

The effect of dynamic range compression on the psychoacoustic quality and loudness of commercial music

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Introduction

Compression of commercial music – systematically increased since the 1980s

Music industry experts (Katz, 2007; Cashmere, 2008) – this produces negative effects on:

- Quality of music
- Quality of listener experience

Aims of research:

- Quantify these expert opinions
- Quantify the effects (both positive and negative) of dynamic range manipulation on the audio signal and subsequent listener experience

Future goal: define recommended standards for the dynamic range levels of mastered music similarly to those of the film industry

Introduction

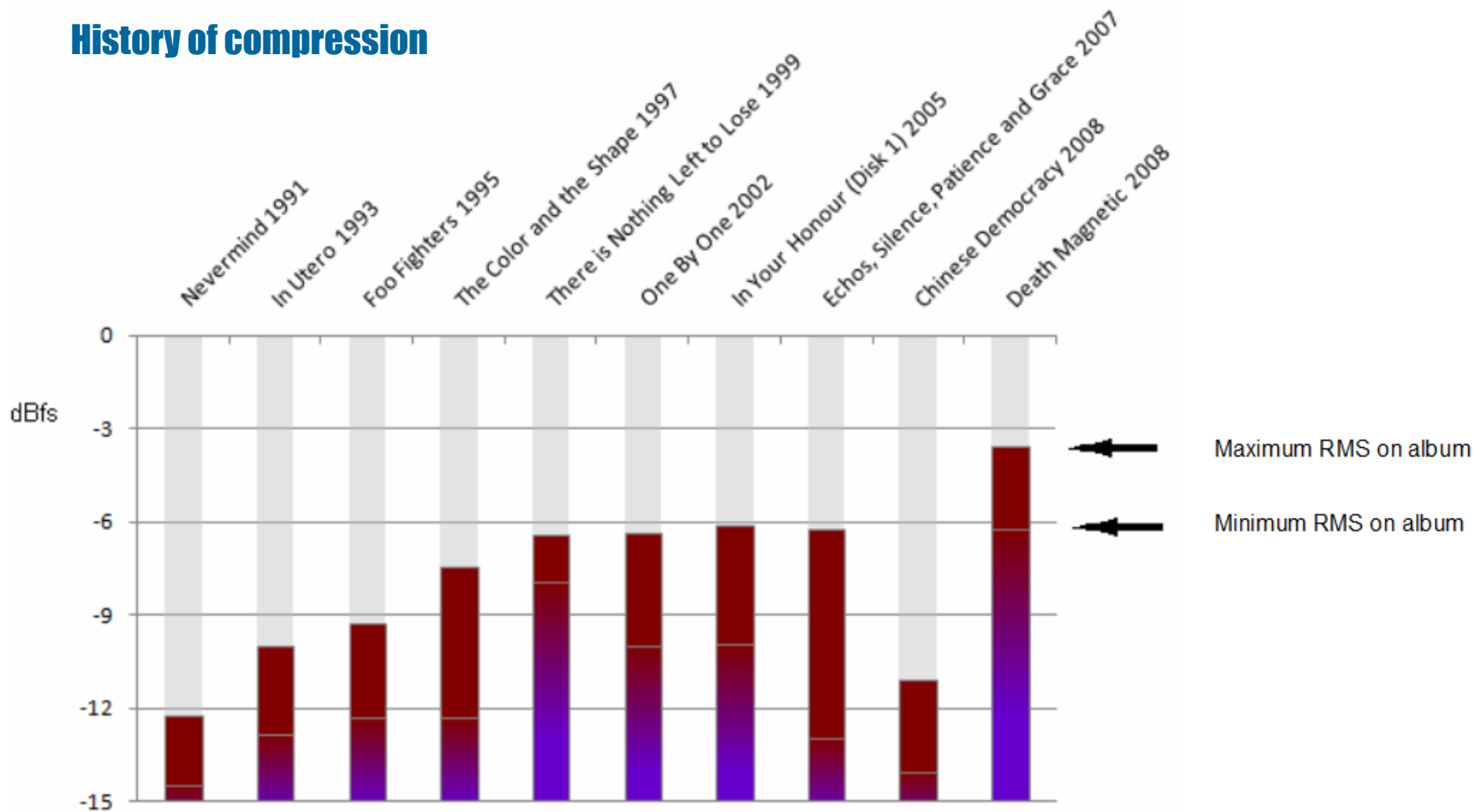
The aims of this paper:

