LABYRINTH of RUINS

Francis Bacon's Encrypted Sonnet Sequence

Volume I

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To my parents

who provided me with a liberal education and
encouraged the lifelong pursuit of learning

Sed nos quos crassa Minerva dedecet,
non patiamur abstrusa esse adyta sacri poematis,
sed arcanorum sensuum investigato aditu,
doctorum cultu celebranda praebeamus reclusa penetralia.

—Macrobius, *Saturnalia* (1.24.13)

(But we who disdain a shallow understanding, will not allow the innermost recesses of the sacred poem to remain concealed, but instead will expose them by finding the pathway to their secret significance, and reveal their deepest meaning, so that by the veneration of scholars, they may be duly honored.)

Acknowledgments

The inspiration to embark on this study arose from the lectures of my teacher at Brandeis, poet and scholar Allen Grossman (1932–2014), who left an indelible mark upon me and my fellow students. I was truly fortunate to receive excellent counsel from many scholars at various stages of this project. The ideas, corrections, and support that I received from the following modern language professors were essential to my undertaking. I am most grateful for the help that I received from Adam Rzepka, who provided sound advice and many detailed comments that shaped both the style and content of this study. Gerhard F. Strasser, a scholar with expertise in the cryptography of the early modern period, provided detailed feedback that resulted in many important improvements to my study. My friend of fifty years, Richard B. Freadman, dispensed valuable advice and answered many of the literary questions that I posed over the past decade. Steven Monte read an early draft of this study: his comments led to changes in its presentation. William Junker provided me with a critique that both refined arguments and initiated new explorations. Finally, James Kee read an earlier study on a related topic, providing essential feedback and encouragement.

The cryptographic aspects of this study led me to consult with a different group of scholars: mathematicians. I owe a great debt to Jacques Cohen, who founded the Computer Science Department at Brandeis. On many occasions, usually over lunch, he provided essential advice on how to move my project forward. Another emeritus professor from Brandeis, Martin Cohn, advised me on certain cryptographic details and mathematical arguments. Chris Thorpe, a mathematician and computer industry entrepreneur, offered many helpful suggestions at an early stage of this project. Finally, the late Steven J. Schwartz, a colleague in the computer industry, taught me to use models to tackle difficult problems.

I also owe a dept to classicists, especially Neo-Latinist Dana Sutton, whose textual work and insights into the *Hekatompathia* proved extraordinarily valuable. I am indebted to Patricia A. Johnston, a Latinist, who

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I deeply appreciate the diligence and thoughtful advice of my editor, Kelly Clody. Her push toward greater clarity and attention to detail were essential to making this complex study accessible. My wife, Penelope, was the editor of the early drafts of this study and provided valuable advice on many critical editorial decisions. Most importantly, she was extremely supportive overall of my pursuit of this project, which consumed considerable time and resources.

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Reader's Guide: Objectives, organization, conventions, and abbreviations

Literary critics do not write two-volume monographs on rarely read works—an explanation is in order. The *Hekatompathia*, the first English sonnet sequence, presents an extensive and complex puzzle that defines a new order for most of the work's sonnets, revealing a radically changed sonnet sequence. The "Puzzle" (the term used throughout this study) also references a set of tables in an influential cryptography manual and asserts that the reader may "decypher" something "cunningly conveighed" by the "secret transposition of letters." The present study solves this literary-cryptographic Puzzle by leading the reader on a step-by-step labyrinthine journey that shows exactly how and why the work's text is rearranged.

The concept of a reader-transformed text has its origins in the medieval and Renaissance practice of "ruined" poetry, which the *Hekatompathia* takes to its ultimate limit. The Puzzle yields a finely detailed blueprint from which the reader produces a new sequence organized around a heterodox cosmology. The Puzzle's directives include prefaces, sonnet headnotes, intratextual links, contradictions in the poetic text that require resolution, and cryptographic messages. As explained in the first chapter, the Puzzle's cryptography stabilizes the interpretation of the Puzzle's literary components.

Solving the Puzzle requires that literary hermeneutics and cryptographic skills be applied in tandem, a task unlike any found in other literary works. In the *Hekatompathia*, cryptography may be thought of as another form of literary communication, like symbolism or allegory. But from our contemporary viewpoint, the work is a chimera, marrying two disparate disciplines, one an art and the other a science. As a result, this study often appears to be eccentric, suddenly (but unavoidably) shifting gears from literary interpretation to codebreaking and back again. Whenever possible, I have separated these disciplines (for example, Chapter 2 is primarily

cryptographic; Chapters 3 and 4 are primarily literary). However, this study's order is necessarily determined by the step-by-step process required to solve the Puzzle, an order established by the Puzzle's creator.

This study's essential task is to win acceptance for the restored text, and toward that end, every detail of the Puzzle's solution must be documented, which requires two volumes. While a relatively complete view of the *Hekatompathia* is presented in this study's first volume, many of the cryptographic details and much of the commentary on individual sonnets are reserved for the second volume. This allows the reader to read only the first volume and refer to the second volume only if greater detail is desired. As the second volume is primarily intended as a reference work, it has been made publicly available on this study's website (Hekatompathia.com).

The first volume solves the Puzzle, step by step, through its seven distinct stages, each of which produces a cryptographic message. The first volume contains all details of the solutions to the first and seventh stages, but for the second through sixth stages, the details appear in Addenda 1–11 of the second volume. The second volume also includes appendices, excursus, and the complete restored text of the *Hekatompathia*. The first volume references the second volume by referring to "Appendix A," "Addendum 1," "Excursus 1," and so forth. (See the table of contents for the second volume, which also appears in this volume.)

Literary criticism has one set of editorial standards; the presentation of technical materials (e.g., mathematics and cryptography) follow different editorial standards. As part of its deciphering process, *Labyrinth of Ruins* uses symbols, numbers, and abbreviations that are not easily handled by the usual editorial standards in the humanities. For example, numbers appear in Arabic numerals, rather than being written out (the standard in the humanities). I have adopted standards, as described below, that are most practical for this study, borrowing from the editorial practices of both fields.

Objectives

The first objective of this study is to win acceptance for the restored text of the *Hekatompathia*. Achieving this goal will grant scholars access to a precisely structured sonnet sequence, with extensive authorial annotations that reveal how this Renaissance poet constructed his sonnet sequence. Indeed, the purpose of the sequence and its Puzzle is to teach its readers how poetry is written and how it is to be read—the hermeneutics of Renaissance poetry (see Chapter 1). Its organization around an Epicurean cosmology will provide new insights into the intellectual

history of the early modern period (see Chapter 14). Its practice of early modern rhetorical strategies will aid us in reading other early modern poetry (see Chapter 1).

Nevertheless, I am concerned that my claim of Bacon's authorship—unexpected, sensational, and thus likely to be met with skepticism—will overshadow the restoration of the sequence. This restoration occurs in the Puzzle's first four stages, and thus may be considered independently from Bacon's authorship, which is only revealed in the seventh stage. Taken together, the Puzzle's stages present such a novel—indeed freakish—contraption to which one's first reaction may be rejection of the Puzzle as a mirage. However, if this study's readers evaluate the Puzzle in a dispassionate and scrupulous manner, considering the detailed evidence presented here for each of its incremental stages, the Puzzle—a marvel and wonder—will gain acceptance.

Online resources at Hekatompathia.com

This study's website, Hekatompathia.com, provides these resources:

- This study's edition of the original and restored versions of the *Hekatompathia*.
- This study's second volume, a reference volume, is made freely available.
- This study's endnotes (to allow for quick access while reading a hardcopy).
- Links to *Hekatompathia* editions at Hathitrust, including the 1582 edition and the Spenser Society 1869 edition (an accurate reproduction).
- Links to Dana Sutton's *The Complete Works of Thomas Watson (1556–1592)*, available in modified form at the University of Birmingham's Philological Museum.
- Links to various editions of Trithemius's *Polygraphiae VI* at the Library of Congress, the Herzog August Bibliothek Wolfenbüttel, and the Bayerische Staatsbibliothek.

Conventions in citing the *Hekatompathia*

I place the *Hekatompathia*'s text in italics rather than quotation marks, following the practice that Helen Vendler adopted in her edition of Shakespeare's *Sonnets*. Because the sonnet text is referenced so frequently, using italics avoids what she calls pages "littered with quotation marks" (xvi). These italicized quotations are followed by the sonnet and line number in parentheses, or only the line number if the sonnet being referenced is clear.

The Puzzle's reordering of the *Hekatompathia*'s sonnets required the construction of a special numbering system that reflects the structure and divisions of the new sonnet order, as described in Chapter 5. Sometimes references use the original sonnet number (in Arabic rather than Roman numerals), and at other times the new numbering convention is used—whichever is more likely to be convenient for the reader. "Sonnet Number Converters" allow for quick translation from one numbering system to the other (located at the end of this volume and in Appendix A of Vol. II). The converters also provide a page number reference for the sonnet's text in the addenda of Vol. II. The abbreviations used in the sonnet references are as follows:

H	Head sonnet of a Series (a subgroup of sonnets, as explained in Chapter 5).
HN	Headnote: a headnote appears above every sonnet.
Sz	Stanza: The *Hekatompathia*'s 18-line sonnets have 3 stanzas: Sz1, Sz2, and Sz3.

The editions of the *Hekatompathia*

All published and dissertation editions of the *Hekatompathia* are listed in the "List of Primary Sources" and are identified by the author's or editor's name: Sutton Edition, Heninger Edition, Murphy Dissertation, Phillips Dissertation, and so forth.

The *Hekatompathia*'s three typefaces

The *Hekatompathia*, printed in a single edition in 1582, uses three different typefaces in its text: Old English, a standard serif font, and italics. The use of these three fonts is deliberate, as explained in Chapter 3 and Appendix D, "Notes on the text." All non-facsimile editions, except the 1869 edition, have consolidated the text into two fonts. This loss of fidelity to the original text is not acceptable, and thus this study utilizes three different fonts in its reproduction of the text. To make reading less laborious, the Old English font is rendered in a semibold serif font, the serif font is rendered in a light serif font, and the italics remain unchanged. However, when the *Hekatompathia*'s text is reproduced in short excerpts, only italics are used and all distinction is lost.

Appendices A, B, C, and D (Vol. II)

Appendix A presents the structure of the *Restored Hekatompathia*. Fig. A.1 is a diagram of the work's 3 Subsequences and 10 Series—a useful overview. Appendix B reproduces the cryptographic tables that are discovered and used throughout the solution to the Puzzle. Appendix C lists the deciphering details for all encrypted messages—a summary of the decryptions made throughout the study. Appendix D includes a description of the text's use of its three typefaces, a list of emendations to the text, and a summary of the press variants among the 11 extant copies.

Addenda 1–11 (Vol. II)

These addenda present the sonnet text, including its headnotes, sidenotes, and designs, on a verso page, with both the literary and cryptographic analyses of the sonnet presented on the opposite, recto page. This allows the sonnets to be viewed at the same time as the commentary—like a facing translation.

Excursus 1–12 (Vol. II)

In some instances, background or ancillary materials have been placed in an excursus.

The *Restored Hekatompathia* (Vol. II)

The restored sequence appears at the end of the second volume. Although the sonnets also appear in Addenda 1–11, they are interspersed with my commentary and organized in accordance with the process of their discovery. The text of the restored sequence appears uninterrupted and complete with all prefaces.

Cryptography

Many readers will have no prior experience with cryptography, and therefore, I have included certain basic information about cryptography, which appears in Chapters 1 and 2. An introduction to the process of codebreaking and the method by which cryptograms are validated is presented in Excursus 3, "Cryptanalysis and the validation of deciphered texts." As this study's central claims are cryptographic, this excursus is worth examining.

