



## Psychoacoustic Study of the Rock Art Sites of Cuevas de la Araña (Bicorp, Spain)

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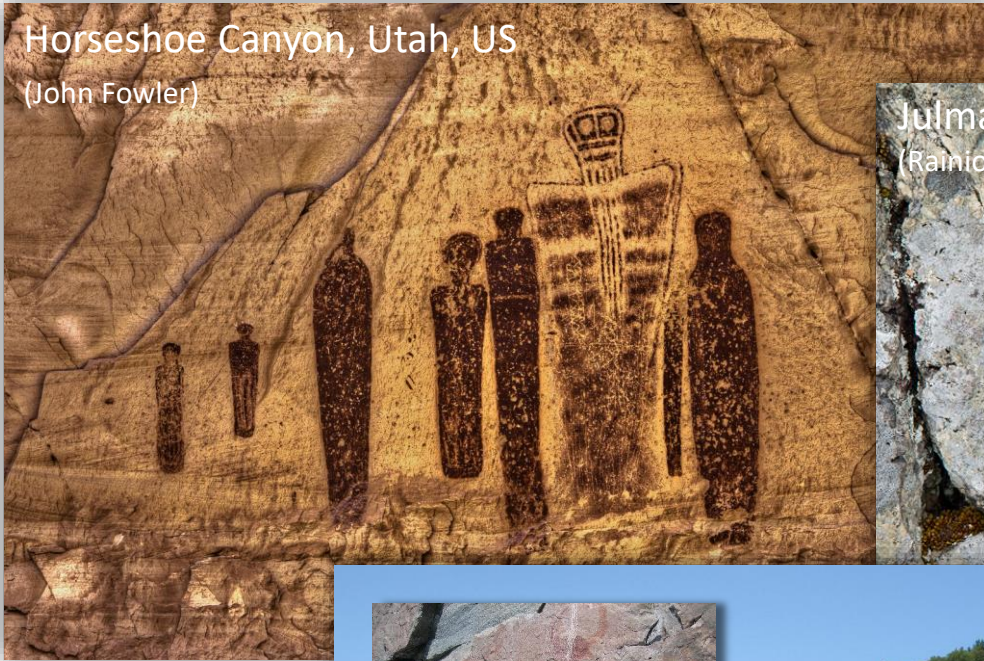
Conference on  
**Sound Perception**  **1-3 Sep. 2023**  
Poznań / Poland

Conference on Sound Perception, 1-3 Sep. 2023, Poznan (Poland)



Horseshoe Canyon, Utah, US

(John Fowler)



Julma-Ölkky, Finland

(Rainio et al., 2018)



Rocher à l'Oiseau, Canada

(Díaz-Andreu et al., 2017)