Brief history of compression

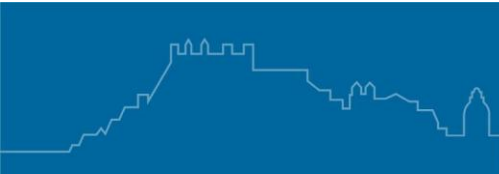
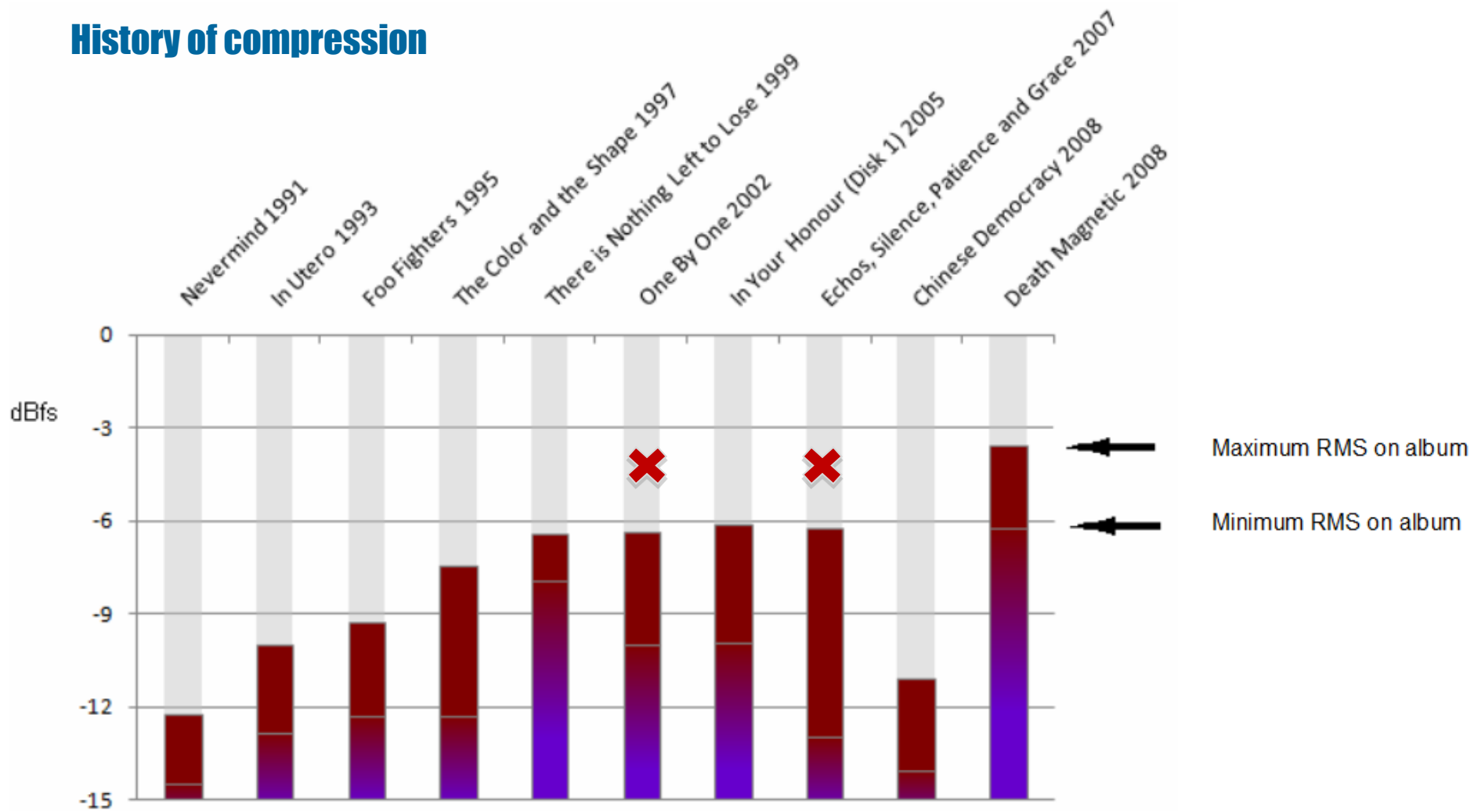
Stone *et al.* (2009) compression experiments for hearing aids

