THE MOTIVATION BEHIND THE USE OF DYNAMIC RANGE COMPRESSION (DRC) IN MUSIC PRODUCTION AND AN ANALYSIS OF ITS SONIC SIGNATURES

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DRC HISTORY

- Automatic amplifiers initially used in broadcast to prevent over modulation
- Early examples (perhaps the first compressors to be mass manufactured) are the RCA 96A in 1936 and Western Electric 110A in 1937
- RCA introduced more compressors during the 1950s
- It's worth noting that as far as I know the concept of using a compressor "creatively" for music as opposed to just making speech more intelligible didn't exist before the 1960s. Limiters were typically used strictly as "protection" to avoid spoiling a take while recording a live orchestra to optical film or analog disk.“ (Olhsson, 2010)
- Compressors then began to be used in music production.
- Early example are the Altec 436 and the EMI RS124
- Joe Meek modified the Altec 436A and B to slow down the attack and release speeds to impart audible pumping on his recordings (Pickford, 2014)

CLASSIC COMPRESSORS

- LA2A: Photoresistor has its resistance changed by a electroluminescent panel. More light equals more gain reduction
- Fairchild: Makes use of 6386 valves. Flow of electrons between grid and gate of the valve are restricted thus creating gain reduction
- Urei 1176: Makes use of Field Effect Transistor (FET) which works as a voltage dependent resistor whose resistance is altered by a control voltage.
- dbx165A: VCA based compressor making use of a voltage controlled amplifier to achieve gain reduction. More precise control over time constants, wider range of speeds and used RMS detection
- The compressors all have unique traits to their design that can affect the resultant sonic signature.

RESEARCH QUESTIONS

- Which sources are commonly compressed?
- Are there any types of compressor that are commonly used when compressing a specific source?
- What adjectives and phrases are used to describe the sonic signature a compressor imparts onto a given sound source?

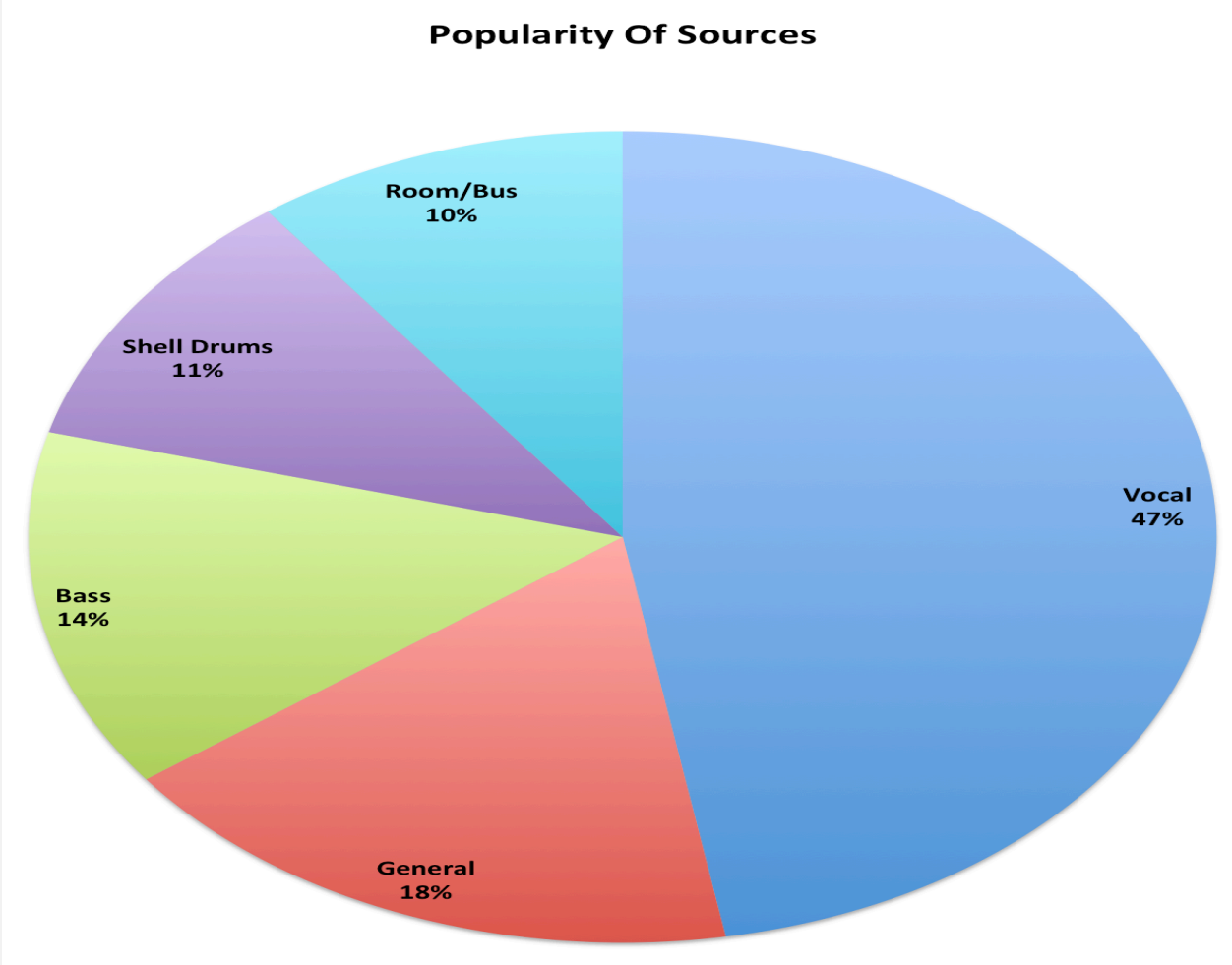
INFORMATION ON THE DATA SAMPLE

- The sample compromised of 100 articles from the *Sound on Sound* magazine series "Classic Tracks"
- 39 articles from another Sound on Sound series "Secrets of the Mix Engineers"
- 140 articles sourced from The Mix magazine's "Classic Tracks" series.
- This created a total of 279 interviews.
- The articles spanned 14 years from January 1999 to January 2013.
- The discussions in these articles explored productions from the 1950s to 2010
- The music genres covered in the interviews was diverse, covering a range of styles including pop, heavy metal, hip-hop, dance music, rock and easy listening.

DATA COLLECTION 1: METHOD

- Used a mix methodology of category analysis and grounded theory
- **Category analysis** was used because I was keeping a record of how frequently types and models of compressors were mentioned in the literature
- Also used to count how frequently sources were mentioned
- **Grounded theory** was used to build a theory on what sonic attributes professionals were trying to impart on program material when using DRC
- The theory was grounded in the data: in this case what the producers were saying

