

Perceived width evaluation on interpolated line sources in a virtual urban square

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Introduction

In urban sound environment reproduction, many sound sources are considered to be point sources in the far-field. However, the near-field experience of these sound sources is important as well. The study of the perceived width, of such non-point sound sources in urban spaces will allow researchers to reproduce the acoustic environment more accurately.

This study aims to investigate the effect of different interpolations of line sources on perceived width under virtual environments through subjective evaluation.

Experiments

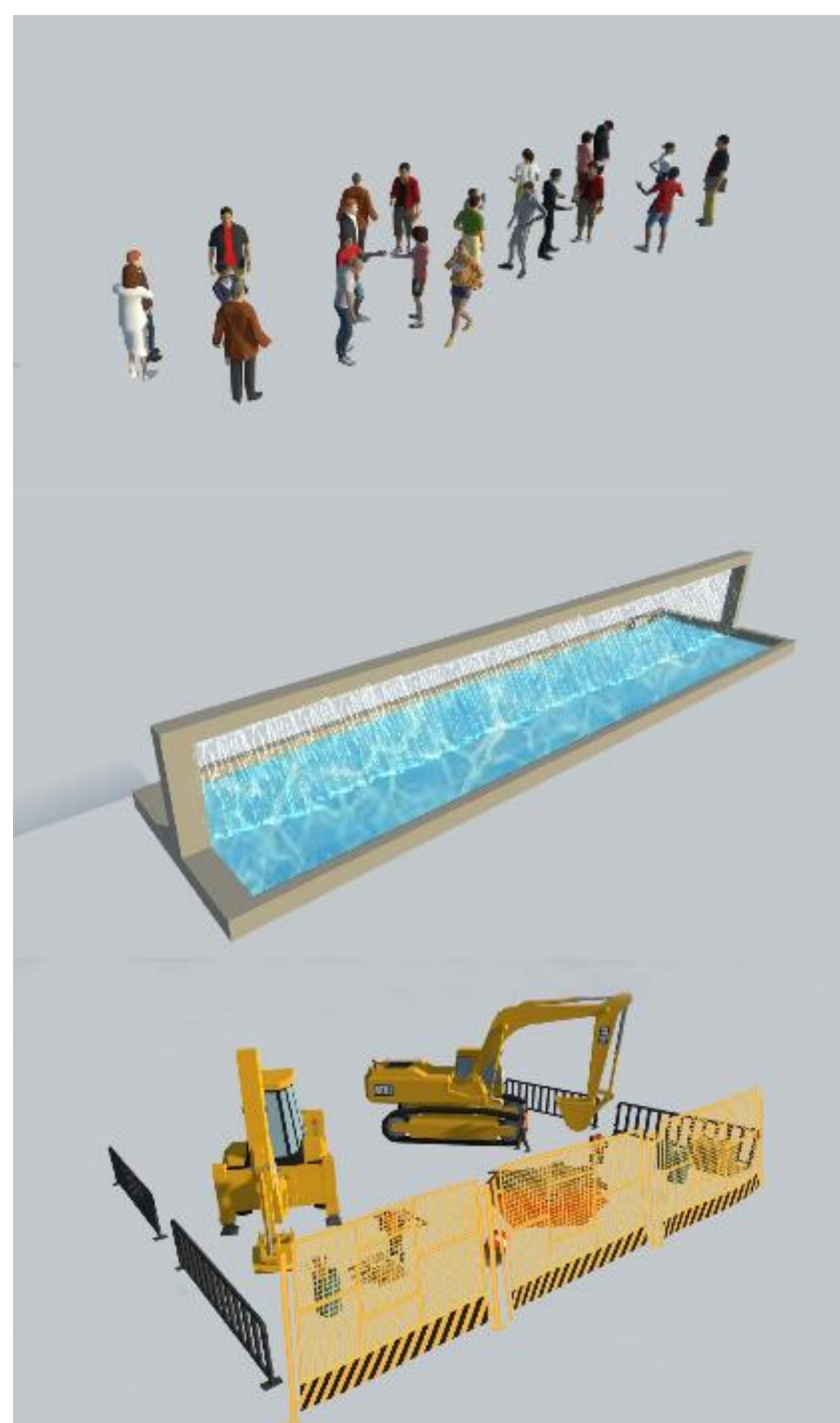
Scene visualisation

An urban space was pre-defined to place sound sources. 6,400 m² was created in VR.

