Sound Perception and Sound Design

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Abstract

Sound design constructs audibility of the world. Sounds carry information about the world. When listening to sounds communication takes place. This is a well-known fact for speech sounds, but it is also true of other types of sounds such as music or product sounds. In principle, each acoustic event can be perceived as a sign carrier by which information about the world is communicated. In its ultimate sense, sound designers are engineers of communication. To be successful they have to take design decisions on the basis of how listeners perceive sounds and of what sort of communication takes place during the perceptual event. The career of sound design requires a special view of acoustic / auditory communication. Amongst others, this is a field of semiotics. This paper looks at sound design from the perspective of semiotics.

1. Introduction

Human beings are multimodal by nature: we receive signals of our environment via our ears, our eyes, our nose and / or our skin. However, not all signals that are available to our sensory organs are actually perceived and processed. Selection takes place. Selection is either a reflexive process (which is not discussed here further) or it is directed by the situation, by the context of experiences, by knowledge and expectations. The result of selection is data reduction. Reacting reflectively, we tend to concentrate only on those input data which seem to be carriers of information in our specific living situation. The question of which parts of the offered sound signals are carriers of potential information is closely connected to attentiveness and to knowledge about the world, to experience, and to expectations. We have learned how the world sounds, and whilst listening to sounds we understand what is going on in our environment. We are attentive if there is a discrepancy between data of perception and data of experience and expectation. We treat the sound as an information carrier which communicates something about the world and associate meaning with the acoustic / auditory event. From the point of view of sound design, reactions to sound events are a major design criterion. The quality of sounds is high if acoustic / auditory events are perceived as carriers of information and processed in such a way that specific meaning is extracted.

2. Sound design

The objective of sound design is to construct audibility of the world. As an example, environmental phenomena can be made more comprehensible by means of well constructed acoustic signals. The “clicking traffic light”, for instance, indicates that the traffic lights are green and pedestrians can cross the street. The acoustic signal is a carrier of specific information. All acoustic signals (natural or constructed) are perceived as carriers of information. They do not stand alone for themselves but they transmit messages when they become an auditory event (similar to speech). Acoustic signals *refer* to something else than themselves. The roaring sound of the interior of a vehicle, for instance, suggests sportiness, the sound of a vacuum cleaner suggests suction power, the rattling of a vintage car suggests nostalgia and a shrill cry of a child suggests high spirits or danger. They all mean something to the listener. Modern industrial product sound design uses sounds in order to systematically transmit messages. The acoustic signal is exploited in order to maximise the influence on the hearing product user. This is not simply working on the surface, because a sound designer constructs signals which evoke certain affective, cognitive or psychomotoric reactions, as long as those signals become an object of audition. The reactions to sounds should be wanted, and should comply with the overall product idea.

3. The meaning of sounds

While listening, memories are aroused and meaning is associated with the auditory event. That means: the hearer disposes of an acquired system of sounds and their meanings or, metaphorically speaking, of a *sound lexicon.* This ‘lexicon’ contains invariant auditory *form features* (such as the typical sound signal caused by a hammer pounding on metal), respective *experience contents* (hammer, clout, ambos) and *interrelations of functions* (forging of steel). These lexical items are aspects of information for the associated meaning of the respective sound. It is these associations and meanings which are activated when we listen to an as yet unknown impulsive sound: perceived features of what is heard are compared to the inner system of meanings which contains all what has been experienced and learned so far (such as the pounding sound of a hammer). Based on memorised meanings, a satisfactory match between data of perception and data of experience and expectation attributes meaning to the auditory carriers. So, if a lorry produces a pounding sound, systems of meanings are activated and consulted as a reference. This is of course a simplification of concomitant auditory/cognitive processes to show that it is not the isolated sound or auditory event which is processed, but its function. The auditory form is an information or a sign carrier. It refers to memorized events. As a result, meaning is attributed to the sound event. [1]

4. Consequences for sound design

Various sound signals that surround us carry specific information. The relation between the acoustic signal and the information conveyed has been learned. Consequently, with regard to sound design, not all possible sounds are suited for carrying specific information, but only those which have a

memory value compatible to the message to be conveyed. In other words: that which is actually auditorily perceived as an information carrier must not contradict that which was experienced beforehand. This is particularly important when sounds are produced artificially, i.e., when sound events are created on purpose – as opposed to sound events which come into existence as a result of natural environmental events. Seen in this way, sound designers are *communication architects* – they enhance messages by making use of acoustic devices. The objective of sound design is to provoke or enhance reactions by means of acoustic signals. The designer has ideas of certain conditions which must be fulfilled and of certain optimisations that must be achieved. Thus sound design is a functional adjustment of an acoustical message to its objective. In order to be successful, design decisions must be geared to the way of auditory perception of a hearer and to what kind of communication is going to take place. Consequently, sound design must be committed to perception, information, communication and meaning. The better this is done, the higher the quality of the created sounds will be. The quality of sound design shows in *what* it transports and *how* it transports it in the concrete context of audition. Hence successful sound design will orientate itself to analyses of demands and expectations as well as to the balance of necessities and needs. Taking this perspective sound design is able to create acoustic-auditory events which are typical of particular contexts and which qualify as carriers and enhancers of messages.

5. Consequences for sound-quality measurements

Strongly generalised, an auditory quality measurement can be referred to as a process which compares data of perception and data of experience and expectation. When these map, the sound is judged of high quality. A large part of instrumental measurement technology, which deals with acoustic (physical) values, demands the achievement of reliable measured values. However, their significance regarding data of perception and data of experience (in the sense of the sound being an information carrier which leads to associations of meaning) has not yet been clarified sufficiently. Consider, for instance, the instrumental methods of measuring loudness and their reference to the actual auditory perception by those concerned. We know that the assignment of meaning my change perceived loudness. Often the people concerned attribute a meaning to what they hear which is not captured by currently available measurement methods. Even more, that which has been said does not only account for instrumental measurement techniques but also for measurements with human test subjects: a measurement (e.g. in a laboratory) is always a simplification of a natural situation and can therefore only be as suitable as the limitations of its measurement context allow for. There must be a solid ground for simplifications in order to motivate decisions.

6. Conclusions

Significant possibilities of improvement in the field of sound perception, sound design, and sound-quality measurements are given when the sound is looked at comprehensively with regard to characteristics of *form*, *content and function* which lead to the association of meaning. First experimental data are discussed in [2,3]. Generally, the central question thus is: *How do human listeners process acoustic-auditory events when they treat these as communicative events generally and as information carriers specifically; how do they react to these and which meaning to they assign to them?* This question characterises one of the present research activities in the field of sound perception, sound design and sound-quality measurements. It can systematically be examined making specific use of modern paradigms from psychoacoustics, communication acoustics and semiotics. I term the new research direction which understands, interprets and constructs auditory events as information and sign carriers *semioacoustics*. *Semioacoustics* is the science of auditory signs.

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8. References

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