



UvA-DARE (Digital Academic Repository)

Temporal expectations and their violations

Ladinig, O.

Publication date
2009

[Link to publication](#)

Citation for published version (APA):

Ladinig, O. (2009). *Temporal expectations and their violations*. [Thesis, fully internal, Universiteit van Amsterdam].

General rights

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

This thesis contains a collection of papers that investigate temporal expectations, by looking at their violations and considering their relations to musical expertise (rule-based learning through formal music training), exposure (implicit learning of statistical regularities), as well as innate cognitive mechanisms. The term ‘expectation’ implies an active role of the listener, who constantly predicts what events will happen at what time in the future. The more confident the predictions are, the more will an outcome that is different to what was predicted lead to a feeling of surprise or violation. This makes the responses to violations of expectations informative about underlying cognitive schemes that generated the expectations.

In the presented work, two kinds of expectation determined by different salience of events in rhythmic patterns were shown to be active (although this is not to say that there are not many other expectations). The first one is based on hierarchical structuring of event salience. In this regard, it could be shown that meter is induced in all listeners, regardless of the level of formal musical training. Hierarchical structuring could be found on all levels of a musical measure.

Since the present study dealt only with the most common meter in Western music, namely 4/4, further investigations will be made with other available simple meters like 2/3, 3/4, and 6/8, and the study eventually will be extended to compound or additive meters.

Furthermore, it was shown that the most fundamental instance of meter induction, namely the discrimination of the downbeat from other positions in a rhythm, was active in newborn infants, which gives rise to exciting speculations about the origins of music and, in particular, rhythm, as well as about a possible fundamental predisposition of the cognitive system to structure novel incoming information in a hierarchical way. As a logical next step, the design is currently being extended to allow probing other metric levels in newborns as well, as such levels could be found in adults with and without formal music training. To explore the nature of beat and meter even further, non-human animals could serve

as potential subjects in the future.

The second type of expectation based on event salience that was considered in this thesis was the serial position effect, known mainly from memory research. It could be shown that for non-musicians, as well as for musicians (but less so), a mechanism was active that can be seen as complementary to hierarchical processing. Primacy and recency effects appeared, which led to an increased salience of events located at the beginning and at the end of a rhythmic pattern. Known from memory experiments showing that items at the beginning and at the end of sequences are recalled faster and memorized longer, it can be argued that these mechanisms can facilitate the perception and processing of rhythmic sequences as well. Since this effect has received little consideration in the music literature, it will require more systematic studies to understand the importance of serial position, and its interplay with hierarchically structured processing. The serial position effect appeared to be more pronounced in non-musicians than musicians, although there were few differences in the hierarchical processing between those groups. However, both mechanisms seem to be active even in subjects located at the ends of the expertise continuum. The serial position effect was only studied by means of listener's judgments in the course of this thesis. Further information could be gained by investigating this mechanism with listeners being in an inattentive state, by employing electrophysiological methods.

On a much smaller time-scale, support was found for the hypothesis that listeners are sensitive to deviations on a temporal micro-level, being able to distinguish tempo-transformed from non-transformed performances, by only focusing on expressive timing. This is supporting previous evidence that timing does not scale proportionally with tempo, with the new finding that also non-musicians are sensitive to distortions. A more surprising finding was that not only the level of formal music training was responsible for this sensitivity, but that exposure to a certain musical genre was giving the listener an advantage in spotting the deviations. For sensitivity to violations on a minute scale, formal musical training was even less an explanatory factor than for expectations based on event salience, and the crucial parameter was primarily the familiarity with the respective musical style.

Another issue that has received attention throughout all chapters of this thesis, and that deserves consideration in future work, is listening competence. Formal musical training alone was shown to be too crude a measure to classify listeners as competent or not regarding skills that do not involve musical performance. A first step in this direction was taken by considering exposure to certain musical styles in classifying a listener as being potentially sensitive to that particular style. Another measure that was developed, but did not become part of this thesis, is based on the breadth of knowledge a listener has regarding various musical styles. This measure asks for familiarity with (not preference for) a variety of genres and styles, intended to measure the degree of musical eclecticism.

To conclude, this thesis contributes to the growing evidence that the perceiver

shapes the percept, by emphasizing the active role of the listener in rhythm perception and processing.