



The Control Room of the future: AI-empowered dashboards

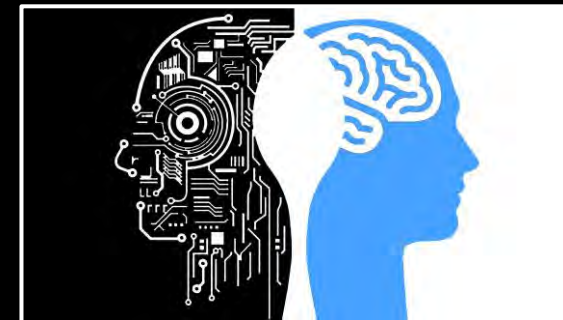


Immersive Analytics

Explainable and transparent A.I.

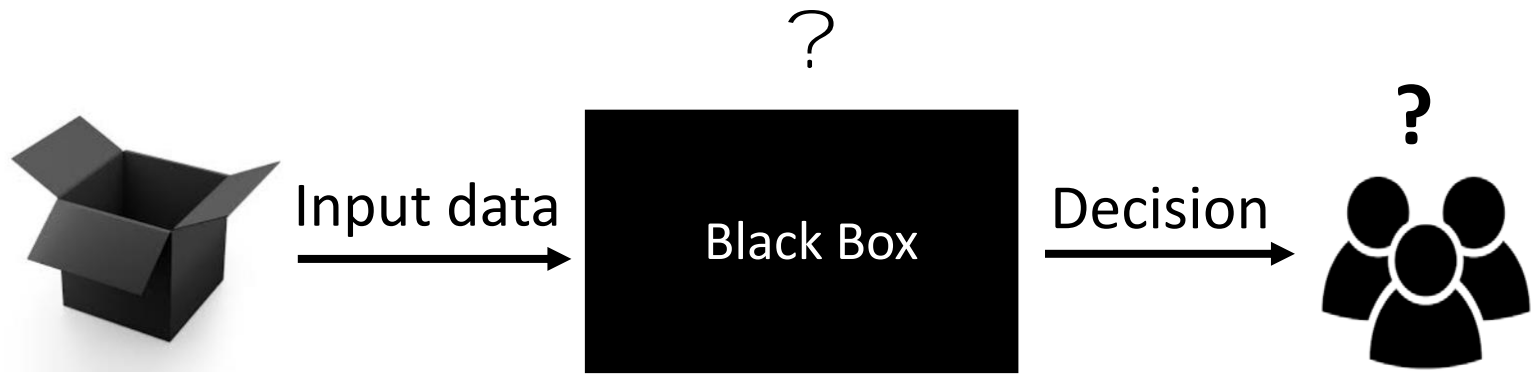
XAI

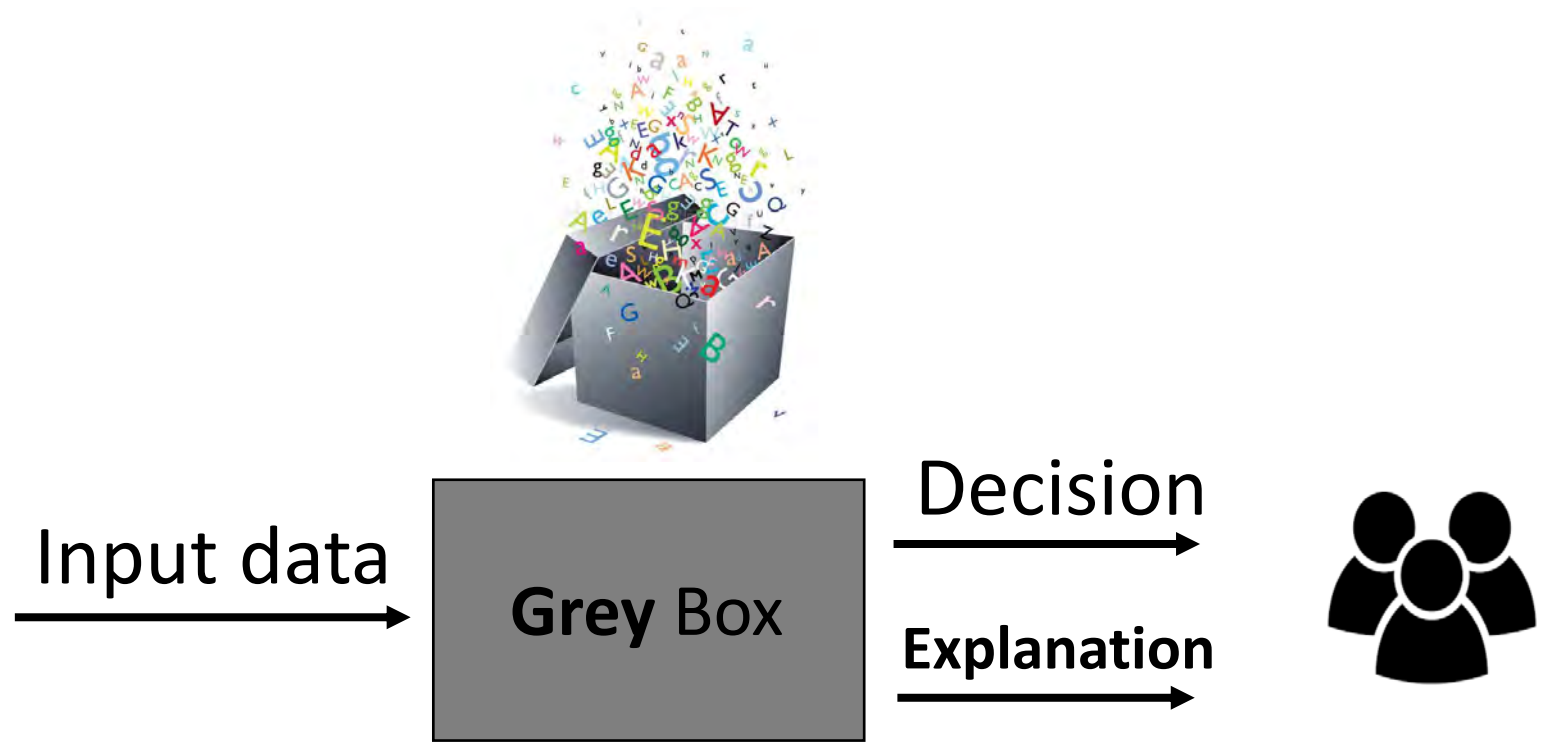
07 October 2022

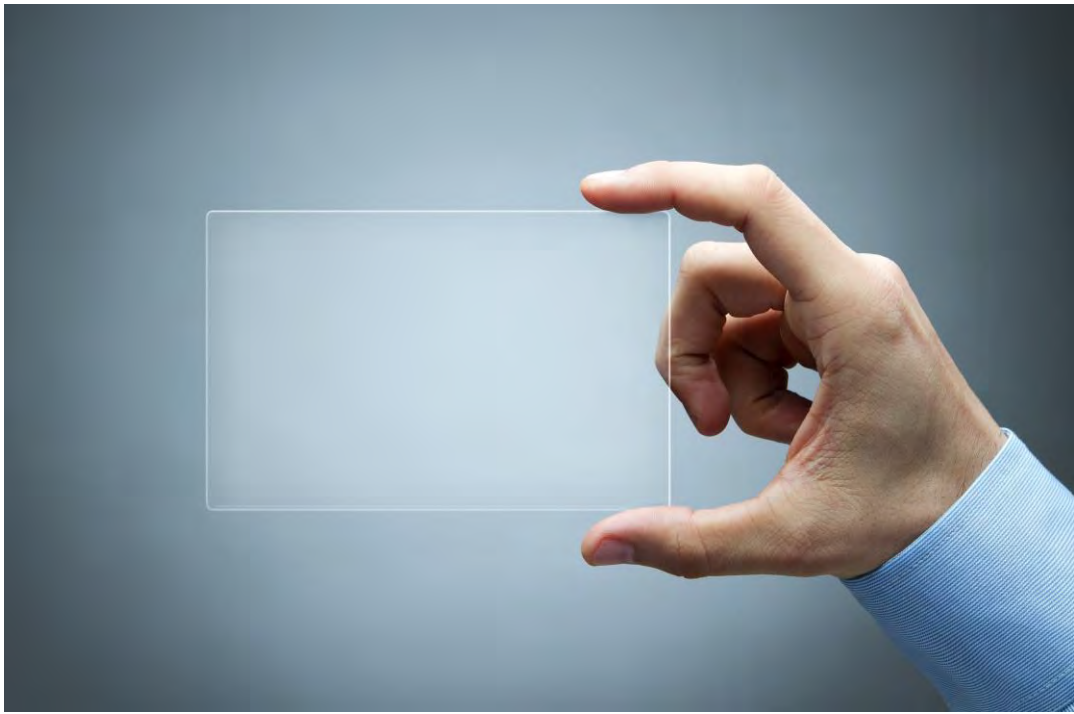




Toward
Automation
Paradigm







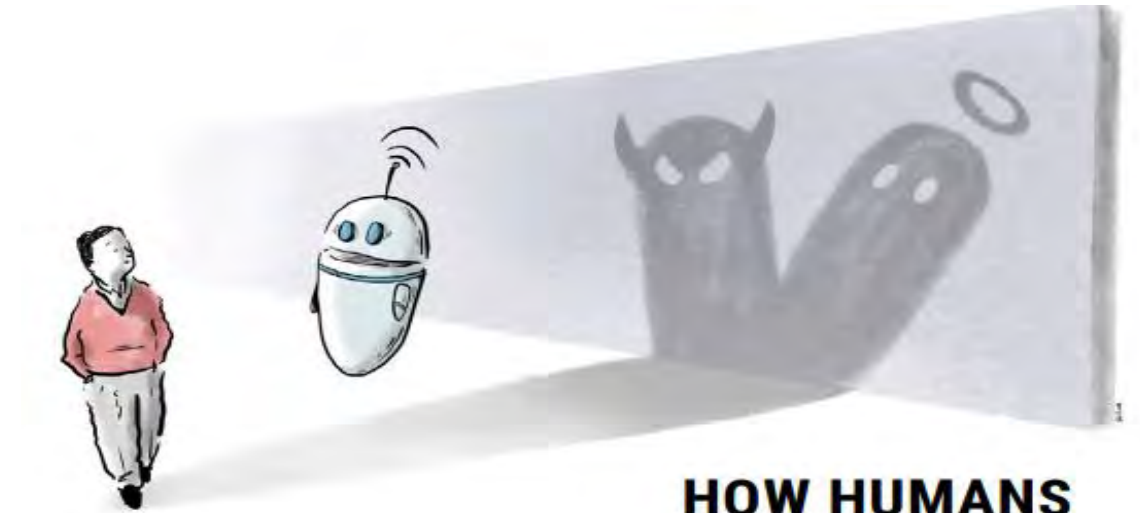
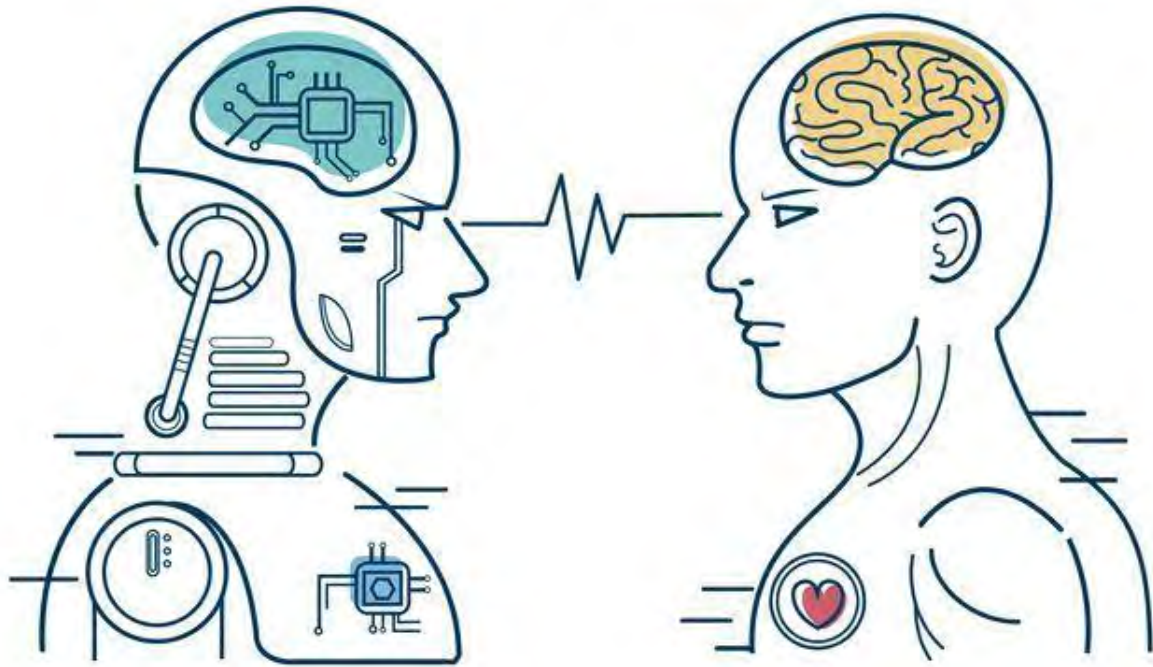
Sometimes, the rationale behind the decision
is more important than the decision itself



How to open black boxes?

The key to supporting this task is not only to **visualize data**, but also to allow users to **interact with it**



