Soundscape and its Relation to Core Affect, Appraisal, and Motivation

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Introduction

While annoying sounds force us to attend our sonic environment and distract, pleasant sound allow us to engage in self-selected activities. This entails that the sounds that comprise our sonic environment motivate us to behave in certain ways. This paper analyzes the relation between core affect, appraisal of the sonic environment, and motivation. It concludes that it make sense to analyze the sounds that comprise the sonic environment in terms of pleasant fore- and background sounds and unpleasant fore- and background sounds.

Appraising sonic environments

Research addressing how we appraise sonic environments has led to two main appraisal dimensions as depicted in Figure 1b). These dimensions are either pleasure and eventfulness [1] or, at a 45 degree angle, vibrancy – in Figure 1 b) the axis monotonous-exciting – and calmness – the axis calm–chaotic – [2], [3]. These (combinations of) dimensions are closely related to the concept of 'core affect' in emotion theory. Core affect is an integral blend of the dimensions displeasure-pleasure (valence) and passive-active (arousal) as depicted in Figure 1a) [4]. Unlike emotional episodes, which are relatively infrequent, core affect is continually present to self-report. Recently, core affect, appraisal, and motivation have shown to be intimately coupled [5]. This short paper addresses the question how and why these concepts appear in the context of soundscape.

Appraisals are *"cognitive evaluations of events that are considered to be the proximal psychological determinants of emotional experience, with different combinations of appraisals corresponding to different emotions"* [5]. Appraisals typically refer to: motivational relevance ("Is it important?"); motivational congruence ("Is it advantageous or disadvantageous?"); agency ("Is it caused by others or myself?"); problem and emotion focused coping potential ("Can I cope with the situation and with my emotions?"); future expectancy ("Is the expected outcome desired or not?"). Appraising the environment therefore combines motivation, coping capacity, and expectations of the future. As such the appraisal process involves the evaluation of possible (inter)actions with the environment.

Depending on the outcome of these evaluations, living agents are motivated to initiate, continue, or discontinue particular courses of action. It is possible to separate exogenous and endogenous motivated activities [6]. Exogenously motivated activities are aimed at reactively coping with acute or future problems and have fear as associated basic emotion. Endogenously motivated activities allow proactive (e.g., preventive) coping and the discovery

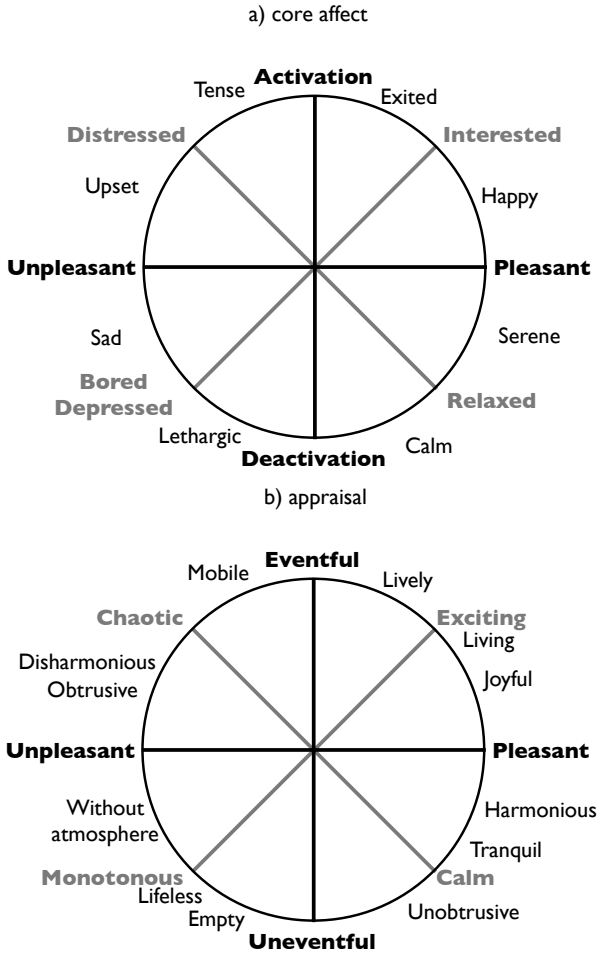

Figure 1: a) Core Affect (descriptive words taken from [4]) and b) Appraisal of soundscapes (words from [1].

of affordances [7], [8] and have interest as associated basic emotion.

