Verbal Description of Musical Brightness

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Introduction

Amongst the most common descriptive expressions of timbre used by musicians, music engineers, audio researchers as well as everyday listeners are words related to the notion of brightness (e.g., bright, dark, dull, brilliant, shining). From a psychoacoustic perspective, brightness ratings of instrumental timbres as well as music excerpts systematically correlate with the centre of gravity of the spectral envelope and thus brightness as a semantic descriptor of musical sound has come to denote a prevalence of high-frequency over low-frequency energy. However, relatively little is known about the higher-level cognitive processes underpinning musical brightness ratings. Psycholinguistic investigations of verbal descriptions of timbre suggest a more complex, polysemic picture (Saitis & Weinzierl 2019) that warrants further research. To better understand how musical brightness is conceptualised by listeners, here we analysed free verbal descriptions collected along brightness ratings of short music snippets (involving 69 listeners) and brightness ratings of orchestral instrument notes (involving 68 listeners). Such knowledge can help delineate the intrinsic structure of brightness as a perceptual attribute of musical sounds, and has broad implications and applications in orchestration, audio engineering, and music psychology.

Method

Corpus 1: Sixty-nine musically naive listeners (average age = 29.8 yrs, SD = 7.2 yrs, range = 17–51 yrs) provided written responses to the question "What is a bright sound for you?" following ratings of 30 sec long music snippets on perceived brightness. Stimuli were taken from diverse music genres and were also rated on complexity and likeness. Listeners were mainly of Greek, German, and Turkish background. Sixty-four of them responded in English and five in German.

Corpus 2: Sixty-eight musically experienced listeners were recruited from audio technology and musicology programmes in Berlin and Vienna (average age = 30.6 years; SD = 9.3 years; range = 18–66 years). They were German native speakers or spoke German fluently. After the completion of two experiments involving pairwise dissimilarity and direct ratings of brightness of orchestral instrument sounds (all had a fundamental frequency of 311 Hz and a duration of 500 ms) listeners provided written responses (in German) to the question "How and according to which criteria did you compare the sounds in terms of their brightness?" (Original in German: "Wie und anhand welcher Kriterien haben Sie die Klänge bzgl. ihrer Helligkeit verglichen?")

German responses in both corpora were translated into English by the two authors who each speak both languages fluently. Verbalizations were analysed on the basis of semantic proximities in order to identify emerging concepts (thereafter denoted verbal units) that could be coded under broader cognitive categories (see Saitis et al., 2017; 2019a, for a similar psycholinguistic analysis of violin quality descriptions). For example, the phrase "giving me uplifting, happy vibes" contained two verbal units, namely "uplifting" and "happy," whereas the phrase "greater proportion of higher frequencies" constituted a single unit.

Results

In total, 162 verbal units were extracted from the responses in Corpus 1 (2.3 units per respondent on average) and 160 units in Corpus 2 (2.4 units per respondent on average) and were classified in 12 distinct semantic categories (Tables 1 and 2). These appeared to span four central themes: *acoustics* (descriptions of spectral, temporal, and loudness characteristics using acoustical terminology); *affect* (judgments of

aesthetic and emotional value), *musical structure* (references to chords, intervals, melodic lines, and instrumentation; e.g., "major chords are brighter"), and *crossmodal correspondence* (descriptions referencing other sensory modalities).

The musical structure theme emerged primarily in corpus 1, where stimuli comprised multi-instrumental musical sounds, with a small number of listeners in corpus 2 (isolated instrument notes only) also citing instrument type/family as a criterion for determining brightness ratings. Corpus 1 further revealed strong relationships between perceived brightness and valence (e.g., happy, cheerful) or arousal (e.g., uplifiting, energetic) emotions in music perception, which warrants further investigation. Verbal units were assigned to the emotional categories of Valence and Arousal consulting (Kolias et al. 2019).

Verbal descriptions of brightness for isolated instrument notes (Corpus 2) predominantly referred to sensory cues, largely through acoustical terminology but also by employing crossmodal metaphors. We classified the latter into three types: words related to the concept of clarity, with dull used sometimes as semantically opposite; direct synonyms of brightness in the visual domain, such as light and brilliance, with dark but also dull used as antonyms; and other visual and nonvisual descriptions that appeared more idiosyncratically, such as rough, soft, sharp, deep, metallic, and cutting, among others. For a more detailed overview see Table 2. Interestingly, a little more than 16% of Corpus 2 related brightness to the attack portion of instrumental sounds (cf. Saitis et al., 2019b).

