THE IMPORTANCE OF HUSSERL’S PHENOMENOLOGY OF INTERNAL TIME-CONSCIOUSNESS FOR MUSIC ANALYSIS AND COMPOSITION

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ABSTRACT

Starting with Edmund Husserl’s seminal text[7] we would like to explore in this paper how musical perception is based on the conscious reduction of acoustic and spatio-temporal diversity into unity. In his lectures Husserl exemplifies his views with an analysis about the perception of a single sound and a sequence of sounds within a melody. They deliver an informative basis for us in order to rethink the perception of musical time and the perception of rhythms in particular. We demonstrate the impact of his phenomenology on music analysis and composition.

1. INTRODUCTION

Husserl’s lectures have been very influential on musicians and composers during the past century. We mention the conducting school of Sergiu Celibidache, especially his student Markand Thakar[16][15], Husserl influences on Henri Bergson and through him on french composer Charles Koechlin. Furthermore, we see references to Bergson in Susanne Langer[9] and we find a discussion of her views on ‘time as passage’ and references to Koechlin and Bergson in an essay by Elliott Carter[2][12]. It is also noted that the Berlin school of Gestalt-Psychology has its roots in the school of Brentano, with whom Husserl, Carl Stumpf and Christian von Ehrenfels studied at the same time. There are numerous references to Gestalt-Psychology in the wider musicological field: from Diana Deutsch’s Psychology of Music[3] over Tenney’s Meta-Hodos[14] back to Heinrich Schenker’s Ur-linie[11].

2. RETENTIONS AND PROTENTIONS

Husserl’s term of retentional consciousness[7] is related to what cognitive psychology later describes as working memory. The counterpart to the retentions are the protentions that point towards the horizon of expectations. The origin of the protentions are the now-points. Protentions are expectations about the immediate future. They are born immediately out of the now-point and are derived from the current perceptions, which reside in the impre- sional consciousness. The consciousness compares permanently the contents of the perception originating from the now-point with retentional phases of earlier content within the working memory. Those phases sink further down into unconsciousness the more distance is created between the temporal position of a phase and the now-point. On the other hand, there is a comparison process between the current perceptual content and past protentions. We assume that learning processes originate from here, which influence the generation of further protentions.

Recently, David Huron[6] drew from the current body of research in cognitive musicology with regards to learning and expectation processes in music listening in order to develop his own ITPRA theory. Huron’s focus is on the emotional responses to expectations that root deeply in the history of human evolution.

Based upon Husserl’s Phenomenology and upon notions of the Gestalt-Psychology we programmed tools that analyse music recordings in search for temporal expressive profiles of performances and which generate transcriptions representing the underlying score[1]. To achieve these goals we had to develop a deeper understanding about the perception of rhythmic Gestalten and how musicians express themselves through timing. This led also to notions of self-organisation, which feed back into composition techniques of polyphony and variation.

3. ONSET RHYTHMS

The onset of a sound is very important for the perception and recognition of musical timbres and the learning of timbre categories. “[...] Researchers [...] have found that [sound source] identification relies on onsets. Identification is accurate if listeners hear onsets, and poor if they don’t. [...] the lack of onsets made it harder to identify the blown instruments in particular.”[8] If the presence or non-presence of the onsets are of such an importance it might well be that their occurrences leave markers in the consciousness which enable and support certain types of rhythm processing in the brain.

From the phenomenological point of view an onset is a primal impression from where a field of running-off continua starts to develop that belongs to the entire time-object ‘sound’. Husserl states that the now-point is a “creative now”, from where a chain of ever new now-points starts. Husserl is then interested in the effects on the intentional consciousness caused by the primal impressions. The consciousness creates for every new now-point of the sound

1 ITPRA stands for the sequence of the following expectation-related responses: Imagination, Tension, Prediction, Reaction and Appraisal.
4. RETENTIONAL RHYTHMS

We would like to focus not only on one side of the double intentionality of the consciousness, which is becoming aware of the sounds as streaming entities of passage, but also to consider the other intention understood by Husserl and also by Hegel[4], which leads to the awareness of rhythmic relationships between and within sounds, their dynamism and their self-induced organisation.

