Universal Oscillations: A Visual-to-Audio Substitution Approach

Thank you for participating in this user study that explores links between auditory and visual perception. Repeatedly, you will encounter two images and two sounds. Your task is to match the sounds to the images according to your perception. Each sound is 20 seconds long, but you don't have to listen to the full length.

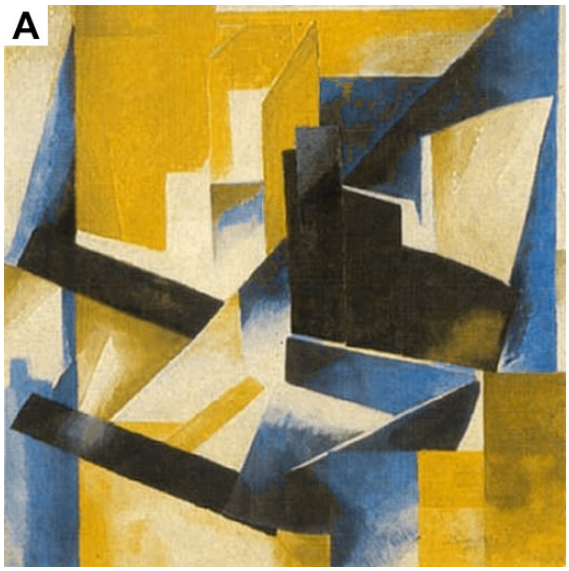
No music, sound or visual expertise is required to participate. All you need is a pair of **headphones or speakers**. The study will take **20-30 minutes** to complete.

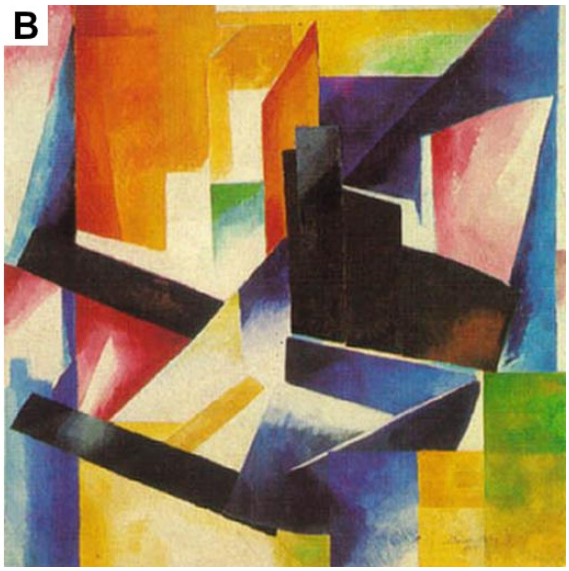
Consent Form

All information collected during this study will be treated with strict confidentiality. Your identity will remain anonymous in any reports or publications resulting from this research. Data will be stored securely and accessed only by authorized researchers. Participation in this study is entirely voluntary, and you have the right to withdraw from this study at any time without facing negative consequences. If you decide to withdraw, any data collected up to that point will be excluded from the study. If you have any questions or concerns about the study or your rights as a participant, please feel free to contact me as a student researcher (Luca Hilbrich; luca_hilbrich@web.de) and/or the lecturer overseeing this project (Dr. Julia von Thienen; Julia.vonThienen@hpi.de). By participating in this study, you acknowledge that you have read and understood this consent form and agree to voluntarily take part in the research.

Universal Oscillations: A Visual-to-Audio Substitution Approach

* 1. Please match each sound to its corresponding image according to your perception.





	A	B
unos 00... SOUNDCLOUD ▶ 59 Privacy policy unos · 0073	◯	◯
unos 00... SOUNDCLOUD ▶ 72 Privacy policy unos · 0092	◯	◯

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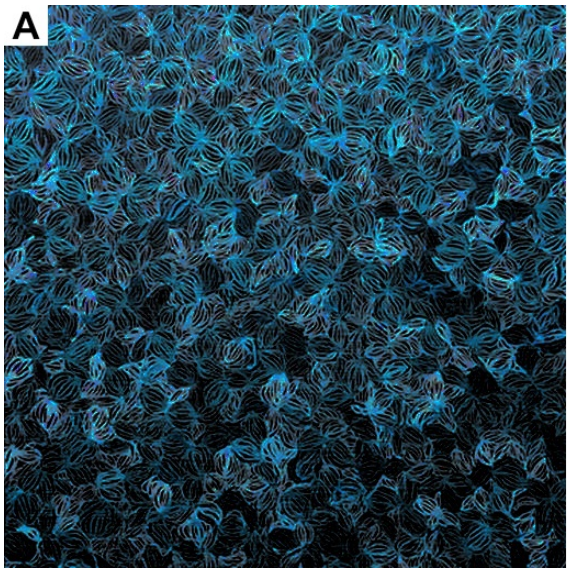
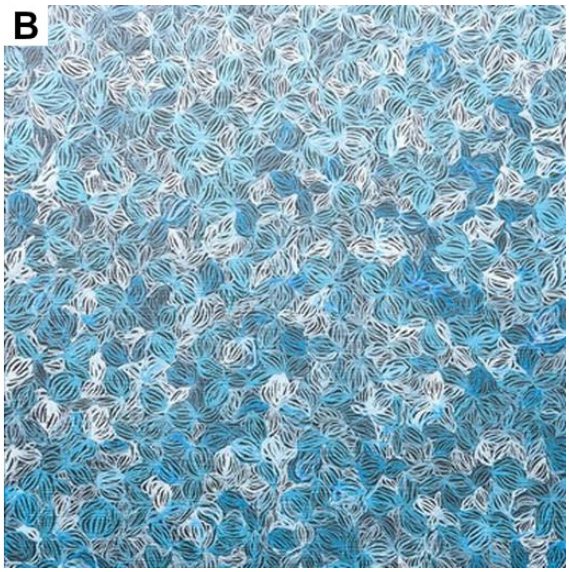
* 2. Please match each sound to its corresponding image according to your perception.





	A	B
unos 01... SOUNDCLOUD ▶ 46 Privacy policy unos · 0134	○	○
unos 01... SOUNDCLOUD ▶ 43 Privacy policy unos · 0178	○	○

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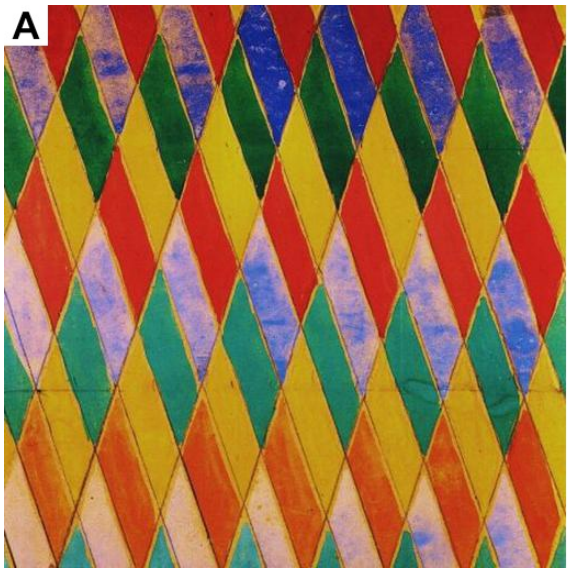
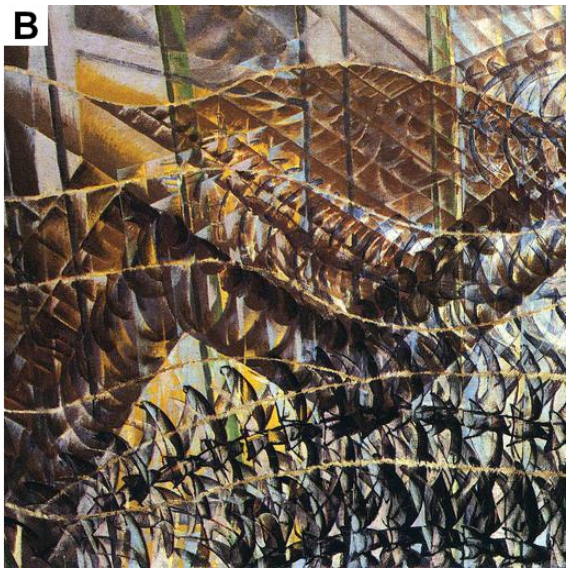
* 3. Please match each sound to its corresponding image according to your perception.





