A Need for Universal Audio Terminologies and Improved Knowledge Transfer to the Consumer

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Summary

Three discussion topics
Each are a particular area of research, but all are interlinked

- The effect of modern listening trends on the techniques employed for music production and final mastering
  - The impact of MP3 audio on production methods
  - Reproduction quality and random play
- High-level production technologies for the listener; allowing a little of the studio into the home
  - Educating the listener
  - Software and hardware
- Moving towards a universal language of audio terminologies
  - Scientific representations of audio terms
  - Sharing the language of audio production with the consumer

The effect of modern listening trends on the techniques employed for music production and final mastering

- Historically the production and mastering of a record has been targeted at a particular media or outlet
  - Analogue (vinyl, cassette tape)
  - Digital media formats (16-bit 44.1kHz CD, 24-bit DVDA)
  - Radio
- MPEG1 Layer 3 (MP3) and compressed audio
  - Unlike HD television broadcast, digital technology has been used to reduce the quality of reproduced music and audio!
  - MP3 compression utilises the fact that our ears can only respond at a finite speed to changes in sound pressure – so some of the data can be removed from high resolution audio and we won't be able to tell the difference!
  - 16-bit 44.1kHz CD quality equates to 1411.2 kbps, MP3 is usually compressed to 128kbps
  - Unfortunately it doesn't take much ear training to hear the major differences in quality between MP3 and uncompressed audio.

The effect of modern listening trends on the techniques employed for music production and final mastering

- Modern listening trends rely heavily on MP3 compressed audio
  - Music consumers seem to be most interested in system functionality and convenience - ‘quantity above quality’.
  - MP3 audio allows users to play songs in random order from a vast database of songs.
  - Songs from different releases are rarely have the same output characteristics.
  - The mastering process is designed for arranging song orders and aligning relative output levels.
- The use of MP3s goes totally against the principle of improving audio quality and mastering an artistic record.
- Listeners’ musical preferences could become more based on the reproduction system used as apposed to the quality and integrity of the music being listened to.
- How do we approach this issue?
  - Accept the current trends and develop production and mastering methods specifically designed for MP3 audio.
  - Educate the music buying public in the values of audio and musical sound quality.

High-level production technologies for the listener; allowing a little of the studio into the home

- Consumers of music are rarely educated in production techniques and the concepts of audio quality.
  - For example, equaliser systems in home audio devices

- It is suggested that a more valuable system would be to allow consumers to improve their home hi-fi audio by, for example
  - increasing the ‘warmth’
  - or reducing ‘sibilance’ in a track
  - or attenuating problem ‘standing waves’ for a given system in a particular room

  If only the consumer understood what these terms meant!

- Further opportunities for high-level advanced home audio processing
  - Intelligent EQ for correction of room acoustics
  - Normalising outputs for CD duke boxes
  - Intelligent output level control for random MP3 playback
  - Intelligent random song selection
  - Intelligent automated DJ (beat and pitch) mixing
  - Advanced correction/optimisation for automotive vehicle cabins

Moving towards a universal language of audio terminologies

Categorising audio terminologies

- Rumsey's (2005) chart of sound quality terminologies
- Technical descriptors can, by definition, be quantified scientifically
  - Pitch, spectral balance - guitar string example
  - Compression
  - Noise
- Spatial descriptors are usually quite easy to quantify scientifically
  - Wide
  - Up-front
  - Boxy
- Timbral descriptors are rarely defined by specific scientific parameters - though this has been shown to be possible (Disley et al, 2006), (Johnson & Gounaropoulos, 2006).
  - Warm
  - Harsh
  - Bright

Moving towards a universal language of audio terminologies

Describing timbre

- "Timbre is that attribute of auditory sensation in terms of which a listener can judge two sounds simultaneously presented and having the same loudness and pitch as being dissimilar" (ANSI, 1960)
- Timbre terminology often uses imagery relating to emotions and senses
  - This is metaphoric by nature and hence subjective
  - The use of subjective imagery to describe scientific parameters is quite paradoxical
- Examples
  - Warm → Touch
  - Bright → Sight
  - Sweet → Taste… Smell…?
- Putting scientific parameters to timbre descriptors
  - Katz' (2002) spectral chart of subjective terms