Replication of Stone *et al.* (2009) compression experiments: applied to music

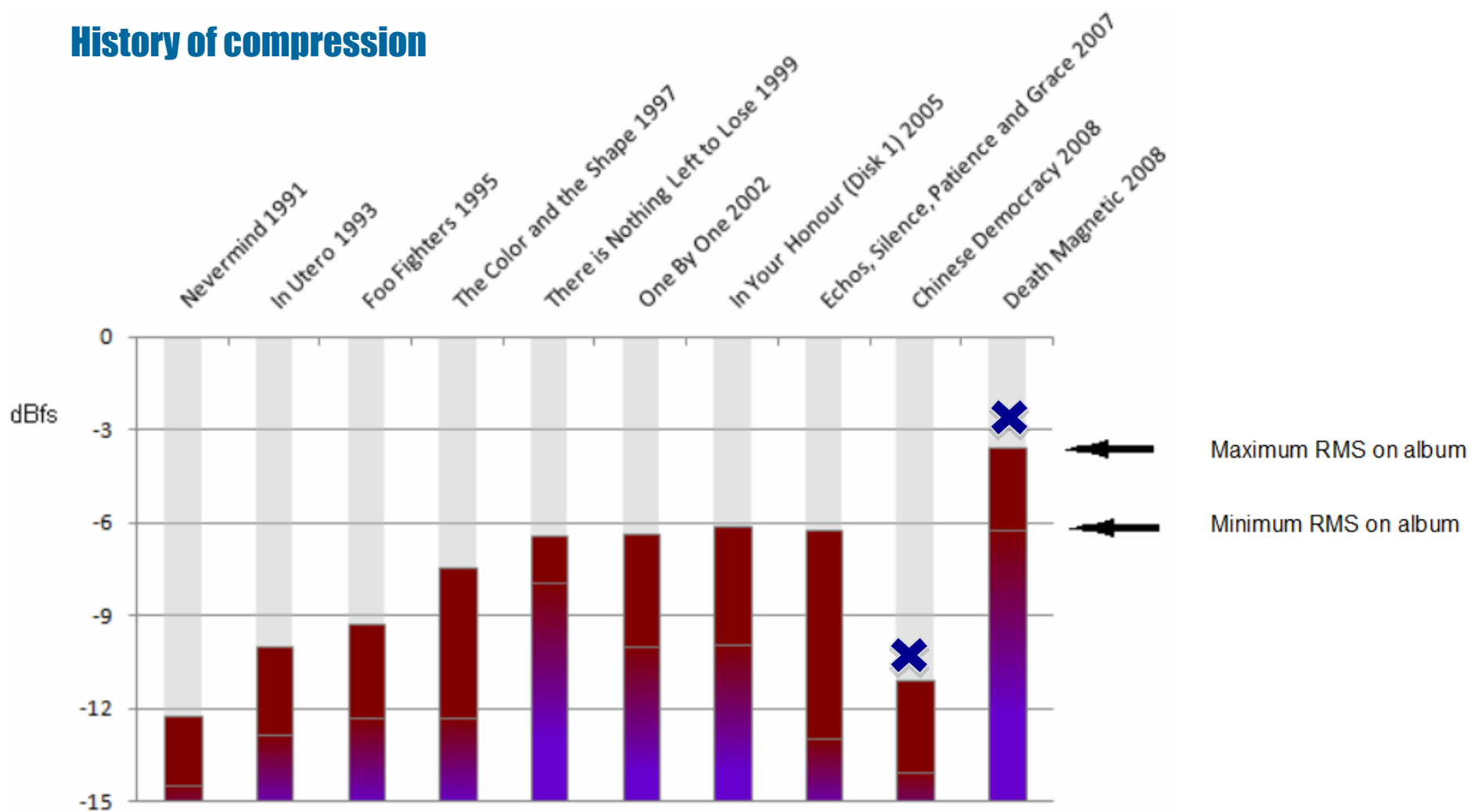
History of compression



History of compression



History of compression

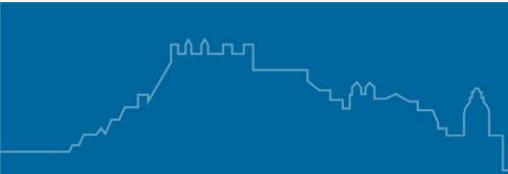


Compression experiments for HEARING

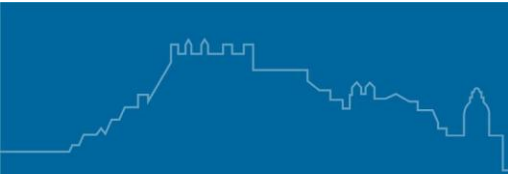
Stone *et al.* (2009) (building on Glasberg & Moore (2002) and Moore *et al.* (2004)) - experiments on compression of speech

Two tests – identify key phrases/words read by two speakers simultaneously:

- *Two voices – compressed separately + summed*
- *Two voices – summed + compressed*



“Compression reduces temporal contrast, that is, amplitude variation of the signal envelope over time, the amount of reduction depending on the speed, compression ratio, and design of the compressor. Multichannel compression also reduces spectral contrast, the amplitude variation across frequency, the amount of reduction depending on number of channels, compression speed, and compression ratio. Loss of both temporal and spectral contrast reduces the information available to the auditory system.” (Stone et al., 2009: 533)



Compression experiments applied to MUSIC

Applying Stone *et al's* (2009) experimental techniques to music
(Toulson & Campbell, 2009)

Hypothesis: the findings of these experiments could be applied directly to music

Method: utilize and expand Stone et al. (2009) methods – investigate the effects of multichannel compression on music and on individual musical instruments.

Test the hypothesis that ‘over-compression’ of music might:
have detrimental effects on the perception of audio quality
contribute to hearing loss
cause listener fatigue
have an emotional effect on the listener.

Preliminary experiment: recording (tracking) and mixing:

Track: *Uncover my eyes* by **Bijoumiyo**

Vocals + Instruments: piano, trumpet, drums, guitar & bass

Produced and engineered by Campbell

Procedure:

Overdubbed recording

Mixed with no signal processing (except stereo panning)

Followed by dynamic compression

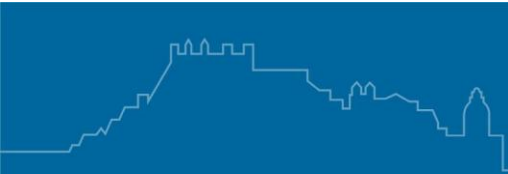
Dynamic limiting rather than compression

