

ANIMA HYBRID WORKSHOP

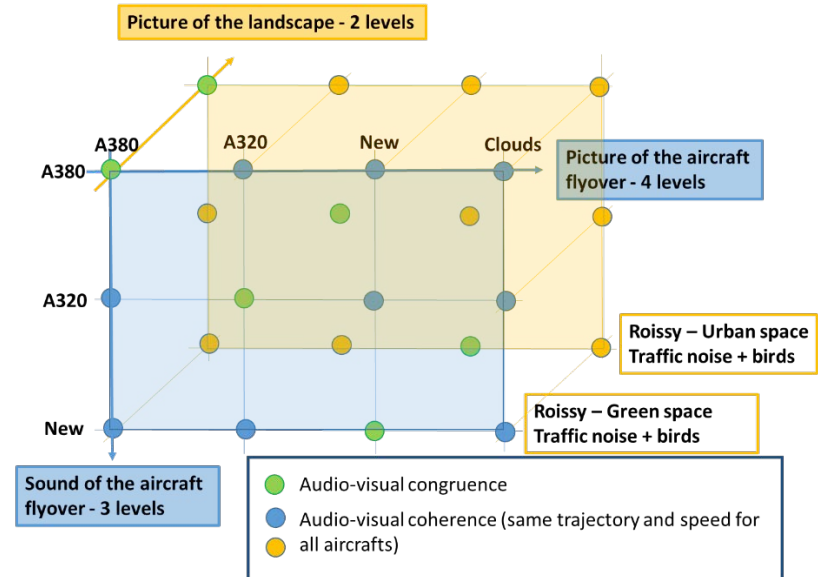
VIENNA, JUNE 22, 2021

NEW APPROACHES TO MITIGATE AVIATION NOISE IMPACT

The use of auralization and visualization tools to engage the airport community

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Laboratory experiment



- Do people recognize the congruent aircraft and sounds?
- Are people influenced by the landscape?
- Do people prefer to see or not the sound source (behind clouds)?
- Are people sensitive to the novelty?

Is the tool of enough quality to ensure realism and immersion?

Design of experiment

Aircraft Architectures



Blended Wing Body (BOLT)



A380



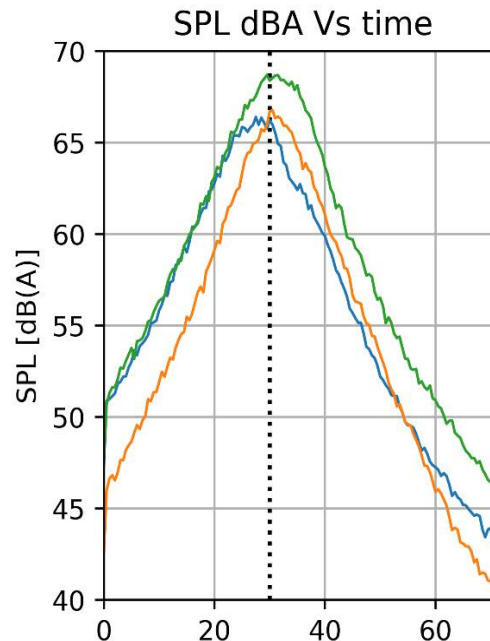
A320neo



Clouds

Aircraft Sounds

	Max [dB]	LAeq [dB(A)]
A320neo	72.1	59.6
BOLT	71.3	60,0
A380	76.1	62.4



Landscape



Protocol

1. Panel:

- 30 participants aged 18-30
- 30 participants aged 30-50

2. Experimental design:

- 12 Audio visual stimuli x 2 Landscapes
- 4 subjective questions
- 1 final questionnaire assessing:
 - Personal variables (QoL, Noise sensitivity, gender, etc.)
 - VR experiment assessment (audio and video quality, sensation of presence in the virtual environment, audio visual realism, control)

