Construal Level Theory (CLT) for designing operational explainability for Human-AI Teaming interfaces in aviation contexts

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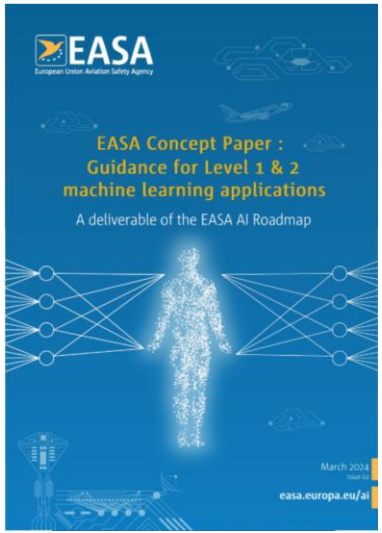
Introduction: what is Operational Explainability?

OpXAI: "*capability to provide the human with understandable, reliable and relevant information with the* ***appropriate level of detail and with appropriate timing*** *of how an AI/ML application produces its results*" [European Union Aviation Safety Agency]

Crucial element in safety-critical contexts (i.e.: aviation, defence, healthcare)



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Types of XAI: Technical XAI vs OpXAI

Technical XAI <>

Goal: to make system interpretable from the algorithmic perspective

Model-Centered
Technical & architectural aspects

Enables ->

Operational XAI

Goal: to present explanations to operators (via HMI)

User-Centered
Human Factors & Human-AI Teaming

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OpXAI of an ATM Use Case

We present the design of OpXAI applied to an Air Traffic Management application,

ISA (Intelligent Sequence Assistant)

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Construal Level Theory (CLT): borrowed from psychology, applied in interface design for OpXAI

Construal Level Theory [Trope and Liberman, 2003]

How humans mentally represent objects based on psychological distance (temporal, spatial, social, hypothetical).

If the object is “far”, we think of it more abstractly (focus on more high-level features)

If the object is “near”, we think of it more concretely (focus on immediate and most important details)

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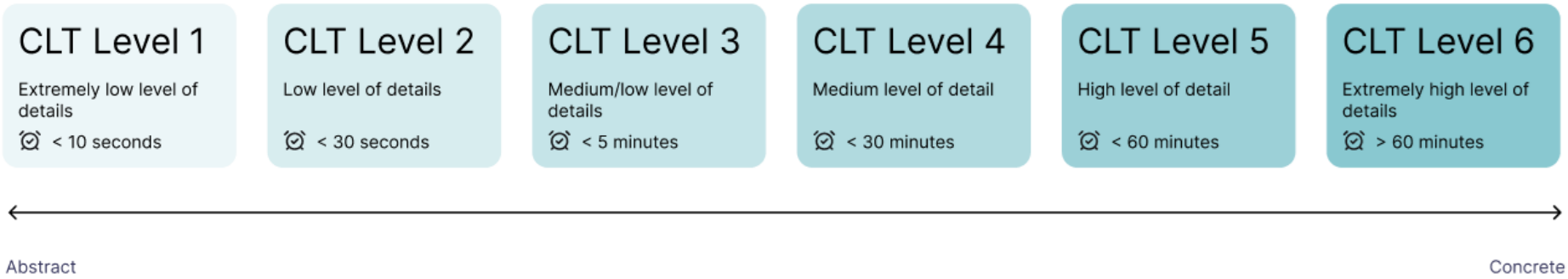
Application to interface Design (McDermott & Folds, 2022)

Based on psychological distance, information in UIs can be organised in abstraction levels accessible through “Progressive Disclosure”