Two methods of applying compression used

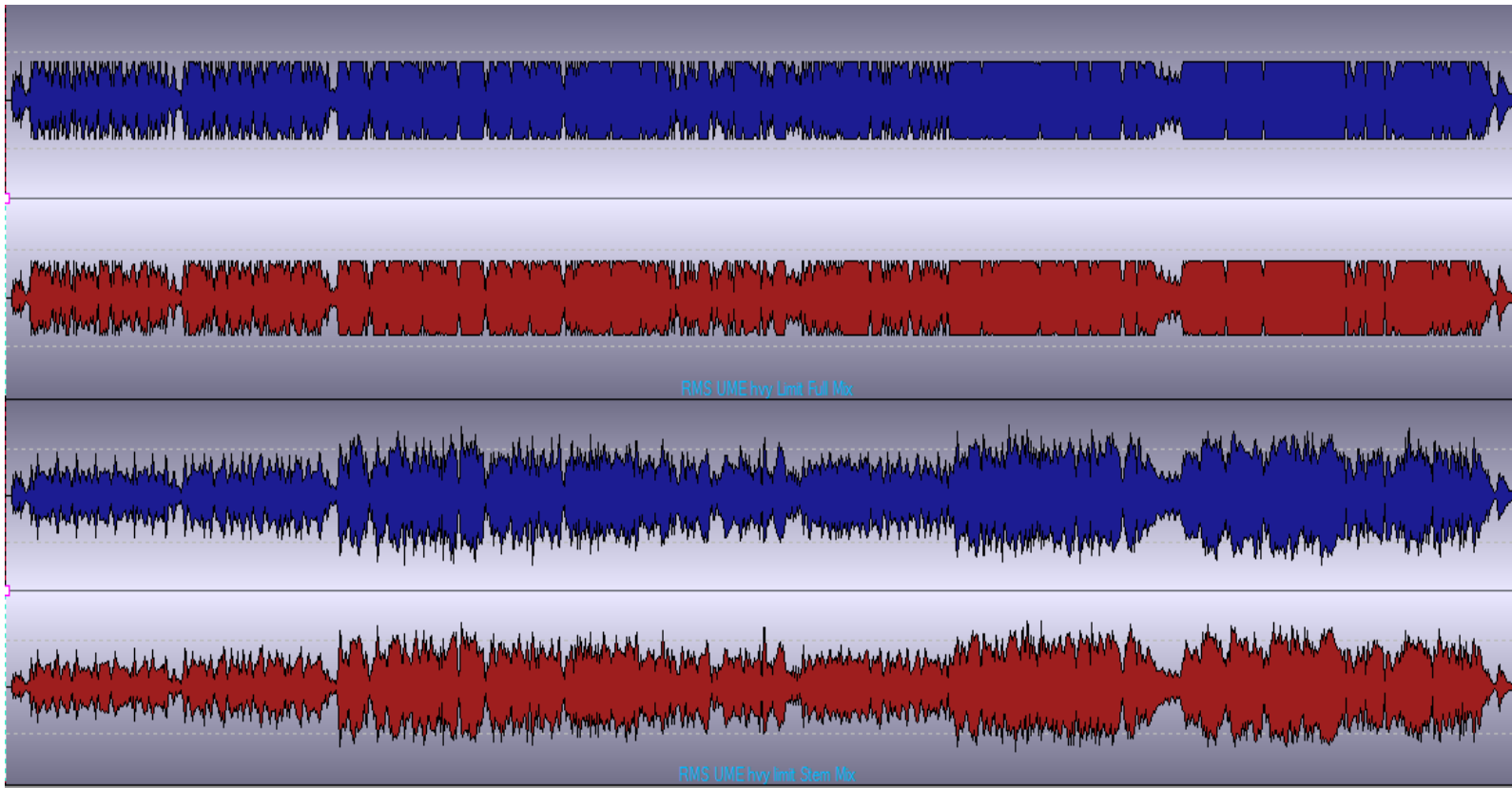
- *Signal set A: discrete signals mixed + compressed*
- *Signal set B: discrete signals mixed to stems + compressed + mixed*

