

Open Peer Commentary

Contextual and cultural factors of consonance and dissonance notions in the *Trecento* and their relevance to contemporary music perception and cognition theories

Nicola Di Stefano

FAST – Institute of Philosophy of Scientific and Technological Practice
Università Campus Bio-Medico di Roma
n.distefano@unicampus.it

The paper focuses on polyphonic compositional practices of *Ars nova* and *Trecento*, highlighting the importance of music cognition perspective to better frame and understand the occurred changes in the history of music. In the present commentary, I would like to emphasize some features of consonance and dissonance notions of *Trecento*, in order to evidence their relevance to music theory and, at the same time, to music perception and cognition theories.

Most of the 14th Century definitions of consonance refer directly to Boethius (Fuller 1998, p. 471-473), evidencing, on one side, the pleasant sensation produced by consonances, and, on the opposite side, the harsh sensory effect of dissonances.

Besides giving a series of counterpoint rules (see Leach 2000), medieval theorists also considered what we may call the “contextual” factors of harmony. In this sense, Johannes Boen, in his *Musica* (1357) evidenced the role of anticipation (which may be seen as a notion related to the Stoics πρόληψις, *prolepsis*) in consonance and dissonance perception. In Boen’s theory, the sweetness and pleasantness of the consonant resolution of a sequence of intervals is somehow prepared and announced by the whole sequence, so that the lack of the last interval would be perceived as negative. The ending interval is therefore perceived as the coherent conclusive part of a specific harmonic context, and not just as an isolated dyad or triad. While listening to harmonic progressions, the ear is induced to expect closure in specific consonances, in particular perfect consonances, which eventually provide pleasant sensations. In this sense, the medieval anticipation theory can be seen as the theoretical basis of the tension-resolution model (Fuller 1992) of harmonic progression: the higher the harmonic tension, the higher the listener expectation of the consonant resolution. Recently, David Huron’s work highlighted the importance of expectation and violation to understand how music evokes emotions (Huron 2006).

In addition to contextual factors, medieval theorists recognized also the actual influence of cultural factors in consonance perception, in particular when they refer to

the differences among people of different regions and epochs in the aesthetical evaluation of musical intervals or compositions (see Fuller 1998, p. 475).

The dependency of music perception in general, and of harmony perception in particular, from both contextual and cultural factors has been widely discussed and investigated in the last decades.

As far as concerns the role of anticipation, i.e. contextual factors, recent studies largely confirmed its actual influence for melody and harmony perception (see for example Schmuckler 1989; Pearce and Wiggins 2012; Tillman et al. 2014). Neurophysiological evidence proved that closure incongruity (i.e. violation in expectation) evokes a specific response both in music experts (James et al. 2008) and in non-musicians (Koelsch et al. 2000), thus strengthening the medieval idea of anticipation and expectation, which nowadays constitutes a prerequisite for the understanding of the mutual relationship between musical elements (i.e. melody and harmony). Since harmonic structures are essentially based on the alternation between consonances and dissonances, they are strictly related also to the expectation of consonant closure (or with its unexpected violation).

Along with the role of a neuro-biological level, different theories of consonance highlighted the actual influence of cultural factors in the aesthetical judgments (Cazden 1945, 1980; Lundin 1947). Pioneering cross-cultural studies mainly focused on the different listeners' evaluation of western and non-western intervals (see for example Butler and Daston 1968). More recent studies emphasize the influence of cultural differences (see Balkwill and Thompson 1999; Balkwill et al. 2003; Trehub et al. 2015), or individual musical training (see Corrigall and Trainor 2009). The cultural factors have been considered as a trait of specific culture or region, which does not affect the existence of universals in music. Nevertheless, universals are rarely concerned with specific aspects of western harmony, such as consonance and dissonance, but with general aspects of musical language, such as the existence of scales, octave equivalence or melody transposition (see for example Harwood 1976; Fritz et al. 2009; Brown and Jordania 2013).

The evolution of musical language grounds on notions permeated with cognitive aspects. Therefore, as stated by Rotter-Broman, "music historians should be aware of implicit cognitive concepts in their analytical and historiographical methods". In our case, musical elements such as consonance and dissonance cannot be considered as separate from their psychological and cultural dimension. Medieval theorists were deeply aware of this aspect, and therefore, from *Trecento*, music theory opened up to the judgment of the ear and paid attention to the perception process, considering elements that are still under debate in the contemporary research on music perception and cognition.

