Integrated Airport Operations: Human Performance Assessment

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IAO
INTEGRATED AIRPORT
OPERATIONS

DLR   AT-One

Automation and Human Performance Why bother?

Ironies of Automation [Bainbridge 1983]
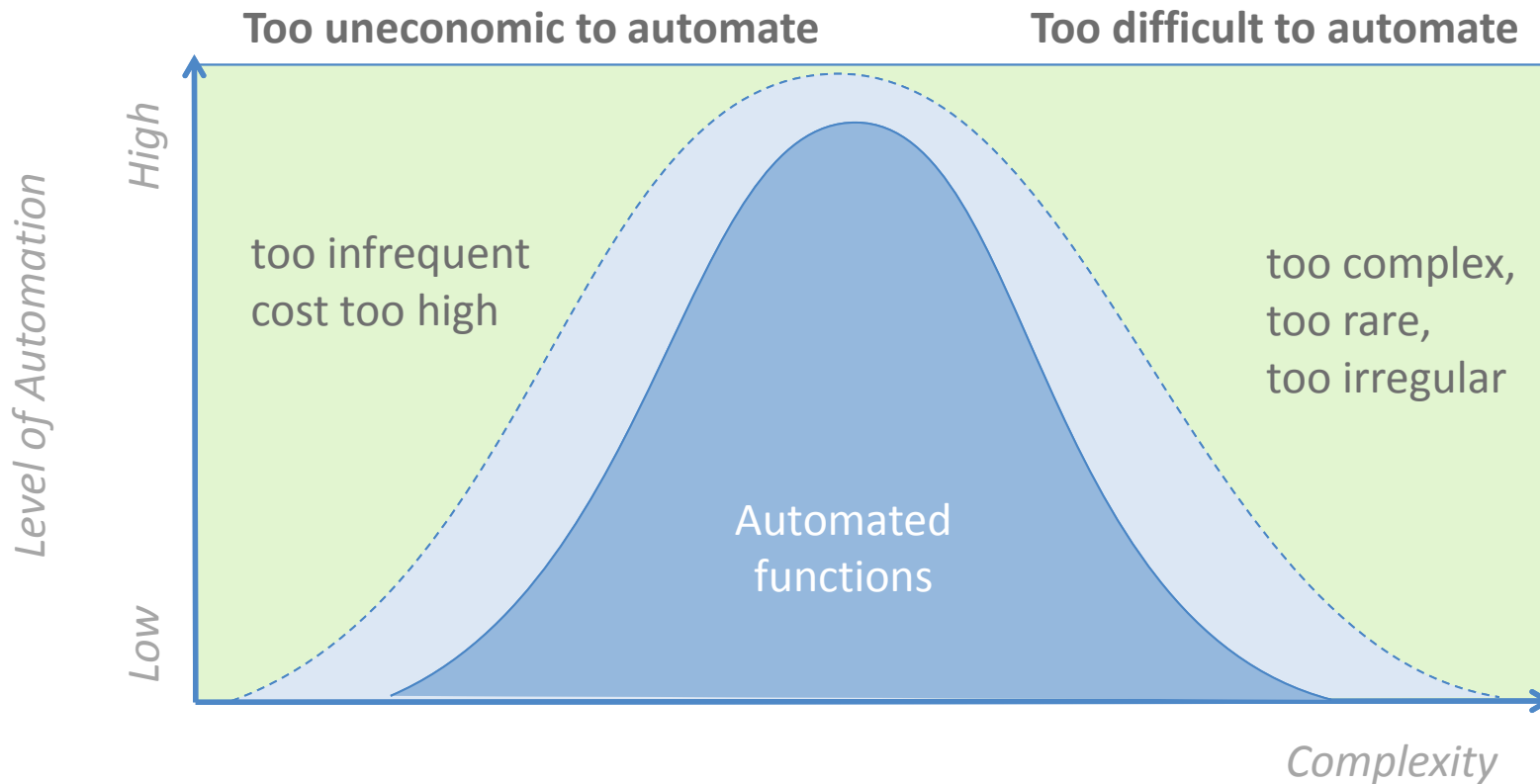
Left-Over Design Principle

Comparison Principle (MABA-MABA)

Automation and Human Performance Why bother?