Three levels of compression

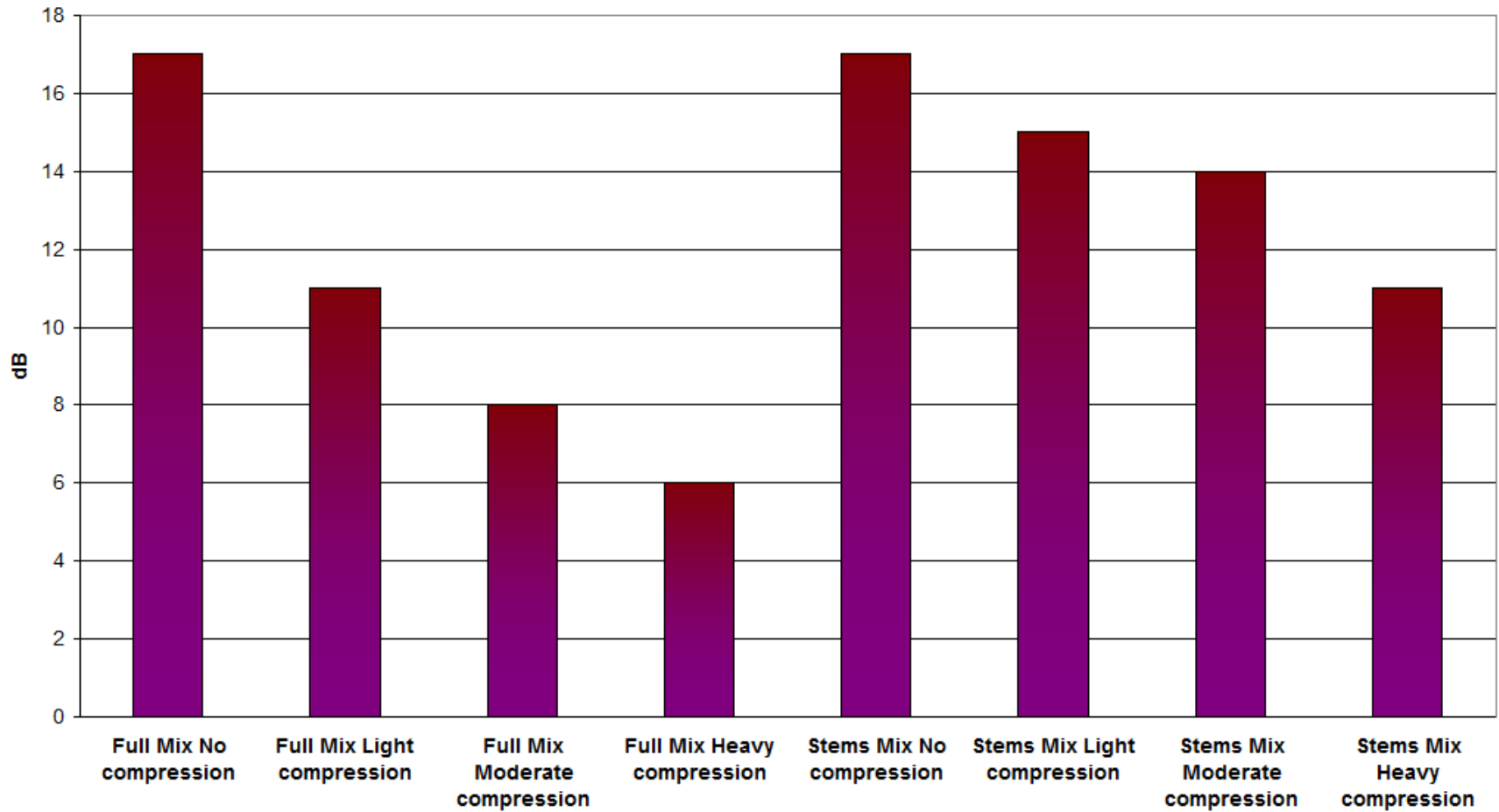
- *Heavy, moderate and light compression*
- *Adjustments were made to work optimally for signal set A; identical settings applied to signal set B for continuity*