For those interested in learning more about the role and practice of cryptography in this period, I recommend Gerhard F. Strasser's *The Rise*

of Cryptology in the European Renaissance and two of his other contributions to the field (see the List of Secondary Sources). A fascinating compendium of early modern cryptographic practices can be found in *Cryptomenytices* (1623) by Gustavus Selenus (Duke August of Wolfenbüttel). Another valuable resource is *A Material History of Medieval and Early Modern Ciphers*, edited by Katherine Ellison and Susan Kim.

Translations

The Latin translations are mine unless otherwise noted. My translations are deliberately literal, and for poetry, usually maintain line boundaries. Translations of other languages are from the texts found in the List of Primary Sources, unless otherwise noted.

Abbreviations

OED for Oxford English Dictionary, 2nd edition; OLD for Oxford Latin Dictionary; LS for the Lewis and Short Latin Dictionary; STC for Short Title Catalog; *Works*, for the works of Francis Bacon (see the List of Primary Sources).

The appearance of numbers

As mentioned above, I have broken with the standard convention for formatting numbers in this study. I made this decision because the representation of numbers by words rather than Arabic numerals is problematic since this study continuously engages in arithmetic operations. Thus, all numbers greater than 9 appear in Arabic numerals; single digit numbers may or may not appear in Arabic numerals, depending upon their context.

Labyrinth of Ruins editions

Prior to this publication, I privately circulated a small number of copies of an earlier edition, titled *Labyrinth of Ruins: Thomas Watson's Self-Restoring Masterpiece*. That work was written at a time when I had solved only three of the puzzle's seven stages. I refer to the present, two-volume edition as the "Second and Complete Edition."

1

Introduction: A Systematically Concealed Text

Everything that is deep loves the mask.
–Nietzsche

The *Hekatompathia* (1582), the first English sonnet sequence, surprises its readers with a cryptographic puzzle at a critical juncture in the text. The puzzle's instructions, enumerated in five points, promise that a message can be deciphered using a specific set of published cryptographic tables. This odd, indeed unique, interruption of a poetic text has long baffled critics. Some have dismissed the puzzle as esoterica; one critic argued that the puzzle is unsolvable because its construction is flawed; what no one has previously done is to solve the puzzle. And so, until now, the mystery has remained. However, by applying both cryptographic and literary skills, this study has uncovered the solution to this extraordinarily elaborate seven-stage puzzle, in which each stage produces a cryptographic message. Even more surprising, the seventh stage's cryptographic message reveals that the work's author is not actually he whose name appears on the title page, Thomas Watson, but rather the philosopher, statesman, and harbinger of scientific progress, Francis Bacon.

Unfortunately, specious claims of cryptographic messages embedded in Elizabethan texts constitute almost a cottage industry. Shakespearean texts seem to particularly attract such illusory notions. However, none of these pseudo-cryptographic claims are based on an actual cryptographic system; instead, they rely on a fanciful and unsystematic extraction of letters to produce the message that the "decipherer" anticipated at the start. In fact, in most of these pseudo-cryptographic claims, there is usually no reason to suspect that the examined text contains a hidden message in the first place. In contrast, the *Hekatompathia* openly asserts that a hidden message is present and provides the instructions and cryptographic tables required to decipher it. This study follows those instructions

to solve the "Puzzle" (the term used throughout this study), which leads to the deciphering of seven messages. Modern-day mathematical techniques are then used to validate the messages.

Given the history of ludicrous assertions that hidden messages are embedded in Elizabethan texts, this study's reader will naturally be skeptical; however, my hope is that he or she will recognize the categorical differences between its argument and those made under the guise of cryptography. As such, I ask that readers take the proper approach to this study's cryptographic arguments, which is to evaluate them based on the tenets of cryptographic science. These arguments are quantifiable, unlike any matters of literary interpretation or authorship attribution based on the historical record. Indeed, false claims based on a true cryptographic system are difficult to concoct because such systems impose significant constraints. In this sense, the evidence presented here to validate the *Hekatompathia*'s deciphered messages bears some resemblance to the evidence available in certain types of DNA testing in which the discovered correlations could not have arisen by chance (assuming uncorrupted samples and full sequencing). Both DNA and cryptographic tests rely on a coincidence of quantifiable information: the sequences of base pairs (A, T, G, C) in the former and the sequence of letters that form words in the latter.

Past scholarship quite naturally accepted the authority of the *Hekatompathia*'s title page and its authorial attribution to Thomas Watson. However, as discussed below, scholars recognize that a culture of literary anonymity was developed in Elizabethan England, especially among lyric poets. One form of anonymity is to write under a pseudonym, either a fictional name or the borrowed name of an actual person. Thus, even though Watson's authorship appears to be supported by contemporary documents, the purpose of writing under a pseudonym is often to mislead one's contemporaries, which the *Hekatompathia* seems to have successfully done.

As my audience will include literary critics who are not familiar with cryptographic science, this introductory chapter begins with a description of the *Hekatompathia*'s cryptography (no prior knowledge of cryptography is assumed). The fundamental difference between the *Hekatompathia*'s cryptography and the pseudo-cryptographic applied to various Shakespearean texts is considered. Turning to literary matters, the *Hekatompathia* and its reception are briefly described, and an overview of this study's course and its primary concerns are then presented.

Cryptography contrasted with pseudo-cryptography

Unfortunately, the term "cryptography" has been badly abused: various pseudo-scholarly claims have been advanced in which ciphers are "found" when in fact none exist. There are many notorious examples of amateur scholars finding "cryptograms" hidden in Shakespeare's works, and these are purported to reveal that his works were written by someone other than the William Shakespeare born in Stratford. Typically, an enthusiastic proponent of an alternative authorship claim believes that a secret message is embedded in an ordinary text. As Katherine Ellison notes, "The imagination can begin to form connections where they are in fact not present."[1] This is an example of pareidolia, the psychological tendency to find patterns where none exist.

Many such claims were examined in 1958 by two distinguished cryptographers, William F. Friedman and Elizebeth S. Friedman, and they debunked all of the claims they reviewed.[2] Often, they found that these imagined cryptograms stemmed from a reliance on an unsystematic selection or rearrangement of the letters of an ordinary text, as opposed to a valid message deciphered using a clearly defined cryptographic system. Mathematical validations rarely accompany such claims because without a cryptographic system, the process of validation is often impossible to define. In the few cases in which validations are provided, serious flaws are evident. In contrast to such pseudo-cryptography, a cryptographic system operates under clearly defined rules, and the system's properties can be quantitatively analyzed.

One might ask how many claims have been asserted in which a Shakespearean text has been deciphered using a cryptographic system. The answer is none: no true cryptographic claims (i.e., ones based on a cryptographic system) have been proffered at all—not even any false ones.[3] That is because it is difficult to make false cryptographic claims: unless a message is really enciphered in a text, any plausible cryptographic system will deliver nothing other than gibberish. To appreciate the ironclad strength of this study's claim, it is essential to understand the difference between these pseudo-cryptographic claims and a true cryptographic system, such as the one employed in the *Hekatompathia*. We therefore will examine one of the pseudo-cryptographic claims as a foil.

One such claim concerns the enigmatic dedication to Shakespeare's *Sonnets*, which appears in the form of a Roman tombstone (all letters capitalized; interpuncts between words). This unusual format has invited speculation that it hides a secret message. One investigator, John Rollett, arranged the dedication's 144 letters into a rectangle of 8 by 18, as shown in Fig. 1.1. He then concatenated certain letters (highlighted in Fig. 1.1),

and by reading either downward or upward, he formed the name WRIOTHESLEY. Many scholars believe that Henry Wriothesley, 3rd Earl of Southampton, is the dedicatee of the *Sonnets*. Rollett claims that the probability of finding this name is one in 20,000 (a calculation that he fails to provide) and that this validates his discovery.[4]

T	O	T	H	E	O	N	L	I	E	B	E	G	E	T	T	E	R
O	F	T	H	E	S	E	I	N	S	V	I	N	G	S	O	N	N
E	T	S	M	r	W	H	A	L	L	H	A	P	P	I	N	E	S
S	E	A	N	D	T	H	A	T	E	T	E	R	N	I	T	I	E
P	R	O	M	I	S	E	D	B	Y	O	V	R	E	V	E	R	L
I	V	I	N	G	P	O	E	T	W	I	S	H	E	T	H	T	H
E	W	E	L	L	W	I	S	H	I	N	G	A	D	V	E	N	T
V	R	E	R	I	N	S	E	T	T	I	N	G	F	O	R	T	H

Fig. 1.1 A rectangular view of the Dedication in Shakespeare's *Sonnets*

Rollett's discovery is not based on a cryptographic system, and indeed, the degree of freedom or latitude in his selection of letters is wide and arbitrary. To begin with, the 11-letter name WRIOTHESLEY could have appeared in 11 contiguous letters, or been split into two or four groups rather than the three that he conveniently settles upon to obtain his desired result. Reading upward or downward is an arbitrary choice. The placement of the segments within the rectangle is also arbitrary. The letters might have appeared diagonally instead of vertically, or even horizontally (for a small number of characters, as the open text appears horizontally). The 144 letters could have instead been used to form a rectangle of different dimensions, including 6 by 24, 9 by 16, 12 by 12, 16 by 9, 18 by 8, and so forth. Finally, there are at least a dozen other dedicatee candidates in addition to Henry Wriothesley, and thus any search should not be restricted to only Wriothesley. When we factor the foregoing variations into the calculation, we find that the true probability is closer to one out of two—which is no validation at all—and far from the one in 20,000 that Rollett claims.[5] Moreover, if the dedication's author really wished to embed someone's name by this method, the dedication's text (Fig. 1.1 read horizontally) could have been easily edited to produce WRIOTHESLEY in a contiguous 11-letter span rather than divided into three segments. Indeed, the arbitrary concatenation of three segments to form WRIOTHESLEY should arouse our skepticism. Such free ranging and non-systemic assumptions permit the arbitrary production of a vast range of texts—the fundamental flaw at the center of pseudo-cryptography. Unlike these so called "Shakespearean ciphers,"

the cryptography presented in this study of the *Hekatompathia* is based on a proper cryptographic system and the work's explicit reference to a set of tables in a widely available cryptographic textbook.

The validation of deciphered texts

Given that the unprecedented claim of Bacon's authorship rests upon the validation of a deciphered message, an explanation of how cryptograms are validated is now provided. An essential cryptographic term is "cryptanalysis": the deciphering of a cryptogram by someone who does not have access to the key. For example, if an enemy courier with an encrypted message is intercepted, an attempt may be made to decipher the message without access to the cryptographic key—often referred to as "cracking" the cipher. In such cases, how do we know that the deciphered message is valid?

When a proper cryptographic system is employed, a deciphered message may be validated using a standard mathematical method. To appreciate how these validations are made, and the level of certainty that they yield, I present a simple example. We examine a 12-letter enciphered message, ZOUMQLDOXMEU, which we suspect was enciphered using the simplest of cryptographic methods, known as a "Caesar shift." In this method, each letter is shifted alphabetically by a fixed number of places. For example, if the shift or key is equal to 3, then the letter that typically occupies position 4 in the alphabet, the letter "D," is encrypted by "shifting" back three letters, and thus the letter "D" is substituted by the letter "A." Similarly, "E" is substituted by "B," "F" by "C," and so on. To decipher the message, one simply reverses the process, substituting D for A, E for B, and so on. In this example, as in all the cryptography of this study, the 24-letter Elizabethan alphabet was used. If our intercepted 12-letter cryptogram is a simple Caesar shift, then the unknown key must be a number between 1 and 23 (24 would be no shift at all). Without knowledge of the key, we may nevertheless decipher our cryptogram (ZOUMQLDOXMEU), commonly called a "ciphertext," by simply iterating through all possible keys, as shown in Fig. 1.2.

