HARMONIC CONSONANCE:
A THEORETIC AND COGNITIVE INTERPRETATION

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Most proposals for an interpretation of the musical notion of consonance lack a general perspective from which it could be easier to separate the paper of mathematically founded acoustics, the importance of perceptivist aspects and the influence of historical and cultural background. Few analysis allow an interpretation of the harmonic behaviour of music which gives a global understanding of both the vertical and the horizontal aspect of harmonic accordance and harmonic progression.

Helmholtz's idea of consonance (1863) was based on a psycho-acoustical definition of roughness as a result of the disagreement due to the interaction between the harmonics of two notes. An other interpretation of the relationship between two spectral series can be found in Schaeffer (1977) and Terhardt (1982). This approach has also been used by Costère (1962) as an harmonic theory.

The whole background of an investigation on musical consonance needs to be understood through both information theory and semiology: (see figure 1).

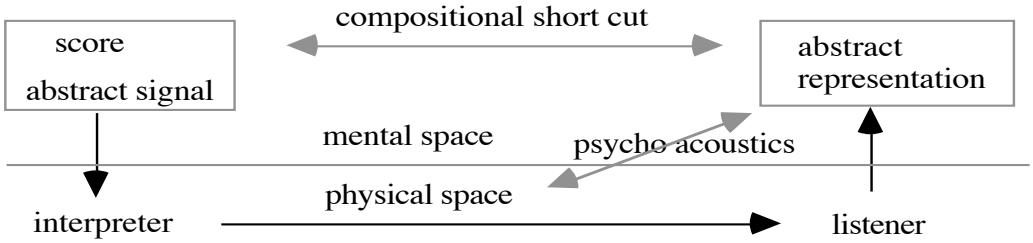

fig.1: schematic representation of music cognitive context.
psycho-acoustic tries to give the implications from the physical space to the abstract mental representations while what we call "compositional short cut" tries to synthetise directly all the information chain.

The abstract signal of the score does not provide directly the abstract representation of the music heard. Among other things because of the "harmony" effect that realises the fusion of the elements separated in the score. On the other hand, the abstract representation privileges global notions that

enlighten more easily some compositional aims and perceptive directionalities. What we call compositional short cut is then a transcoding of the abstract signal into an abstract representation that gives an approximated but appropriate "image" of what is to be listen to, in relation with the whole transmission chain.

A fully mathematical approach is proposed which aim is to give a model of such a transcoding. Several elements must be considered such as pitches distribution (average, variance, etc.), general dynamic, consonance. Among those elements consonance may appear as one of the most significant. We define the harmonic concordance of several notes as a function of a spectral representation of the notes. It leads to a powerful tool in the analysis of harmonic behaviour hence it is fully competent both as a vertical procedure and, combined with the notions of form theory (Chouvel 90 & 92), as an horizontal one.

The gaussian function we are led to use may describe both an energetic indeterminacy and a probabilistic behaviour of the components of the acoustic chain. The main point is that even if we can not localise this phenomena precisely in the chain, we will be able to predict the final global representation accessible to the mind. It allows to establish a relation in between the evolution of the sensibility of the ear and the maximum of combinatorial tone's roughness (33 Hz in Helmoltz hypothesis). It also gives a mean for harmonic colour prediction unrestricted to any specific scale or timbre. Harmonic topography can be represented in a map until three notes and specific projections can be obtained for more. This can represent an advance in the wide uncertainty of contemporary music's thought about harmony.

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