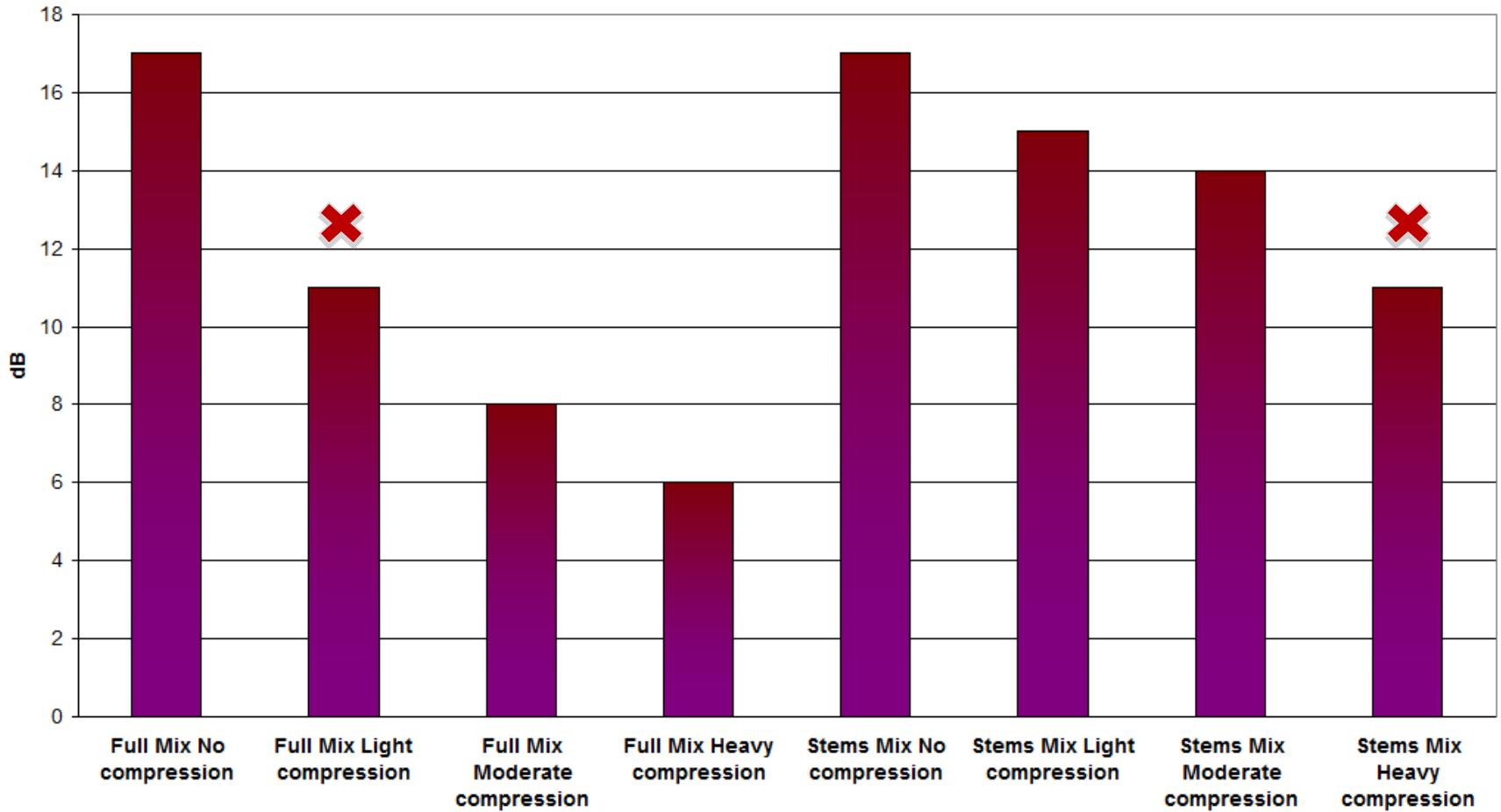
Results. Full mix and Stem mix compared



Dynamic Range



Dynamic Range



Compression experiment applied to music

Preliminary observations:

Compressed stems mix sounds better than compressed full mix:

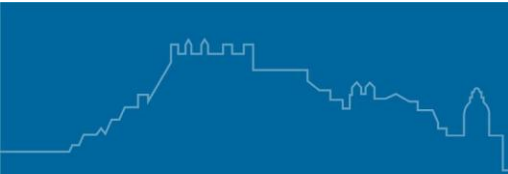
The drums have more punch and are less distorted

The noise floor (air conditioning and breathing noises) is lower

There is much more space in the mix

Phase distortions are less noticeable in the trumpet and cymbals

Vocals sound less ducked



Compression experiment applied to music

- Variation of compression ratios
- Variation of temporal settings
 - Above applied against peak and/or RMS values
- Variation of thresholds
 - All of the above, but applied to individual instruments and channels, as well as sub-groups
 - All of the above, but utilizing various spectral separations via multi-band compression
- All limited signals scrutinized using various analytical tools to ascertain and further define the effects of varied compression
- All subjective appraisal validated via established clinical survey technique

Conclusions

Stone *et al.*'s (2009) experiments for the advancement of hearing aid development can be applied to music to discernable effect

Whilst compression of sub-groups is a long established practice, and stem mastering has focused on this approach, the early stages of this research demonstrate the transferability of the methodology

Through pursuing this methodology, a new insight into the quantification and perception of long established studio practice will be gained, thus opening the door for its future evolution.

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QUESTIONS

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