Ciphertext:	Z	O	U	M	Q	L	D	O	X	M	E	U
Key = 1	A	P	W	N	R	M	E	P	Y	N	F	W
Key = 2	B	Q	X	O	S	N	F	Q	Z	O	G	X
Key = 3	**C**	**R**	**Y**	**P**	**T**	**O**	**G**	**R**	**A**	**P**	**H**	**Y**
Key = 4	D	S	Z	Q	U	P	H	S	B	Q	I	Z

(Keys 5 through 23 are omitted)

Fig. 1.2 Cryptanalysis of Caesar shift cipher

A key value of 3, shown in bold in Fig. 1.2, produces the deciphered text CRYPTOGRAPHY; all other keys produce gibberish. Even though we do not have direct knowledge that the encipherer used a key value of 3, our sense is that our deciphered message must be correct because the disorder created by all the other alphabetic shifts is so high that an English word or phrase is extremely unlikely to be produced purely by chance. Alphabetic shifts are essentially a randomizing process and are foreign to any natural communicative use of the English language.

We now quantify the probability of the unlikely event that a valid message is produced serendipitously, that is, purely by chance. Is it possible, for example, that a different key value would yield another 12-letter word, say, WICKETKEEPER? What is the probability that when cracking a 12-letter cryptogram enciphered by a Caesar shift, we obtain a valid English message that was not intentionally enciphered? To calculate this probability, we first determine the number of all possible ciphertext messages. The ciphertext could have any of 24 letters as its first character, any of 24 letters as its second character, etc. Cryptographers refer to this as the "absolute rate of language," and it is equal to the number of characters in the alphabet, 24, raised to the power of the number of characters in the message. In our example, the number of all possible 12-letter texts (the absolute rate of language) is 24^{12}, equal to approximately 36,520 trillion. We now must calculate the number of valid messages. For the purpose of illustration, we will make the simplifying (but inexact) assumption that the message can only be a 12-letter word rather than a phrase. (In this study's validations, a more sophisticated calculation is made that allows for multiple words in the deciphered messages.) The number of 12-letter English words is approximately 20,000. What is the probability that one of the 36,520 trillion possible ciphertexts will produce one of these 20,000 12-letter English words?

This probability calculation may be analogized as the purchase of lottery tickets. Suppose that there is a one in one billion chance that any single lottery ticket is a winner. Suppose further that we purchase one thousand lottery tickets. What then is the probability that one of our one thousand tickets wins the lottery? It is approximately one thousand divided by one billion, which is equal to one in one million.[6] Applying this simple division to our 12-letter cryptogram, the probability that any Caesar shift will produce one of the 20,000 12-letter words is 20,000 divided by the number of possible ciphertexts (the absolute rate of language or 36,520 trillion), which is equal to approximately one in 1.8 trillion. Thus, the probability of serendipitously deciphering an unintended message with a given key is very remote. However, we must also account for our examination of all 23 possible keys in the deciphering process (known as "key

equivocation"). This has the effect of increasing the probability by a factor of 23. The probability that any of our 23 keys might serendipitously generate a valid message is thus one in 79 billion (23 divided by 1.8 trillion). For all practical purposes, a probability of one in 79 billion describes an event that will never happen.

In this example, three factors enter the calculation: the absolute rate of language (the full range of the ciphertext), the number of valid messages (all valid 12-letter words), and the range of the key (23). This calculation applies the standard methods developed by the founder of Information Theory, Claude Shannon (1916–2001). The basic principle behind the validation of cryptograms is that there are only two circumstances that can produce a valid message: either someone actually encrypted the message using the key, or by some freakish chance, a valid message serendipitously emerged. If one can show that the probability of the second circumstance is sufficiently remote, then the deciphered message must be the encipherer's authentic and intended message. Put another way, a cryptogram is validated by showing that the chance of its accidental generation is essentially nil.

We now consider the difference between the above Caesar shift example and the pseudo-cryptography applied by Rollett to the dedication in the *Sonnets*. In the former, a standard method was applied, and the key had a very narrow range (1 to 23). In the latter, an ad hoc method was applied, and the key effectively had a very wide range. In Rollett's deciphering, the key range is essentially a product of his varied and not-well-defined methods, resulting in an astronomical key range: he arbitrarily selected the rectangle size, the number of segments, the place of each segment, the direction of reading, and so forth. If we multiply the range of each of these arbitrary choices together (as probability theory dictates), the result is billions of keys. In his process of deciphering, Rollett worked backward, looking for the name WRIOTHESLEY (one of two prominently suspected dedicatees of the *Sonnets*) and making key or method choices that result in that name. This is the operative principle behind Shakespearean pseudo-cryptography: the cumulative and wide-ranging arbitrary choices made in the process of deciphering allow for almost anything to be discovered.

In contrast, a true cryptographic system applies a key with a clearly defined range. This clearly defined key range allows for an authoritative calculation of the probability that a deciphered message is valid. Unlike pseudo-cryptography, the messages deciphered in this study are based on a cryptographic system, and the components of that system can be found in various sixteenth-century cryptographic manuals. These deciphered messages are examined mathematically, using the standard methods of Shannon and probability theory.

Unlike pseudo-cryptographic claims, this study discovers Bacon's name only subsequent to the discovery of other deciphered messages. These Latin messages explain the author's poetic purpose, and Bacon's name is revealed only at the end—and with extraordinary flair. The Puzzle's 7-Stage labyrinth design makes it impossible to work in reverse: one cannot start with an assumed name and then choose keys or methods that produce that name. Moreover, the deciphered messages in two of the Stages appear elsewhere in the text, which verify the cryptographic system. In short, the *Hekatompathia*'s cryptography has nothing at all in common with the pseudo-cryptography used in spurious claims of hidden messages in Elizabethan literature.

The *Hekatompathia* and its reception

The *Hekatompathia* ("one hundred love passions") is an unusual work in many respects, beginning with its name, which, as it appears on the title page, includes a word in Greek: *Ἑκατομπαθία or Passionate Centurie of Loue*. The *Hekatompathia* (as it is known) consists of 100 poems, which the author refers to as either "passions" or "sonnets."[7] Most are 18 lines long and consist of three sestets with a rhyme pattern of ababcc; 6 are Neo-Latin poems. I have chosen to refer to all of its poems as sonnets, followed by the number designated in the text. Although this terminology improperly characterizes the Neo-Latin poems as sonnets, it allows for a simple and consistent reference system.[8] For convenience, I use Arabic numerals rather than the original's Roman numerals.

The sonnets draw heavily from both classical and Renaissance sources. Occasionally, they offer a direct translation of an earlier poem, but more often, the poem is a synthesis of tropes or ideas from the source material. The poet displays an extraordinary level of erudition in drawing upon over two hundred sources,[9] exhibiting a profound "knowledge of Greek, Roman, Italian, French, and Continental Latin literature."[10] The *Hekatompathia* provides details on these sources in the headnotes, which precede every sonnet, and sometimes in sidenotes. The headnotes often include lines from the source or sources in their native language and frequently point out differences between the poem and its source. According to A. E. B. Coldiron, the poet's "highly visible commentary elevates lyric to an object of careful study."[11] Some scholars find these headnotes similar to the glosses of E. K. in Spenser's *Shepheardes Calender* (1579).[12] In both E. K.'s glosses and those found in the *Hekatompathia*, one sometimes encounters a peculiar viewpoint or inconsistency, and this presses the reader to a closer reading of the text and to consider various rhetorical and hermeneutic practices, which are taken up in Chapter 4.

A significant bibliographic feature of the *Hekatompathia* is the placement of woodcut figures or designs below most of the sonnets. Throughout this study, they will be referred to as "Designs." There are 18 different Designs, some appearing as often as a dozen times, but others appearing only once. Some Designs seem to consist of flowers or other parts of a plant while others are elaborate drawings.

The *Hekatompathia* comes to us from a single edition published in 1582, of which 11 copies survive.[13] The work has been republished five times (see this study's List of Primary Sources). Dana Sutton's *Complete Works* (1996) is the most recent edition: it is set in modern type and includes valuable notes and commentary. Sutton details the differences between the printed edition and a surviving manuscript. This manuscript is an earlier version of the work, titled "A Looking glasse for Loovers," but only 80 of the *Hekatompathia*'s 100 poems appear in it.[14] There are two unpublished critical editions that contain much helpful material: dissertations by William M. Murphy (1947) and Wendy Phillips (1989).

Unfortunately, there are few, if any, studies focused on interpreting the work itself, as opposed to understanding its place within literary history or how it exemplifies some feature of Elizabethan poetry. Critics have usually lauded its poetic technique: the poet is said to display excellent diction, his rhymes are rarely forced, and his metrical practice "is notable for the unwavering regularity of its meter; even a simple trochaic substitution is extremely rare."[15] On the other hand, with respect to artistic merit, critical judgment varies considerably. Edward Arber counts him a vastly underrated poet, arguing that "in power of gifts, genius, and learning, we would put Spenser first; Watson, second; and Sidney, third."[16] In contrast, more recent scholarship has often been reserved, sometimes taking a dim view of its borrowings from earlier poets. These critics see such direct adaptations of earlier works as lacking originality. No critic has been stronger in his censure than Murphy:

> For the *Hecatompathia* is nothing but a mosaic of Petrarchan conventions, affirmed and reaffirmed through hundreds of lines of precise but unilluminated verse. Watson was not a creative thinker, but rather the inheritor and warden of a sterile culture, who tried to keep alive a tradition whose possibilities had already been fully exploited. ... To study Watson is to study "pure" literature—literature divorced from emotion, philosophy, and human nature, wedded to scholarship and the outworn ideas of the past.[17]

Here Murphy greatly misjudges the work by wrongly applying present-day aesthetic standards to a very different era. The work's borrowings of poetic

lines and ideas from other poets, with credit given in his extensive headnotes, follows the Renaissance practice of *translatio*, which is by no means unoriginal replication.[18] Cesare Cecioni sees this practice of borrowing from other works as part of the Petrarchan tradition:

> But the Petrarchan is not a plagiarist in the modern sense of the word: he is a Renaissance poet, i.e. a rational imitator of what he considers the best in the works he takes as models.[19]

Unlike Murphy, other scholars have recognized the work's creativity. After all, intertextual appropriations, ubiquitous in poetry, do not exclude originality. Phillips believes that "his treatment of sources is far from slavish imitation."[20] A. E. B. Coldiron deftly critiques the work's use of sources:

> Watson seems much more willing to force the sources to accommodate to his structures than the other way around, since he so variously rejects replicativity and so often subordinates sources, chopping them up and altering their essential features, even while putting them on display. ... Watson fragments, decontextualizes, and radically recontextualizes the bits and pieces he translates.[21]

Stephen Clucas writes, "Watson emphasizes, then, the plasticity of his sources, and... he is perfectly happy to vary his sources for 'more allowable' considerations of invention or expressivity." He notes that it was popular in sixteenth-century Italy to fabricate poems from fragments of other poems, like mosaics, and is critical of Murphy's dismissive comments about the *Hekatompathia*, believing the work to be undervalued.[22] Edgar Wind insists that "one must abandon the common prejudice that imitation is always a cold and uninspired performance, and hence incompatible with a creative spirit."[23]

Another reason that the *Hekatompathia* has been undervalued is its putative impersonal quality— "divorced from emotion," as Murphy asserts. It disclaims autobiographical truth and lacks the narrative details that can make fictions seem real. This is unfavorably compared with the emotional immediacy found in the sequences of Sidney and Shakespeare. In a sense, the *Hekatompathia* seems akin to mannerist art in its artificiality, self-consciousness, and dependence upon an elaborate and complex set of conventions. Yet these are features, not faults, of certain sixteenth-century poetry, and an issue to which we will return.

