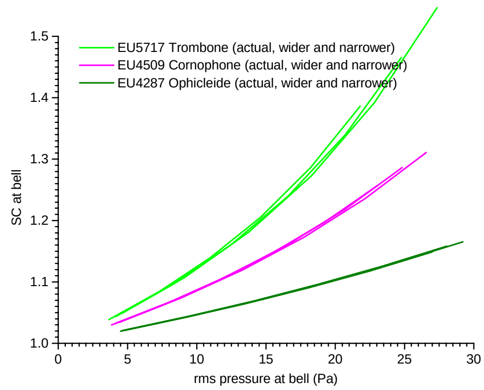

Figure 11: Plots of simulations of three instruments, scaled up and down, centroid at plane of bell plotted against pressure at plane of bell

Figure 11 would suggest that a wide bore instrument of the same proportions as a narrower bore is neither brassier (brighter timbre) nor less brassy for a given output rms pressure. However, to achieve a given sound energy output (volume of sound) a wide bore instrument will require a lower output rms pressure since the sound is being radiated from a larger cross-sectional area, so a wide bore instrument can be expected to sound less brassy than a narrow-bore instrument for the same sound energy output.

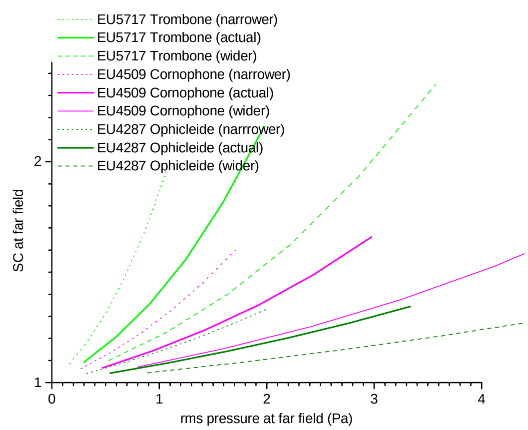

Figure 12: Plots of simulations of three instruments, scaled up (dashed lines) and down (dotted lines), centroid at far field plotted against pressure at far field

Looking at the simulated far field signal (500mm from the bell plane on axis), the ratios between spectral centroids of the far field signals and the input signal (Figure 12) are greater when the bore is narrowed [dotted lines] and less when the bore is widened [dashed lines]. This would indicate that a wide bore instrument of the same proportions as a narrower bore is less brassy (brighter timbre) for a given output rms pressure. This effect of bore size is a linear effect and is complementary to the non-linear contribution to brassy sounds.

In a musical performance situation the listener hears neither the signal in the plane of the bell nor the far field signal on axis, but the total output of the instrument modified to some extent by room acoustics.

5. PRELIMINARY CONCLUSIONS

Tentative conclusions from this work are that:

- Narrowing the bore by 25% has an effect on brassiness potential equivalent to increasing B by 10%
- Widening the bore by 25% has an effect on brassiness potential equivalent to decreasing B by 10%

The effect on spectral enrichment of a 25% increase or 25% reduction in absolute bore size can be approximately equated to the effect of changing the bore profile to give a 10% reduction or 10% increase respectively in the value of B. This is an initial ballpark figure which needs further testing and theoretical refinement.

6. ACKNOWLEDGEMENTS

The authors are grateful to:

- Shona Logie (University of Edinburgh) for help with data analysis
- Robin Pyle for participating in playing tests

7. REFERENCES

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