Application of Synesthetic Design as multi-sensory Approach on Sound Quality

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Introduction

During perception of sound events it appears to be obvious that auditory attributes transfer information about objects of the world, which in most cases imply multi-sensory aspects. Hence, analysis of perceived sounds must include analysis of references which point to attributes of other modalities. Studies of the past have shown that an optimized, satisfying consideration of cross-sensory interaction is not possible if based on a single process of coupling [1].

This contribution provides a concept of synesthetic design which includes various strategies of cross-sensory coupling evident within the human perceptual system. Based on recent results of perception and cognition, this concept enables an extensive alignment of design rules to perceptual functions. Sound attributes can then be analysed with view on a whole set of multi-sensory features. Those features can be of basic nature, show associative (iconic) content or semantic features (meaning). Research on individual phenomena of (genuine) synesthesia offers further aspects.

Challenges of Product Redefinition

Challenges for sound design and practical noise engineering are quickly rising with time. Main tasks include much more than only a refinement of marginal features. It is more and more recognized that a product sound considerably defines impression, emotion and valuation of a customer. Therefore the (multi-sensory) sum of all features to which given stimuli refer to has to be assessed to understand the customer's ratings. Particularly in case a product needs a complete new definition of features, e.g. exchanging an ignition engine by an electrical drive, a new and unusual sound behavior has to be handled. Design solutions must be found which gain intuitive plausibility. Synesthetic design offers a feasible concept for alignment of noise behavior of objects to other sensory channels and to integrate new auditory features into the entire context of sensations.

Cross-Sensory Implications of Sound Sensation

Physical objects from the human environment (including the own body) are not as such represented in the perceptual system, but by means of simplified models. Those models connect basic features of each sensory channel (roughness, intensity, color, pitch, etc.) to each other, thus shaping multi-sensory perceptual objects. The various features integrated into those objects, however, are not of physical nature - although the nature of stimuli is physical, or chemical. Instead a specific subjective representation is generated as a cumulation of subjective features, named *qualia*. The impression of color is a typical subjective quality: it does not exist in the physical environment, where optical qualities of light are defined by spectra and temporal behavior. In contrary, colors sum up various spectral features to generate a highly simplified, subjective "tag" for the much more complicated reality. Therefore color is a subjective representation which in principle cannot be compared between individuals. The same problem applies to auditory perception, e.g. the sensation of timbre.

Synesthetic design is based on best possible alignment of design features to multi-sensory perceptual objects of the individual, e.g. the customer, user, operator, etc. Theoretically, the approach is quiet simply: the subjective effect of each sensation of sound is assessed by description of the multi-sensory perceptual object to which it is referring to. In practice, however, this perceptual object is characterized by specific qualia which are only experienced by the individual. The perceptual object and its attributes can be described verbally, its visual features can roughly be sketched and each feature can be compared to other phenomena of common perception (rhetorical: by means of a tertium comparationis).

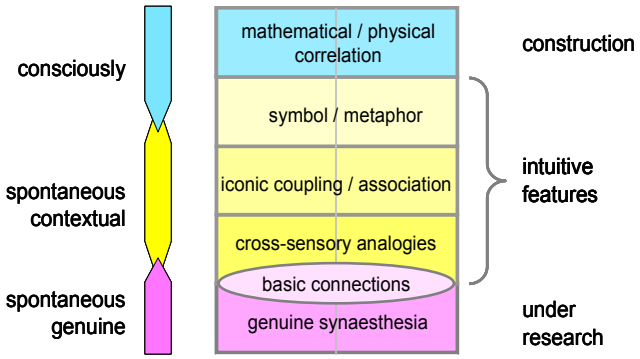

Figure 1: Overview of main perceptual strategies of cross-sensory coupling.

Functional Correlations

The perceptual system generates cross-sensory connections via various main strategies, which can be intuitive links, conscious constructions or highly individual phenomena of genuine synesthesia. Additionally, basic connections provide correlated activity of sense organs and coordinated body motion. Each strategy contains a variety of specific processes, e.g. analogies includes aspects of temporal (e.g. synchronicity), spectral (e.g. brightness) or spatial alignment (e.g. motion). This model has been extensively described before [2, 3, 4]. In order to create a common cross-sensory design of products the intuitive features need special attention while they provide a common and plausible appearance of objects. It is important that perceivable product features are consistent between all senses to provide a close alignment to the product's functionality. Otherwise it will not be possible to operate highly sophisticated technical devices.