But regardless of how we judge the work's artistic merits, a closer analysis of the *Hekatompathia* is warranted because of its extensive influence. It was a progenitor of the many sonnet cycles of the 1590s and of

Shakespeare's *Sonnets* in the following decade.[24] Phillips documents a number of strong connections, mostly borrowed tropes and words, that connect the *Hekatompathia* to Shakespeare's *Sonnets*.[25] C. S. Lewis writes, "Watson is perhaps closer to Shakespeare than to any other sonneteer in his conception of the sonnet."[26] Lisle John believes that the *Hekatompathia* is "one of the most important but least-read books of the century."[27]

The authorship of the *Hekatompathia*

The *Hekatompathia*, according to its title page, was "composed by Thomas Watson, Gentleman," which has long gone unquestioned by scholars. The *Hekatompathia*'s poet is recognized as having been both a polymath and polyglot.[28] Much of his work was written in Latin and directed toward an elite, well-educated audience.[29] Michael Hirrel reports that "Watson's learning and writing, especially *Amyntas* and [his translation of] *Antigone*, were highly esteemed by his contemporaries, both during his life and long after. A great many encomia survive."[30] Moreover, he "not only helped shape modern drama in general, but directly touched the plays of Kyd, Marlowe and Shakespeare."[31] Watson appears to have been a member of the Philip Sidney literary circle, in which he apparently developed a close relationship with Sidney and possibly Edmund Spenser.[32] Dana Sutton argues that "his literary output serves to present a cumulative portrait of Watson as first and foremost a philosophical moralist and apostle of Continental culture."[33]

Judgments about Watson's personal life, however, are not complimentary: "He was in his personal life, truly, a rogue."[34] In 1579 he accepted a fee from a mentally unstable woman for soothsaying, which fed her delusion and ultimately caused her to suffer.[35] He was a friend of Christopher Marlowe, and in 1589 interceded in a duel between Marlowe and another man, Bradley. After being seriously wounded by Bradley, Watson killed him, saving both his own life and Marlowe's, though doing so landed him in jail for several months. In another unsavory affair, he participated in a scheme to defraud his employer.[36] Perhaps this should alert us that something is afoot: it seems odd that a man with such deep intellectual pursuits and "a philosophical moralist" should have engaged in these illicit activities.

The *Hekatompathia*'s four separate authorial prefaces (an extraordinary number for any time period) assert that the work may be read in two possible ways: either as a "toy," or in some other, more serious manner. In the last of these prefaces, just prior to the first sonnet, the poet addresses his book as if it were a person and then makes this enigmatic statement:

> **But still observe this rule where ere thou staye,**
> **In all thou mai'st tender thy father's fame,**
> „ Bad is the Bird, that fileth his own nest. (*Quatorzain*, 8–10)

Many books were published anonymously in this period, either without any author's name, with initials only, or under a pseudonym. The above lines suggest that the author is concerned about his reputation, and that the book adheres to some unspecified *rule*, presumably to protect the author's reputation, for *Bad is the Bird, that fileth his own nest*. However, *in all*, the book shall *tender* the poet's *fame*. Solving the Puzzle's seventh and final Stage elucidates the meaning of these words, for that Stage's cryptographic message reveals that Francis Bacon is, in fact, the *Hekatompathia*'s author, not Watson.

Bacon wrote under a pseudonym on a few occasions, and here wrote under the name Thomas Watson, a real person.[37] The lives of Bacon and Watson coincide in several respects: both were believed to be playwrights (Bacon wrote a masque); both were close to Francis Walsingham, England's spymaster, and likely part of Walsingham's intelligence network in France in the late 1570s; both were lawyers; both were members of the Sidney-Leicester literary circle.

There are a few scattered indications that Bacon wrote poetry. In one letter, he refers to himself as a concealed poet.[38] A poem written after his death, found among the papers of Bacon's chaplain (Rawley), identifies him as a poet.[39] He was a master of rhetoric, and sonnet sequences are a form of rhetoric (epideictic). His *Wisdom of the Ancients*, an interpretation of ancient myth, displays considerable literary knowledge. He was a close associate of members of the Sidney-Leicester literary circle and is believed to have written masques at Gray's Inn.[40] None of this provides even circumstantial evidence that Bacon wrote the *Hekatompathia*, and certainly not, as some might claim, the works of Shakespeare. My purpose in listing these references is to show that his contemporaries would not have been surprised to learn that he wrote poetry. However, as discussed above, my argument that he wrote the *Hekatompathia* is not based on historical evidence, but on the mathematically validated deciphered message that identifies him as the author.

However, if Bacon wrote the *Hekatompathia*, why does Thomas Watson's name appear on its title page? The appearance of a false name is a form of anonymity, which was widely practiced in this period, according to Marcy North:

> The modern neglect of anonymity as a subject of study is somewhat surprising given how popular and interpretable anonymity was in

> early modern England. ... Whether for reasons of personal safety, social decorum, or political and rhetorical effectiveness, early modern authors and book producers manipulated anonymity in remarkably diverse ways, sometimes looking back to medieval conventions of anonymity, sometimes responding directly to the demands of print culture and Tudor-Stuart politics, and often employing age-old conventions of anonymity in unique and surprising ways.[41]

North reports that literary anonymity was "cultivated" and "became very popular among the lyric poets." She gives several examples of the use of false names, including that of dramatist John Bale.[42] Often when the author's name is suppressed, no attribution is possible due to the lack of historical evidence. The use of a false name is especially problematic because there may be no indication of the deception.

An intriguing case of authorship suppression is found in *The Arte of English Poesie* (1589), published anonymously, but later attributed to George Puttenham. Paradoxically, *The Arte*'s author advises authors to shun anonymity, which directly conflicts with his own decision to publish anonymously. Yet this ambiguous depiction of anonymity is consistent with the conflicting social aims of discretion and the desire for recognition for the purpose of advancement.[43] North argues that Puttenham's suppression of his own name, his advice against doing so, and his story of how the manuscript arrived with no author's name at a printer is indicative of a literary game of concealment and revelation:[44]

> Although anagrams, name games, and even anonymity occupy a space that is more internal than that of a modern signature, Puttenham consistently expects the disguised names and the anonymity that propels them to identify subjects and authors in a complex bi-directional process. ... When addressing elite audiences, authors were especially dependent on the audience's willingness to respect the guise of anonymity and see through it simultaneously.[45]

Bacon had many reasons for not publishing the *Hekatompathia* under his own name. He was beset by various difficulties stemming from his father's recent death, and he was attempting to begin a political career, which required discretion. One might ask why he used another person's name rather than publishing under "Anon" or "Ignoto." One advantage of using Watson's name is that it might act to deflect speculation about authorship that publication under "Anonymous" might encourage. The *Hekatompathia* displays an extraordinary learning that borrows from hundreds of sources, and if the question of the work's authorship had been left

completely open, then the coincidence of certain biographical details (Bacon's role in an embassy to France and his close connection to Walsingham) may easily have led to speculation that Bacon was the author.

A potentially graver concern was that his text might easily be read as blasphemous: its cosmogony contradicts Christian doctrine, and thus Bacon had good reason to obscure his authorship. In such circumstances, an author may wish to communicate two different messages within the same text: one to the general public and another to an elite group sympathetic to his dangerous ideas. An obvious technique for accomplishing this is the use of cryptography—something at which Bacon excelled. Richard Serjeanston, in his analysis of Bacon's use of a pseudonym to conceal his authorship of *Valerius Terminus*, explains that pseudonymity was commonly practiced by Bacon's associates:

> Pseudonymity served a similarly protective function in the indistinct world of Elizabethan epistolary espionage that was inhabited by Bacon's early friend Thomas Phelippes and by his brother Anthony Bacon. A more contrived form of pseudonymity was also prominent among writers of verse in the Elizabethan court, where perhaps its most notable exponent was Sir Philip Sidney, whose sonnet sequence is addressed by the figure of "Astrophel" (star-lover) to a lady called, just like Bacon's annotator, "Stella." Bacon was no stranger to these worlds, having moved in all of them since his youth.[46]

Both North and Serjeanston see the practice of pseudonymity as a natural response to the political and social dangers of this period.

Francis Bacon

Bacon was a philosopher, theorist of experimental science, statesman, and lawyer. In an often-quoted letter to his uncle, William Cecil, he brashly states, "I have taken all knowledge to be my province."[47] He proposed fundamental changes in application of common law that allowed more recent case law to supersede older and less relevant law—a fundamental reform that remains with us to this day. He initiated the idea of the modern research university. He believed in a future in which man would learn to harness the forces of nature, which would result in technological innovations greatly benefiting mankind. Most relevant to this study, he developed the experimental methods that are the foundation of modern science. Andrew Hiscock asserts that Bacon has been characterized, both by scholars and himself, as "the High Priest presiding at the dawn of a new age of intellectual discovery."[48]

As this study unfolds the *Hekatompathia*'s complex, multistage Puzzle, the genius that went into its creation will become apparent. Surprisingly, some of the Puzzle's components utilize techniques found in modern-day software systems. Only the rarest of geniuses could have created such a Puzzle. Bacon made extraordinary contributions to several fields and saw far beyond his own time—a comparison might rightly be made to Leonardo da Vinci, who foresaw inventions that only became practical centuries later. The rare incidence of such talent severely limits the number of potential authors of the *Hekatompathia*, should we suspect that Watson is not the true author, because only a truly exceptional mind could have created its unprecedented Puzzle. To demonstrate the unusual fecundity of Bacon's mind in his practice of cryptography, we can examine an invention that he developed in his youth, the "biliteral cipher" (the biliteral cipher plays no role in the *Hekatompathia*).[49]

Bacon's "biliteral cipher" uses a subtle difference in the appearance of text to encode a message. In this technique, two different styles are used in the composition of a letter. An example of a biliteral cipher is shown in Fig. 1.3, which employs two different styles of type, one bold and the other light. The difference in style has been made obvious in the figure for the sake of clarity; in practice, the difference must be subtle enough to go unnoticed by all but those who know to look for it.

EV**ERY**TH**I**NG IS **PEA**CE**F**U**L**

EV**ER**Y	**T**H**I**NG	IS **PEA**	CE**F**U**L**
00110	10100	00111	00101
6	20	7	5
F	U	G	E

Fig. 1.3 An example of a biliteral cipher

The open message, "everything is peaceful," hides a secret message: each group of 5 letters encodes one letter of a secret message. The differences in type style produce a binary number, shown in the second tabular row of Fig. 1.3. The third row converts this to a decimal number, and the fourth row translates this to a letter in the Elizabethan alphabet (e.g., 6 designates "F," the sixth letter of the alphabet). The secret message, FUGE (Latin: flee), warns the decipherer that everything is *not* peaceful and that he or she had better flee.

Bacon recognized that 5 bits of information can encode an alphabet of up to 32 letters ($2^5 = 32$). The use of binary numbers to designate letters is a fundamental computer technology (ASCII) developed in the twentieth

century, and to find it used in the sixteenth century is surprising. Adding to our surprise, Bacon points out that the information content of the open text is 5 times the size of the secret text: "The infolding writing shall contain at least five times as many letters as the writing infolded."[50] In other words, the ratio of the information in the open text to that in the secret text is 5:1. Bacon has quantified the amount of information a message holds logarithmically, a concept that only reemerged four centuries later when Claude Shannon developed his Information Theory, a staple of modern computer and communications technology.[51]

Bacon saw himself as presiding over an intellectual revolution. He rejected the deference given to the authorities of antiquity, "how men are ever saying and doing what has been said and done before."[52] In *The Refutation of Philosophies*, Bacon's speaker derides Plato and Aristotle, placing them "among the Sophists."[53] Bacon's natural philosophy rejects Platonist and Aristotelean conceptions of the natural world, instead reaching back to the views of certain pre-Socratic philosophers.

