

Holst, F. (2002). Conceptual integration in the domain of music. In: The Way We Think, Anders Hougaard & Steffen Nordahl Lund (Eds), Odense Working Papers in Language and Communication No 23, August 2002, University of Southern Denmark, Odense. Volume 1, pp 181 –192.

Conceptual integration in the domain of music.

Presentation at the conference “The Way We Think / Conceptual Integration Network Theory”.

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Musical concepts can typically be described as conceptual integrations of properties from different domains e.g. a high pitch combining properties from physical space and sound. A precise account of conceptual blending in music depends on a description of musical properties. I follow R.I. Godøy's (1993) proposal of a spatial description of the properties of musical objects (in an phenomenological understanding) and apply P. Gärdenfors' (2000) theory of Conceptual Space as a foundation for describing the conceptual domain of music. On this basis, musical concepts can be accurately described as conceptual integration. This is exemplified through the melodic and rhythmic aspect. This approach to cognitive musical theory has interesting perspectives in regard to teaching and learning of music. Furthermore, conceptual integration theory contributes with new insight on central issues of learning as such.

„Musik... du Sprache, wo Sprachen enden“

With this quote from Rilke, Roger Scruton opens his article „Understanding Music“ (Scruton 1983), a discussion of what we mean when we ascribe a content to music. Scruton points to the central role of the metaphor:

..in our most basic apprehension of music, there lies a complex system of metaphor, which is the true description of no material fact. And the metaphor cannot be eliminated from the description of music, because it is integral to the intentional object of musical experience. Take this metaphor away and you take away the experience of music. (Scruton 1983).

In ”The unanswered question - Six talks at Harvard” Leonard Bernstein (1976) points to analogies between language and music and the role of the metaphor:

Music has intrinsic meaning of its own, which are not to be confused with specific feelings or moods, and certainly not with pictorial impressions or stories. These intrinsic musical meanings are generated by a constant stream of metaphors, all of which are forms of poetic transformations.

Cognitive linguistics

Lakoff and Johnson (1980) introduce in the book 'Metaphors we live by' a new understanding of metaphors as something which do not merely describe an exception. It is central that meaning is derived from a complexity of underlying schemata. In the same sense Ronald Langacker's (1986) Cognitive Grammar (alias *space grammar*), assumes that language is neither self-contained nor describable without essential reference to cognitive processing. Understanding the structure of a sentence and its meaning requires focusing on the cognitive processes involved in understanding or producing it. In cognitive grammar, linguistic units are identified as parts of domains which are themselves based on basic domains (space, time, sensible qualities such as colour etc.) endowed with some sort of geometric structure (Langacker 1987). Jean Petitot – one of main contributors of the morphodynamic school – thus makes the point that, according to cognitive grammar, concepts at the most basic level are positions / locations or configurations in some geometric manifold (Petitot 1995).

Conceptual Space (CS)

The work of Peter Gärdenfors (2000) of the morphodynamic school of thought (Thom 1991, Petitot 1995) as well as of cognitive linguistics (Lakoff and Johnson 1980, Langacker 1987) provides an extensive theoretical basis for conceptual spaces as a fundamental and universally applicable mode of reasoning. The theory presents a framework for representing information on a conceptual level, bridging between the symbolic and connectionist approach. A Conceptual Space is built up from geometrical and topological structures based on a number of quality dimensions. The dimensions are taken to be infra-linguistic in the sense that we can think about the qualities of objects, without presuming an internal language in which these thoughts can be expressed. A metaphor expresses a similarity in topological or metrical structure between different quality dimensions. In this way one can account for how a metaphor can transfer knowledge about one conceptual dimension to another – especially carrying information from a more fundamental quality dimension, for which the topological structure is well established conceptually, to a less fundamental dimension for which the structure is not yet completely determined.

In accordance with R. I. Godøy's (1993) proposal of a *spatial approach* for cognitive music theory, combining a phenomenological and morphodynamic approach, I have been working on a model for the Conceptual Space for Music since 1998 based on the theory of Peter Gärdenfors, and this model has been applied in an investigation of melodic expectation of children (Holst 2001). The approach appears to be rewarding, however a problem arises when cross-domain properties are involved - when musical properties from e.g. the melodic aspect and the rhythmic aspect "join" into a new type of less fundamental quality dimension. Musical concepts are typically such

‘multiple matrixes’: a high note combines a dimension of physical space (high – low) with sound, a dark tone combines a visual property with sound.

