## MUSI 486/586: Corpus Methods in Music Research
## Instructors: Prof. Ian Quinn, Chris White
## Yale University, spring 2012
## Th 1:30–3:20 (Stoeckel 211)

### Course description

This course investigates computer–assisted methods for formulating and investigating empirical research questions about music at the "inter–opus" level — i.e., questions about musical corpora rather than individual works. We'll discuss the types of questions posed by researchers working with corpora, the role of empirical research in the field of musicology generally, and particularly its relationship to the specific questions of music theory. Students will learn the basics of programming in Python and will implement research questions using the music21 software package.

### Undergraduate prerequisites

All students should be familiar with music notation. In addition, students should have completed either a programming course or a course in music theory at Yale.

### Course requirements

All students will work weekly problem sets (programming exercises) for the first 8 weeks of class.

All students will be expected to complete a computer–based research project at the end of term. This will (a) involve giving a preliminary project presentation of approximately 10 minutes' duration immediately after spring break, (b) writing a paper around 15 pages in length (25 for graduate students), (c) giving a research presentation of approximately 30 minutes' duration, and (d) turning in all code used in the research.

Graduate students will additionally be expected to write weekly critical responses to the reading assignments.

Grades for undergraduates will be determined as follows: 50% problem sets, 40% final project, 10% participation and preparation. No exams will be given in this course.

**Weekly lab section (to be scheduled)**

In addition to the dedicated seminar time, we will meet weekly for a lab section to work on techniques of Python and music21 programming.  This lab will be scheduled at the beginning of the term.


**Bibliography (additional topics to be added at the end of the term according to student interest)**

GENERAL MONOGRAPHS

Huron, David. 2006.  Sweet Anticipation: Music and the Psychology of Expectation. Cambridge: The MIT Press.

Temperley, David. 2007. Music and Probability.  Cambridge: The MIT Press.


OVERVIEW AND METHODS

Cook, Nick. 2004. "Computational and Comparative Musicology," Empirical Musicology: Aims, Methods, Prospects (ed. Eric Clarke and Nicholas Cook). Oxford: Oxford University Press.

McVicar, Matt, Yizhao Ni, Raul Santos-Rodriguez, and Tijl De Bie. 2011. "Using Online Chord Databases to Enhance Chord Recognition," Journal of New Music Research, 40:2, 139–152.

Pardo, Bryan and William P. Birmingham. 2002. "Algorithms for Chordal Analysis," Computer Music Journal. 26:2, pp. 27–49.

Pearce, Marcus T., and Geraint A. Wiggins. 2004. "Improved Methods for Statistical Modelling of Monophonic Music," Journal of New Music Research. Vol. 33, No. 4, pp. 367–385.


MELODY

Bernabeu, José L. F.,  Jorge Calera-Rubio,  José L. M. Iñesta, and David Rizo. 2011. "Melodic Identification Using Probabilistic Tree Automata," Journal of New Music Research, 40:2, pp. 93–103.

Bod, Rens. 2001. "Memory-Based Models of Melodic Analysis: Challenging the Gestalt Principles," Journal of New Music Research 31:1, pp. 27–37

Brinkman, Alexander Russell. 1978. Johann Sebastian Bach's 'Orgelbuchlein': A Computer-Assisted Study of the Melodic Influence of the Cantus Firmus on the Contrapuntal Voices. Ph.D. Dissertation, The Eastman School of Music.

Conklin, Darrell, and Christina Anagnostopoulou. 2011. "Comparative Pattern Analysis of Cretan Folk Songs," Journal of New Music Research, Vol. 40, No. 2, pp. 119-125.

Conklin, Darrell. 2006. "Melodic analysis with segment classes," Machine Learning, 65, pp. 349-360

Knopke, Ian, and Frauke Jürgensen. 2009, "A System for Identifying Common Melodic Phrases in the Masses of Palestrina," Journal of New Music Research, Vol. 38, No. 2, pp. 171-181.

## STYLE

Crerar, M.A. 1985. "Elements of a Statistical Approach to the Question of Authorship in Music," Computers and the Humanities, Vol. 19, No. 3 Jul. – Sep., pp. 175-182.