Left-Over Design Principle

Too uneconomic to automate   Too difficult to automate

Level of Automation

High

Low

too infrequent
cost too high

too complex,
too rare,
too irregular
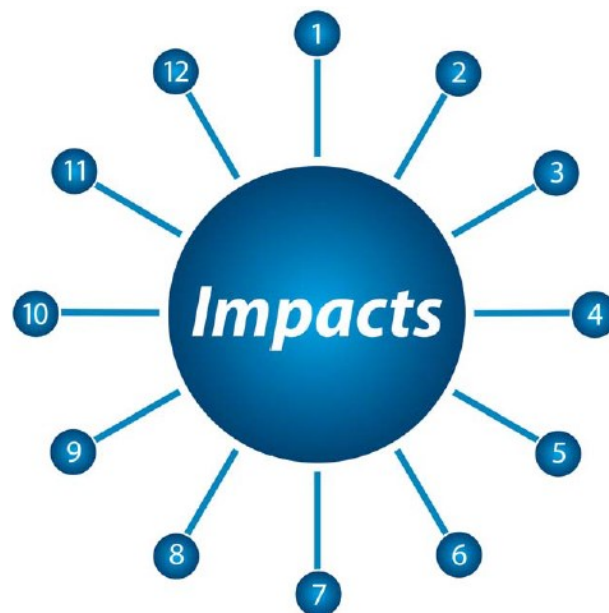
Automated
functions

Complexity

What is not automated is left for the operator

[e.g. Hollnagl, 2003]

Human Performance Assessment

1. Understand the ATM Concept → Reference Scenario vs. Solution Scenario

2. Identify Nature of Change (HP issues) and generate assumptions

3. Collect evidence to support assumptions → requirements and recommendations

Impacts

1. Acceptance
2. Cognitive Processes
3. Comfort
4. Error
5. Fatigue
6. Job Satisfaction
7. Motivation
8. Situational Awareness
9. Skill Change
10. Stress
11. Trust
12. Workload

Human Performance
What is relevant for IAO?

HP argument branch	Change & affected actors
1. ROLES & RESPONSIBILITIES	
1.1 ROLES & RESPONSIBILITIES	
1.2 OPERATING METHODS	ATCOs have to update the system with clearances given by voice to the aircraft.
1.3 TASKS	ATCOs are assisted […]
2. HUMAN & SYSTEM	
2.1 ALLOCATION OF TASKS (HUMAN & SYSTEM)	Route management constitutes a change in the allocation of tasks and would require HP assessment contribution.
2.2 PERFORMANCE OF TECHNICAL SYSTEM	The routing function shall propose suitable routes […]
2.3 HUMAN – MACHINE INTERFACE	System update is a critical issue related to alert functions […]
3. TEAMS & COMMUNICATION	
3.1 TEAM COMPOSITION	
3.2 ALLOCATION OF TASKS	
3.3 COMMUNICATION	
4. HP RELATED TRANSITION FACTORS	
4.1 ACCEPTANCE & JOB SATISFACTION	ATCOs should accept new solutions […]
4.2 COMPETENCE REQUIREMENTS	
4.3 STAFFING REQ. & STAFFING LEVELS	

Human Performance Methods for shadow mode tests

„Think of the last shift you worked as a controller. Would you rate this shift as a normal shift? If not, think of the last normal shift"
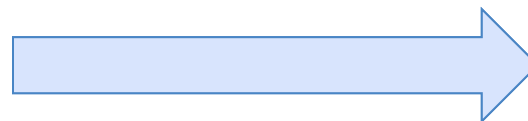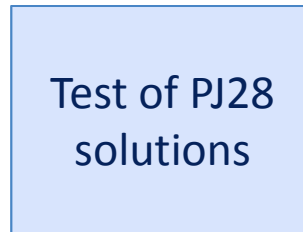
Mental Baseline
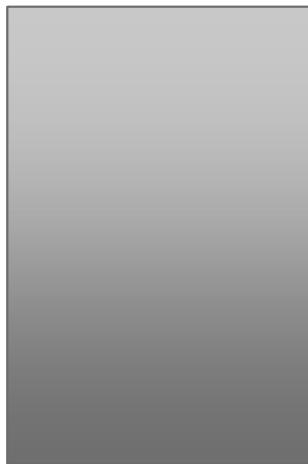
Solution

