

Ethological concepts on the communication of symbolic musical meanings

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Abstract: Ethology is a subfield of Zoology that studies animal behavior, gestures and patterns of expression in order to obtain information about their emotional state. These ideas can be used for the study of emotions evoked by music, in terms of musical listening and/or performance. This work investigates the occurrence of musical meaning generated by the manipulation of sound objects (in terms of expressed or perceived meaning), as well as its following effects in the listeners, such as evoked emotion. This article aims to relate analytical psychology, on symbols and the unconscious mind, with principles of ethology, on animal (including human) communication, in relation to the cognitive, emotional and behavioral processes related to music listening.

Keywords: Musical meaning. Emotions. Nonverbal communication.

Conceitos etológicos na comunicação de significados simbólicos musicais

Resumo: A etologia é um subcampo da Zoologia que estuda o comportamento, os gestos e padrões de expressão animais, a fim de obter informações sobre seus estados emocionais. Estas ideias podem ser utilizadas para o estudo das emoções evocadas pela música, em termos da escuta e performance musicais. Esse trabalho investiga a ocorrência de significados musicais gerados por meio da manipulação de objetos sonoros (em termos de significados expressados ou percebidos), assim como seus efeitos decorrentes nos ouvintes, tais como as emoções evocadas. Esse artigo tem como objetivo relacionar a abordagem da psicologia analítica sobre os símbolos e a mente inconsciente, com os princípios da etologia sobre a comunicação animal (incluindo humanos), em relação aos processos cognitivos, emocionais e comportamentais referentes à escuta de música.

Palavras-chave: Significado musical. Emoções. Comunicação não verbal.

1. Introduction

Music and language are occurrences that many scholars consider to flourish only among humans. The origin of music goes back in history and, along with language, has been occurring since the dawn of humankind, in all communities on record (Patel, 2008). In spite of its indeterminate origin, it is likely that music may have arisen from the human attempt of imitating sound patterns found in natural soundscapes (the landscape of sounds that surround us and identify a specific location), such as the acoustic regularities found in birdsongs, insects flying, waterfalls, wind blowing through tree branches and storms. Often, contemporary musicians, in their creative processes, are also inspired by acoustical regularities found in soundscapes. The process of collecting such aspects has been happening over the centuries and thus have become part of human societies Collective Unconscious, a term coined by Carl

Jung, referring to the structures of the unconscious mind that are shared by individuals of the same species (Jung, 2002). In addition to this concept, several researchers (Panksepp & Bernatzky, 2002; Trehub, Hannon & Schachner, 2010; Juslin and Laukka, 2003) argue that, since its origin, music has been an extension of human affective communication (innate emotional sounds), i.e., the prosodic elements of our vocal expressions and the regular rhythmic movements of our motor apparatus (Panksepp & Bernatzky, 2002), which act as a communicative stimuli (ethological signals) capable of expressing emotional states. With the emergence of verbal communication (with semantic meaning), this began to present strong cultural traits, due to the expansion of the cerebral neocortex, which allowed the appearance of imaginative thinking (Panksepp, 2009).

It can be said that human voice is capable of transmitting Valence (emotional dimension going from negative/sad to positive/happy), Arousal (emotional dimension going from negative/bored to positive/excited) and emotional intensity through its spectral and temporal changes (Schlaug et al., 2013). This fact provides evidence to support that the vocal tract has been the first musical instrument of humankind, later followed by drums (Panksepp, 2009). Moreover, the maternal singing/speaking with their pre-verbal offsprings, together with their musical emotional responsiveness may have been what fomented the transition between animal primitive emotional sounds and the proto-musical abilities of our ancestors (Trehub, Hannon & Schachner, 2010; Panksepp, 2010).

This communicative vocal aspect (Panksepp, 2009), innate and inherent to our species, influenced the emotional responses of individuals as they were exposed to music. The prosodic elements of vocal expression grounded the underlying mechanisms to the evoking of emotions by music, which occur in an unconscious level of the mind, and whose cerebral processing occurs largely in the limbic system; a primordial region of the human brain, also common to other animal species (reason why it is sometimes called “reptilian brain”). There is little evidence that other animals besides humans are provided with a musical mind as ours, but it is a fact that they have emotional ones, specially mammals. The primitive affective feelings expressed by other animals, as well as our own, emerge from subcortical brain regions such as the limbic system (Panksepp, 2009).

From this initial argument, the following question can be proposed: would it be possible to create musical excerpts capable of communicating determined symbolic meanings in order to influence the evocation of specific meanings on the listener? The next section presents an ethological basis to the deepening of the discussion on the possibility of promoting a specific symbolic meaning communication through music.