	A	B
unos 02... SOUNDCLOUD ▶ 64 Privacy policy unos · 0297	○	○
unos 02... SOUNDCLOUD ▶ 45 Privacy policy unos · 0256	○	○

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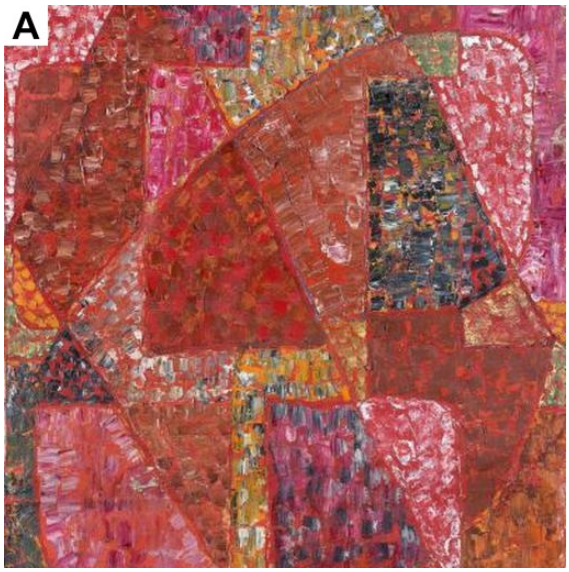
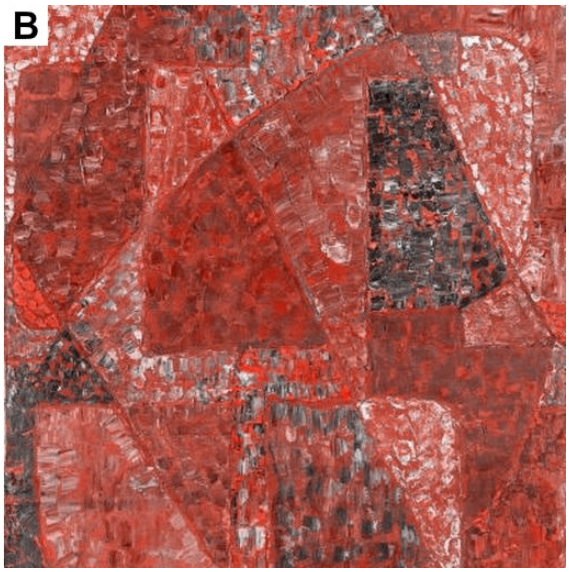
* 4. Please match each sound to its corresponding image according to your perception.





	A	B
unos 03... SOUNDCLOUD Privacy policy ▶ 64 unos · 0327	◯	◯
unos 0365 Privacy policy ▶ 57 unos · 0365	◯	◯

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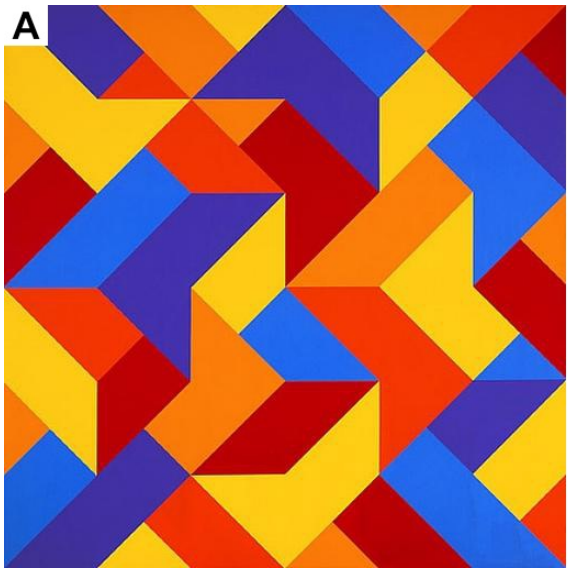
* 5. Please match each sound to its corresponding image according to your perception.



	A	B
unos 0408 Privacy policy ▶ 42 unos · 0408	○	○
unos 04... SOUNDCLOUD Privacy policy ▶ 40 unos · 0467	○	○

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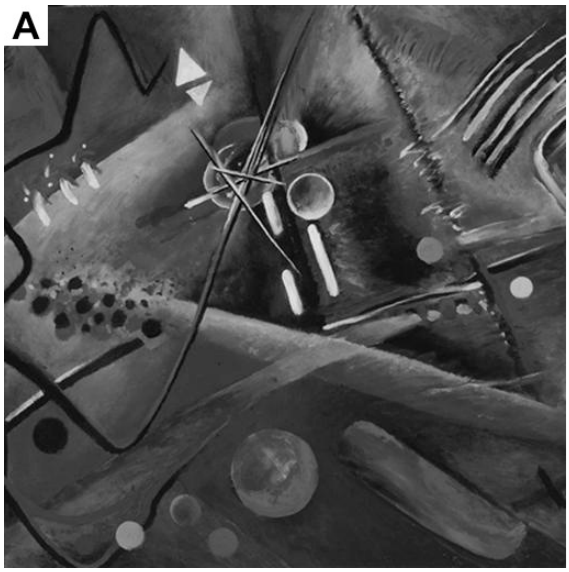
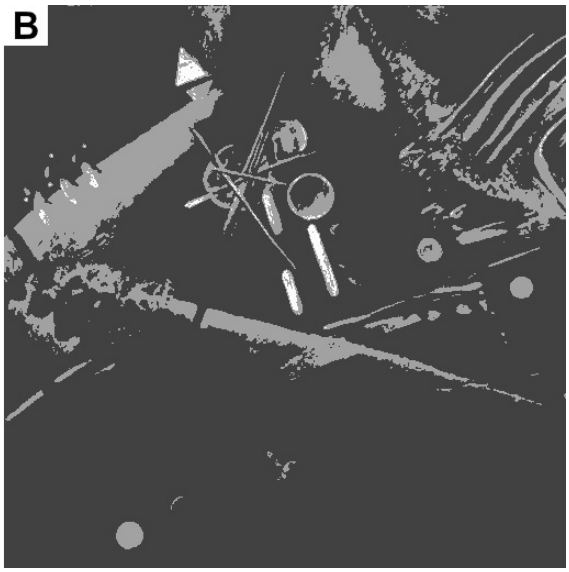
* 6. Please match each sound to its corresponding image according to your perception.





	A	B
unos 05... SOUNDCLOUD Privacy policy ▶ 45 unos · 0539	○	○
unos 05... SOUNDCLOUD Privacy policy ▶ 43 unos · 0582	○	○

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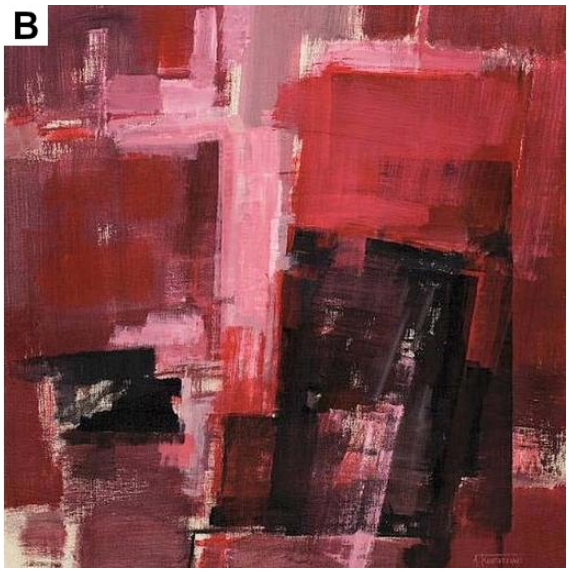
* 7. Please match each sound to its corresponding image according to your perception.



	A	B
unos 06... SOUNDCLOUD Privacy policy ▶ 44 unos · 0628	◯	◯
unos 06... SOUNDCLOUD Privacy policy ▶ 39 unos · 0648	◯	◯

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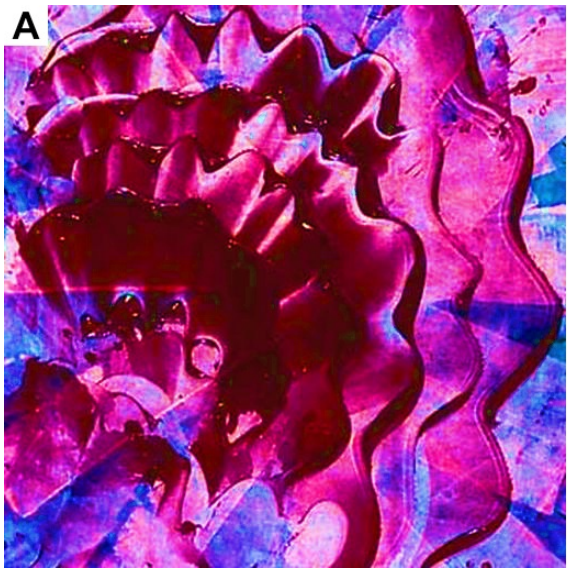
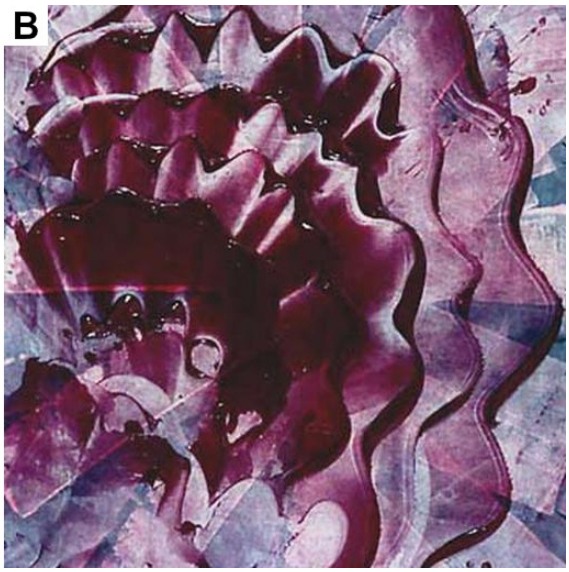
* 8. Please match each sound to its corresponding image according to your perception.