Interpretation of Δ

Test of PJ28 solutions

Data Acquisition Hamburg
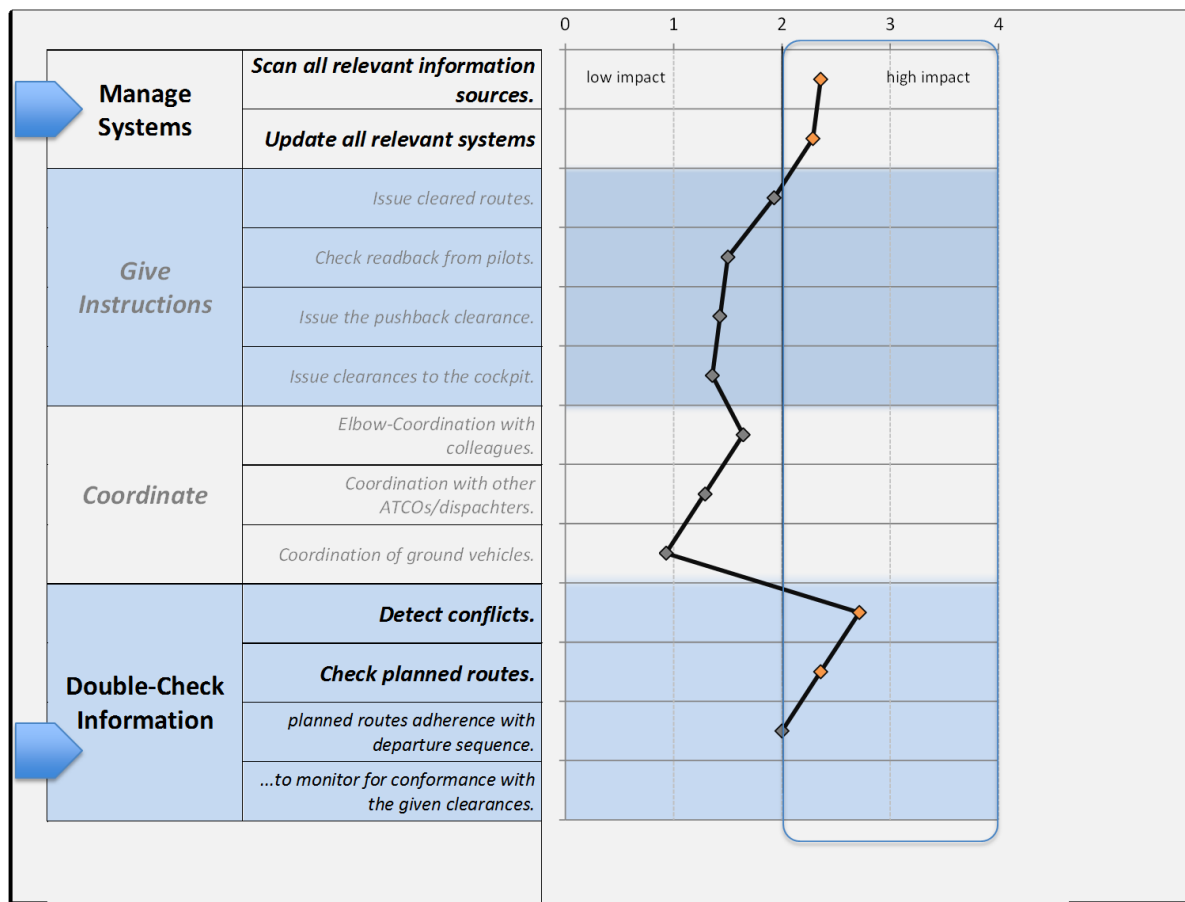
N = 14 Controllers

6 female

age: 25-51 ys (mean 38,1)

Experience: 3-27 ys (mean 11,9)