Expectations in music perception and performance: How historical musicology can inform cognitive research

Frédéric Marmel

Manchester Centre for Audiology and Deafness (ManCAD)
University of Manchester
frederic.marmel@gmail.com

Dr. Signe Rotter-Broman's research points to the inappropriateness of interpreting early polyphony with modern concepts. Specifically, the author argues that describing the history of polyphony in the Middle Ages as a continuous tendency to increase the number of voices from one (monophony) to four is misleading. Trecento songs were often transmitted in both two- and three-voices versions. The contratenor voice played a different role than the other voices (cantus-tenor); there was a contrast between the fixed cantus-tenor counterpoint core and the freer (*ad libitum*) contratenor that played with listeners' expectations.

The author lists a number of potential difficulties when interpreting early music in historical musicology that are also relevant for music cognition research. Notably, the importance of taking into account the constraints of conceptual frameworks and of the cultural environment on musical practice when interpreting early polyphonies resonates with current concerns in music cognition research on improvisation (Ashley, 2009; Goldman, 2013). More generally, this work suggests that historical musicology research can be a source of inspiration for the study of the cognitive processes at work in musical practice.

The author warns the readers against comparing the contratenor/cantus-tenor distinction to a modern improvisation/composition distinction, as composition and improvisation processes were less distinct from each other than they are now. One question this raises for music cognition researchers is: How do neural processes involved in composition and improvisation compare? Composition and improvisation have often been compared (Larson, 2005; Goldman, 2013). Both are arguably complex cognitive practices that rely on formal knowledge, structural planning and mental hearing. Monitoring neural activity while composers/performers compose/improvise short pieces could be a window on the interaction between sensory, cognitive, and motor systems during musical practice.

Another potential link between the author's work and music cognition research comes to mind when the author mentions that music expectations in Trecento ballatas were being shaped by the structure of the poetry. The author makes a connection with cognitive studies investigating the effect of the temporal organization and the rhythmic structure of poetry and music on memory. How language structures (poems/lyrics) and music structures shape each other may be a research topic for which the confrontation of historical musicology and music cognition could be especially fruitful.

Broadening the *contratenor* horizon

Uri Smilansky
King's College, London
uri.smilansky@gmail.com

Any work that contributes to the debunking of still-prevailing linear concepts of music history and style-change is entirely welcome, especially when—as here—another important step is taken in explicitly demonstrating the mutual benefit in establishing interdisciplinary relationships between historical research and more self-consciously ‘modern’ fields of inquiry such as music cognition, neuro-musicology, computational musicology and the philosophy of music. In this vein, I would like to emphasize the two-way potential of such exchanges. It is clear, for example, that careful application of statistical analyses to large data sets can benefit our understanding of any musical oeuvre. More specifically to the medieval context, our understanding of polytextual practices will doubtlessly deepen with a greater knowledge of the brain’s ability to process complex linguistic structures. Nevertheless, our growing realization of just how differently the medieval saw, understood, and experienced the world can act as an important buffer between the analyses of modern trends in musical cognition and asserting their results as applicable to all music.ⁱ Returning to the present contribution, I would particularly like to praise the section concerning the vital role of the creation and manipulation of expectations in musical language and expressivity, and its application to Medieval styles. Nevertheless, in discussing the specifics of *contratenor* behaviour, *contrapunctus* and musical language, I would like to point towards a few areas where a closer look would yield a more complex image.

Rather than a single edifice, *contratenors* range from integral parts of the conception of songs to afterthoughts temporally, geographically and stylistically removed from the original setting. Of these, some operate as simple, mechanical filler-voices while others self-consciously interact with or subvert their host compositions. The voice by Matteo da Perugia presented one such example, wherein his fondness of *Ars subtilior* stylistic traits caused the addition to undermine the harmonic and rhythmic language of the original. Third voices can also change character according to genre and purpose: liturgical polyphony behaves subtly differently from the song repertoire considered. Even in polyphonic songs, texting patterns also influences the relationships between voices. Other mediating factors between composer and manuscript include accidents of circulation and the degree of intervention applied by compilers and copyists.

