

MONKS, MANUSCRIPTS, AND OTHER PEER-TO-PEER SONG SHARING NETWORKS OF THE MIDDLE AGES

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ABSTRACT

The centuries between the creation of medieval manuscripts and their rediscovery today can lead scholars into thinking that the repertory of music is even more distant and fragmentary than it actually is. By using techniques from peer-to-peer network analysis, comparative study of fifteenth-century sacred music, and close examination of reconstructed stemmata, this paper bolsters the argument that surviving music from the Italian fourteenth century represents far more than just the “tip of the iceberg” of what was once written.

When I opened up my laptop at the hotel to put the finishing touches on this paper before presenting it at the Schoenberg Symposium, I started up iTunes for some music. In doing so, I gained access to a wealth of songs, symphonies, and other pieces from more countries and different eras than any medieval monk could ever dream of. 14,000 pieces, needing forty-two days to play them all, sit on my hard drive, ready for entertainment, edification, or mere background noise. Of course, only a modern philistine would limit himself to such a meager selection. Thanks to

free Wi-Fi, I also had further access to thousands of Internet radio stations, new MySpace music bands, the nearly infinite holdings of the music-sharing site Pandora, musical links posted by friends on Facebook, and about 37,000 CDs on Naxos's music network. But what was most limitless was a small link floating in the left side of the iTunes window, tantalizingly promising me two shared libraries worth of music curated by owners of nearby computers (Figure 1).

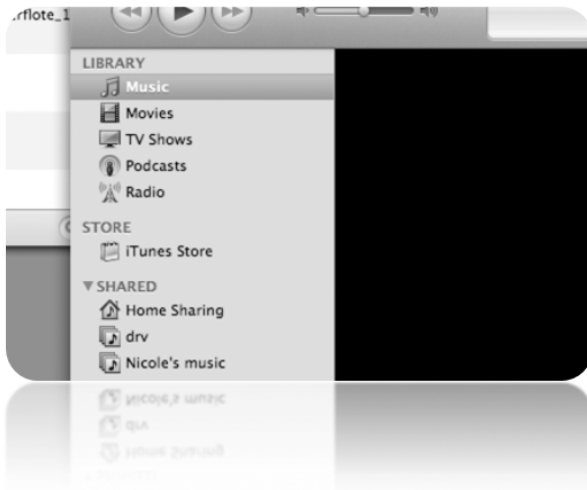


Figure 1. Shared music on a modern iTunes library.

Together, the collections of these two unknown but generous souls potentially added another ten days' worth of listening to my options and, more importantly, added genres of music in which my own library is weak, in this case, folk music, electronica, and soundtracks. Before Apple changed their default iTunes settings to allow sharing only if users had explicitly turned on the feature, many more collections of music tended to be available. Of course, iTunes is not the only way of getting to shared music. Before three judges from the U.S. Ninth Circuit Court of Appeals declared it illegal, the Napster system developed by Northeastern University dropout Shawn Fanning gave access to the music collections of over 26 million people (though

not all at any one time), spanning the connected globe. The systems that sprung up to replace Napster, with names such as Limewire, Kazaa, and Demonoid, ride networks with names like Gnutella and BitTorrent, opening up the shared music collections of over a million people at a time.¹

What is different about these newer networks and what makes them harder to police (and therefore shut down) is their spread out and sparse distribution throughout the Internet. Unlike with Napster, there is no centralized list of which, or even how many, computers are connected to their networks at any moment.

It is this uncertainty associated with the size of decentralized networks that makes them relevant to our study of how medieval and Renaissance music was collected and spread throughout Western Europe. If the reader has ever searched for a song on LimeWire (before it was recently shut down), he or she will know that the search is not instantaneous by any means. Since there is no central database either of songs or of computers that are on the Gnutella network, each computer can only know the locations of a few other computers that are currently active.² Those computers send along the list of songs that they store along with a list of computers that they know are currently

¹ On the rise and fall of Napster and its implications for music copyright and music distribution, see Ulrik Volgsten and Yngve Åkerberg, "Copyright, Music, and Morals: Artistic Expression and the Public Sphere," in *Music and Manipulation: On the Social Uses and Social Control of Music*, ed. Steven Brown and Ulrik Volgsten (Oxford, 2006), pp. 336–364; and Tom McCourt and Patrick Burkart, "When Creators, Corporations, and Consumers Collide: Napster and the Development of On-line Music Distribution," *Media, Culture, & Society* 25 (2003), 333–350.

² For a (slightly) more detailed description of how other computers are found on these networks, see M.Kelaskar, et al., "A Study of Discovery Mechanisms for Peer-to-Peer Applications," *Proceedings of the 2nd IEEE/ACM International Symposium on Cluster Computing and the Grid* (2002), available online at <<http://www.computer.org/portal/web/csd/abs/proceedings/ccgr/id/2002/1582/00/15820444abs.htm>>.

connected to the network. The computers on that list are then searched, and the computers that they know about are then searched, and so on and so forth. These searches, unless carried out over a long period of time with some clever algorithms, can never find all the repositories out there. Instead the searches stop—or more often the searchers get impatient and stop waiting—when the river of new songs that are found winds down to the thinnest trickle. New computers continue to be found, albeit more and more slowly, but the stream of new songs dries up as the newly discovered libraries contain only already known works.