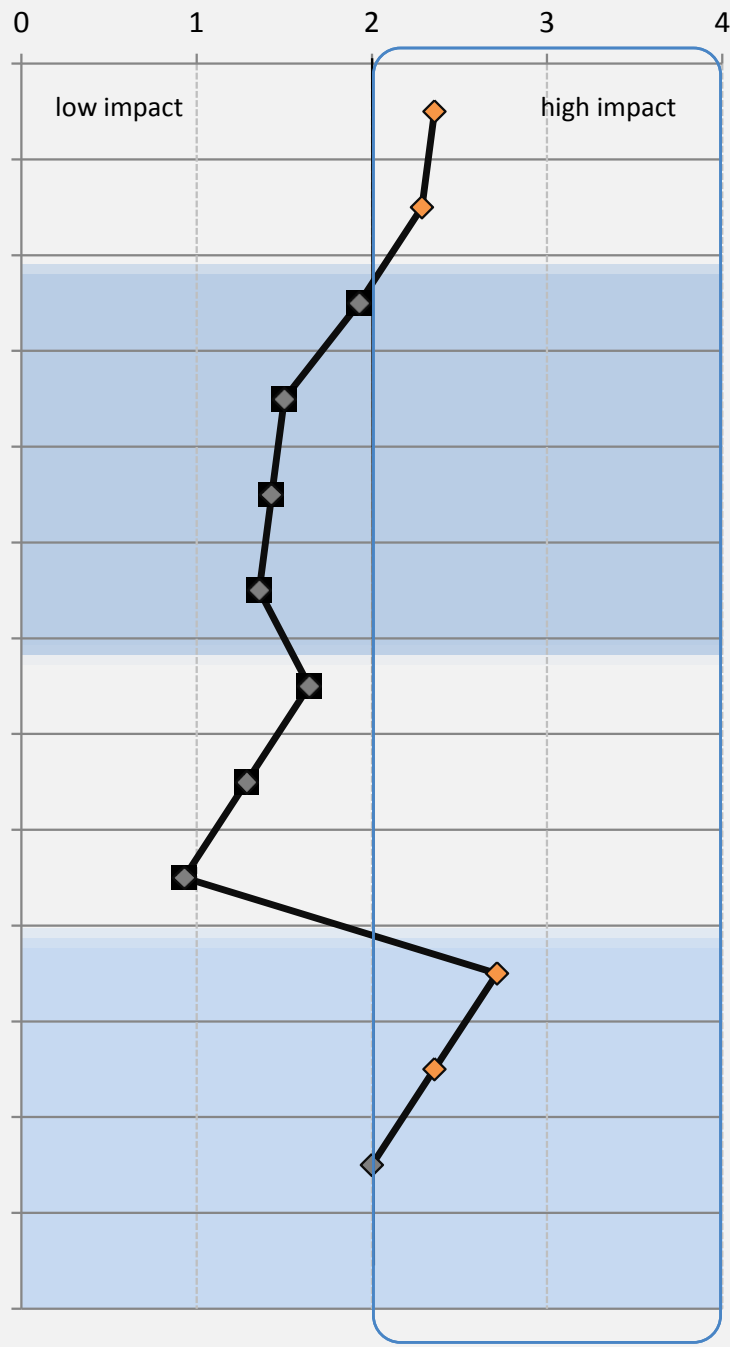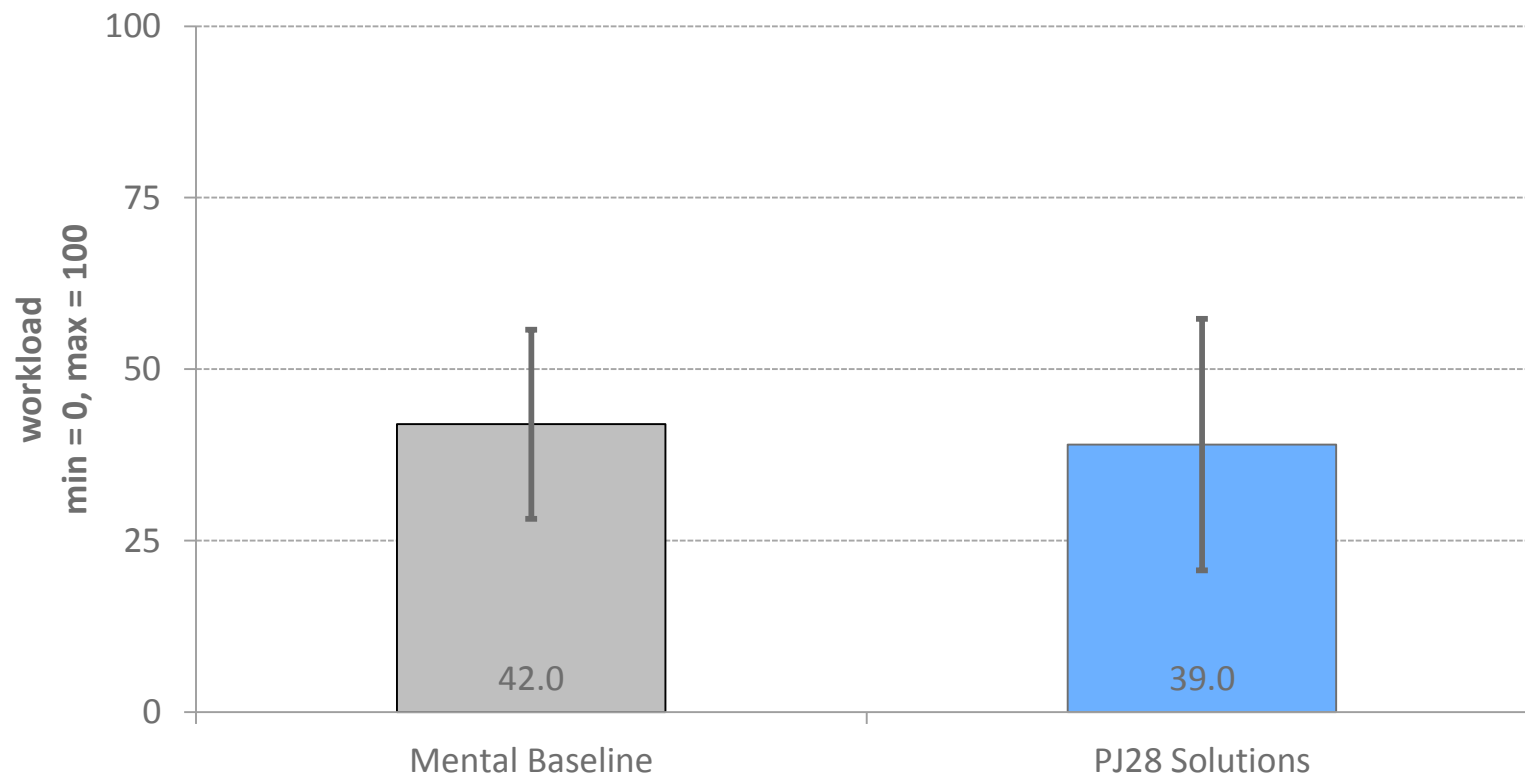| Time	
09:00	Introduction and Briefing PJ28; **Mental Baseline Questionnaire**
09:40	Workshop „Routing examples„ (paper-based: routing comparison of ATCO and algorithm)
10:40	Break
11:00	Introduction CWP and Hands-on Demonstration
12:15	Break
12:25	**Post-run Questionnaires** and Debriefing
13:00	End