In analyzing the question of musical language, recent scholarship has fine-tuned our understanding of the relationship between *contrapunctus* theory and actual composition, whereby our expectation for an adherence to strict rules of contrapuntal grammar are substantially reduced.ⁱⁱ This is not to say that such grammar does not exist: many other studies have demonstrated various linguistic and grammatical characteristics in both the behavior and notation of fourteenth century music.ⁱⁱⁱ

Finally, practical considerations can be added to the discussion of improvisation and counterpoint: in a predominantly oral culture where even written music is not presented in score, careful holistic analysis is all but impossible for anyone without an exceptional musical memory and imagination or very deep pockets and willing musicians. Therefore, anyone attempting to add a voice needs a reliable reference point. The *tenor*, with its simpler rhythms, clearer sentence structure, formulaic progressions and low range is the obvious point of call. Expectations apply to the performer just as much as they do to the listener, making it possible to 'read' the polyphony by looking only at this voice: its behavior suggests the location and pitch of cadences, and highlights places where a third voice can enjoy freer or more constricted movement. All the subversions of cadential arrivals discussed in the example given follow this logic: in b. 5-6 the avoidance of full *contratenor* cadences is consistent with the shortening of arrival notes in the *tenor*, while the protracted *tenor* arrival in b. 15-6 hints at the availability of wriggle-room for a *contratenor* to take melodic or harmonic initiative. Such procedures are not fail-proof, but then again, many surviving third and fourth voice additions regularly clash with the higher voices. In this context it is noteworthy to mention that added voices often offer 'better' *contrapunctus* for the *tenor* than the more holistically worked-out *cantus* lines. This tendency can be explained by some of the procedures used for such additions, by which the tenor was taken as reference point and interpreted as creating harmonic and cadential expectations that are then amplified by the new voice.

Structure knowledge and expectations in the contemporary brain processing early polyphonic music

Barbara Tillmann
Lyon Neuroscience Research Center
barbara.tillmann@cnrs.fr

Rotter-Broman proposes historic musicology to integrate concepts of cognition, taking into consideration the brains of composers and listeners. She discusses the potential cognition of composers and listeners of the 14th century, in particular regarding musical expectations.

Expectations and the "predictive brain" have been the subject of numerous research projects in cognitive sciences and neurosciences. The brain extracts regularities from the environment, builds up knowledge and develops expectations for future events. Expectations facilitate perception and memory, and have been attributed a role in musical expressivity and emotions. In addition to cognitive, knowledge-based expectations, there exist sensory expectations that are based on sensory information stored in short-term memory buffers without requiring knowledge. Music cognition research has pointed out the need to control experimental materials (e.g., used musical pieces, melodies) to provide evidence for cognitive expectations, without low-level

sensory influences. Of course, all findings were observed for listeners of the 20th/21st century, whose brains can be studied in the laboratory.

How can we study cognitive processes of “ancient listeners”, which are based on listeners’ exposure to the new music of their time (early polyphonic music) and their knowledge acquired by mere exposure? We are necessarily restricted to remain at the level of hypotheses and speculations, but further insights might be provided by tools of cognitive sciences.

1) Computational approaches might allow simulating the contemporary brain (see Pearce and Eerola, this issue). This requires extensive analyses of the musical corpus to extract regularities, expose computational models to learn these regularities and simulate expectations and perception for other musical pieces. This approach has been successfully applied for contemporary listeners of Western tonal music and music of other cultures.

2) A useful source of information might be provided by analyzing the traces left by the predictive brain, notably by analyzing production errors of scribes copying scores. Indeed, errors might be created by the predictive brain, such as, for example, an “over-correction” or over-regularization (i.e., making it closer to a prototypical structure) than what the composer actually wrote. Research in musicology might find inspiration in music cognition research investigating musical performance. Analyzing performance errors has provided insight into underlying cognitive processes, as for example memory limits (i.e., how far can performers plan ahead, and the influence of tonal structures) or the influence of performers’ tonal knowledge on the played tones (i.e. replaced tones are more likely to be in-key tones than out-of-key tones).

These two examples do not focus on specific individual pieces or societal contexts, but generalize across listeners and musical pieces. Generalization might be a first step to help further understanding specificities and/or is complementary to studying specificities. This could be compared to the approaches used in either general cognitive psychology or differential psychology (searching for communalities between individuals vs. inter-individual differences). Interestingly, this reflects a recent development in music cognition research, which has started to investigate inter-individual differences and differential perception as a function of musical style.

It could be a fruitful exchange between musicology and cognitive sciences to share information about brains exposed to a musical environment from a different historic epoch, thus being complementary to cross-cultural research. If implicit learning, knowledge and expectations are general features of brain functioning, we should find also there some traces of the above-mentioned characteristics of cognition and of the predictive brain.

