



Universitat
Pompeu Fabra
Barcelona

JND in brightness, but not the one you are thinking about

SMC - Music Perception and Cognition project 2022-2023

GROUP C

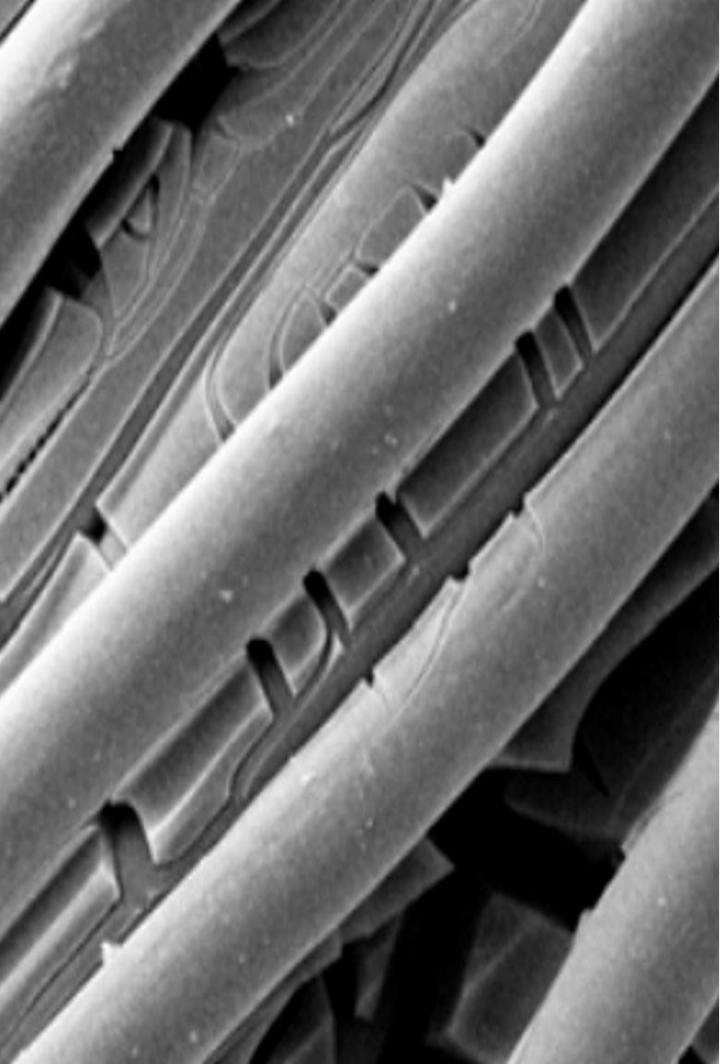
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INDEX

01

INTRODUCTION

02

METHODOLOGY

03

RESULTS

04

CONCLUSIONS

INTRODUCTION

Research Question:

Can the perception of brightness in sound be affected by different levels of brightness in images? Could this affect the just noticeable difference of what we consider a bright sound?

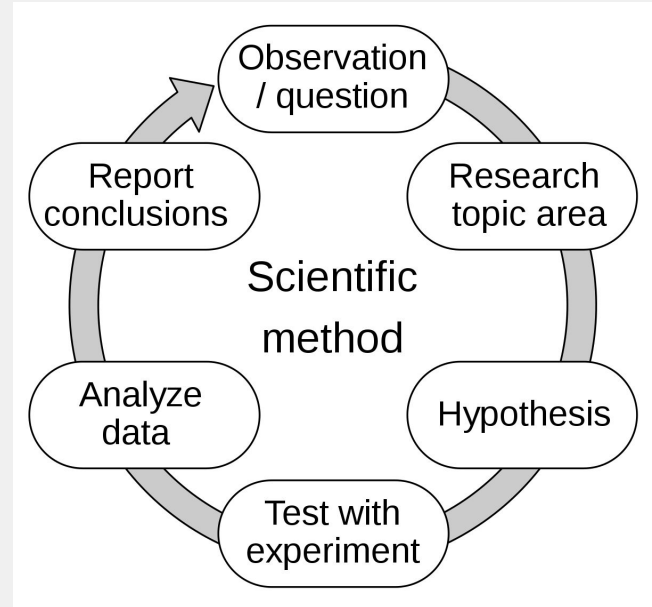


INTRODUCTION - Context

- Little research on relationship between brightness of an image & perceived brightness of sound
- JND (just noticeable difference) measures perceptual sensitivity & varies with stimulus, intensity & individual
- JND studies primarily focused on visual stimuli, not auditory
- Our research explores relationship between perception of brightness & JND in sound & images
- **Hypothesis:** Level of brightness in image affects perceived brightness of sound & JND of "bright" sound."