**Main site**

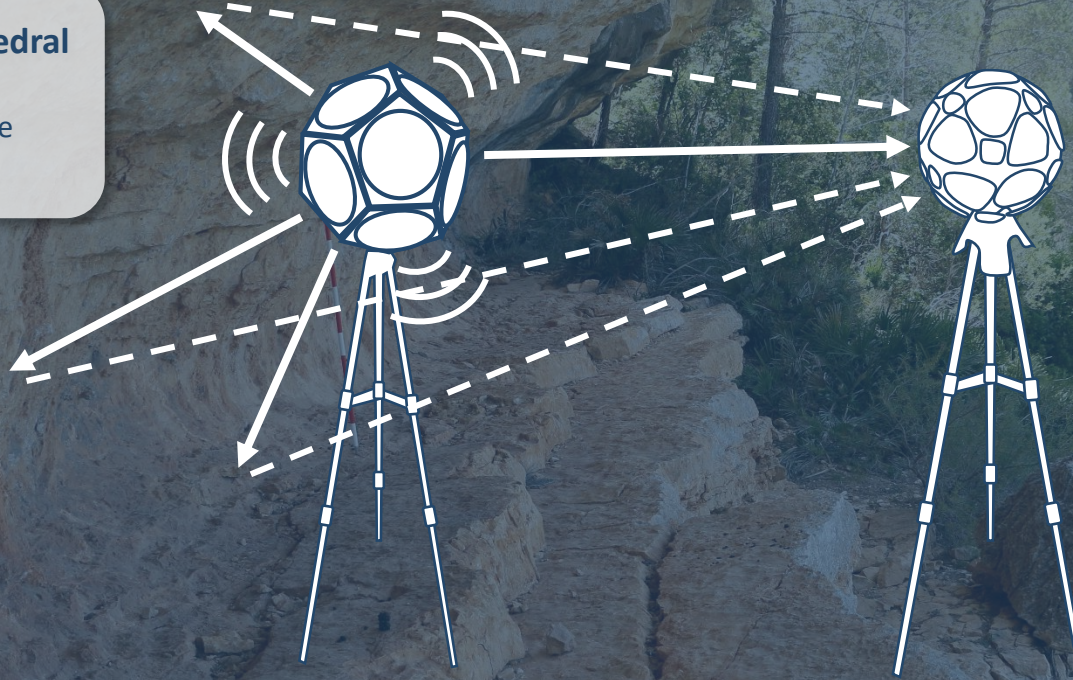


**Satellite sites**  
Less amount and  
diversity of rock art



**Source: dodecahedral  
loudspeaker**

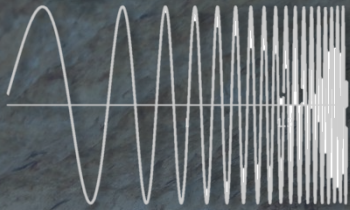
- Excit. signal: sine sweep



**Ambisonics  
microphone**

- 3D Audio Impulse Responses

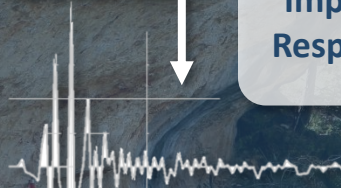
