Dedicated to innovation in aerospace

Using blended learning to make AR work in maintenance error reduction

Anneke Nabben | FSF- IASS 2019 | Taipei

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https://digitaltmuseum.org/021018293226/kalmar-telefonstation-fore-automatiseringen-1946-interior

https://www.theguardian.com/business/picture/2015/mar/10/kipper-williams-on-the-apple-watch

Source: https://www.marketingfacts.nl/berichten/waarom-zou-een-ziekenhuismedewerker-twitteren

Source: http://www.b737.org.uk/flightinstsmax-maint.htm
Onboard Maintenance Function - www.b737.org.uk

Four Human Risks

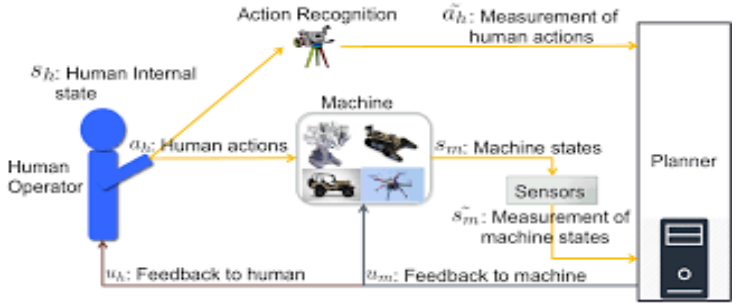
Complacency

Automation bias

Skill decay

Skill atrophy

Mitigation strategies



Automation design

Training

Requirements mitigation by training

- Work with automated system
- Problem based training
- Performance without automation
- Experience non accuracy
- Recurrent training

