**Meeting Notes**

THEORY407, Fall 2022

# Contents



# 2022-09-23

1. Go to: Humdrum.org
2. Read at least chapter 1 of the user's guide.
3. In at least 250 words, write a review of humdrum that indicates how useful (or not) this kind of approach is for the questions you are interested in exploring this semester.

## Humdrum Ch.1

It seems like a tool used for analyzing music similar to music21. With multiple funtionalities, Humdrum can be used for counting specific notes, showing certain voice in a piece, and sometime even some specfic analysis on harmonic/tonal funtions. It is more like a library of tools on my idea of searching how similar two pieces are. We can conduct research with the same approch, but with different methods. Starting with these simple metrics:

- **Note Sequence**: How many notes are the same, how many are different?
  - Might be useful for comparing two pieces in the same work, such as *Gymnopedie*. But will yield a very low score if the key changed.
- **Note Sequence with Key**: How many notes are the same, given pieces in different key but represented in a $\mathbb{Z}_7$ format.
  - Can address some very basic isssues such as exact transposition, but not effective if the phrase changes.
  - Can use the technique mentioned in the proposal to solve the above problem. But what if the phrase was changed a lot?

We then shall do the analysis with more and more complex methods such as counting leading tones, and chords using current avaliable tools. In this way I believe we can come up with various ways to compare two pieces, but not being too impractical to do. The ultimate goal is also simple: output a "similarity score" for two pieces.

**Will Read:**

- Temperley, *A Bayesian Approach to Key Finding*
- Lerdahl, *Tonal Pitch Space* **Chapters ***
- Tymoczko, *Geometry of Musical Chords* **Chapters ***

## Temperly

1. It's a modification on Krumhansl and Schmuckler. A Bayesian probablistic method.
2. Key profiles feflect basic theoretical principles of tonal music.
3. The defects of the original Krumhansl and Schmuckler:
   a) The notes are "weighted" by duration, which means repeated notes would take on more weight which might alter the final decision.(P196)
   b) It does not take into the account of modulation between different keys.(P198)
   c) The original key-profile model did not distinguish between different spelling fo the same pitch (A#=Gb).(P199)
4. The solution to the problems above:
   a) Binary representation $\{0, 1\}$ given certain metrical unit(mesure, second, etc) in terms of prescence.
   b) Calculate a key for segmented phrases. Introduce "change penalty" ig the key for one segment differs from the key of the previous segment until the score for new key is the dominant key.
   c) Infer the speeling might be "cheating" in some sense, so not addressed.

**Baysian Modeling** Recover the multiple possible strcutures (keys) from a single representation of the surface (notes). And we want to select the best one:

$$\arg \max_{\text{strcuture}} \Pr[\text{strcuture}|\text{surface}]$$

Using Bayes' rule, We have:

$$\Pr[\text{strcuture}|\text{surface}] = \frac{\Pr[\text{surface}|\text{strcuture}]\,\Pr[\text{strcuture}]}{\Pr[\text{surface}]}$$

For any structure, $\Pr[\text{surface}]$ stays the same(since surface stays the same). So we need only conscider: $\arg\max_{\text{strcuture}} \Pr[\text{surface}|\text{strcuture}] \cdot \Pr[\text{strcuture}]$

**Key Profiles as Baysian Model**

- There is a set of probabilities of each segment in the piece the initial probability of the key given before the first segment is $\frac{1}{24}$, notated as $S_{m0}$
- For subsequent segments, there is a high probability of remaining in the same key as previous segment and a low probability of changing to any other key, all notated as $S_{mi}$.
- The probability of surface can be established by the key profile that reveal how often certain pitch class is used in each segment of the key.(P201)
- For a given ket, the probability of a certain pitch class set being used in each segment is given by the product of the key-profile values presented and absent called pc-scores, written as: $\prod_p S_{pc} \cdot \prod_{\neg p} \neg S_{pc}$
- For an entrire piece, this can be represented as a prodcut of modulation score and pc-score for all segments: $\prod_s S_m \cdot \prod_p S_{pc} \cdot \prod_{\neg p} \neg S_{pc}$ Then we shall take the natural log of the product and get the sum of the log of the score: $\sum_s (\ln S_m + \sum_p \ln S_{pc} + \sum_{\neg p} \neg \ln S_{pc})$

**Comments on the paper**

- It only conscider with major and minor keys, what about modal music? (**Ask about modes.**)
- It presumed each pitch class is independent of each other, but apparently they are not, we might need to calculate the probability of chosing certain pitch class given the previous one like $\Pr[p_i|p_{i-1}]$. (**Ask about this.**)