Synesthetic Design

A conventional process of designing multi-sensory products is based on single sensory channels (modalities; figure 2, left hand side): e.g. auditory elements are designed separately to other sensory spaces. Only during a late phase, some sound features may be aligned to other modalities, e.g. a bright engine sound corresponds to a bright driver's environment. In contrary to this proceeding, synesthetic design is targeted to cross-sensory alignment in an early phase of the development process (figure 2, right hand side; [3]).

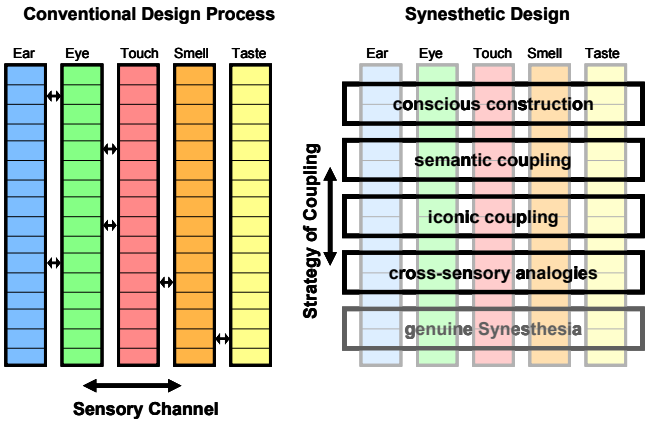

Figure 2: Principle of the synesthetic approach on product design

At first, the intuitive coupling strategies analogies, iconic coupling and semantic relations [5] are considered. Those strategies are most important to provide an intuitive design for products which can easily be handled by the user. Then, appropriate attributes (pitch, auditory dynamics, color, shape, associative elements, symbolic content, etc.) are chosen to provide cross-sensory alignment by these strategies. Finally, the chosen attributes have to be adjusted to provide an optimized integration of the selected features across all strategies. Perceptual integration must be based on the relevance of each coupling strategy and each attribute. It shall include processes for minimization of contradictions, to avoid negative emotions induced by cognitive dissonances. The relevance of genuine synesthesia for common perception is still unknown, but will presumably – after some research - offer new perspectives for the future. Conscious construction like definition of algorithms for visualizations used by media players can be applied, but shall include references to intuitive strategies.

Synesthetic design does not necessarily increase development effort, complexity or costs of systems. In contrary, the most important features for a design that shows optimized cross-sensory alignment are chosen during an early phase of development. Therefore sound design is not only applied on a rather finalized functional and visual appearance, but cross-sensory aspects of sound will also be aligned to the auditory potential of a given functionality.

Conclusion

Today, advanced design concepts increasingly broaden the horizon towards cross-sensory interaction [6, 7]. Synesthetic design offers powerful tools to optimize the multi-sensory appearance of product. It has to be chosen whether features shall play the main role which are already known by the customer. In this case, design must primarily be based on coupling of iconic features. This procedure applies if a new vehicle drive technology is equipped with traditional sounds, e.g. by use of electrical generation of sounds or play-back of samples. If a new and unusual sound design is used, however, design must provide plausible correlations on the level of analogies. This will enable intuitive acceptance of innovative product features, which in customer perception soon will also be established on the iconic level, due to individual experience of those new features. In general, cross-sensory analogies provide the base on which iconic coupling can be established. This also prepares the definition of symbolic content, which is the strongest way of product characterisation. Analogies of single features, however, provide much better flexibility and are therefore capable to slightly modify the image of a product or to introduce unexpected features, e.g. a futuristic sound.

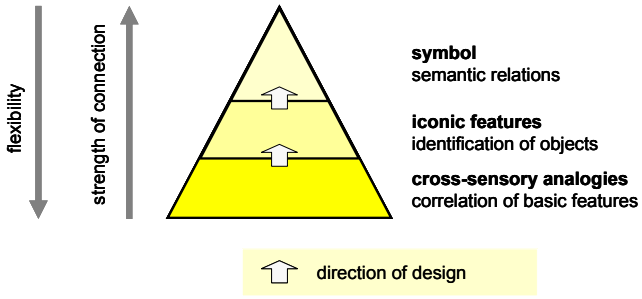

Figure 3: Preferred direction of designing intuitive product features with optimized cross-sensory correlations

The conventional development processes with a sequential optimization for different modalities (function & visual appearance first) need to be modified to provide in-parallel optimization of all features. This may also imply modification of organizational structures, but will cause increased efficiency of development and better cross-sensory alignment of product sounds to all other modalities.

References

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