Repeatability of the balloon pop sound source in a room

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Background

The (party) air-filled balloon burst is widely employed as an impulse sound source in room acoustics measurements

There is limited information in the literature on the suitability and reliability of this popular and convenient sound source

Aim

To determine and assess the repeatability of this source as employed in field room acoustic testing

Method

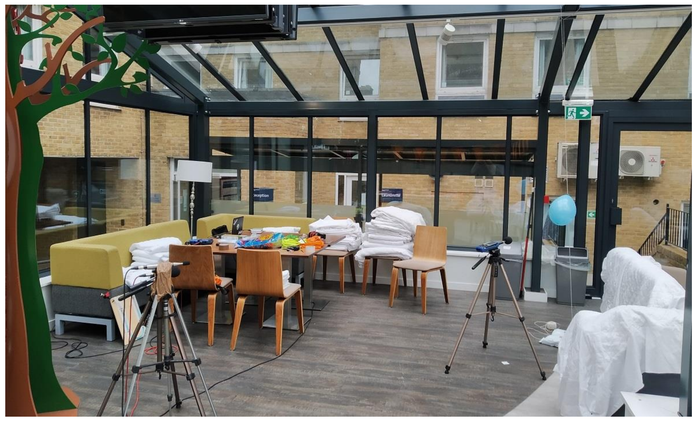
Two sets of balloon sizes of fifteen balloons, each set inflated to their maximum safe level

Balloons were popped in turn in at one source location in a 173m³ furnished room (photo below).

Sound level meter measured Lpeak while a computer based measuring system captured the impulse responses (IR)

Spectral distribution and Reverberation Time (RT30) derived from IR. Receiver – source distance : 3m

The repeatability evaluated based on the standard deviation (σ) of Lpeak, RT30 and spectrum



Results and analysis (I)

Lpeak (tables 1 and 2)

Standard deviation (σ) relatively low and comparable to results in literature [1][2]

σ equal for the two sizes suggesting that Lpeak repeatability was independent of the balloon size.

Lpeak increases with balloon size. This general trend also seen in the literature

Table 1. Regular size

Source	Space	diameter (cm)	sample (n)	Average Lpeak (dB)	std (dB)
this study	Lounge	17.4-21.8	15	120.6	2.4
Pätynen [2]	Anechoic	18±1	30	129.9	2
Horvart [1]	Anechoic	15	N/A	123.8	N/A

Table 2. Big size

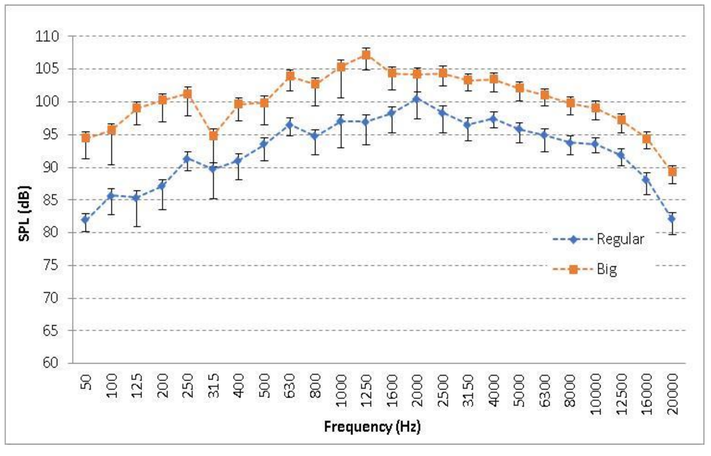
Source	Space	diameter (cm)	sample (n)	Average Lpeak (dB)	std (dB)
this study	Lounge	36.6	15	129.1	2.4
Pätynen[2]	Anechoic	39-40	3	131.1	3.5
Horvart[1]	Anechoic	25	N/A	125.4	N/A

Spectral density (graph below)

Similar low σ (error bars in the graph) across the frequency range for both sizes (both sizes mean σ = 2.7dB)

As seen in other studies [1][2], the larger size type generated higher SPL levels across the frequency range

Both sizes showed similar spectrum shapes , agreeing with others investigations spectrum shapes [1][2]



Results and analysis (II)

RT30 (graph below)

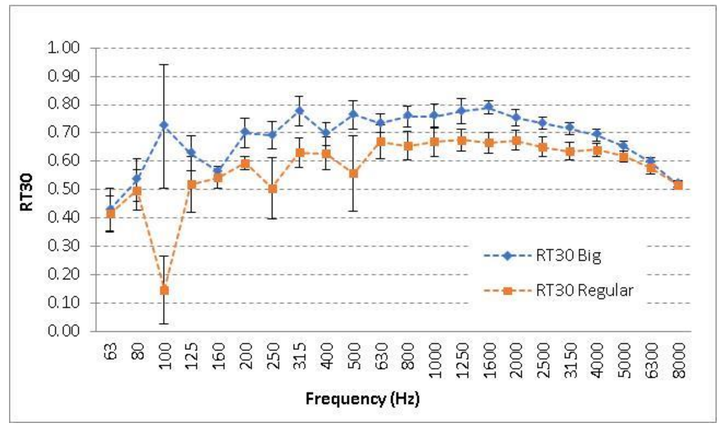
Similar low σ (error bars in the graph) across the frequency range for both sizes (mean σ = 0.04dB big; 0.05dB regular)

Anomalous result observed at 100Hz. Results excluded from averages and conclusions.

In general σ was similar for the two sizes which suggests that RT30 repeatability is independent of the balloon size

Across the frequency range the regular size RT30 values were lower than the big size ones.

The average of differences between the two sizes was 0.08sec and the median 0.08sec



Conclusions

The air-filled balloon burst used as impulse sound source has showed acceptable values of repeatability

Repeatability showed to be independent on the size type

Results in general agrees well with other in the literature

Further work intended to continue and expand to include other balloon sizes, different type of rooms and to evaluate more acoustics parameters

It is hope this study will inform practitioners on the reliability and suitability of the balloon burst sound source when selecting methods for obtaining room acoustics parameters

[1] M. Horvat, K. Jambrosic, and H. Domitrovic. A comparison of impulse-like sources to be used in reverberation time measurements, Proceedings of the Acoustics'08, Paris, France (2008)

[2] J. Pätynen.B. Katz, T. Lokki, Investigations on the balloon as an impulse source, *Journal of the Acoust. Soc. Am,* 129 (1), (2011)