Moving towards a universal language of audio terminologies

Describing timbre

- But timbre descriptors often describe a combination of scientific and spatial qualities, for example ‘warmth’
  - Energy in the lower mid-range of the audio spectrum (200 – 500 Hz)
  - Depletion in the upper mid-range of the audio spectrum (2.5 – 6 kHz)
  - Subtle non-linear compression as in analogue audio recording devices (analogue tape)
  - Subtle harmonic distortion as in analogue (thermionic valve) audio amplification devices
- So if the above describes ‘warmth’, does that mean the opposite describes ‘cold’?
- Atsushi and Martins (2005) experimented with several bipolar timbral adjectives
  - Dark … Bright
  - Thick … Thin
  - Muddy … Clear
  - Strong … Weak

Moving towards a universal language of audio terminologies

Visualising musical sound

- ‘Bright’ sounds have
  - Greater energy in the high-midrange and treble regions (2 - 20 kHz)

  and/or
  - Depletion in the bass and lower midrange (60 - 2000 Hz).

- A particularly bright percussive instrument is the cymbal, but many timbral descriptors for instruments are often contradictory and confusing, for example

  - Zildjian Dark Thin Crash

  - Byzance Medium Thin Crash 

“Medium Thin Crash - Significant, washy and fairly dark sound with a full frequency spectrum. Voluminous attack with moderate sustain”

(http://www.meinlcymbals.com, 2006)

Moving towards a universal language of audio terminologies

Visualising musical sound

- Colour is often used as a timbre descriptor for individual instruments
  - Trumpet example 
  - Flute example 
  - Cello example 
- Colour descriptors often group together a number of metaphoric descriptors, which in turn relate back to scientific parameters, for example

  - Trumpet - scarlet indicates ‘warm’, ‘smooth’, ‘bold’

  - Cello - brown indicates ‘rich’, ‘deep’, ‘thick’

- So the use of metaphors and imagery is a very powerful tool for describing complex attributes of music and audio in a single term.
- Unfortunately, the subjective nature of the current use of these terminologies allows for regular contradiction and confusion.

Conclusions

- Modern consumer listening trends embrace the use of MP3 compressed audio, though generally at the expense of the reproduced audio quality.
- There is a need to educate listeners in the values of quality audio which in turn can provide a business case for more intelligent home audio processing hardware and software systems.
- Given that many timbral adjectives are subjective by nature, music production industry professions must first develop a uniform language of terminologies before advanced knowledge can be transferred to consumers.
- It has been shown here and previously that it is possible to define particular scientific qualities of audio which can be referenced using simple metaphoric terms or timbral adjectives. Groups of terms can further be used to describe complex sounds as higher-level adjectives.
- Further psychoacoustic experimentation correlating timbral adjectives with specific scientific properties should be conducted to achieve a universal language of music and audio descriptors.

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Home Equaliser Systems

Graphic EQ

Bass, Treble, Loudness

Preset EQ shapes

Figure 1.