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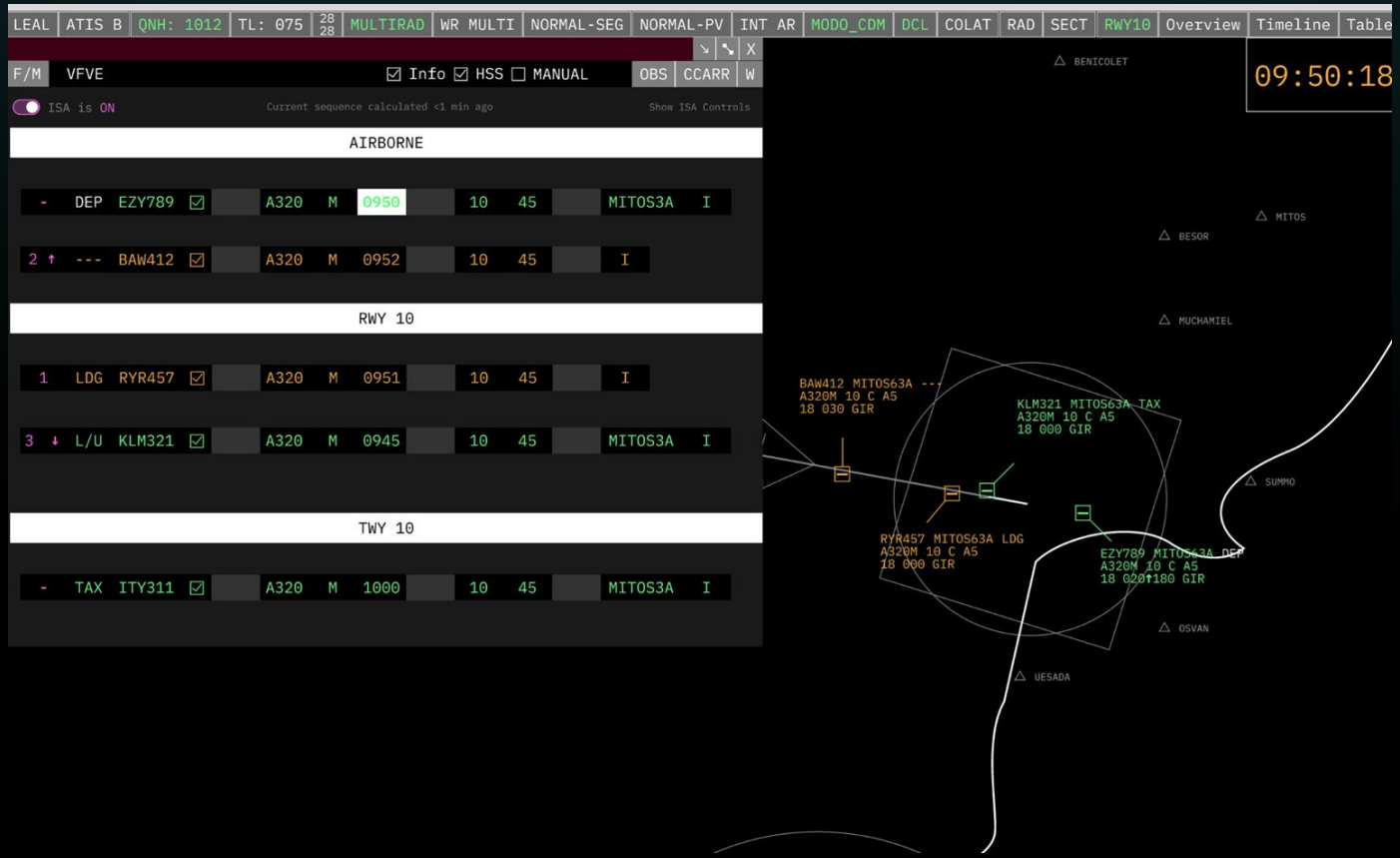
Application on HAIKU Use Case 4: Intelligent Sequence Assistant (ISA)



Interaction Scenario

An Air Traffic Controller sits down for the shift. The task is to sequence incoming/outgoing aircraft (= decide the order of arrival and departure).

