



AURALIAS RÉGION WALLONNE



Impact of visual modality on acoustic assessment of rooms

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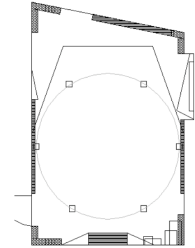
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Context of research

AURALIAS project

- **Virtual** environment for cooperative work between architects and acousticians to assess the acoustical quality of rooms
- **Multimodal** environment : three-dimensional auditory simulation along with a projected three-dimensional picture of the evaluated room while allowing virtual navigation inside the room
- In order to **design** this environment (with an ergonomics and user-centered approach), we're interested in the potential interferences between the auditory and the visual channels. This mutual interactions between sensory channels are well known and this phenomenon is called **multimodality**.

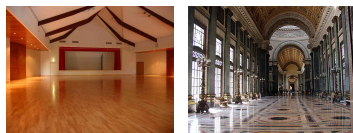


Auditory stimuli

Set of 10 sound clips of various reverberation levels

Visual stimuli

Set of 5 pictures of increasing reverberation



increasing reverberation time

Pretest : paired comparisons (Wilcoxon test) $p < .01$

Method

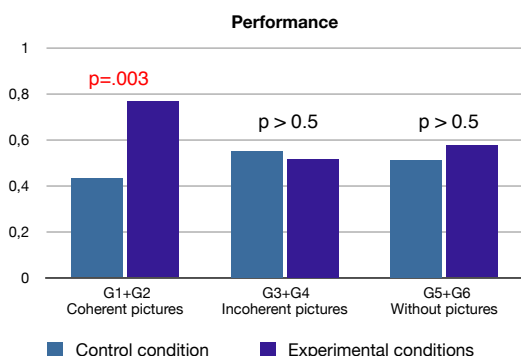
- **Subjects' task** : ordering 5 sound clips according to their reverberation time
- **Two successive conditions (intra-subject)** :
 - Control (sound clips without any picture)
 - Experimental
 - Coherent condition (sound clips with coherent room pictures)
 - Incoherent condition (sound clips with incoherent room pictures)
 - Control condition (sound clips without any picture)
- **Two populations** : expert (students in architecture) and novice (students in other sections)
- **Two dependent variables**:
 - Performance analysed by the Spearman correlation coefficient between the theoretical order and the observed order
 - Response times to perform their choices

Experimental design

0	1	2	3
Baseline condition (without picture : acoustic filter 1)	Coherent condition (sound+picture – acoustic filter 2)	Incoherent condition (sound+picture – acoustic filter 2)	Control condition (without picture : acoustic filter 2)
G1: 10 architects G2: 17 novices	G1: 10 architects G2: 17 novices		
G3: 10 architects G4: 17 novices		G3: 10 architects G4: 17 novices	
G5: 8 architects G6: 8 novices			G5: 8 architects G6: 8 novices

Results

- No effect of expertise
- Positive impact of coherent pictures
- No effect of incoherent pictures
- No training effect due to the repetition of the task



Conclusion

- Coherent pictures increase performance and decrease response times
- Incoherent pictures decrease response times but do not degrade performance
- Auditory and visual modalities are redundant :
 - task can be completed with auditory modality alone
 - visual information disambiguates the message
- Auditory modality remains the main modality
- Visual modality is secondary in case of perception conflict
- Displaying a picture could improve the acoustic assessment :
 - it's never detrimental to the subjects' performance
 - it can improve performance under certain conditions