Artificial vs HUMAN Intelligence

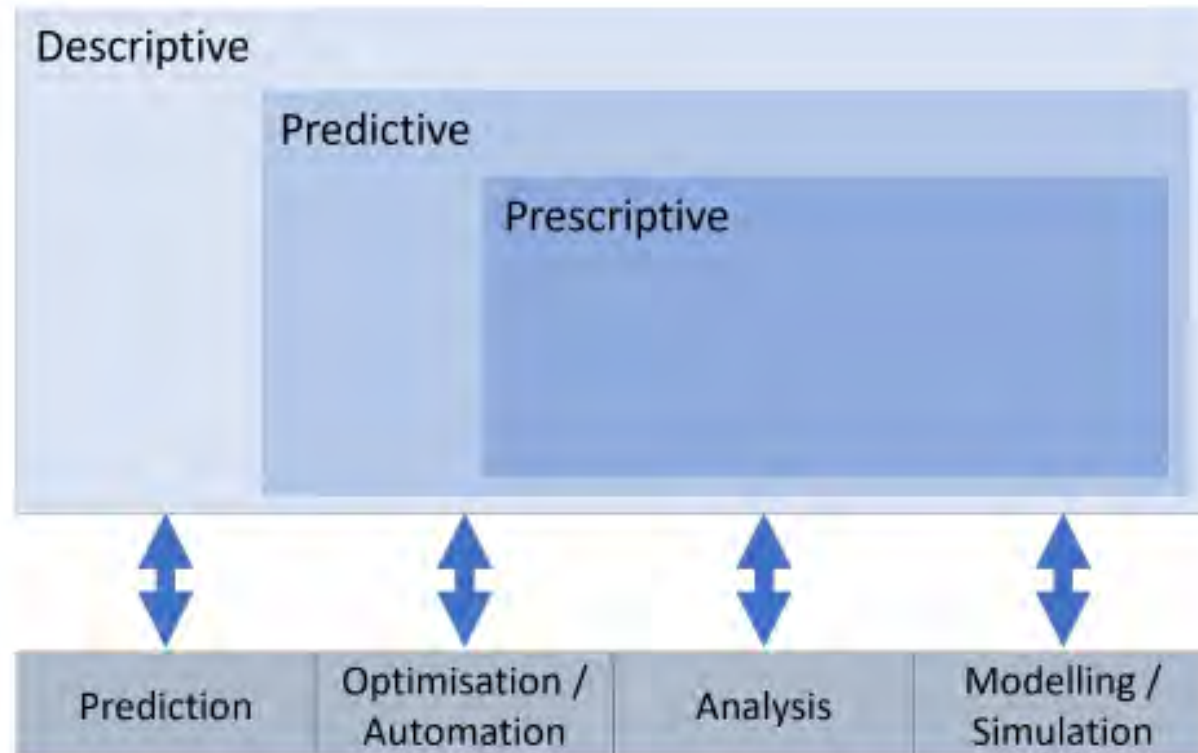


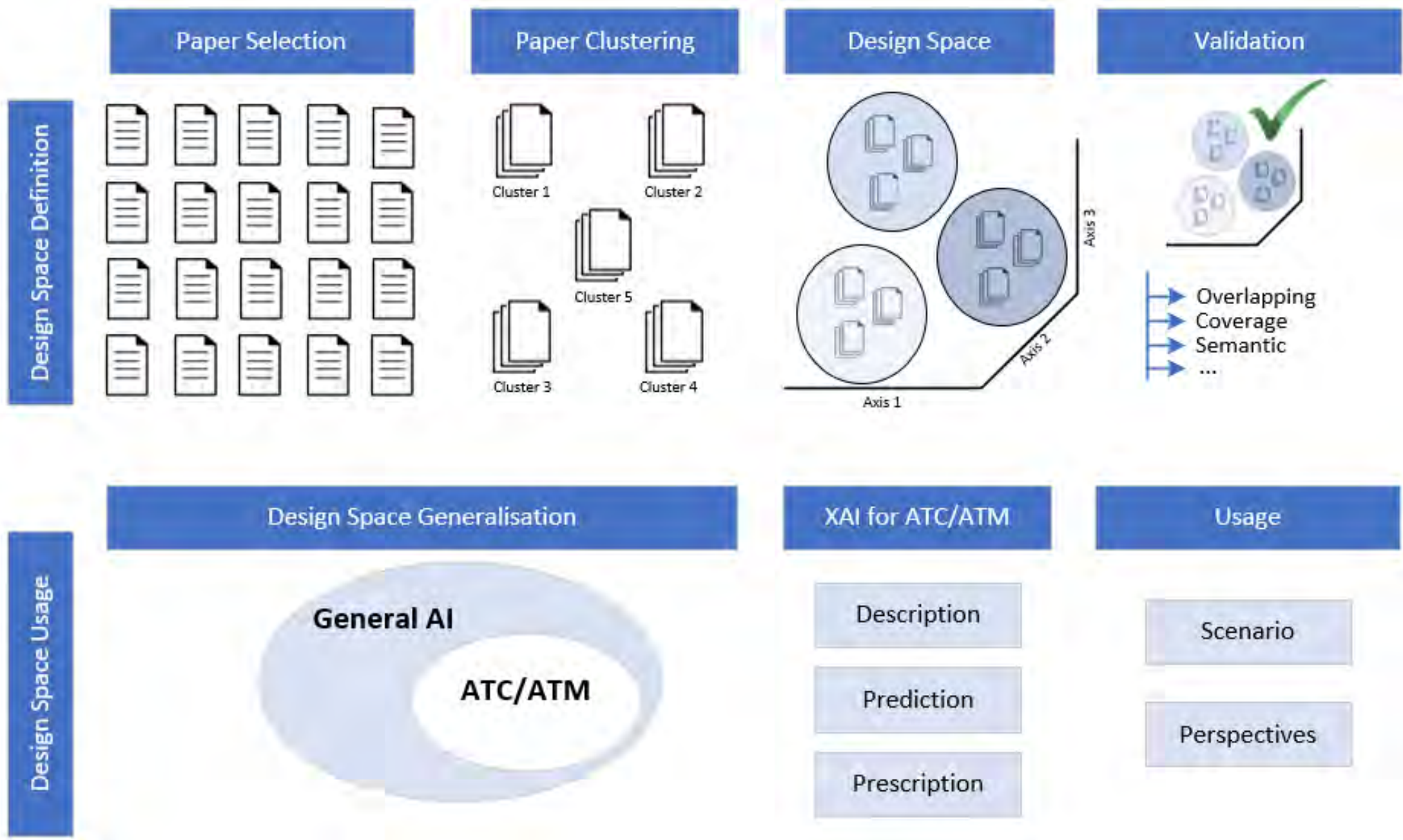
HOW HUMANS **JUDGE** MACHINES

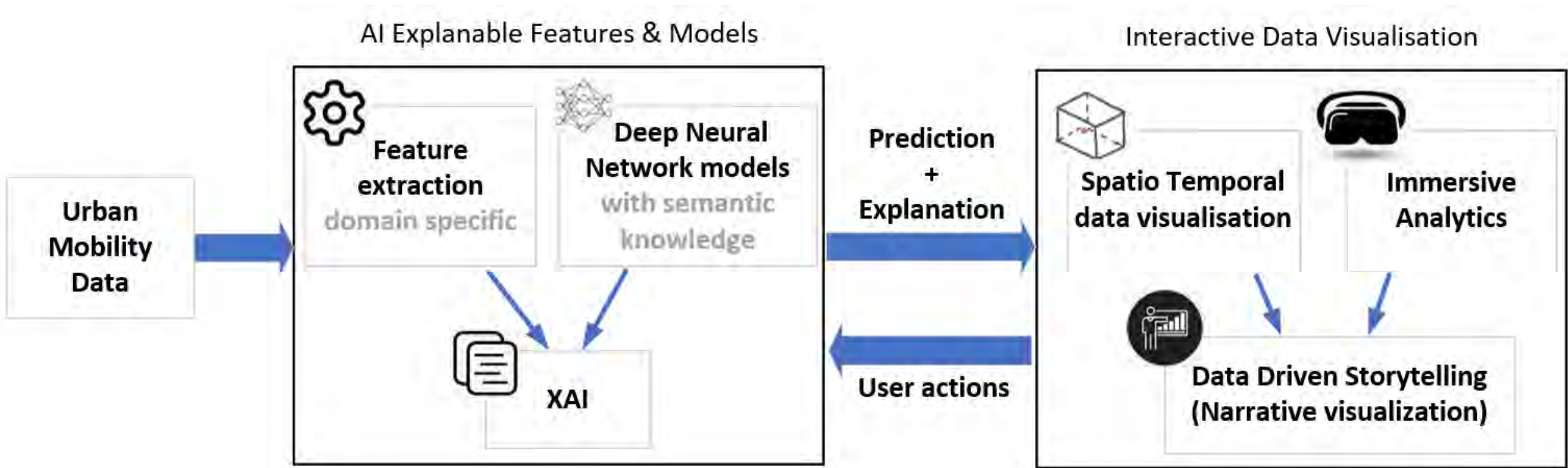
Cesar A. Hidalgo, Diana Orghian, Jordi Albo
Canals, Filipa De Almeida. How Humans
Judge Machines Relié – 2 février 2021. The
MIT Press

A Survey on Artificial Intelligence (AI) and eXplainable AI in Air Traffic Management: Current Trends and Development with Future Research Trajectory

Augustin Degas ^{1,*} , Mir Riyanul Islam ^{2,*} , Christophe Hurter ¹ , Shaibal Barua ² , Hamidur Rahman ² , Minesh Poudel ¹, Daniele Ruscio ³ , Mobyen Uddin Ahmed ² , Shahina Begum ² , Md Aquif Rahman ², Stefano Bonelli ³, Giulia Cartocci ⁴ , Gianluca Di Flumeri ⁴ , Gianluca Borghini ⁴ , Fabio Babiloni ⁴  and Pietro Aricó ⁴ 







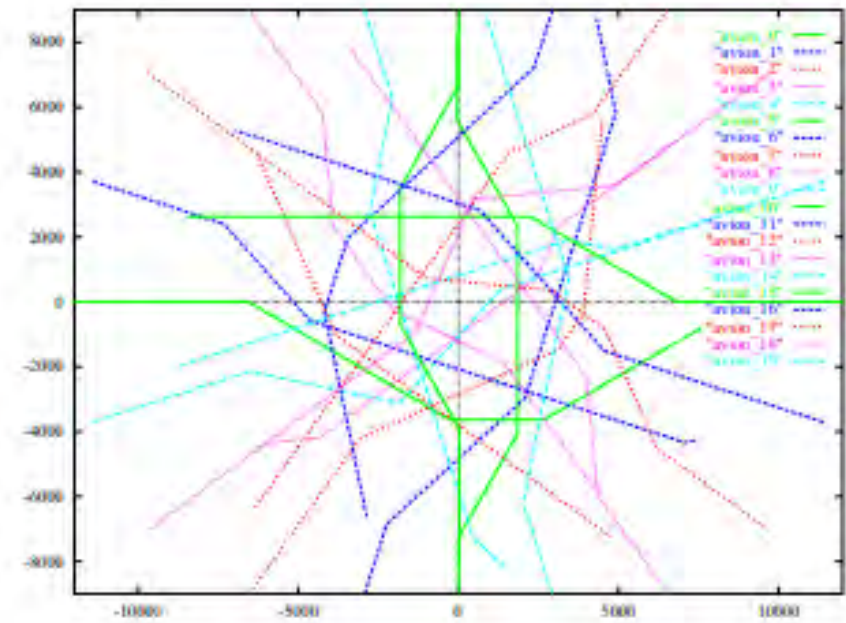
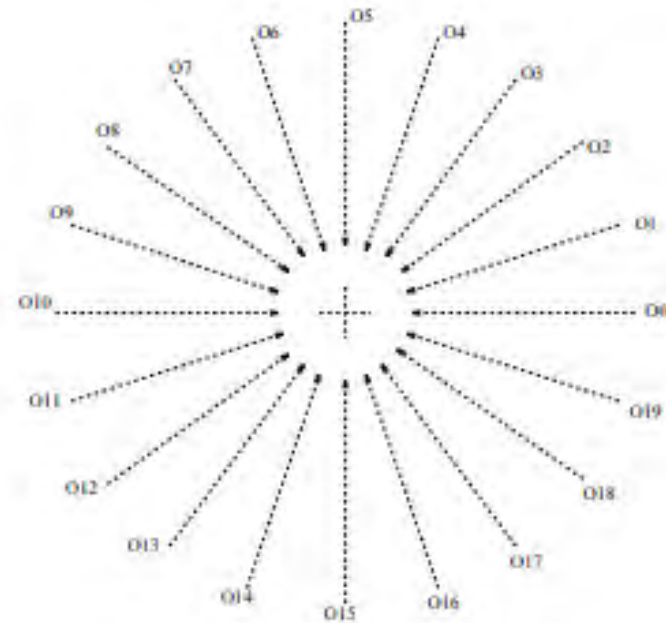
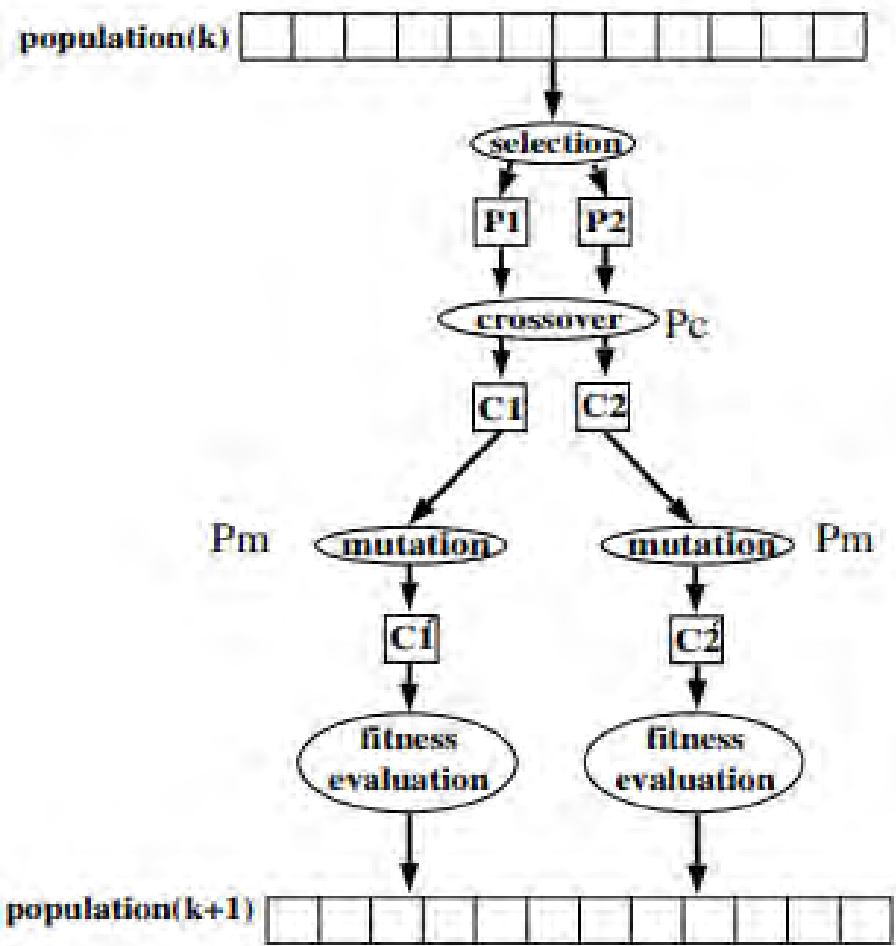
**Transparent
Artificial intelligence and
Automation to Air Traffic
Management
Systems**





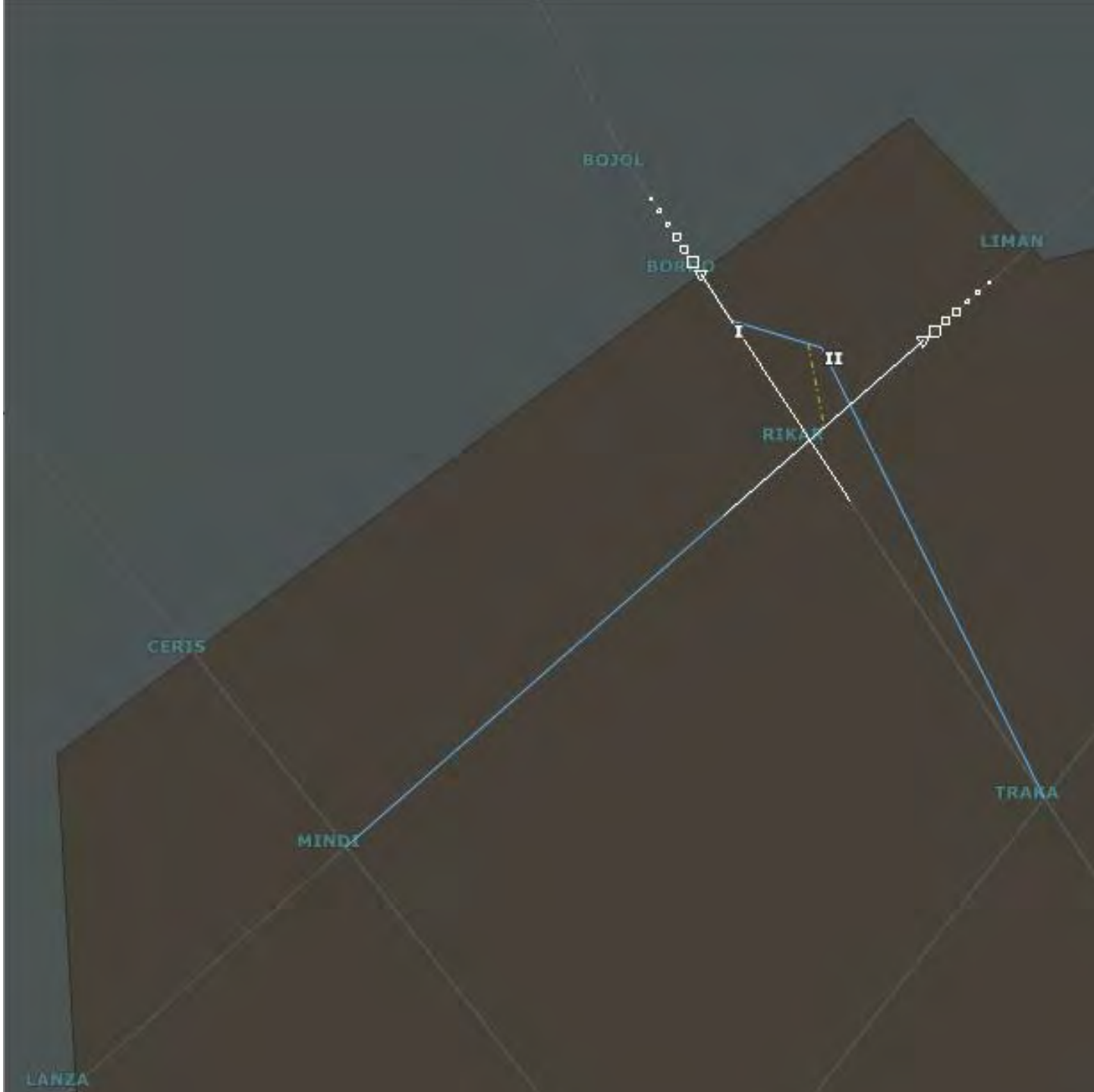
This project has received funding from the SESAR Joint Undertaking grant agreement No. 699381 under European Union's Horizon 2020 research and innovation program