Overview of the Puzzle

The Puzzle abruptly appears at a critical juncture in the *Hekatompathia*, at the beginning of its second subsequence. The reader is explicitly challenged to decipher an encrypted message using a specific set of tables. The Puzzle provides a set of instructions on a page numbered as if it were the 80th sonnet, followed by an acrostic sonnet presented in two different formats on subsequent pages. This interruption of a poetic collection to present a cryptographic puzzle is bizarre and unprecedented. Commentators, lacking any literary context in which this might fit, have either ignored it or attempted to explain it as some mystical or esoteric digression. To my knowledge, no one has previously attempted to solve it.

The Puzzle's instructions are only the beginning of a journey through a complex, hierarchically structured labyrinth that, in certain respects, bears a surprising resemblance to a modern computer adventure game. The Puzzle tests the would-be-solver's poetic knowledge, inductive reasoning skills, and cryptographic expertise. Each step in its solution advances the puzzle-solver along a labyrinthine course through the Puzzle's seven levels or "Stages." Knowledge acquired in each Stage of this hierarchy aids the puzzle-solver in subsequent Stages. Remarkably, some of the Puzzle's mechanisms resemble features found in present-day computer software: a network of interdependent tables, redundant indices, linked lists, inheritance, and recursion. Although the appearance of this technology in the sixteenth century might seem highly improbable, these technological mechanisms are improvements upon, or intensifications of, existing late

Renaissance practices: elaborate indexing methods, the place-logic of influential Dutch humanist Rodolphus Agricola, and the *Ars Memoriae* (mnemonic techniques). These methods, widely practiced during the Renaissance, are combined with sixteenth-century cryptographic methods to form an unusual hermeneutic system—the Puzzle. It pushes the reader to closely evaluate the poetic text, which leads to its radical rearrangement: 83 of the sequence's 100 sonnets are reordered. This reordering completely transforms the significance of the text: effectively, a new sixteenth-century sonnet sequence is revealed. Thus the occlusion of Bacon's authorship is part of a larger obfuscation: that of the correct order of the text itself.

The Puzzle resembles a jigsaw puzzle: each piece—or sonnet—must be placed in its proper, predetermined location. This location is established by the sequence's well-defined structure and by multiple systems of intratextual links, including links between adjacent sonnets. The *Hekatompathia* also resembles a labyrinth: solving the Puzzle requires the navigation of the sequence's tightly defined structure toward a predetermined endpoint. After the sequence is reordered, each sonnet's context—the newly adjacent poems and its overall position within the sequence—often radically alters our reading of it. Thus, the new order and its finely articulated architecture re-signifies its component parts, its sonnets. As such, the sequence is utterly transformed, and its new order exhibits a thematic development that ends quite differently from the work in its published order.

The scrambling of the sonnet order and the provision of the Puzzle that allows the reestablishment of the true order serve two purposes: the work's heretical cosmology is hidden and the puzzle-solver is forced into an intimate engagement with the details of the text. This close reading of the text is concomitant with the work's didactic intent: the reader is fully immersed in the sequence's architecture and the significance of its poetry.

How is it possible to rigorously specify the order of the 83 sonnets that have been scrambled? The number of permutations in which 83 sonnets may be ordered is an astronomical number ($83! \approx 4 \times 10^{124}$). If the new order is to be rigorously defined, then some special apparatus is required. This apparatus, the Puzzle, consists of two systems, which I call the Heuristic System and the Precision System, as shown in Fig. 1.4. The Heuristic System provides various mechanisms that allow the puzzle-solver to restore the sonnets to their proper order. These mechanisms include indices, intratextual links, thematic subdivisions, the poet's glosses, semiotic designs, ring patterns, and thematic progression. All of the foregoing mechanisms were in use in the sixteenth century and some much earlier. I have characterized this system as heuristic because it depends on

language and interpretation, which are inexact. For example, the index mechanism requires that the puzzle-solver match phrases from a list to sonnet lines, in a manner similar to how a crossword puzzle's clues link to its words—an interpretive judgment must be made.

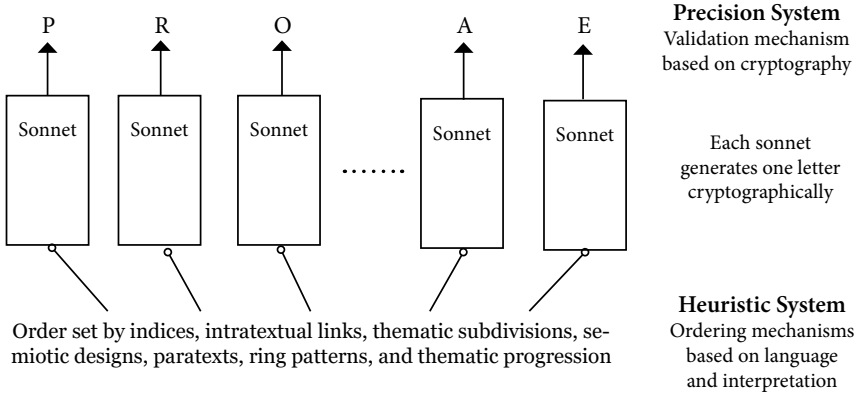

Fig. 1.4 The Puzzle's architecture

However, the question may arise: will different interpretations result in different restorations of the sonnet order? The Heuristic System protects against this by using multiple mechanisms to specify a sonnet's location. These overlapping mechanisms increase the puzzle-solver's confidence in their decision to place a sonnet in its new position. Indeed, often an initial interpretation will be made, only to later find that it conflicts with what is indicated by another one of the Heuristic System's mechanisms. An interpretation must then be found that satisfies both mechanisms. In this way, the Heuristic System requires interpretation but guards against misinterpretation, which follows Bacon's pedagogical model (see "Poetry and pedagogy" section below). The ultimate purpose of the Heuristic System is to instruct readers in hermeneutics—the art of reading poetry.

The Heuristic System's overdetermination is augmented by the Precision System, which further ensures the correctness of the reordering process. It utilizes various cryptographic techniques practiced in the sixteenth century, as will be discussed in Chapter 6. It validates the sonnet order by having each sonnet generate a single letter in a cryptographic message. If the message is coherent, then the sonnets must be in their correct order; if they are not correctly ordered, then the message is garbled. Fig. 1.4 depicts the beginning and ending letters of the message enciphered in the Puzzle's second Stage: the first three letters are PRO and the final two are AE. The complete message is PRODIGA LIBERTAS ANIMAE (an overly free state of mind), which appears in one of the work's Neo-Latin poems,

as will be discussed in Chapter 7. The message enciphered in Stage 3 is also a known text; the messages in Stages 4 through 6 are unknown texts that help the puzzle-solver's advance through the Puzzle; the message in Stage 7 contains Bacon's name.

The genius of the Puzzle's design is its incorporation of two systems that work in tandem, one heuristic and one reasonably precise. The Heuristic System tests and develops the puzzle-solver's understanding of poetry: poems must be reordered to make the sequence coherent. Hints about order are provided in many forms, including phrase lists that serve as indices, links between adjacent sonnets, hints in sonnet headnotes, and repetitive structures. Nevertheless, the great number of permutations and the uncertainties of language make the reordering process challenging and somewhat uncertain. The Precision System is an adjunct that stabilizes interpretation, akin to an answer key: if the reordering is incorrect, the deciphered message is incoherent. The deciphered message acts like the combination lock on a safe: the exact numbers must be entered if the safe is to be opened. If the puzzle-solver has not correctly ordered the sonnets, he or she must return to the Heuristic System to find and correct his or her mistakes in ordering the sonnets. A clever mechanism, later explained, makes it difficult to use the Precision System in reverse, that is, to derive the sonnet order from the deciphered message. The Puzzle is designed to force the reader into a close engagement with the text, interpreting it under the guidance of the Heuristic System. The Precision System acts like a good instructor: it refuses to give the student the answer directly, and instead indicates where the student's work is correct and where deficiencies require further effort. In effect, the Precision System acts as a proxy for the absent poet.

The Precision System is not entirely free of language judgments, that is, it has some overlap with the Heuristic System. As will be later explained in Chapter 4, it uses linguistic links to designate certain lines that are then employed as ciphertext. Nevertheless, the Precision System's mechanisms are robust enough to allow a mathematical validation of its cryptographic results. The Puzzle is crafted so that the discovery of the work's hidden significance is very challenging, yet once discovered, that significance can be verified mathematically and recognized as the author's true intent.

The primary mode of solving the Puzzle is unlike cryptanalysis (codebreaking). The cryptanalyst usually has the ciphertext in hand but must discover the tables by which it was encrypted. In the Puzzle, as shown in Fig. 1.4, the ciphertext is generated from scrambled sonnets, and until those sonnets have been properly reordered using the Heuristic System, no ciphertext is available. On the other hand, the initial encryption tables are given to the puzzle-solver, as described in Chapter 2.

The obscured text

Often an author wished to communicate two messages within a single text, each to a different audience: a public message that anyone could read, and a hidden message, often contradictory to the apparent message, that was directed toward a select audience. The belief that art could be used to speak both falsity and truth was also prevalent in antiquity. The muses tell Hesiod that "we know how to speak many false things as though they were true; but we know, when we wish, to proclaim true things."[54] A poet must follow this example of the muses, and rather than simply revealing the truth, the truth must be rhetorically hidden under a cover of lies. Philosophy may also make good use of lies, something not lost on Plato, according to Stanley Rosen:

> Throughout Plato's dialogues, one finds a continuous interest in falsehood, suspicion, deception, and concealment, an interest that is curiously unnoticed in the secondary literature. For an appreciation of this side of Plato, one must turn to Nietzsche, who is the first major thinker of my acquaintance to appreciate explicitly the connection between spiritual nobility and the mask. [In the *Republic*], Socrates makes the interesting assertion that falsehood is not useful for the gods, whereas it is useful for mortals in the form of a medicine [*pharmakon*].[55]

Pharmakon can mean a magic potion or a poison, and we are reminded of Plato's "noble [or medicinal] lies," necessary falsehoods that his ideal republic requires in order to function. We will find that the outer form of the *Hekatompathia*, its necessary lies, serve an educational purpose: the reader must identify and eradicate these lies by solving the Puzzle, which reveals the hidden truths within.

Leo Strauss recognized that radical ideas can only be safely expounded by means of an obfuscated text. In his *Persecution and the Art of Writing*, he describes how Maimonides, Judah Halevi, and Spinoza hid the expression of ideas that would have endangered their lives. "Ordinary language is utterly insufficient" for this purpose, and the writer must resort to "parabolic and enigmatic speech." Yet understanding these writers centuries later is extraordinarily difficult: "However greatly we may think of the qualities of the modern historian, he certainly is neither per se able to understand esoteric texts nor is he an esoteric writer."[56] According to Strauss, Maimonides recognized certain formal deficiencies in the Torah (e.g., abrupt changes, unnecessary repetitions, contradictions), and his method of embedding hidden meaning is based upon intentional formal deficiencies in his own text. The reader of Maimonides's *Guide for the*

Perplexed must therefore recognize textual deficiencies and figure out why they appear.[57] Indeed, according to Strauss, Maimonides implies that the Bible itself is an example of parabolic literature.[58]

The obfuscation of literary texts was common in the sixteenth century, an era of religious strife. Erasmus, "the West's chief humanist at the dawn of humanism," thought that certain beliefs should be treated as "mysteries reserved for the initiated."[59] Those who were erudite could be trusted with such secrets, but a mass audience could not.[60] The *Hekatompathia* not only hides meaning using cryptography but also follows a long tradition of hiding its secrets by means of rhetorical practices.[61]

In Bacon's *De Augmentis*, immediately after detailing his biliteral cipher, he describes methods of communication that differentiate between "vulgar" and "select" auditors. The former is addressed using an "Exoteric" method and the latter by an "Acroamatic," or esoteric, method. He explains that the ancients usually prepared different texts for each group, but that, in "later times," the obscurity of the delivered message is used "to exclude the vulgar (that is the profane vulgar) from the secrets of knowledges, and to admit those only who have either received the interpretation of the enigmas through the hands of the teachers, or have wits of such sharpness and discernment as can pierce the veil."[62] Bacon depicts these two opposed methods of communication on many occasions. In "Cassandra," the first myth in his *Wisdom of the Ancients*, he makes clear that presenting certain topics indiscreetly risks damaging one's reputation.[63] Bacon's *New Atlantis* "can easily be seen as an allegory for this relationship between secrecy and publicity," according to David Colclough.[64] In *The Refutation of Philosophies*, he describes a speech delivered in a secluded location to a select group of learned men, in which the speaker launches a radical attack against the Western philosophical tradition.