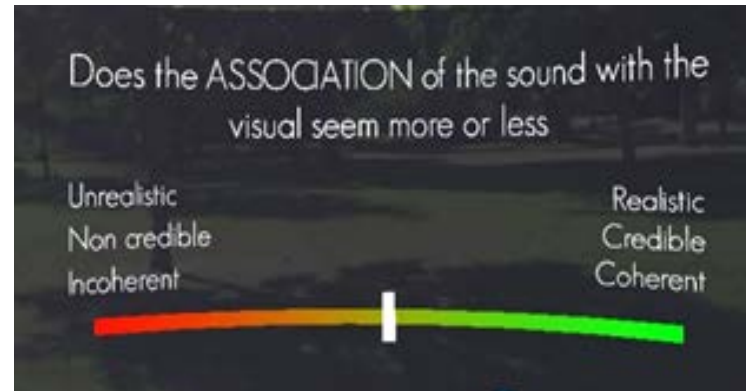


3. Hardware setup:

- Virtual Reality device: [Oculus Rift](#)
- Headset: [Sennheiser HD650](#)

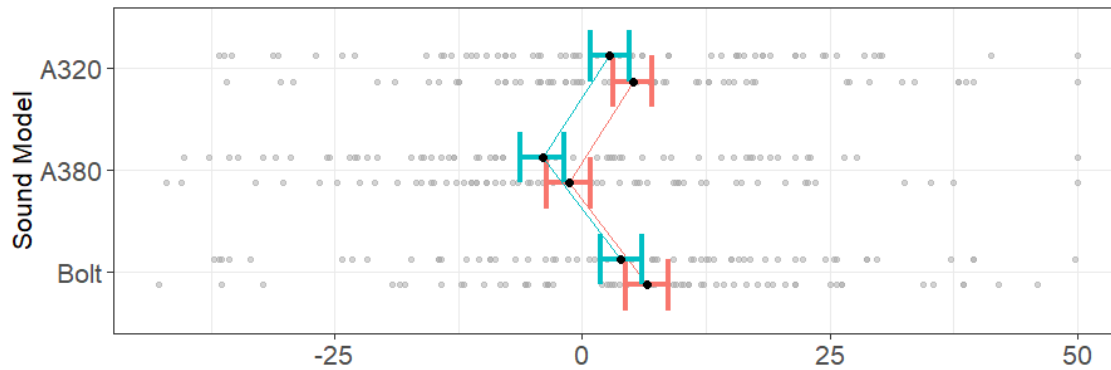


Subjective questionnaire



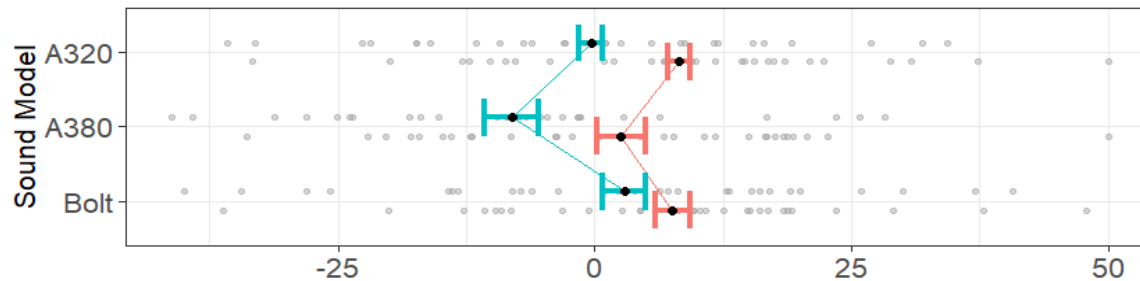
- (1) Overall, does this situation seem more or less Unpleasant/Unbearable Pleasant/ Bearable?
- (2) Does the association of sound with visual seem more or less Unrealistic/Non credible/Incoherent Realistic/Credible/Coherent?
- (3) Is the sound of this aircraft more or less Unpleasant/Unbearable Pleasant/Bearable?
- (4) Does the noise level of this aircraft seem more or less Strong/Loud Weak/Quiet?