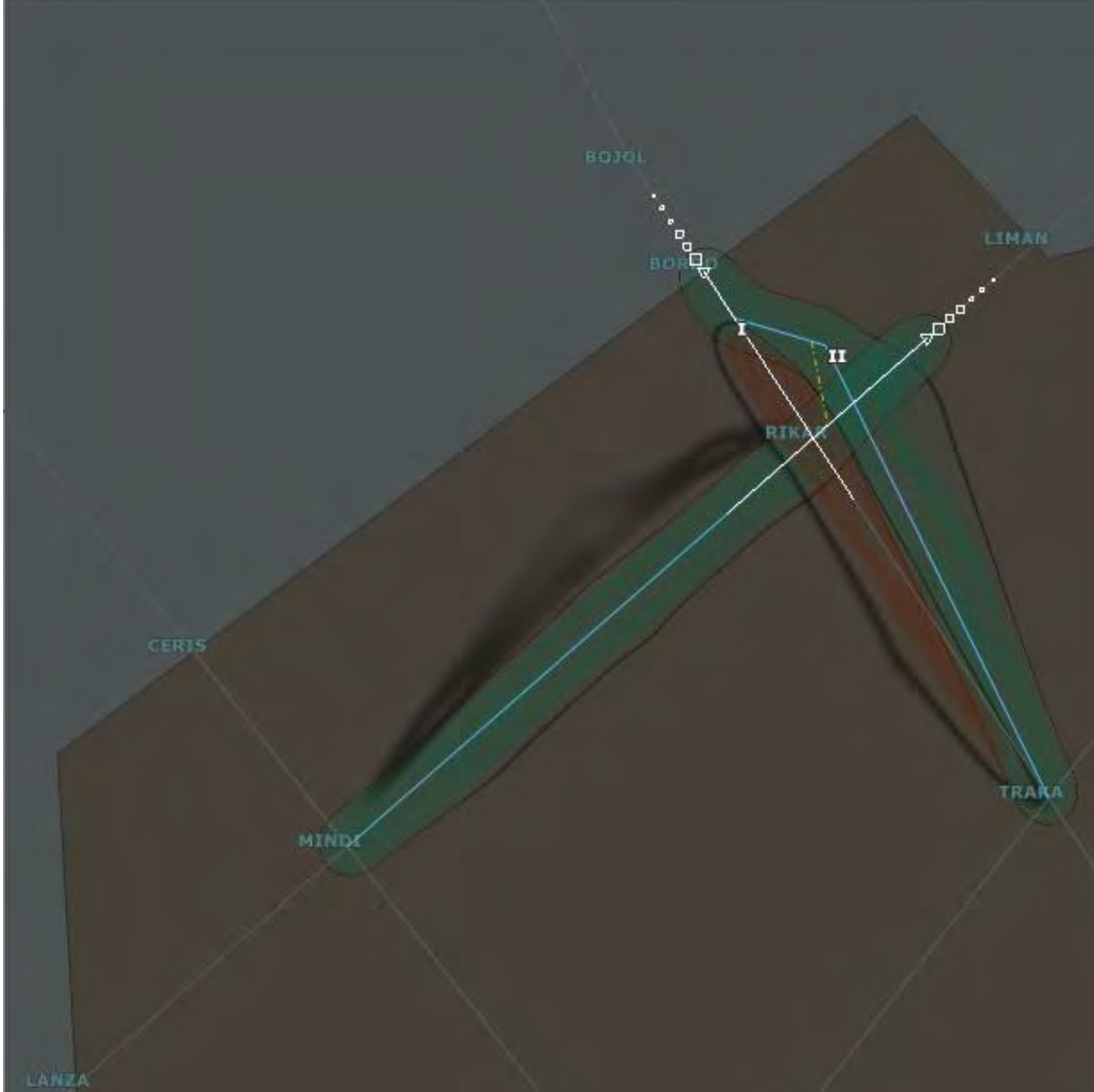


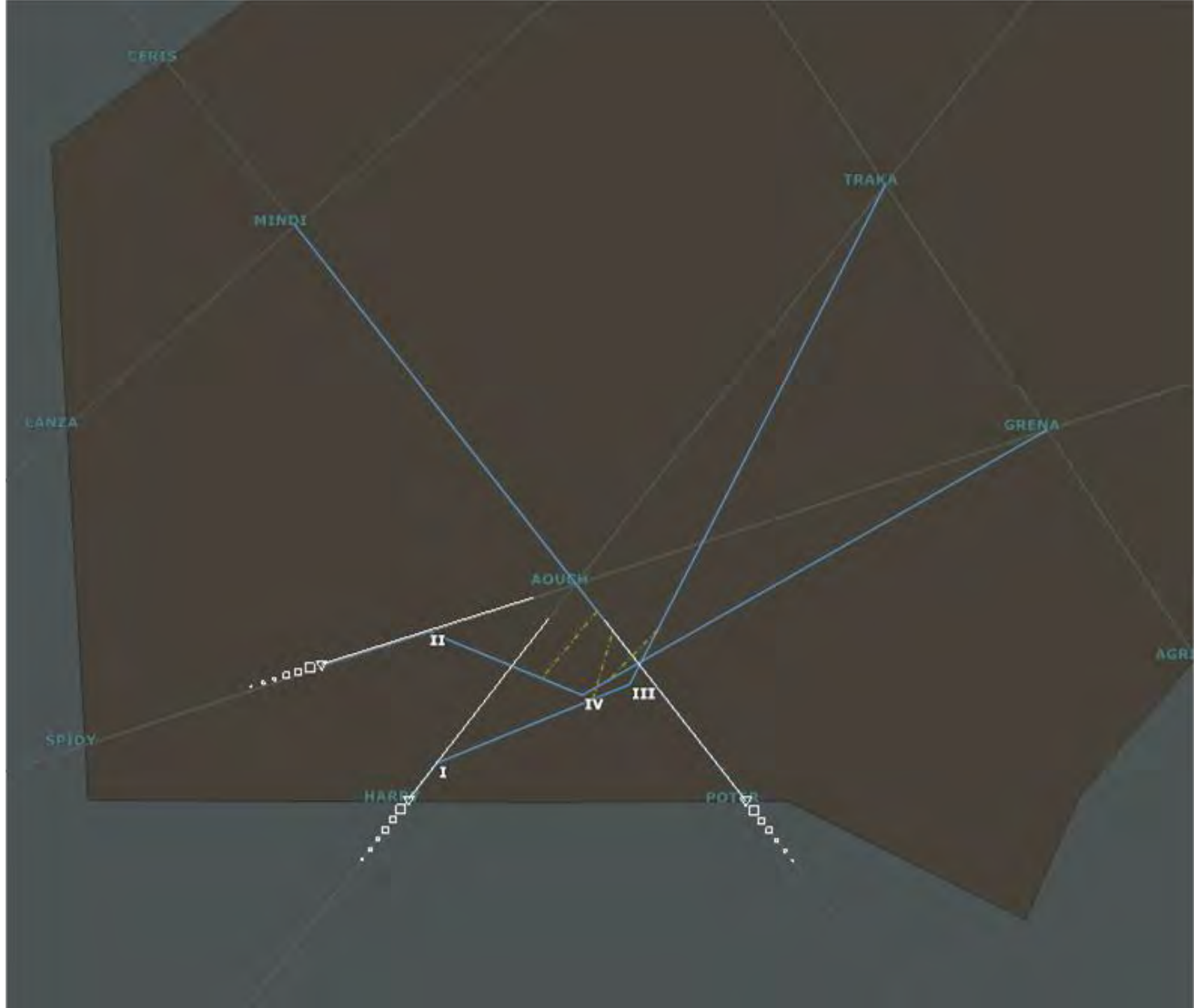
Durand, N., Alliot, J. M., & Noailles, J. (1996, February). Automatic aircraft conflict resolution using genetic algorithms. In *Proceedings of the 1996 ACM symposium on Applied Computing* (pp. 289-298).