Melodic properties

A theory of melodic expectation (Narmour 1990) is empirically tested across style, musical training and culture. I have tested it with children (Holst 2001) confirming the theory, but showing an asymmetry not accounted for in the original theory. This asymmetry points to a possible grounding in spatial properties. An interesting (but not necessarily reliable) point is that some of the children used spatial metaphors for melodic movement. This “hunch” is however supported by neuropsychological investigations by Zatorre and Halpern (1999) who based on PET scannings show that melodic imagination are bound to spatial imagery (SMA). This supports the notion of melody being grounded in the auditory- and the spatial domain. This does however not necessarily mean that melody is bound to words like high and low, which – to use Gärdenfors’ terminology – would be on a symbolic and not on a conceptual level.

Rhythmic grounding

The rhythmic aspect of music is based on regularity, on something periodic. The regular beat of the music can be considered to be grounded in basic type experiences of regularity e.g. the heartbeat or the regular modification in sound. Regular modifications of sound is a more likely explanation, as they contain structures comparative to the metric systems used in music. However at the same time the rhythmic aspect of music is based on irregularity, on something aperiodic and more organic than mathematic. Body-movement is a probable explanation for the grounding of such properties. Further timing of body-movement is related to an expressive aspect. Transfer from body-experience to rhythm is based on isomorph structure in the two spaces, which makes it possible to transfer the property of e.g. a limping movement to rhythm – as it can be found in Schuberts “Die Schöne Müllerin”.

The doubleness of rhythm poses a serious problem for the choice of a model for rhythmic perception. Desain and Honing (2002:54) discusses this central problem in regard to rhythmic research:

First, without rhythmic categorisation there would be no reference against which to judge the expressive duration of a note: one would not be able to appreciate the difference between a deadpan and an expressive performance. And secondly, too much and too strict categorisation would cause a loss of timing information and the difference between a deadpan and an expressive performance would not even be noticeable.

They raise two topics: doubleness and balance. It is difficult to find a ‘single scope’ model which could account for this problem, and this approach would outrule balance.

Conceptual Integration (CI) and rhythm

Gilles Fauconnier and Mark Turner published in 1994 *Conceptual Projection and Middle Spaces*. (Fauconnier, Turner, 1994), and have just recently published the book “The Way We Think, Conceptual Blending and the Mind’s Hidden Complexities”(Fauconnier and Turner 2002). They describe the (double scope) blend as follows:

...the Blends create new structures by allowing counterparts to be mapped to distinct elements, with distinct attributes, and by allowing importation of specific structures in the inputs. The key constraint is that we don't just have a union of the inputspaces: only selected structure in the inputs is exported to the blend, but the overall projection will contain more structure than is available from the inputs ... The 'whole' that we find in the blend is thus both greater and smaller than the sum of the 'parts' ... we get a truly novel structure, not compositionally derivable from the inputs. Therein lies the creative force of such blends. New actions..., new concepts..., new emotions and understandings... emerge.
(Fauconnier and Turner 1994:16)

The counterparts in question in the following rhythmic blend are:

A: Regularity which is periodic with identical stress for each event, with no accents.
B: Irregularity which has an accent pattern, the different events have different stress or “weight”, but they appear in an aperiodic way.