This essay grows out of my most recent work concerning how we know what we know about the number of pieces that once circulated in the late Middle Ages and early Renaissance. I have been engaged for some time with the detritus of medieval codicology: fragments, that is, small scraps of music, usually of one to five or six sheets of paper or parchment from presumably once glorious manuscripts, mostly from Italy, of the fourteenth and early fifteenth centuries, a period often referred to as the long Trecento.³ These sources are fascinating records of a peninsula hungry for copies of the latest songs in Italian and French, for the newest motets, and for sections of the Mass that often push the boundaries of compositional technique and, in some cases, of good taste.⁴ Often these sources have been terribly preserved. They may have been

³ On the fragments as a group, see Michael Scott Cuthbert, "Trecento Fragments and Polyphony Beyond the Codex," (Ph.D. Dissertation: Harvard University, 2006), online at <<http://www.trecento.com/dissertation>>.

⁴ On a particularly boundary-pushing Trecento piece, see Zachara's paired works, *D'amor languire* and *Credo scabioso*, where the latter's quotation of the former implies that the Holy Spirit is a scab that you scratch at until pus begins to flow; see Cuthbert, "Zacara's *D'amor Languire* and Strategies for Borrowing in the Early Fifteenth-Century Italian Mass," in Francesco Zimei, ed. *Antonio Zacara da Teramo e il suo tempo* (Lucca, 2004), pp.337–57.

used to strengthen the bindings of other books or employed as covers holding “important” notarial documents such as sewage payment records, or else the music notation was scrapped off the parchment, which was then reused, creating palimpsests.

Restoring these documents to legibility and performability requires a keen eye and ear and is greatly aided by the new technologies such as those created by Julia Craig-McFeely of the Digital Image Archive of Medieval Music (DIAMM) project.⁵ Yet the results of such restorations more often reveal already familiar pieces known from other manuscripts than they unearth truly new discoveries of unknown pieces. Of the last four Italian fragments to be discovered or identified containing secular music, only one has any new pieces; the other works were long known from other sources. This lack of new pieces raises the question: have Trecento music studies reached the point that the LimeWire searches eventually do, where digging for new manuscripts will find fewer and fewer new songs?

The conventional wisdom says no. It says that as more manuscripts are found, they will contain many new pieces because the surviving repertoire is but the “tip of the iceberg” whose main contents remain submerged in lost sources. The iceberg metaphor was first used by Nino Pirrotta and soon spread throughout the literature. I have since disagreed with the use of this metaphor in an article published in 2009.⁶ This assumption has hardly been investigated or questioned, and I believe that, on the contrary, there are many signs pointing to a much smaller

⁵ Julia Craig-McFeely, “Digital Restoration,” <<http://www.diamm.ac.uk/restoration/index.html>>. See also pp. XX-XX.

⁶ Nino Pirrotta, “The Oral and Written Traditions of Music,” in *Music and Culture in Italy From the Middle Ages to the Baroque* (Cambridge, Mass, 1984), pp. 72–79. I outline my response to the use of this metaphor in “Tipping the Iceberg: Missing Italian Polyphony from the Age of Schism,” *Musica Disciplina* 54 (2009), 39–74.

body of lost works than has previously been suspected. I have given some of the reasons for my belief in my previously cited article, but the most important of these reasons bear brief repetition here. Literary evidence suggests that we have the majority of pieces that listeners would have expected to know at the time. The sonnets of the Italian poet Simone de Prodenzani, for example, abound in citations of musical works. The 35th sonnet of his *Il Saporetto* describes the May songs as played on a viola of some sort:⁷

	Known works	Unknown
COLLA VIVOLA FE' Cançon di Maio,		
Rosetta che non cambi mai colore,	(1)	
le sui nafres tam fort, Dolce sapore,	(2)	(1) ²
<i>Comme da te partir me degio oma'io?</i>		(2) ²
D'amor languire e puoi <i>El dolce raio,</i>	(3)	(3) ²
O rosa bella, che m'alegrie 'l core,	(4)	
Legiadra donna e poi Donna d'amore,	(5) (6)	
Un fior gentile del qual mi 'namoraio,	(7)	
<i>Questa mirabil donna, Margarita,</i>		(4) ²
Con lagrime bagnando el suo bel viso,	(8)	
Deducto se' e fè <i>Sella mia vita,</i>	(9)	(5)
<i>Costei sarebbe bella in Paradiso,</i>		(6)
Non credo, donna, <i>O giemme incolorita</i>	(10)	(7)
del Cicognia una parte fu l'avisio.		

Table 1. Known and unknown works in *Saporetto*, sonnet 35.