	A	B
unos 07... SOUNDCLOUD ▶ 38 Privacy policy unos · 0734	○	○
unos 07... SOUNDCLOUD ▶ 44 Privacy policy unos · 0789	○	○

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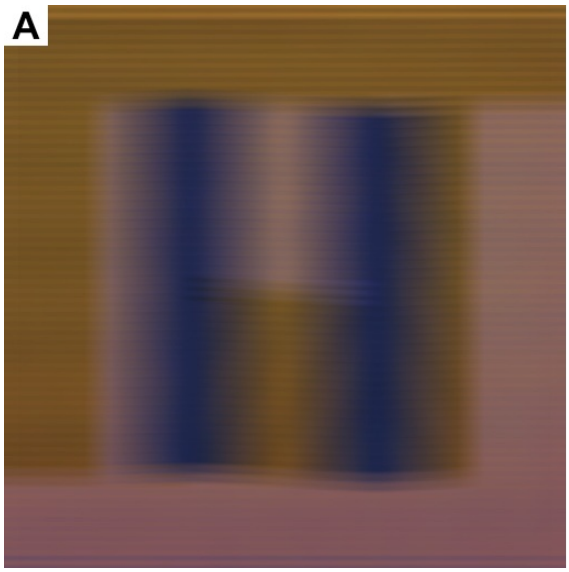
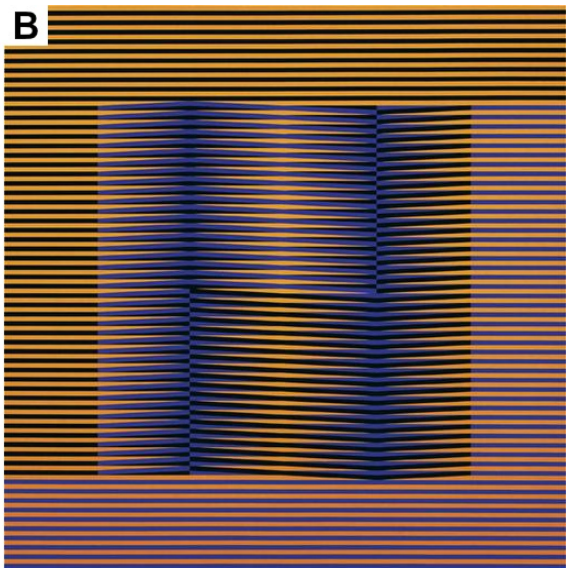
* 9. Please match each sound to its corresponding image according to your perception.





	A	B
unos 0812 Privacy policy ▶ 38 unos · 0812	○	○
unos 08... SOUNDCLOUD Privacy policy ▶ 200 unos · 0863	○	○

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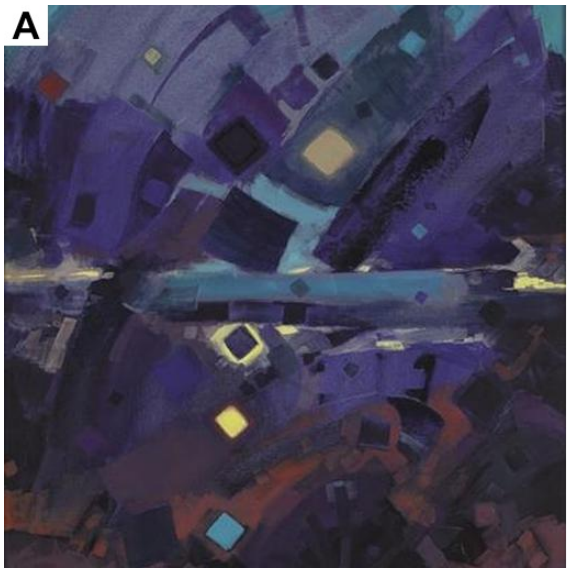
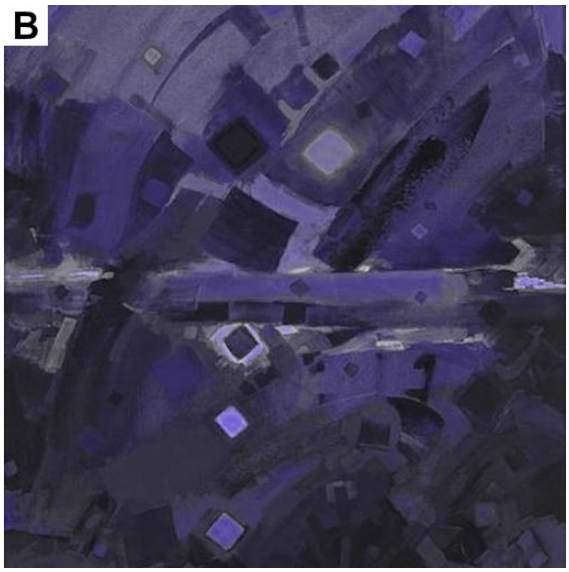
* 10. Please match each sound to its corresponding image according to your perception.

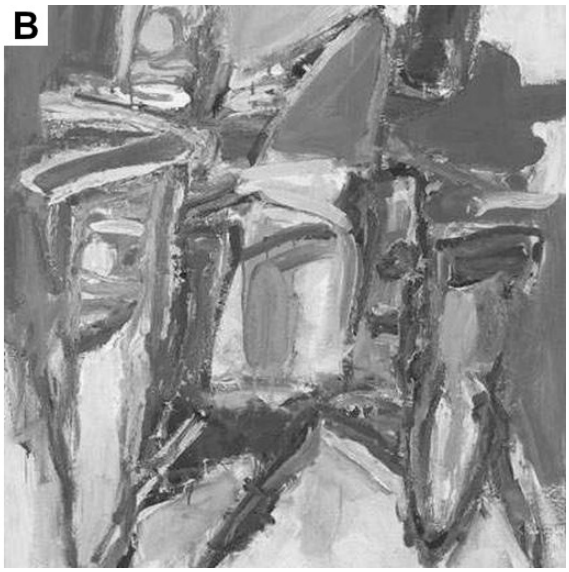




	A	B
unos 09... SOUNDCLOUD Privacy policy ▶ 108 unos · 0923	◯	◯
unos 09... SOUNDCLOUD Privacy policy ▶ 51 unos · 0948	◯	◯

Universal Oscillations: A Visual-to-Audio Substitution Approach

* 11. Please match each sound to its corresponding image according to your perception.



	A	B
unos 1037 Privacy policy ▶ 43 unos · 1037	○	○
unos 10... SOUNDCLOUD Privacy policy ▶ 43 unos · 1083	○	○

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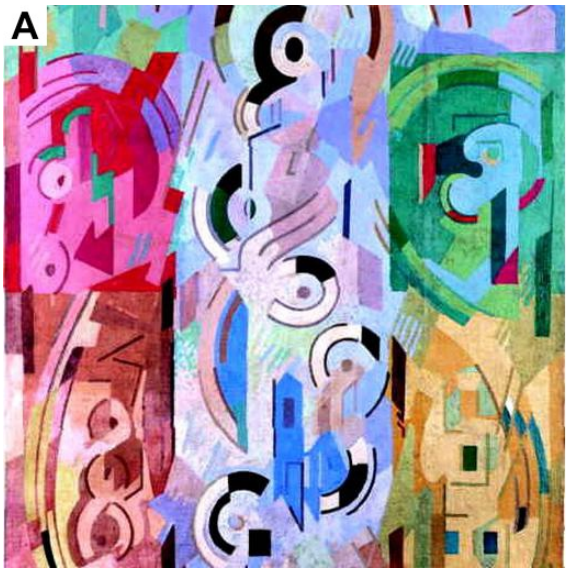
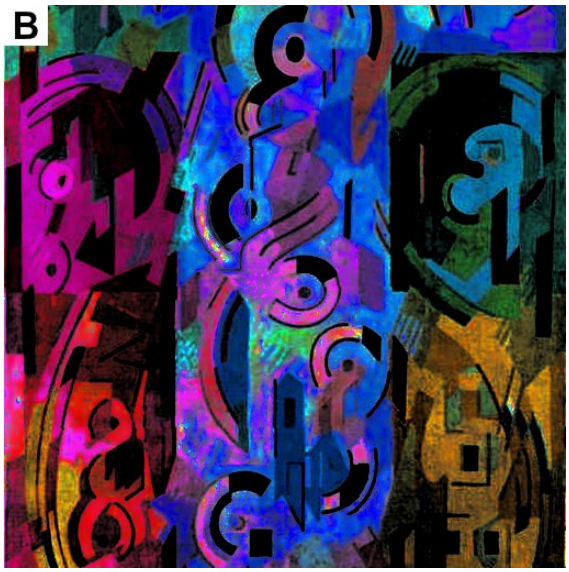
* 12. Please match each sound to its corresponding image according to your perception.