POPULARITY OF SOURCES



GAIN REDUCTION STYLE BY SOURCE

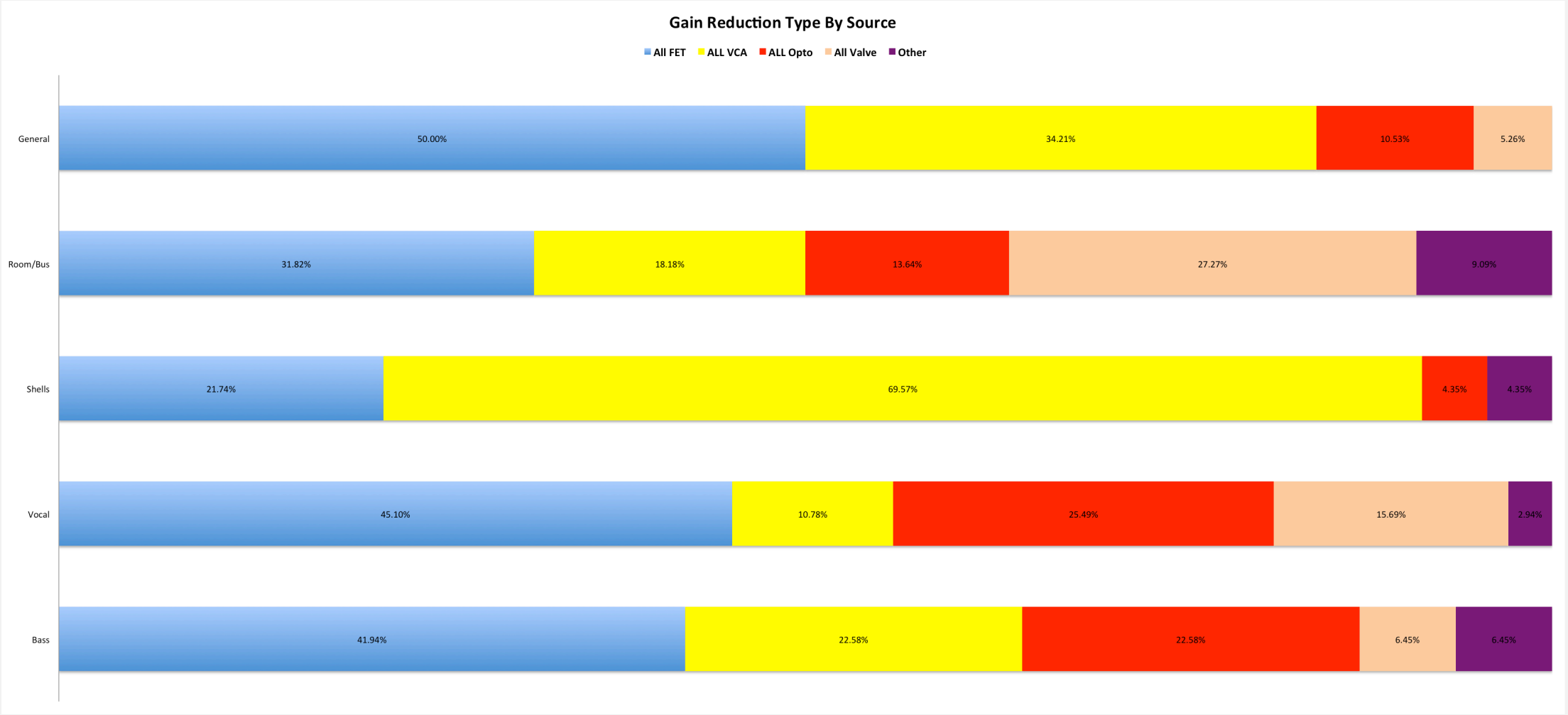
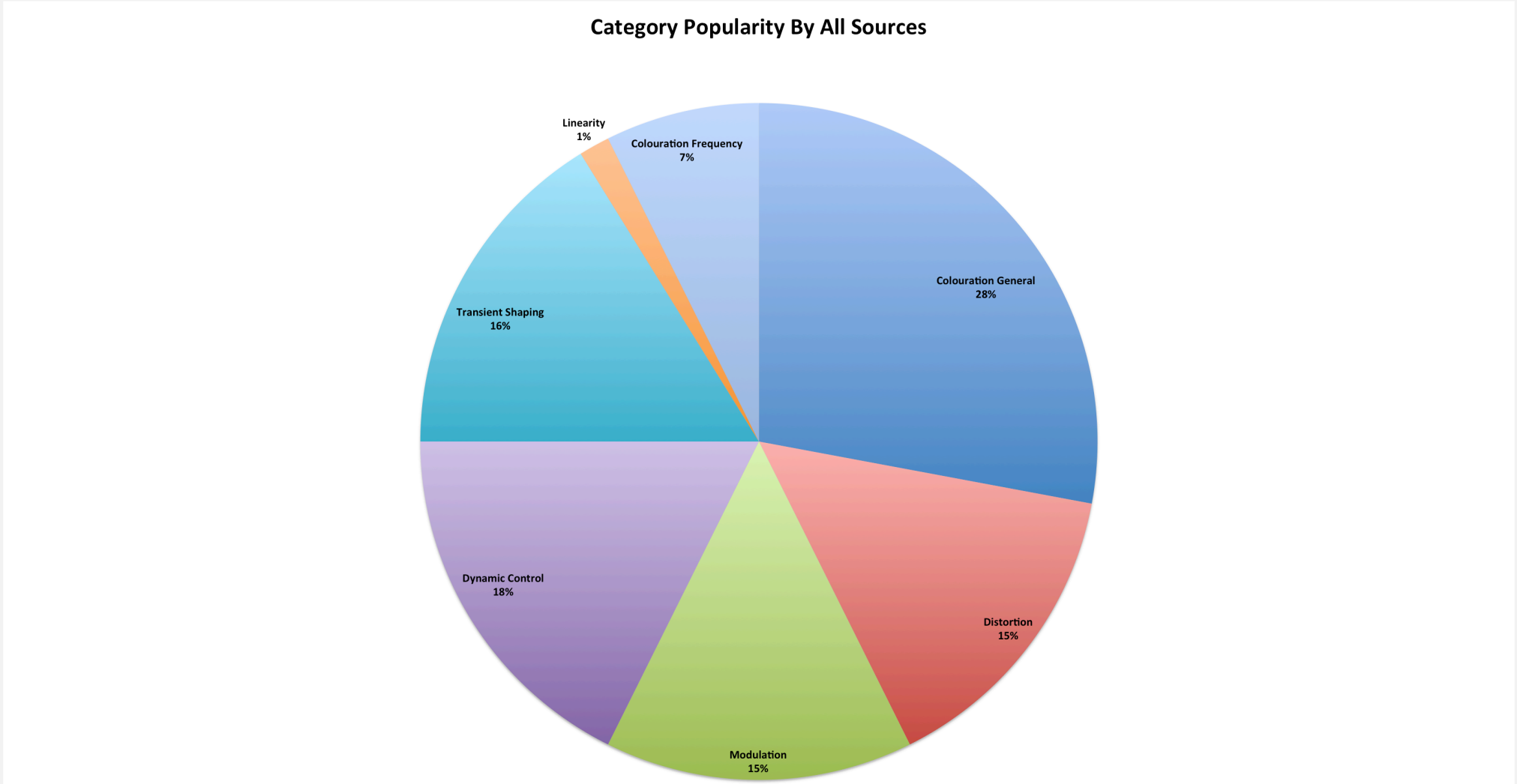