Of the seventeen songs described here, at least ten survive, or about 60%.⁸ The survival rate of songs mentioned in this sonnet is pretty typical of Prodenzani's citations; I could have chosen sonnets with much higher survival rates. Of the fifty-nine songs found in his entire work *Il Saporetto*,

⁷ Edition adapted from Simone de Prodenzani, *Simone De' Prodenzani: Rime*, edited by Fabio Carboni, vol. 2 (Manziana, 2003) pp. 260–63. Table reproduced from Cuthbert, “Tipping,” p. 41.

⁸ For more specifics on this analysis which allow us, less conservatively, to believe that 75% of these songs survive, see, Cuthbert, “Tipping,” p. 42.

Nádas finds concordances for forty of them, or about 70%.⁹ Other poets' works sustain this ballpark figure. Among the nine late-Trecento works that Franco Sacchetti reports as having been set to music by others, two-thirds of them, or about 67%, survive. Among the lists of French pieces that we know were once copied, we find similar survival rate. A fragment that was once in the collection of the Duchess of Trémoille (Paris, Bibliothèque Nationale de France, MS fonds nouvelles acquisitions françaises 23190, *olim* Angers, Château de Serrant), gives an index of 114 compositions that were once in this missing manuscript. Between seventy-four and seventy-eight of these compositions survive today, or about two-thirds, the same percentage as we find from the evidence of Prodenzani or Sacchetti.

Finally—and I will admit, most controversially—statistical methods that were devised to make estimates of the size of animal populations can be adapted to make estimates about the number of lost pieces from a given time and place. Adapting the well-regarded methodology of Bohen, Bohen, and Caron to the manuscript evidence of late Trecento and early Quattrocento Italy, the method predicts that nearly 80% of the pieces once copied in Italy between 1380 and 1415 survive.¹⁰ Another probabilistic methodology that I devised independently predicts that approximately 75% of pieces survive, though my methodology gives much higher survival rates for secular works (between 80-85%) than for sacred and ceremonial works (of which approximately half survive), a prediction sustained by the most recent manuscript discoveries which combine already known secular works with a mixture of known and new Latin pieces.

⁹ John Nádas, "A cautious reading of Simone Prodenzani's *Il Saporetto*," *Recercare* 10 (1998), 23-47.

¹⁰ Shahar Boneh, Arnon Boneh, and R. J. Caron, "Estimating the Prediction Function and the Number of Unseen Species in Sampling with Replacement," *Journal of the American Statistical Association* 93 (1998), 372-379.

Now enough with the old. On to some new ideas.

WHAT DOES IT MEAN TO HAVE LOST A LOT VS. A LITTLE?

My vested interest in the project of estimating the number of lost pieces comes not from trying to prove a particular result. Indeed, when I started working on popularity studies, I was hoping to confirm the correctness of the iceberg metaphor, rather than disprove it. Rather, I am more interested in the methodologies for obtaining these results and finding new ones for the study of medieval and Renaissance music. Because comprehensive and computer-parsable data on what pieces and manuscripts survive from any given period is so hard to come by, I have not been able to replicate my study on any repertoires beyond the late-Trecento. (And even that work took several years of preparation to make the catalogue that was necessary to support it). So, one cannot say what the survival rates for other musical collections would be. I do, however, have a hunch that there are other repertoires in which the results would be similar to those of the late-Trecento; certain fifteenth-century song repertoires come to mind, as do untroped *Benedicamus Domino* chants of the late Middle Ages. Both of these repertoires have a large number of works, and new discoveries of sources are common. Yet the total number of new pieces is growing much more slowly. By contrast, some repertoires seem to lack many pieces, such as simple, sacred polyphony of the fifteenth century.

I really cannot be sure, however, about any of these repertoires without further data. Because we need more data in any form (along with many other reasons), I welcome Rob Wegman's recent paper, "Publication Before Printing: How Did Flemish Polyphony Travel in Manuscript Culture?"¹¹ In the article, among other ideas about

¹¹ Published in *Books in Transition at the Time of Philip the Fair: Manuscripts and Printed Books in the Late Fifteenth and Early Sixteenth Century Low Countries*, ed. Hanno Wijsman with Ann Kelders and Susie Speakman Sutch, *Burgundica* 15 (Turnhout, 2010), pp. 165–80.

possibilities for exchanges of music, Wegman suggests that the lost repertory of anonymous Masses in the fifteenth century was vast compared to the few that survive; in other words, we have only the visible tip of the iceberg. As part of his evidence, Wegman cites no fewer than eighteen documented but now lost Masses.

But what does this number mean in the larger context of fifteenth-century Mass composition? In fourteenth-century studies, eighteen lost Masses would be a large proportion of the surviving repertoire. If we were to infer that these eighteen lost Masses stood in for, perhaps, fifty lost and undocumented fourteenth-century Masses, then the iceberg metaphor would be apt for that period. But the surviving repertory of fifteenth-century Masses is much larger, and eighteen lost Masses are small in comparison. Suppose that the eighteen lost but documented Masses implied that there were 100, 200, or even 500 missing Masses that were undocumented. These numbers would still not mean that only a small part of the original repertoire survives. There are over 700 Mass cycles extant (complete or in part) from the mid-fifteenth century and early-sixteenth centuries.¹² Clearly, finding 100 new Masses would make an impact on musicology of the fifteenth century, especially in our understanding of how important composers, courts, and trends are situated in larger contexts.