	A	B
unos 11... SOUNDCLOUD ▶ 46 Privacy policy unos · 1102	○	○
unos 11... SOUNDCLOUD ▶ 49 Privacy policy unos · 1154	○	○

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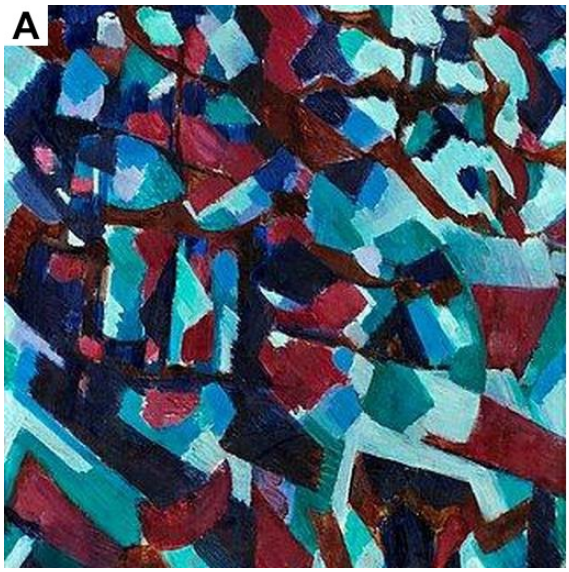
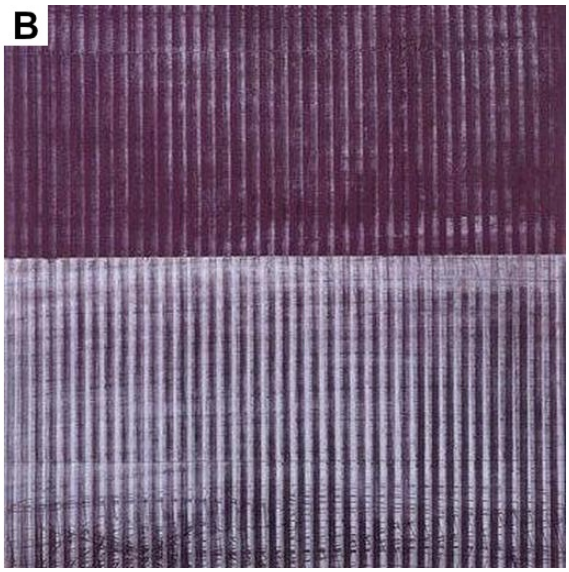
* 13. Please match each sound to its corresponding image according to your perception.





	A	B
unos 1253 Privacy policy ▶ 35 unos · 1253	○	○
unos 1267 Privacy policy ▶ 72 unos · 1267	○	○

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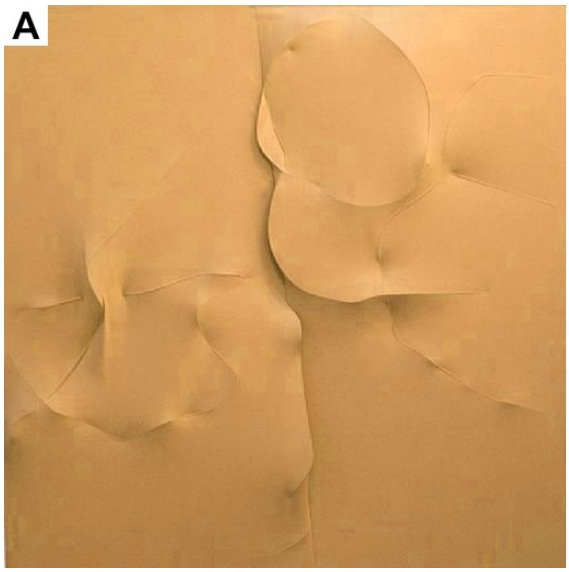
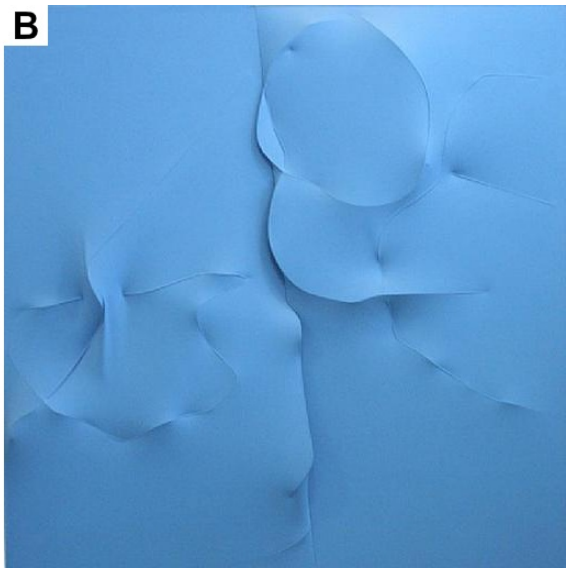
* 14. Please match each sound to its corresponding image according to your perception.

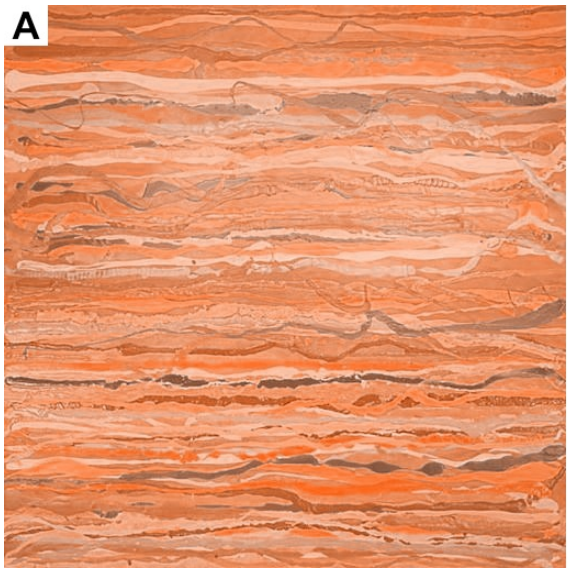


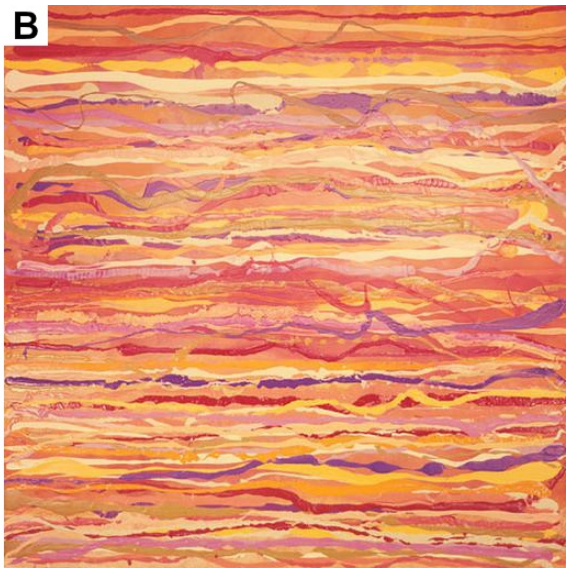


	A	B
unos 1374 Privacy policy ▶ 37 unos · 1374	○	○
unos 13... SOUNDCLOUD Privacy policy ▶ 34 unos · 1309	○	○

Universal Oscillations: A Visual-to-Audio Substitution Approach

* 15. Please match each sound to its corresponding image according to your perception.