Results
Impact on tasks

		0 1 2 3 4
Manage Systems	*Scan all relevant information sources.*	low impact ◆ high impact
	Update all relevant systems	◆
Give Instructions	*Issue cleared routes.*	◆
	Check readback from pilots.	◆
	Issue the pushback clearance.	◆
	Issue clearances to the cockpit.	◆
Coordinate	*Elbow-Coordination with colleagues.*	◆
	Coordination with other ATCOs/dispachters.	◆
	Coordination of ground vehicles.	◆
Double-Check Information	**Detect conflicts.**	◆
	Check planned routes.	◆
	planned routes adherence with departure sequence.	◆
	...to monitor for conformance with the given clearances.	

		0	1	2	3	4

Manage Systems
- *Scan all relevant information sources.*
- *Update all relevant systems*

Give Instructions
- *Issue cleared routes.*
- *Check readback from pilots.*
- *Issue the pushback clearance.*
- *Issue clearances to the cockpit.*

Coordinate
- *Elbow-Coordination with colleagues.*
- *Coordination with other ATCOs/dispachters.*
- *Coordination of ground vehicles.*

Double-Check Information
- *Detect conflicts.*
- *Check planned routes.*
- *planned routes adherence with departure sequence.*
- *...to monitor for conformance with the given clearances.*