This discovery would not, however, create a new repertory that dwarfs what actually survives. Indeed, I would propose a rereading of the Masses discovered since the 1950s mentioned in Wegman's Appendix II (coincidentally, also numbering eighteen). I would argue that these discoveries are small compared to the hundreds that had been previously discovered, only increasing the corpus by three percent. Compared with the number of new fourteenth-century pieces found over the past sixty years, the 3% increase in the number of surviving fifteenth-century Masses implies that that repertory is even more

¹² Wegman, "Publication Before Printing," pp. 170–71.

complete than the fourteenth-century repertory. This intuition accords with the received assumption that, in general, a smaller percentage of the music is lost with each succeeding generation of composers.¹³

PEER-TO-PEER NETWORKS

Returning to the topic with which I began this paper, I would like to consider new evidence from a widely different research area that may shed light on musical losses in earlier periods.

At the 2010 International Symposium on Music Information Retrieval in Utrecht, Netherlands, Noam Koenigstein of Tel-Aviv University presented work undertaken with his colleagues on a problem of high importance and interest to the music industry: how to improve the accuracy of systems that recommend songs to listeners on the basis of other songs they own (and presumably like).¹⁴ Such recommendation systems form the heart of websites such as Pandora, structure the “genius” feature of iTunes, and shape suggestions for bundled purchases on Amazon.com. Improving the quality of recommendations is valuable enough to the industry that

¹³ Wegman makes one observation that I am unable to reconcile with the evidence for high rates of survival, being less familiar with this repertory, but scholarly integrity compels me to mention it. He notes that the majority of Masses appear in only one or two sources (“Publication Before Printing,” p. 169), which in itself does suggest a higher rate of loss than the other models. Perhaps the sheer size of the repertory compared to the surviving number of manuscripts accounts for this discrepancy. Given the small number of manuscripts and given how many of them are small fragments that survive incompletely, would it even be possible for the typical Mass to appear in three or four sources?

¹⁴ Noam Koenigstein, Yuval Shavitt, Ela Weinsberg, and Udi Weinsberg, “On the Applicability of Peer-to-Peer Data in Music Information Retrieval Research,” *Proceedings of the International Society for Music Information Retrieval* 11 (Utrecht, 2010), pp. 273–78.

technology companies have offered huge prizes to researchers whose work yields even small improvements over the current technology.¹⁵ Large stores of data are crucial to improving any algorithm for predicting listeners' tastes. These datasets are generally lists of songs that listeners have said that they like. Most computer algorithms perform better when they are based on more data. But gathering this information about listeners' tastes is difficult. Polling hundreds or thousands of listeners is expensive, time-consuming, and ultimately impractical.

The extensive data gathered by for-profit companies such as Pandora and Amazon is off-limits to academic researchers since such companies are understandably reluctant to give away information that could give competitors a leg up on improving their own systems. To solve this problem of how to gather more data inexpensively and quickly, the Israeli research group led by Koenigstein came up with an innovative solution. They looked at commonly-paired songs on people's shared music lists found on peer-to-peer file sharing networks. They thus saw which songs tended to appear together on a single person's computer. Although finding these pairings was the ultimate goal of their research, Koenigstein's research group discovered along the way another trend, one important to understanding the popularity of songs over time. They found that within any geographical region, as the number of computers they uncovered increased, the number of songs they found increased at a much slower rate. Figure 2 adapts one of their charts to show the data of most interest to medieval musicologists. Comparing the reading for 100,000 computers to that for 20,000, it shows that a five-

¹⁵ The most prominent prize for improving recommendation systems was the \$1,000,000 offered by Netflix for any research group demonstrating an improvement of 10% or more in movie suggestions. See <http://www.netflixprize.com/>.

fold increase in the number of computers less than doubles the number of songs that are found.¹⁶

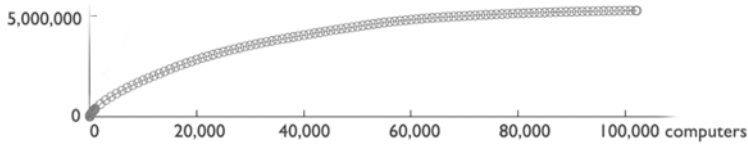


Figure 2. Number of unique songs as a function of the number of computers discovered.

The graph follows what are called power laws, where the number of new songs is related to the logarithm—that is, to the orders of magnitude—of the number of computers that are observed. If the number of computers the researchers found were reduced by 90%—that is, if they were to find only 10,000 instead of 100,000 people sharing (i.e., just the “tip of the iceberg” of people), they would still have access to 38% of the number of songs that would otherwise be available, or about 1.8 million.

