

## Chapter 17

### In Search of Arcs of Prototypicality

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#### 17.1. Introduction

In his 1947 book, *On Human Finery*, Quentin Bell argued that fashions change because of imitation: we imitate people that belong to social groups of which we would like to be a part [3]. At the same time, we attempt to identify ourselves as part of a social group to exclude those that we think should not be a part of that group. This implies that fashion is in a state of perpetual change. As more people acquire a certain fashion, the original members will seek to be more individualized and unique. Fashion, Bell would argue, is a perpetual motion machine, in which groups are constantly trying to assimilate, which incentivizes others to dissimilate, *ad infinitum*.

Some theories of musical change have also incorporated this concept. Meyer [15] argues that musical style, defined as “a replication of patterning, whether in human behavior or in the artifacts produced by human behavior, that results from a series of choices made within some set of constraints”, can change gradually over time — the result of internal factors — or immediately and rapidly — a consequence of an event or an individual’s actions. This mirrors much of the work done in sociolinguistics on the cause of linguistic and dialectical change [13]. Within this notion of change, music theorists often discuss how there is a process of assimilation and

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dissimilation that occurs across the lifespan of musical styles. For example, Gjerdingen [9, 10] discusses how musical ideas undergo an “arc of prototypicality”, which seem to follow the trajectory of a bell curve, and are correlated with the usage of the musical idea. As a musical gesture is used more frequently, it is used more consistently, and as it begins to be used less, it undergoes mutates and splinters into new ideas. Much like Bell’s notion of fashion, the musical ideas that are quite commonplace are replaced with those that are increasingly differentiated from the norm, which, in turn, becomes the norm to which others assimilate.

Corpus studies, however, have tended to focus on arcs of *usage*, rather than arcs of *typicality* (for example, see [5]). Although Gjerdingen [9] hypothesizes that the two are inextricably linked, the relative dearth of studies looking at such shifts might lead one to question why this might be the case. It is quite likely that there are practical challenges to a computational examination of typicality in general: although we can discuss melodies as similar or dissimilar (see Chapter [16]), discussing their relative similarity in relation to the broader whole requires quite a bit of data. Additionally, what is analyzed as a marker of prototypicality (often termed a schema) can mutate in ways that are not always discernable through traditional search patterns. Searching for gestures based on metric regularity is possible, but is likely to miss quite a few options. One way around this might be to avoid the schema question entirely, instead focusing on “low-level” aspects such as entropy, variance, and correlation to a broader whole. Here I discuss some of these issues while examining a recently-curated corpus, the RISM-World Dataset. Specifically, I will look at eighteenth-century Italian melodies, as a great deal has been written on the schema — and prototype — driven nature of much of music in this repertoire. I explore the question of prototypicality by looking primarily at “high-level” and “low-level” features, and will discuss the barriers that still need to be crossed in order to more fully engage with a question of changing waves of prototypicality in music.

## 17.2. Using the RISM Corpus

Before discussing this, however, it might be valuable to discuss the types of data one might use to ask such a question. Music theory has recently seen an influx in corpora over the past decade or so. For quite a while, a significant proportion of corpus studies examined the Barlow and Morgenstern Dataset [2] when looking at WesternArt music, and the Essen Folksong Database [16] for investigating broader questions pertaining to folk music. Both datasets were encoded more than 20 years ago, and were converted to Humdrum Toolkit [12] by David Huron and the collaborators at the Center for Computer Assisted Research in the Humanities at Stanford (CCARH). Recent studies have included full transcriptions of Native American Folksongs [17], the harmonic progressions of jazz standards [5], Dutch folksongs [18], hip-hop transcriptions [6], and a curation of web-based online MIDI transcriptions and performances [19], among others.

This study employs the RISM-World Corpus, which has been curated from the broader RISM collection of data from libraries across the globe (Shanahan, Sapp, and Bell, *in progress*). The entire dataset contains more than one million incipits. Composer information, including nationality and birth and death dates were added by both human and algorithmic processes, and the algorithmic addition of metadata was corrected by hand. Specifically, an algorithm scraped online sources such as the Virtual International Authority File (VIAF, see [4] [14]), and searched for matching information. If information matched completely, it was labeled as accurate, while if there were two mismatched nationalities, it was checked by a human being. When removing duplicates, and when only examining the composers for which we could acquire metadata, the corpus contains roughly 600,000 melodic incipits. This study will only be using a selection from the eighteenth centuries written by Italian composers. This subset contains roughly 101,000 incipits, although each test was run on a sample of 10–15,000 melodies due to computational limitations.