low impact   high impact
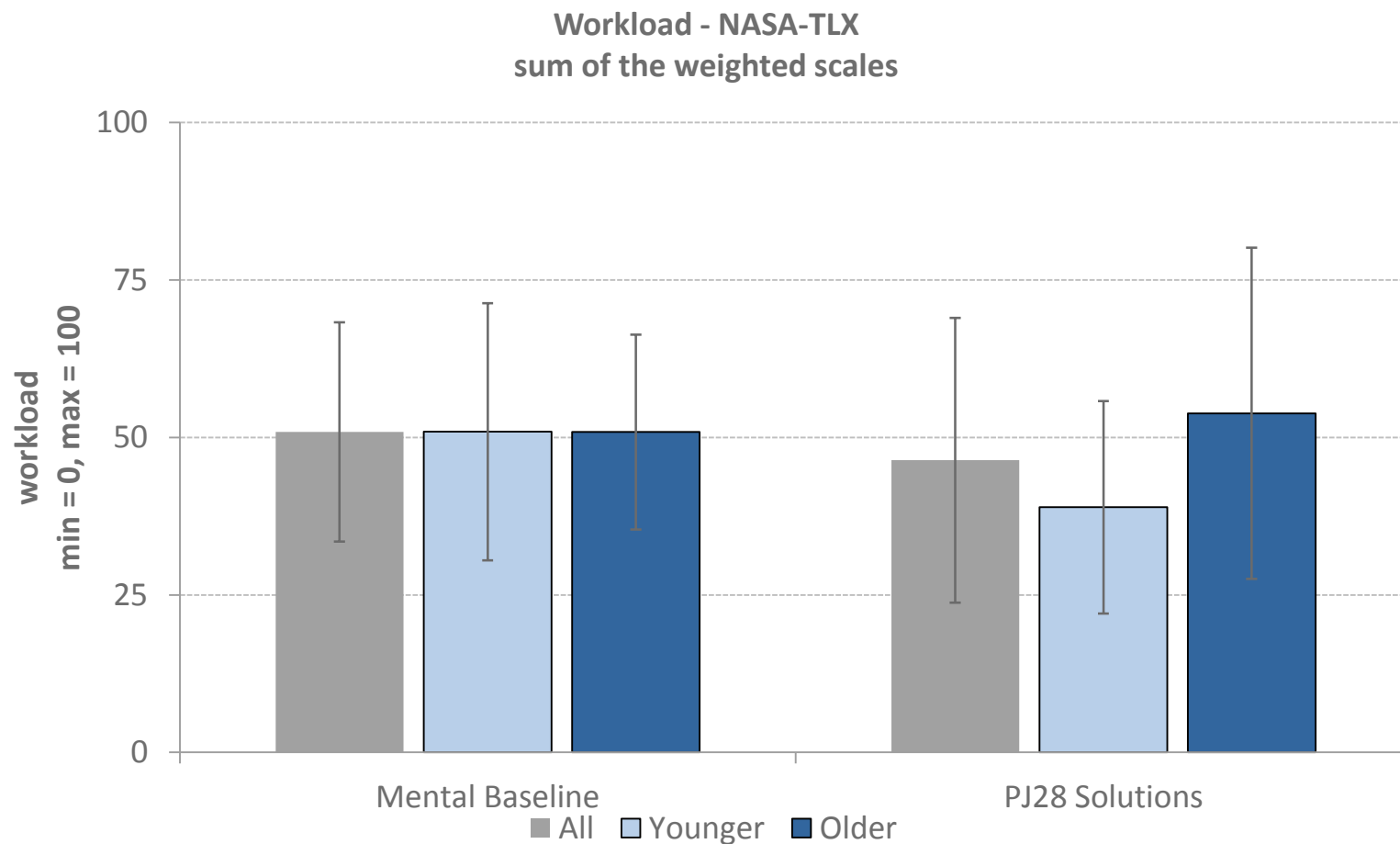
Results
PJ28 solutions and workload