This investigation presents an approach that is equally relevant to late-medieval and early-Renaissance music. To test whether fourteenth-century music also follows such power laws, researchers can conceptually “lose” some portion (say half) of the manuscripts from our catalogs (that

¹⁶ Adapted from Koenigstein, et al., “On the Applicability,” p. 276. The authors give two different definitions of what constitutes a different song: either a change (or even slight variant) in the name or performer of a song or any change in the title or music, including imperceptible changes induced by encoding the song differently. Obviously, using the second metric results in many more different “songs,” but the first method accords much more closely with our common-sense definition of a different song. In fact, we would hardly consider small variants in the name of a musical piece (“Rite of Spring,” vs. “The rite of spring”) or of the performer to represent a different piece, and thus the number of new songs per computer may be much lower, and the curve much flatter, than what Koenigstein, et. al., reports.

is, omit them) and see how many songs vanish. Though my conclusions are preliminary, it seems that losing half the copies of pieces loses about 20% of the songs, a number about on par with the peer-to-peer data for modern music. Extrapolating from this proportion, if the number of known sources doubled, only 20% more pieces would be found. If we believe that, say 3% of medieval musical manuscripts survive, then we would need to double our sources about five times to return to the original corpus, and thus we should believe that the number of lost pieces is about 150% bigger than the number that survives. Put another way, this thought experiment suggests that the original number of songs was a bit over double the current number, and our survival rate is about 40%, and that what survives, while not necessarily the majority of works, is far larger than just the tip of an iceberg.

Both our intuition and the data from the study of peer-to-peer networks do allow for one way in which a lost repertory much larger than that which I have just suggested may once have existed. If our surviving sources are not representative of the original diversity of music, then there may be other, undetected sub-repertoires. As an analogy, the Tel-Aviv team discovered that if the computers selected for the study omitted those from a single country with isolated and idiosyncratic musical tastes, such as Japan, then the number of pieces missing from the larger survey would be larger than it would be if the computers were omitted randomly. We can imagine the same effect happening in medieval music. For instance, Turin, Biblioteca Nazionale Universitaria, MS J.II.9, is the lone surviving polyphonic codex from Cyprus. It preserves hundreds of pieces that appear nowhere else. Thus while I believe we have the majority of pieces from cultures we have examined closely, such as Tuscan Italy, branching out musicological investigations to understudied regions, such as Croatia, Bohemia, and Poland, has the potential to uncover many new pieces in styles as yet unknown.

MANUSCRIPT STEMMAS

Even more difficult than trying to figure out how many pieces have been lost over the centuries is estimating how many manuscripts of medieval music have disappeared. As I wrote in “Tipping the Iceberg”, there are at least three definitions of lost medieval music that “are too often lumped together”: music that was never written down in the first place, lost manuscripts, and finally, lost songs of the written tradition.¹⁷ At the time I noted that I had little to say about the first two types of music, and indeed, I still have no significant findings to contribute to our understanding of the first, that is, unwritten music (though the fact that most of the *ballatas* whose texts appear in poetic anthologies survive with notated music suggests that there were few unwritten songs in this genre). However, in thinking more about lost manuscripts, I propose that there are techniques that could hint at the number of lost sources, or at least should make musicologists skeptical of a commonly used analytical tool: stemmatics.

Comparing the percentage of extant to lost manuscripts in old library catalogues could give a sense of the proportion of surviving manuscripts as a whole. For instance, Giovanna Cantoni Alzati’s magnificent study of the library of the monastery of Santa Giustina in Padua reveals that a sizeable portion of their original manuscripts still survive.¹⁸ Yet this methodology has its own dangers: perhaps the libraries that took the time to add call numbers and make systematic catalogues took better care of their collections than the majority who did not. Or perhaps institutions preserve their books better than private collectors, certainly an intuition that would be true if the

¹⁷ “Tipping the Iceberg,” p. 40.

¹⁸ Giovanna Cantoni Alzati, *La biblioteca di S. Giustina di Padova: Libri e cultura presso i benedettini padovani in età umanistica* (Padua, 1982).

situation back then was anything like it is today. All in all, it does not seem like this provides a practical approach for obtaining trustworthy and concrete numbers for estimating the loss of manuscripts.

I would like instead to reexamine stemmatic diagrams as a way of looking at what assumptions they carry about the number of lost manuscripts. Stemmas (or stemmata, if you prefer) are visual ways of representing relationships between sources based on the similarities and differences among their versions of shared pieces. Usually the relationship being sought is the direct copying of one manuscript from another (perhaps with minimal scribal intervention or the inadvertent introduction of errors). In the hypothetical stemma in Figure 3, a Parisian and a Roman source are shown to have been copied from a manuscript in London.

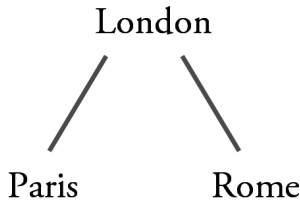


Figure 3. Hypothetical stemma showing three sources.

Stemmas can be more elaborate; we might note that two manuscripts in Utrecht and Prague are themselves copied from the Roman source, while the London manuscript and another manuscript in Essex must have been copied from a now lost source, designated α . (Lost or hypothetical sources are usually denoted with either Greek letters or with letters from near the end of the alphabet such as X, Y, or Z). This more complex relationship is shown in Figure 4.