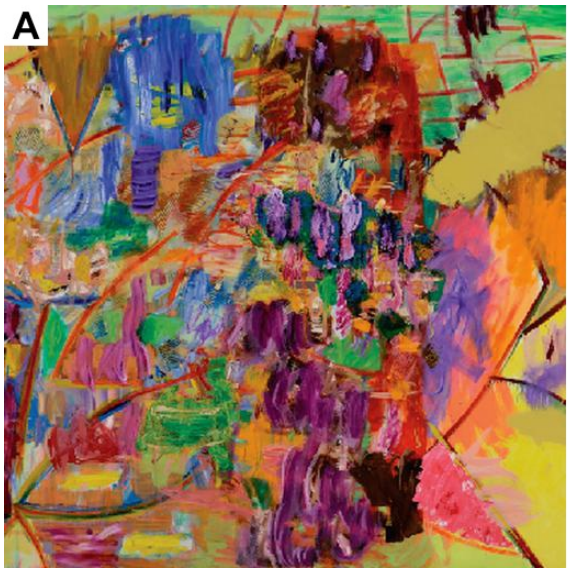




	A	B
unos 14... SOUNDCLOUD ▶ 36 Privacy policy unos · 1479	○	○
unos 14... SOUNDCLOUD ▶ 35 Privacy policy unos · 1482	○	○

Universal Oscillations: A Visual-to-Audio Substitution Approach

* 16. Please match each sound to its corresponding image according to your perception.



	A	B
unos 15... SOUNDCLOUD ▶ 44 Privacy policy unos · 1537	○	○
unos 15... SOUNDCLOUD ▶ 176 Privacy policy unos · 1590	○	○

Universal Oscillations: A Visual-to-Audio Substitution Approach

* 17. Please match each sound to its corresponding image according to your perception.

	A	B
unos 16... SOUNDCLOUD Privacy policy ▶ 108 unos · 1683	○	○
unos 16... SOUNDCLOUD Privacy policy ▶ 146 unos · 1604	○	○

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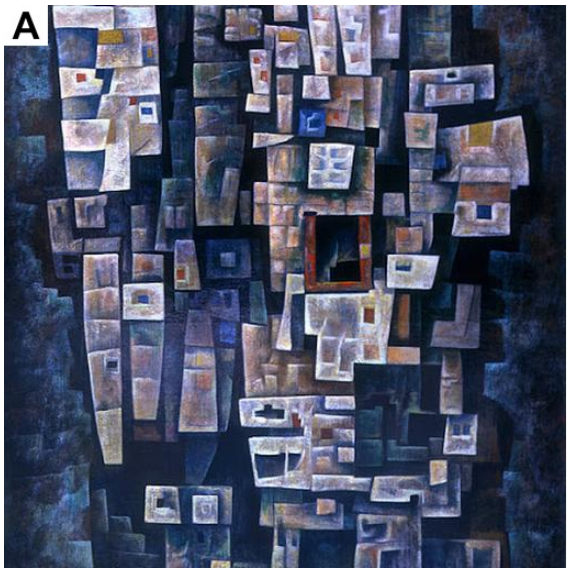
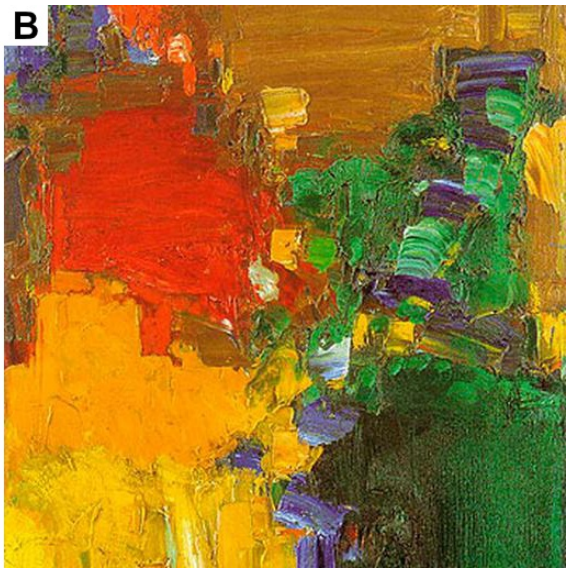
* 18. Please match each sound to its corresponding image according to your perception.

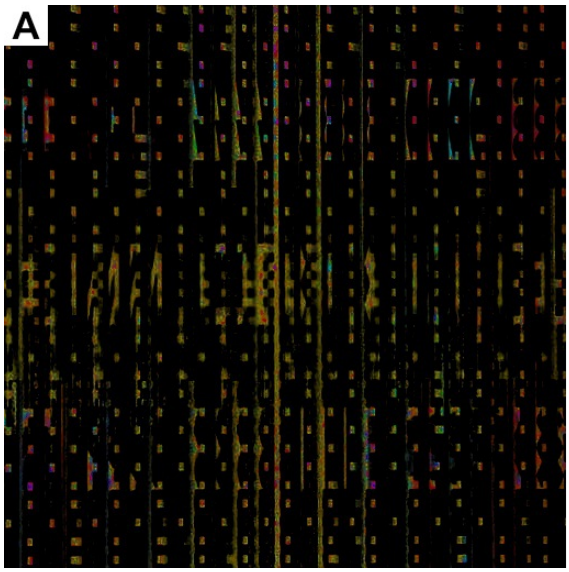


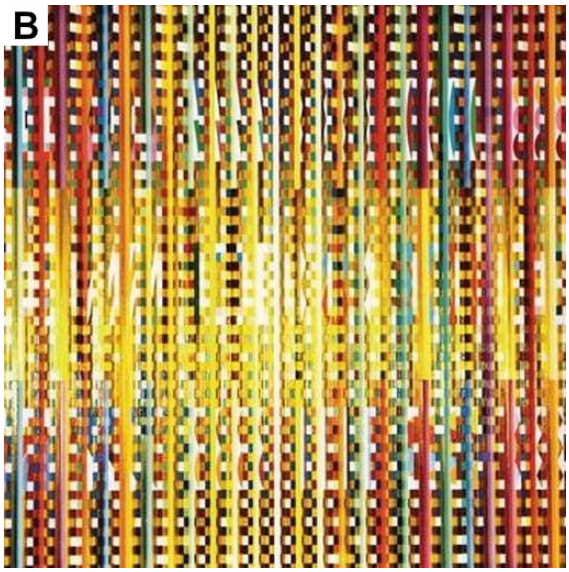


	A	B
unos 17... SOUNDCLOUD Privacy policy ▶ 57 unos · 1783	○	○
unos 17... SOUNDCLOUD Privacy policy ▶ 71 unos · 1705	○	○

Universal Oscillations: A Visual-to-Audio Substitution Approach

* 19. Please match each sound to its corresponding image according to your perception.

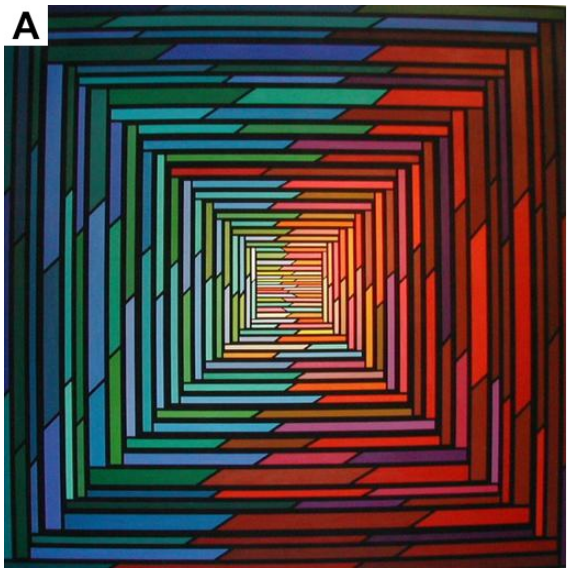


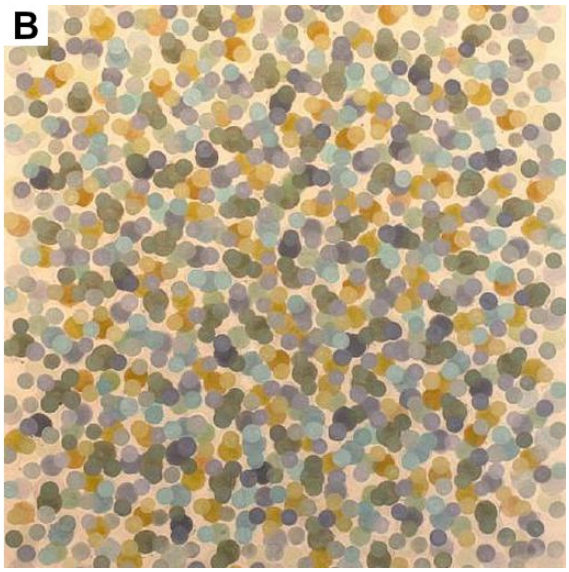


	A	B
unos 18... SOUNDCLOUD ▶ 112 Privacy policy unos · 1833	○	○
unos 18... SOUNDCLOUD ▶ 34 Privacy policy unos · 1897	○	○

Universal Oscillations: A Visual-to-Audio Substitution Approach

* 20. Please match each sound to its corresponding image according to your perception.