Workload - NASA-TLX
sum of the weighted scales

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PJ28 solutions and workload
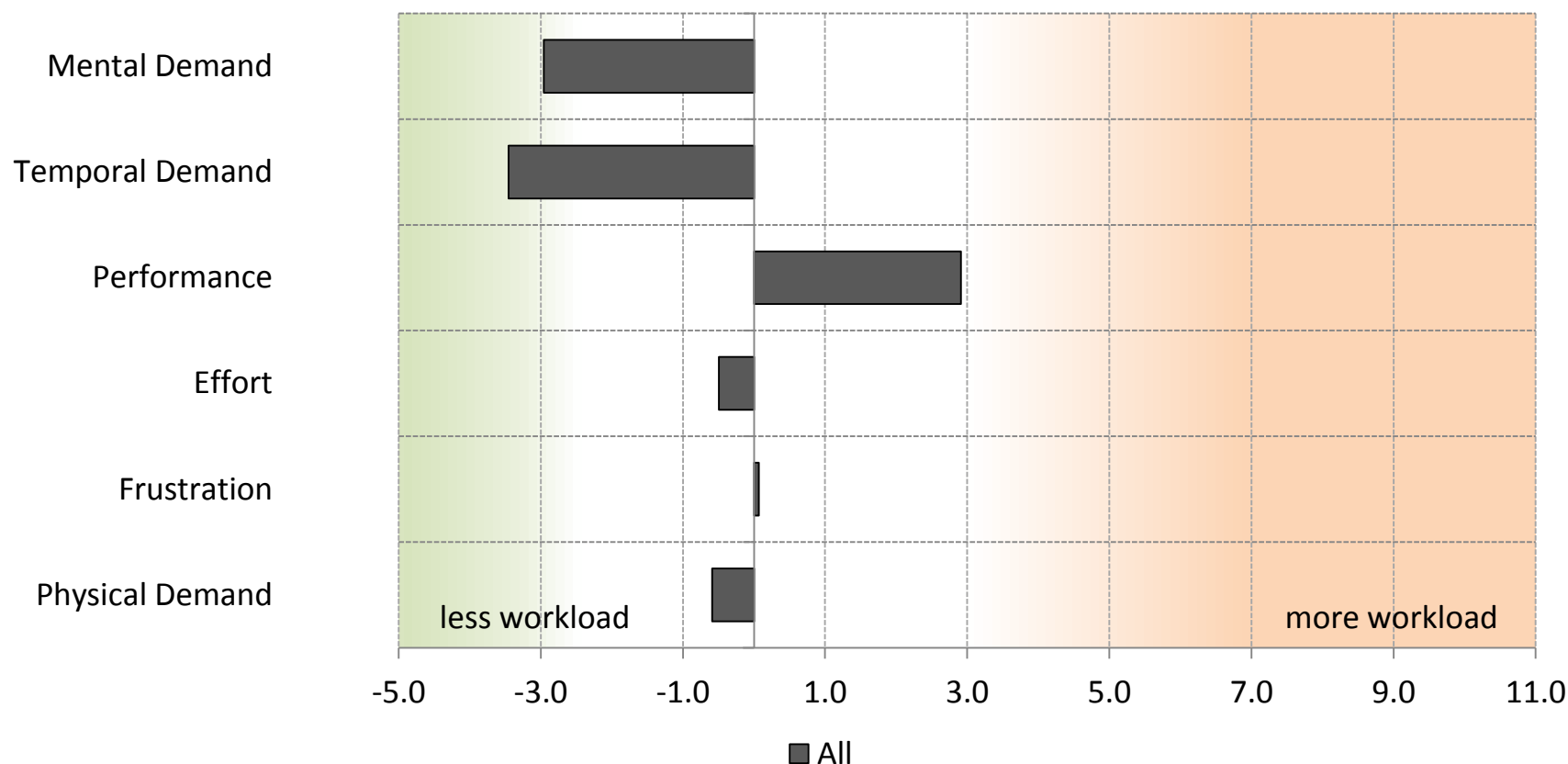
**Workload - NASA-TLX
sum of the weighted scales**

Explorative Analysis – which factors explain variance in PJ28 ratings? Age and experience of controllers lead to descriptive differences.
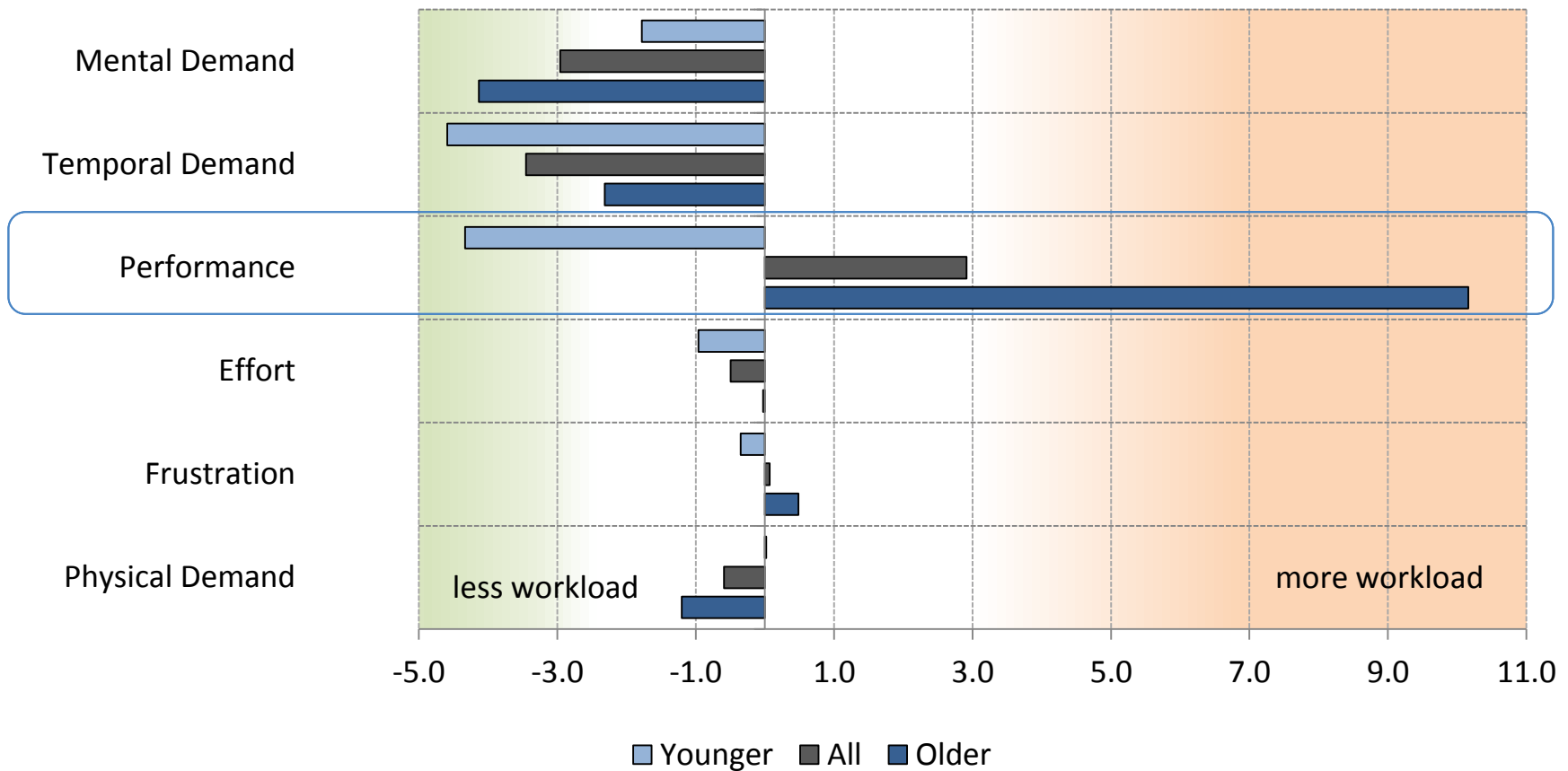
Results
What can we learn?