The following slides show the interaction with the HMI of ISA and the CLT levels during (and after) operations

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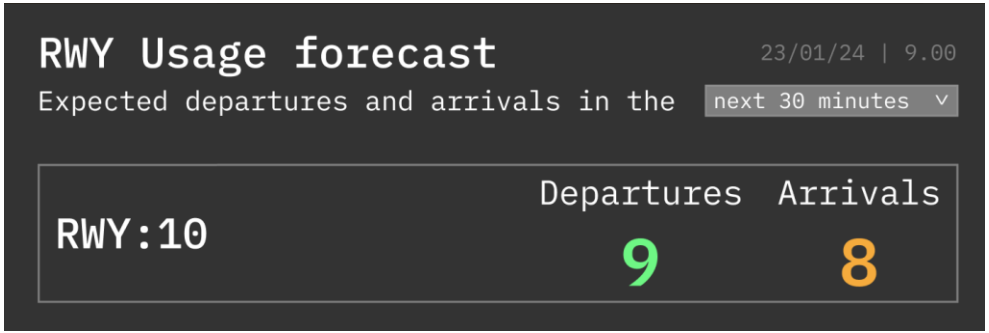
CLT Level 1 for ISA

ATCO wants an overview of the expected traffic to build a mental picture of the ongoing situation
Level of detail: low, Assimilation time: less than 5 seconds



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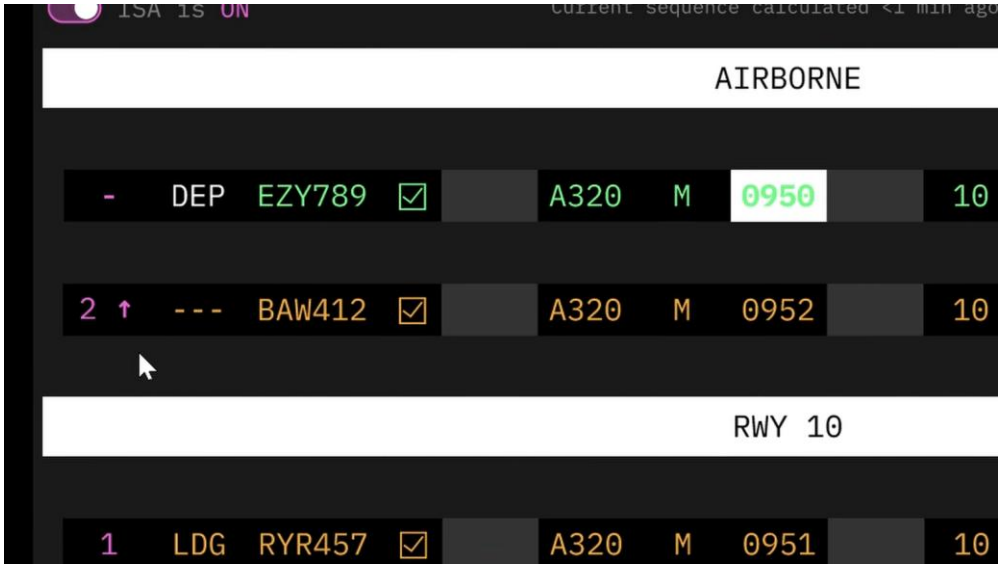
CLT Level 2 for ISA

The AI suggests a solution for a sequence, and a concise explanation is provided when hovering the electronic strip
Level of detail: low, Assimilation time: less than 10 seconds



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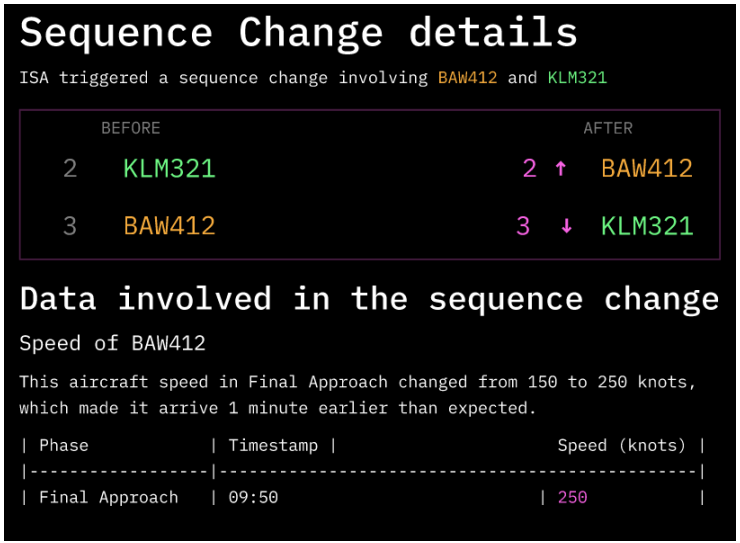
CLT Level 3 for ISA