The *Hekatompathia*'s authorial prefaces suggest that the work may be read in two different modes, one exoteric and the other esoteric: in one mode, the work is frivolous (*A toye*), and in the other, it is taken seriously, but the manner of reading is left unspecified.[65] The second of these modes is only accessible through the Puzzle, which allows the reader to pierce its "veils" and restore the text to its proper order. In the first mode, reading the *Hekatompathia* in its published order, love is a powerful and debilitating force that the speaker rejects. In the second mode, reading the sequence in its restored order, love is a primordial and insurmountable natural force that appears to rival or even supplant the Christian belief in God.

The Puzzle is extremely complex and places inordinate demands upon the exegete. Why make things so difficult? One reason, according to a belief that dates back to antiquity, is that the difficulty of interpreting a text made the discoveries all the more memorable.[66] One fifteenth-century

Italian humanist tells us that "what is described by the poets with the highest artifice is at length sought out with great industry and labor, and once discovered is more valued."[67] Aquinas argues that "the darkness of figures serves to exercise those eager to learn."[68] Macrobius, in the quotation that prefaces this study, sees the unveiling of hidden truths in a text as the true office of a scholar. According to Augustine, "what is attended with difficulty in the seeking gives greater pleasure in the finding," a sentiment also found in Arthur Golding, who believed that overcoming difficulty "makes the mynde more glad."[69] Anthony Bacon concurs when he writes *Difficilia quae pulchra* (difficulties make for beauty/nobility).[70]

According to Kenneth Borris, Platonizing allegory was common in the early modern period, and included "the soul's nature and its path to knowledge, true self-recognition, and the fruition of its highest capacities; its quest for reality and truth amidst the bewildering welter of appearances, and its means of returning to heaven; ... ideal imitation and icastic truth, as opposed to their misleading counterparts; and the universal correspondences supposed to structure reality."[71] Such esoteric wisdom, it was believed, did not come easily, and thus, it was appropriate to dispense it only in a veiled manner. Such veils are made difficult to remove—for to do otherwise would devalue the esoteric knowledge that is hidden, as Boccaccio instructs us:

> Surely no one can believe that poets invidiously veil the truth with fiction, either to deprive the reader of the hidden sense, or to appear the more clever; but rather to make truths which would otherwise cheapen by exposure the object of strong intellectual effort and various interpretation, that in ultimate discovery they shall be more precious. ... As saith Francis Petrarch ... "what we acquire with difficulty and keep with care is always the dearer to us." ... But I repeat my advice to those who would appreciate poetry, and unwind its difficult involutions. You must read, you must persevere, you must sit up nights, you must inquire and exert the utmost power of your mind. If one way does not lead to the desired meaning, take another; if obstacles arise, then still another, until, if your strength holds out, you will find that clear which at first looked dark.[72]

The last two sentences describe the challenges faced in solving the Puzzle: the unwinding of "difficult involutions," the false paths that lead only to frustration, and, above all, the need to persevere. Although on first encountering the Puzzle one might judge its complexity and scope to be idiosyncratic, its intricacy and entanglements with multiple modes of signification were not uncommon in this era. As C. S. Lewis points out, the intellects of this period delighted in building large, ordered models,

especially in cosmology and philosophy.[73] Such works as the *Roman de la Rose* and *The Faerie Queene* attest to the complexity of the literary canon of the medieval and early modern periods.

Erasmus's Silenic literary model

The concept of two reading modes, one public and the other secret, is found in Erasmus, who posited a literary model in which a shell of outer meaning obfuscates a text's inner meaning. Erasmus's "The Sileni of Alcibiades," published in a 1515 edition of *Adages*, was widely available and had a considerable influence in England.[74] The title refers to Alcibiades's speech in the *Symposium* in which he compares Socrates to "those little Sileni that you see on the statuaries' stalls... they're modeled with pipes or flutes in their hands, and when you open them down the middle there are little figures of the gods inside" (215b). Silenus, a satyr (a ludicrous figure), was the tutor of Dionysius, and the statue of Silene appears "worthless or ridiculous," according to Erasmus, but "on closer and inward consideration, [it] proves admirable."[75] Erasmus explains that Socrates "had the face of a country bumpkin, a bit like that of an ox, and a snub nose always running with snot." Nevertheless, he writes, "if you open up this Silenus, who is outwardly so ridiculous, you find within someone who is closer to being a god than a man, a great and lofty spirit, the epitome of a true philosopher."[76] In this "statue of Silenus" model, an ugly outward appearance hides inner beauty, a concept that here is applied to a person but could easily also pertain to a literary work.

This "Silenic" rhetorical model is especially applicable to the *Hekatompathia*. Other sixteenth-century works also employ this model, including Erasmus's *Moriae Encomium* (*In Praise of Folly*), which, like the *Hekatompathia*, confronts the reader with ambiguity and contradiction that the reader must resolve to make sense of the work. Erasmus's personified Folly describes pairs of contradictory images that must be "undone" in order to disclose "a new semblance."

> For fyrst it is not vnknowen, how all humaine thyngs lyke the Silenes or duble images of Alcibiades, haue two faces muche vnlyke and dissemblable, that what outwardly seemed death, yet lokyng within ye shulde fynde it lyfe: and on the other side what semed life, to be death: what fayre, to be foule: what riche, beggerly: what cunnyng, rude: what stronge, feable: what noble, vile. ... Briefely the Silene ones beyng vndone and disclosed, ye shall fynde all thyngs tourned into a new semblance.[77]

Arthur Kinney argues that Erasmus converts a rhetorical sophistry into a poetics, pushing "his reader to work at the task of reconciliation" of the opposites that Folly presents.[78] David Wootton, in his introduction to "The Sileni of Alcibiades," asserts that the Silenus statue trope "implies that every text participates in a debate about how to interpret the world, and that the language in which texts are written is slippery, with the meanings of words... constantly liable to turn into their opposites."[79] This Silenic rhetorical model was also taken up by Rabelais, who in his prologue to *Gargantua* pays homage to Erasmus's "The Sileni of Alcibiades." He recommends that the reader have "a sagacious flair for sniffing and smelling out and appreciating such fair and fatted books, to be swift in pursuit and bold in the attack, and then, by careful reading and frequent meditation, to crack open the bone and seek out the substantifical marrow."[80] Thus, he defines his text as a quest, challenging the reader to ferret out the work's "marrow" or substance, which, he promises, will be no easy task.

The *Hekatompathia*'s hidden "marrow" only becomes visible after the reader restores the sonnet sequence to its proper order. Its poet has scrambled the order of its sonnets, building upon a prevalent literary mode, the "ruined text," that emerged in the sixteenth century. Just as Rabelais in the prologue to *Gargantua* alerts the reader to hidden meaning, the *Hekatompathia*'s prefaces point to hidden significance that the reader must uncover to arrive at a deeper understanding of the work. Like *In Praise of Folly* and *Gargantua*, the *Hekatompathia* is a tissue of violations of grammar, logic, and decorum, and the reader's task is to puzzle through these anomalies in order to reach the "marrow" that is secreted within the text. However, unlike those works, or any other known work, the *Hekatompathia* contains a precise device, the Puzzle, that allow the reader to cut through to the "marrow," and this leads to a comprehensive and authenticated restoration of the ruined work. Only the later Stages of the Puzzle are devoted to hiding the poet's name; the purpose of the earlier Stages is to restore the order of the *Hekatompathia*'s scrambled sonnets, revealing a very different sonnet sequence. The poetics of the ruined text will be taken up in Chapter 4.

How could Francis Bacon, who railed against the excesses of poetic fictions, be himself a lyric poet? On closer examination, however, Bacon expressed sharply divergent attitudes towards poetry, and this self-contradiction (which occurs in Bacon's preface to *Wisdom of the Ancients*) was noticed long ago by a contemporary, Henry Reynolds:

> What shall we make of such willing contradictions, when a man to vent a few fancies of his owne shall tell vs first, they are the wisdome of the Auncients, and next, that those Auncient fables were

> but meere fables, and without wisdom or meaning til their expositours gaue them a meaning; & then scornefully and contemptuously (as if all Poetry were but Play-vanity) shut vp that discourse of his of Poetry with *It is not good to stay too long in the Theater*.[81]

This contradiction has frustrated many contemporary critics in addition to Reynolds. What many critics seem to have missed is that Bacon practices esotericism in his discussion of esotericism. Indeed, contradiction is central to esoterism because although it obscures the truth, it also reveals the means by which the truth may be discovered: the resolution of the contradiction. Bacon is a "master practitioner of the esoteric," an art that he likely learned from multiple sources, including Plato and Montaigne.[82] His aphoristic writing is a "knowledge broken" that can only be understood if the reader mends the work (as this study has done for the *Hekatompathia*). Thus, fragmentation serves Bacon's didactic purposes.[83] Ronald Levao describes a critical tradition that has had difficulty grappling with Bacon's apparent self-contradiction:

> Bacon's wavering reveals a split found throughout his work that has produced a critical tradition of two fundamentally opposed portraits: Bacon as the enthusiast of both "powers of imagination and understanding" and Bacon as harbinger of narrow objectivism, the "dissociation of sensibility," and worse.[84]

For Bacon, poetry, and imagination are both necessary and dangerous.[85] Poetry, a form of rhetoric, appeals to the reader's imagination, and it carries the force of persuasion, which is necessary for its effectiveness. However, it has no claim upon the truth (also Plato's concern in his *Republic*). Bacon's ambiguous attitude to poetry may be better understood by considering his treatment of an analogous problem that presents itself in scientific advancement:

> The understanding must not however be allowed to jump and fly from particulars to remote axioms and of almost the highest generality (such as the first principles, as they are called, of art and things), and taking stand upon them as truths that cannot be shaken, proceed to prove and frame the middle axioms by reference to them; which has been the practice hitherto; the understanding being not only carried that way by a natural impulse, but also by the use of syllogistic demonstration trained and inured to it. But then, and then only, may we hope well of the sciences, when in a just scale of ascent, and by successive steps not interrupted or broken, we rise from particulars to lesser axioms; and

> then to middle axioms, one above the other; and last of all to the most general. ... The understanding must not therefore be supplied with wings, but rather hung with weights, to keep it from leaping and flying. Now this has never yet been done; when it is done, we may entertain better hopes of the sciences.[86]

In both poetry and experimental science, the imagination is necessary, but needs to be fettered. The Puzzle is a "weight" that controls and stabilizes the interpretation of the text. Solving the Puzzle requires a process similar to that used in scientific investigation: one must proceed step by step, Stage by Stage, through the Puzzle in a slow ascent. Bacon intentionally created locks between the Puzzle's Stages to enforce this slow ascent, and indeed, whenever I attempted to "jump and fly," bypassing a step or Stage, I was blocked. The Puzzle's Heuristic System often requires the puzzle-solver's imagination to progress; the Precision System is the weight that stabilizes and validates meaning. Solving the Puzzle requires shuttling back and forth between these systems, which was fundamental to Bacon's new approach to learning, according to Levao:

> What keeps this mental shuttling between affirmation and hypothesis in motion is the stimulus of unresolved contradiction, the sustaining of opposed intellectual motions. Intellectual heat, no less than physical heat, requires a prolonged contest—"perpetually quivering, striving and struggling, and irritated by repercussion." ... The new organon he offers seeks out its adversary, whether it is the world of brute, unexplained "nature" or the "mimic and fabulous worlds" of theologians and poet-philosophers. If the lines of opposition are initially set by the renovating force, that force is itself contingent on and revised by successive acts of opposition.[87]

The Heuristic System, poetic and hypothetical, and the Precision System, scientific and affirmative, fulfill complementary roles. The "obsessive modern opposition between scientific and poetic knowledge" makes this difficult for us to grasp today, but the *Hekatompathia*'s Puzzle achieves a harmony between these two opposed forms of knowledge.[88]

Andrew M. Cooper claims that for Bacon, a fable (a fiction like myth and poetry) might serve as "a collective repository of common sense [and] supply a model for the new organon based on induction and shared enterprise."[89] He concludes that the "fable is a prototype of inductive empiricism."[90] Christopher Crosbie argues that Bacon's "approach to the fable [was] compatible with his project of reforming natural philosophy [and] remains in this regard rather consistent throughout his writing life."[91]

The Puzzle is a rigorous test of one's skill in inductive reasoning: it requires the puzzle-solver to make inferences—sometimes imaginative ones.