### 17.2.1. *The issue of date affixation*

There is an ongoing debate in the field of corpus studies as to how to affix a date to a composition when analyzing pieces over time. The obvious method would be to simply use date of first publication or performance, but the abundance of posthumous pieces, as well as pieces performed or published significantly after composition casts some doubt on this method. Albrecht and Huron look at the year in which the composer turned 25, as they argue that most of the learning of tonal grammars and stylistic nuances will have taken place by then [1]. Daniele and Patel use the composer's midpoint year [2] and subsequent work has shown this to be a fairly reliable indicator [8].

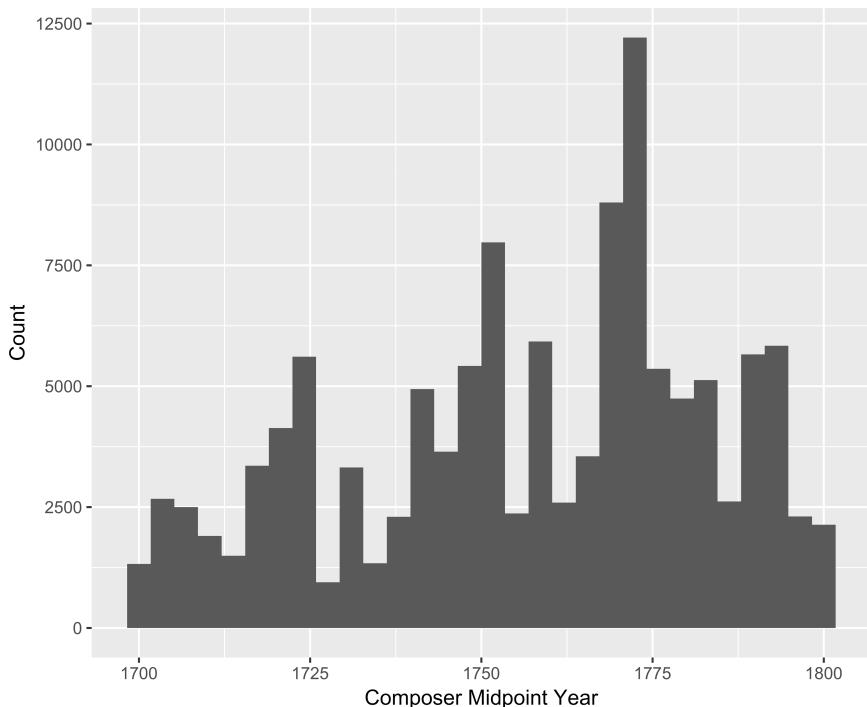


Fig. 17.1. Histogram of themes by composer midpoint year,  $N = 176,335$ . A number of these themes lacked key information, and were not able to be included in the final analysis, in which  $N = 100,000$ .

This study therefore employs composer midpoint (that is, the mean between the birth and death years of the composer) to affix dates for each composer. This can be seen as problematic: it ignores stylistic change within composers, instead affixing a single point to each individual. Given a large enough sample, however, we might expect to find broader change over time between individuals. As we are examining such large scale changes, we will focus on the between-composer differences, rather than the within-composer differences here.

As can be seen in Fig. 17.1, there is a healthy distribution of composers throughout the eighteenth century, with peaks in the latter half. Daniele and Patel argue that there were a number of nationalistic changes that took place in the eighteenth century as German nationalism began to rise, and composers turned away from more “Italianate” styles. By only examining Italian style, I hope to simply look at changes in compositional grammar over time, and at what rate these changes were adopted.

### 17.3. Examining the Changing Tonal Grammar Through “Low-Level Features”

One approach to examining “wave of style” might be to first examine the tonal grammar being used in a short period of time, such as a decade, and examine how that grammar changes. Once it has been established how this change has occurred (for example, perhaps 4 and 7 are used far less in the early decades of a century, rather than the later decades) the “key-profile” of each melody can be correlated with the key-profile of each decade. We would expect to find the correlation coefficient to increase as the decade approaches, and decrease as the decade passes. Albrecht and Huron used this approach to trace the evolution of the major and minor mode from 1400–1750, continually examining the key-profiles over time [1]. Similarly, examined how evolving key-profiles function differently when given examples of ambiguous key [20].

Using this approach can illustrate the change in compositional styles throughout the eighteenth-century, and would ideally

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demonstrate relationships of each melody to a more general tonal “norm”. We might consider this a “bottom-up” approach, or one that focuses on “low-level” features such as overall pitch-class distribution, rather than “high-level” features such as melodic gestures or harmonic progressions. Given the pitch distribution of a certain period in time, will we would expect to see a change in the correlation of a given pitch distribution to the given pitch distribution.

