

# Math/Music: Aesthetic Links

## Research Paper: List of Composers

The following is a list of composers for the Research Paper due on April 20. Included are possible pieces for study or topics to investigate, and, in some cases, a relevant source. In the course of your research, you may find other pieces of interest for your paper. You are required to use at least four sources (historical, mathematical, musical, etc.). Alan Karass, the Music Librarian, will be giving a brief overview of library and internet-based resources in class on February 18.

### 1. Milton Babbitt

- *Composition for Four Instruments*
- Extension of Schoenberg's twelve-tone method to include rhythm and timbre

### 2. Johann Sebastian Bach

- *The Musical Offering*
- *The Well-Tempered Clavier*

### 3. Béla Bartók

- *Mikrokosmos*, Book 6, BB 105: No. 141, *Subject and reflection*
- *Music for Strings, Percussion and Celesta* (Use of the Golden Section and Fibonacci Numbers?)
- Book: *Béla Bartók: an analysis of his music* by Ernő Lendvai

### 4. Pierre Boulez

- *Structures*
- *Le marteau sans maître* ("The Hammer Without a Master")
- Pitch multiplication, controlled chance

### 5. Peter Maxwell Davies

- *Ave maris stella*
- *A mirror of whitening light*

### 6. Claude Debussy

- *La Mer* (Use of the Golden Section?)
- Book: *Debussy in proportion: a musical analysis* by Roy Howat

### 7. Joseph Haydn

- *Piano Sonata No. 41*, "Minuet and Trio" in A major, (reused in *Sonata No. 4 for Piano and Violin* as well as his *Symphony No. 47*)

8. Paul Hindemith
  - *Ludus Tonalis* (“Game of Tones”)
9. György Ligeti
  - *Études for piano*, Book I and II
  - Influence of fractal geometry on his music
  - Article: “Fractal dimension analysis of complexity in Ligeti piano pieces” by Rolf Bader, *Acoustical Society of America Journal*, **117** No. 4, pp. 2477 – 2477 (2005).
10. Franz Liszt
  - *Hungarian Rhapsody #2*
11. Cindy McTee
  - *Einstein’s Dream*
  - *Circle Music I-IV*
12. Oliver Messiaen
  - Use of symmetry in time and pitch, non-retrogradable rhythms, and modes of limited transposition
  - *Quatuor pour la fin du temps* (“Quartet for the End of Time”)
13. Wolfgang Amadeus Mozart
  - *Musikalisches Würfelspiel* (“Musical Dice Game”)
  - The Golden Section in his piano sonatas? See “The Golden Section and the Piano Sonatas of Mozart” by John F. Putz, *Mathematics Magazine*, **68** No. 4, pp. 275 – 282 (1995).
14. Steve Reich
  - *Four Organs*
  - *Clapping Music* — See “Clapping Music – A Combinatorial Problem” by Joel K. Haack, *The College Mathematics Journal*, **22** No. 3, pp. 224 – 227 (1991).
15. Arnold Schoenberg
  - Twelve-tone method of composition
  - *Piano suite*, Op. 25
  - *Pierre Lunaire*, No. 18
16. Iannis Xenakis
  - *Metastasis*
  - *Pithoprakta*
  - Book: *Formalized music; thought and mathematics in composition* by Iannis Xenakis