Please have a Look here:
Successful Guidance of Air Traffic Controller’s Attention

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Air Traffic Controller Attention

• Air Traffic Controller (ATCo)
  • Ensures safe and efficient air traffic
  • Supported by a situation data display
  • Assuming: Eye gaze focus = Attention focus

• Challenge: **Visual attention** at the right spot
  • Dense traffic (efficient task order)
  • Adopted air traffic control (ATC) methods (modified tasks)
  • Large screens (not miss information)
  • More automation (“passive” traffic monitoring)

→ Need for Attention Guidance
Use Case: Flight-Centric ATC

- Sectorized control
- Sectorless / flight-centric control
Loop for DLR Attention Guidance (AG) Prototype

- Mouse cursor as backup for attention focus

Next relevant ATC event

<table>
<thead>
<tr>
<th>Target Attention</th>
<th>Where should the ATCo focus his attention? (Target)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Attention</td>
<td>Where is the ATCo focussing his attention? (Actual)</td>
</tr>
<tr>
<td>Attention Guidance</td>
<td>If Target ≠ Actual, then guide attention! (Guidance)</td>
</tr>
</tbody>
</table>

Handling/Solving ATC event
Trigger Logic for ATC Events

• Global
  • Prioritize currently active ATC events (short-/medium-term conflict/handover)
  • Weighting regarding importance and time criticality
  • Unawareness (no cue if ATCo focus on respective area)
  • Which event to display/delete?

• Local
  • Escalation level per event
  • Priority and time of non-observance
  • Increase or decrease of escalation level
Escalation Levels for Visual Cues
Validation Trials in Budapest (HungaroControl)

- 5 ATCos
- Two simulation runs of 50 min
- Baseline run (just flight-centric setup, no AG functionality)
- Solution run (flight-centric setup with AG functionality)
ATCo Tasks during Validation Exercise

- ATCos to control dense traffic as trained the 3 days before
- Afterwards rate questionnaire items
- Debriefing following semi-structured interview method
- Log files of eye-tracking and mouse were captured
Results: Workload

- Lower scores are better
- AG solution yielded lower peak and lower multiple task workload
Results: User Acceptance and Confidence

- Higher scores are better
- AG solution yielded better user acceptance and confidence
Combined Results

- Higher scores are better
- AG solution yielded
  - less workload
  - comparable tasks ability
  - better confidence and acceptance
  compared to baseline run without AG
- AG concept and logic was well-understood and transparent
Number of Escalated ATC Events

- Most escalated ATC events are detected in low escalation levels
Average Time for Noticing ATC Events

- Escalated ATC events are noticed in appropriate time
Tailor-made Attention Guidance Questionnaire (1)

• When using Solution system, I liked best that...
  ...incoming and outgoing traffic is highlighted if not scanned.
  ...it highlighted the conflicts, in case I forgot.
  ...it is really a good idea and simple to use.
  ...it really helped to find blind spots: very cool!
Tailor-made Attention Guidance Questionnaire (2)

- For Solution system the main disadvantage that I can think of is that...
  ...it sometimes asks to take you away from an area or problem you need to focus on.
  ...no disadvantage was present due to attention guidance.
Tailor-made Attention Guidance Questionnaire (3)

- I could imagine to work with Solution system, because...
  ...I think the visual guidance tool has only advantages.
  ...it’s an addition that can complement the existing features.
  ...but only in training new ATCos.
  ...it can help in a dense traffic situation.
  ...it helps to draw my attention when I am more tired.
Tailor-made Attention Guidance Questionnaire (4)

- I could not imagine to work with Solution system, because...
  ...somebody may not want to get tracked.
  ...I can’t imagine.

- For an additional implementation in Solution system, I would wish that...
  ...it was already implemented as it really gives me help.
Debriefing Comments

• The visual cues are non-intrusive.
• Eye-tracking works really robust after calibration and thus interaction is fine.
• The AG functionality really supports me to have a look at HMI spots that I would not have looked at this timely.
• The AG system is already ready to be used in operational life.
• I want to have AG in my current CWP tomorrow.
Outlook on Future Work

• Cues for other ATC events
  • Wrong Mode-S settings
  • Route adherence monitoring
  • Approaching restricted areas
  • Cleared flight level alarm
  • Current flight level different to exit flight level close to exit point
  • Unattended aircraft

• “Working time” dependent on current gaze focus

• Technical zoom issue

• SESAR Wave 2 PJ.10-96 “HMI Interaction modes for ATC centre”
  • 3 Exercises of European partners

• Automatic Speech Recognition as sensor for AG and vice versa
Summary

- Indicators that assumption (gaze=attention) holds true
- ATCos felt supported by *Attention Guidance* prototype
- Very positive and encouraging results
- Found to be ready for operationalization
Thank you

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The opinions expressed herein reflect the author’s view only. Under no circumstances shall the SESAR Joint Undertaking be responsible for any use that may be made of the information contained herein. The project has received funding from the SESAR Joint Undertaking under the European Union’s Horizon 2020 research and innovation programme under grant agreement No 734141.