Each melody was analyzed using the Humdrum Toolkit [12], and the key-profile of each decade was calculated. It would be likely that the second half of the century would exhibit the most stylistic change. The end of the Galant era, along with the increased output of iconoclasts such as Mozart and Haydn might suggest a shift in the usage of tonal grammars. Therefore, we might learn a great deal from examining the key-profile distribution relative to the distribution of the 1750s. Figure 17.2 shows a random sample of

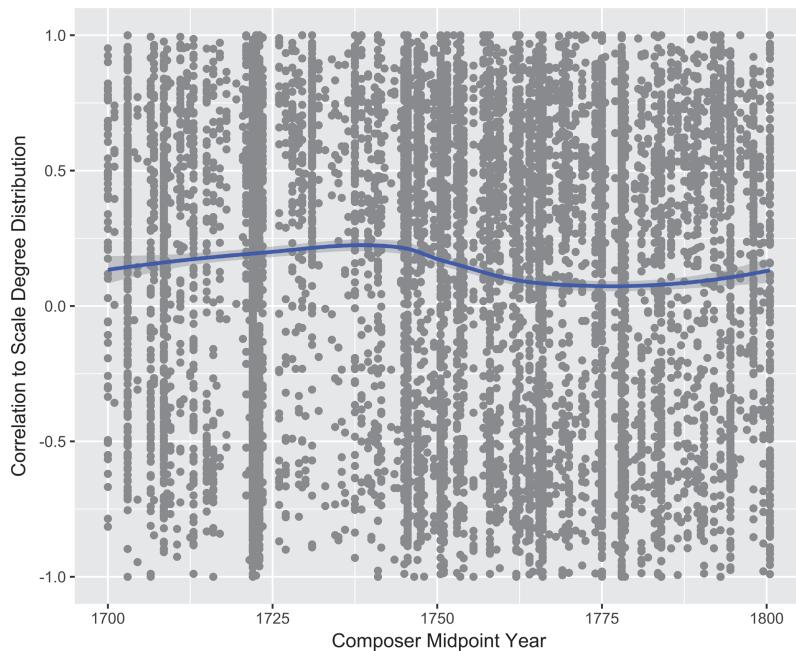


Fig. 17.2. A localized regression of the correlation coefficients of a random sample of 10,000 melodies (out of a total of 101,709 themes) to the 1750s prototype. Note how there is an incline leading int 1750, followed by a period of dissimilation throughout the decade.

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10,000 themes by composers whose midpoint years fall within the eighteenth century, along with a localized regression line (LOESS) indicating the changing correlation of a theme to the scale degree distribution of the 1750s.<sup>a</sup> As would be expected, we do see an increased relationship as we move into the 1750s, and then a sharp decline throughout that decade. It would seem that, melodies began to employ different distributions throughout the course of the decade, moving away from the prototypical grammar, dissimilating as would be expected.

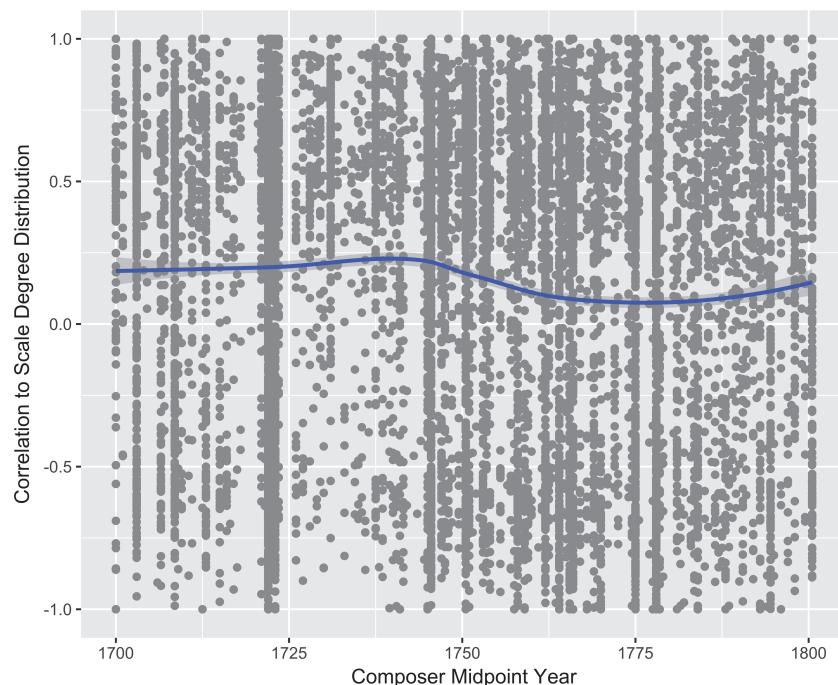


Fig. 17.3. A localized regression of the correlation coefficients of a *second* random sample of 10,000 melodies to the 1750s prototype.

