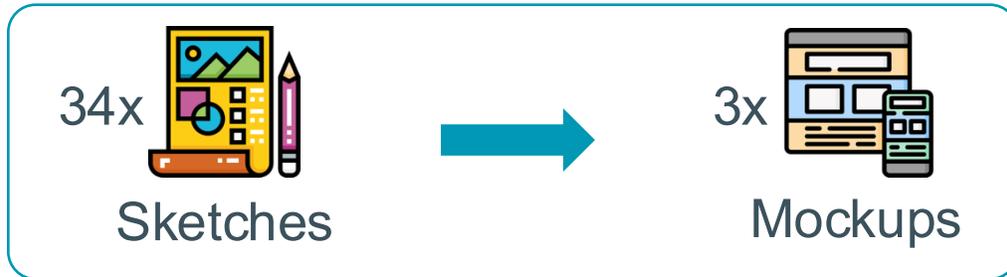
The digital workshop led to opportunities we would not have reached otherwise.



Participants should not think about the requirements and design process. Instead, they should focus on the creative tasks.



Stage 4: Mockup Refinement



First team	Second team	Final mockup
<div style="display: flex; gap: 5px;"> <div style="background-color: #4a7ebb; color: white; padding: 2px 5px;">xyz</div> <div style="background-color: #e67e22; color: white; padding: 2px 5px;">lorem</div> <div style="background-color: #27ae60; color: white; padding: 2px 5px;">amet</div> </div>	<div style="display: flex; gap: 5px;"> <div style="background-color: #e67e22; color: white; padding: 2px 5px;">lorem</div> <div style="background-color: #e67e22; color: white; padding: 2px 5px;">ipsum</div> <div style="background-color: #f1c40f; color: white; padding: 2px 5px;">dolor</div> </div>	
		
		



2x
8 hours

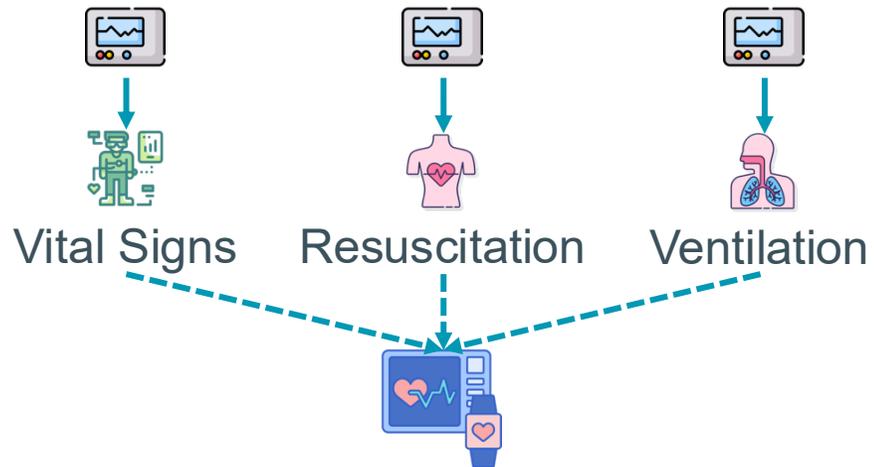
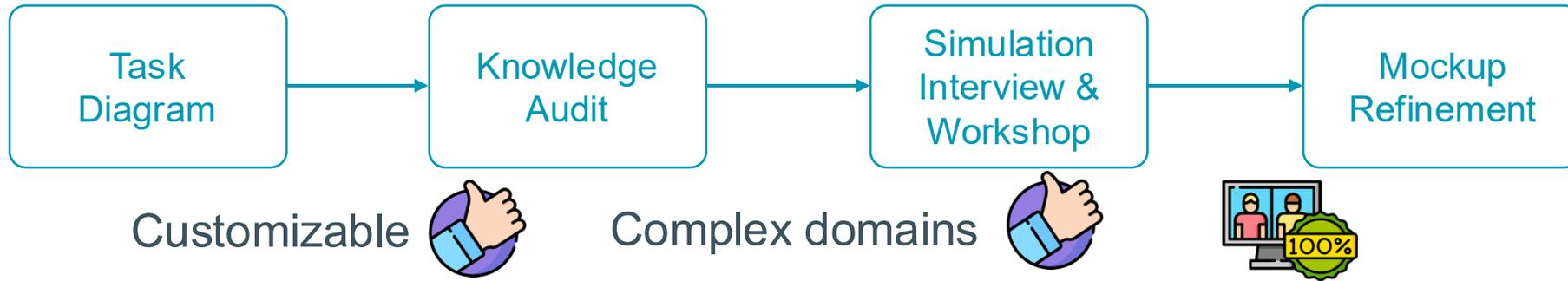


21 numerical parameters
+ 10 additional graphs

 **Have preliminary requirements at hand.**

Summary

Applied Cognitive Task Analysis (ACTA)



1 HTA diagram
340 difficulties
34 sketches
3 mockups
6 Lessons learned

What's next?

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<https://arxiv.org/abs/2108.05622>



<https://uhh.de/mast>

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Abstract—Preclinical patient care is both mentally and physically challenging and exhausting for emergency teams. The teams intensively use medical technology to help the patient on site. However, they must carry and handle multiple heavy medical devices such as a monitor for the patient's vital signs, a ventilator

Therefore, depending on the scene and the communicated state of the patient, the emergency team decides beforehand which devices they carry from the ambulance to the scene. In case they need additional equipment, one of the team