Contratenor parts in polyphonic songs: A Commentary on Signe Rotter-Broman

Edward Wickham

St Catharine's College, University of Cambridge

eaw37@cam.ac.uk

The challenge to musicologists of framing arguments about cognition in Late Medieval music is at the very least 'not unproblematic'. Discussion of how we might listen with a 'period ear' to the music of the past has been enthusiastic and wide-ranging in recent years,^{iv} but in order to access this level of engagement with a repertory such as the Trecento ballata, one needs to clear a path through a pile of polemical baggage. Under investigation is the way we, or our putative Trecento audience, might perceive contrapuntal grammar, and the fulfilment or frustration of expectations based on a knowledge of that grammar: such investigation requires consideration of performance factors such as whether the 'added' contratenor is sung, and sung with or without text.^v It also begs questions of the cultural environment for performance, and who might the 'connoisseurs' be who are so accustomed to a well-turned dyadic cadence that they smile knowingly when their expectations are confounded;^{vi} as they are in bar 15 of the Bartolino da Padova ballata.

Yet we should not shirk the challenge altogether, and the author offers us some important insights as she engages with it. Of particular interest is the notion of a vocal line whose character is shaped by the complex interactions of improvisation, memory and notation. Just as all performance, however prefabricated, has an element of improvisation, so all improvisation has elements of the prefabricated; and, as Anna Maria Busse-Berger reminds us, memory and orality operate in a different way when one can imagine the text as notated.^{vii}

With this in mind, it might be instructive to take a closer, comparative look at the alternative contratenors with which *El no me giova* is associated. The contratenor presented in the Reina and Squarcialupi manuscripts is, as contratenors go, remarkably insipid. Rarely moving in intervals of more than a third, it is repetitive, rhythmically unadventurous and, with the few exceptions observed by the author, highly predictable. It conscientiously reinforces the *senaria perfecta* mensuration while occasionally indulging in worthy but uninspired syncopation. By contrast, the contratenor ascribed to Matteo da Perugia in ModA is a virtuosic affair. It leaps about in a way typical of contratenors in early 15th century 'chanson format' repertoire – a style which has in the past been interpreted as indicative of instrumental performance, but could just as credibly be described as quintessentially, even 'hyper'-vocal. In its mensural organisation it plays sometimes with, sometimes against, the prevailing duple division of the semibreve, and rhythmically it is full of lively syncopation, imperfection and alteration. That this contratenor of Matteo is to be found on its own, without Cantus or Tenor, in the opening folios of ModA, a section devoted entirely to Matteo's polyphony, also suggests strongly that in this contratenor is invested a compositional ambition which is lacking in its counterpart.

Crucially, not all of the rhythmic complexity of Matteo's contratenor makes it to the sonic surface; nor is it always detectable in a modern edition. One striking example

occurs in bars 6-7 of the transcription, where the rising *a-b-c*' of Matteo's contratenor is rendered as three crotchets (note values having been quartered by the author). In ModA each of the three notational symbols here are distinct: the *a* is presented as a minim, which through alteration becomes worth two minims duration; the *b* is a void semibreve, reducing the semibreve in major prolation from three minims to two minims duration; and the *c* is a black semibreve, also reduced to two minims duration as a result of the minim which follows, and imperfects, it. There is a degree of notational artistry here which reflects a different relationship between composer and musical source to that which we observe in the simpler, Reina/Squarcialupi contratenor. I can imagine that insights gained from study of musical cognition might indeed help in examining the processes by which such different contratenors might come about: processes which involve varying interactions between the written and the oral, the improvised and the pre-fabricated.

Author's Response

Reply to the commentaries

Signe Rotter-Broman
Universität der Künste Berlin
rotter@udk-berlin.de

All commentaries share the conviction that expectation and anticipation play a vital role for the study of early polyphony and could be regarded as connecting point for further interdisciplinary studies. A closer look reveals that the commentaries clearly separate in two thematic groups depending on the disciplinary origin of the authors.

(1) The commentaries from the field of music cognition (Nicola di Stefano, Frédéric Marmel and Barbara Tillmann) highlight the interdisciplinary potential of the article and complement the argument in different valuable ways.