<sup>a</sup>It should be noted here that, due to the large number of pieces in question, I'm avoiding discussing statistical significance. Significance allows us to understand if we have enough power to examine the question at hand, demonstrating whether our mathematical microscope provides enough resolution. With this many themes, most relationships are significant.

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Examining a broader correlation, such as each melody to the scale degree distribution of the *entire century* shows that there is a fairly stable relationship. That is, if our window of prototypicality covers something as broad as an entire century, it would make sense that it would be difficult to see much change. This can be seen below in Fig. 17.3 on a subset of roughly 15,000 pieces.

We might then surmise that the tonal grammar changes in relatively small windows, but that is likely not the case. As Fig. 17.4 shows, instead of the tonal usage changing over time, we find an almost frustratingly stable distribution of pitches. Although there is a little bit of change in usage with  $\hat{3}$  and  $\hat{4}$ , specifically around the 1760s and 1770s, it seems to be quite minor. How could this be? Surely the tonal language of the eighteenth-century, a period encompassing the height of the Baroque era, the entirety of the

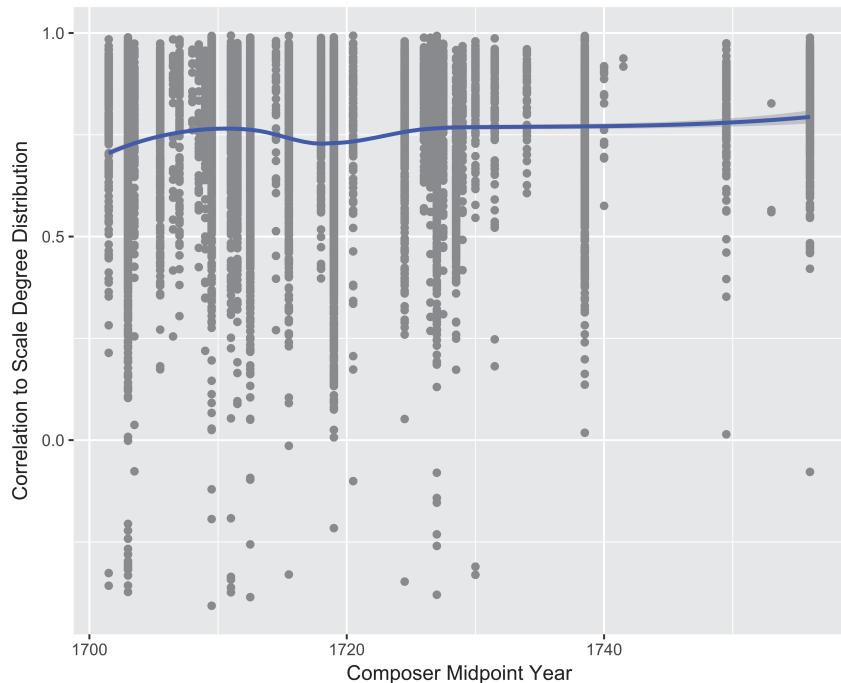


Fig. 17.4. The average correlation of a theme to the broader scale degree distribution of eighteenth-century Italian melodies ( $n = 15,484$ ).

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Galant era, and the majority of classicism, was anything but static. The answer might lie within the notion of style vs. structure. In languages, words come in and out of use, and slang terms are picked up and discarded quite readily. The syntax and grammar of a well-formed sentence, however, does not change: sentences still need verbs, and these verbs should be appropriately placed. While this is definitely a primary concern of this immediate research question, my goal in discussing this here is to also stress the disconnect between the computational convenience of low-level features and the often ineffable nature of musical prototypicality and similarity. For more discussion on this (see Chapter 16). Nevertheless, we can see *traces*