NASA-TLX: mean difference between mental baseline and PJ28 solutions

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Human Performance Assessment Discussion and Summary

PJ28 solutions do have an impact on intended tasks.

PJ28 demonstrations have had a strong focus on Human Performance.

Changes in working procedures and concepts need time, training and systems should be designed to be able to adapt to individual needs.

Designing automated solutions: „**one size does not fit all"**

To **keep the human in the loop** and **support the strengths of human decision making**, automation should be designed carefully:

* Enable experienced operators to make use of an automated system, e.g. **teach the automation**

* **Adapt automation levels** to individual needs

From a human performance perspective, PJ28 solutions were generally accepted.

[http://www.automationnews.org/wp-content/uploads/2011/10/Automation-Cartoon-1.jpg]
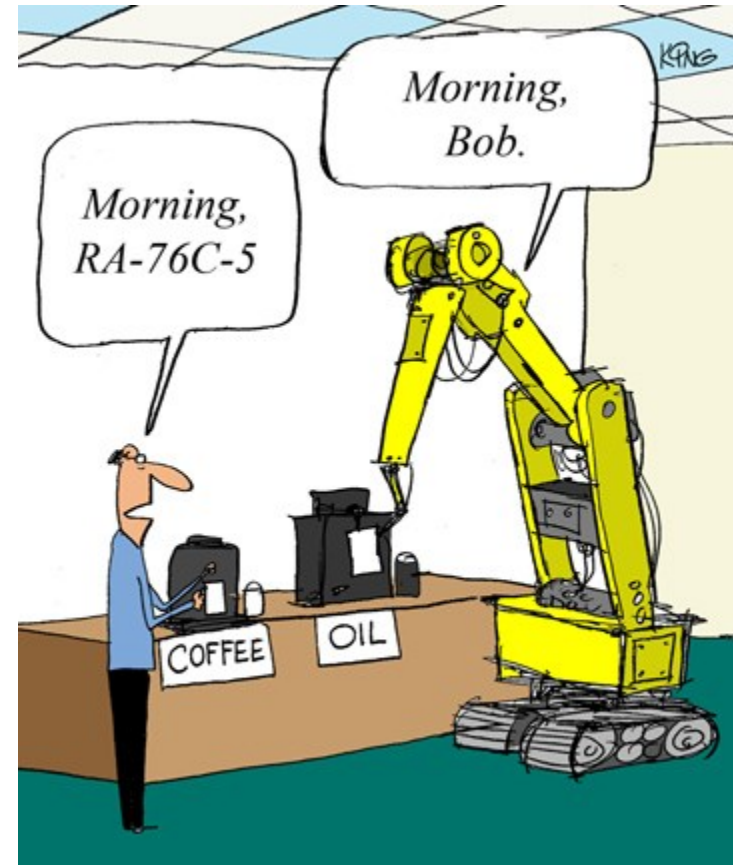
Integrated Airport Operations (PJ28) - Dissemination activities – WP4

Questions?

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