William Eamon recognizes the importance of a creative imagination in Bacon's method, which included analogy, conjecture, and a search for clues, which Bacon called "prerogative instances." Sometimes the investigator "must make intuitive leaps from the seen to the unseen."[92] However, such leaps must always be tested. In the case of the Puzzle, testing is performed using the Precision System and progress only occurs when hypotheses are validated. Only then can we accept as valid an axiom about the Puzzle's operation or make an entry into one of its numerous tables. The Puzzle, like the physical world in which scientific hypotheses are tested, governs the interpretation of the text. According to Eamon, Baconian induction was an attempt to translate *metis*—"the artisan's cunning or the natural magician's intuition—into a method." Bacon attempted "to define a rigorous methodology for conjecturing from the seen to the unseen aspects of nature, and from effects to causes."[93]

Reading rhetorically

How does one read esoteric works? The most important lesson I learned in solving the Puzzle was that one must assiduously pursue the quest for coherence despite the appearance of disorder, or rather, because of the appearance of disorder. The section in Chapter 4 titled "Alerting the reader: breaches of decorum" provides examples of how contradictions, irrelevant digressions, and other breaches of decorum are flagrant signals that should not be ignored. Such breaches must be pursued because they point to a solution, and if tenacious enough, the reader will prevail and discover underneath an exterior cloak of chaos, a unified work.

This argument suggests that Bacon's work is closed rather than open, which runs against the trend in contemporary criticism. David Parry believes that this has led to misreading Bacon:

> Given Bacon's recognition of the contingency of human knowledge and his anxieties about the capacities of language to mislead, it is tempting for literary scholars after Derrida to read Bacon as an anti-teleological advocate of the perpetual free play of signifiers with no final resolution, but this would be to misread Bacon, since Bacon holds that "that vse of wit and knowledge is to be allowed which laboureth to make doubtfull thinges certaine, and not those which labour to make certaine things doubtfull" (*Advancement* 91).[94]

The Puzzle is a device that allows us to make "doubtfull thinges," the heuristic reordering of the text, "certaine." It closes an open text and enables the work's teleological purpose to be realized.

Our understanding of esotericism has been greatly enhanced by Nietzsche, whose long practice of philology greatly influenced not only his own work, but that of later scholars. He advises readers:

> Philology is that venerable art which demands of its votaries one thing above all: to go aside, to take time, to become still, to become slow. ... It teaches to read well, that is to say, to read slowly, deeply, looking cautiously fore and aft, with reservations, with doors left open, with delicate eyes and fingers.[95]

The practice of "close reading," promoted by I. A. Richards and William Empson in the first half of the twentieth century, deserves our consideration today. The process of solving the Puzzle required that I practice close reading. Every sonnet had to be read carefully to discover its structure, links to other sonnets, relationship to source material cited in the headnote, and its place within the sequence's finely specified architecture. This resulted in the present study, which in filling two volumes, seems out of proportion for a sonnet sequence that is not often read. Nevertheless, this was required to solve the Puzzle.

In addition to close reading and careful attention to contradictions, the exegesis of esoteric works often benefits from an examination of the work's structure. The Puzzle, of course, is welded to the structure of the work, which was fundamental to Bacon's plan. In the *Novum Organon*, he contrasts his own writing with that of the ancients, whom he is criticizing:

> [The ancients] thought it superfluous and inconvenient to publish their notes and minutes and digests of particulars; and therefore did as builders do,—after the house was built they removed the scaffolding and ladders out of sight. (*Works*, 4.111)

In contrast, Bacon leaves his scaffolding in place, or at least partially visible, and the skilled reader uses it to extract the work's esoteric significance. Bacon is a master builder, and the method by which he constructed a text cannot be separated from the text itself. The Puzzle is valuable because it reveals the methods by which other texts (even though they lack puzzles) may be mined for their esoteric content. The Puzzle hides not only the author's name, but a radical materialist philosophy. It lays bare the scaffolding used to construct a complex poetic collection and reveals its secret significance.

Cryptography as a poetic device

The use of a cryptographic system as the stabilizing backbone of a poetic collection is unprecedented. Sometimes cryptography is confused with numerology (a form of symbolism), esotericism, or the occult; however, it is really a practical science. Although it was sometimes associated with the occult during the Renaissance, it is first and foremost a technology that allows for secure communication. It was used extensively in military and diplomatic operations, as well as in private correspondence.

The literary uses of cryptography have typically been limited to the hiding of an author's name (e.g., in acrostics), which dates as far back as Anglo-Saxon literature (see "The uses of cryptography in literature," Excursus 1). The *Hypnerotomachia Poliphili* (1499) hides a message (which may or may not include the author's name) using steganography, a form of cryptography.[96] Steganography refers to the hiding of one text within another, a technique used by the Puzzle, as described in the next chapter and in "Steganography: Exterior and interior writing methods," Excursus 2. The *Hekatompathia*'s expansive use of cryptography has, to my knowledge, no known predecessor.

The Puzzle's design allows for the puzzle-solver to discover the true order of the work's sonnets. Each sonnet may be thought of as a *topos* (topic or place), a discrete packet of knowledge. Terence Cave sees *topoi* as a major concern of sixteenth-century French literature:

> The redeployment or re-grounding of topoi is, of course, a major preoccupation of French Renaissance writing in general. Rabelais, Ronsard, and Montaigne are all caught, in their different ways, in the same problem: the resistance of alien fragments within a new formal context tends to disrupt the movement of the text towards a stable meaning, and thus draws attention to the mode of operation rather than to the product of the writing system. As a corollary, this same phenomenon blocks the possibility of full thematic closure.[97]

A cornucopia of diverse materials extracted from earlier writers proves difficult for a writer to integrate in a manner that leads to stable meanings and thematic closure. Cave believes this results in an open text—a plurality of possible meanings—a position consistent with modern literary theory. He argues that "the absence of any extra-linguistic criterion ruins the possibility of a reassuring dialectic and imprisons the speaker or writer in the labyrinthine detours of language, in its surface or *species*."[98]

In contrast to this characterization of French Renaissance literature, Bacon hopes that his reader will escape the labyrinth and arrive at "full

thematic closure." Although this may have been unattainable for those French writers discussed by Cave because they lacked "any extra-linguistic criterion," the *Hekatompathia*'s cryptography, its Precision System, is an extra-linguistic device that allows for definitive thematic closure. Bacon has presented his readers with scattered poetic fragments—ruins—and expects them to build a "sonnet palace" based on the blueprints he provides. Those blueprints include the Heuristic System, in which order and interpretation emerge, and the Precision System that regulates and validates the order derived from the Heuristic System.

Poetry and pedagogy

Poetry was considered a form of rhetoric, and sonnet sequences fall under the category of epideictic poetry: the good is praised and practical knowledge is instilled in the reader. The title of an incomplete manuscript version of the *Hekatompathia*, "A Looking glasse for Loovers," indicates that the work follows the literary tradition of *specula principum* (mirrors for princes). This genre reflects back to the reader (or prince) his faults and also presents an ideal image to which the reader should aspire. Solving the *Hekatompathia*'s Puzzle is foremost an educational exercise that is meant to instruct the reader about the nature of love, and at the same time, test and develop the reader's reasoning and inductive skills.

Bacon distinguishes between two pedagogical methods or modes of communication: magistral and probative. In the former, an eminent authority disburses knowledge to the student, who readily accepts it. Bacon describes the giver and receiver of knowledge in this magistral mode of communication:

> For he who delivers knowledge desires to deliver it in such form as may be best believed, and not as may be most conveniently examined; and he who receives knowledge desires present satisfaction, without waiting for due inquiry... sloth making the receiver unwilling to try his strength.[99]

Bacon rails against this approach: "The sciences are presented in such a way as to enslave belief instead of provoking criticism; the intervention of a blighting authority precludes fruitful research."[100] In contrast, in the probative method of transmission, according to David Colclough's description of it, "the reader's understanding is facilitated by a reproduction of the writer's arrival at his conclusions."[101] In the probative mode, the communication from giver to receiver is subtle and insinuative. Bacon describes it thus:

> But knowledge that is delivered to others as a thread to be spun on ought to be insinuated (if it were possible) in the same method wherein it was originally invented. And this indeed is possible in knowledge gained by induction; but in this same anticipated and premature knowledge (which is in use) a man cannot easily say how he came to the knowledge which he has obtained. Yet certainly it is possible for man in a greater or less degree to revisit his own knowledge, and trace over again the footsteps both of his cognition and consent; and by that means to transplant it into another mind just as it grew in his own.[102]

For Bacon, a reader must understand a writer's thinking, and follow it step by step in a manner that imitates the writer's invention of his material. This is the very method of the Puzzle: it forces the reader to rethink the creation of the *Hekatompathia*, mimicking the process by which the poet ordered and arranged his sonnet sequence. According to Rhodri Lewis, for Bacon, "any text that purports to impart true learning must do so heuristically, thereby initiating the student into the true significance of what was being taught." Lewis suggests that Bacon, in his *Thoughts and Conclusions*, "heaped praise on the pre-Socratic philosophers for the aphoristic form of their fragments, and it is no coincidence that, in [his *Advancement of Learning*], King Solomon is depicted as teaching through 'excellent Parables and Aphorismes.'"[103] The fragmentary nature of aphoristic writing forces the reader to make connections, just as allegory or parables demand interpretation. In both cases, the reader must heuristically create a fully formed work in his or her own mind that is organic and coherent, to whatever extent possible.

Bacon's promotion of probative over magistral instruction is derivative of Plato's educational method. Plato's intellectual opponents, the Sophists, taught oratorical skills and rhetoric for the purpose of persuasion. In contrast, Plato believed that students should be taught how to think for themselves: when thoughts or knowledge is handed down, there must be a renewal of that knowledge (see *Symposium* 207e). Unlike a Sophist instructor, a good writer...