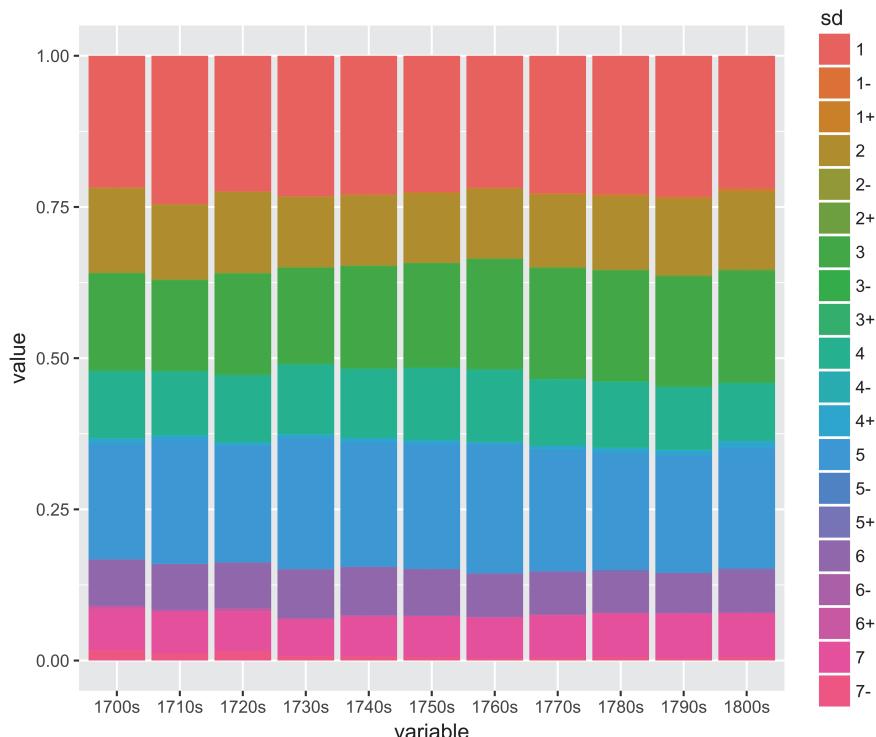


Fig. 17.5. The change in scale degree usage by decade in eighteenth-century Italian melodies in the RISM corpus. Note the astonishingly consistent distribution of scale degrees throughout the century.

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of these stylistic changes when paired with a specific period, given enough data.

Examining shifts in prototypicality from the perspective of “low-level” features such as correlation of key-profiles would therefore seem to be leading us down a garden path. Studies that have focused on the changing nature of schemata have demonstrated how they can change quite rapidly. For example, Broze and Shanahan argue that harmonic schemata in Jazz standards change quite rapidly, correlated with the death of Charlie Parker in 1955, not the advent of modal jazz in 1959, as predicted [5]. Yet, low-level features — at least those pertaining to scale degree usage — seem to change at an almost glacial pace. We might extrapolate that this hierarchy of features can be mapped onto the dichotomy of “internal/external” and “gradual/rapid” stylistic change: grammar is relatively stable, but styles are fluid (Fig 17.5).

#### 17.4. Conclusions

When performing large-scale corpus studies, it is easy to sometimes rely on factors because of “computational convenience”. Gjerdingen [11] writes that there are a number of assumptions we tend to make, often out of convenience, when engaging in such studies. First, we assume that the music is existing as a single auditory stream. Even a monophonic piece, such as a Bach cello suite, contains a number of implied harmonies and contrapuntal points that are not readily picked up by searching with a computer. Additionally, he argues that corpus studies tend to privilege contiguous events, often ignoring relationships at variable distances from one another. It could be argued that, in examining prototypicality through computational methods, we are falling into these same pitfalls. The RISM-Corpus short incipits deemed to be salient for the purposes of looking up musical works. They are often short, and provide only melodic information. That it is difficult to see the process of assimilation and dissimilation in tonal usage likely speaks to the likelihood that such changes occur primarily as “high-level” features, changing over a constant profile of tones.

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This is not to say that corpus methods should not be used to investigate aspects of prototypicality, but one should focus on the type of corpus used. Ideally, entire pieces would be encoded, including as much harmonic information as possible. Ideally, much of this information would be annotated by humans, allowing for the labeling of schema that might fall outside of the scope of traditional searching methods (for example, non-metrically regular schema). Unfortunately, there is not an abundance of these corpora at the moment. The Yale Classical Archives Corpus [19] provides one possibility, but its high proportion of performed MIDI transcriptions might mean that the rhythmic information is somewhat unreliable. Nevertheless, as musical corpora continue to proliferate, it is likely that we will be able to ask more musically-informed questions of them, and perhaps begin to understand more about the fashions of musical style.

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