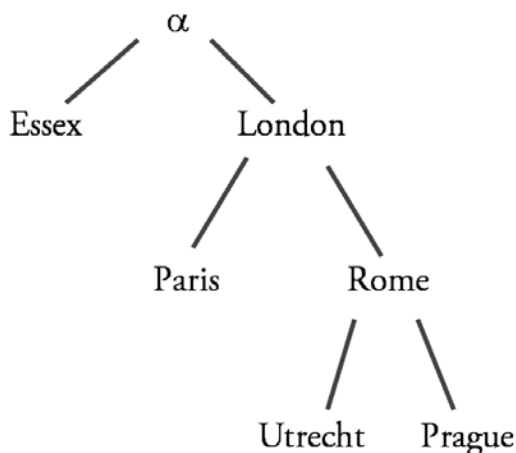
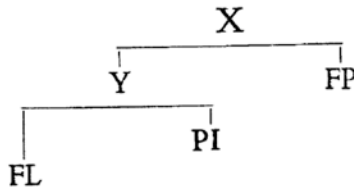


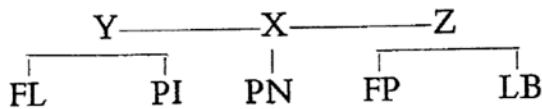
Figure 4. Hypothetical stemma showing six surviving sources and one lost source.

This hypothetical tree represents what might be considered a typical, well-constructed stemma, where most surviving sources are connected to one another with one or a few lost sources filling in gaps in knowledge. But few, if any, stemmas of Trecento sources, or of individual songs contained in Trecento sources, behave like this one. Figure 5 gives three examples taken from the work of Eugene Fellin, a scholar who published a series of articles on relationships of notation among Trecento sources of madrigals.¹⁹

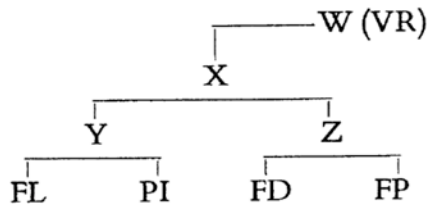
¹⁹ Eugene Fellin, "Le relazioni tra i manoscritti musicali del Trecento," *Rivista Italiana di Musicologia* 8.2 (1973), pp. 165–80, adapted from his Ph.D. dissertation, "A Study of Superius Variants in the Sources of Italian Trecento Music: Madrigals and Cacce," 4 vols. (Ph.D. dissertation: University of Wisconsin, 1970).



Vidi nell'ombra, p. 171



La douce çere, p. 176

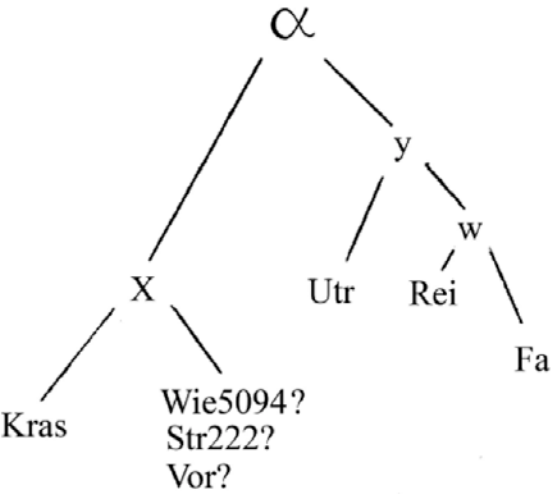


La Bella Stella, p. 177

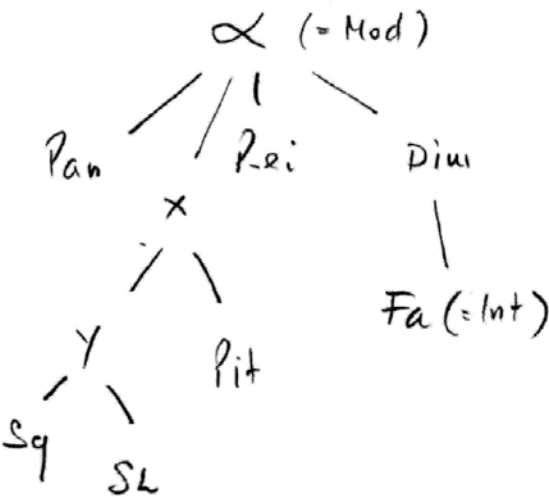
Figure 5: Three examples from Fellin's work. (W, X, Y, and Z are lost sources).