Overall Pleasantness

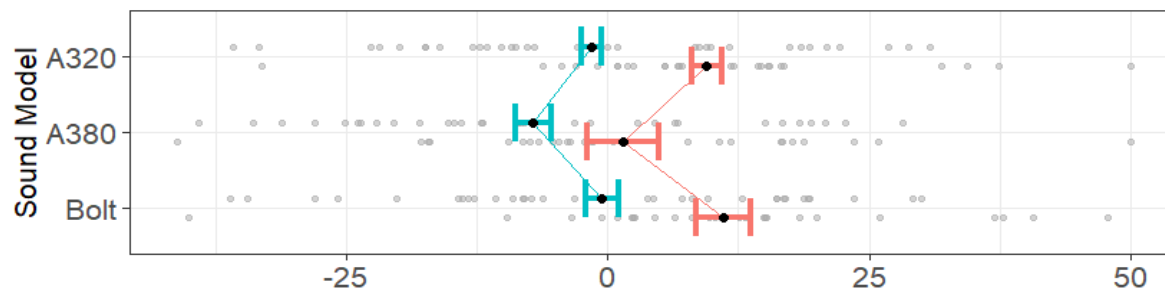


testPart ● Part.1 ● Part.2

But no landscape influence

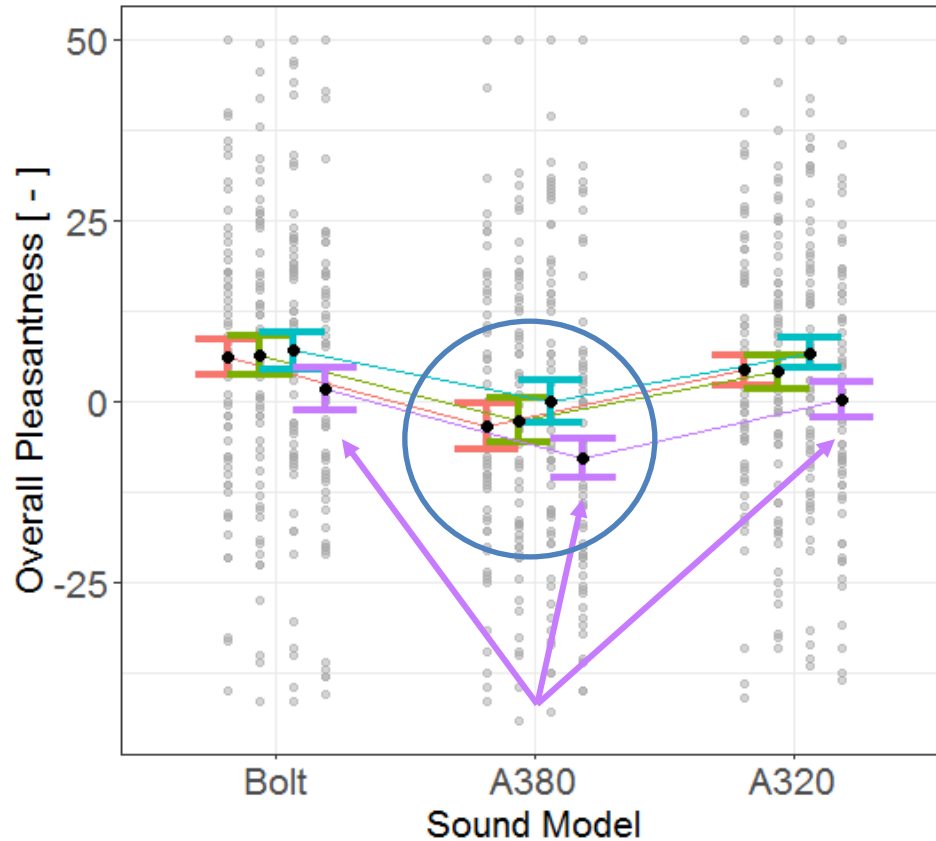


AgeCat ● 18-29 ● 30-60



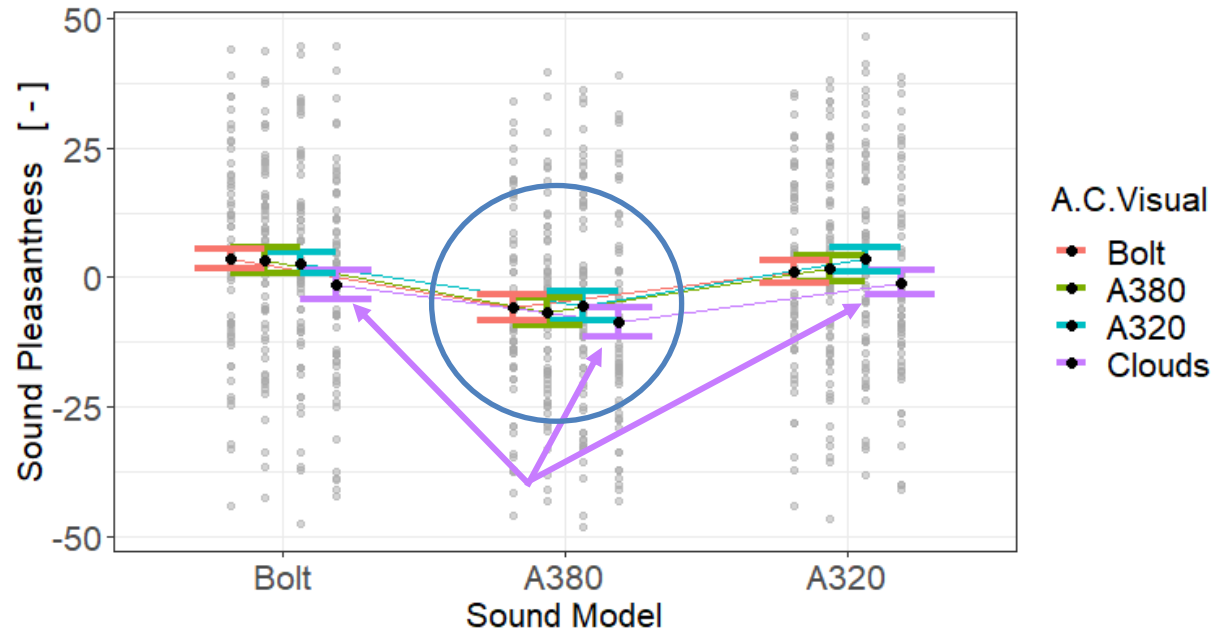
Sens.Cat ● NS ● S

Overall Pleasantness



- Large dispersion among participants