Nicola Di Stefano rightly observes the tendency of 14th-century music theory to explicit take up cognition-related categories like anticipation or closure. Even if the relationship of the treatises cited (e. g. Johannes Boen) to composers in Late-Trecento Italy cannot be clearly traced, this direction of research - i. e. to look for the period's sensibility to cognitive categories and processes based on studies of treatises, images etc. - is immensely productive and has already prompted valuable insights. One example is the pathbreaking study of Mary J. Carruthers^{viii} on the function of written texts in the memory-based culture of the Middle Ages.

Frédéric Marmel agrees that it is not appropriate to understand improvisation and composition as diametrically opposed processes. Following him, the distinction could

be questioned not only regarding medieval songs, but in today's surroundings, too. He regards this as a challenge for music cognition research on today's improvisation and composition processes and suggests to compare neural processes concerning today's musicians' activities labelled as 'improvisation' and 'composition'. Furthermore, he responds to the idea that the structure of the poetry and its relationship to temporal organization of the music are playing an important role within the contratenor concept in the trecento. He thus gives future research on questions of the temporal organization of medieval songs cognitive air under the wings.

Barbara Tillmann's commentary encourages music historians to simulate the period brain's learning processes with the help of computational models based on a large-scale corpus of pieces in digital form. While there are some practical obstacles concerning 14th century music (i. a. establishing valid, 'processable' editions of liturgical and/or secular music from this time) the idea is notwithstanding worth discussing. As an important point for further interdisciplinary investigation she refers to the examination of musical „errors“, e. g. scribal errors recognizable in medieval sources, because they can be understood as indicators for activities of the „predictive brain“. Scribal errors have for a long time been at the core of editorial practice in musicology. In the field of the Trecento, Pedro Memelsdorff recently has gained impressive insights concerning the Codex Faenza.^{ix} Even more generally, the interest in musicology for the phenomenon of „errors“ in music as a cultural, performative and notational category is currently vital.^x

Another important point is Tillmann's suggestion to study musical performers' memory limits in temporal extension („How far can performers plan ahead?“) to which I will return below.

All authors from the field of cognitive studies are highly sensitive to the restricted possibilities of their disciplines to answer questions concerning musicians from the middle ages and would supposedly subscribe to Uri Smilansky's statement (with reference to the above-named book by Carruthers): „Nevertheless, our growing realization of just how differently the medieval saw, understood, and experienced the world can act as an important buffer between the analyses of modern trends in musical cognition and asserting their results as applicable to all music“.

(2) The propositions from the field of music history document above all the vital debate on 14th and 15th century contratenor practice which has been going on for some time in the field of medieval music. Uri Smilansky's plea for „broadening the contratenor horizon“ is significant for this research area, where in recent decades it has become increasingly obvious that „the“ contratenor is „no single edifice“, but is rather shifting from integral part to geographically and temporally removed „afterthoughts“. ^{xi}Smilansky himself gives many examples from the so-called *ars subtilior* in his impressive dissertation.^{xii} Smilansky objects mainly to two aspects of my analysis, namely the strict adherence to *contrapunctus* theory while recent research has offered a more differentiated picture, and to the *cantus-tenor* core as reference system whereas he sees the tenor as the best „readable“ voice for the singer conceiving a contratenor to a given *cantus-tenor*-core.

Here the general problem arises that, as I have to admit, the factual basis of my article with only one short music example can in no way provide a sufficient base for a discussion of these issues. The article is explicitly addressed to a non-specialist public, and my concentration on *contrapunctus* rules is partly due to the intended interdisciplinary audience because of the relatively easy possibility to introduce these rules to scholars from other disciplines. Smilansky's (and even Wickham's) points are part of a more specialist discussion in which I would primarily refer to my book *Komponieren in Italien um 1400*,^{xiii} where I have discussed several of the studies Smilansky refers to in detail.

Concerning the *cantus* as a representant for the song's structural core, I regard this as a specific trait for Late Trecento ballatas and madrigals, and it is, in my view, working thanks to the strong generic (i. e. musico-poetic) traditions of these genres. I admit that different ways of imagining the composition of contratenors are possible, depending on whether the song is imagined as accessed by the musicians through reading and playing from a manuscript or within a three-voice practice that is not necessarily bound to written transmission (which I have assumed). For the further development of hypotheses around questions like these, the above-mentioned suggestion by Barbara Tillmann to involve cognition research on memory limits for musical performance could provide additional help.