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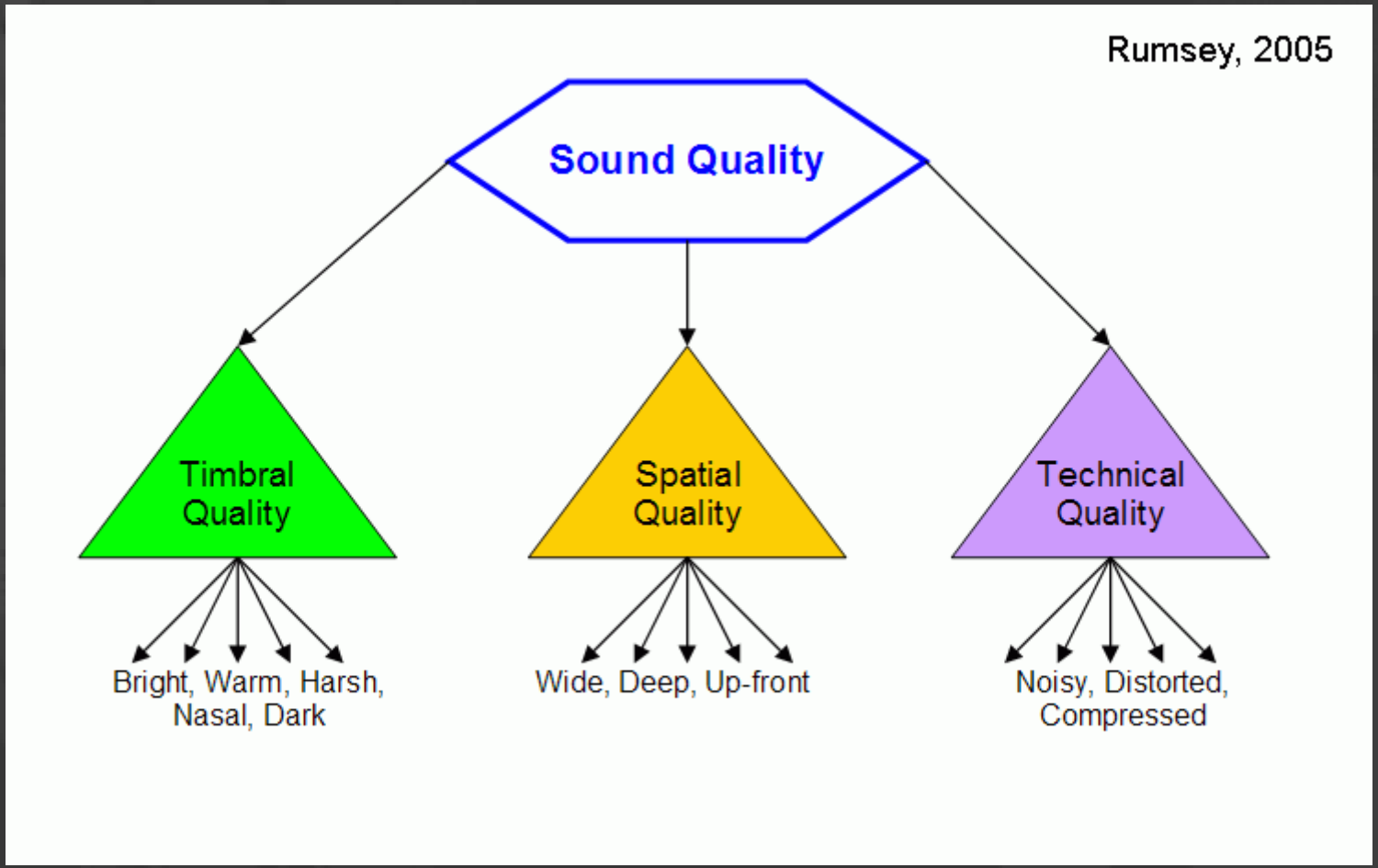

Figure 2.

