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Data Article

Raw high-speed schlieren footage of acoustic waves in air for subsequent computational analysis and audio recovery

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ABSTRACT

The dataset presented here comprises 79 raw, unprocessed video files obtained from the high-speed schlieren imaging of acoustic waves in air, each with a corresponding metadata file. The majority of the footage was recorded at 50,000 frames per second, with each condition filmed for a duration of 20 ms. The dataset includes footage corresponding to a wide range of signals, in terms of waveform, frequency, and amplitude, as well as varied imaging parameters (exposure, frame rate, spatial resolution). This Data in Brief article is to accompany the research article “Visualization of acoustic waves in air and subsequent audio recovery with a high-speed schlieren imaging system: Experimental and computational development of a schlieren microphone” [1].

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Specifications Table

Subject area	Engineering
More specific subject area	Optics
Type of data	Video
How data was acquired	High-speed schlieren imaging, using Photron SA5 camera

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Data format	Raw
Experimental factors	
Experimental features	Footage obtained by high-speed schlieren imaging of acoustic waves propagating through air produced by a speaker.
Data source location	Oxford, UK
Data accessibility	Data is available at Mendeley Data: [2] Harvey JS, Smithson HE, Siviour CR. Data for: Visualization of acoustic waves in air and subsequent audio recovery with a high-speed schlieren imaging system (Harvey et al.). Mendeley Data, v1. 2017 http://dx.doi.org/10.17632/mjrx5467mv.1
Related research article	[1] Harvey JS, Smithson HS, Siviour CR. Visualization of acoustic waves in air and subsequent audio recovery with a high-speed schlieren imaging system: Experimental and computational development of a schlieren microphone. <i>Opt Lasers Eng.</i> (2018) 107:182–193.

Value of the data

- This is the first publicly-available dataset of videos containing footage of sound captured through high-speed schlieren imaging.
- The dataset includes videos recorded for a diverse range of acoustic waves, and different imaging parameters. This will facilitate the development of new methods of audio extraction from high-speed schlieren video.
- The videos set a new benchmark for visualization of sound waves in air without laser technology or seeding particles, which are commonly used for other methods such as Laser Doppler Velocimetry or Laser Doppler Anemometry. They also provide an indication of the schlieren sensitivity achievable from the system used.

1. Data

This dataset comprises 79 raw, unprocessed video (uncompressed AVI) files obtained from the high-speed schlieren imaging of acoustic waves in air, each with a corresponding metadata (CIH) text file. Conditions for each experiment are indicated by the filename; imaging parameters may be confirmed by inspecting the metadata file, similarly named for each video. The dataset presented here is unprocessed. As addressed in [\[1\]](#) the visibility of the acoustic waves may be improved by filtering and signal processing. The audio signals may then also be recovered by recombining phase-aligned signals and subsequent integration [code yet to be published].

2. Experimental design, materials, and methods

The footage was collected with a single-mirror double-pass coincident schlieren apparatus described in detail in [\[1\]](#), with a FASTCAM SA5 high-speed camera fitted with a Nikkor 200 mm lens, a XENON NOVA 300 light source, and a spherical mirror of focal length 1.5 m. Sounds were produced by a Scanspeak D2604/833000 Tweeter, with signals generated by either a function generator or online application. The majority of the footage was recorded by varying the parameters of the acoustic wave under constant imaging conditions of 50,000 frames per second. Both sine waves and square waves were recorded, at a range of frequencies between 110 Hz and 40 kHz, at various different amplitudes (given as sound pressure level (SPL) measured a constant distance from the speaker), and each condition was filmed for a duration of 20 ms. Additionally, some footage was captured under varied imaging parameters, including variations in exposure (between 4 and 20 μ s), frame rate (40, 50, and 60 fps x 1000), and spatial resolution.

Transparency document. Supporting information

Transparency data associated with this article can be found in the online version at <https://doi.org/10.1016/j.dib.2018.06.069>.

References

- [1] J.S. Harvey, H.S. Smithson, C.R. Siviour, Visualization of acoustic waves in air and subsequent audio recovery with a high-speed schlieren imaging system: experimental and computational development of a schlieren microphone, *Opt. Lasers Eng.* **107** (2018) 182–193.
- [2] J.S. Harvey, H.E. Smithson, C.R. Siviour, Data for: visualization of acoustic waves in air and subsequent audio recovery with a high-speed schlieren imaging system (Harvey et al.), Mendeley Data (2017), <http://dx.doi.org/10.17632/mjrx5467mv.1>.