Damián H. Zanette (2006) "Zipf's law and the creation of musical context," Musicae Scientiae 10: 3-18

Manaris, Bill, Juan Romero, Penousal Machado, Dwight Krehbiel, Timothy Hirzel, Walter Pharr, and Robert B. Davis. 2005. "Zipf's Law, Music Classification, and Aesthetics," Computer Music Journal, 29:1, pp. 55-69, Spring.

Mendel, Arthur. "Some Preliminary Attempts at Computer-Assisted Style Analysis in Music," Computers and the Humanities, Vol. 4, No. 1, Humanities/Computers 69: A Symposium (Sep., 1969), pp. 41-52

Meyer, Leonard B. 1989. Style and Music: Theory, History, Ideology. Chicago: The University of Chicago Press. (pages TBA)

## HARMONY AND VOICE-LEADING

Aarden, Bret and Paul T. von Hippel, 2004. "Rules for Chord Doubling (and Spacing): Which ones Do We Need?" MTO, 10:2

Conklin, Darrell. 2002. "Representation and Discovery of Vertical Patterns in Music," in C. Anagnostopoulou, M. Ferrand, and A. Smaill (Eds.): Music and Artificial Intelligence: Proc. ICMAI 2002, pp. 32-42, Springer-Verlag.

Cope, David. 2002. "Computer Analysis and Composition Using Atonal Voice-Leading Techniques," Perspectives of New Music, Vol. 40, No. 1 (Winter), pp. 121-146.

DeClercq, Trevor and David Temperley. 2011. "A corpus analysis of rock harmony," Popular Music. 30:1, pp. 47-70

Gillick, Jon, Kevin Tang, and Robert M. Keller. 2010. "Machine Learning of Jazz Grammars," Computer Music Journal, 34:3, pp. 56–66, Fall.

Temperley, David. 2011. "The Cadential IV in Rock," Music Theory Online. Volume 17, Number 1, March

Tymoczko, Dmitri. 2011. A Geometry Of Music: Harmony and Counterpoint in the Extended Common Practice. Oxford: Oxford University Press. Chapt 7.

Rohrmeier, M. & Cross, I. (2008). "Statistical properties of harmony in Bach's chorales." In Miyazaki, Hiraga, Adachi, Nakajima, Tsuzaki (eds.), Proceedings of the 10th International Conference on Music Perception and Cognition, pp. 619–627 .

## COMPARING CORPORA / SCHEMATA

Conklin, Darrell, and Mathieu Bergeron. 2008. "Feature Set Patterns in Music," Computer Music Journal, 32:1, pp. 60–70, Spring.

Cope, David. 2003. "Computer Analysis of Musical Allusion," Computer Music Journal, 27:1, pp. 11–28, Spring.

Jan, Steven. 2004. "Meme Hunting with the Humdrum Toolkit: Principles, Problems, and Prospects," Computer Music Journal, 28:4, pp. 68–84.

## INFORMATION THEORY

Cilibrasi, Rudi, Paul Vita´ and Ronald de Wolf. 2004. "Algorithmic Clustering of Music Based on String Compression," Computer Music Journal. 28:4. 49–67.

Cohen, Joel E. 1962. "Information Theory and Music," Behavioral Science, 7:2, pp.137–163.

Knopoff, Leon, and William Hutchinson. 1983. "Entropy as a Measure of Style: The Influence of Sample Length," Journal of Music Theory, Vol. 27, No. 1 (Spring, 1983), pp. 75–97.

Margulis, Elizabeth Hellmuth, and Andrew P. Beatty. 2008. "Musical Style, Psychoaesthetics, and Prospects for Entropy as an Analytic Tool," Computer Music Journal, 32:4, pp. 64–78, Winter.

Shannon, Claude. "A Mathematical Theory of Communication." Bell System Technical Journal, 27. pp. 379–423 and 623–656. Bell Labs.

## KEY-FINDING

Bharucha, J. J. (1987b).Music cognition and perceptual facilitation: A connectionist frame-work. Music Perception, 5, 1–30.