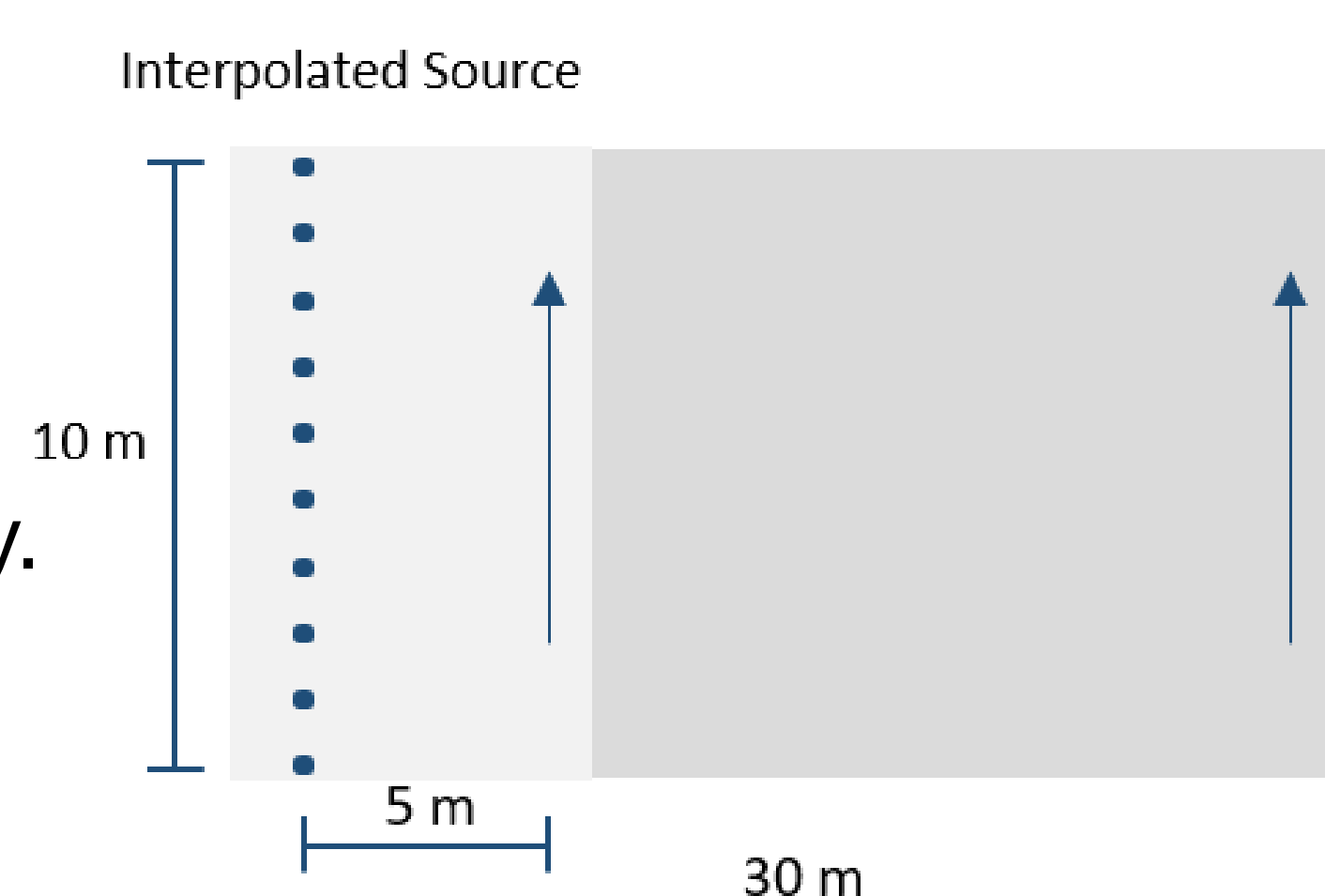


Sound selection and auralisation

- Voices from a group of people
- Water sound from a water blade/waterfall cascade
- Noise from a construction site
- 10 s per sound
- Animation attached with the scenes
- 44.1 kHz/ 16 bit.
- The **length** of the line sound source is **10 m**.
- 5, 21, and 101 points for interpolation.** The mean distances between the point sources are **2.5 m, 0.5 m and 0.1 m**.
- Two observation points at **5 m and 30 m** away from the sound source.



- Both observation points are **moving in parallel** to the line source.
- For the case of 5 m, the angle between two adjacent point sources for the observer is **22.5°, 4.5° and 0.9°** accordingly. For the far case of 30 m, the audible angle is around **4.7°, 0.9° and 0.2°**.