Starting point

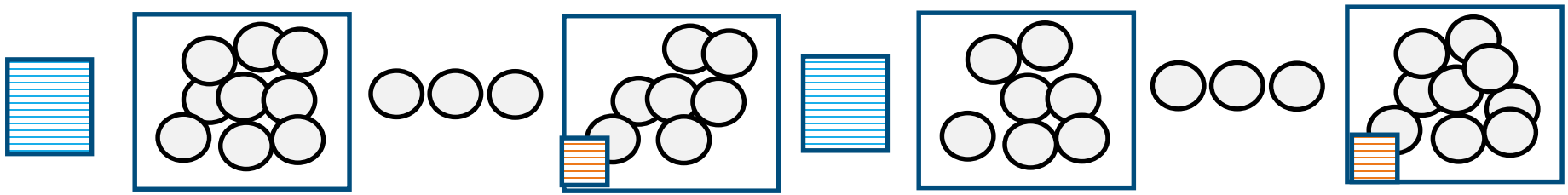
Training needs

Training concept

Training design

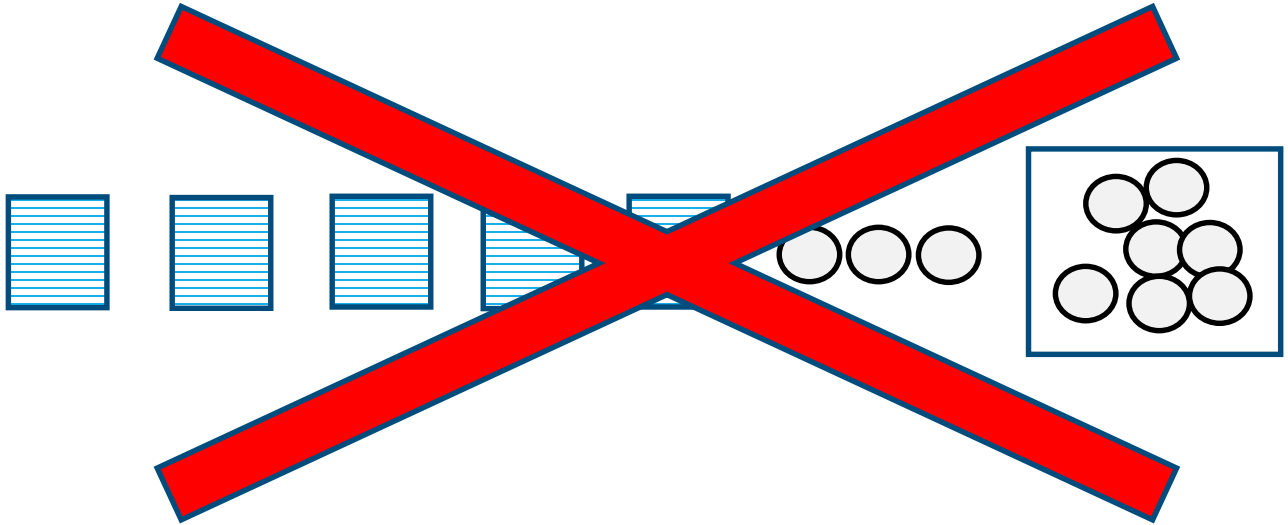
Training media

Training design



Supporting & JIT theory

Training design



Training media selection

Cool technology!

Promises!

Training media user requirements?

Training requirements

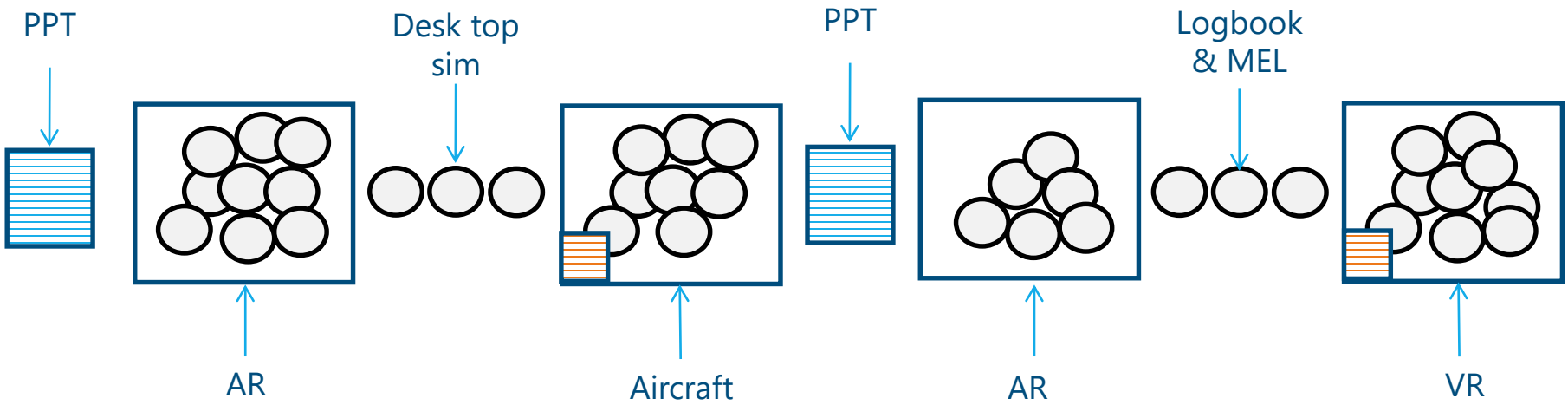
- Cooperation
- Coaching
- Performance Monitoring
- Adaptivity
- Complexity Factors
- Instructor Operating requirements

Technical requirements

- Aircraft, system and cockpit physics
- Aircraft, System and cockpit behaviour
- Tools
- Environment

