Disentangling perception with drawings

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Abstract

Sound localization experiments are common tests describing the individual perception of the spatial sound. However, 3-D audio auralization techniques include spatial scenarios more complex than those presented in the experiments. In those cases, a three-dimensional drawing of the aurally perceived space delivers detailed information about the individual perception. The present experiment was performed by architecture students, who listened to an auralized scene while scale drawing what they thought the auditory environment could look like. This poster presents the graphical data produced in the experiment. The correlation of the design properties of the drawings with some psychoacoustic parameters are presented by Kohnen et. al [1] also in this conference proceedings.

Description of the graph

First part of the test (drawing): every subject listened to the same soundscape after individual equalization of the headphone transfer function. The soundscape represents an indoor environment with four sound sources: a guitar player, a group of people sitting at a table, a man rising the stairs and a woman walking along a balcony on the second floor. All the scene takes place in a space of 6 meters high with a stair case and a balcony. The scene was modelled and auralized for the audio reproduction.

Second part of the test (psychoacoustics): every subject was asked to locate the distance of a sound source presented via headphones. After a presentation of an anchor sound source at 2m, the subject was asked to locate another sound source. The distance was selected by the subject with a slider, in meters. Two sound sources were presented, at 4m and 9m. Three trials of each distance were repeated in order to average them.

The goal of the test is the correlation between the distances located in the drawings and the distances located in the psychoacoustic test.

The definition of the room and test procedure are described in detail in Kohnen et. al [1].

The graph displays some relevant data from each subject:

- The distance from the listener to the sketched position of the guitar is represented by squares. The guitar was situated to the front side at a distance of 10.5m of the listener in the auralized scene.
- The distance from the listener to the sketched position of the group of people is represented by diamantes. The group of people was situated to the right side at a distance of 4.3m of the listener in the auralized scene.
- The total volume of the sketched room is represented by hexagonal stars.
- The distance from the listener to the perceived position of the 9m sound source in the psychoacoustic test is represented by circles
- The distance from the listener to the perceived position of the 4m sound source in the psychoacoustic test is represented by triangles.
- Every subject is represented by a colour. Every subject ID is plotted at the right side of each value.
- The dotted lines relate only the values of the same subject that are close to the each other. The criteria used for this relation is: each value which is further than five steps to the other is rejected. In other words, two values of the same subject are only related if the distance between both in the X axis is smaller than five steps.
- The sketches are displayed in the upper part of the graph. All spaces are represented by an axonometric perspective, as requested in the test.