- A380 sound creates less overall pleasantness
- Clouds generate less overall pleasantness
- Audio influence (2%)
- Visual influence (1%)
- Audition is twice more important than vision for the overall pleasantness

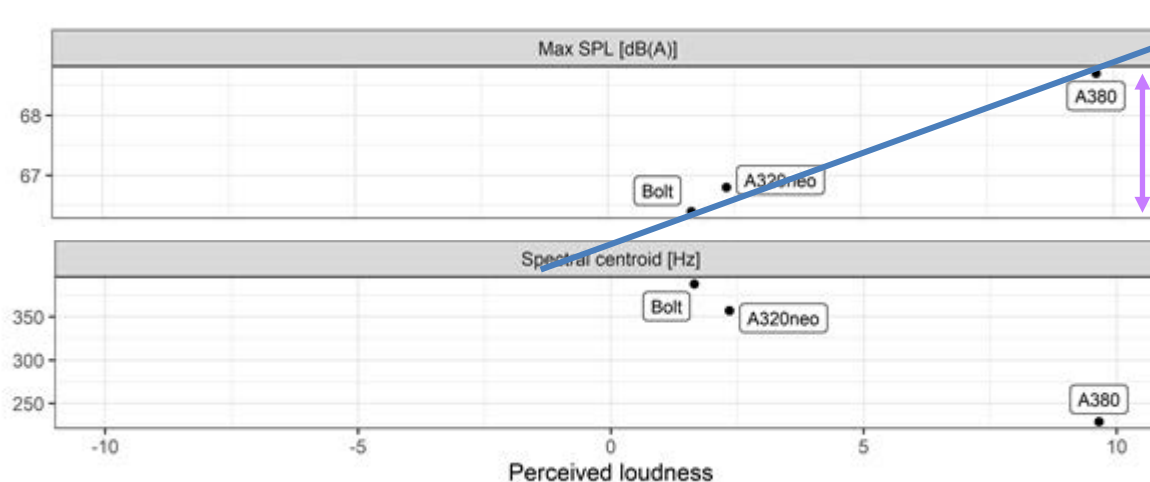
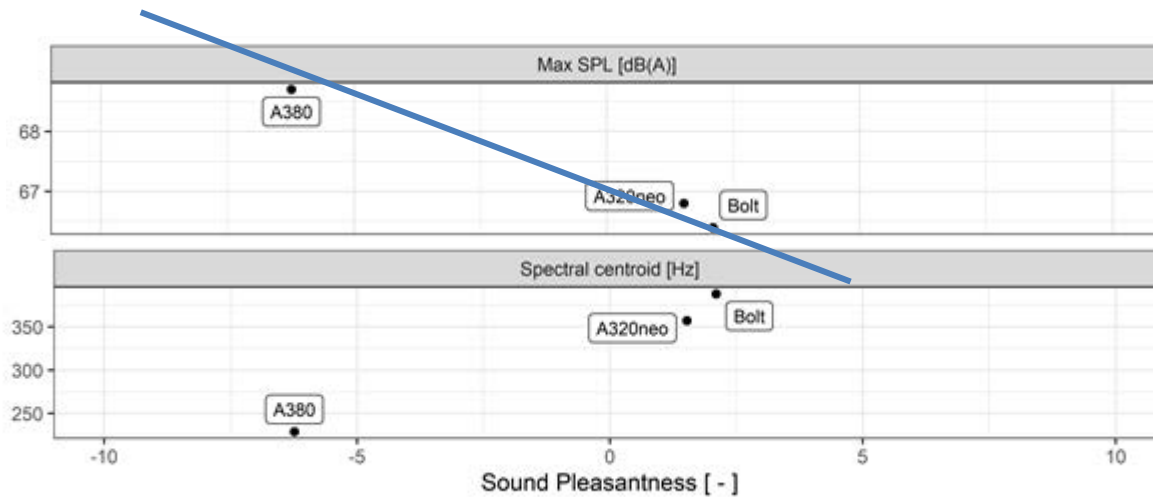
+ Sound Pleasantness / - Loudness