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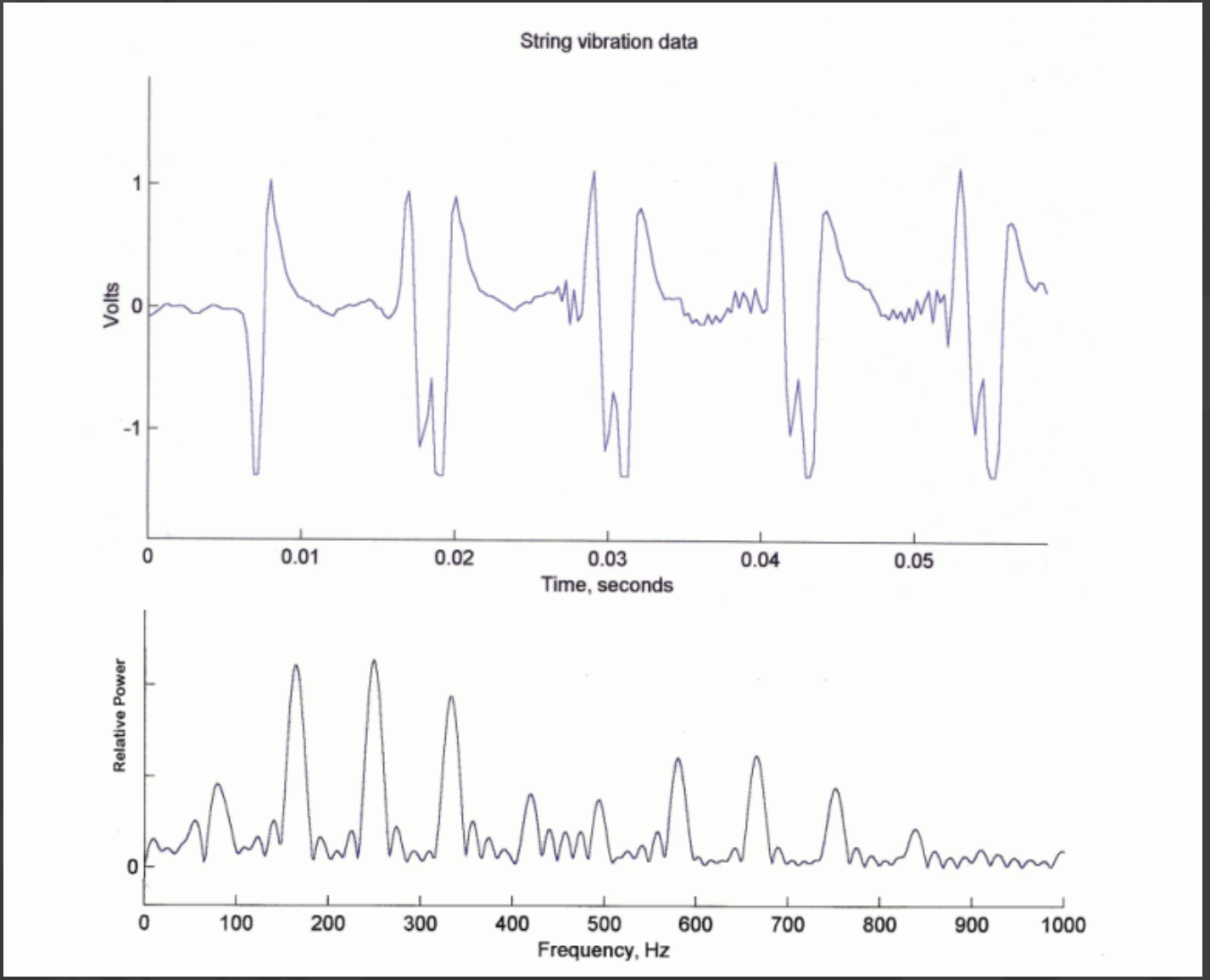

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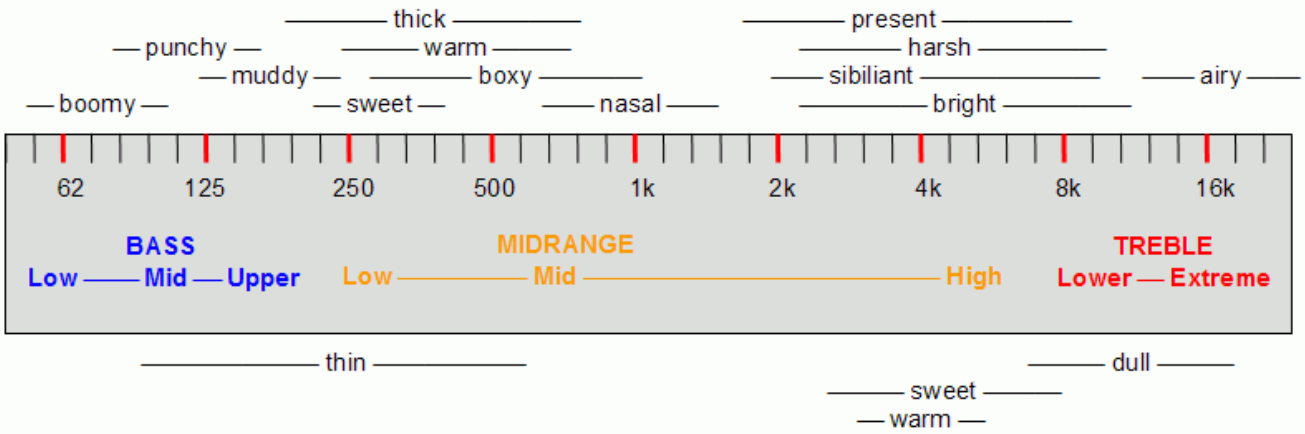

Subjective audio terms describing excess and deficiency of the frequency spectrum (Katz, 2002)

Figure 4.