Original signal

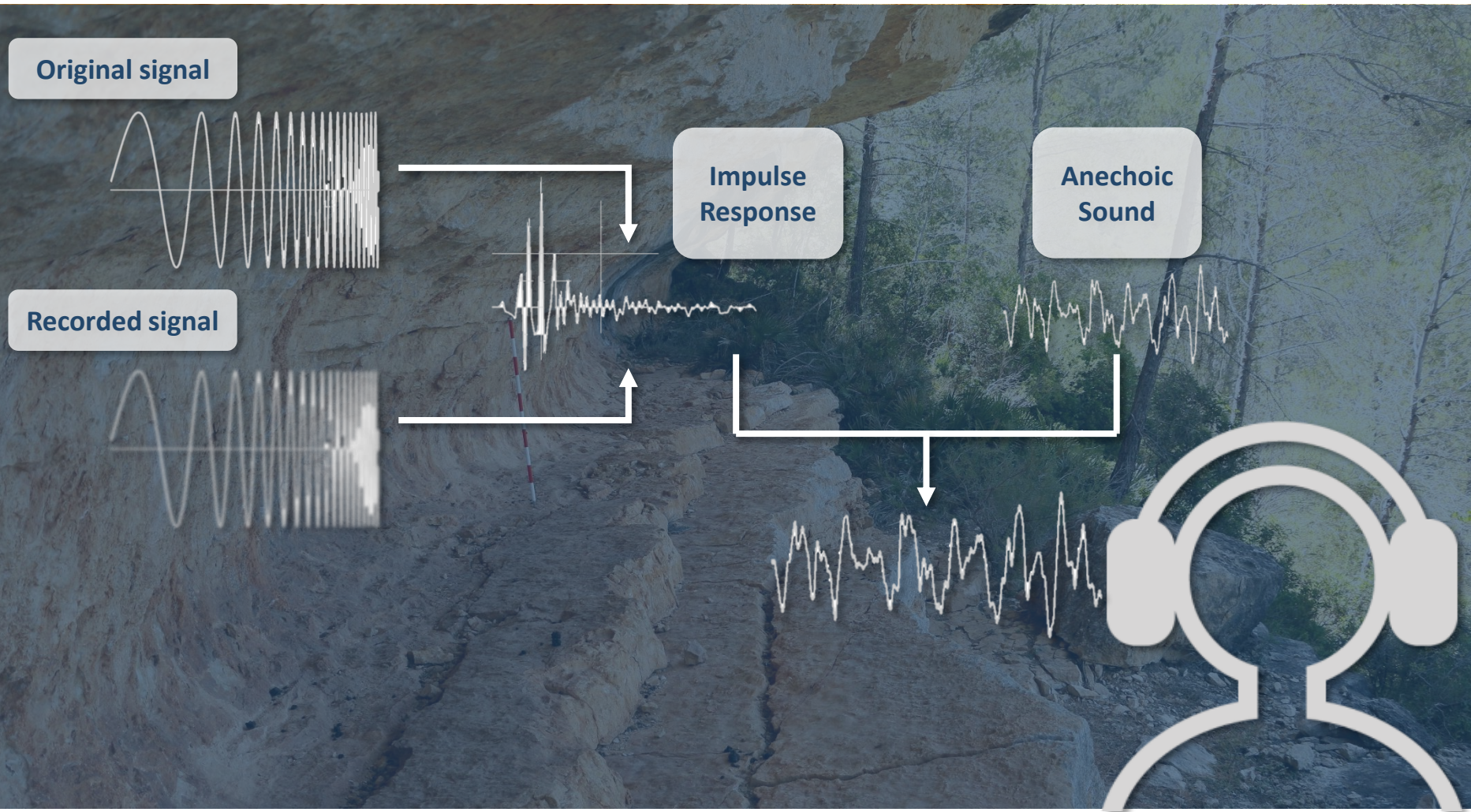


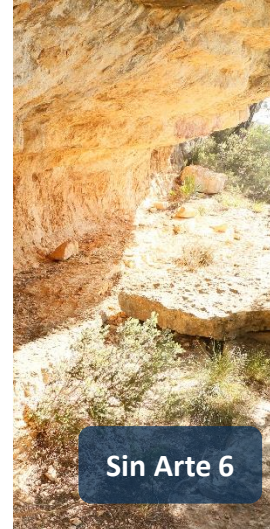
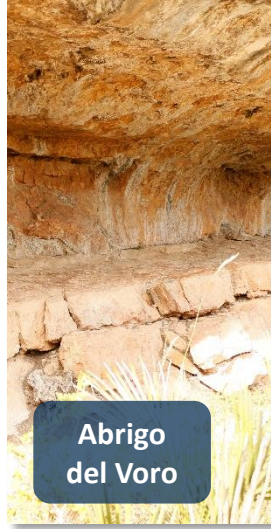
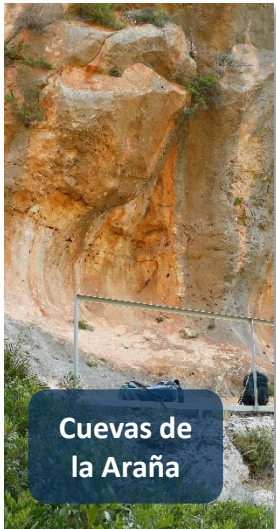
Recorded signal



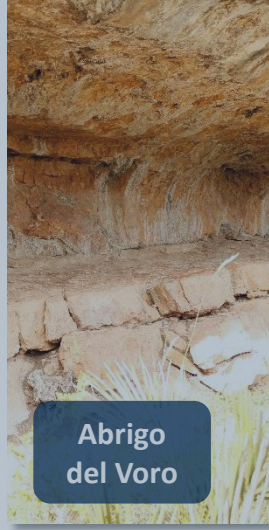
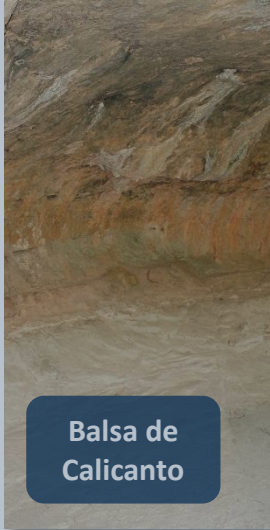
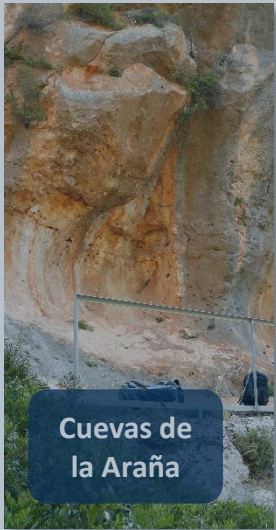
Impulse Response