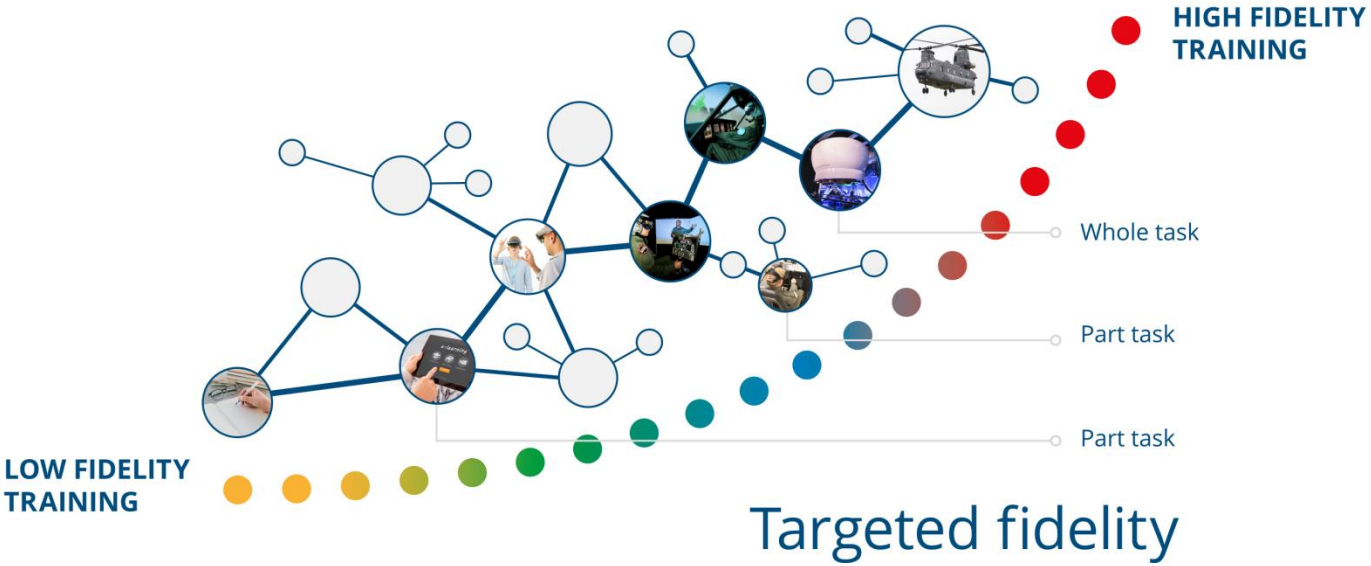
FUTURE PROOF

Training media

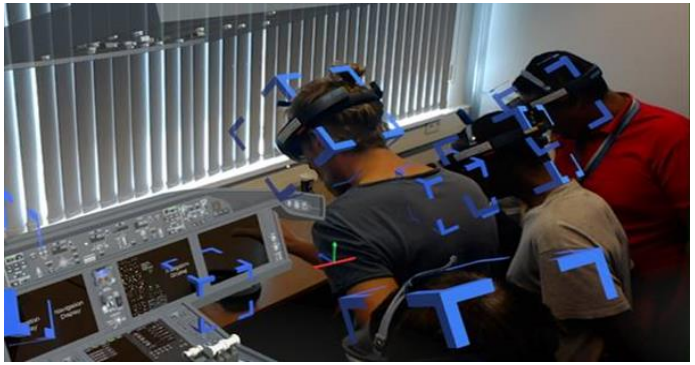


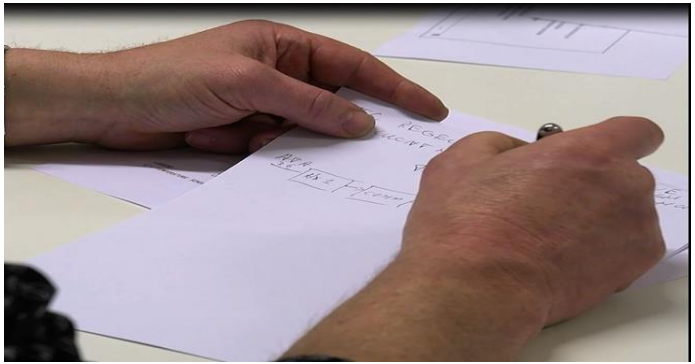
Final selection

Blended Learning Environment Process



KLM blended learning project





Active problem solving without automation:

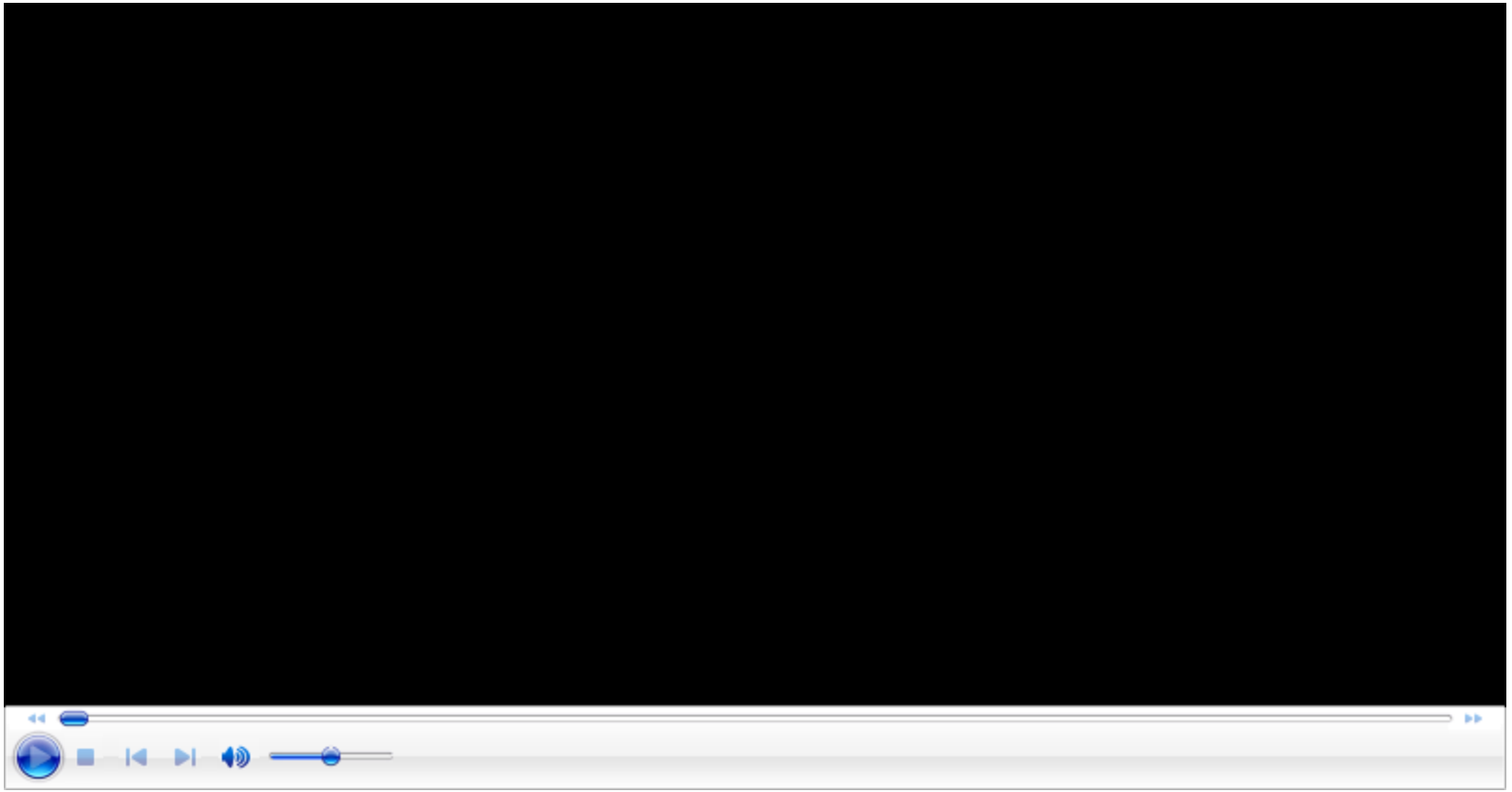
- Supports system understanding
- Prevents automation risks