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Figure 5.

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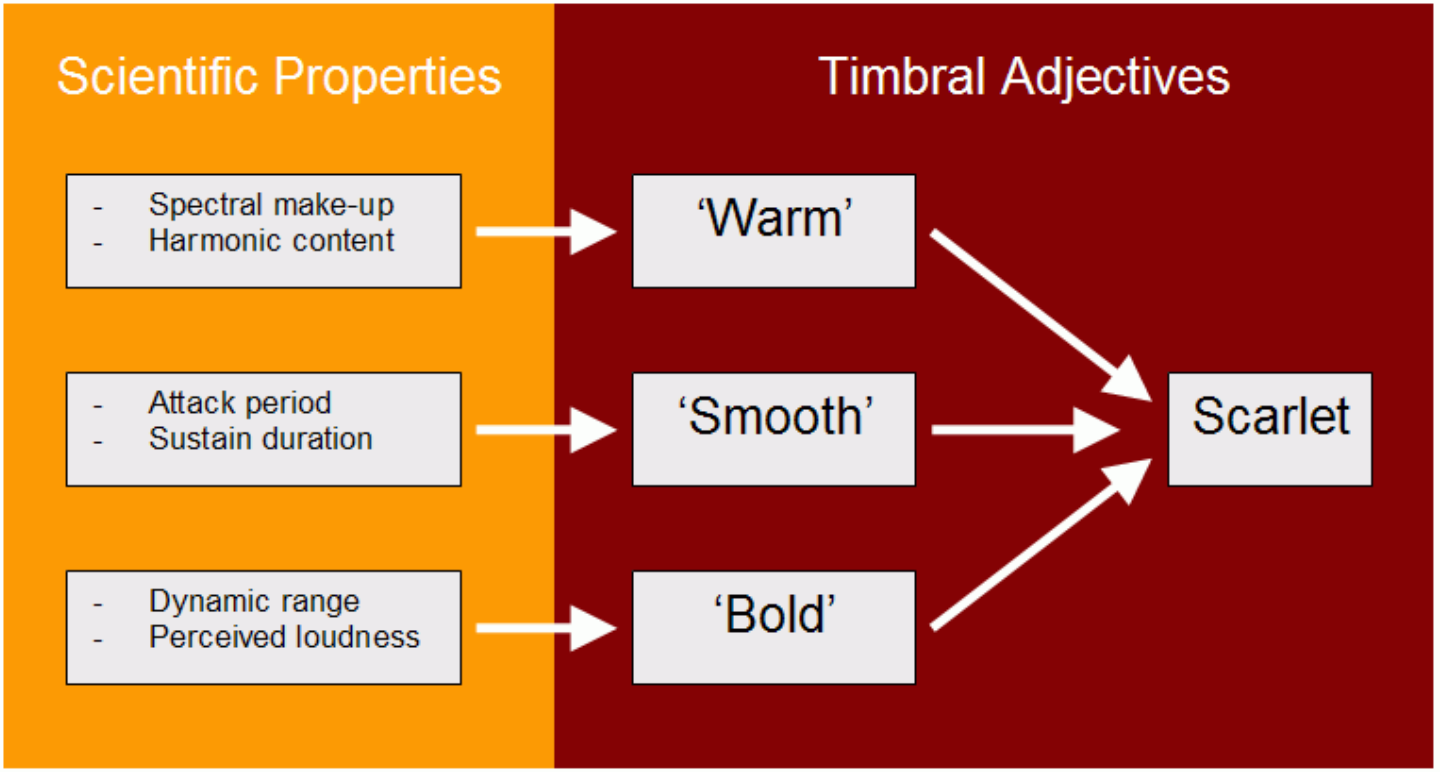

Example relationship between scientific properties and timbral adjectives of musical sound.

Figure 6.