MOTIVE TRANSFORMATIONS BASED ON FINGER MOVEMENTS

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ABSTRACT

In this research report a model is presented, which simulates two-hand and finger movement types to make harmonic transformations of motives. In motional composition strategy (MCS) different types of movements are used for different types of harmonic transformations. Two types of (keyboard playing) hand movement have inspired this strategy. In the modelled situation the chordal pitches are played successively, as a pitch pattern. The fundamental types are a) *whole hand moving sideways* where adjacent fingers are successively pressed down, suitable for scale type movements and b) *hand spreading movement*, two fingers, ex. thumb and little finger, are moving away or towards each other when the hand itself stays in place, suitable for interval type motives.

To examine this possible relation between certain movement types and music a computer model (MCS) was devised to simulate the composition using motional oriented strategy. To enable the focusing to the actual dynamical movement processes only simple contextualization (i.e. culturally oriented enhancements) was incorporated. Several test runs using the model were made to harmonically process precomposed motives. Pieces generated by the MCS-model were generally very homogenous and fluent and motives were harmonically transposed in "natural" way. The results show that this simple compositional strategy without any additional rules is enough to generate plausible music in pattern-oriented style which is based on triad harmonies. Simple motional composition strategy enhances the coherence in generated pieces and facilitates the harmonic transformation of the motives

1. INTRODUCTION

The concept "compositional strategy" denotes in this research report the compositional techniques which are systematically used and which may generate major part of the features of musical piece. Examples of compositional strategies are the use of whole diatonic scales (a la Mozart) use of only very limited set of patterns (like certain Bach preludes for example), serial technique or use of strict counterpoint rules. Conventionally the compositional strategy has referred to more or less verbal compositional rules and constraints. In this paper also the motion-based composition strategy is considered. To simulate motion-based strategies moves also the computational focus from AI problem solving and implementation of rules to adjusting of dynamical pattern generators.

There have been relatively few publications about possible strategies in fingering in music playing (see for example E.F. Clarke, R. Parncutt, and M. Raekallio 1998). There exists even less publications which suggests that the actual finger movements could be a part of the actual compositional strategy (one example I am aware of is Clynes 1982). However I have not found any publications about the usage of movement patterns as a compositional strategy.

The major question when considering motion based compositional strategy is what movements are allowed in the process. We can assume that only those patterns which are good for making repeating patterns or other musically common phenomena are used. The use of limited set of movement types as compositional strategy enables even the everyday improviser and composer to generate intensive, coherent, and complex enough musical passages. To examine this possible relation between certain movement types and music a computer model (MCS) was devised to simulate the composition using motional oriented strategy.

2. THE MODEL FOR MOTIONAL COMPOSITION STRATEGY (MCS)

When the harmony, i.e. the background chord changes, it is necessary to change the pitches so that they are relevant in the new harmony. In the western music it is very common, that at least the pitches which are on accented position (in the model simply: when time modulo 2 == 0) are required to be chord pitches. There may be side notes between the chord pitches in non-accented positions. If the pattern or motive is adjusted to new chord pitches mechanically some awkward sounding patterns may result (see figure 1). In the figure the bar 1 is the original pattern, the bar 2 the "bad" transformation without MCS and bar 3 the correct transformation using MCS. It seems that especially the pitch sequence similar to that in bar 2 are very seldom in western music. The bars 4 – 6 show how the interval type pattern is transformed from C-major to G-major. The bar 4 is the original, the 5 the "bad" and the bar 6 the correct. The bar 6 is better over bar 5 because the required interval movements are much smaller. Moving the whole hand sideways, instead of spreading the fingers, would result in pitch sequence of bar 5.

It seems that to conserve the properties of the motive does not only require certain "fuzzy" approach (Lemström et al. 1999), but it requires also a special strategy to apply suitable transformation function for each type of motive in question. In earlier paper about motion-based strategy (Laine 2001) two movement types were used. In the current paper third movement type is considered necessary.

The motional-composition strategy (MCS) means that different types of movements are used for different types of harmonic transformations. Two fundamental types of (keyboard playing) hand movement are considered to be the origin of this strategy.

ISBN 3-931852-67-9
ISSN 1617-6847

The model handles the situation, where the chordal pitches are not played simultaneously, but successively, as the part of the pitch pattern. The fundamental types are a) *whole hand moving sideways* (in the object system named scale-type class), suitable for scales etc. and b) *finger spreading movement* (interval-type class) when the hand itself stays in place, suitable for interval type motives. Less fundamental type is the c) *hand turning movement* (triadic class), where the hand and fingers stay in place, but the hand is turned so that thumb (1), middle finger (3) and little finger (5) touch the keyboard in different times and produce a triad.

The playing movements are represented using *movement-class*. The patterns represented are phase-locked, which means that the starting point (in relation to the position in the bar) of the pattern does not change. (The same pattern cannot start some time in 1st beat and in the next time in 2nd beat). Patterns have to start in strong beat position. Only one chord is used during the pattern.

The scale-type class which is a subclass of movement-class represents the whole hand movement. The main functionality of the scale-type class is that it transforms the whole pattern to the nearest harmonically suitable point. This sub-class allows for side notes also.

The finger spreading movement is represented by *interval-type class*. This sub-class allows transformation of the intervals, without transposing the whole pattern. Normally no side notes are allowed in this class. Its basic functionality is to "move fingers" so that nearest notes which are members of the current chord are reached.