Sharing is key

User requirements:

- Cooperation in problem solving
- Using system description manuals

Teaser



Experiment

Control group

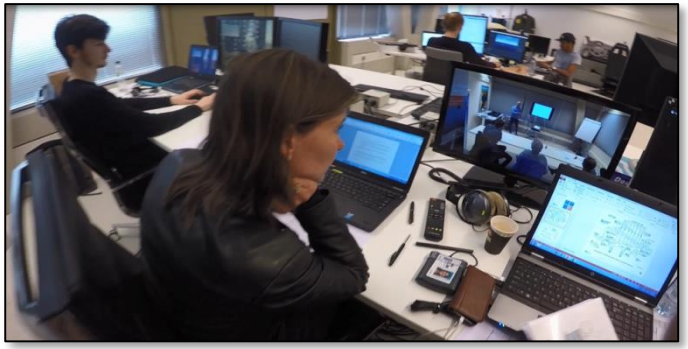
Traditional training	3 experienced mechanics 3 basic training students
Evaluation	Trainee experience knowledge Impact

AR group

New training	3 experienced mechanics 3 basic training students
Evaluation	Trainee experience knowledge Impact

Compare Results

Augmented Reality for Maintenance Training



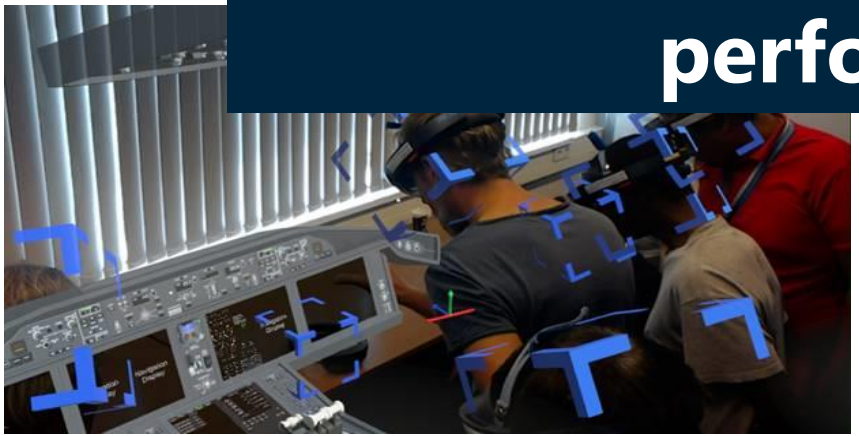
Criteria	Subcriteria	AR	Traditional
System knowledge & comprehension	Active knowledge	83%	50%
	Passive knowledge	80%	73%
	Able to recall 2D (and 3D*) model	66%*	0%
	Confidence to apply knowledge into practice	83%	0% (50% felt to have only basic knowledge)
Impact measurement	Component location	64%	45%
	Explaining airflow	63%	19%
	Explaining function	33%	25%

Trainee feedback

Traditional training	Training with HoloLens
Good instructor skills	Student interaction Student collaboration Variety in training methods Transfer from 2D > 3D > Real
No student interaction Losing attention No supporting tools Passive: sit back & listen Too much information Lack system knowledge Training time too long	Comfort: HoloLens can be exhausting

Next steps

Part 147 Practical task performance



Advantages blended learning

When selected well and properly integrated in the training design:

- Practice without safety issues
- Motivating
- Learning styles
- Accessible
- Formal/ informal

Deep understanding

Faster

Less mistakes

Improved safety

Thanks!

Dedicated to innovation in aerospace

Fully engaged

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Foundations role

1. Assemble an AeroSafety World or website article to highlight the usefulness of a process to select media and build blended learning environments
2. Invite early adopters around the world to share lessons learned in introducing innovative training media