2. Ethology on Emotion and Music

According to Ethology, the subject of Zoology that studies animal behavior, there are two types of animal communication: Signals and Cues (Huron, 2012c). Signals are intentional communicative acts, involving innate behaviors and physiological mechanisms intended to evoke a sudden change on the behavior of the subject. Signals are biologically prepared in relation to both the specific behavior of the transmitter and the specific reaction of the receiver, when in observation of a signaling act. A typical example of a signal is the rattling of the rattlesnake. Signals tend to be evident, purposeful and multimodal, i.e., they occur simultaneously through more than one communicative display (visual, auditory, olfactory, etc.). On the other hand, cues are unintentionally informative behaviors, whose meanings (and therefore the reactions) are artifactual and learned through exposition in an environment. Cues are mostly unimodal, as their meaning were not embedded throughout evolution in the subject cognition in order to be communicative, although they can also be multimodal. One typical example of cue is the buzzing sound of a mosquito, which has no intention of informing the target of its attack, although the attacked may learn to relate this characteristic sound with the mosquito bite.

In terms of human emotion, sadness is a good example of cue (Huron 2012c). Sadness is an affective state of low physiological arousal, that can be characterized by low heart rate, shallow respiration, slumped posture, loss of appetite, sleepiness, reduced engagement with the world, a tendency to avoid conversation, and rumination (thinking sad thoughts). Its occurrence is related to a low level of acetylcholine, making the subject's muscles less tense, more relaxed and with lesser reactivity. The subject's voice becomes softer, slower and with a darker timbre, lower and more monotone, and speech becomes mumbled. However these features can be deceiving and easily confused with a relaxed or tired state, therefore corroborating with the ethological definition of a cue (instead of being a signal). In contrast, grief is a typical signal, which is an affective state of high physiological arousal, characterized by faster heart rate, erratic respiration, flushed face, tears, nasal congestion, pharyngeal constriction and ingressive vocalizing (sound production while inhaling). These make vocalizations to present higher pitches with gliding contours, punctuated exhaling, and also some instability between modal and falsetto phonation ("breaking" voice). These features altogether are highly evident and distinctive, thus making it possible to infer that grief is in fact an ethological signal.

Both types of emotions frequently occur at the same time, due to the adaptive functions related to these emotional states. Sadness, as being a cue, intends to change the

individual's own behavior, by inducing depressive realism, which makes the subject to lower expectations and reconsider more adaptive life strategies. Grief, as being a signal, intends to change the behavior of the subject in interacting with other individuals, encouraging in them a more altruistic reactions towards the subject. All of these features can be observed in emotions induced by music (Huron, 2008).

In terms of melodic constructions, scales with pitch intervals lower than normal, as suggested by ethological principles, have greater tendency to be considered sadder (Huron, 2010). Taking into account that in Western culture about 75% of all music produced is in major tonality, individuals in this culture tend to create expectations of hearing major-scale music, therefore they tend to consider minor-scale music as sad, since it breaks the usual listener's expectation as minor-scales have pitch intervals smaller than major-scales ones. In contrast, in Bulgaria this (the average listener necessarily considering minor-scale music as sad) would not occur, since music in that region is most commonly made in minor-scale.

But why do exactly minor-scales sound sad, and not other scales that also have pitch intervals smaller than major-scales? Modifying some pitches in major mode makes some intervals become smaller, but others become larger. If the statistical distribution of the occurrence of all pitch intervals in a scale were equal and all pitch sequences were equally common, then the modification of one interval would not have any effect in the average of interval's size. However, in music, some pitch intervals have greater probability of occurring than others. Therefore changing some specific pitches in a scale can affects the average size of melodic intervals. Huron (2010b) performed an experiment, with 300 melodies in major mode, about the effect of altering some specific scale degrees in the average of interval's size. The results showed that diminishing the 3rd and 6th degrees (harmonic minor mode) creates the smaller average, and raising only the 4th degree (Lydian mode) generates the greater average, making music sound respectively sadder and happier than normal in these scales.

3. Unconscious and Symbol

Hearing is one of the first senses that become operational during the human fetus formation (David, 2007). Since the moment hearing is in its full operation, which happens approximately in the 20th week of gestation, this sense never stops capturing acoustic information. It is then possible that we can only deal with this huge and unstoppable amount of information, due to the existence of the unconscious mind (the set of mental processes that occur without the participation or monitoring of attention) as we are not conscious of every information coming through our senses. We only direct our attention (the major faculty of

consciousness) to data considered relevant by our reality assessment cognitive processing. Though the unconscious is more than an information storage. It's a mental functioning system with laws of articulation and its own language (Garcia-Roza, 2009). The language of the unconscious is symbolic and dissociated with verbal language, yet with mental images (or patterns, that are not necessarily visual), which consist of representations of what was previously perceived; the percepts (Damásio, 1999).

According to Jung (2008), symbol may be a term, a name, or a familiar image that holds special meanings, beyond its common ones. This word or image has wider unconscious aspects, which cannot be precisely defined or explained. When the mind explores a symbol, it's led to concepts that can be out of reason's reach. According to Freud, this happens because the conscious reaches only the representation of the thing (person, object, or concept) in conjunction with the representation of the word to which it refers, whereas the unconscious refers to the symbolic representation of this thing, which does not take fundamental association with verbal language (Garcia-Roza, 2009).