The term affordance is closely related to the appraisal process. Affordances are perceived action possibilities, provided by an environment [8] that might be used to satisfy (immediate or future) needs. Interest driven interaction extends the capacity to perceive affordances. For example Silvia [9] concludes that "*by motivating people to learn for its own sake, interest ensures that people will develop a broad set of knowledge, skills, and experience. One never knows when some new piece of knowledge, new experience, or new friendship may be helpful; interest is thus a counterweight to feelings of uncertainty and anxiety."*

Interesting environments provide discoverable affordances to extend knowledge and skills through, typically, playful interaction [10]. Boring environments are devoid of discoverable affordances and do not provide appreciated

High complexity	High on affordances
Chaotic: in a state of complete confusion and disorder **Mobile:** able to move or be moved freely or easily **Disharmonious:** lack of harmony or agreement **Obtrusive:** noticeable or prominent in an unwelcome or intrusive way	**Exciting:** causing intense and eager enjoyment, interest, or approval to do or to have something **Joyful:** feeling, expressing, or causing great pleasure and happiness **Living:** have an exciting or fulfilling life **Lively:** (of a place) full of activity and excitement, (of mental activities) intellectually stimulating or perceptive
Low on affordances	**Low complexity**
Monotonous: dull, tedious, and repetitious; lacking in variety and interest **Without atmosphere:** a place or situation without a pervading tone or mood **Empty:** containing nothing; not filled or occupied **Lifeless:** lacking vigor, vitality, or excitement	**Calm:** the absence of violent or confrontational activity within a place or group **Unobtrusive:** not conspicuous or attracting attention **Tranquil:** free from disturbance **Harmonious**: forming a pleasing or consistent whole.

Table 1: Dictionary entries (New Oxford Dictionary) for selected words used to appraise sonic environments [1]

novelty (e.g., because they are devoid of stimuli, or the stimuli are ether too ordered or too complex).

The complexity of an environment is, in this context, a reference to how difficult it is to cope with the challenges and opportunities the environment provides. Complexity therefore refers not to the environment per se, but to the question of how difficult it is for an agent to decide on situationally appropriate behavior. Low complexity environments are highly redundant (each part "predicts" the whole, leading to an impression of harmony), which entails that most perceptual evaluations of the environment lead to a similar overall interpretation of pervasive safety. In low complexity environments action outcomes are relatively insensitive to the details of action selection and execution; one is neither forced nor enticed to act overtly.

In contrast, highly complex environments are less redundant (for example because of a lack of internal coherence due to a multitude of uncorrelated processes, giving an impression of chaos or confusion). This entails that the focus of attention needs to be chosen well to ensure a proper selection and execution of coping behavior. In contrast to low complexity environments, complex situations may force one to act in a highly controlled fashion and in response to particular events. This entails that action outcomes are highly sensitive to detail.

This interpretation is supported by an analysis of typical words (taken from [1]) that are often used to describe the four quadrants of appraisal. Dictionary lemmas (source: New Oxford Dictionary) of the words in Figure 1b are provided in Table 1. These support the key role of affordances and complexity as defined above.