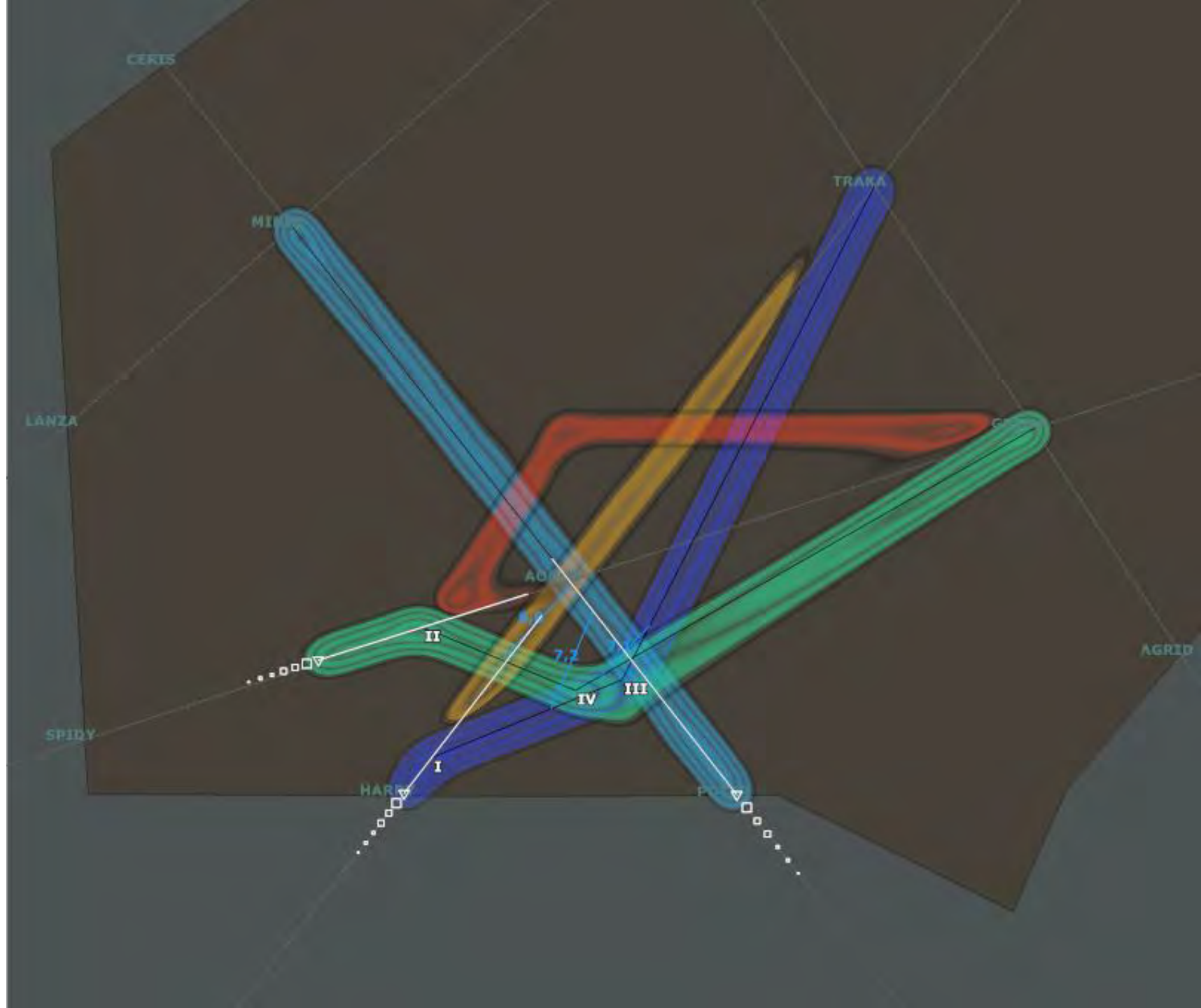
Two aircraft crossing

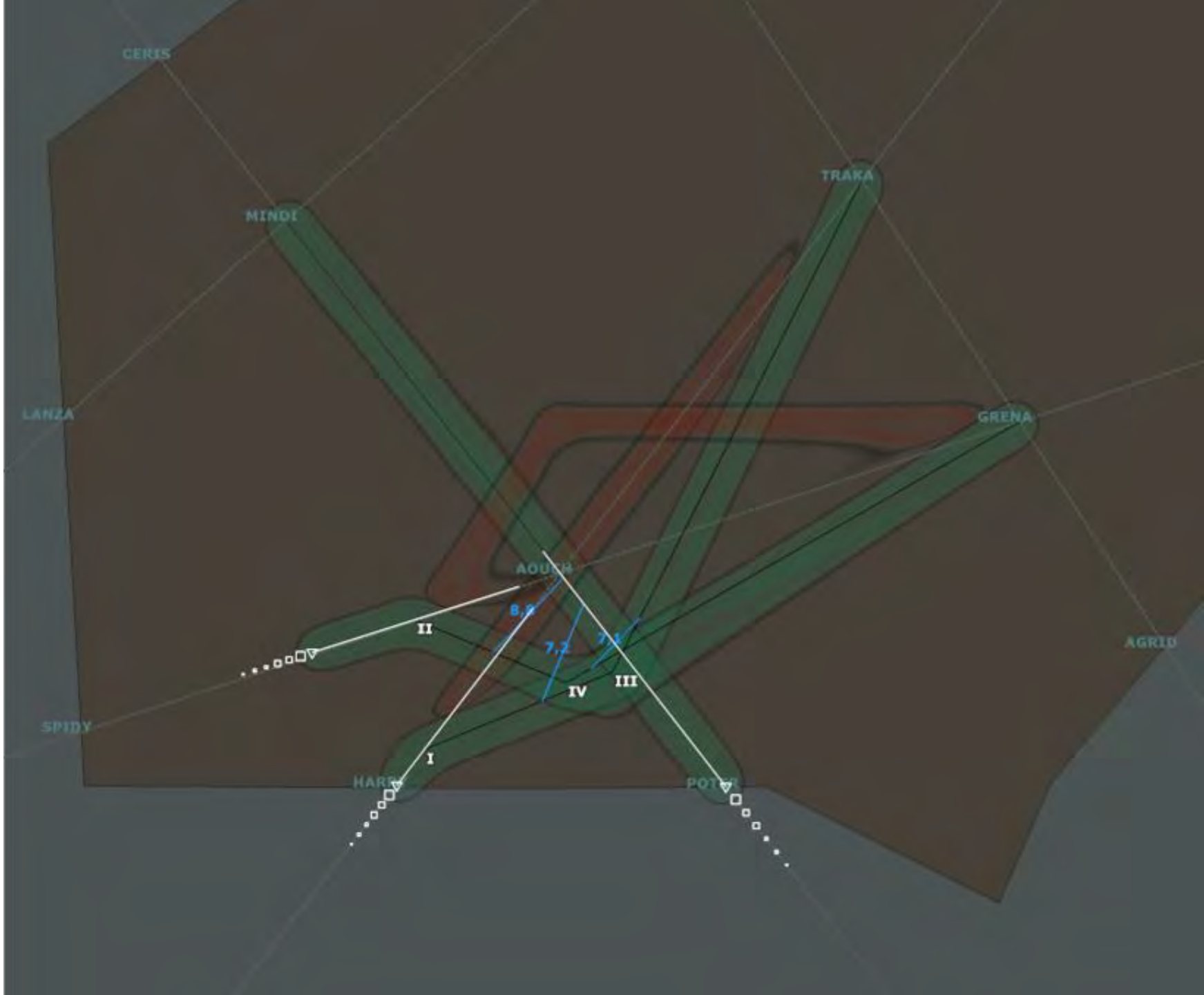


Two aircraft
crossing



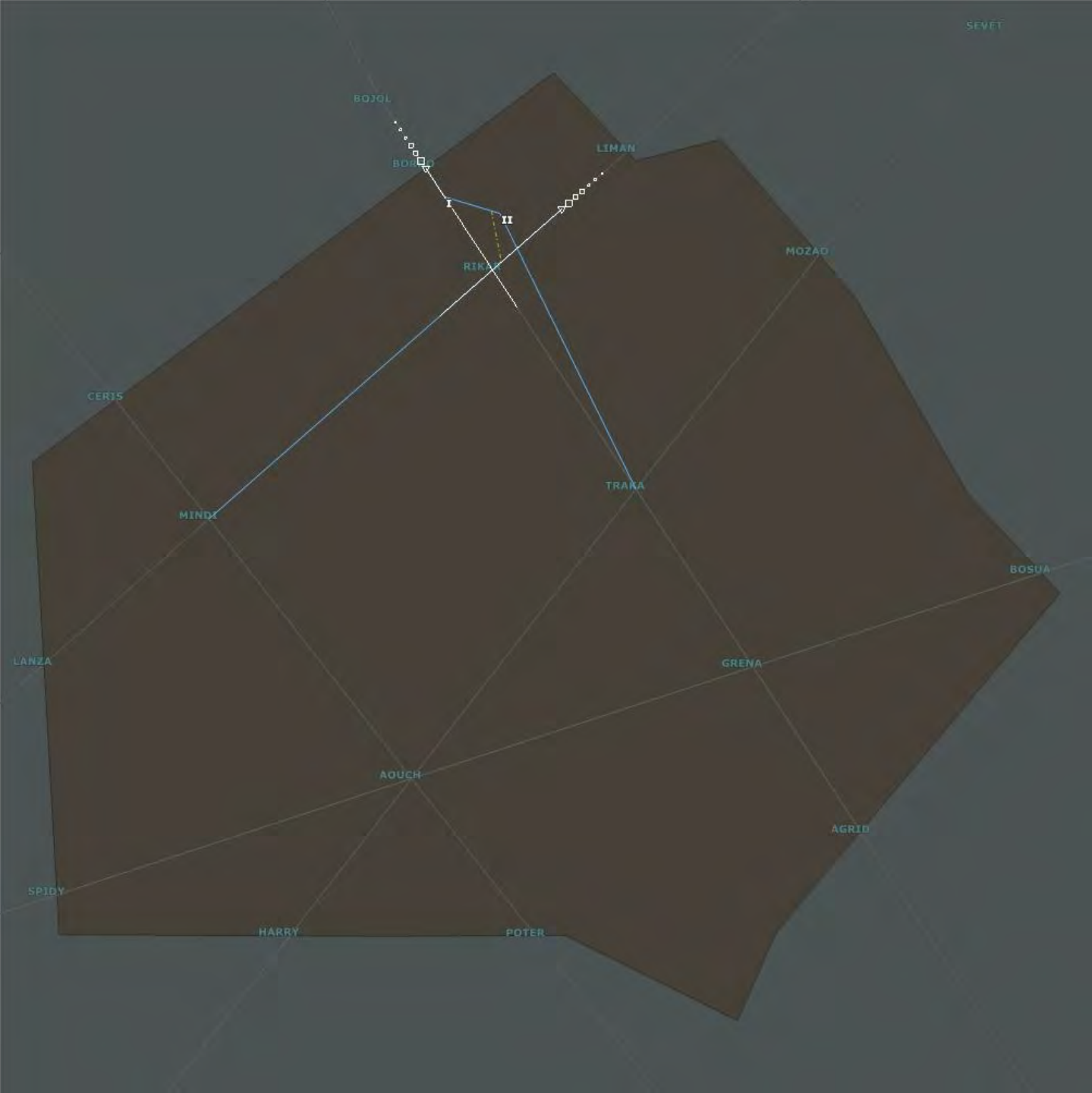




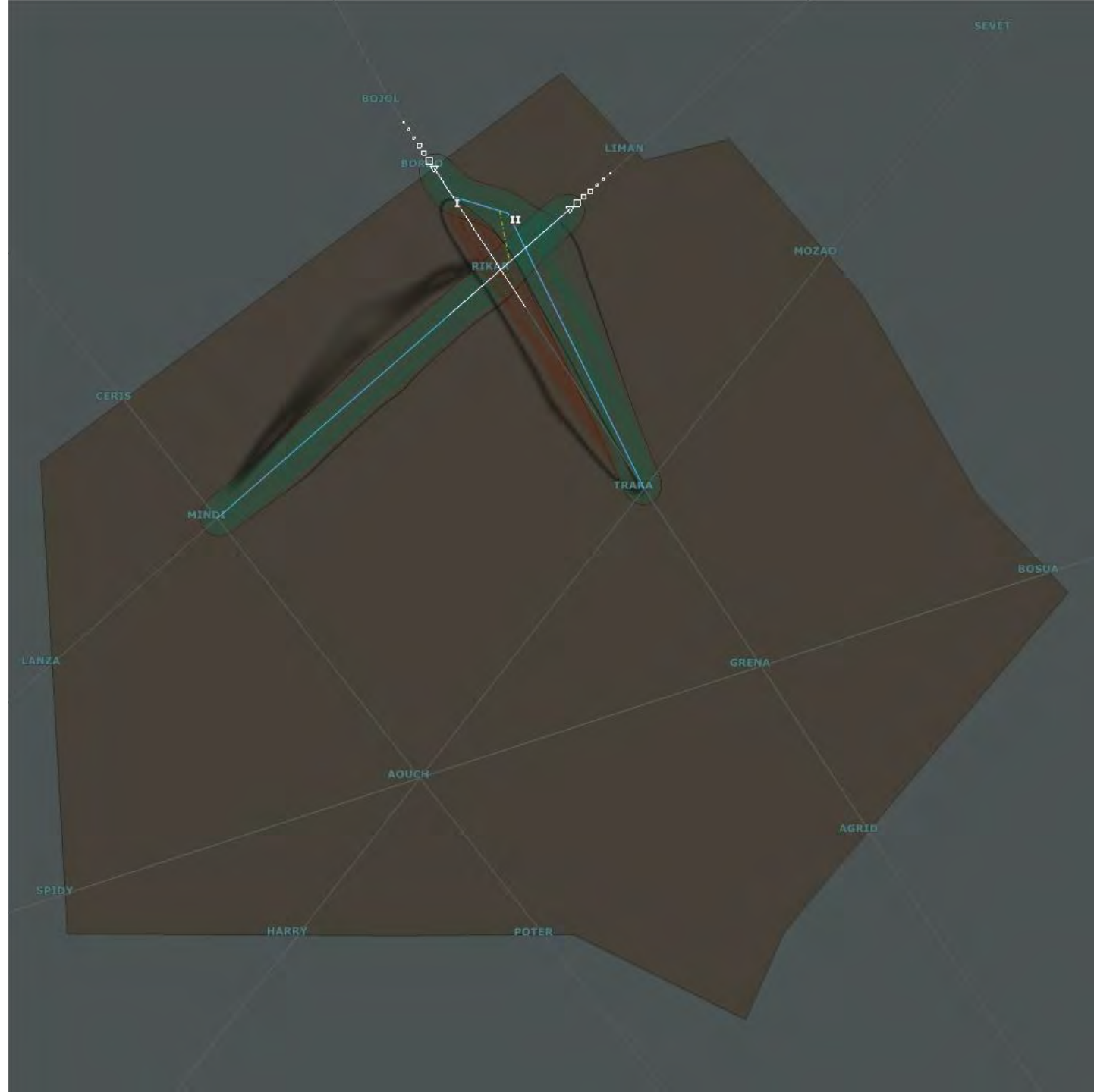


Three levels of algorithm transparency

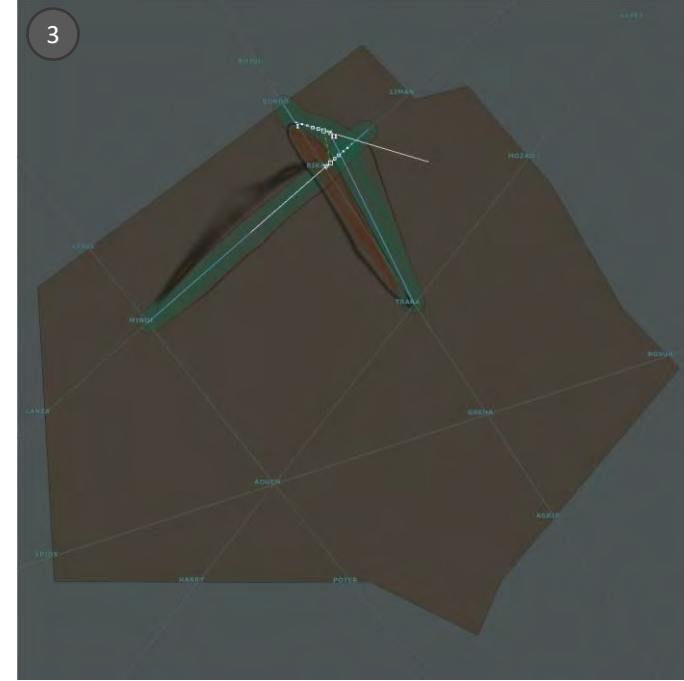
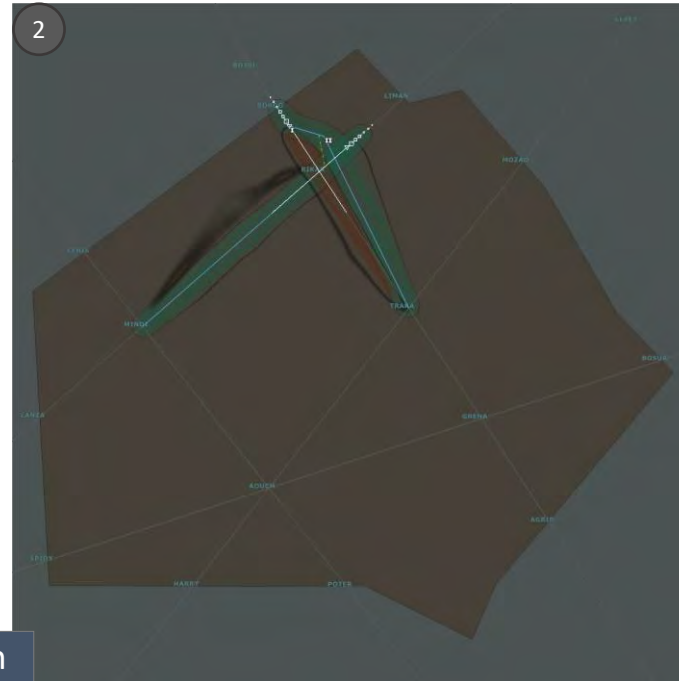
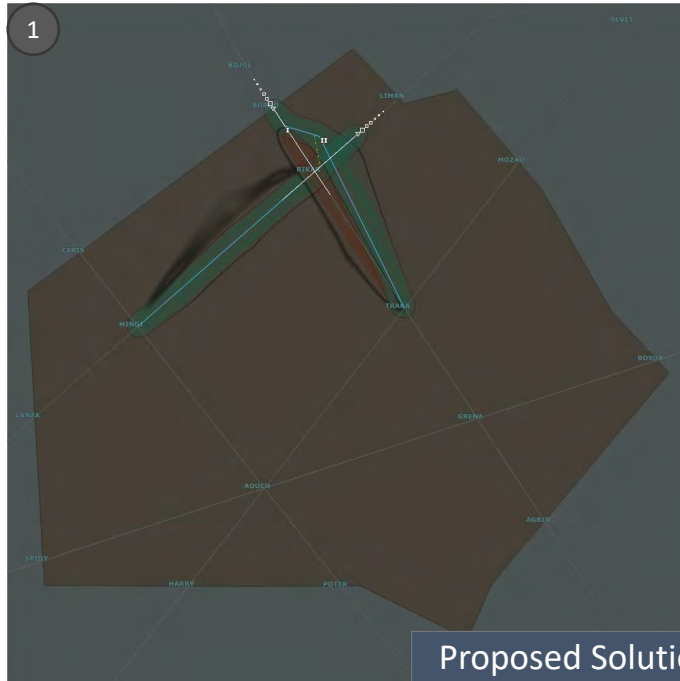
BB: Black Box



HM: Heatmap

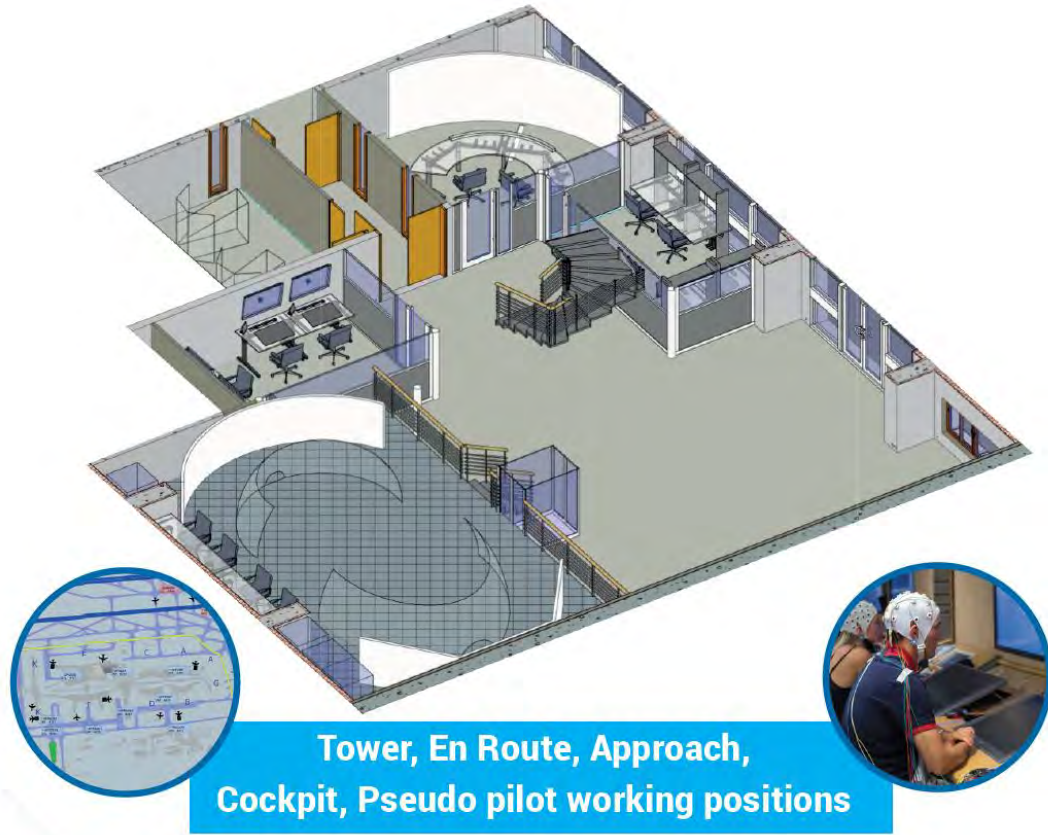


SB : Storyboard



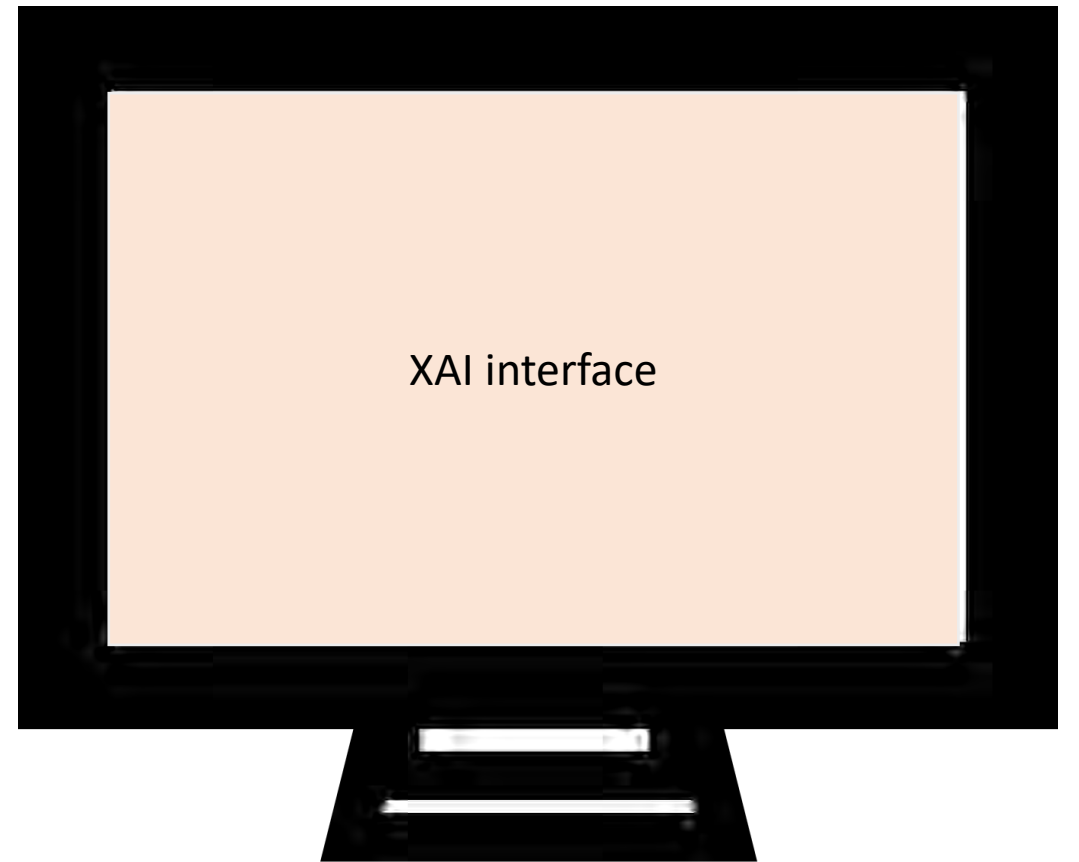
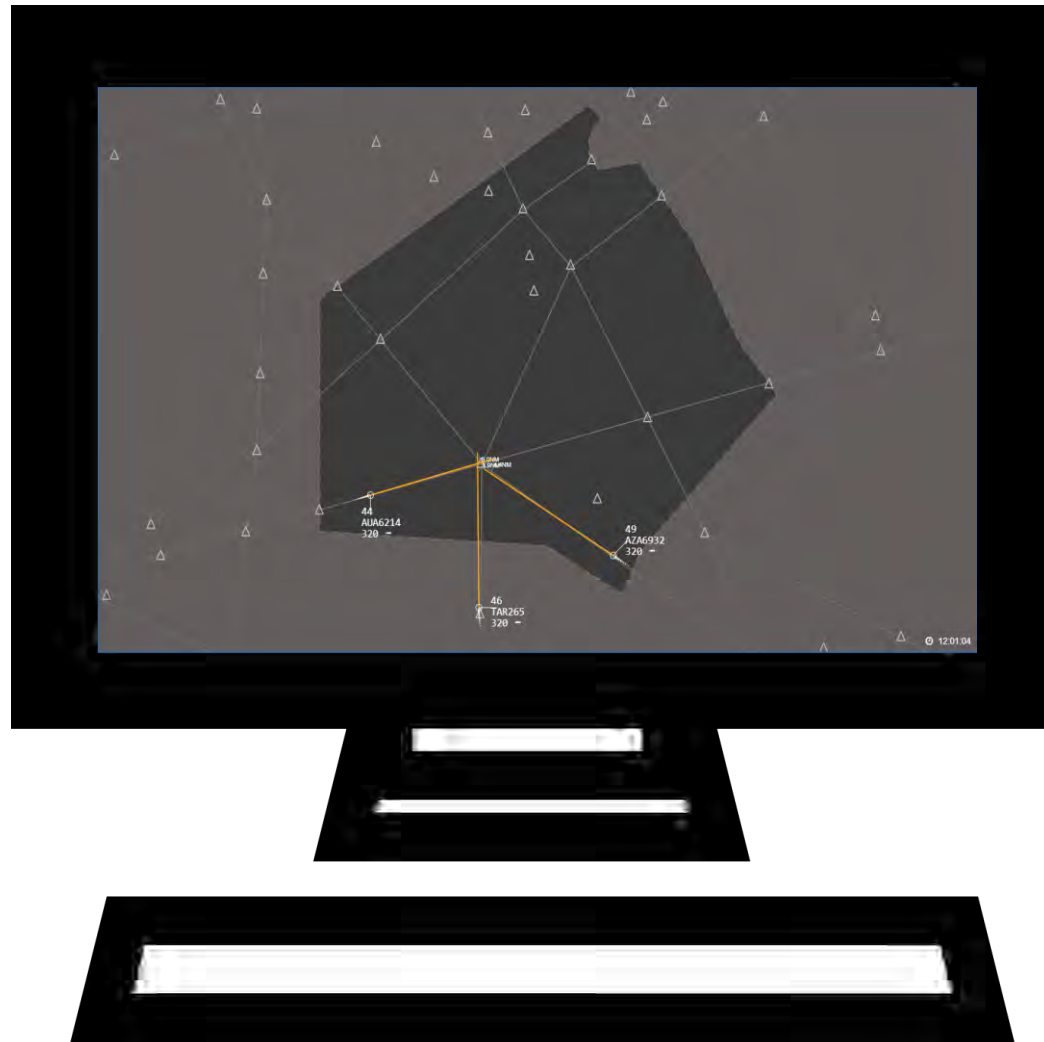
Experimentation Setting