- Large dispersion among participants
- Audio influence (3%)
- Visual influence (0.5%)
- Audition is 6 times more important than vision for sound pleasantness
- The BOLT is louder behind the clouds

	BOLT	A320neo	A380
Leq [dB(A)]	60.0	59.6	62.4
Loudness [sone]	20.6	19.4	23.1
Max SPL (@30sec) [dB(A)]	66.4	66.8	68.7

Sound pleasantness / Perceived loudness

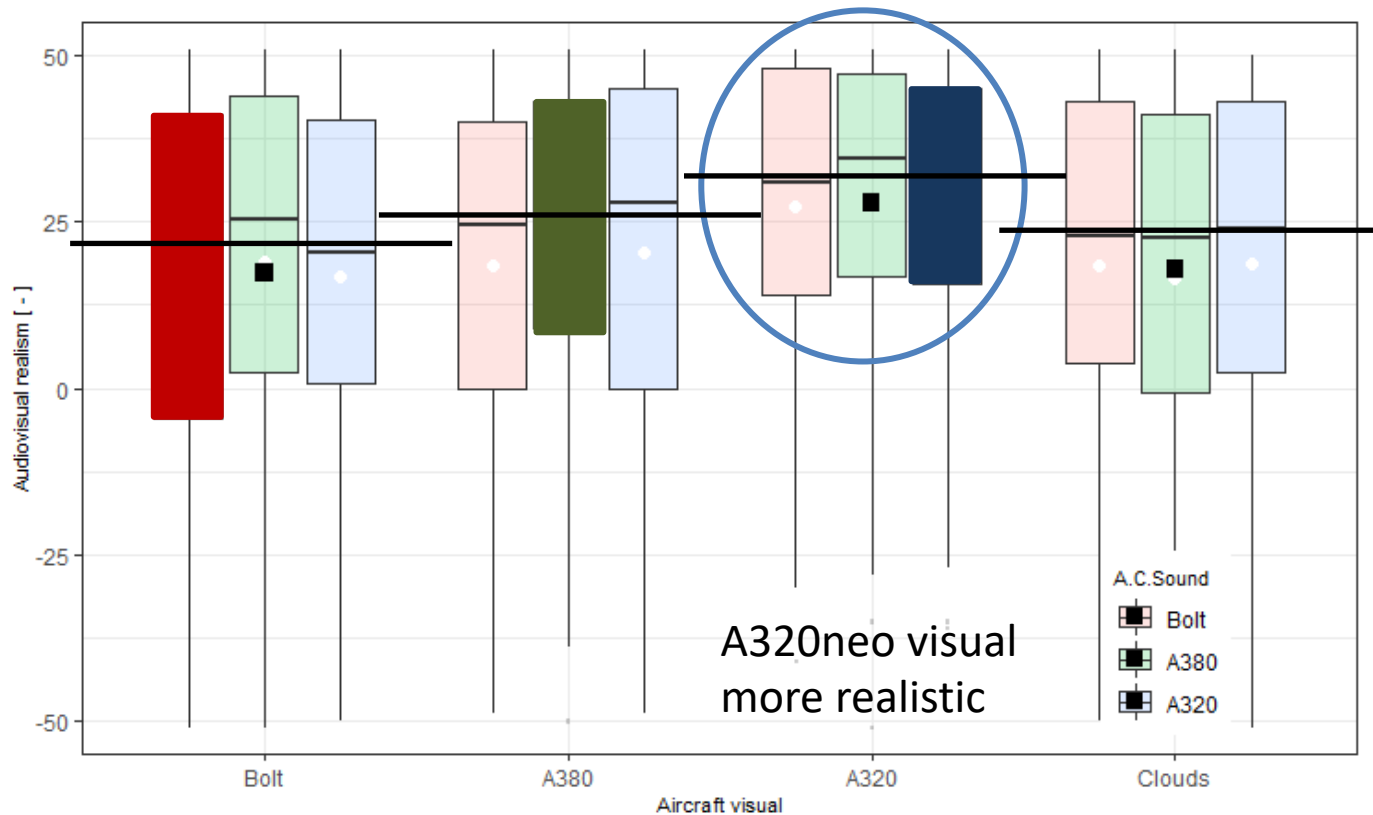


$$\Delta L_{\max} = 68.7 - 66.4 = 2.3 \text{ dB(A)}$$

$$\Delta L_{\text{Aeq}} = 62.4 - 59.6 = 2.8 \text{ dB(A)}$$