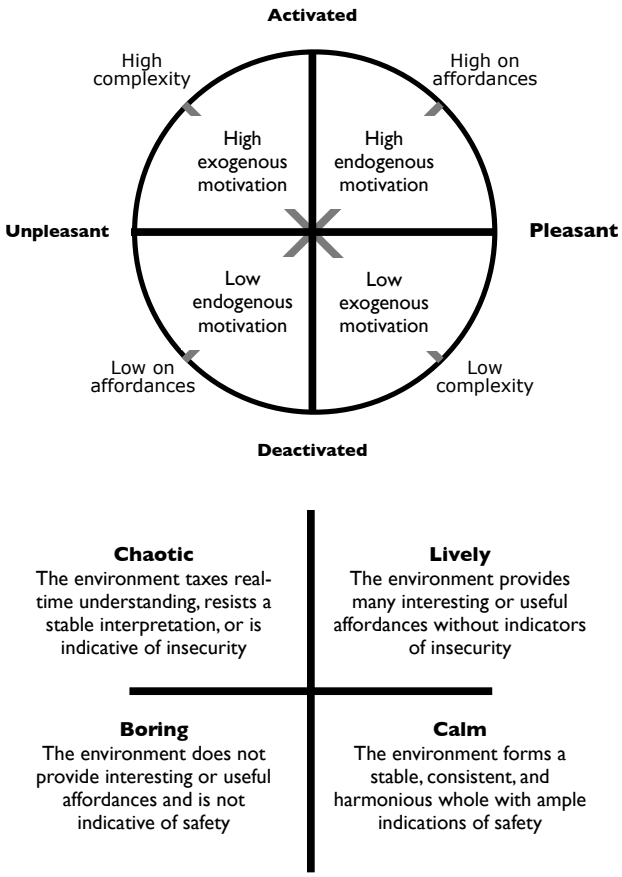

Figure 2: Four different qualitative domains of soundscape appraisal. The upper panel interprets the environment in terms of exo- and endogenous motivation. The lower panel summarizes the properties of each quadrant in terms of complexity and affordance content.

Four types of sonic environments

This analysis suggests four qualitatively different types of sonic environments in terms of the complexity of action selection and affordance content. The complexity depends on the prevalence and reliability of indicators of safety. Highly complex or chaotic environments are difficult to interpret (e.g., due to a overabundance of sound producing activities) or actively indicative of insecurity. A boring sonic environment is low on useful audible affordances and is also not indicative of safety. In contrast, a lively environment represents many affordances that provide ample interesting opportunities to attract attention and is not indicative of insecurity. The fourth environment is a calm or relaxing one because it provides ample indications of safety and allows as such full freedom to relax and recuperate. Figure 2 provides these four domains of soundscape appraisal.

These four types of environments can be connected to results regarding noise sensitivity. Job [11] concludes that *"results consistently show that, despite ubiquitous reference to noise sensitivity as a single entity in the literature, in fact noise sensitivity is not a unitary concept. Rather, it generally contains two distinct factors: sensitivity to loud noises produced at a distance from the hearer (e.g., road traffic or jackhammer noise), and sensitivity to situations of*

distraction or close but quieter noises (e.g., rustling paper at the movies, people talking while watching television)". Sensitivity to noise therefore comprises both distal and proximal situational awareness as distinct components.

Distal situational awareness is predominantly determined by the loudest (foreground) sounds and proximal situational awareness by the subtle (background) sounds. This suggests a matching fourfold separation in pleasant and unpleasant fore- and background. An unpleasant foreground is chaotic and either difficult to understand in real-time or outright indicative of danger. An unpleasant background is boring and devoid of indicators of safety or positive affordances. A pleasant foreground is lively and full of appreciated affordances. Finally, a pleasant background is relaxing due to the harmonious (and therefore redundant) nature of the sonic environment that provides – for that reason – ample indications of safety (conform [6]). This is depicted in Figure 3.

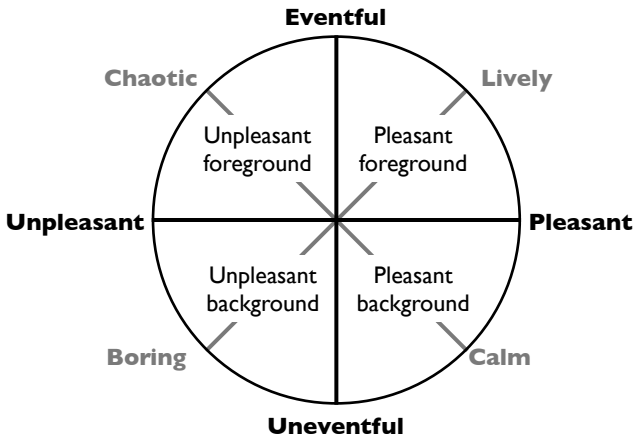

Figure 3: Four different qualitative domains of signal properties.

This qualitative description of pleasant and unpleasant fore- and background sound provides functional information that can be used to build more versatile and intelligent back- and foreground models.

All in all it can be concluded that core affect, appraisal, motivation, and even signal processing can be integrated in a single conceptual framework that may not only offer theoretical simplicity and coherence, but also might become a constructive tool for the development of novel soundscape analysis tools.

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