Conclusions

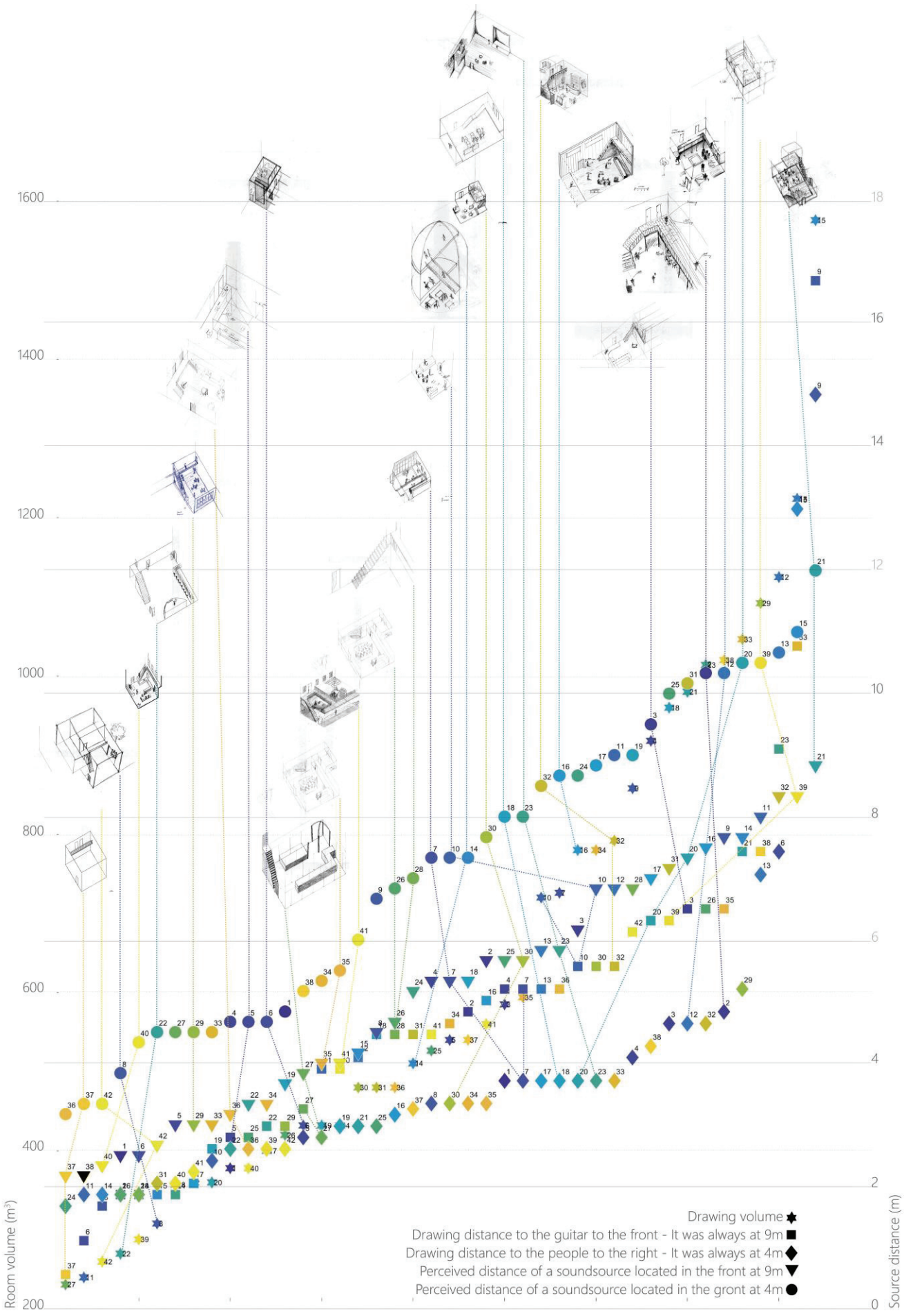
The relation between the values is not always the same. There are subjects that show a relation between the perceived distance of 4m and the distance of 9m in the psychoacoustic test. This indicates that they present a specific perception trend in the distance perception. However, they do not show a correlation with the distances sketched. Other subjects perform relation between the sketched distance of 4m and the perceived distance of 9m in the psychoacoustic test. However, they do not present the same relation with the other distances. The correlation conclusions are presented by Kohnen et. al. The present research is continuation of previous studies [2,3].

Biography

[1] Kohnen, Michael; Llorca-Bofí, Josep; Vorländer, Michael. (2020). Limitations of spatial perception in room auralizations. In *Fortschritte der Akustik – DAGA 2020* Hannover, March, 2020.

[2] Llorca-Bofí, Josep; Llorca-Bofí, Vicent and Redondo, Ernest. (2019). *Representation of the soundscape in the architectural design process*. EGA Revista de Expresion Gráfica Arquitectónica. 24 (37) : 192. Doi: https://doi.org/10.4995/ega.2019.11780

[3] Llorca-Bofí, Josep; Redondo, Ernest; Alba, Jesús, Mendoza, Héctor. (2018). Generation of architectural designs using soundscapes: first findings. In *Fortschritte der Akustik – DAGA 2018 München*, March, 2018. https://www.dega-akustik.de/publikationen/online-proceedings/


1600
1400
1200
1000
800
600
400
200
Room volume (m³)
18
16
14
12
10
8
6
4
2
0
Source distance (m)
Drawing volume
Drawing distance to the guitar to the front - It was always at 9m
Drawing distance to the people to the right - It was always at 4m
Perceived distance of a soundsource located in the front at 9m
Perceived distance of a soundsource located in the gront at 4m