- People are able to perceive a variation of less than 3 dB(A) for a non stationary sound

Audio visual Realism



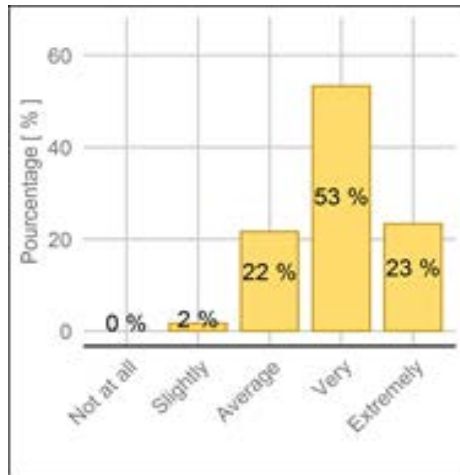
No effect of sound auralizations to assess realism

No congruence effect

Final questionnaire

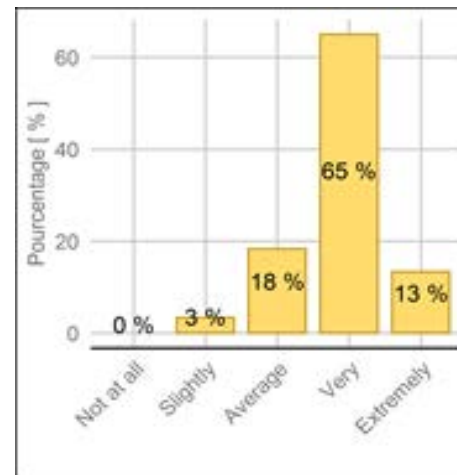
Audio realism

How realistic was what you HEARD in the virtual world?



Visual realism

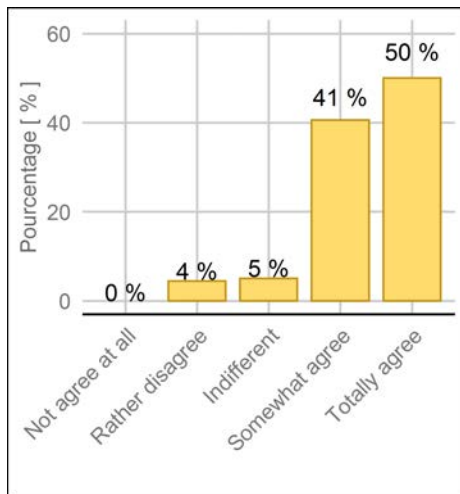
How realistic was what you SEEN in the virtual world?