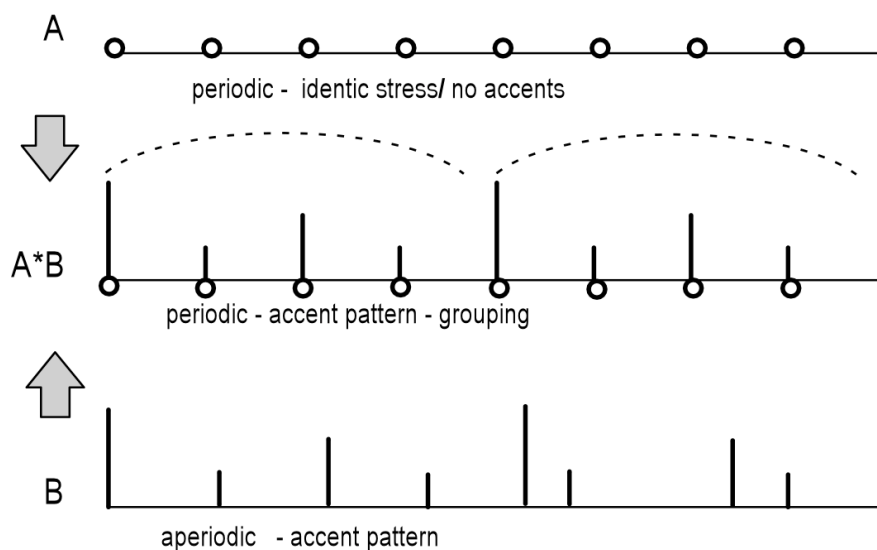


Figure1: Combination of partial properties

A selected structure from space A and space B are mapped on the Blend A*B. Properties are mapped and the combination of *periodic* and *accent-pattern* together constitute the new property *grouping*. The necessary conditions for grouping are neither present in A nor B, but in A*B. There are common structures in A and A*B as well as in B and A*B, which again are the necessary conditions for transfer. The common structure between A and B - Generic Space - is time.

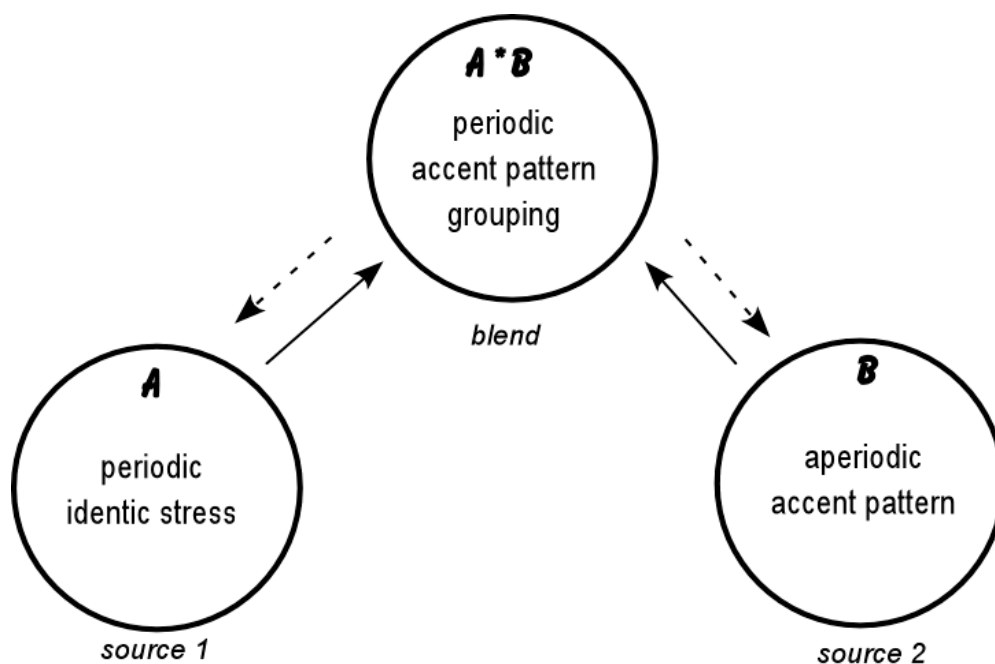


Figure 2: The rhythmic blend

Through experience and transfer (which is now possible due to the common structures) the new space with its specific properties, can now be extended and stabilized in accordance with the CS-theory.

Properties and balance

When a timespan in music is split up – and an extra note is placed between two beats – the original timespan is not always split into two equal parts. The ratio between the two parts is called the swingratio. Categorizing swingratios according to a periodic property - space A - means that the ratios are limited to proportions like 1:2, 1:3, 1:4, 1:5 etc. i.e. rational numbers. In this way a new periodic partitioning is made. If the swingratio however is not a rational number, the partitioning is not periodic and would thus be a property of space B. Swingratios depend on style of music and Friberg and Sundström (1997) have shown that it also depends on tempo. A waveform analysis of Errol Garner: I Got the World on a String (a recording from 1954) shows that the swingratios can be a very dynamic affair within the same style and tempo. The periodic quality (deriving from space A) established a meter (a

timegrid) against which deviations can be perceived which e.g. could result in a 'drive'. Such displacements are typical in jazz music, and Garner is well known for delivering such 'drive'. Another type of displacements found is changes from one swingratio to another within a short phrase. There are two way these changes could occur: sudden or gradually. A sudden shift from one swingratio to another would point to properties from space A, whereas a gradient change would point to properties from space B.