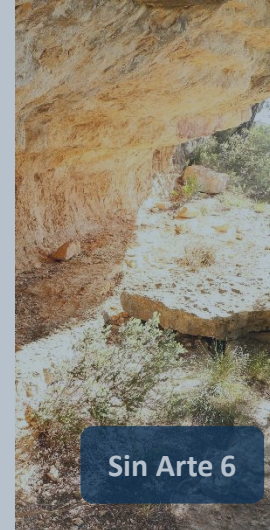




**art+**

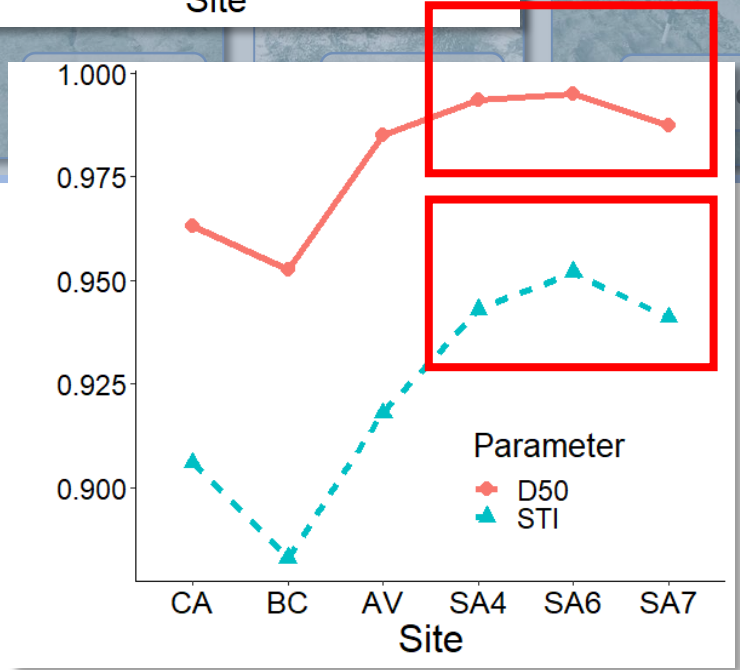
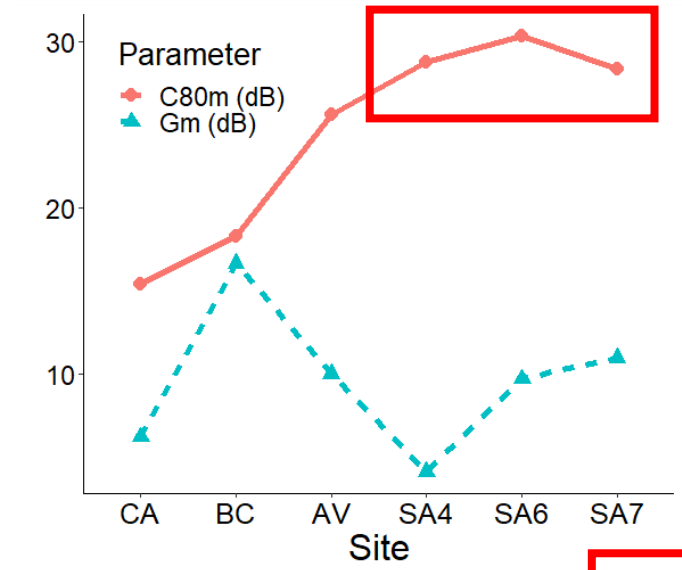
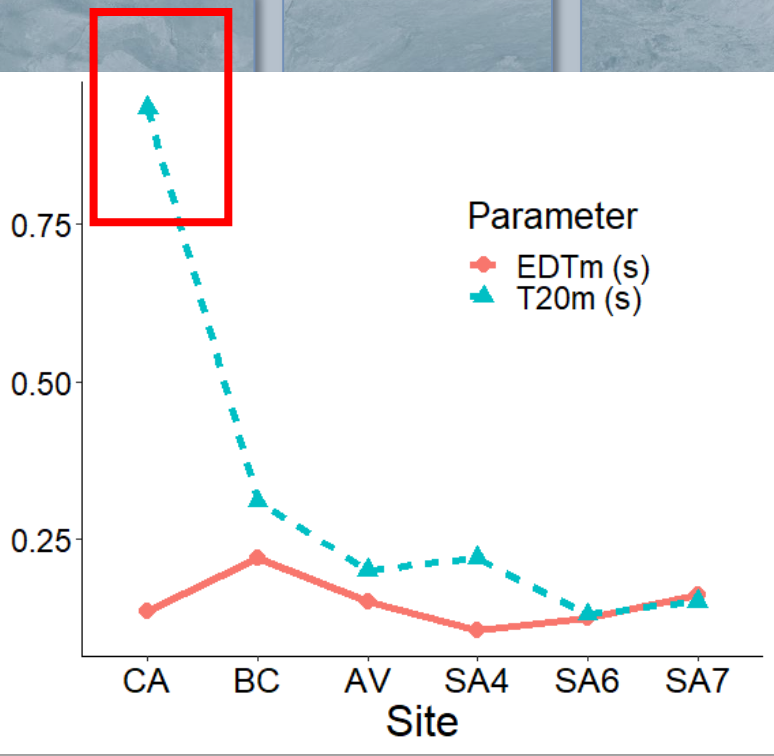