16 healthy French-speaking participants (8 men) aged 21-29 years ($M = 24.56 \pm 2.68$), with 14-19 years of education.

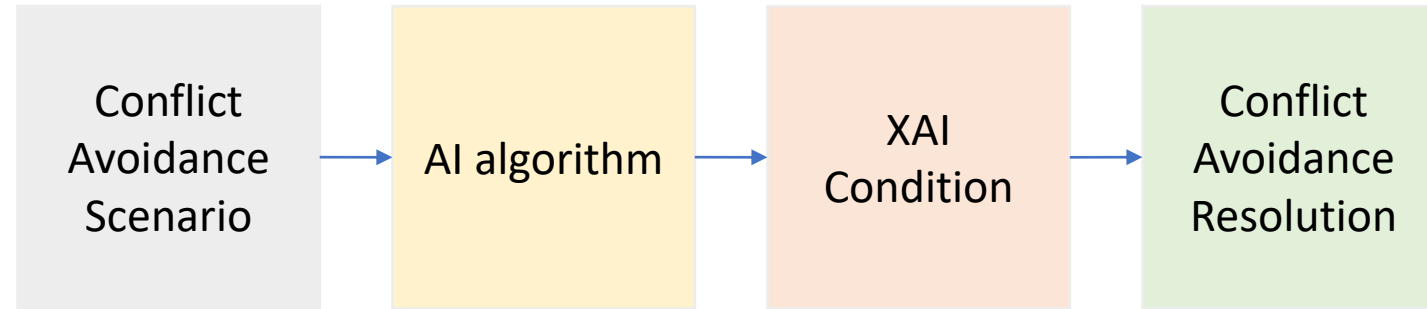


Simulation Running 2 minutes





Three XAI Conditions

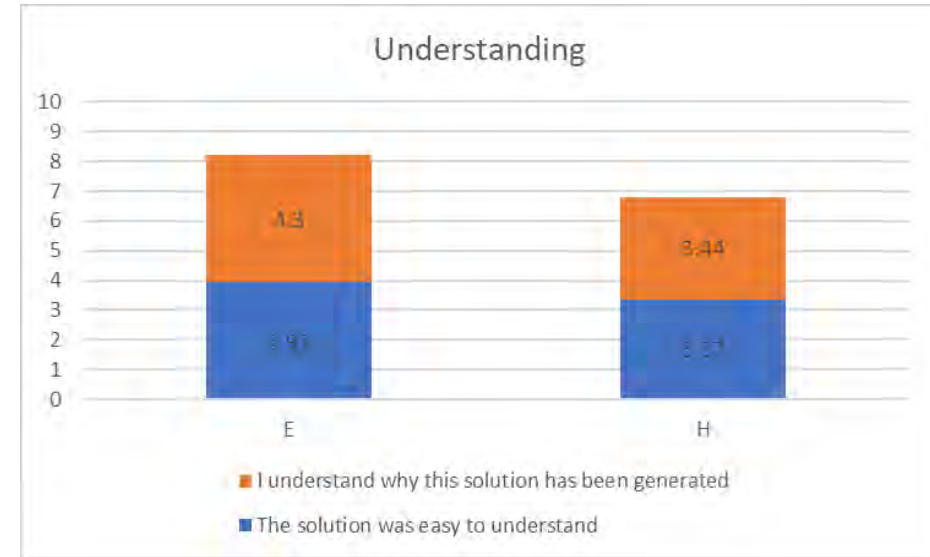
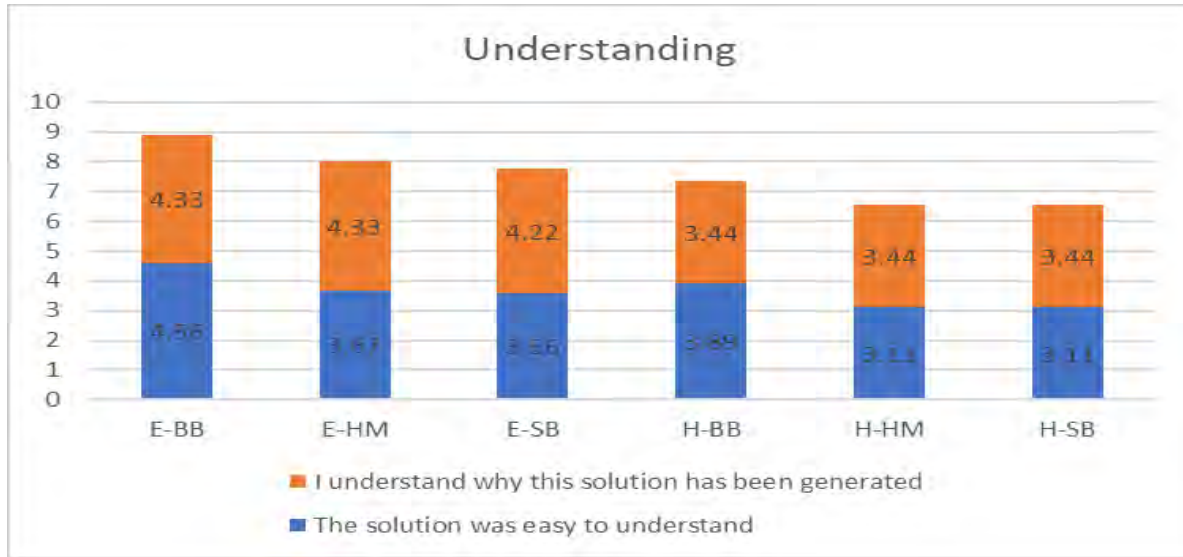


Condition 0: **BB** - Black Box

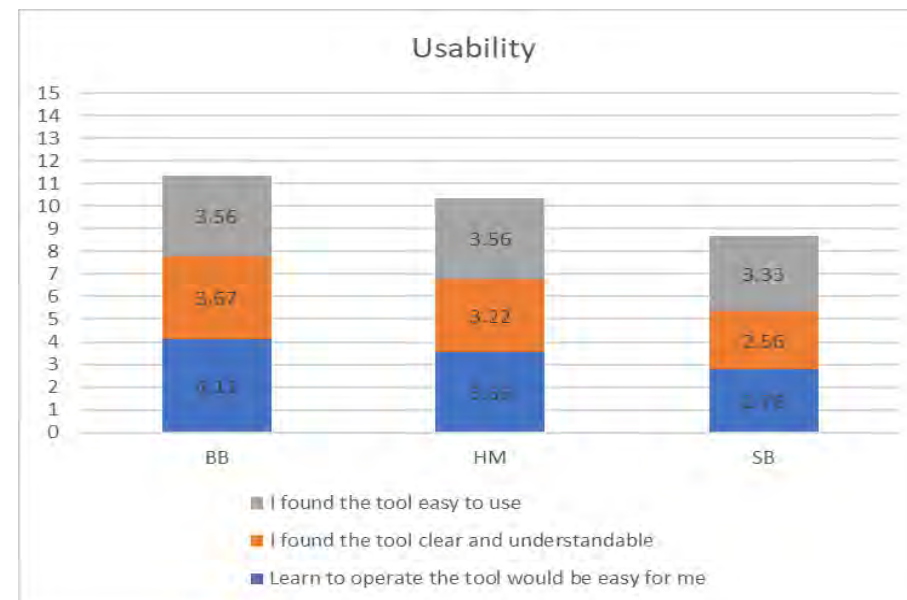
Condition 1: **HM** - Heatmap

Condition 3: **SB** - Storyboard

Understanding of the proposed solution



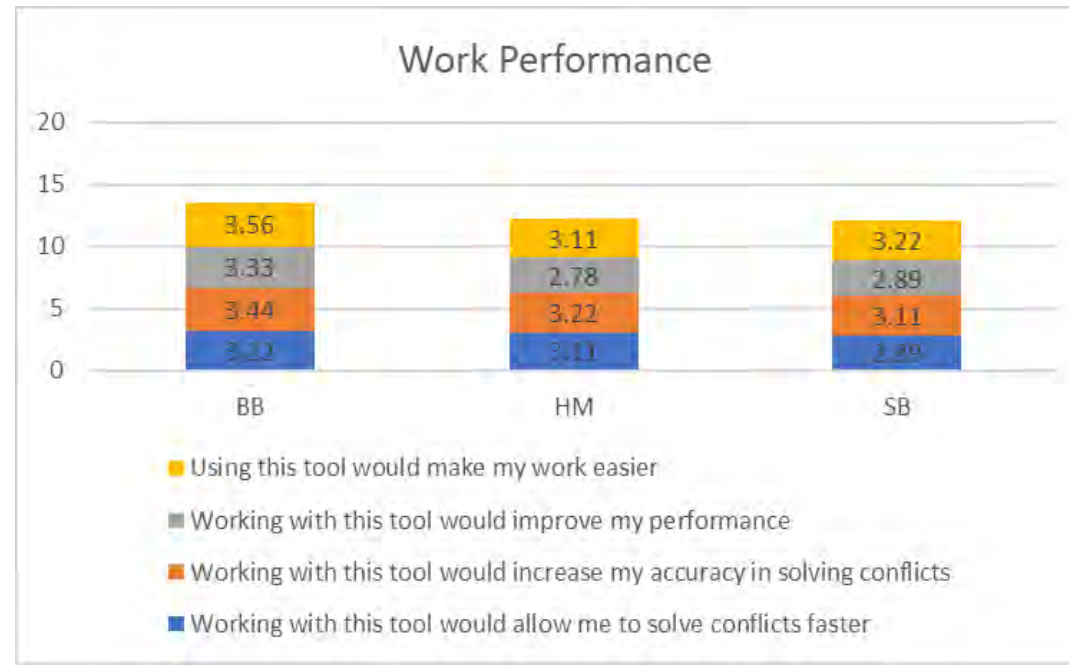
Usability of the proposed solution



The trust and the acceptability of the proposed solution



The efficiency of the proposed solution

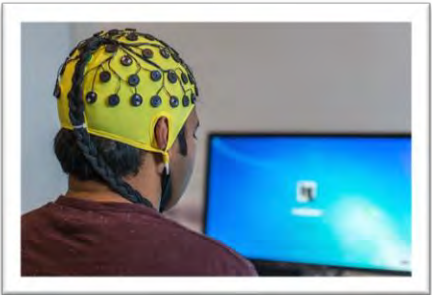


Results



AI support and types of conflicts: the proposed AI solutions were not useful for conflicts with only two aircraft.

Human Machine Interface: Heat Maps were not straightforward to understand by ATCOs.



Trust and XAI: the main outcome from the collected feedback is that more trust is provided with transparent solution.

Safety: improved safety with user ‘in the decision loop’.

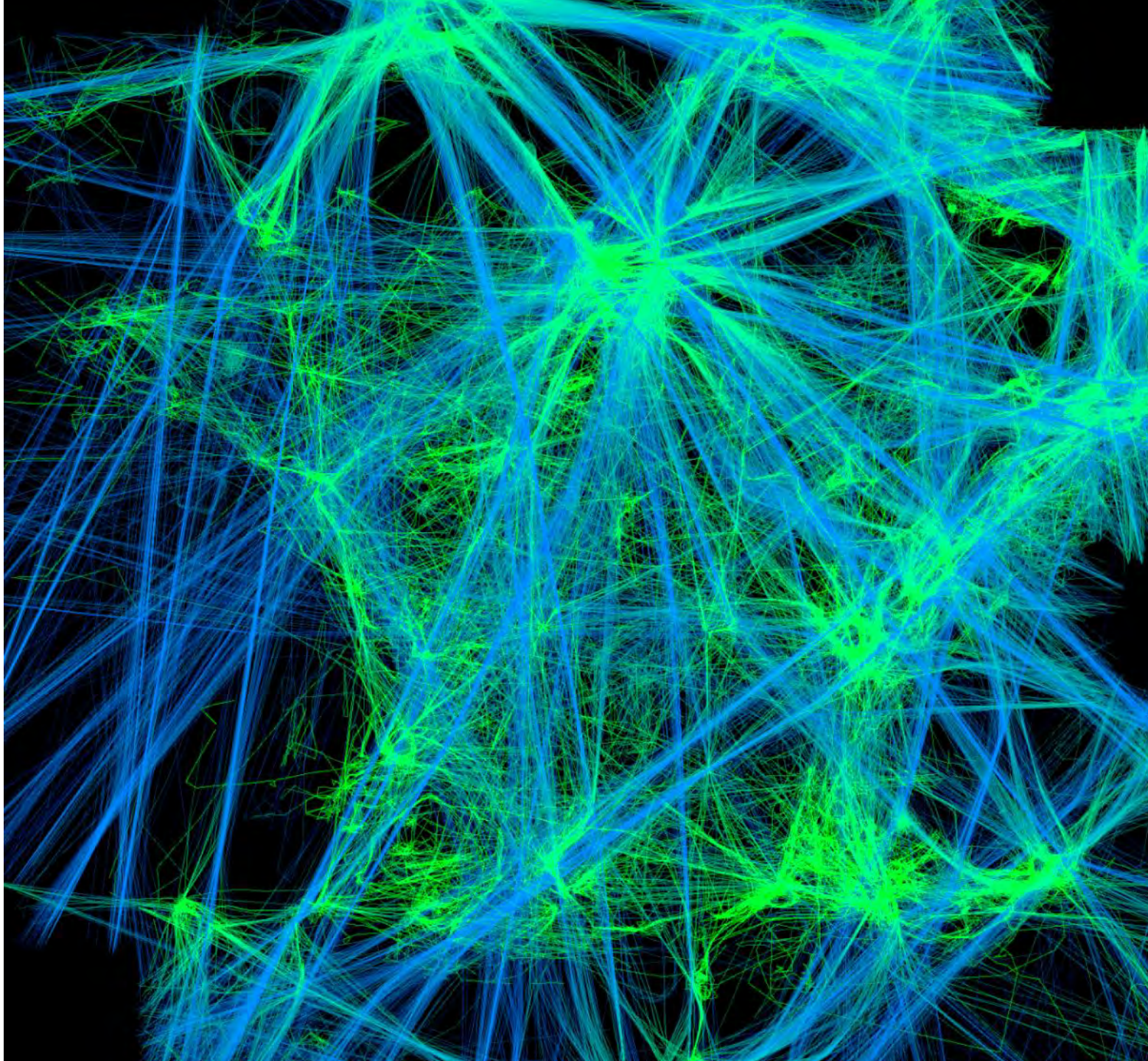
Training: five ATCOs mentioned that it would be interesting to explore and understand better the advantages of the XAI solutions for training.