Fig. 8 Popularity of gain reduction style by source

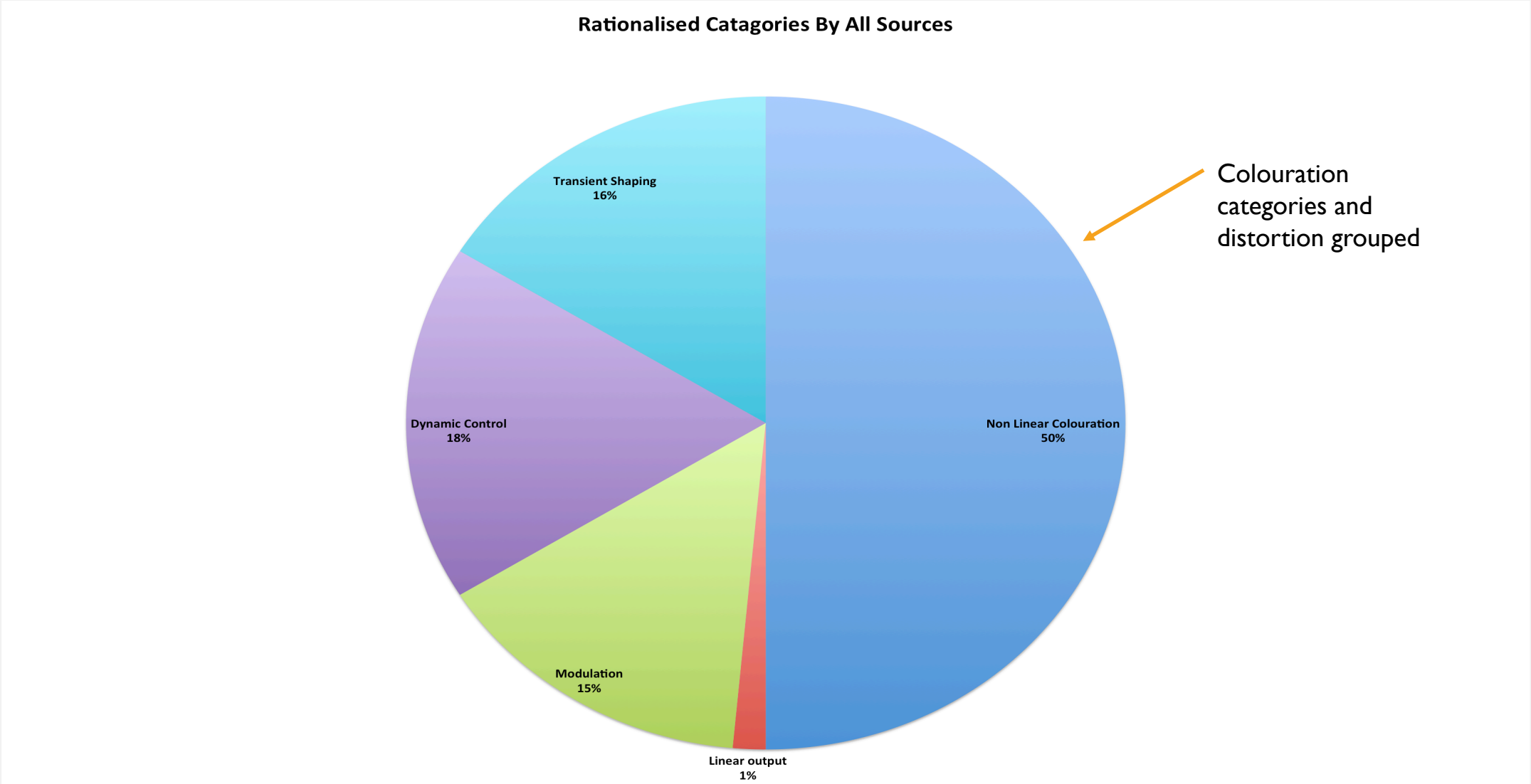
WORD CLOUD OF DESCRIPTORS

Fig. 9 Descriptors used to describe the sound quality of using a compressor

INITIAL CATEGORIES FROM CODING

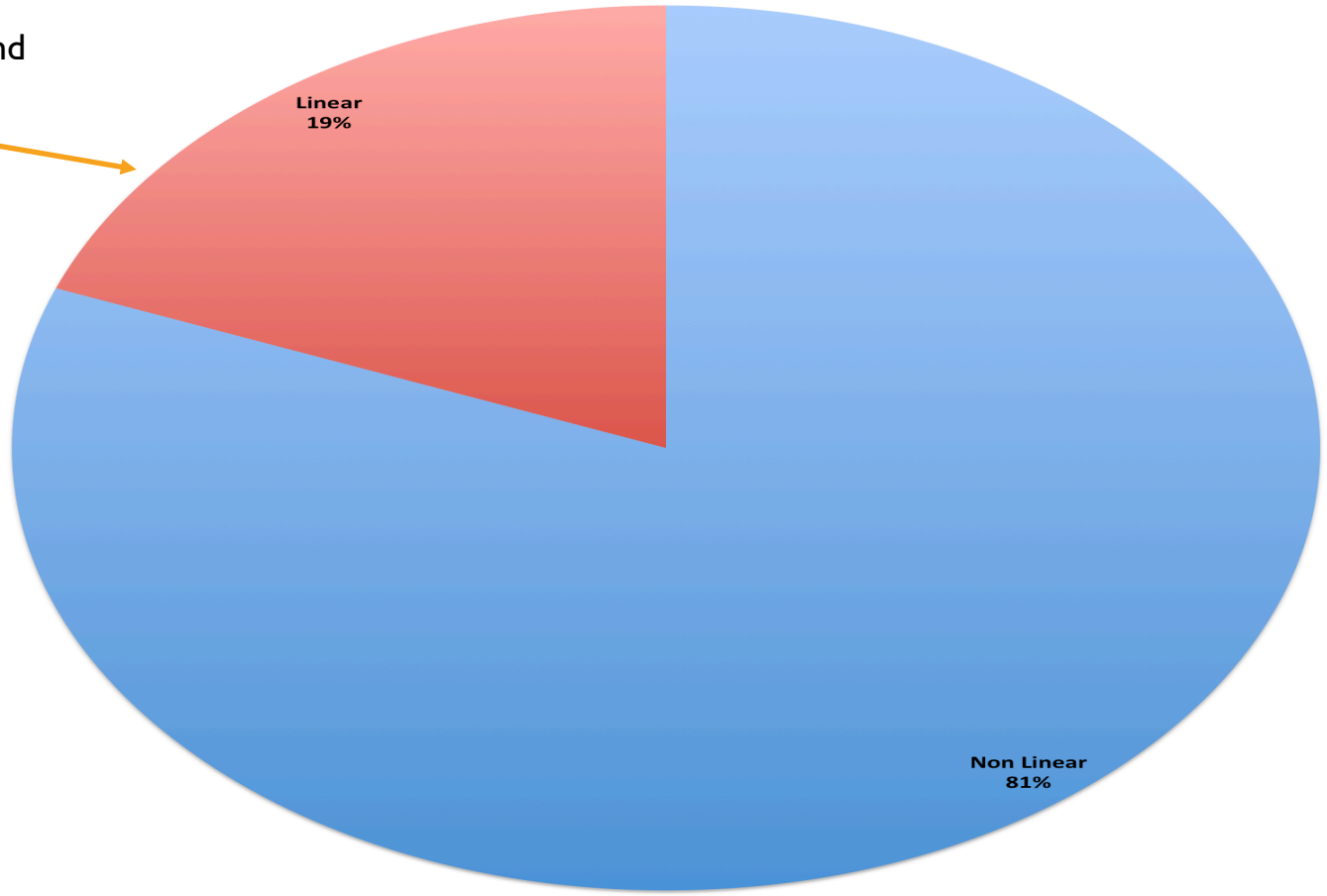


RESULTS OF AXIAL CODING



CORE CATEGORIES OF GROUNDED THEORY ANALYSIS

Dynamic range control category and linear processing grouped



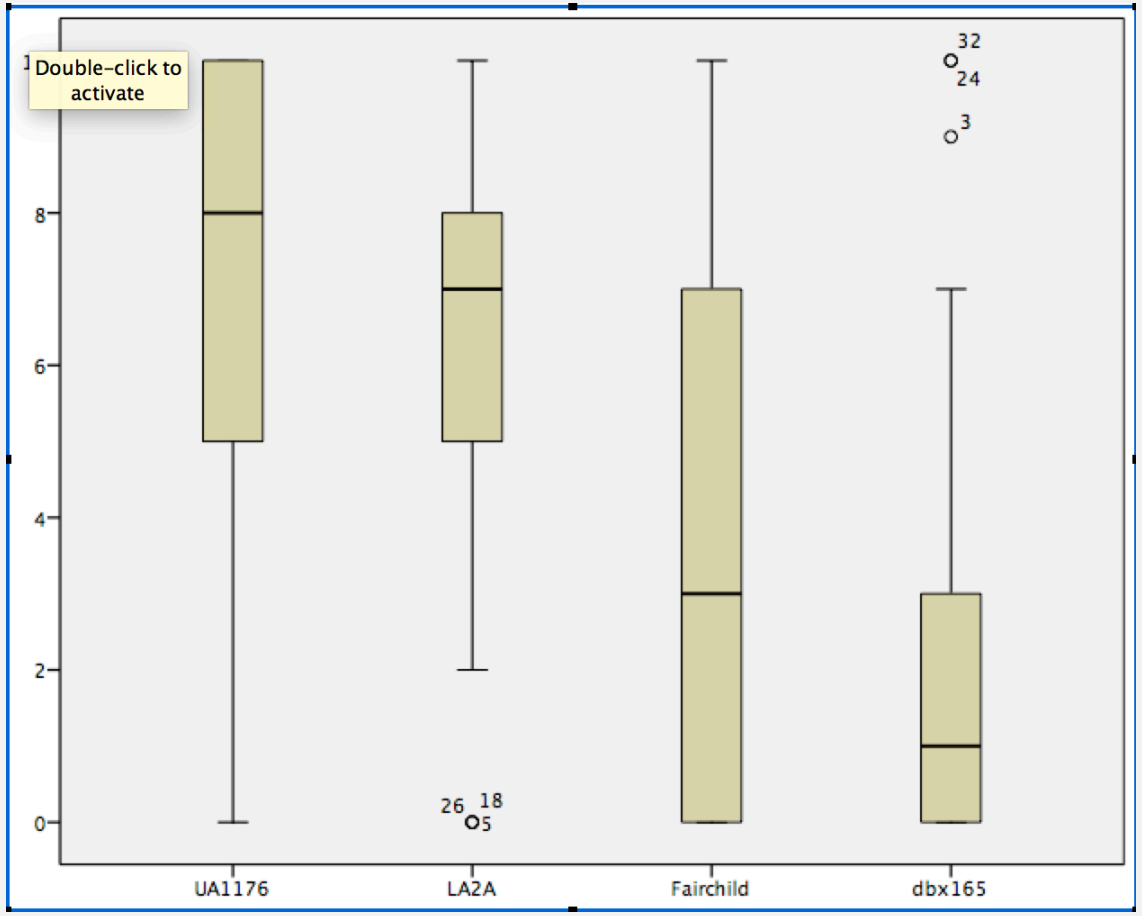
LIMITATIONS OF STUDY

- It can be argued the producers are only expressing the sound quality of compression when it is having a noticeable effect
- If compression is controlling the dynamic range they are not as likely to describe the sound quality, they will simply say they compressed source X
- Grounded theory method needs to have multiple coders to ensure validity
- A small number of the descriptors were difficult to interpret.
- Used experience in music production to come up with reasonable assumptions but there is the possibility that others would interpret the words differently
- Arguably this does not effect the two core categories however

DATA COLLECTION 2: METHOD