The hand turning movement is represented by *triadic-class*. This sub-class tries to find closest possible transformation of the original triadic pattern to support new harmony. The triadic class is quite natural addition to the other two classes both because it facilitates the usage of all three pitches in the chord and also because it simulates very natural hand turning movement.

The transformation of precomposed motives was restricted to pitches only. The phase lock was used to lock the start of the motive to original position of the bar as well as length lock to lock the motives length. Harmonic pitches were forced on accents and side notes could occur only in non-accented positions. The resulting pitches were mapped to diatonic scale and put out to normal music notation. For the interval-type transformation it was necessary to develop additional functionality to find the most suitable pitch changes for given situation. The most suitable pitches are constrained by the harmonic inversion and the intervals of the original motive. The motives were also given information about the previous motive, so that it was possible to make the transition to the next one smoother.

3. RESULTS

Several test runs using the model was made using different sets of precomposed motives. The resulting music was generally very homogenous and fluent. Because different motion types were used the motives were transformed harmonically in inconspicuous way.

The Figure 2 shows one bar of two-voice piece generated by CMS test system. In the example there is a chord sequence I-VI-I. In the upper part one can notice the interval type transformation while in the lower voice there is a scale type transformation. The harmonic changes are handled without problems. Tests made using larger polyphony showed similar results: the motives were correctly transformed according to harmonies and the integrity in the motives prevailed (Figure 3).

In figure 3 one can see also the triadic motive (highest voice, first bar, first quarter) being transformed in several places (third voice, second bard, second quarter and third quarter in inversion).

4. DISCUSSION

Because only the harmonic transformation of the motives was studied the used MCS motives were precomposed. It is possible to compose also the patterns automatically, although for the current study the motivic patterns were manually composed.

This means that the rhythm and phase-position had already been selected to be suitable for current composition. Also the approximate intervals as well as interval directions were preselected.

The results demonstrate the MCS-system ability to transform and modify the patterns so that they are suitable for given position. The deterministic and systematic modifications of the patterns result in quite coherent and fluent musical texture.

In the current model of MCS there were no voice-leading rules at all. The results are satisfactory however. It can be assumed that this is the result of the patterned, not melodically oriented style.

5. CONCLUSION AND FURTHER RESEARCH

A tentative system for experimenting with motional composition strategy has been described. Only few motion types was considered and a very simple system was used to combine the motives transformed by different motion types. The results show however that the system can be potentially effective when doing stylistic simulations of certain pattern based musical styles. Further research is required to discover the real possibilities of the MCS, the use of other movement-types and more integrated ways to combine the movements. Another issue is also, that the current model is designed only for diatonic music and diatonic harmonic transformations. The inclusion of chromatic changes of the patterns could result in fundamental changes in the whole movement strategy, which do require a new model.

The MCS can establish pattern-rhythmic and harmonic-melodic integration with very simple means, thus enabling effective composition with minimum of (verbal-logical) thinking effort required. This supports the hypothesis that such simple strategies can be an integral part of human compositional skill. These strategies enhance the synergy of coherence, intensity and complexity in music.

ISBN 3-931852-67-9
ISSN 1617-6847

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ISBN 3-931852-67-9
ISSN 1617-6847

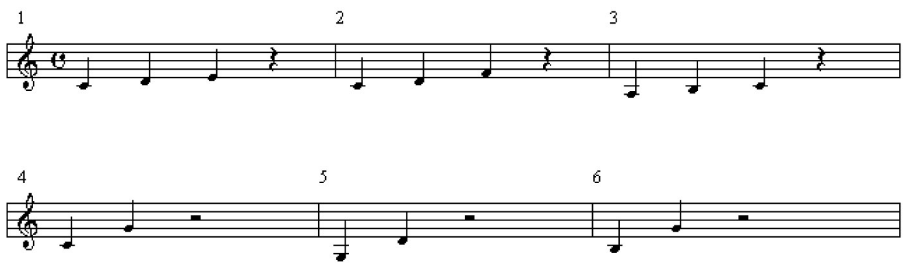

Figure 1: In the bars 1 – 3 the scale-type pattern is transformed from C-major to F-major. In the bars 4 – 5 a interval type pattern is transformed from C-major to G-major. The bars 2 and 4 are 'bad' transformations, bars 3 and 6 are 'good' transformations resulting from the use of MCS.

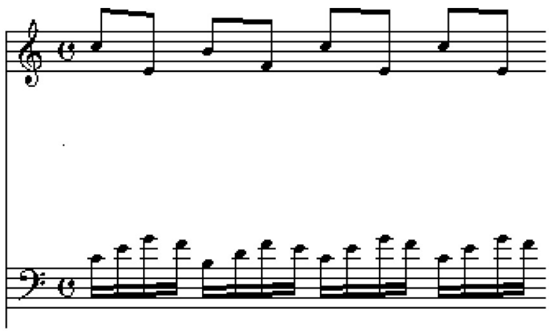

Figure 2: The upper line uses interval-type transformation and the lower line uses scale-type transformations. The harmonic sequence is I-V-I-I (C-G-C-C). The pattern length is one quarter note.

Figure 3: A four-voice example of free counterpoint using MCS.

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