**art-**





art+



*art+*



Cuevas de la Araña

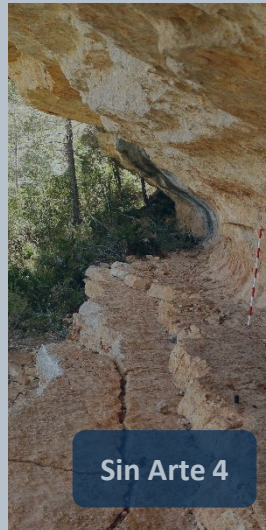


Balsa de Calicanto

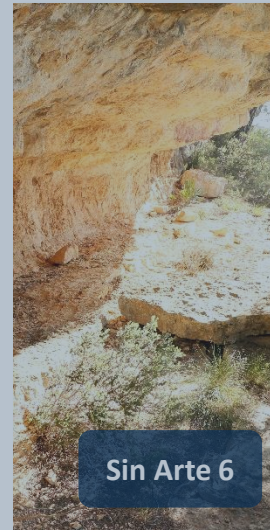


Abrigo del Voro

*art-*



Sin Arte 4



Sin Arte 6



Sin Arte 7



CONVOLUTION

**Sound 1**

Female singer,  
folk song

**Sound 2**

Male singer, folk  
song

**Sound 3**

Female singer,  
pop song

**Sound 4**

Male singer, pop  
song

**Sound 5**

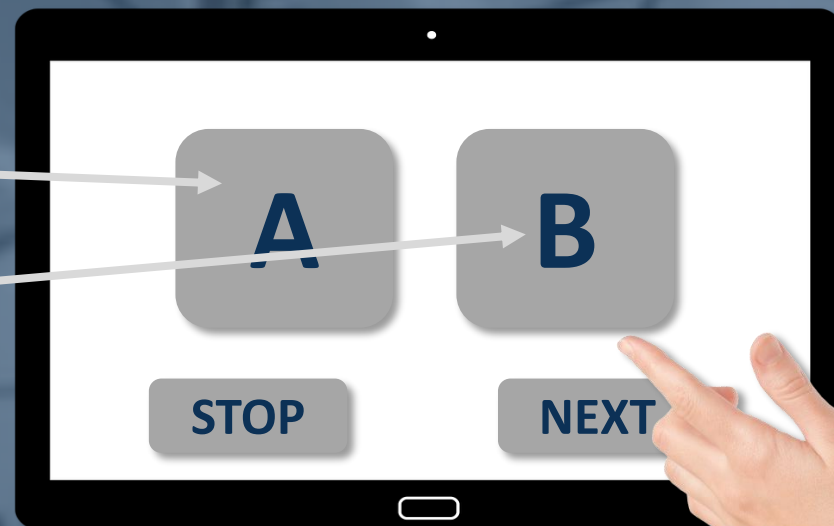
Drum beating,  
120bpm

Sound<sub>n</sub> art+

Sound<sub>n</sub> art-

\*Reproduced in loop

\*Can be switched as many times as wanted



45 trials

Describe the differences

*Trial 1*

A	B
- further	- less reverb
- more reverb	- less intense
- duller	-
-	-

*Trial 2*

A	B
- closer	- more open
- more lively	-
-	-
-	-

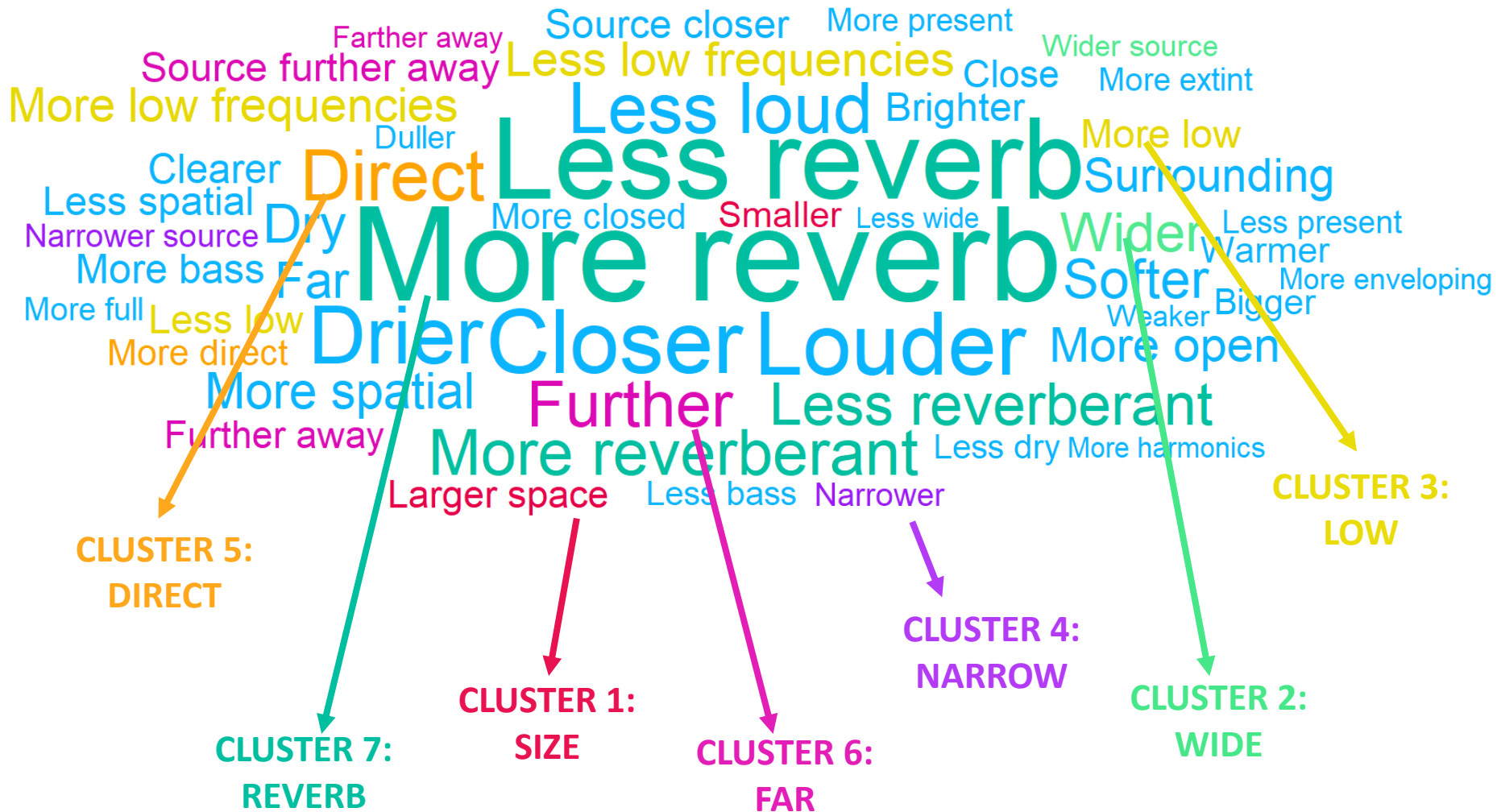


- \*All combinations of *art+*/*art-*
- \*Random order of trials
- \*Random order within trial (A/B to *art+*/*art-*)