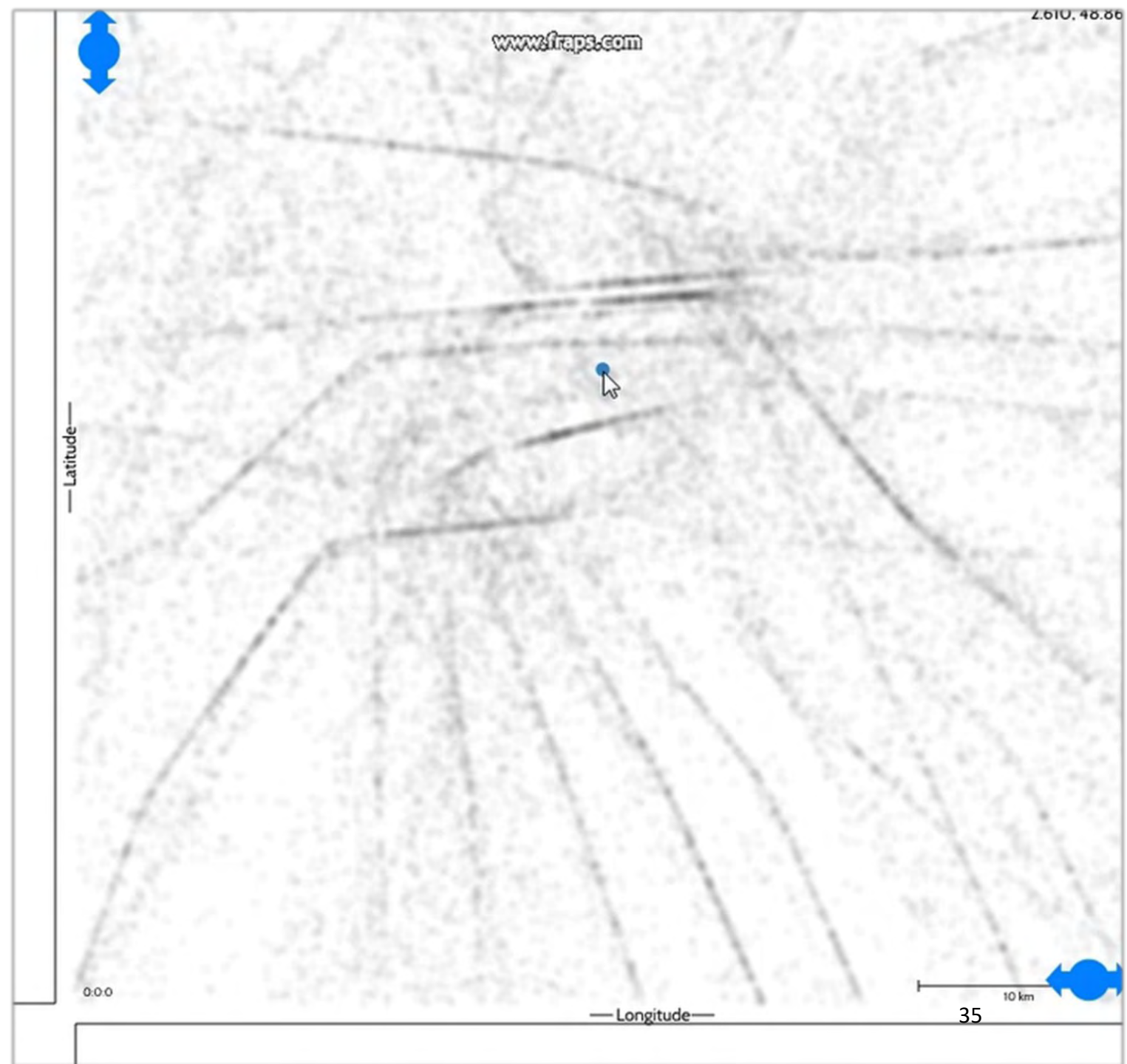
Visual / Immersive Analytics

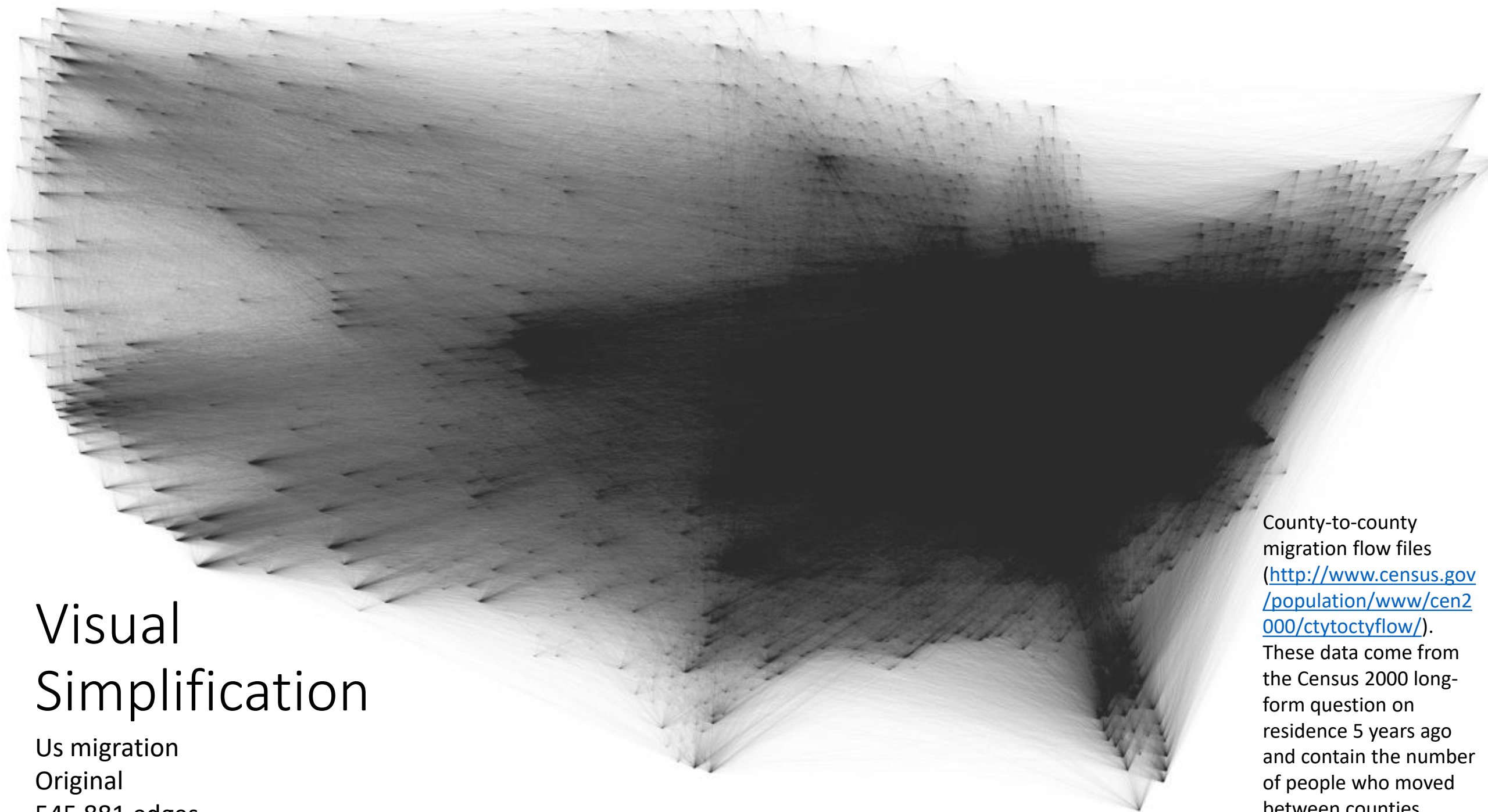
Traffic Analysis

C. Hurter, B. Tissoires, S. Conversy.
**FromDaDy: spreading data across views to
support iterative exploration of aircraft
trajectories.**
InfoVis 2019



Traffic Dynamics





Visual Simplification

Us migration
Original
545 881 edges

County-to-county
migration flow files
(<http://www.census.gov/population/www/cen2000/ctytoctyflow/>).

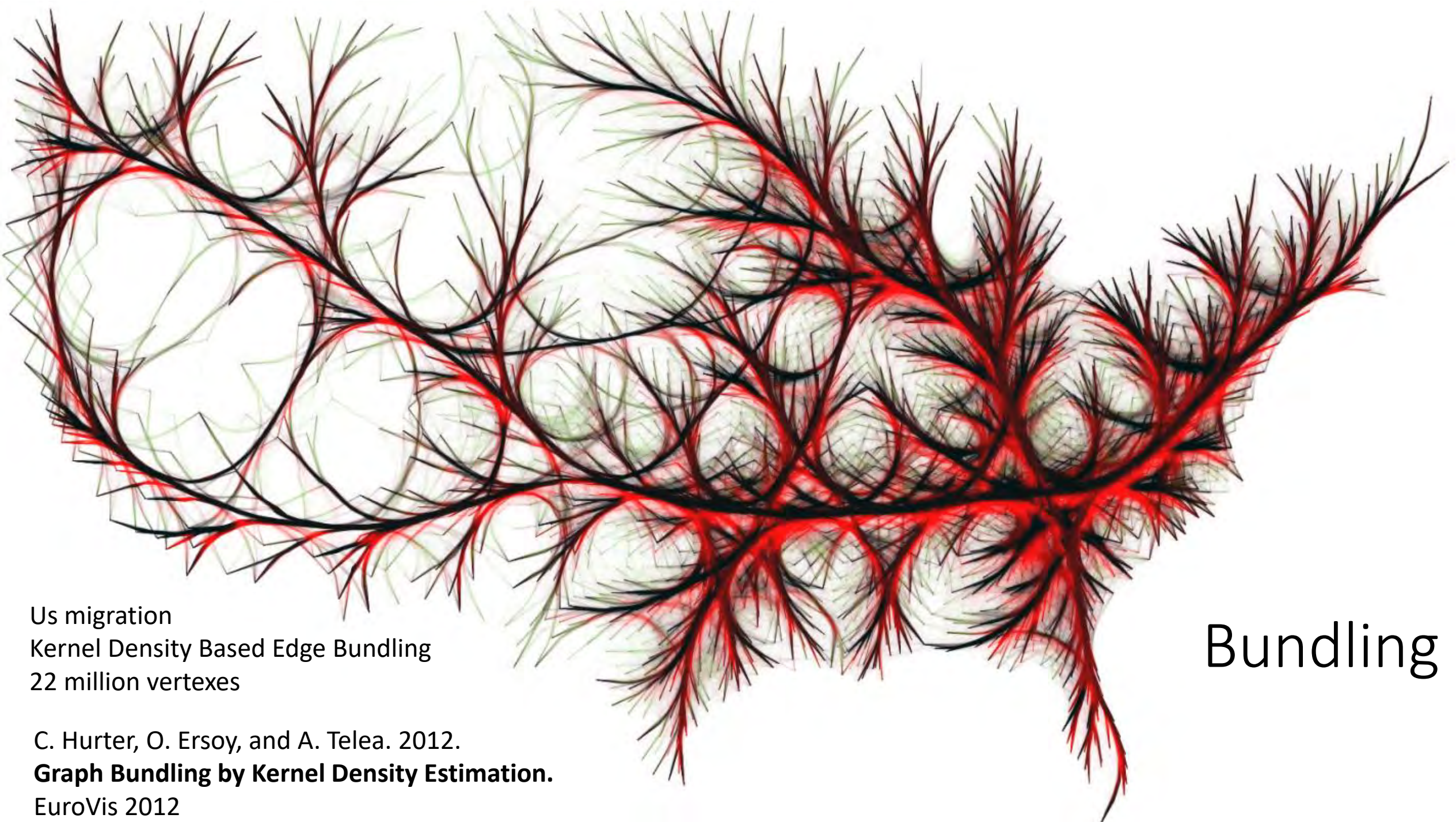
These data come from the Census 2000 long-form question on residence 5 years ago and contain the number of people who moved between counties.