Edward Wickham, too, draws on the phenomenon of medieval contratenors as „complex interaction of improvisation, memory and notation“. He rightly observes that without a thorough historical research of the cultural environment of the stipulated Trecento audience the reconstruction of a ‚period ear‘ is highly problematic. In his eyes, one point is underrepresented in my argumentation, namely the vast aesthetic gap between the „insipid“ contratenor in the Reina and Squarcialupi codex on the one hand and the ambitious Matteo contratenor in *ModA* on the other hand. I am far from denying this difference, but I am less interested in compositorial qualities than in reconstructing common compositional procedures beyond the musical surface. In this respect, I find it noteworthy that the two stylistically contrasting contratenores share the deceptive tendencies at cadence points in the cantus-tenor core (b. 5 and b. 15). The question of „notational artistry“ falls in the same rubric. Here we should, though, keep in mind that it is not at all sure that Matteo actually *wrote* the *ModA* contratenor.

Apparently, issues of the late medieval contratenor practice, its relationship to cognitive capacities and its historiographic and aesthetic (re-)evaluation will keep us busy for some time to come.

References

- Ashley, R. 2009. *Musical improvisation*. In S. Hallam, I. Cross, & M. Thaut (Eds.), Oxford handbook of music psychology (pp. 413-420). Oxford, UK: Oxford University Press.
- Balkwill L-L, Thompson WB, Matsunaga R. 2003. *Recognition of emotion in Japanese, Western, and Hindustani music by Japanese listeners*. Jpn Psychol. Res. 46, 337–349.

- Balkwill L-L, Thompson WB. 1999. *A cross-cultural investigation of emotion in music: psychophysical and cultural cues*. *Music Perception*, 17, 43–64.
- Brown S, Jordania J. 2013 *Universals in the world's musics*. *Psychol. Music* 41, 229–248.
- Butler J.W., Daston P.G., 1968. *Musical consonance as musical preference: a cross-cultural study*, *The Journal of General Psychology*, , 79, 129-142
- Cazden N., 1945. *Musical Consonance and Dissonance: A Cultural Criterion*, *The Journal of Aesthetics & Art Criticism*, Vol. 4, n. 1, 3-11
- Cazden N., 1980. *The definition of consonance and dissonance*, *International Review of The Aesthetics and Sociology of Music*, 2, 123-168,
- Corrigall K.A., Trainor L.J., 2009. *Effects of Musical Training on Key and Harmony Perception*, *Ann. N.Y. Acad. Sci.* 1169, 164–168,
- Goldman, A. (2013). Towards a cognitive-scientific research program for improvisation: theory and an experiment. *Psychomusicology: Music, Mind, and Brain*, 23, 210-221.
- Fritz T, Jentschke S, Gosselin N, Sammler D, Peretz I, Turner I, Friederici A, Koelsch S. 2009 *Universal recognition of three basic emotions in music*. *Curr. Biol.* 19, 573–576.
- Fuller S., “*Delectabatur in hoc auris*”: *Some Fourteenth-Century Perspectives on Aural Perception*, *Musical Quarterly*, 82 (3-4), 466-481, 1998.
- Fuller S., 1992 *Tendencies and Resolutions: The directed progression in Ars nova Music*, *Journal of Music Theory* 36,2, 229-257
- Harwood D.L., 1976. *Universals in Music: A Perspective from Cognitive Psychology* «*Ethnomusicology*», 20, 3, 521-533,
- Huron D., 2006. *Sweet Anticipation: Music and the Psychology of Expectation*. Cambridge, Massachusetts: MIT Press,
- James C.E., Briz J., Vuilleumier P., Hauert C.-A., Michel C.M., 2008. *Early neuronal responses in right limbic structures mediate harmony incongruity processing in musical experts*, *Neuroimage*, 42, 4, 1597–1608
- Koelsch S., Gunter T., Friederici A.D., Schroeger E., *Brain Indices of Music Processing: ‘Nonmusicians’ are Musical*, *Journal of Cognitive Neuroscience*, 12, 3, 520-554, 2000
- Larson, S. 2005. *Composition versus improvisation?* *Journal of Music Theory*, 49, 241-275.
- Leach E.E., 2000. *Counterpoint and analysis in fourteenth-Century song*, *Journal of Music Theory*, 44, 1, 45-79
- Lundin R.W., 1947. *Toward a Cultural Theory of Consonance*, *The Journal of Psychology*, Vol. 23, 45-49
- Pearce M.T. and Wiggins G.A., 2012. *Auditory Expectation: The Information Dynamics of Music Perception and Cognition*, «*Topics in Cognitive Science*», 4, 625-652
- Schmuckler M., *Expectation in Music: Investigation of Melodic and Harmonic Processes*, *Music Perception*, 1989, 7, 2, 109-150
- Tillmann, B., Poulin-Charronnat, B. & Bigand, E. 2014. *The role of expectation in music : From the score to emotions and the brain*. «*WIREs Wiley Interdisciplinary Reviews: Cognitive Science*», 5, 1, 105-113
- Trehub S.E., Becker J. and Morley I., 2015. *Cross-cultural perspectives on music and musicality*, «*Philosophical Transaction B*»,