Bharucha, J. J. (1991). Pitch, harmony and neural nets: A psychological perspective. In P. M. Todd & D. G. Loy (Eds.), Music and connectionism. Cambridge, MA: MIT Press.

Carol Krumhansl. 1990. Cognitive Foundations of Musical Pitch. Oxford: Oxford University Press.

Raphael, Christopher and Joshua Stoddard. 2004. "Functional Harmonic Analysis Using Probabilistic Models," Computer Music Journal, 28:3, pp. 45–52, Fall.

Temperley, David. 2009. "A Unified Probabilistic Model for Polyphonic Music Analysis," Journal of New Music Research 38:  3–18.

Quinn, Ian and Panayotis Mavromatis. 2011. "Voice Leading and Harmonic Function in Two Chorale Corpora." In Carlos Agon et al., eds., Mathematics and Computation in Music, pp. 230-240. Heidelberg: Springer.

RHYTHM AND METER

Chordia, Parag, Avinash Sastry, and Sertan Sentürk. 2011. "Predictive Tabla Modelling Using Variable–length Markov and Hidden Markov Models," Journal of New Music Research, Vol. 40, No. 2, pp. 105–118.

Huron, David, and Ann Ommen. 2006. "An Empirical Study of Syncopation in American Popular Music, 1890-1939," Music Theory Spectrum, Vol. 28, No. 2, Fall, pp. 211–231.

Patel, Ani. 2006. Music, Language, and the Brain. Oxford: Oxford University Press.

Temperley, David. 2010. "Modeling Common–Practice Rhythm." Music Perception. 27:5, pp. 355–376.

Temperley, David and Nicholas Temperley. 2011. "Music–Language Correlations and the 'Scotch Snap,'" Music Perception, 29. 51–63.

# MUSI 486/586 – Corpus Methods in Music Research
## Weekly seminar and lab topics

| Week | Seminar topic | Seminar readings | Lab topic |
|---|---|---|---|
| 1 | Overview | Knopke and Jurgensen (2012), Cook(2004), | Introduction to the Eclipse IDE; Python basics |
| 2 | Style I | Meyer(1989), Crerar(1985), Manaris(2005), Mendel (1969) | Descriptive statistics with music21 |
| 3 | Melody | Huron(2006, ch. 6), Bod (2001), Conklin(2011), Conklin(2006) | melody analysis with music21 |
| 4 | Harmony | Huron(2006 ch. 7,13), Tymoczko (2011, ch. 7), Temperley and deClercq (2011), Rohrmeier, M. & Cross, I. (2008). | Some statistical tests and Markov (n–gram) models in Python/music21 |
| 5 | Rhythm and Meter | Huron(2006 ch. 10), Temperley (2010), Temperley and Temperley (2011), Patel(2006), Chordia (2011) | Basics of information theory; computing entropy and cross–entropy in Python/music21 |
| 6 | Tonality 1 | Temperley(2007), Temperley (2009), Quinn (2010) | Smoothing n–gram models |
| 7 | Automated Analysis | Raphael and Stoddard (2004), Temperley(2007 ch. TBA), Pardo and Birmingham (2002), Kruger(2008), Wild (ISMIR paper) | TBA |

| 8 | Information Theory | Shannon(1948), Meyer on Information(1957), Margulis (2008), Cohen(1962), Cilibrasi(2004) | TBA |
|---|---|---|---|
| 9 | Tonality 2 | Conklin(2002), Quinn and Mavromatis (2011), Aarden and von Hippel (2004), | Cluster analysis in R |
| 10 | Harmonic Grammar | Gillick (2010), White(TBA), Quinn(TBA), Temperley (2011) | TBA |
| 11 | Style 2 | Cope (2003), White(TBA), Albrecht(dissertation), Duane (forthcoming), Conklin (2006) | TBA |
| 12 | TBA | TBA Based on student interest | [individualized work with students] |
| 13 | | Research presentations | [individualized work with students] |
| 14 | | Research presentations | [individualized work with students] |