Husserl speaks of the consciousness of succession. It means that the relationship of two sounds (A - B) sinks down in the consciousness and its content changes as well as its perception through the flow of consciousness, because the consciousness of the individual sounds A and B as well as their relationship remain within the retentions that Husserl calls the primary memory. These are the reference points for all future sounds, whose new relationships are integrated with the past sounds and relations through the retentional memory. Here all sounds are being continuously transformed “the way that” they appear.

The physical inter-onset-time between the sounds A and B is of main importance for the perception of the duration of sound A. Although a pause might happen after A for reasons of articulation, A might have decayed before the attack of sound B, their relationship remains characterised by the full time span between them. Of course, one can connect this pause with both sounds and obtain a relation of three elements. With regards to articulation and phrasing this type of musical silence between notes becomes more stringent and convincing if it is carried out with proportions in mind, proportions that take care of the conscious participation of all three elements in that sequence: A - silence - B. It is also clear that the now-points of the onsets and the perceived durations and relationships between different sounds remain at the same position in time within the retentional consciousness. Only in this way it is possible to learn and to recognise rhythmic categories and their Gestalten. According to Husserl, this is due to the a priori condition of the homogeneity of absolute time and has obvious implications for the perception of time objects.

It is now possible to draw a map of the original time field within the retentional consciousness. From the continuum of the now-points we select only the note onsets and inter-onset times. It is further assumed that the memory keeps the time-object ‘note’, which consists of its onset, its sound continuum and its duration, within a continuous feedback loop. The following example in figure 2 illustrates the time field by using a ternary rhythm as its base.

The original rhythm is presented here on the 1st staff
with the next four retentional layers on separate staves belows. Every note on the retentional layers represents the starting point of a new cycle of the feedback loop that keeps the original note as a time object in memory. Lines connecting the notes illustrate the sequence of onset repetitions per feedback loop. The crossovers of the sequences are based on the different durations within the original rhythm.

This polyphony of retentional rhythms has a number of remarkable properties. All layers are different from each other. None of them is identical to the original rhythm E1. E2 is always in sync with E1 because of the definition of inter-onset time. The more levels are added, the longer the new level and the entire cycle becomes. This is of course determined by the structure of the original rhythm. Its composed ritardando via increasing note durations is replicated through the entire cycle of all levels together. On the other hand, a composed accelerando would certainly lead to compressed versions of the rhythm on the retentional levels. The density of onsets is increasing at the beginning and decreasing when the perceived rhythm has ended. Short durations within the perceived rhythms are running faster through all levels than long durations. The change of short and long durations leads also to crossovers of the past now-points, i.e. the trajectories of the running-off modes (Husserl) diverge or converge at points that are determined by the durations of the perceived rhythm. At certain moments there are simultaneous onsets, which means the feedback-loops become synchronised. How many synchronisation points happen is again determined by the perceived structure. We think that those sync points between the retentional layers and the perceived layer have an influence on the perception of beat or tactus and that deviations from the sync enable listeners to follow tempo changes with adequate response. On the flip side one can say that certain rhythmic structures are designed to create a high number of these sync points whereas other designs want to more or less avoid them. At least one can say that because of this structure of internal time consciousness every rhythm perceived, even if its only a single voice, has an internal tendency to create a polyphonic network of its own. More than that, none of the retentional layer shows a simple imitation, a delayed version of the perceived rhythm but presents us always with a variation. It would be therefore most interesting to study classical polyphonic pieces whether they show any relations between the rhythms of voices that could have been derived from a retentional version of a main voice.