¹ See, for example, Mary Carruthers, *The Book of Memory: A Study of Memory in Medieval Culture* (second edition: Cambridge, 2008).

ⁱⁱ Sarah Fuller, 'Contrapunctus Theory, Dissonance Regulation and French Polyphony of the Fourteenth Century' in Judith A. Peraino (ed), *Medieval Music in Practice: Studies in Honor of Richard Crocker* (Middleton, 2013), pp. 113-152.

ⁱⁱⁱ See, among others, Christian Berger, *Hexachord, Mensur und Textstruktur: Studien zum französischen Lied des 14. Jahrhunderts*, in *Beihefte zum Archiv für Musikwissenschaft*, xxxv (Stuttgart: Steiner, 1992); Thomas Brothers, *Chromatic Beauty in the Late Medieval Chanson: An Interpretation of Manuscript Accidentals* (Cambridge, 1997); Anna Maria Busse-Berger, *Medieval Music and the Art of Memory* (University of California Press, 2005); Nicoletta Gossen, *Musik in Texten, Texte in Musik: der poetische Text als Herausforderung an die Interpreten der Musik des Mittelalters* (Amadeus, 2006); Yolanda Plumley, *The Grammar of Fourteenth Century Melody: Tonal Organization and Compositional Process in the Chansons of Guillaume de Machaut and the Ars subtilior* (New York, Garland, 1996), as well as myriad articles and dissertations by Margaret Bent, Graeme M. Boone, Sarah Fuller's invaluable framings of the discussion of medieval harmonic language, Peter Lefferts, Elizabeth Eva Leach, Daniel Leech-Wilkinson, David Maw, Pedro Memelsdorff, Uri Smilansky, Jason Stoessel, Anne Stone, Reinhard Strohm, Dorit Tanay and the previously mentioned authors.

^{iv} Collections of essays on this topic appear in *Early Music* 25/4 (1997) on 'Listening Practice'; *Musical Quarterly* 82/3&4 on 'Music as Heard'; ed. Nikolaus Bacht, *Listening: Interdisciplinary Perspectives* in *Journal of the Royal Musical Association* 135 (2010)

^v For an overview of the debates on this issue, see Daniel Leech-Wilkinson, *The Modern Invention of Medieval Music* (Cambridge) 2002, pp 88-156

^{vi} See Christopher Page, *Discarding Images* (Oxford), 1993, pp 65-111 for discussion of the analogous notion of 'litterati' in the reception of the Ars Antiqua motet

^{vii} Anna Maria Busse Berger, *Medieval Music and the Art of Memory* (Berkeley) 2005, pp 45f. and Ch. 6

^{viii} Mary J. Carruthers: *The Book of Memory. A Study of Memory in Medieval Culture* (= *Cambridge Studies in Medieval Literature*, 10), Cambridge 1990.

^{ix} Pedro Memelsdorff: *The Filiation and Transmission of Instrumental Polyphony in Late Medieval Italy: The Codex Faenza 117*, PhD Dissertation, Utrecht 2010; id., *The Codex Faenza 117. Instrumental Polyphony in Late Medieval Italy. Introductory Study and Facsimile Edition* (= *Ars Nova, Nuova Series* 3), Lucca 2012.

^x E. g. as part of the research project „Beethovens Werkstatt: Genetische Textkritik und Digitale Edition“ at the Beethoven-Haus Bonn. Christiane Tewinkel (Berlin) is actually planning a research project on the cultural history of musical errors.

^{xi} Cf. the literature cited in n. viii and xiv in my article.

^{xii} Uri Smilansky: *Rethinking Ars subtilior. Context, Language, Study and Performance*. PhD Dissertation Exeter 2010.

^{xiii} Cf. n. iv in my article.