Music Listening from an Ecological Perspective

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Aim

We will present a broad spectrum of perceptual features related to source properties that can be motivated from an ecological/survival point-of-view and discuss their potential relevance in music listening.

Background

It is evident that we normally analyse sounds in our environment regarding the source properties rather than the quality of the sound itself (Gibson 1966, Gaver 1993). This is natural in everyday listening considering that the human perceptual system always tries to understand and categorize sensory input. We can from the sound estimate physical properties of the objects, such as size and material (Giordano and McAdams, 2006).

This ecological approach can also be extended to human communication. From a person's voice we can estimate identity, distance, effort, and emotion. From footstep sounds we can estimate gender and other properties (Li et al., 2006).

This type of source perception is thus evident for environmental and human sounds but is the same mechanism also active in music listening?

It seems plausible if we consider music as a human to human communication. Also, as pointed out by Clarke (2005) it is hard to make any distinction between everyday listening and music listening. Thus, we may assume that both kinds of listening involve the same perceptual processing.

We will focus here on the different perceptual features/cues that might be potentially important during music listening. Many of them are self-evident and empirically validated, while some others still lack empirical evidence.

Basic object properties

Source separation – Identify different sound sources, e.g. everyday objects or musicians. It is suggested that we start by scanning the environment for primary agents (e.g. musicians), their roles and relationships. Thereafter we identify other sources (Andean 2011, Gibson 1966).

Principles for source separation in music are rather well researched, e.g. Gestalt principles or streaming (Bregman 1990, VanNoorden 1975).

Source localization - Distance and direction determined by binaural sound perception. Considered very important for a realistic music reproduction. Effective in acoustic live music performance but often simplified in recordings by using volume panning.

Size/Material - related directly to basic acoustics: small objects - high frequencies, large objects - low frequencies (Material identification and size, see Giordano and McAdams 2006). Obviously applies also to musical instruments.

Classification/Identification - related to objects, humans (Juslin et al 2002) or instruments. Identification of specific objects/instruments, personal parameters from footsteps (Li et al. 2006) or recognising a certain singer/musician from the timbre and performance style.

Deviation from expectation - Is it worth considering, thus does it deviate from the normal sound environment or musical expectation?

This has been suggested a major mechanism for creating meaning in music (Meyer 1956), as well as for creating an emotional reaction (Huron 2006). For example, we recognise tones or chords deviant from established scale or tonality (Krumhansl 1990).

This recognition of audio/music deviations is a basic mechanism that can be unconscious (e.g. Escera et al 1998).

Human properties

Human movement - Is related to music on a number of different levels as evidenced in current research.

- Speed of a person can be determined from footstep rate and sound which is related to musical tempo.
- Different rhythmic patterns are related to different movement patterns (Gabrielsson 1973).
- Dancing is afforded when body resonance and musical tempo coincide (Toiviainen 2011).
- Musical pulse is in the the same range as walking and running (van Noorden and Moelants 1999).
- Articulation similar to foot contact time while walking and running (Bresin and Battel 2000).
- Final ritardando similar to stopping from running (Friberg and Sundberg 1999).
- Tempo curves in phrasing similar to hand gestures (Juslin et al 2002).

Thus, it is logical to assume that we to analyse musical rhythm in terms of motion patterns relating to human gestures and locomotion patterns, possibly using mirror neurons. This can be related to our experience of self-motion as well the motion of other people.

Energy - relates to the physical effort used to produce the sound. For example, we seem to estimate perceptual loudness not only from the sound level but in some circumstances also from the physical work needed to produce the sound (Ladefoged and McKinney 1963, Ericsson and Traunmüller 2002).

Dynamics in music (related to effort) can be estimated from timbral properties of the sound to some extent (Fabiani and Friberg 2011).

Intention - What is the sender trying to communicate?

Emotion - What is the mood of the person/music? The emotional aspect is central for both listeners and musicians (Juslin & Laukka 2004).

The communication of emotion in music is quite well investigated (see e.g. Gabrielsson & Lindström 2010). The mechanism seem to utilize a number of features that can be related to above-mentioned movement/ rhythm, energy, as well as pitch. Further, relevant perceptual features vary in a similar way as in speech (Juslin & Laukka 2003) and as the motion features in gestures (Dahl & Friberg 2007) expressing the same emotions.

Skill - Is it someone that knows his profession? This could mean different things such as technical ability or expressive ability. Apparently very important aspect when judging musicians.

Authenticity/sincerity - Can we trust this person/ musician?

Conclusions and discussion

By analysing music listening using an ecological perspective we can provide an alternative viewpoint that serves as a unifying framework.

This ecological framework provide an explanation and motivation of the musical meaning for many different musical aspects ranging from instrument sounds and melody to motion and emotion.

Still, many important musical aspects are not incorporated and are less likely to be treated from an ecological viewpoint. The above mentioned features focus on rather brief percepts corresponding to an everyday/causal music listening (c.f. Plazak & Huron 2011). Aspects such as long-term structure or complex melodic/harmonic patterns are less likely to be perceptually processed in this way.

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