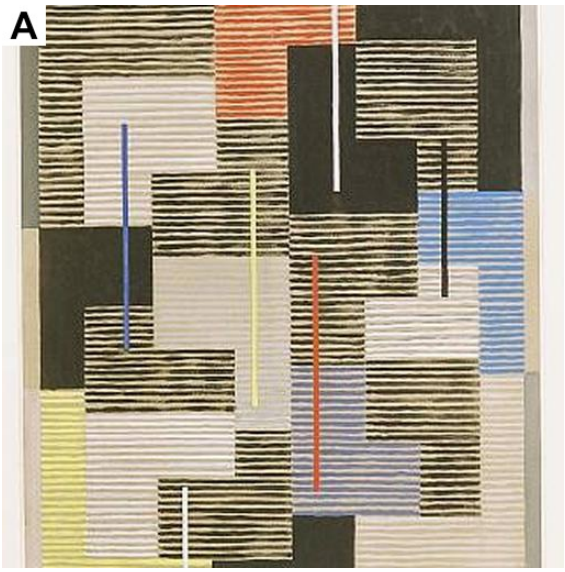


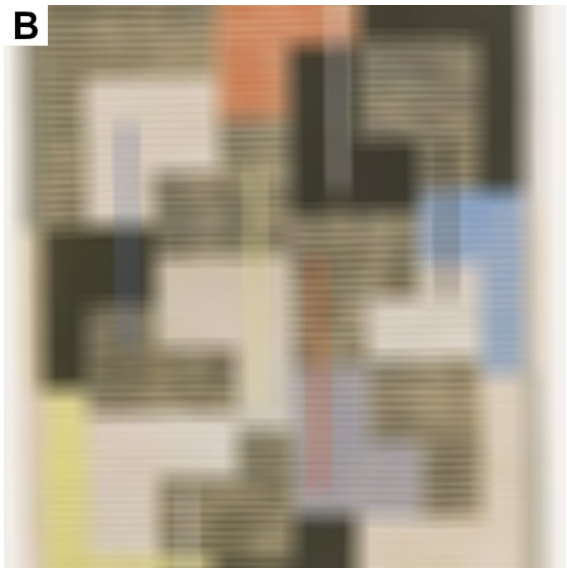


	A	B
unos 19... SOUNDCLOUD Privacy policy ▶ 36 unos · 1902	○	○
unos 19... SOUNDCLOUD Privacy policy ▶ 35 unos · 1934	○	○

Universal Oscillations: A Visual-to-Audio Substitution Approach

* 21. Please match each sound to its corresponding image according to your perception.

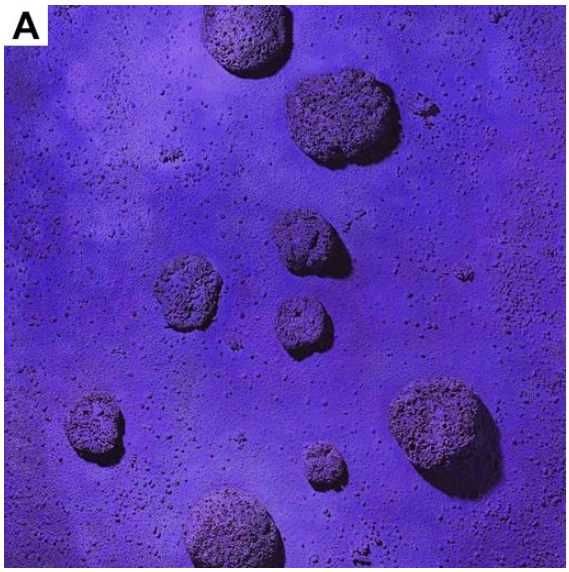




	A	B
unos 20... SOUNDCLOUD Privacy policy ▶ 35 unos · 2001	○	○
unos 20... SOUNDCLOUD Privacy policy ▶ 33 unos · 2016	○	○

Universal Oscillations: A Visual-to-Audio Substitution Approach

* 22. Please match each sound to its corresponding image according to your perception.



	A	B
unos 21... SOUNDCLOUD ▶ 37 Privacy policy unos · 2101	○	○
unos 21... SOUNDCLOUD ▶ 44 Privacy policy unos · 2184	○	○

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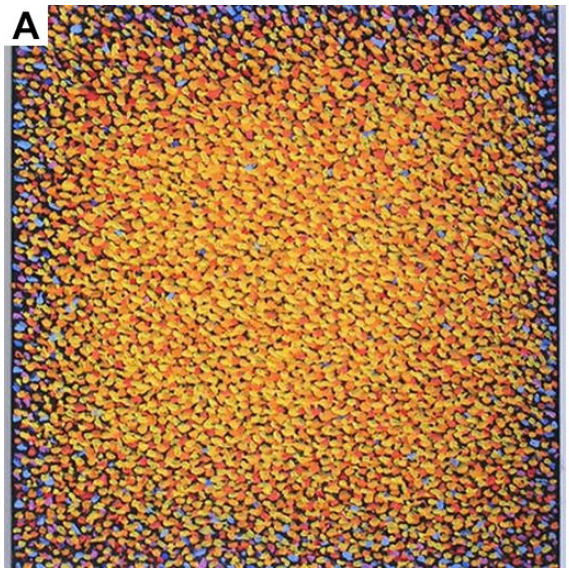
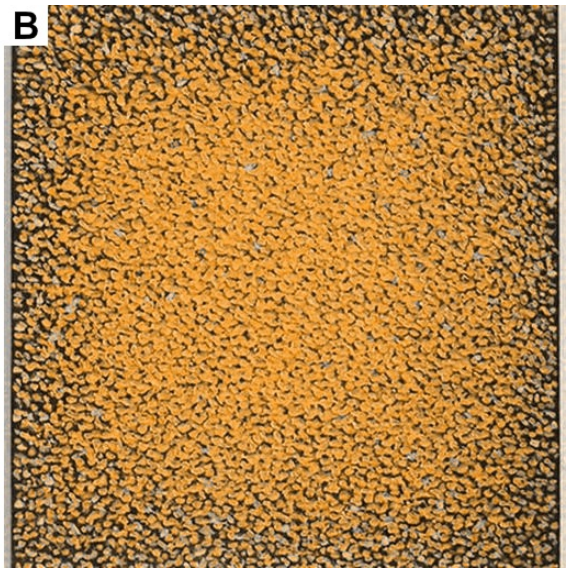
* 23. Please match each sound to its corresponding image according to your perception.





	A	B
unos 22... SOUNDCLOUD ▶ 36 Privacy policy unos · 2205	○	○
unos 22... SOUNDCLOUD ▶ 37 Privacy policy unos · 2227	○	○

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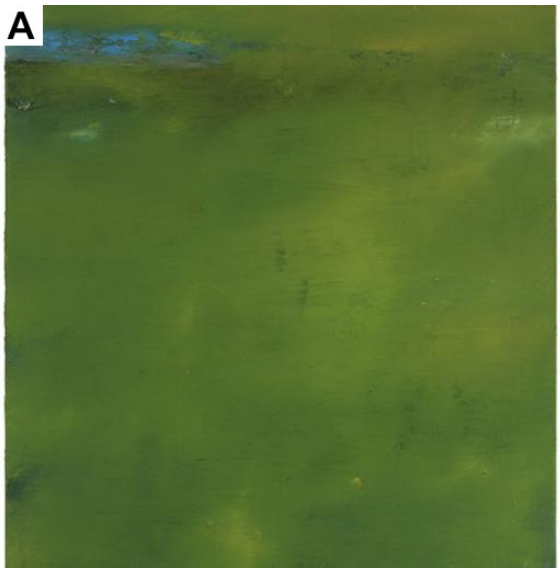
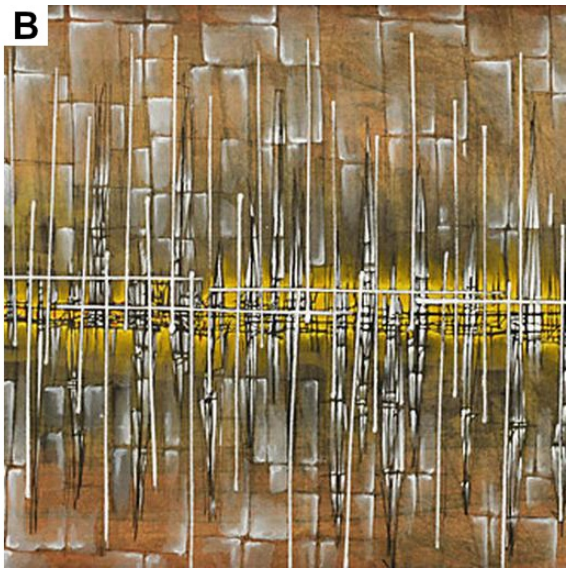
* 24. Please match each sound to its corresponding image according to your perception.