Table 1: Distribution of categories within and across corpora
(N=total verbal units; parentheses report proportion over N)

Categories	***Corpus 1 (N=162)***	***Corpus 2 (N=160)***	***Categories***	***Corpus 1 (N=162)***	***Corpus 2 (N=160)***
Spectral char.	*14 (8.6)*	*58 (36.3)*	*Harmony*	*15 (9.3)*	*-*
Temporal char.	*-*	*26 (16.3)*	*Instrument/ation*	*9 (5.6)*	*7 (4.4)*
Loudness	*4 (2.5)*	*3 (1.9)*	*Rhythm/melody*	*10 (6.2)*	*1 (0.6)*
Valence	*65 (40.1)*	*4 (2.5)*	*Clarity*	*15 (9.3)*	*13 (8.1)*
Arousal	*15 (9.3)*	*-*	*Light*	*5 (3.1)*	*19 (11.9)*
Aesthetics	*7 (4.3)*	*2 (1.3)*	*Other crossmodal*	*3 (1.9)*	*29 (16.9)*

Discussion

These findings would appear to suggest that non-expert listeners relied more on affective connotations of the word brightness than their expert counterparts, whereas the latter focused almost exclusively on timbral characteristics (via acoustical or metaphorical language). However, it is not clear whether these can be ascribed to effects of acoustical material (multi-instrumental excerpts versus solo instrument sounds), of musical experience (naïve versus expert listeners), or of language and culture (see Method for differences between the two corpora). More research is needed to understand how brightness and emotion interact in musical contexts (cf. Wallmark et al., 2019). Such knowledge can help improve orchestration strategies for conveying emotional intention in music.

Table 2: Distribution of verbal units across semantic categories

Spectral char.	*high frequencies (15), high-pitch (5), pitch (6), overtones (5), overtone spectrum (3), tone frequency (2), spectral distribution (2), proportion of high frequencies (2), frequency spectrum (2), higher partials, everything up 3Khz-4Khz, higher note, higher register, high harmonics, upper frequency spectrum, dominant frequency range in sustain, spectral energy, dominance of harmonics to fundamental, tonal spectrum, proportion of high noise, no bass, time course of the harmonics, comparison to low frequencies, high cut, low frequencies, harmonics of reverb, frequency, ratio of high to low frequencies, spectral components, register, clear frequency components, proportion of highs, low sound, share of high frequencies in the frequency spectrum, percentage of low frequencies, dominance of certain particularly noticeable frequency ranges, noise level/filter, sound higher, overtone richness*
Temporal char.	*attack (3), attack time (2), duration of impulse, decay of sound, dominant frequency range in sustain, short touch for more brightness, attack of tone, tone time, time course of the harmonics, impulse character, damping, envelope, harmonics of reverb, duration, envelope curve, reverberation, tail of the sound, with reverb, dry, the speed of the attack, the speed of the transition, the speed of the response, transient phase*
Loudness	*louder playing, playing in ff (fortissimo), louder, full of power, impact strength, resonance, nuances*
Valence	*happy (16), positive (9), cheerful (6), uplifting (4), joyful (3), not melancholic (2), makes you smile (2), not sad (2), cheer you up (2), pleasant (2), "pure" (2), joy, "peace in mind", "open", "not hiding", "not pretending", motivating, not depressing, not negative, bright emotions, hope, innocence, peaceful, serene, not annoying, comfortable, chirpiness, without fear, feel good, "beautiful"*
Arousal	*uplifting (4), dance (2), energetic, vivid, motivating, not depressing, fast movement, peaceful, serene, resonates inside me, chirpiness*
Aesthetics	*good sound, natural, mysterious, digital, no scratches, projected, quality, presence, better/worse audible*
Harmony	*major chords (4), major scales (2), major key (2), major mode, not minor mode, harmony (minor, major, atonal or modal), harmony in background, simple harmonic structure, more major than minor, harmony*
Instrument/ ation	*marimba, xylophone, vibraphone, solo, orchestration, light orchestration, high-pitched instruments, high-frequency instruments, drums, a full symphonic orchestra, timbre of the instrument, timbre, light vs dark instruments, from instrumental knowledge, sound of instruments, instrument*
Rhythm/ melody	*clear melody, rhythmic beats, bassline, simple melodies, uptempo, interval succession, melodic line, fast beats, good tempo, speed/rhythm*
Clarity	*clear sound (8), clarity (7), dullness (as opposed to clarity) (2), clean sound (2), purity of sound, clear melody, crystal clear, clear frequency components, without noise, listen clearly, dull (as opposed to clear), clarity vs dullness, blurriness*
Light	*dull (as opposed to bright) (6), dullness (as opposed to brightness) (4), dark (4), sun (2), shining, sunny, bright colours, light vs dark instruments, brilliance, radiant, nitid, tonal brightness*
Other crossmodal	*tone colour (3), soft (2), sound colour (2), sharp (2), deep (2), not deep tones, bright colours, spectral colour, texture, hardness, cutting, metallic, shrill, dry, tonal sharpness, presence/absence of depth, narrowness, width, material, roughness, height/depth, height of note, high cut*

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