METHODOLOGY

- Survey: General Information
- Experiment Part 1: Explanation with 4 sounds.
- Experiment Part 2: Ranking of sounds.
- Experiment Part 3: Ranking of sounds with images.



METHODOLOGY – Examples

Do you use earplugs to protect your ears when you attend to those activities? *

☐ Yes

☐ No

☐ Other...



Sound 1 *

1

2

3

4

5

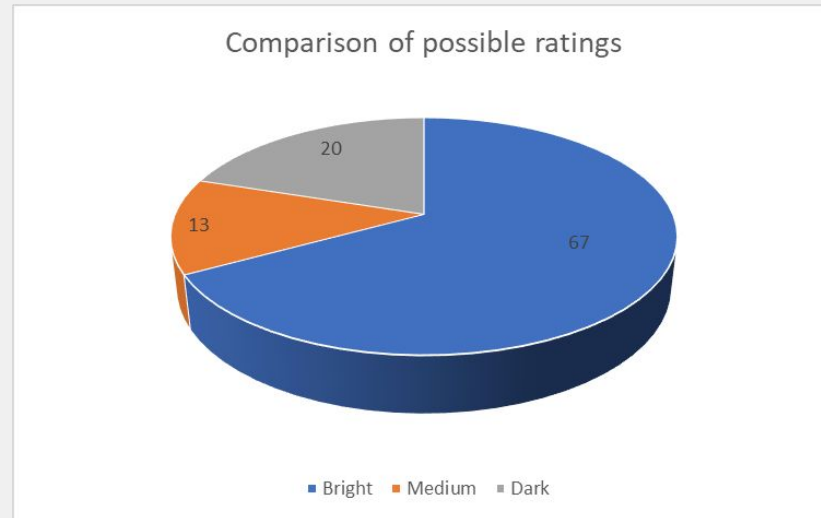
Not Bright

☐☐☐☐☐

Bright

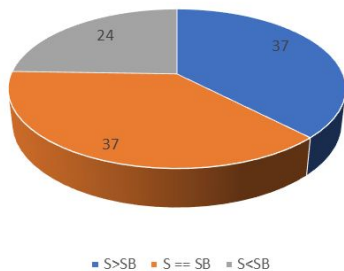
RESULTS

The data collected from the experiment was analyzed to determine if the images had any effect on the subjects' ratings of the sounds

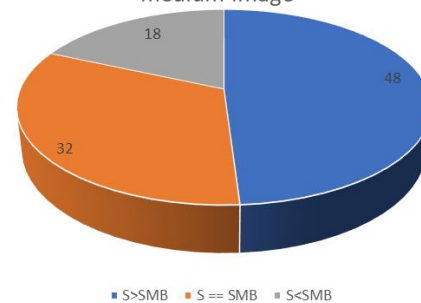


More results

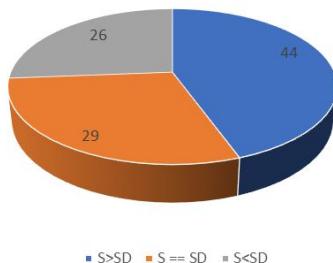
Comparison between sound and sound with bright image



Comparison between sound and sound with medium image



Comparison between sound and sound with dark image



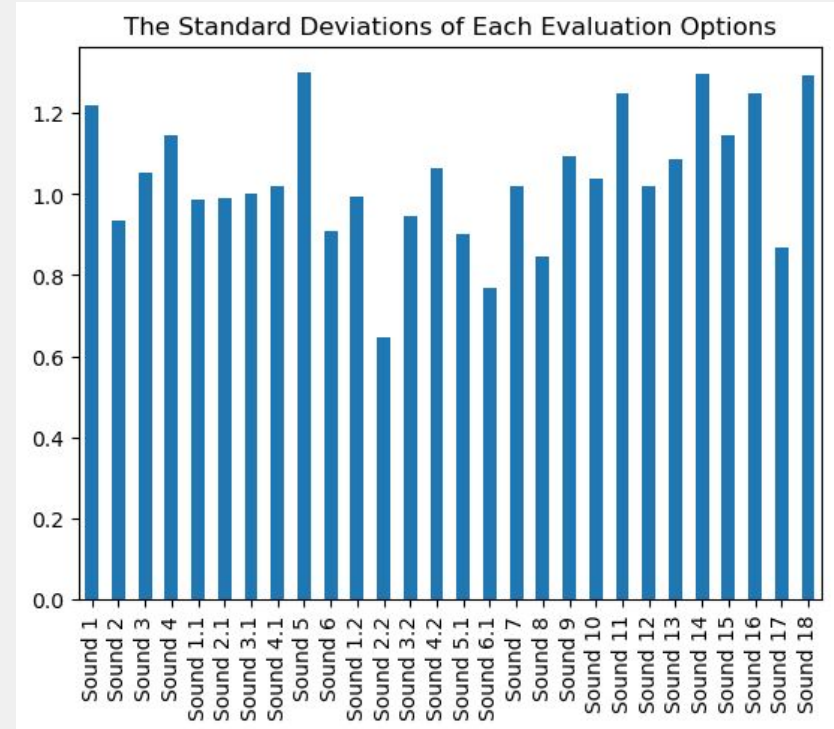
Some more results (Definitions)