US migration

dataset

realtime bundling



Us migration
Kernel Density Based Edge Bundling
22 million vertexes

C. Hurter, O. Ersoy, and A. Telea. 2012.
Graph Bundling by Kernel Density Estimation.
EuroVis 2012

Bundling

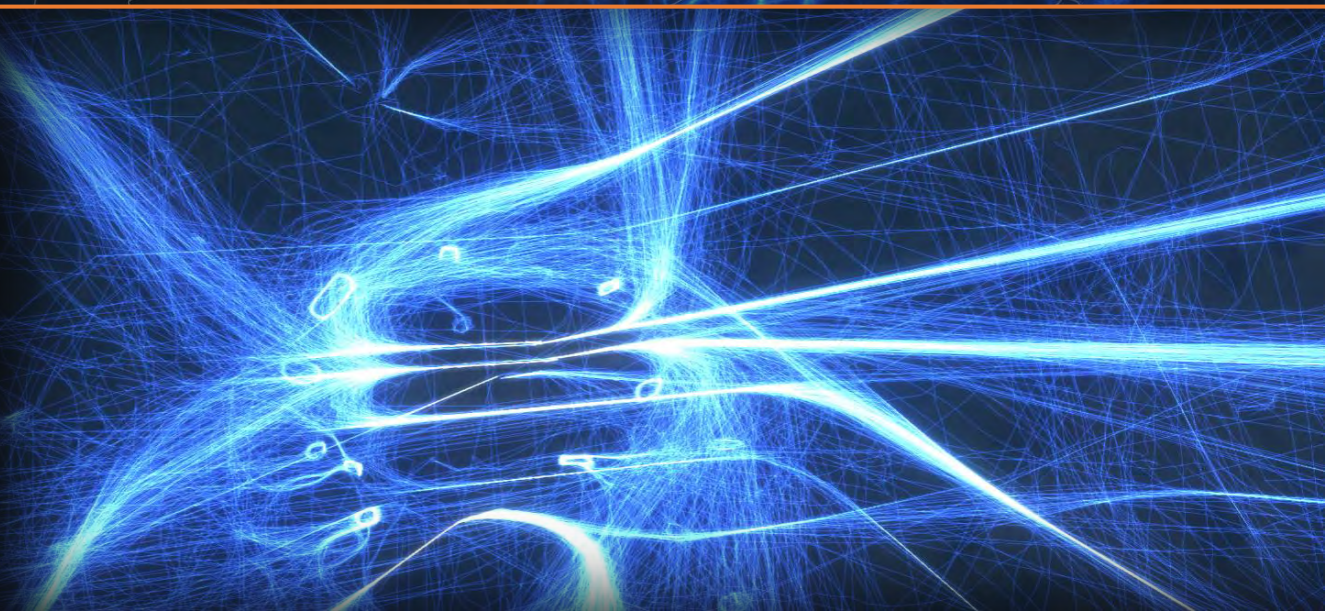


RenderLine

Next-generation of
Data Visualisation Tool

RenderLine

Next-Generation of Data
Visualisation Tool

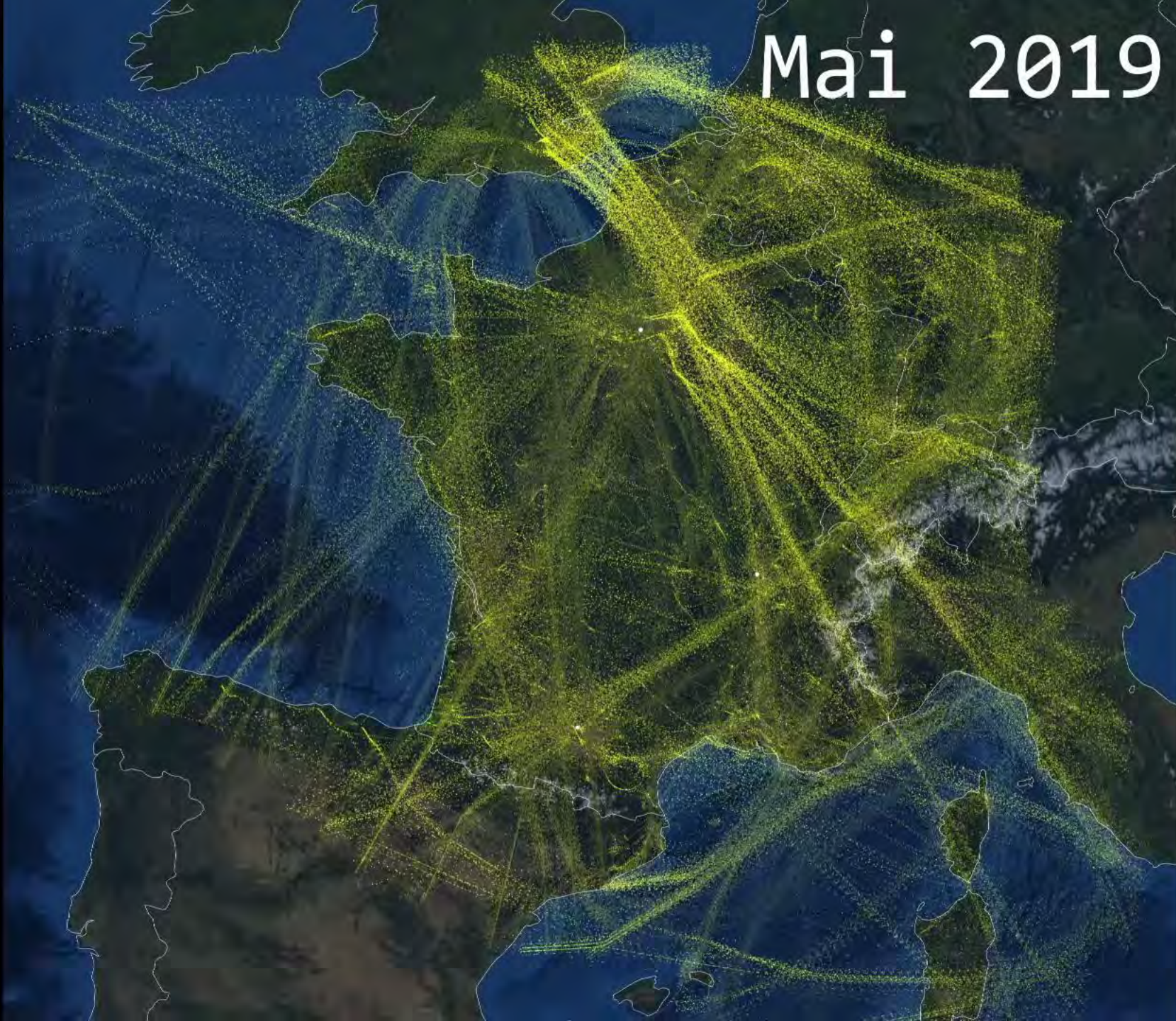


Renderline

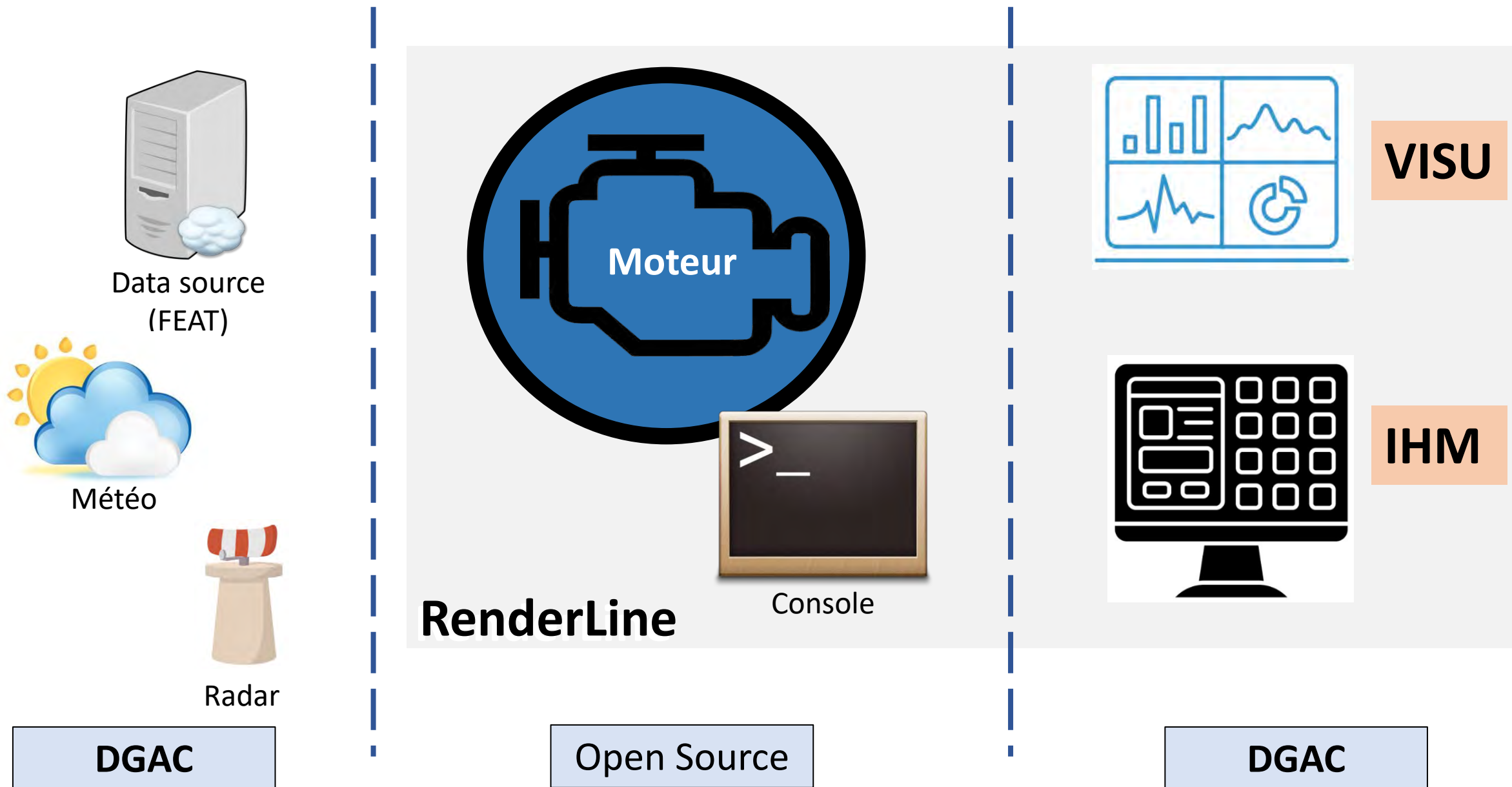
Moteur de rendu de trajectoires en 3D

Un outil pour la communication et l'analyse

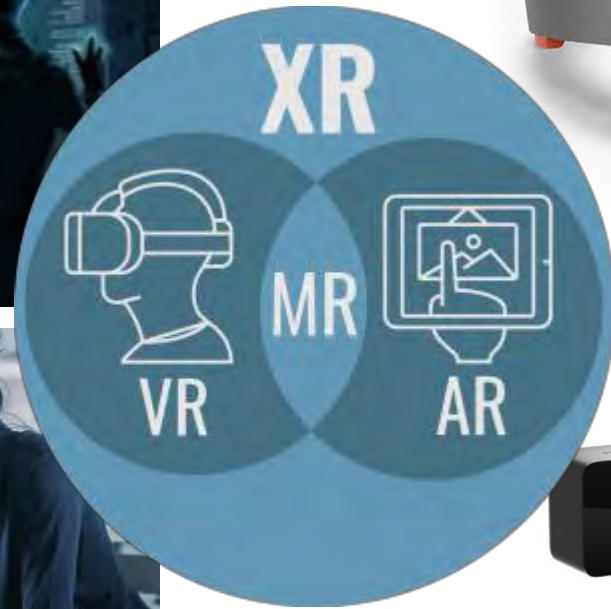
Mai 2019



Architecture de la solution



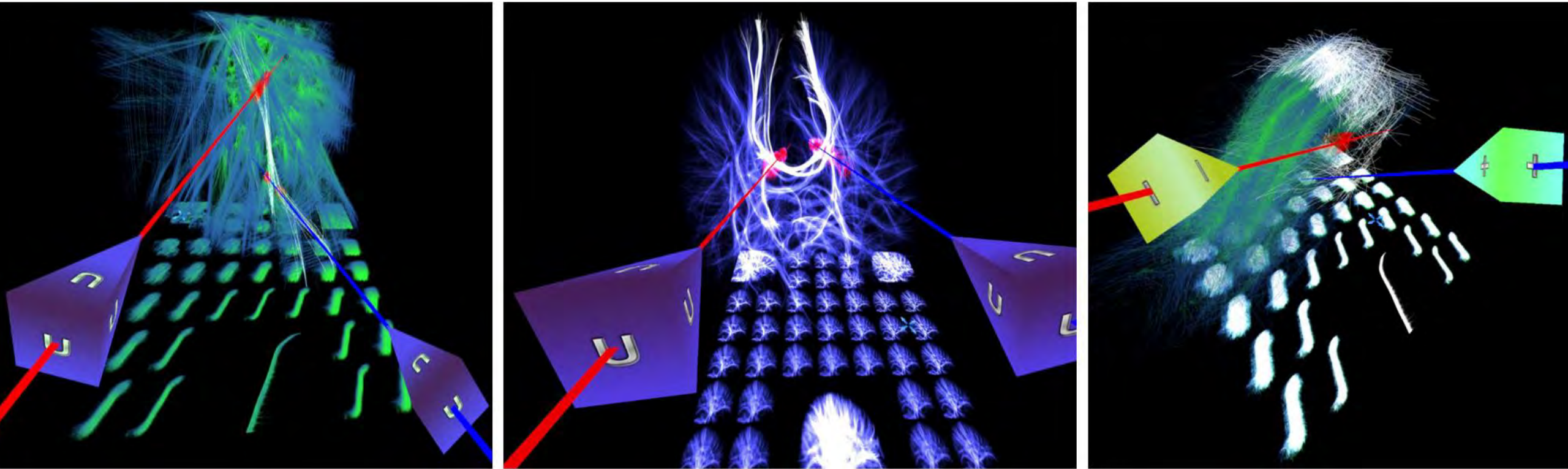
Immersive Analytics





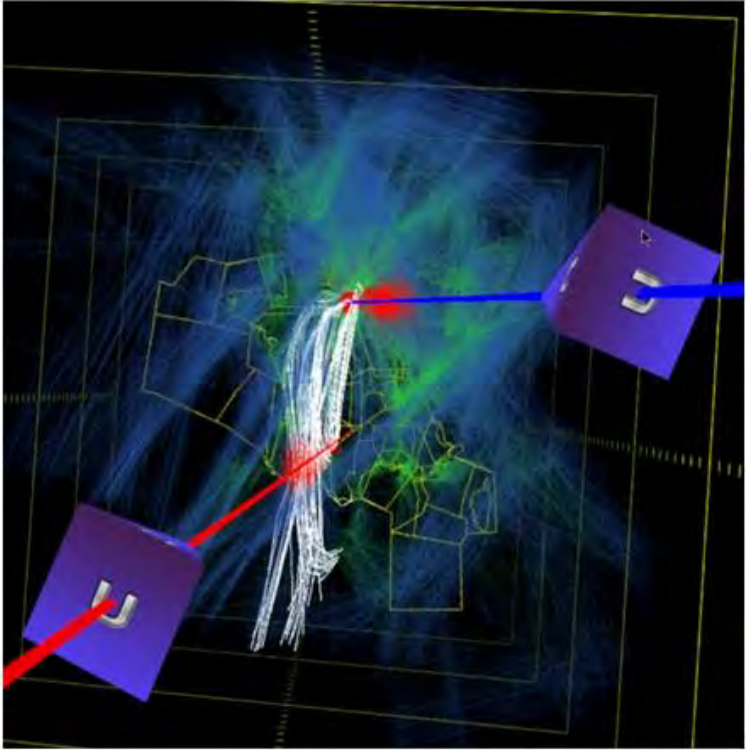
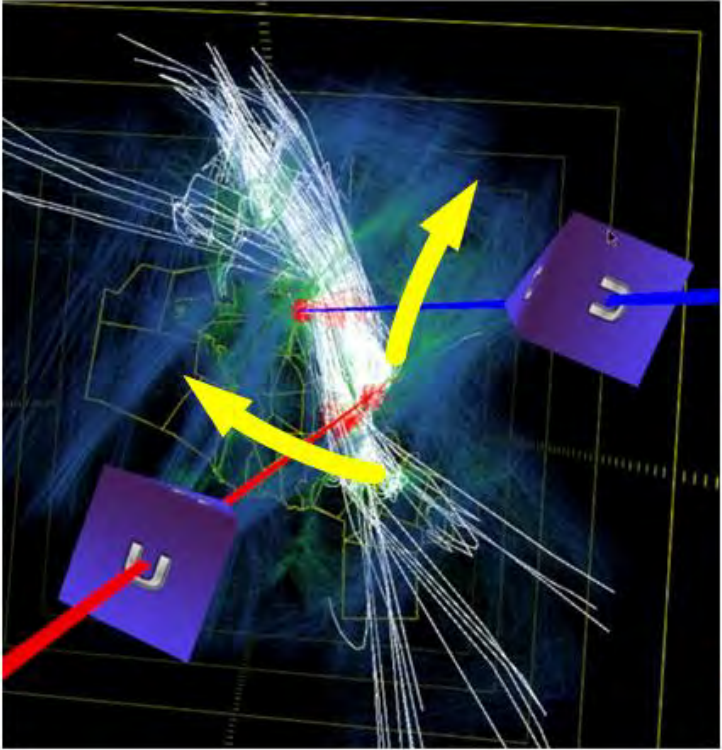
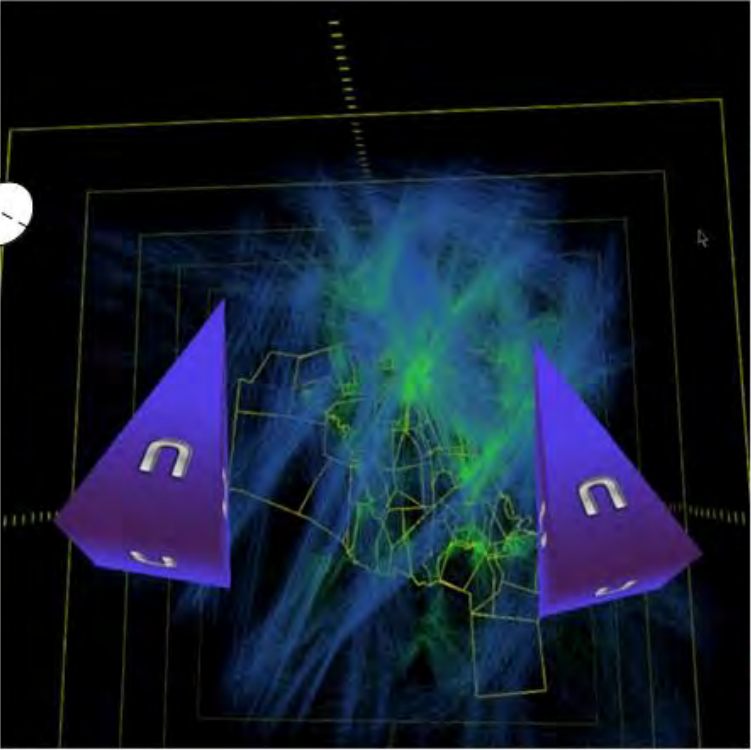
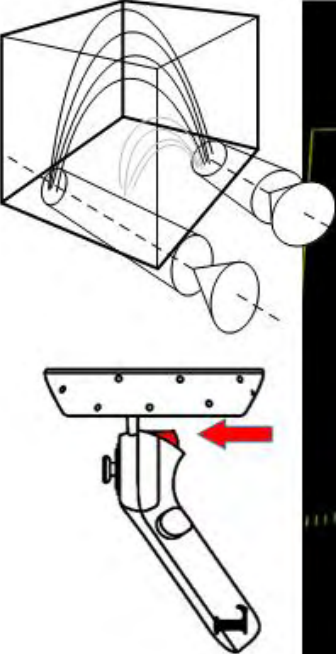


FiberClay: Sculpting Three Dimensional Trajectories to Reveal Structural Insights