Immersion

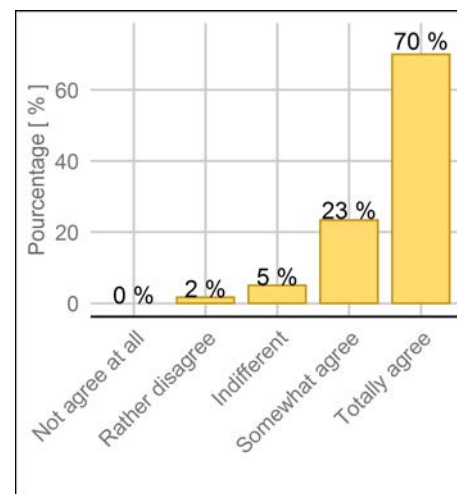
I felt surrounded by the environment ;

I felt like I was physically present in the environment;



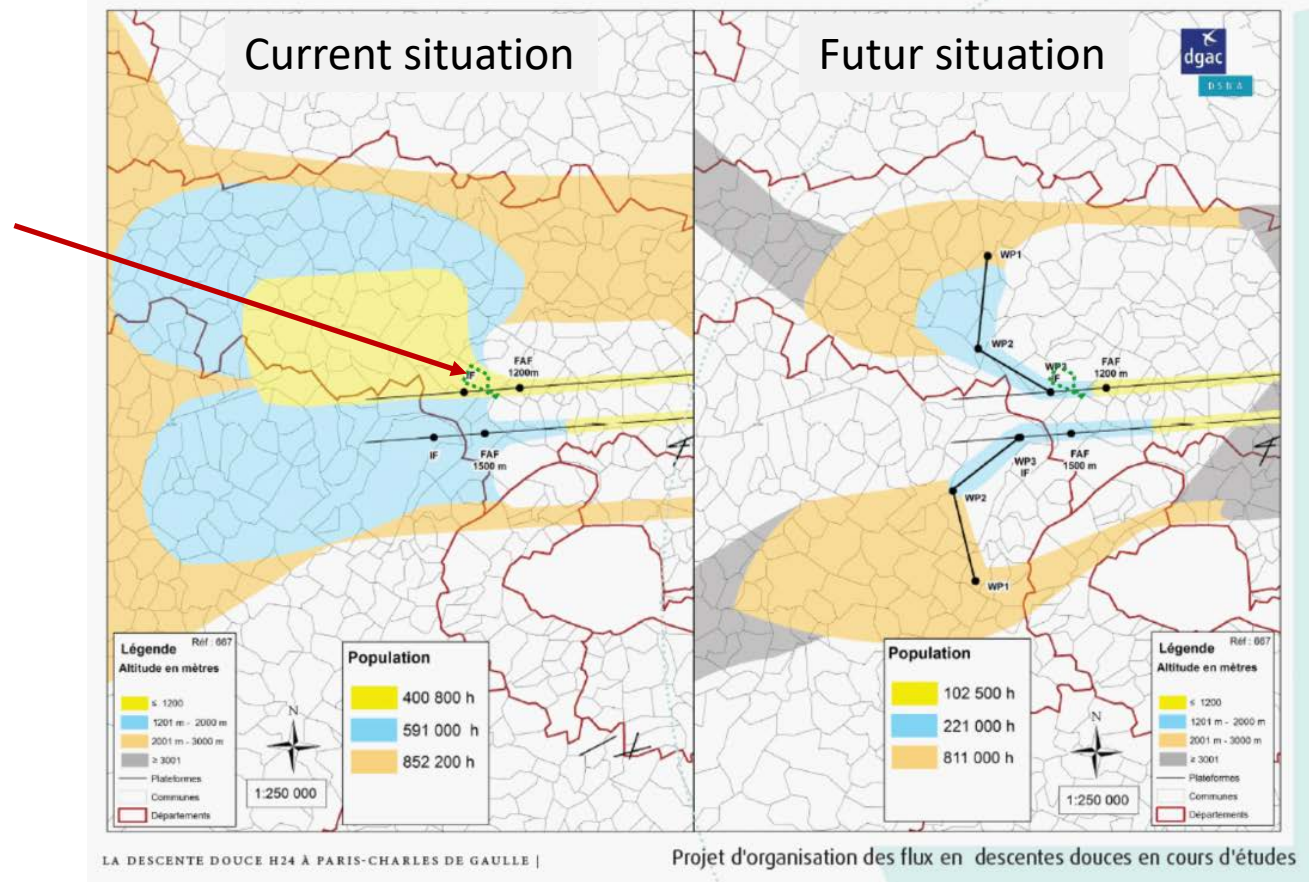
Control

I felt that the environment was reacting correctly to the actions I was performing.