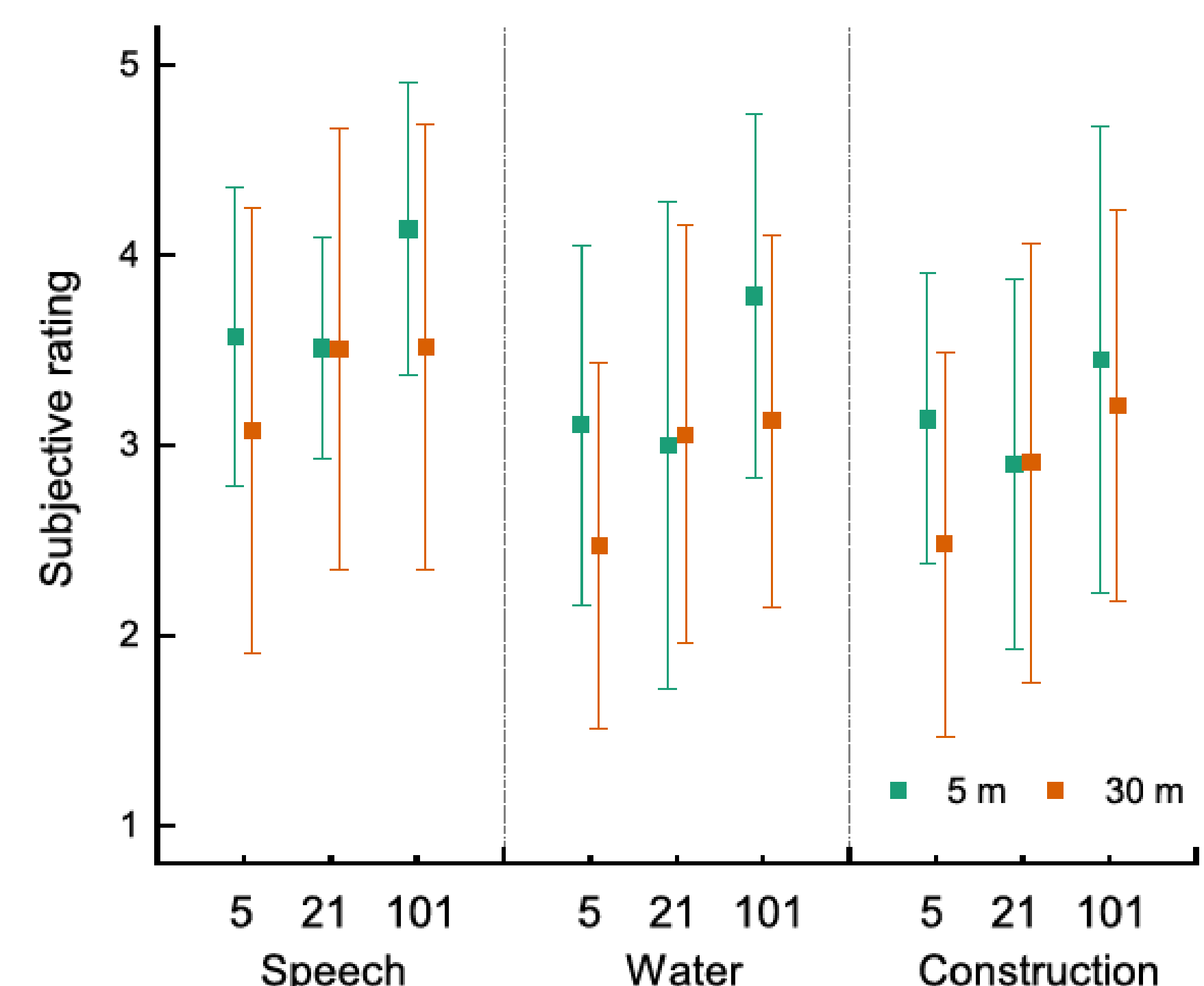


Subjective test

- The participants heard the audio using a wired earphone connected to their smartphones.
- Each video with one interpolated sound lasts **10 s**.
- They were asked to rate the perceived width (**narrow---wide**) in a structured questionnaire.
- Each participant watched **18 videos** (three interpolations, three sounds, and two distances) in total.



Results



When the distance from the sound source is at 5 m, the width ratings show a visible increase for three types of sounds with 101 points. When the distance from the sound source is at 30 m, the rating difference between 5 and 21 points is noticeable.

When the audible angle is less than 1°, the perceived width for such line sources does not vary significantly under virtual urban environments. When the points of the interpolated source form a sufficiently small audible angle (<1° in this study), the perceived width of the line source will significantly improve under VR experience. This increase in the perceived width may result in a more immersive experience for the virtual sound experience.

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