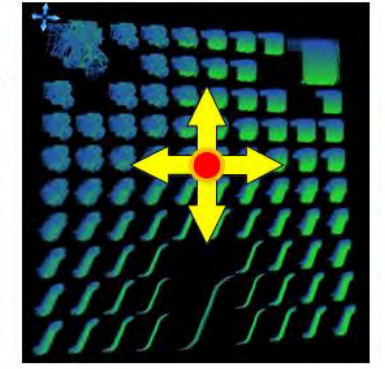
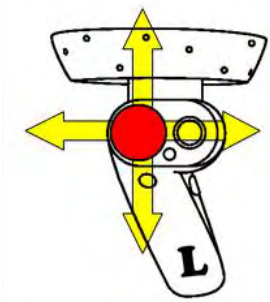
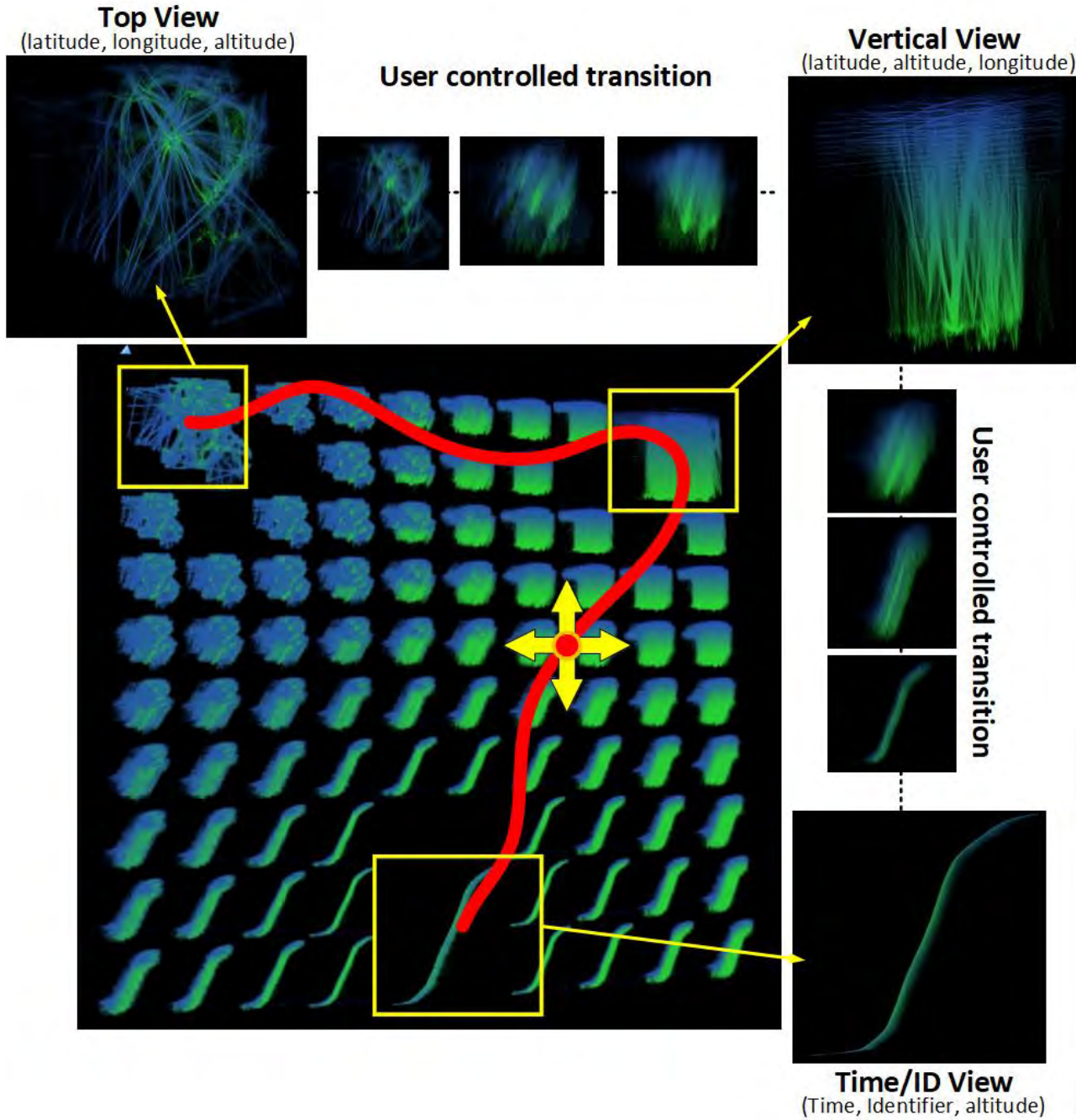


Hurter, C., Riche, N. H., Drucker, S. M., Cordeil, M., Alligier, R., & Vuillemot, R. (2018). Fiberclay: Sculpting three dimensional trajectories to reveal structural insights. *IEEE transactions on visualization and computer graphics*, 25(1), 704-714.

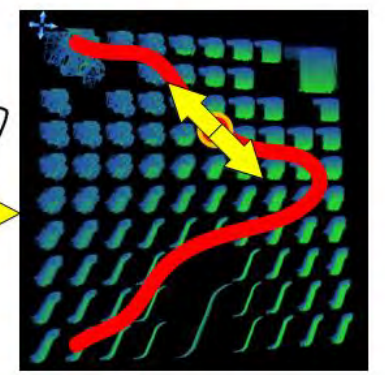
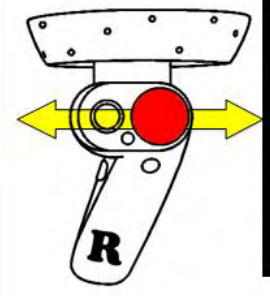
Brush Union



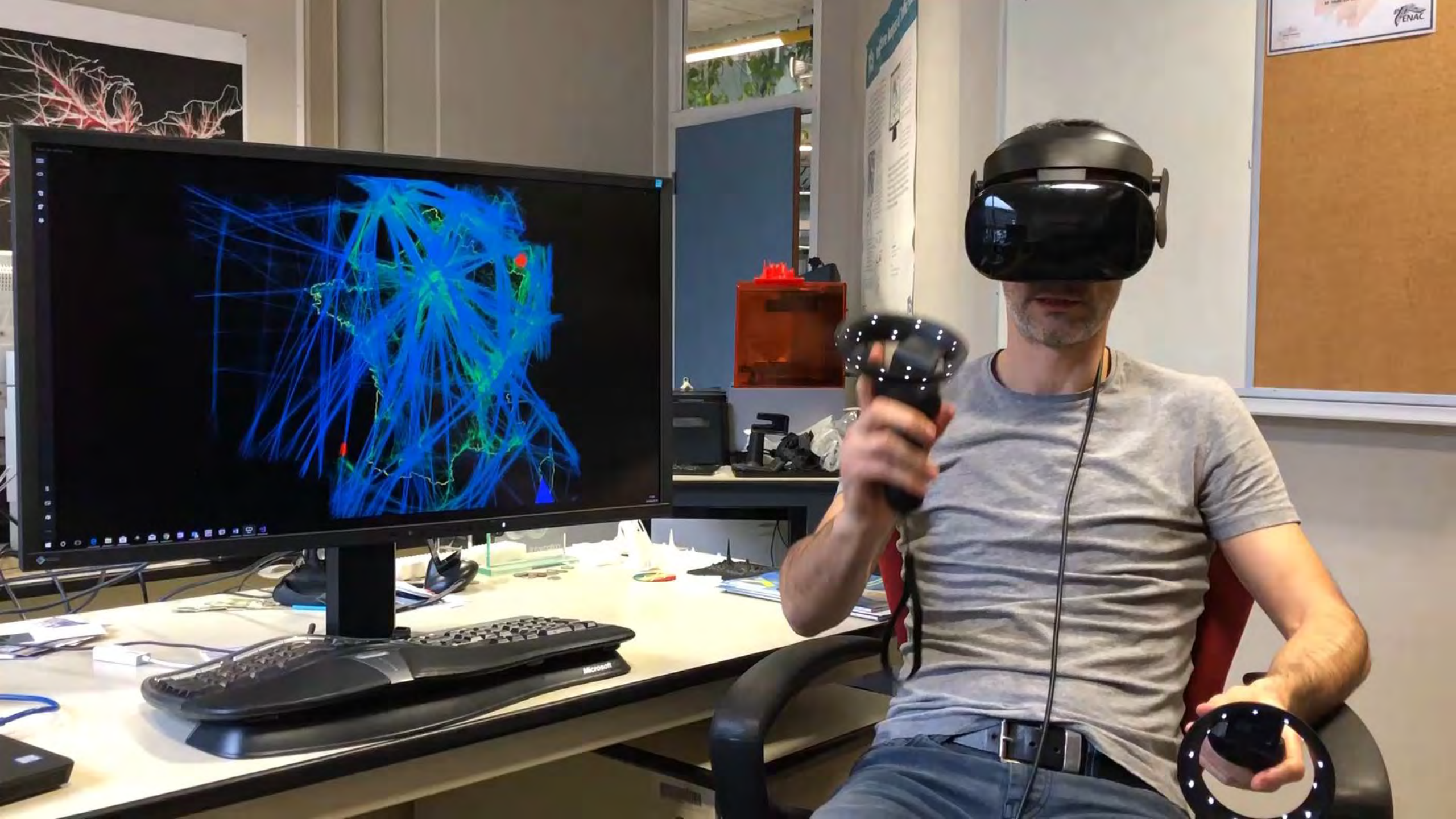
Presets navigation



User free navigation between the visual configurations

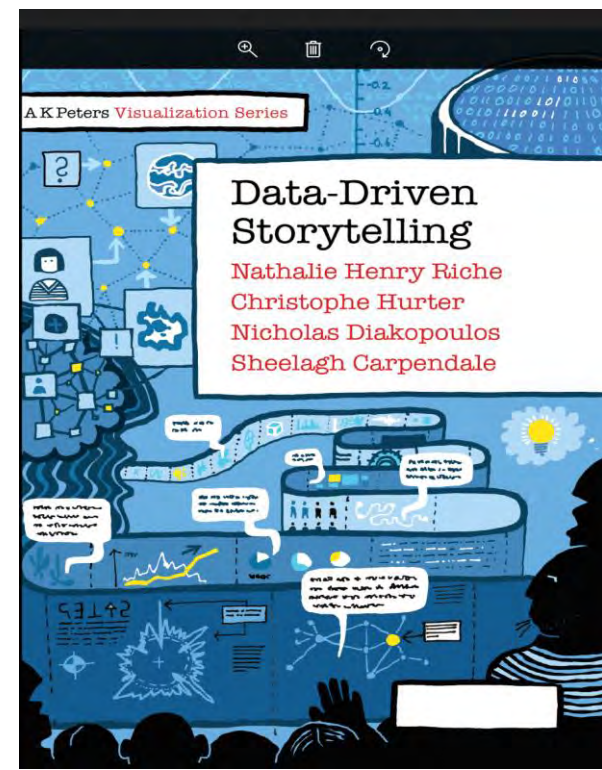
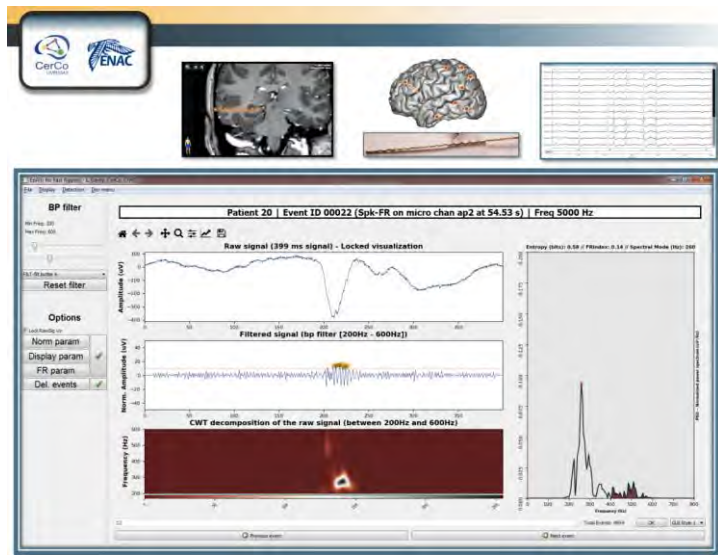
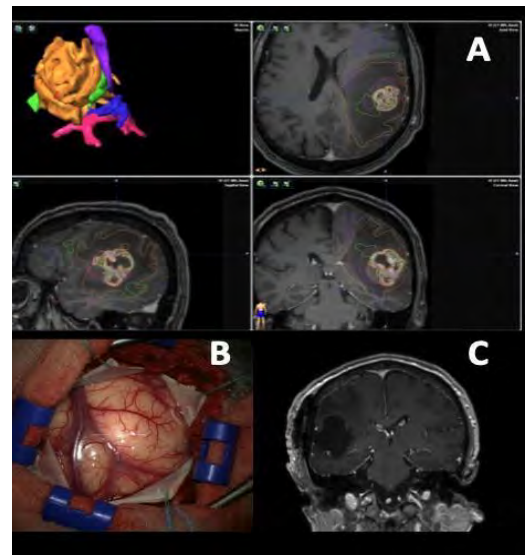
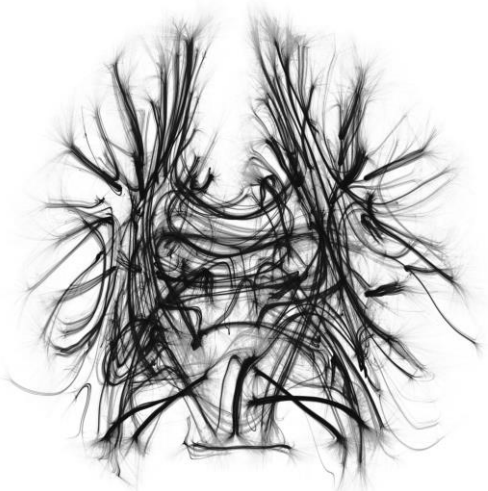


User constrained navigation along the last path recorded by the left controller

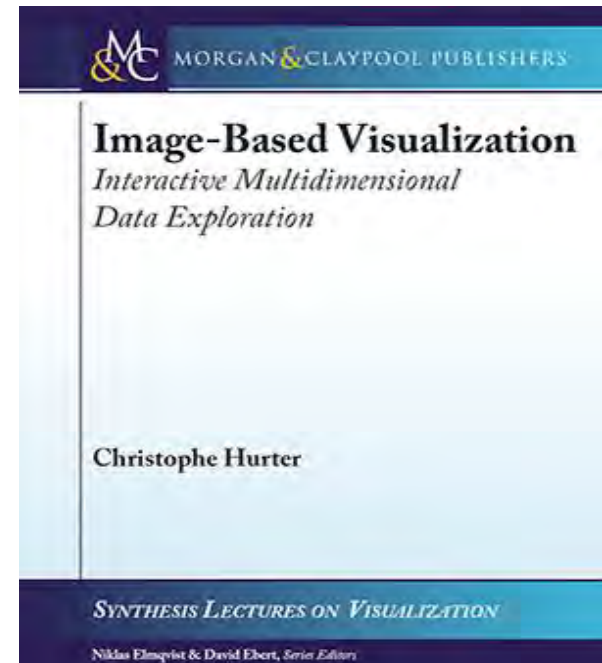
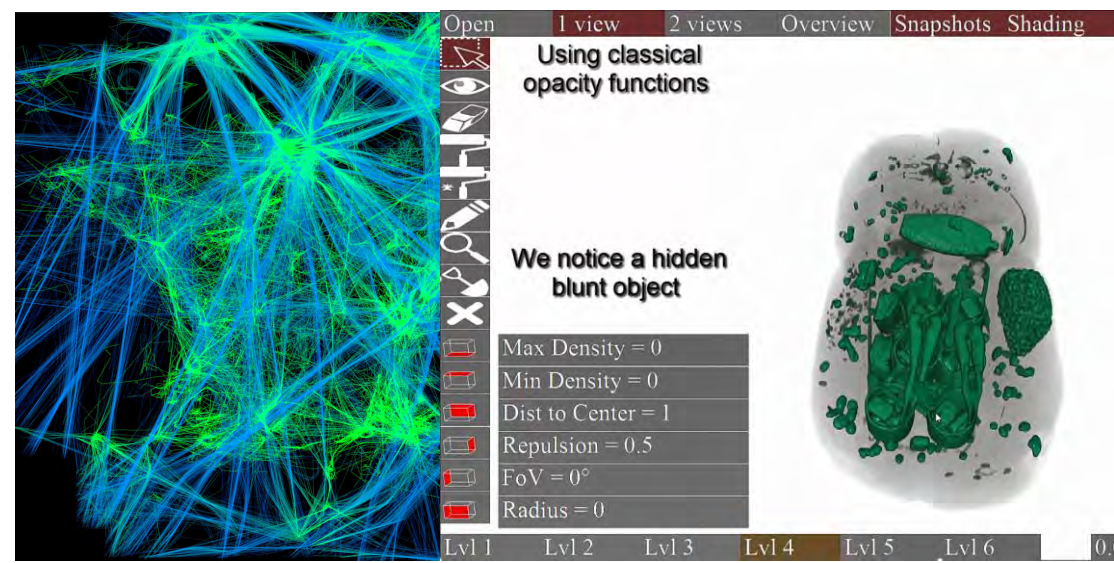


Research Areas

Medical



ATC





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Questions

<https://www.artimation.eu/>