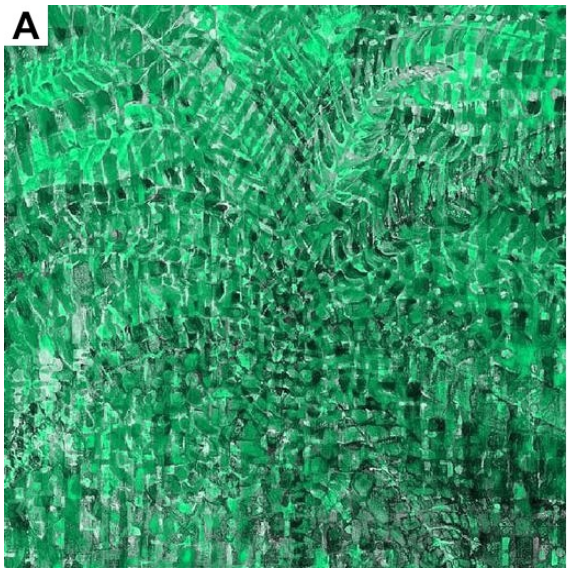


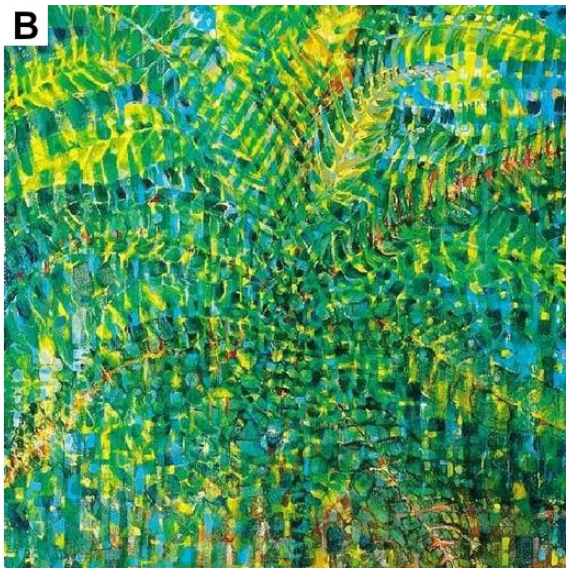


	A	B
unos 23... SOUNDCLOUD ▶ 36 Privacy policy unos · 2311	○	○
unos 23... SOUNDCLOUD ▶ 73 Privacy policy unos · 2347	○	○

Universal Oscillations: A Visual-to-Audio Substitution Approach

* 25. Please match each sound to its corresponding image according to your perception.

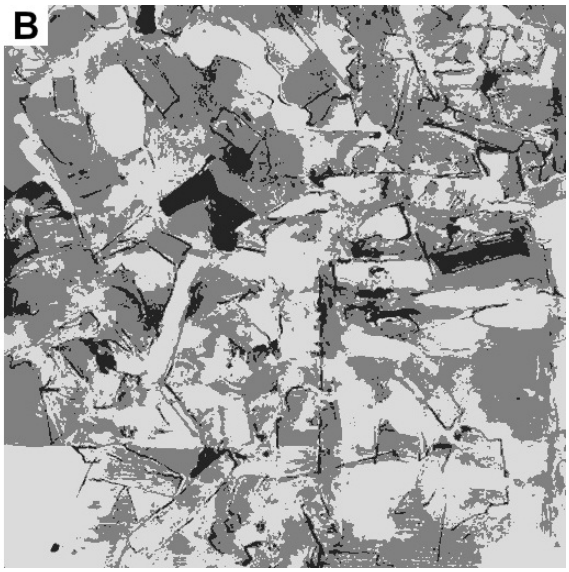




	A	B
unos 24... SOUNDCLOUD ▶ 38 Privacy policy unos · 2485	○	○
unos 24... SOUNDCLOUD ▶ 35 Privacy policy unos · 2446	○	○

Universal Oscillations: A Visual-to-Audio Substitution Approach

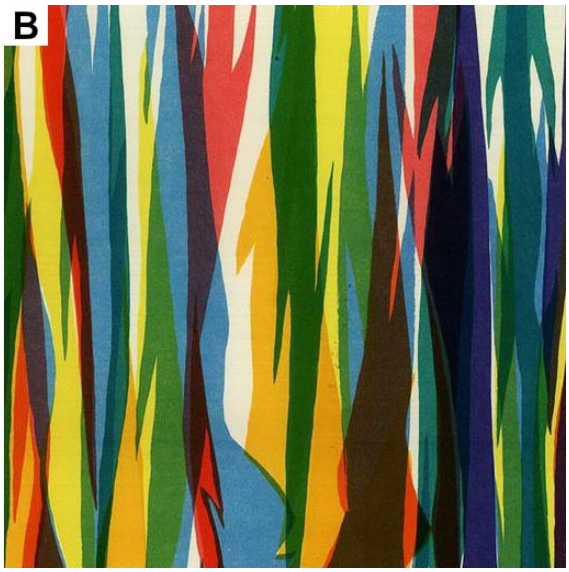
* 26. Please match each sound to its corresponding image according to your perception.



	A	B
SOUNDCLOUD Privacy policy unos · 2574	○	○
SOUNDCLOUD Privacy policy unos · 2508	○	○

Universal Oscillations: A Visual-to-Audio Substitution Approach

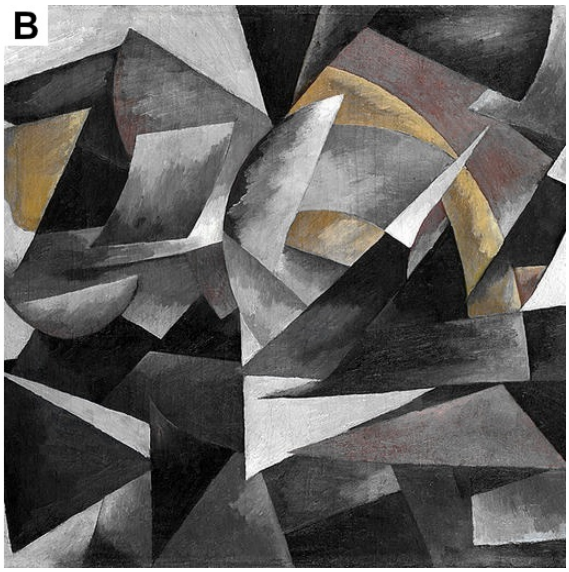
* 27. Please match each sound to its corresponding image according to your perception.



	A	B
SOUNDCLOUD Privacy policy unos · 2689	○	○
SOUNDCLOUD Privacy policy unos · 2603	○	○

Universal Oscillations: A Visual-to-Audio Substitution Approach

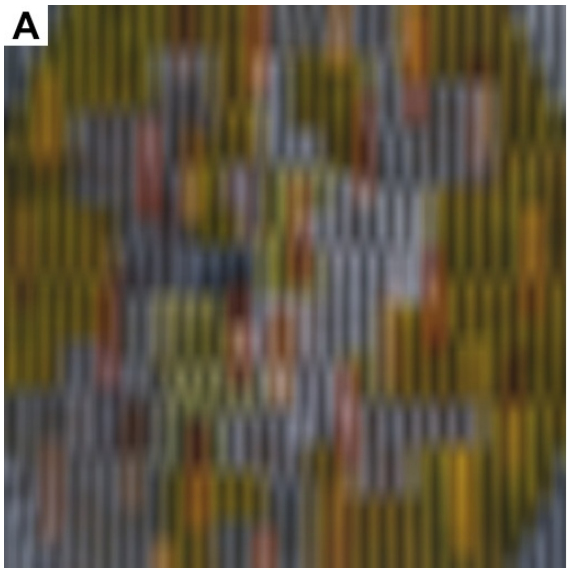
* 28. Please match each sound to its corresponding image according to your perception.