A second example illustrates the properties of the retentional rhythms. The original rhythm in figure 3 is taken form Elliott Carter’s 2nd string quartet and it is a composed accelerando. The continuous shortening of the durations leads to a lense-like contraction of the rhythms on the retentional layers. The shortest layer is .75 quarters long with 4 onsets, whereas the original has 7 onsets within 4.5 quarters. Beyond this point the structures expand again. We presume that the compression of the first layers reflects and amplifies the perceptual effect of the accelerando.

When investigating how many onsets are in sync in our example and writing them into a score where the notes on the first staff represent one onset per note, the second staff represents two onsets per note, the third one three onsets and so on, we obtain the following result (see figure 4).

We assume that a high number of synced onsets within the retentional layers contribute to the perception of a beat or tactus. More examples are published on our research website: http://dream.cs.bath.ac.uk/transcriptions/

It might seem problematic that a notated sequence of durations is only a representation, which is not to be confused with a real musical performance that always produces unique spatio-temporal phenomena and is therefore unrepeatable. On the other hand, notation is the basis for many western compositions and performances. Research has shown that rhythmic categories notated in the score are also correlated with a corresponding class of perceived rhythms [5][10]. It is well known, that even the simplest rhythmic ratio is never played with mathematical precision. But within the cognitive domain they remain simple ratios, because as we have seen every proportion is embedded in a network of relations. And only on the basis of comparisons within the retentional consciousness a listener is able to learn, form and recognise rhythmic categories out of groups and classes of similar proportions. Each of the rhythmic categories represents then a field of possible realisations.

5. COMPOSITIONAL APPLICATIONS

The formula for the generation of retentional onset maps is given a stream of onsets. As opposed to a sequence of notes it is also possible to perceive changing spectral properties as rhythms within a single sound. According to our phenomenological analysis each duration will be kept
for a certain amount of time in a feedback loop within the working memory. We present the following examples showing a creative application of the analysis. The formula is:

\[ ER_k = EW_k + n \times ZW \]  

with \( k \) := index of the onset in the sequence, \( n \) := a natural integer, \( ER \) := onset of the feedback loop within the tentional layer \( n \), \( EW \) := onset time within the perceived layer, \( ZW \) := inter-onset time within the perceived layer as \( EW(k+1) - EW_k \).

If \( n \) is an integer > 0, the formula generates the onsets of the \( n \)-th tentional layer. The chances are then relatively high that any \( ER_k \) may coincide with a \( EW(k+i) \), with \( i \) as an integer > \( k \). But if \( n \) is a rational number > 0, the chances are relatively high that any \( ER_k \) may not coincide with a \( EW(k+i) \), but rather falls in-between inter-onset times of the perceived layer. Instead of discrete tentional layers (with \( n \) as an integer) there is then a time field with an infinite number of layers between the discrete layers. If \( n \) changes for consecutive \( k \) of onsets one obtains proportional transformations of the inter-onset times within a tentional layer. If \( n \) changes for each one of the individual layers one obtains non-linear trajectories between the onsets of the feedback loops leading downwards from layer to layer. If \( n \) is < 0 one obtains the inverse of the principle, i.e. a given rhythm would be mapped on a fictitious rhythm in the past, as if the fictitious rhythm in the past would be the 'perceived' rhythm and the given rhythm would be a tentional layer of that fictitious rhythm. This negative principle again offers the same options as before, i.e. \( n \) as an integer or a rational number, changing from one onset to the next onset or between individual layers. In the end one can imagine free trajectories through any point of the tentional time field. In this manner one generates new rhythms over and over again, but always based upon one and the same single line of durations.

6. CONCLUSION

Husserl gave us a lot of insights into what happens within the consciousness of a listener when perceiving sounds and sequences of rhythms. We have shown the impact that Husserl already had on many musicians in the past century and pointed to important questions that still remain, i.e. can we prove in field experiments the existence of tentional rhythms and would they be useful in order to write better programs for beat and tempo tracking? We also demonstrated a huge potential for musicological research on rhythm composition and discovered also a new organic way of dealing with rhythms that would be useful for composers and musicians.

7. REFERENCES