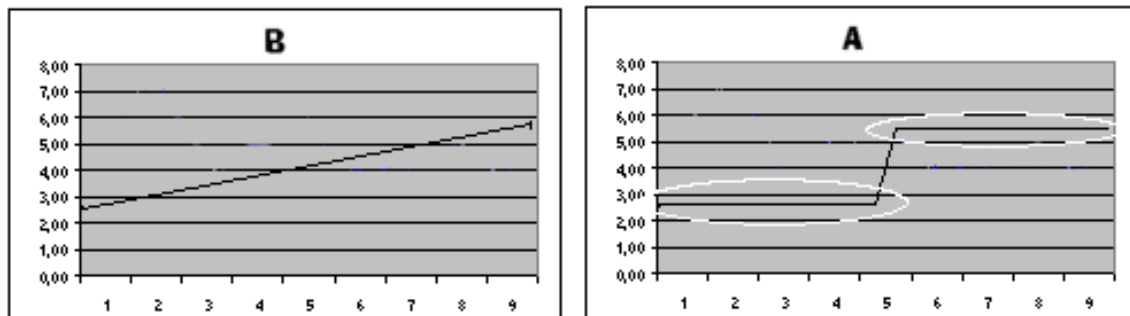


Figure 3: Sudden or gradual change

The analysis shows gradient changes, sudden shifts and mixtures. Complex gradual shifts appear in passages with a high expressive character. An example of this is measure 10 where the tempochanges are very differentiated – following the tonal curve thus intensifying the tonal expression.

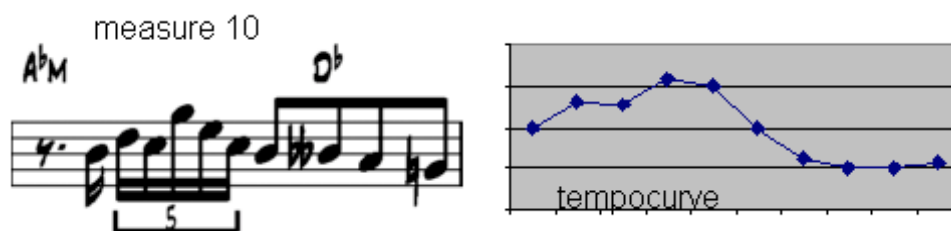


Figure 4: Gradient changes

The dynamic tempochanges and rhythmic regularity are clashing properties. The conflict-free blend is *periodic* combined with *accent-pattern* adding up to *grouping*. Deviations from the conflict-free blend can account for musical tension. A tempo-curve like the one above indicates properties from space B – properties grounded in body-movement, however the conflict from shifting the weight to space B is dissolved in the end of the phrase returning to a periodic swingratio. The changes, which also could be described as transformations, can be understood as double scope blends which are balanced differently – a remix, a change of weight – between potential clashing properties.

Conceptual networks and learning

The conceptual integration of rhythm blends spaces of more fundamental quality dimensions, for which the topological structure is well established conceptually, to a more abstract / less fundamental dimension for which the structure is not yet completely determined – the transfer described by Gärdenfors. The transfer is based on a partial isomorphy – and this requires that the more abstract / less fundamental dimensions are established, which is done through the blend.

This process of establishing new structure is a major question in the Science of Learning a.o. called *genuine learning* and part of the well-known dichotomy assimilation / accommodation. The blending-theory describes this process as a *creative process*, which gives a new perspective to the role of the creative process in learning, changing the role from mainly having to do with selfconfidence and identity to having a central role in the core process of learning. Blending can thus be seen as a central process in learning, establishing new structure and enabling transfer as described by Gärdenfors. Together the two processes gives a new understanding of the dichotomy assimilation/acommodation.

In this light, it appears very rewarding to investigate the conceptual network of music with a special view to evolving new knowledge about teaching / learning music.

As the conceptual network would involve cross-domain connections it might furthermore be possible to map cross-domain transfers concerning music. In the music field there has been a lot of speculations about non-musical results of musical learning often called the “Mozart-effect”. A six-year study in Berlin on this subject was finished last year. There are important findings in this area, but also a certain scepticism maybe due to a lack of focussed research on transfer. The blending theory opens new perspectives in regard to such a cross-domain mapping and further reseach in the field of music may very well be able to lead to new knowledge generally.

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