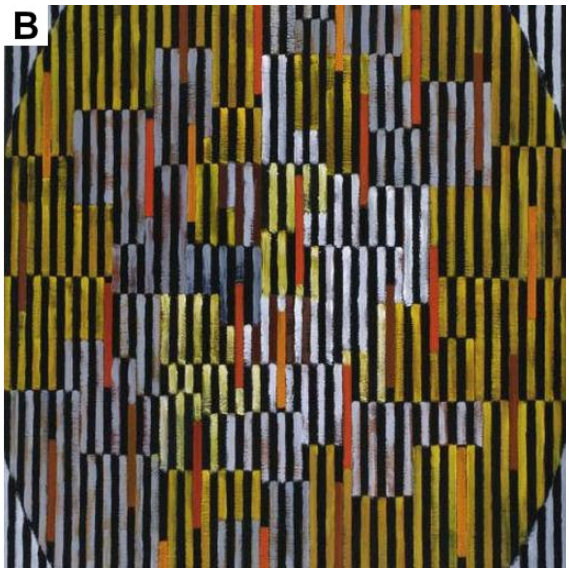


	A	B
SOUNDCLOUD Privacy policy unos · 2784	○	○
SOUNDCLOUD Privacy policy unos · 2754	○	○

Universal Oscillations: A Visual-to-Audio Substitution Approach

* 29. Please match each sound to its corresponding image according to your perception.

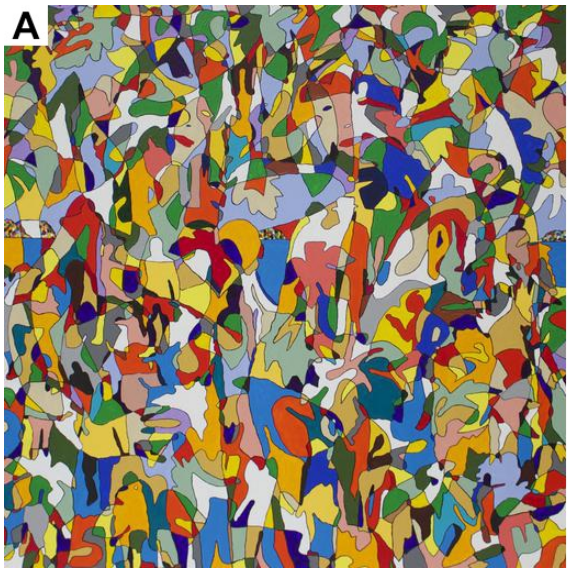


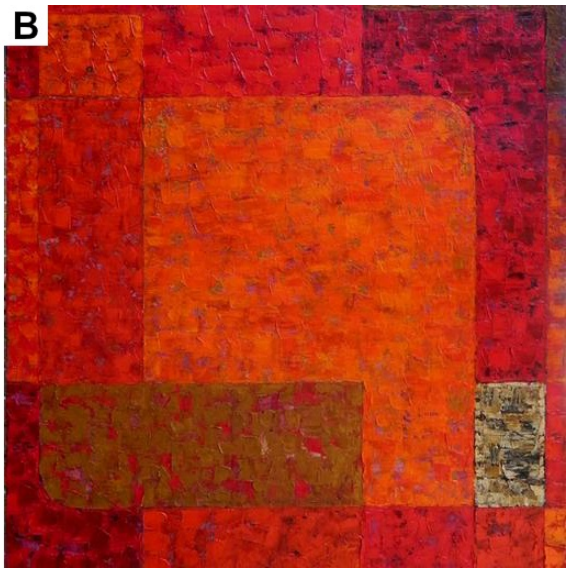


	A	B
SOUNDCLOUD Privacy policy unos · 2894	○	○
SOUNDCLOUD Privacy policy unos · 2801	○	○

Universal Oscillations: A Visual-to-Audio Substitution Approach

* 30. Please match each sound to its corresponding image according to your perception.





	A	B
SOUNDCLOUD Privacy policy unos · 2917	○	○
SOUNDCLOUD Privacy policy unos · 2944	○	○

Universal Oscillations: A Visual-to-Audio Substitution Approach

* 31. How confident were you in matching the sounds to the images?

- ◯ Not confident: I frequently felt lost and resorted to choosing sounds randomly.
- ◯ Slightly confident: I had some clues for matching sounds to images, but wasn't entirely sure.
- ◯ Moderately confident: I had a general idea but encountered moments of uncertainty.
- ◯ Fairly confident: I felt reasonably sure about most matches, with a few doubts.
- ◯ Very confident: I almost always knew the right sound to choose.

* 32. What is your primary field of education or training?

- ◯ Engineering, Technology, Computer Science
- ◯ Natural Sciences (e.g., Biology, Chemistry, Physics)
- ◯ Social Sciences (e.g., Psychology, Sociology, Economics)
- ◯ Humanities (e.g., Literature, History, Philosophy)
- ◯ Business and Management
- ◯ Health and Medical Sciences
- ◯ Arts and Design
- ◯ Education and Teaching
- ◯ Vocational/Job-specific Training (e.g., Electrician, Plumbing, Sales, Culinary)
- ◯ Other (please specify)

[ ]

* 33. Please rate your experience level in working with music.

- ◯ Novice: Limited experience and knowledge in working with music.
- ◯ Intermediate: Moderate experience and understanding of music theory and practice.
- ◯ Advanced: Extensive experience and proficiency in playing instruments, composing, or performing music.

* 34. Do you consider yourself an auditory learner?

- ◯ Yes: I learn best through hearing and listening. I rely heavily on auditory input to understand, process, and retain information. Listening to lectures, discussions, or audio recordings greatly enhances my learning experience.
- ◯ Partially: While I learn well through hearing and listening, I often choose to utilize other learning channels such as reading, visualization, or doing things hands-on to understand and memorize content.
- ◯ No: I prefer other learning modalities such as visual or hands-on. I find that seeing or doing things directly helps me grasp concepts and retain information more effectively than relying on auditory input.

* 35. How often do you engage in activities that involve actively listening to audio content (e.g., podcasts, audiobooks, music)?

- ◯ Rarely or never
- ◯ Occasionally
- ◯ Regularly

* 36. For what time have you been trained or have practiced the following fields?

	no experience	<1 year	1 - 5 years	>5 years
Sound engineering	◯	◯	◯	◯
Speech therapy	◯	◯	◯	◯
Music	◯	◯	◯	◯
Other auditory field	◯	◯	◯	◯

* 37. Please rate your ability to distinguish and identify different sounds or auditory cues.

- ◯ Low: I have a below-average ability to distinguish and identify different sounds or auditory cues.
- ◯ Moderate: I have an average ability to recognize sounds or auditory cues.
- ◯ High: I have a keen ability to discern and identify a wide range of sounds or auditory cues.

* 38. Please rate your experience level in working with visual content.

- ◯ Novice: Limited experience and knowledge in working with visual content.
- ◯ Intermediate: Moderate experience and understanding of visual elements, design principles, or visual arts.
- ◯ Advanced: Extensive experience and proficiency in creating, designing, or working with visual content professionally.

* 39. Do you consider yourself a visual learner?

- ◯ Yes: I learn best through seeing and observing. I rely heavily on visual input to understand, process, and retain information. Diagrams, images, and visual aids greatly enhance my learning experience.
- ◯ Partially: While I learn well through visual means, I often choose to utilize other learning channels such as reading, listening, or hands-on activities to grasp concepts and memorize content.
- ◯ No: I prefer other learning modalities such as auditory or hands-on learning. Visual input is not my primary way of understanding and retaining information.

* 40. How often do you engage in activities that involve actively using visual content (e.g., graphic design, drawing, photography)?

- ◯ Rarely or never
- ◯ Occasionally
- ◯ Regularly

* 41. For what time have you been trained or have practiced the following fields?

	No experience	<1 year	1 - 5 years	>5 years
Graphic Design	◯	◯	◯	◯
Drawing/Painting	◯	◯	◯	◯
Photography	◯	◯	◯	◯
Other visual field	◯	◯	◯	◯

* 42. Please rate your ability to interpret and understand visual information.

◯ Low: I have difficulty interpreting and understanding visual content or complex visual data.

◯ Moderate: I have an average ability to interpret and understand most visual information.

◯ High: I have a keen ability to interpret and understand various forms of visual content and complex visual data.

* 43. Do you have auditory-visual synesthesia? (When you hear sounds and/or music, it triggers visual perceptions.)

◯ Prefer not to tell

◯ No

◯ Yes (please specify)

* 44. Do you suffer from any form of hearing impairment?

◯ Prefer not to tell

◯ No

◯ Yes (please specify)

* 45. Do you suffer from any form of color blindness?

- ◯ Prefer not to tell
- ◯ No
- ◯ Yes (please specify)

* 46. What is your gender?

- ◯ Prefer not to tell
- ◯ Non-binary
- ◯ Female
- ◯ Male
- ◯ Custom

* 47. What is your age?

- ◯ Under 18
- ◯ 18-24
- ◯ 25-34
- ◯ 35-44
- ◯ 45-54
- ◯ 55-64
- ◯ 65-74
- ◯ 75+