Unlike the hypothetical stemma of Figure 4, in these examples there are almost as many lost sources as there are surviving sources. Furthermore, in none of these examples have the surviving sources been copied from one another. Similarly-structured diagrams are found throughout more recent work on fourteenth- and early fifteenth-century sources. Figure 6 produces three diagrams taken from Pedro Memelsdorff's incomparable recent dissertation on the Faenza keyboard manuscript.²⁰

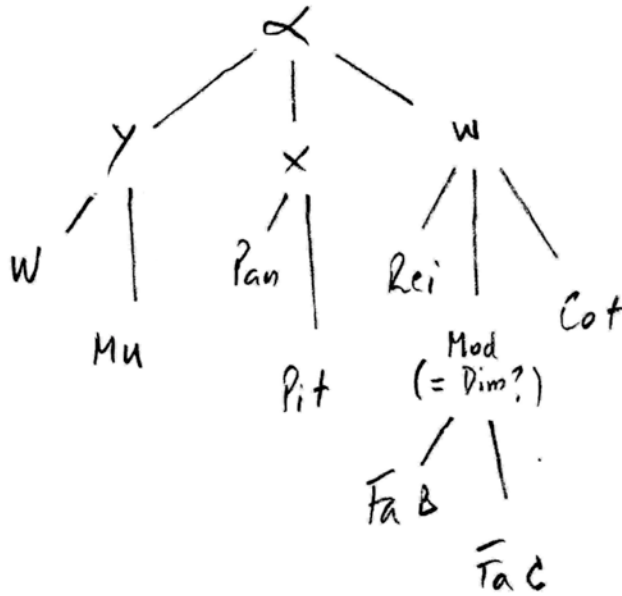
²⁰ Pedro Memelsdorff, "The Filiation and Transmission of Instrumental Polyphony in Late Medieval Italy: The Codex Faenza 117," (Ph.D. dissertation: Universiteit Utrecht, 2010).



Indescort, p. 174.



Soto limperio, p. 216.



Jour a jour la vie, p. 197.

Figure 6. Three examples from the work of Memelsdorff.

In these diagrams, in addition to single Roman and Greek letters, the phrases “Dim.” and “Mod.” also represent lost sources of specific types: diminutions (i.e., keyboard versions) and model compositions, respectively. Thus, there are nearly as many lost sources as surviving ones, and no surviving source is copied from another. Why does it matter that these stemmata do not resemble the model stemma I gave before? Let me not try the reader’s patience further and get to the point: these stemmata are only plausible if thousands or even millions of polyphonic music manuscripts are lost.

Consider the stemma for *Jour a jour la vie* again. It consists of eight surviving sources: Wolkenstein (capital W), Munich, Panciatichi, Pit., Reina, two distinct sections of the Faenza codex, and a source in the Cotton collection of the British Library. It also depicts five lost sources, lowercase-w, x, y, α, and Mod. Suppose for a moment that these thirteen

sources were the only sources for this *rondeau* that ever existed. We know that sources get lost over time and that the survival or loss of any particular source follows no particular pattern; one can therefore calculate the odds that every one of the lost sources would be a critical missing link in the stemma connecting two or more sources that survive. It is really not too hard to calculate: randomly distribute known and unknown sources among the positions in the stemma and compute the probability that the positions linking two or more sources are only occupied by unknown sources. It would be $5/13 \times 4/12 \times 3/11 \times 2/10 \times 1/9$, or less than 1 in 1,000. Those are pretty low odds. Thus, a stemma of thirteen sources where none of the eight surviving sources were copied from each other would be very unlikely indeed.

Fortunately, there are more likely stemmas in which none of the surviving sources were copied from each other. If we assume that there are many more missing sources than what we see here, then the odds that no surviving source was directly copied from another surviving source become much more likely. For instance, if we add ten more lost sources of *Jour a jour la vie* to the five that Memelsdorff has postulated, then the odds become $15/23 \times 14/22 \times 13/21 \times 12/20 \times 11/19$, or about a 1 in 11 chance that no surviving source would be copied from another surviving source. To create a stemma which would have a decent chance (say over 50%) of occurring where none of the sources were copied from each other, we would need to speculate that there were once fifty-six more sources of *Jour a jour la vie* than we currently have, thus implying that there were seven lost manuscripts for every one that survives.

The ratio of seven lost manuscripts to one surviving source does not seem high in itself. But the ratio jumps dramatically when one considers that *Jour a jour la vie* is not the only piece for which Memelsdorff makes a stemma in which no surviving source was copied from another. There are ten large stemmas in his study of Faenza (along with several smaller ones), none of which imply a direct relationship between any two manuscripts. So, we need to ask not just how many sources would have once needed to

exist to make Memelsdorff's proposed stemma for *Jour a jour* likely, but also how many sources would need to once have existed to make it probable that none of the ten pieces was directly copied from another surviving source. The number of lost sources skyrockets. For it to be likely that none of the manuscripts containing any of these ten pieces were copied from another surviving source, there would have to have been for each surviving source of a piece about eighty sources that do not survive; thus, about one percent of manuscripts exist. Again, this is not an out-of-the-ballpark conclusion in itself, but the more stemmas we create without two Trecento sources that are copied from each other, the more hypothetical lost sources need to be imagined. For instance, twenty stemmas would require a ratio in excess of 150 to 1 of lost to surviving sources for any given piece.