- Judgement sampling used
- This means the subjects were not randomly selected by hand picked according to their perceived usefulness
- Pros- the respondents should give good quality responses because they are knowledgeable
- Cons- It is prone to bias.
- Survey asked how likely respondents were to use a compressor gain reduction type on a given source
- They rated the above on a 0-10 scale with 0 being never and 10 being all the time.
- Asked respondents to to describe the sound quality when compressing a given source
- 35 respondents in total

POPULARITY OF COMPRESSOR TYPE: VOCALS



- Hypothesis- There is a significant difference between the choice of compressor type for a given source
- Data was not normally distributed so a Friedman test was used to test for significance
- The results revealed there was significant difference
- Wilcoxon signed rank test was conducted (pairwise comparison of all the conditions to check where the significance is)
- No difference between 1176 and LA2A
- No difference between Fairchild and dbx1165A
- 1176 and LA2A the most popular choices

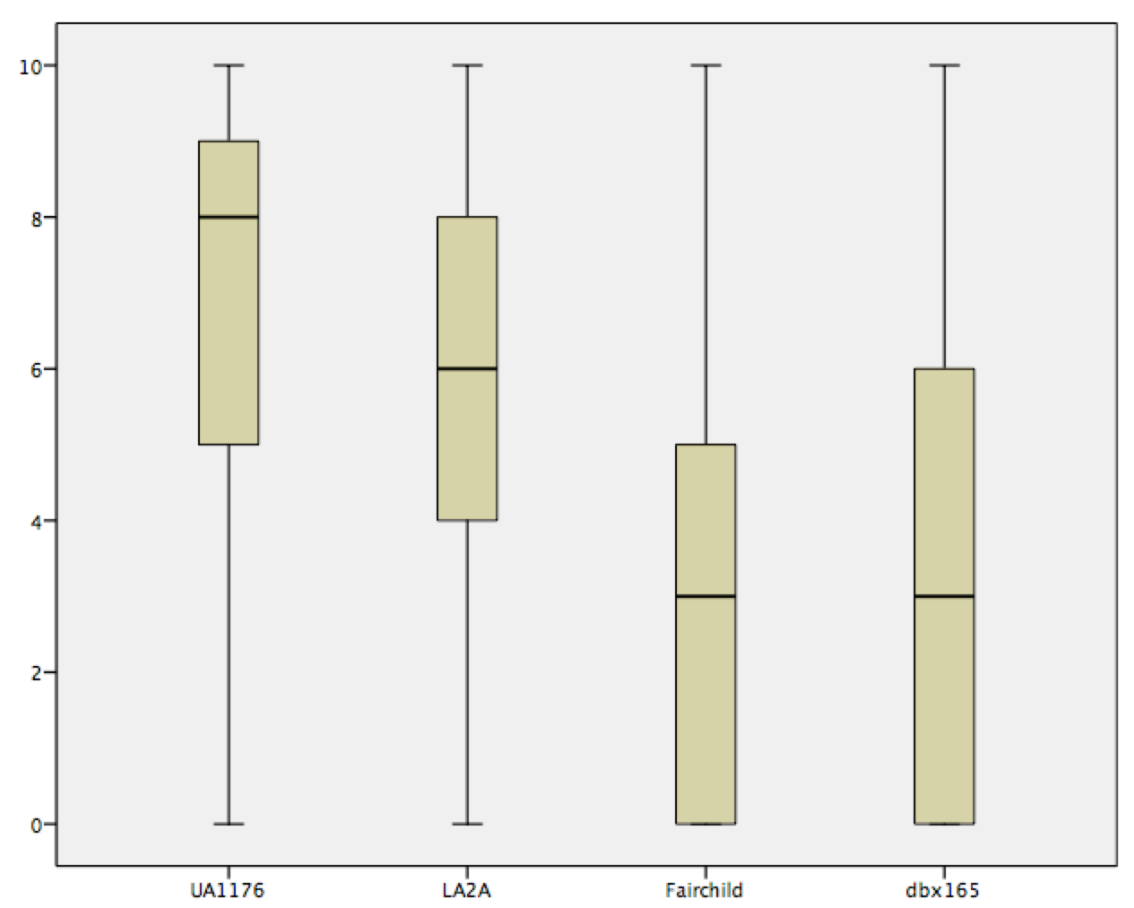
Test Statistics[a]

	LA2A – UA1176	Fairchild – UA1176	dbx165 – UA1176	Fairchild – LA2A	dbx165 – LA2A	dbx165 – Fairchild
Z	-.640[b]	-3.528[b]	-3.905[b]	-3.112[b]	-3.917[b]	-1.662[b]
Asymp. Sig. (2-tailed)	.522	.000	.000	.002	.000	.096

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

POPULARITY OF COMPRESSOR TYPE: BASS



- No difference between 1176 and LA2A
- No difference between Fairchild and dbx165
- 1176 and LA2A the most popular choices
- 1176 highest median

Test Statistics[a]

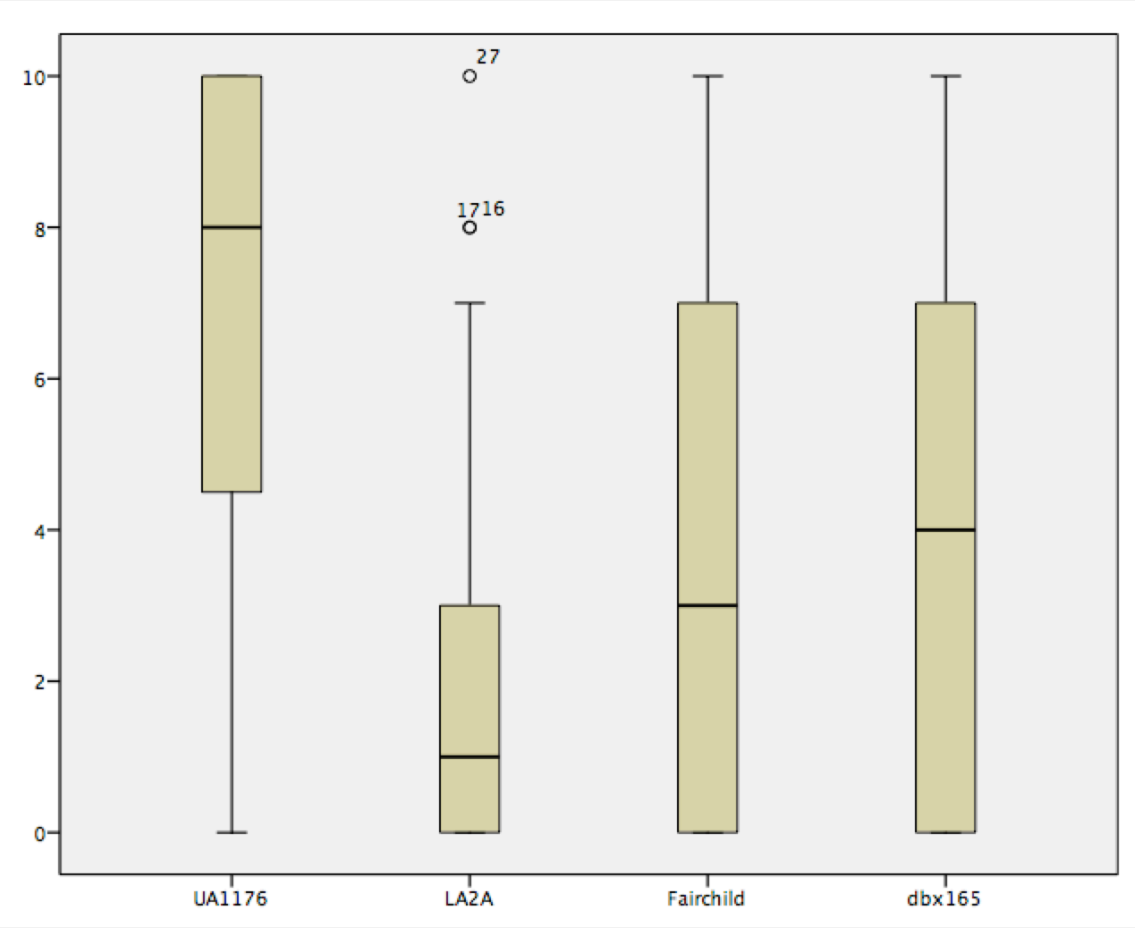
	LA2A – UA1176	Fairchild – UA1176	dbx165 – UA1176	Fairchild – LA2A	dbx165 – LA2A	dbx165 – Fairchild
Z	-1.084[b]	-3.819[b]	-3.338[b]	-3.948[b]	-2.897[b]	-.380[c]
Asymp. Sig. (2-tailed)	.279	.000	.001	.000	.004	.704

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

c. Based on negative ranks.

POPULARITY OF COMPRESSOR TYPE: ROOM MIC



- Significant difference between the 1176 and all the other compressors
- No significant difference between the Fairchild and dbx165
- 1176 the most popular choice
- The LA2A the least popular choice (although the three outliers show that it is the first choice for a small number of users
- 1176 highest median by far

Test Statistics[a]

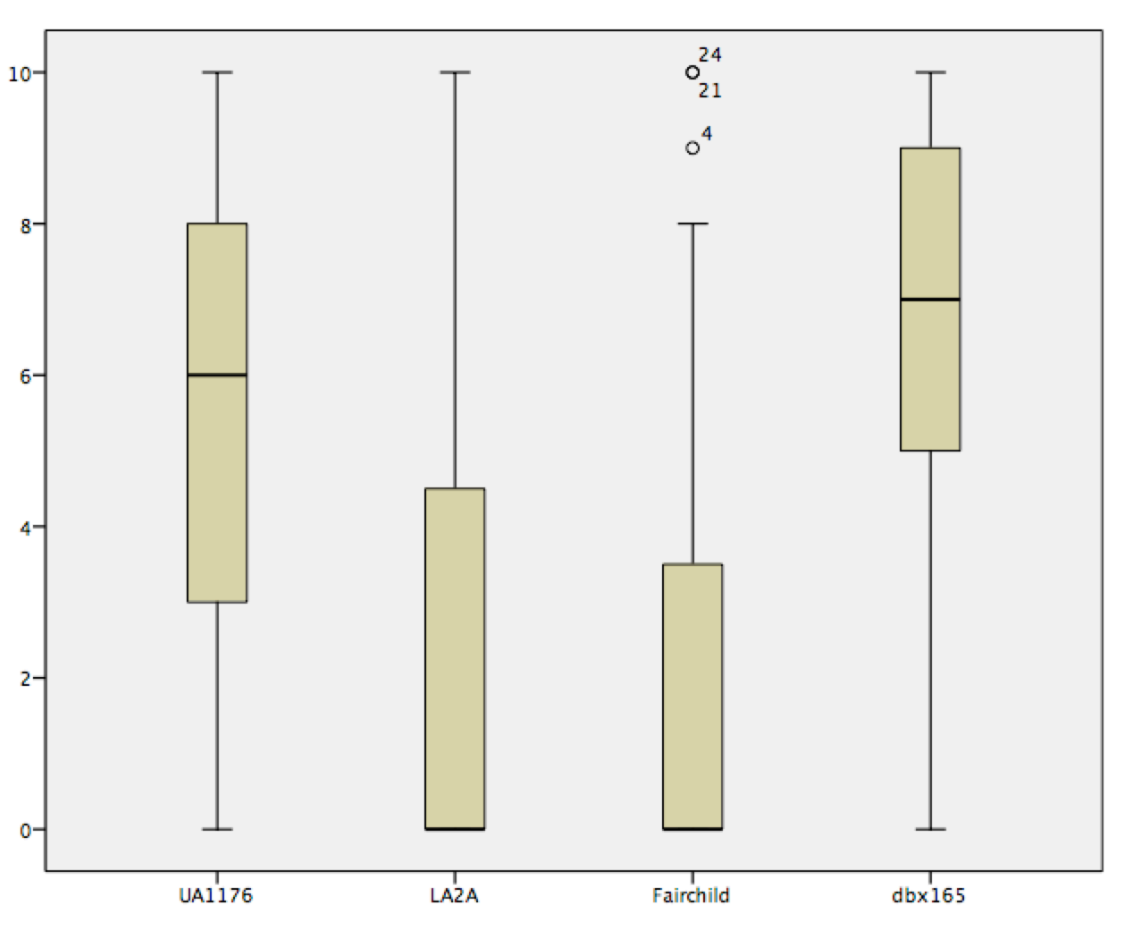
	LA2A – UA1176	Fairchild – UA1176	dbx165 – UA1176	Fairchild – LA2A	dbx165 – LA2A	dbx165 – Fairchild
Z	-3.981[b]	-3.397[b]	-2.916[b]	-2.213[c]	-2.396[c]	-.260[c]
Asymp. Sig. (2-tailed)	.000	.001	.004	.027	.017	.795

a. Wilcoxon Signed Ranks Test

b. Based on positive ranks.

c. Based on negative ranks.

POPULARITY OF COMPRESSOR TYPE: SPOT MIC DRUMS



- Significant difference between the 1176 and dbx165 and all the other compressors
- No significant difference between the 1176 and dbx165
- 1176 and dbx165 are the most popular choice
- Dbx165 better at accentuating transient for punchy hits
- 1176 better at attenuating transients for softer hits
- Presumably why both are popular choices

Test Statistics[a]

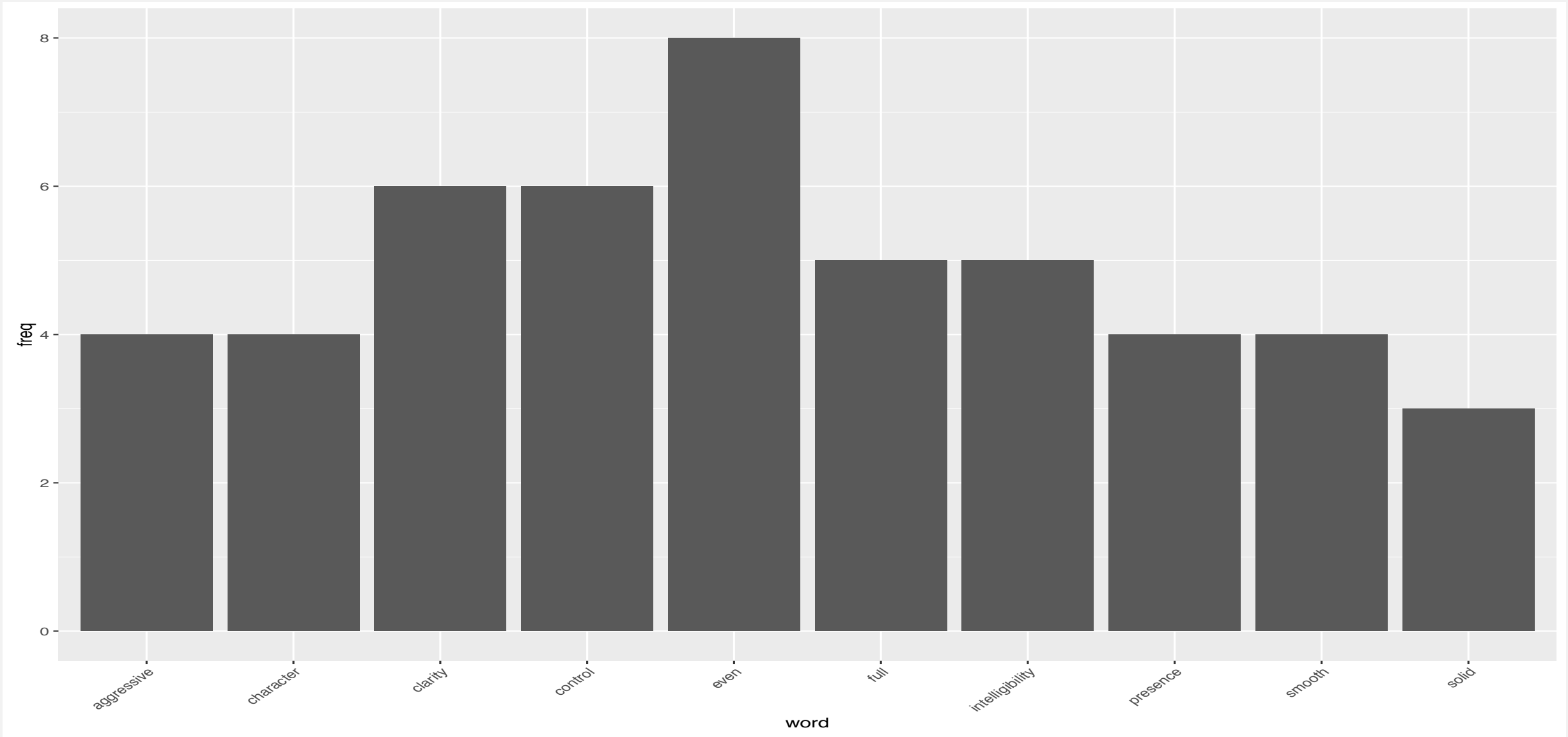
	LA2A – UA1176	Fairchild – UA1176	dbx165 – UA1176	Fairchild – LA2A	dbx165 – LA2A	dbx165 – Fairchild
Z	-3.931[b]	-3.824[b]	-1.777[c]	-.338[c]	-4.278[c]	-4.097[c]
Asymp. Sig. (2-tailed)	.000	.000	.076	.736	.000	.000

a. Wilcoxon Signed Ranks Test

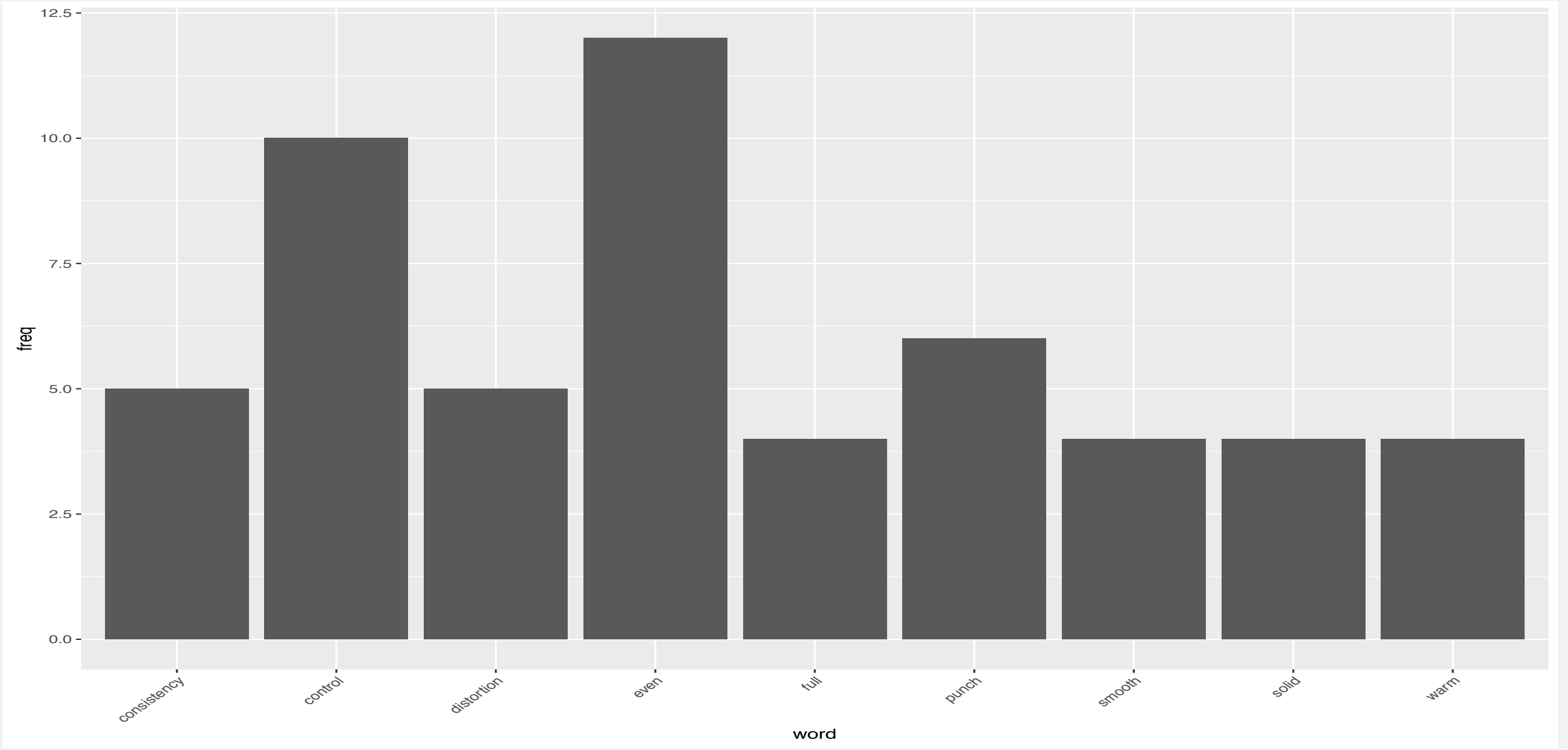
b. Based on positive ranks.

c. Based on negative ranks.

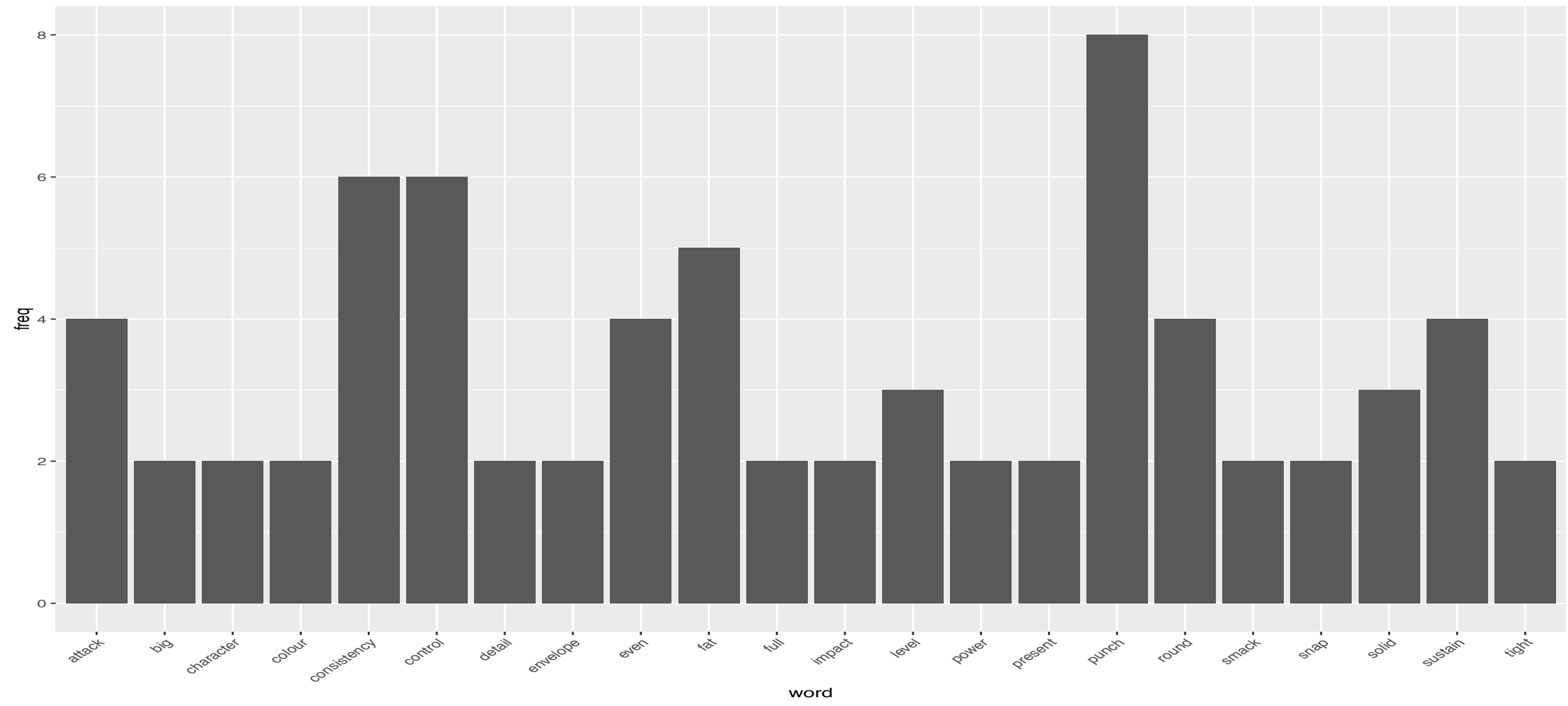
DESCRIPTORS: VOCAL MORE THAN ONCE



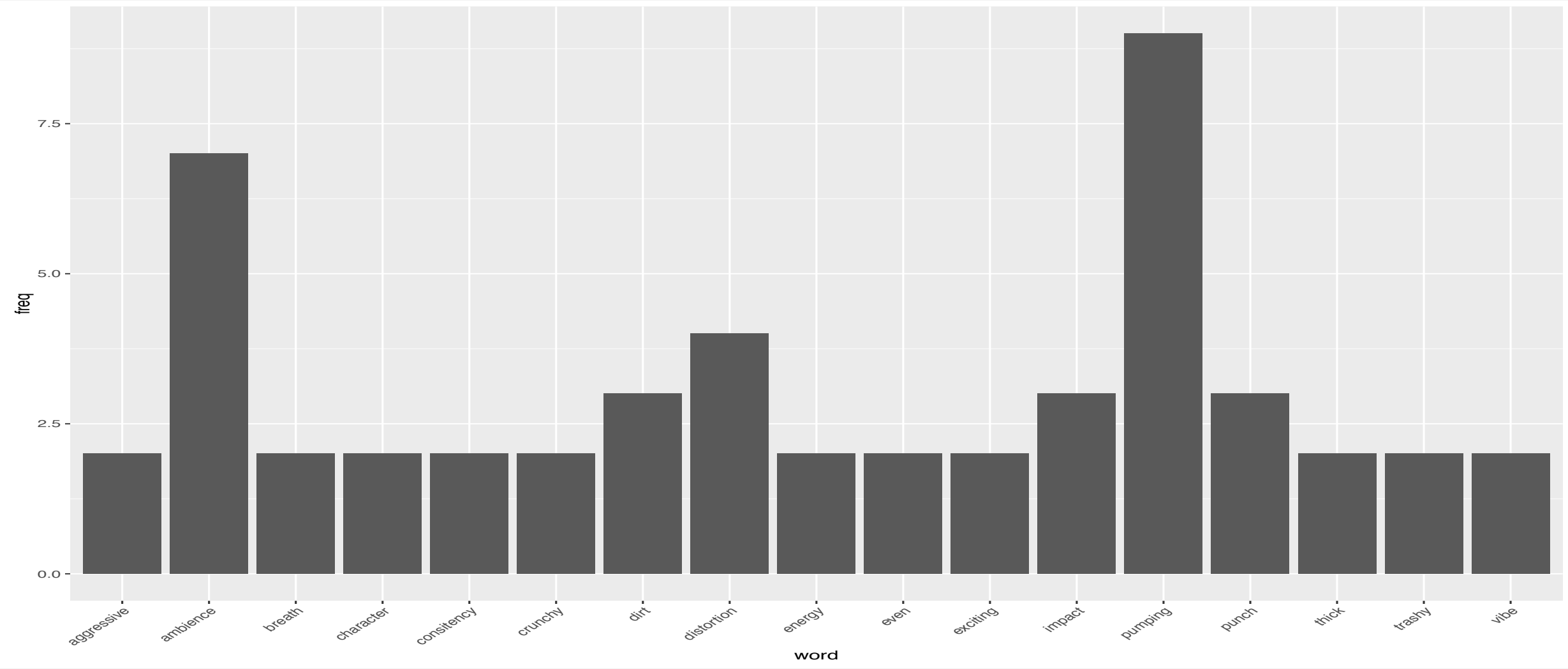
DESCRIPTORS: BASS MORE THAN ONCE



DESCRIPTORS: SPOT MICS MORE THAN ONCE



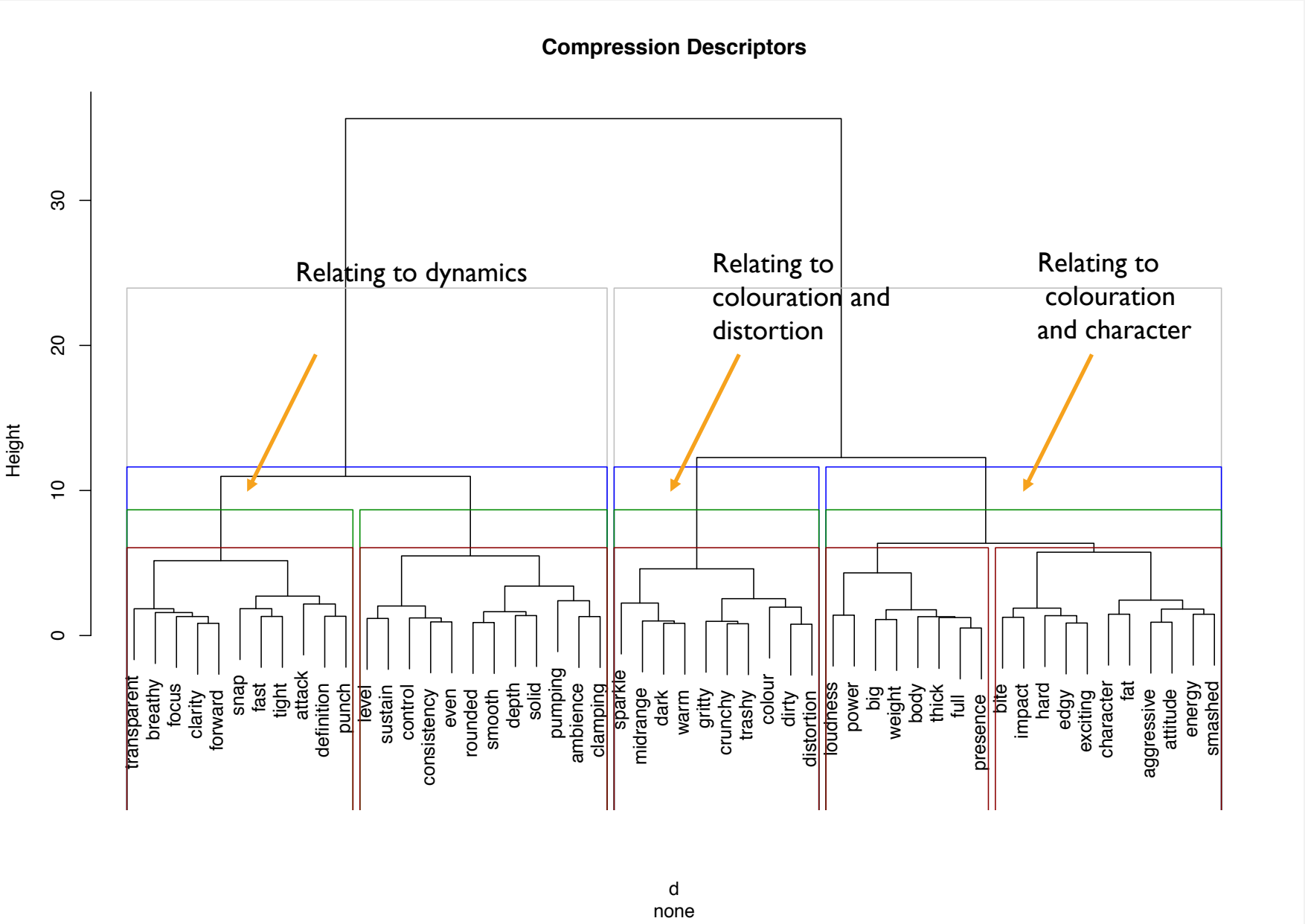
DESCRIPTORS: ROOMS MORE THAN ONCE



HIERARCHAL CLUSTERING: METHOD

- Engineers were asked to complete a similarity matrix
- They completed this online and independent of one and other
- The matrix listed the 52 most popular compression descriptors along the Y axis and a categories of common compression activities along the X axis
- The categories were: linear processing, frequency related colouration, general colouration, distortion, modulation, accentuating transient, attenuating transient, general dynamic range compression
- Each participant assigned each descriptor a grade for each compression activity to rate how appropriate the descriptor was in describing the sound quality of a given compression activity.
- They used a 0-4 scale, with 0 being totally inappropriate and 4 being totally appropriate
- The results were then averaged to create a mean score and clustering was calculated using the Euclidean distance and the Ward clustering method

DENDROGRAM OF RESULTS



LIMITATIONS OF STUDY

- Tried to get data for two different studies simultaneously
- A number of respondents didn't notice they had the option of responding if they didn't use the named compressor.
- This led to respondents not completing or emailing to complain they didn't use the named compressors
- There was no other option. This was not intended to be a part of the study but in retrospect it perhaps should have been
- 0-10 scale was perhaps unwise. Should have used 0-5
- Number of respondents for first part fairly large (35) but modest (12) for second stage
- Possibility that not all respondents interpreted the compression activities the same in the similarity matrix

FURTHER WORK

- Increase the amount of respondents completing the similarity matrix
- Look for relationships between some of the other more nebulous words
- Conduct listening experiments to test if there is agreement between listeners on the meaning of these words
- Currently investigating this for the word aggressive
- 18 participants took place in a listening experiment using a multi stimuli interface using Web Audio Evaluation Tool (WAET)
- Totally random presentation of stimuli, all level matched to LUFS, no one knew how the material was processed and they rated two songs over four interface pages on perceived distortion and then perceived aggression
- Early analysis of the results suggests a moderately strong correlation between compression with audible distortion and an aggressive sonic signature
- Conduct a larger survey on the use of compression and get more data that is not as focused on the compressors i have been researching

REFERENCES

- Olhsson, B. (2010). *What's the history of compression?* . Retrieved from https://www.gearslutz.com/board/so-much-gear-so-little-time/126571-whats-history-compression-2.html.
- Pickford, J. (2014). *Studio Icons: Altec 436*. Retrieved from http://www.musictech.net/2014/05/altec-436/.