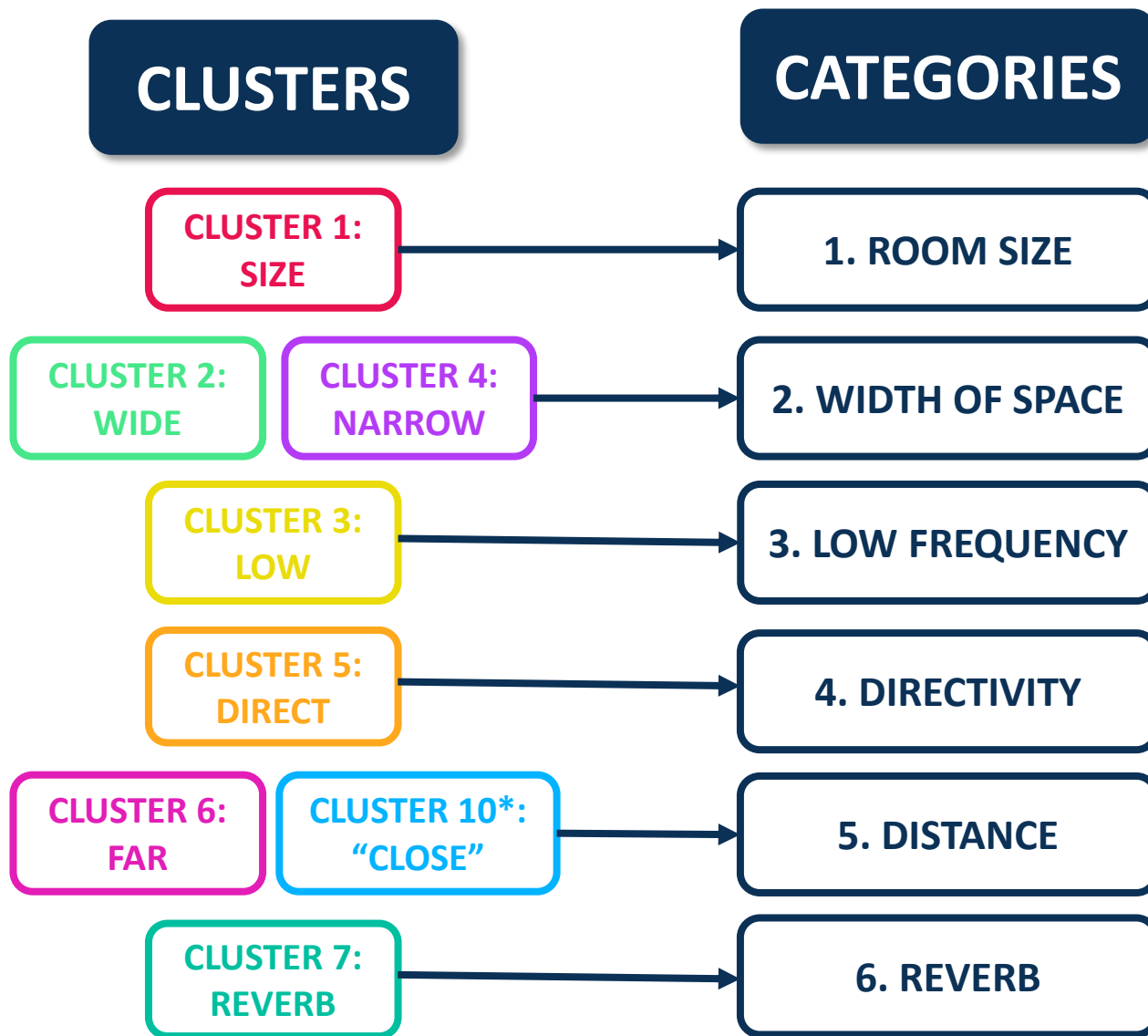


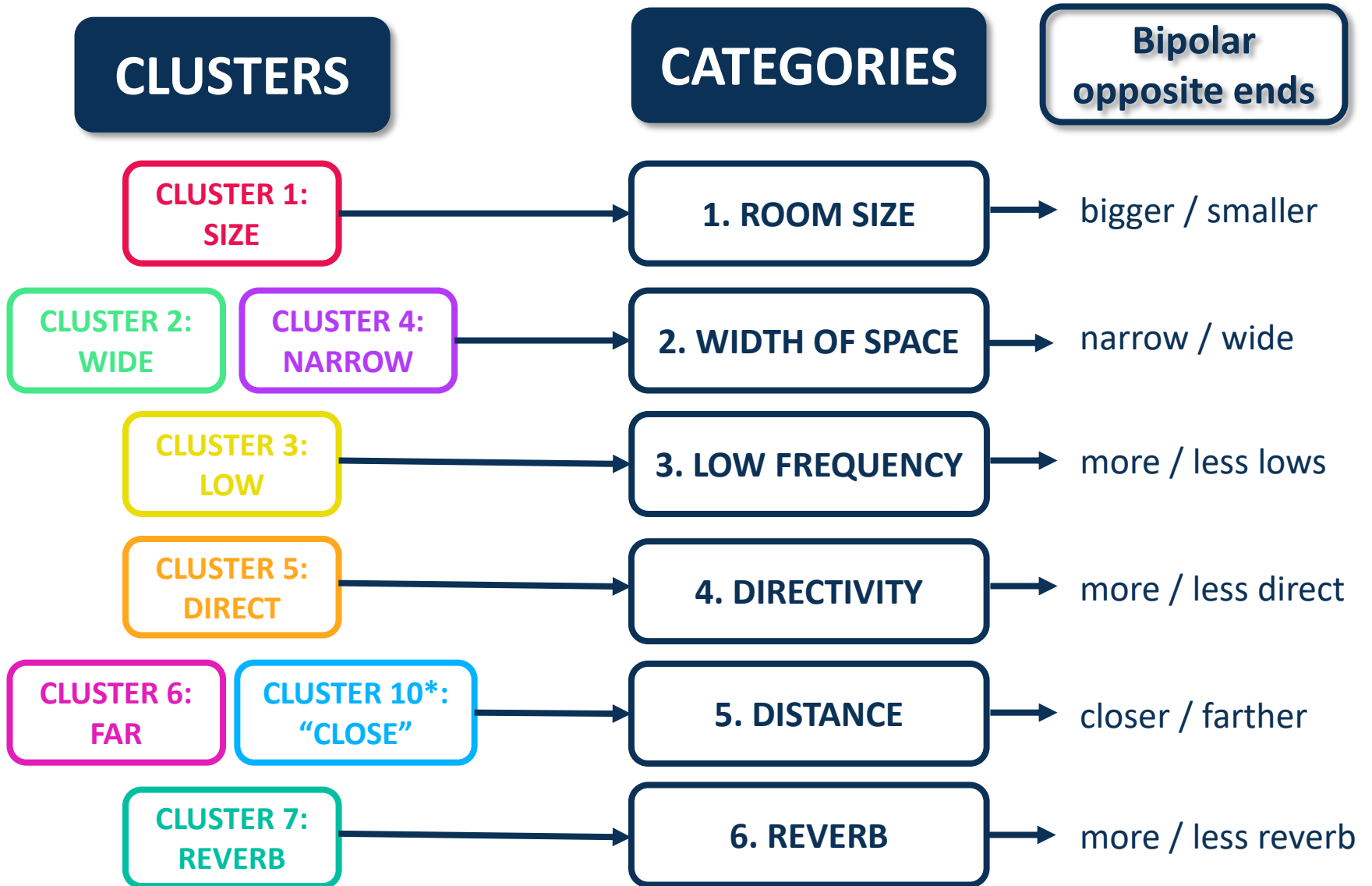








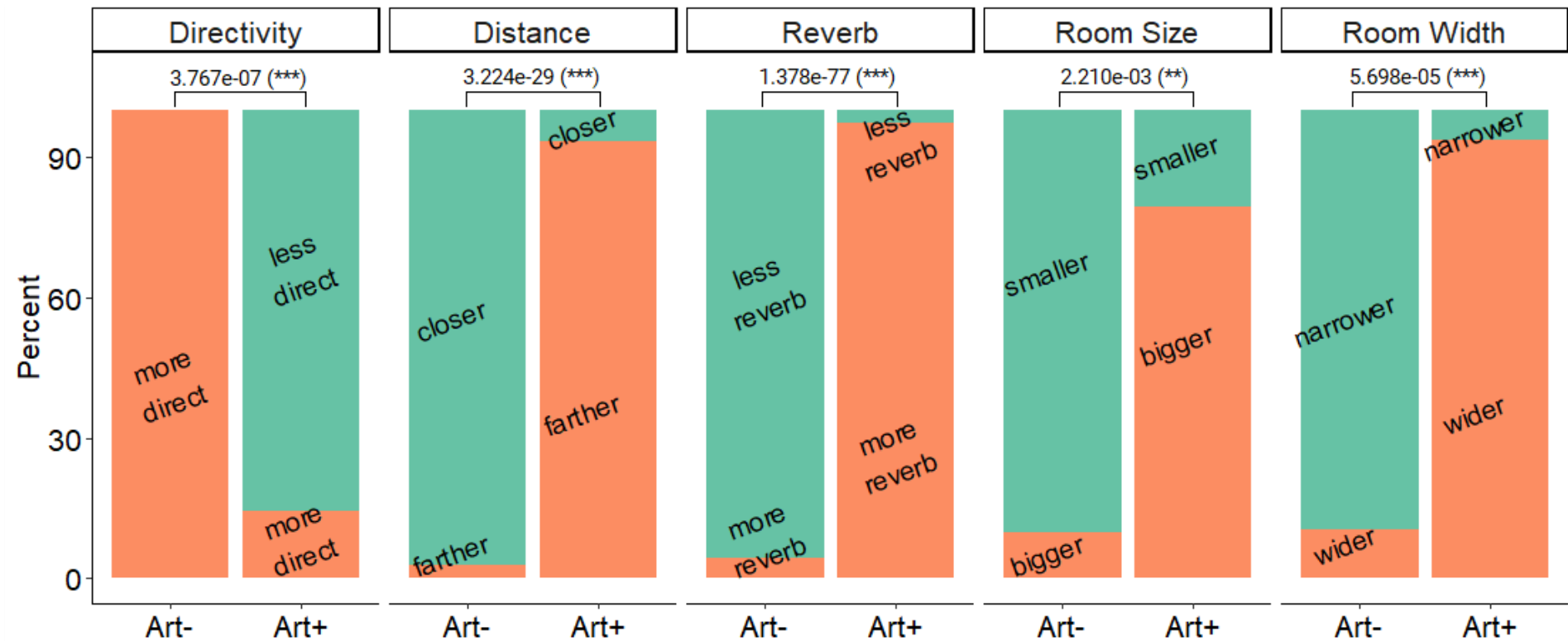




		<b>ROOM SIZE</b>	
		<i>bigger</i>	<i>smaller</i>
<i>art+</i>	23	6	
<i>art-</i>	3	28	

		<b>REVERB</b>	
		<i>more</i>	<i>less</i>
<i>art+</i>	202	6	
<i>art-</i>	7	156	



\* $\chi^2$  test results

\*p-values corrected for multiple testing

- Audible differences between *art+* and *art-*

- Audible differences between *art+* and *art-*
- Reverberation explains why *art+*
  - *Less direct*

- Audible differences between *art+* and *art-*
- Reverberation explains why *art+*
  - *Less direct*
  - *Bigger and wider*



- Audible differences between *art+* and *art-*
- Reverberation explains why *art+*
  - *Less direct*
  - *Bigger and wider*
  - *Farther*



- Audible differences between *art+* and *art-*
- Reverberation explains why *art+*
  - *Less direct*
  - *Bigger and wider*
  - *Farther*
- Currently: studying IR-based bias
- Future experiments: emotional self-report, electrodermal activity and heart rate

## The Artsoundscapes Team



Prof. Margarita  
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Prof. Carles Escera  
(Senior Staff)



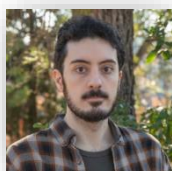
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Daniel Benítez  
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**Aalto Acoustics Lab**

**A!**  
Acoustics Lab

**Thank you!**



**Contact**

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