The ATCO has time to look at the reasons for the sequence change

Level of detail: Medium/low, Assimilation time: less than 1 minute



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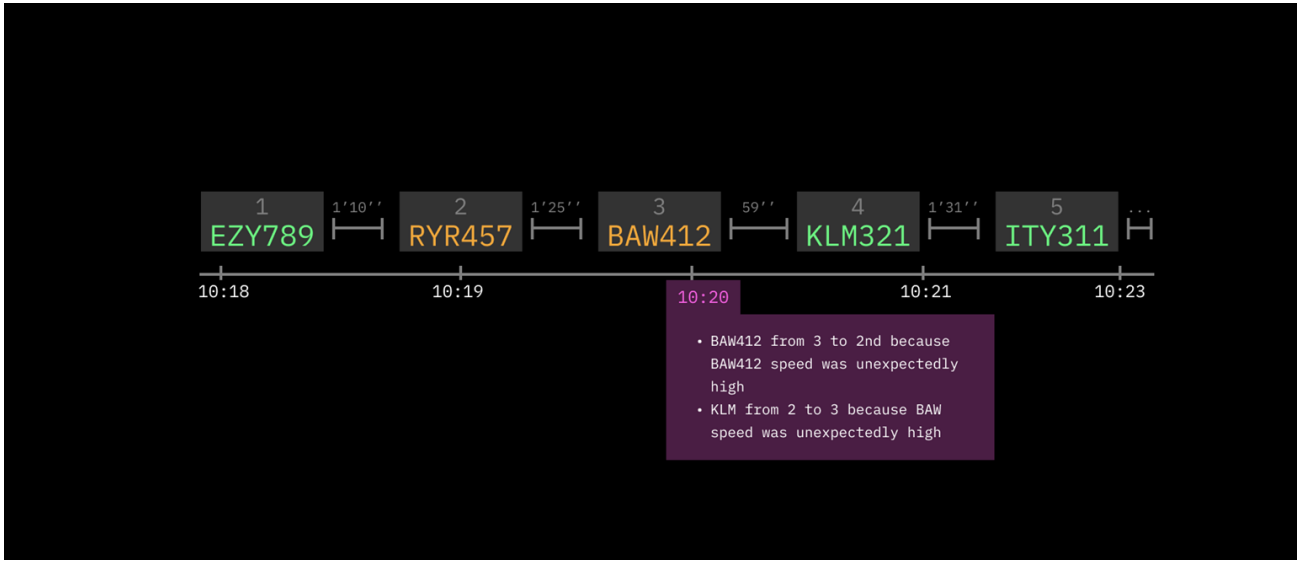
CLT Level 4 for ISA

After the operations, the ATCO has time to review all sequences, and the detailed reason behind each change

Level of detail: Medium Assimilation time: Between 1 and 5 minutes



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Conclusions

CLT can be used to answer questions related to OpXAI such as

What information to show?

When to show?

For how long?

At what level of detail?

To what user?

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HAIKU Project: Human AI teaming Knowledge and Understanding for aviation safety

OpXAI is a topic we researched in HAIKU. HAIKU is a 3-year (2022-2025) project financed by EU that aims at developing 6 aviation AI-powered prototypes.

Key challenge: **human-centric Intelligent Assistants**, integrating **human values**, **needs**, **abilities** and **limitations**.

HAIKU Website (come have a look!) ->

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