Conclusion: the VR can be used with community

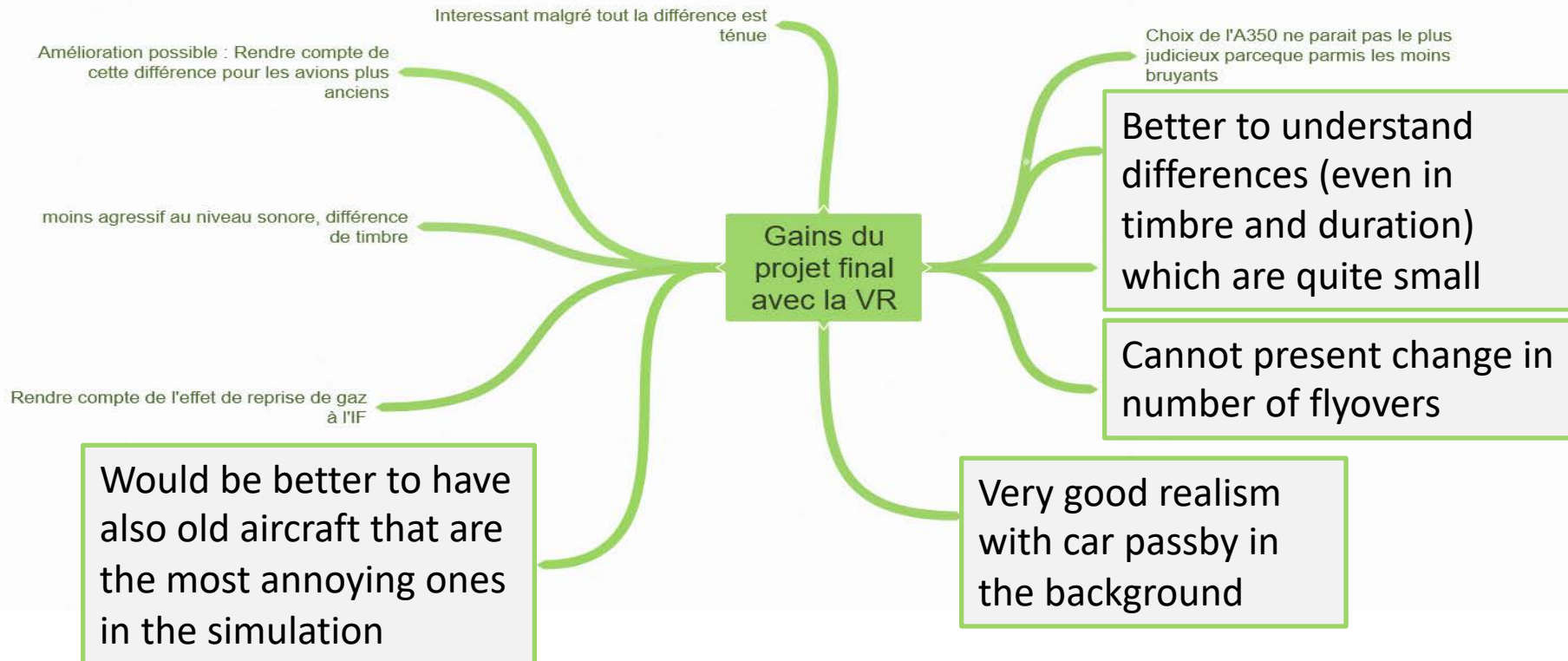
In situ experiment: Beauchamp 24km of Roissy



Presentation of change with official documents
Stepped Descent versus Continuous Descent Operations



VR contribution for understanding the change



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Thank you for your attention

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