Based on that, it can be implied that sounds can also acquire meanings beyond the ones fundamental to their existence (normally manifest and obvious) and appropriate indirect connotations and nuances, representing ideas, concepts, emotions and feelings, thus assuming a symbolic function, which is often communicated from/to the unconscious.

Lévi-Strauss claims that culture is a set of symbolic systems, and that these systems are not constituted from the moment in which external data are built in symbols, yet instead it's the symbolic thought that constitutes the cultural or social fact. These systems with symbolic functions constitute the structural laws of the unconscious (Garcia-Roza, 2009). Since music is also a fundamental part of a community's culture, it is also constituted of symbols and obeys it's symbolic functions. Film music is one area based on this concept, as a determinant role in its compositional process. It can be said that film music is composed with the purpose of transmitting messages to the viewers psyche, with which it's intended to persuade them to experience the emotional framework determined by the movie's plot. In this specific case, music communicates a symbolic meaning implicit to visual imagery (Green, 2010). Another interesting musical domain is instrumental music, which does not accompany the semantic signification contained in lyrics (as do songs), but that also has the ability of inducing, in a symbolic manner, the unconscious mind of the listeners, so that they respond emotionally within the context of their own life experiences (Nebenzahl, 2000).

4. Emotion and Feeling

In relation to the brain activation of listeners and music performers, the processing of hearing and tonal thoughts apparently occurs in specialized groups of neural pathways, in the superior temporal and frontal regions of cortex, particularly in the right hemisphere. However, recent studies have shown bilateral activity in occipital areas, normally involved in visual processing, despite the absence of visual input in music listening (Brandt, 2009). Moreover, parts of motor cortex are also activated, and paralimbic areas (activated in emotional processing) were also shown to be involved in the assessment of the musical experience.

According to Damásio & Habibi (2014), when music is pleasant to the listener and causes chills (a sudden strong feeling of excitement or fear; a frisson), physiological changes occur, like raises in the heart and respiration rates, changes in the skin conductance and decrease in body temperature. In addition, there are also alterations on dopamine liberation in brain regions like nucleus accumbens and caudate nucleus (highly correlated with the sensation of pleasure, or more specifically with the seek for reward and learning reinforcement), congruent with pleasure in the anticipation of events. On the other hand, when music does not evoke pleasurable feelings and emotions, but rather a negative valence, the typical outcomes are behaviors of anxiety, frustration, fear and/or sadness, jointly with a raise on brain activities of parahippocampal gyrus, precuneus and amygdala, which could be generated, for example, as a consequence of dissonant musical passages.

According to Damásio (2011), emotions are related to a series of standardized chemical and neural responses produced by the brain, when it identifies an emotionally competent stimulus, like a relevant object or situation. There are two action pathways of emotions, which are: 1) the bodily pathway, as they create a state that involves adjustments in the homeostatic balance, and generates specific behaviors and facial expressions, and 2) the cerebral pathway, which produces alterations in its operation mode during those bodily adjustments, resulting, as an example, in a modulation of the attention spent to certain stimuli. Feelings, on the other hand, as mental representations of the physiological changes that characterize emotions, provide mental alerts to the organism, which amplify the impact of a given situation, improving learning, and enhancing the anticipation probability of future comparable situations.

5. Conclusions

The epistemological foundations (namely analytical psychology, music cognition and ethology), presented as theoretical grounding to the present paper, are distinct

investigation paths that converge. It is noticeable that the acoustic affective communication of animals (specially mammals) is the result of manipulations of physical aspects intrinsic to each species, which occurs in a natural manner. These manipulations create acoustic alterations, which would not carry by themselves any intrinsic meaning without their historical evolutionary contexts (whose information is stored in the collective unconscious of the communities), as is the case of music.

Observing the messages communicated by animals, one can notice their symbolic character, which connects the internal states (detected through behavior) with their meaning. For example, we can take the howl of a wolf, that doesn't carry in its acoustic features any inherent meaning, but that communicates symbolically its internal state. That's also the case of music, which doesn't carry any intrinsic meaning at first, but if taken as a more sophisticated variation of animal affective communication, it allows us to obtain more detailed indications of their symbolic meanings. For this purpose, we can learn from ethology some revealing concepts for this question. Signals and cues can be understood as symbolic configurations of affects, whose musical correspondence is significant. Signals, as related to more archetypical (collective unconscious) communication, can be represented in music and more directly felt by listeners across cultures. This doesn't mean all listeners respond to these stimuli in the same way, since there are several types of affect induction through music (Huron, 2012). On the other hand, musical cues can be deceiving and are culturally dependent, creating different kinds of perceptions and evoking different emotional responses across cultures.

Ultimately, this research aims to generate contributions with aspects involved in this interdisciplinary field of music cognition, which may foment the development of future research about musical analysis methods, studies on musical genre or style differentiation, all based on emergent symbolic meanings, and other developments in other research fields related and beyond music cognition.

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