The ratios of 80 to 1, or even 150 to 1, do not seem too implausible for the proportion of lost to surviving manuscripts. They become more surprising, however, when one recalls that these are just the manuscripts needed to contain the ten or twenty works for which stemmas have already been made. How many total manuscripts of Trecento polyphony would we expect there to have once been in order to have 80 or 150 copies of all pieces with similarly disconnected stemmas? The answer to this question depends on how likely we expect new manuscript discoveries to bring with them new works. If most works survive, then the total ratio of lost to surviving manuscripts increases only a bit. This is the view that my "tipping" hypotheses suggest. However, if the proportion of lost pieces were very high, then absurdly high numbers of lost sources would need to have once existed.

There are other ways to respond to this information than to ignore it or insist that statistics do not belong in the humanities. Scholars might believe that there were in fact many, many manuscripts of medieval music (a Library of Congress of missing Trecento polyphony alone). Or, they may embrace the "tipping" hypothesis. Or, they might abandon the use of stemmatics as a research tool. Any of these choices is a logical response to the information at hand. But one cannot believe simultaneously in the power

of stemmatics while simultaneously believing in the tip-of-the-iceberg hypothesis without also imagining a medieval world swimming in polyphonic manuscripts.

CODA: THE POSITIVE SIDE OF HAVING FEWER PIECES

It may be easy to take this article as a pessimistic view of how we have conducted research: Stemmas are too complicated. Our iceberg metaphor is wrong. Don't bother digging in archives if you want new pieces. There are, however, positive aspects to take away from this research, so let me end with two of them.

The recent discovery by Mark Everist of fragments from several fourteenth- and fifteenth-century manuscripts gives another opportunity to test the hypothesis that a good percentage of pieces from the *ars nova* survive.²¹ Among the fragments he discovered were three beautiful French songs. One of these songs was already known, while two were new discoveries. However, two further fourteenth-century pieces on fol. 158 remained a mystery in his study. I have had the opportunity to study the source, and both of them are previously-known Latin motets. One is the well-known work *Flos ortus inter lilia/Celsa cedrus*, known previously from Trémoille, Ivrea 115, Cambrai 1328, Paris 2444, and San Lorenzo 2211, but here presented for the first time with a Contratenor. The reverse side (now the recto but probably originally the verso) contains the missing top voice to the motet *Plausu querulo*, whose second voice and tenor were found in a fragment in Cortona, and which can be transcribed and performed now for the first time.²² The

²¹ Mark Everist, "A New Source for the Polyphony of the *Ars subtilior*: Paris, Bibliothèque nationale, nouvelles acquisitions françaises 22069," in *A late Medieval Songbook and its Context: New Perspectives on the Chantilly Codex (Bibliothèque du Château de Chantilly, Ms. 564)*, ed. Yolanda Plumley and Anne Stone (Turnhout, 2010), pp. 283–301.

²² Margaret Bent has informed me that these identifications have been made independently by herself and Giuliano di Bacco

knowledge that any newly discovered piece is more likely than not to be a concordance of an existing source should embolden scholars to perform exhaustive searches before concluding that the new source is a *unicum* work.

Finally, musicologists can take heart and cast off the too-prevalent notion that we know next to nothing about what medieval music was really like, on account of having lost so much of it. Handicaps to true understanding still exist since musical notation leaves much unspoken. Yet scholars need no longer say that so little of what was once written in the Middle Ages survives. Nor need they say that they have no idea what music was popular. Many pieces do survive, and we have a good idea which works were popular. Using other methodologies,²³ it is possible to identify several pieces that were definitely popular and do not merely survive in many sources as a result of random chance. For example, we can say with some certainty that many of the most popular sacred pieces of the late-fourteenth and early-fifteenth century were composed by Antonio Zachara da Teramo, the hunchbacked, disfigured singer and scribe to the pope. Zachara's Mass movements dominate the list of the most popular pieces of the Trecento, yet they are rarely performed, almost never recorded, and seldom studied. Thus, the study of much that was prized by medieval musicians remains low-hanging fruit for researchers to pluck in their quest for knowledge. Through greater studies of these works, we might reestablish connections with those distant peers of ours: medieval scribes who copied, listened to, and exchanged music on the song-sharing networks of centuries past.

as well. Di Bacco discussed them further in a presentation titled "Plausu querulo' and other Latin Compositions in MS Paris 22069," at the Medieval and Renaissance Music Conference in Barcelona, July 2011. I will thus leave to my good friend the joy of further work on these interesting pieces.

²³ Cuthbert, "Tipping the Iceberg," pp. 49–52.

Cantus scriptus

Technologies of Medieval Song

Proceedings of the 3rd Annual Lawrence J. Schoenberg
Symposium on Manuscripts Studies in the Digital Age

November 20-21, 2010

Edited by
Lynn Ransom
Emma Dillon



gorgias press

2012

Gorgias Press LLC, 954 River Road, Piscataway, NJ, 08854, USA

www.gorgiaspress.com

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2012



ISBN 978-1-61719-056-8

A Cataloging-in-Publication Record is Available from the Library of Congress.

Printed in the United States of America

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