- “When the sound sounds crisper and gives a more relaxed feeling”
- “The feeling of crystal, usually a higher pitch”
- “Hear clearly and comfortably”
- “Sound like high pitch without hurtful “
- “Incisive if it is too loud”
- “Brightness in audio I would say is a very subjective thing. I would say I consider a brighter sound to be a more direct, sharper, more shrill sound. I think it's quite difficult to define”
- “A sound without white noise and high pitch”
- “How many frequencies from 4Khz onwards”
- “Clear sound with few low frequencies”

Discussion

The confidence of the experiment

The right plot shows the standard deviation distribution of subjects' evaluation options, and the average of the Std. is 1.038 which shows that the options subjects choices for each audio questions converged to some scopes.



Discussion

Some Improvements:

1. To prepare a specific experiment space with exactly the same experimental equipments for subjects, and all subjects would be assisted with our supervising.
2. To define the brightness of color with numerical values of frequency, hue, brightness, and saturation.
3. To define the audio with frequency spectrums and then to analyze each of them with spectral centroid, spectral flatness, and harmonicity.

Some omissions

1. As the experiment contains many impact factors, and the procedure is completely online without any supervision, it's possible that subjects might finish the experiment in some slightly different scenarios of impact factors.
2. Some of the observation impact factors have not been defined with numeric methods, including the brightness of color and audio.

Discussion

01

WE HAVE
SUCCEEDED IN
SOME PARTS OF
THE EXPERIMENT

Comparison between
sounds with different
images

02

LACK OF
SUBJECTS

We have realized that
we need more subjects
to be able to generalize
our hypothesis

03

WE CAN'T
CONCLUDE THAT
WE SUCCEEDED IN
OUR HYPOTHESIS

To conclude this, we
would need a bigger
difference between how
was the sound
perceived applying some
of the images

04

VERY OPEN AND
SUBJECTIVE
RESPONSE

We believe that
brightness in sound, and
more related to images,
is a very subjective topic
in which make
conclusions is very
tough.

What have we learned from this project?

- More about how the perception of music can be impacted by the brightness of images
- How important it is to conduct experiments with people in controlled environments
- Not to let unexpected or unwanted results lower our motivation
- Studying JND in brightness is a tough and subjective topic to do research about; that is why is difficult to find references
- One of the biggest problems in experimental research is lack of subjects



References

- Wallmark, Z., Nghiem, L., & Marks, L. E. (2021). Does Timbre Modulate Visual Perception? Exploring Crossmodal Interactions. *Music Perception*, 39(1), 1–20. <https://doi.org/10.1525/mp.2021.39.1.1>
- Dresch-Langley, B., Monfouga, M. (2019). Combining Visual Contrast Information with Sound Can Produce Faster Decisions. *Information* 2019, 10, 346. <https://arxiv.org/ftp/arxiv/papers/2011/2011.06456.pdf>
- Telescopic Website. https://www.telescope-optics.net/eye_intensity_response.htm
- Almeida, A., Schubert, E., Smith, J. et al. (2017) Brightness scaling of periodic tones. *Atten Percept Psychophys* 79, 1892–1896. <https://doi.org/10.3758/s13414-017-1394-6>
- Schuber E., Wolfe J. (2006). Does Timbral Brightness Scale with Frequency and Spectral Centroid? *ACTA ACUSTICA UNITED WITH ACUSTICA Vol. 92 (2006)* 820 – 825.
https://aulaglobal.upf.edu/pluginfile.php/1608672/mod_forum/post/255791/About%20brightness.pdf

Links

Survey

Experiment

Video used

References for the images used in this Presentation

[1] Bright Image – <https://www.istockphoto.com/es/fotos/bright-sun>

[2] Icon of a person thinking –
<https://flyclipart.com/person-thinking-icon-png-png-image-person-thinking-png-138499>

[3] Icon of a speaker – <https://www.cleanpng.com/free/sound-icon.html>

[4] Rest of the images are from a Google Template

Thank you for your
attention.
Have a tangerine:

