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“Heaviness” and the metal music guitar. Interactions between harmonic structure and sound from acoustic and perceptual perspectives

BACKGROUND
In recent music studies discipline, “heaviness” is considered the determining criterion of the genre. On the ground of Berger’s (1999) work on death metal, heaviness has been associated with the sound of the electric guitar until today. Berger and Fales (2005) claimed the dominance of treble frequencies, high loudness and harmonic dissonance to constitute heaviness. Since it greatly affects these parameters, Berger and Fales concluded guitar distortion to be the primary acoustic phenomenon of heaviness in metal music. The list of research on heaviness and the distorted electric guitar is short. From a music theory perspective, perfect intervals and chords of little structural complexity produce a more consonant sensation because more of the partials interfered by distortion coincide (Lilia, 2015; Herbst, 2017). Recent work by Czekis-Eysenberg, Krauf and Reuter (2016, 2017) showed that musical heaviness can be quantified with acoustic features. Accordingly, percussive elements, a flat envelope, high loudness and intense treble frequencies increase the sensation of heaviness irrespective of any musical genre.

RESEARCH INTEREST AND METHOD
This study explored the interaction between the electric guitar’s sound and chord structures acoustically and perceptually. Based on findings in music theory, metal music studies and the author’s experience as a guitar player, playing complex chords with overdriven and distorted sounds was expected to diminish sensory pleasantness. This sensation was assumed part of what constitutes the feeling of heaviness. Moreover, the reasons for this perception such as acoustic features and personal factors were of interest. The research followed a two-phase design with subsequent triangulation.

1. Acoustic experiment: Power chords (fifth interval), major, minor and alternating dominant chords were recorded with three guitars, five valve amplifiers and three sounds (clean, overdrive, distortion). The 270 samples were analysed with music information retrieval technology (Lattixtad & Toivainen, 2007), following a design similar to Czekis-Eysenberg, Krauf and Reuter’s (2015, 2017) work. The sensory pleasantness was operationalised with Terhardt’s (1984) and Aures’ (1985) model that considers both musical harmony and sensory consonance. Roughness, spectral fluctuation, sharpness, loudness and tonalness served as key parameters.

2. Listener experiment: Chords with the three different sounds taken from the acoustic experiment were rated by 177 respondents (mean age 22.06 years; SD = 3.33; 53% women) on a 10-point scale (1 = very unpleasant, 10 = very pleasant). Each chord was rated three times to reduce order effects. The mean ratings were transformed into scales for the sounds with excellent reliability (clean r = .92, overdrive and distortion r = .97) and explained variance (clean 67%, overdrive 82%, distortion 88%).

RESULTS
As the different guitars and amplifiers did not significantly affect the five acoustic parameters, they were not taken into account further. This result and the findings on the correlation statistics (Table 1) indicate structure and sound to influence the features of the audio samples primarily. Regression analyses (Table 2) highlight the influence of structure and sound. The structural complexity was much more relevant than the sound in the case of tonalness. All other parameters however reacted to the sound more often, even if a different degree.

The tests of between-subjects’ effects (Table 4) demonstrated a large effect distorted overdrive and distorted sounds that did between clean and overdrive sounds. The harmonically neutral power chord and the major chord differed only with a small effect. The ratings between all other chords differed much more. Overall, the difference between the chord ratings were greater when adding overdrive to a clean signal than when shifting from overdrive to distortion.

TRIANGULATION
Spearman correlation indicated a close connection between the listeners’ ratings and most of the acoustic parameters (Table 6). In compliance with the psychoacoustic model (Terhardt, 1984; Aures 1985), all parameters but tonalness reduced the pleasantness of the chords. Roughness correlated with the listeners’ ratings least, in contrast, spectral flux as an alternative parameter for roughness had a much almost perfect prediction. Strong effects of spectral centred and loudness were also confirmed to reduce pleasantness.

Person-related factors hardly affected the ratings of the clean sound but they did so in the cases of overdrive and distortion. Yet, the results of the overdriven and distorted sounds were similar. The univariate ANOVA (Table 5) of ratings of distorted sounds showed that music preference is most relevant, followed by the age and being an electric guitar player. Older participants showed a higher liking of distorted chords, r = .32, p < .001, as did men, r = .26, p < .01. Being a guitar player also affected the rating positively, r = .33, p < .001.

REFERENCES
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Table 1: Descriptive statistics of the parameters of sensory pleasantness

Table 2: Categorical regression models of the parameters of sensory pleasantness

Table 3: Descriptive statistics of chord ratings with different sounds

Table 4: Effects of between-subjects’ effects of structure and sound

Table 5: Year of between-subjects’ effects for the distortion sound

Table 6: Correlation matrix of sociodemographic data and parameters of sensory pleasantness

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