> will sow his seed in literary gardens... collecting a store of refreshment both for his own memory, against the day 'when age oblivion comes,' and for all such as tread in his footsteps. ... The dialectician selects a soul of the right type, and in it he plants and sows his words founded on knowledge, words which can defend both themselves and him who planted them, words which instead of remaining barren contain a seed whence new words grow up in new characters, whereby the seed is vouchered immortality, and its possessor the fullest measure of blessedness that man can attain unto. (*Phaedrus* 276d–277a)

Bacon is a rhetorical Platonist: dialectic argument, unresolved paradox, and rhetorical complexities all provoke the engagement of the reader, who, through the interpretive process, breathes new life into the work. The *Hekatompathia* delivers "seeds," scrambled sonnets, relatively barren of meaning in their disordered state, which the puzzle-solver must bring to an ordered state. In the *Theaetetus*, Socrates compares his method to that of a midwife, who does not create the child but assists in the process of bringing it forth into the world (150bcd). M. F. Burnyeat, in his reading of the *Theaetetus*, explains the difference between the educational method of the Sophists and that advocated by Socrates:

> The Sophist treats his pupil as an empty receptacle to be filled from the outside with the teacher's ideas. Socrates respects the pupil's own creativity, holding that, with the right kind of assistance, the young man will produce ideas from his own mind and will be enabled to work out for himself whether they are true or false.[104]

The *Hekatompathia*'s exegete, like Socrates's "young man," must "work out for himself [what is] true or false." The puzzle-solver engages in no ordinary reading experience, but becomes the poet's apprentice and, under the guidance of the poet's hidden blueprint, must reconstruct the poetic text. The great advantage of this scheme is that it immerses the puzzle-solver in the details of a poetic collection's creation: deciphering the poet's rhetorical glosses, discovering intertextual sources, recognizing the links in its concordantial text, interpreting symbols and figures, perceiving metric anomalies, and unraveling the overarching structure that governs the work. The puzzle-solver is forced to engage with the work at both the architectural level and down to the smallest of details, providing comprehensive lessons in the art of poetic creation. Thus, the *Hekatompathia* practices the Platonic ideal of active participation of the student, and, it must be acknowledged, on an extraordinarily expansive scale.

Bacon derived his pedagogical methods not only from Plato but also from sixteenth-century humanists, including Erasmus (the Silenic literary model, discussed above). Philip Sidney begins his *Defence of Poesie* with a discussion of horsemanship: the relationship between rider and horse is a metaphor for the relationship between poet and reader. Rather than provide direct instruction, the poet ought to instruct the reader (i.e., the horse) in such a manner that he or she still feels as if they are in control. Yet, at the same time, the poet (i.e., the rider) exercises significant control over which direction the reader takes.[105] In Rabelais, Gérard Defaux finds "a special kind of dialogue, in which the author dictates both the questions and the answers and keeps the reader, so to speak, on a leash."[106]

Bacon not only promoted this probative mode of writing but practiced it himself. According to Julianne Werlin, Bacon "reserves his highest praise for 'Parabolical' poetry, because it demands intensive and skilled interpretation: it conceals and 'infold[s]' its teaching, allowing authors to write about subjects whose 'dignity... requires that they should be seen as it were through a veil.'" Yet he was concerned that readers might stray too far in their interpretations, and thus, he "hedged his writing with additional layers of authorial direction."[107] In his *Wisdom of the Ancients*, he pushes the reader to reconsider the traditional readings of ancient mythology, offering new allegorical interpretations for the reader's consideration. Lewis argues:

> [In Bacon's critical vision, the] student of mythopoeic allegory is a heuristic and creative agent, completing the poem's field of reference for himself through an act of rational reconstruction. In its turn, this reflects Bacon's preferred mode of initiative or probative rhetoric, but it also implies that no single mythographic interpretation could be definitive. ... The mythographer's true task is to identify and assess the wisdom that lies behind the allegories of the textual record, not within them.[108]

Mythographic and allegorical interpretation are obviously subject to multiple interpretations and misinterpretation, which may conflict with a poet's desire to clearly convey a single or unified meaning. The challenge the poet faces is to harness the great energy inherent in allegory and myth, and at the same time, subtly inform the reader which meaning among several potential meanings is the intended one. The poet has various methods at his disposal, including prefaces (and other paratexts) that offer direct guidance, rhetorical signals within a text, and the work's organizational structure. The need for coherence across a text restricts the range in which the reader may rationally reconstruct meaning and may be sufficiently restrictive to recover hidden meaning with a high degree of confidence.

Colclough believes that "the proleptic gesture is present almost everywhere in [Bacon's] writings."[109] *The Refutation of Philosophies* practices this probative mode through a "rhetorical refiguring," in which a received text "is accorded authority, then framed by a commentary and a contextualizing preface only in order for it ultimately to be superseded."[110] This strategy is similar to that used in the *Hekatompathia*, where four authorial prefaces and the headnotes that precede each sonnet provide context for reading the text. Further, the *Hekatompathia* explicitly builds upon others' poetry, often Petrarchan sonnets, but modifies and reorganizes these materials for its own ends. Building upon a root stock—Petrarchan poetry—that is deeply established, Bacon gains at the outset a receptive audience. Yet, the ordering and glossing of these materials

allow him to subvert his source texts, and as I later argue, expound a counter-Petrarchan philosophy.

Bacon's poetic practice may be understood in the context of Gadamer's phenomenological thesis concerning works of art, which was derived both from his reading of Plato's dialogues and Heidegger. According to Gerald Bruns, Gadamer sees a work of art as "an event as well as an object."[111] Gadamer argues that like music, "it is in performance and only in it… that we encounter the work itself."[112] Bruns describes Gadamer's thought:

> On this theory it is a mistake to think of the work as a self-contained formal object that merely persists in time and retains its identity as a relic that fills up museums and standard editions. The work of art is not (or not just) an aesthetic object. … Hermeneutic identity is not something to be construed like a meaning, but something to be constructed as the form that occasions the event of the work. In *Truth and Method* Gadamer calls this event "transformation into structure," a taking shape in which the work materializes as the thing it is in our experience of it—something that happens again and again each time we experience the work.[113]

The Puzzle induces the reader to effect a "transformation into structure." The *Hekatompathia* has been read as an aesthetic object, without much consideration given to its structure, and obviously its ruined state deserves much blame. Nonetheless, even in its ruined state, the first 17 properly ordered sonnets should have been analyzed for their structure, as this study does (see Chapter 3). Also, little attention has been paid to the structure of individual sonnets. Nor do critics read the work as a performance; instead, it has been treated as a cultural artifact or museum piece. Although thoroughly cataloged by curators, attempts at exegesis have been rare, even though there is much to consider even without solving the Puzzle.

Nietzsche argued that art is "not knowing but schematizing, superimposing as much regularity and as many forms onto chaos as suffices our practical needs."[114] For Nietzsche, like Bacon, the schematizing function is a product of the imagination.[115] Human beings must live in illusion (*das Leben im Schein*), which may be realized by the creation of their own little worlds.[116] Art is making for Nietzsche, as it is for Sidney in his *Defence* and in the *Hekatompathia* as well: the Puzzle's fundamental purpose is to teach the art of making. Stanley Rosen argues that "From Descartes to Kant, Fichte, and Hegel… if in different ways… the identification of knowledge as construction or projection is regulated by the mathematical conception of identity and order but therefore implicitly by the Platonist

doctrine of formal unity."[117] The Puzzle, most remarkably, develops the reader's imagination and ability to schematize, while at the same time, compelling the restoration of the work to its predetermined end state, in which formal unity is realized.

The *Hekatompathia* practices the probative mode of communication at its extreme limit: it destroys the order of 83 sonnets but provides the reader the tools by which he or she may effect a perfect restoration. The Precision System is the essential technological apparatus that makes this radical practice possible. Only by means of a quantitative technology such as cryptography can such a massive reconstruction of sonnet order be reliably specified. The Puzzle, with its paired Heuristic and Precision Systems, allows the poet to both insinuate meaning in its initiative or probative rhetoric, and at the same time, guarantee perfect fidelity in the transmission of meaning. Werlin argues that Bacon's goal is to avoid misinterpretation: "*New Atlantis* reveals that Bacon is a theorist of a complexly disseminated system of written knowledge, which notwithstanding its power could introduce, as well as eliminate, misinterpretations."[118] The *Hekatompathia*'s Precision System guarantees correct interpretation, that is, the proper reconstitution of sonnet order, which profoundly changes our reading of the *Hekatompathia*'s individual sonnets as well as the sequence as a whole. In the restored order, the work's conclusion is completely inverted: love is a blessing rather than a curse.

The Puzzle and Baconian experimental science

The Puzzle and the method of its solution are best understood in the context of Bacon's views on scientific discovery, even though they were published decades after the *Hekatompathia*. In antiquity, nature was viewed as hiding behind a veil: one medical treatise declares that one must do violence to Nature to force her to reveal her secrets.[119] This metaphor of a veiled nature that must be forcefully interrogated continues through to the early modern period. Bacon, in his recounting of the myth of Pan, describes the "hunt of Pan" (*venatio Panis*):

> The discovery of things useful to life… is not to be looked for from the abstract philosophies… but only from Pan; that is from sagacious experience and the universal knowledge of nature, which will often by a kind of accident, and as it were while engaged in hunting, stumble upon such discoveries.[120]

Bacon describes one method of inquiry that he calls *experientia literata* (literate experience), which proceeds by "extending or transferring or

putting together former inventions."[121] Sophie Weeks describes Bacon's *experientia literata*:

> There must be a first digestion of materials to reduce the mind's confusion when confronted with the disorganised and seemingly infinite range of materials that constitute the primary history. … In Bacon's scheme, *experientia literata* is both a phase of inquiry in itself and an incipient part of a higher phase of inquiry (interpretation of nature) that culminates in the discovery of forms. In its broadest sense, *experientia literata* refers to the primary history drawn into 'titles and tables.' The tables bring 'all the experiments of all the arts… collected and arranged [*digesta*]… within one man's knowledge and judgment.[122]

This closely resembles the process by which the Puzzle is solved. The reader is confronted with anomalies and disorganized materials such as scrambled sonnets, and at first, these difficulties seem intractable. But then one notices certain structures or forms that may offer a path forward. These structures are often in the form of a table whose entries are incomplete. The challenge is to properly interpret and organize the poetic text, a process managed largely by the completion of table entries, which tests one's knowledge and judgment. This process of discovery, analogous to the search for Pan, occurs within the Puzzle's Heuristic System.

As one progresses through the Puzzle, and more table entries are discovered, the Puzzle's overall architecture begins to emerge. The Puzzle's regulatory apparatus, its cryptography-based Precision System, comes into view. The Precision System plays a role analogous to that of axioms in Bacon's theory of scientific discovery, the Heuristic System is akin to experimental testing performed in his theory. Solving the Puzzle requires both Systems, just as there are two independent processes in Bacon's model of scientific inquiry. Weeks describes these two processes or methods:

> First, the range of information assembled forms the input and its structuring in tables (*experientia literata*) provides the equivalent of a directing mechanism, in the sense of homing in on a target. Second, the experimental attempt to confirm the axiom provides the feedback. The positive feedback (production of *nova*) from the experimental testing is the guarantee that the investigation is still pursuing its target in nature (*res*).[123]

The Puzzle's Precision System will either produce a coherent message or gibberish. If a coherent message is obtained, the construction of the tables (the *experientia literata*) using the Heuristic System is validated and one

progresses; if gibberish is obtained, the puzzle-solver must descend back to the Heuristic System and correct their errors. I experienced this shuttling up and down many times in the course of solving the Puzzle. Weeks calls this a "cybernetic epistemology:"

> Bacon states time and again that his 'route is not laid on the flat but goes up and down—ascending first to axioms, and then descending to works.' According to Bacon, 'all true and fruitful Natural Philosophy has a double scale or ladder going in different directions, ascendent and descendent.' ... Interpretation of nature is a continual play of error correction that produces a cybernetic epistemology, guaranteed to find the target. ... Bacon's procedures are cybernetic by virtue of his asymmetrical criterion of truth which incorporates negativity in an error-correcting procedure. ... The negative instance excludes useless pursuits and redirects the inquiry back onto a fruitful course. The experiments of philosophical mechanics feed back into the inquiry in a continual play of error correction: this is the basis on which I chose the term 'cybernetic epistemology' to characterise Bacon's blending of error correction and truth production.[124]

The Greek root of "cybernetic" means "governance:" the Precision System governs interpretations derived in the Heuristic System, rejecting any incorrect interpretation. The *Hekatompathia* begins in chaos, as does ancient Greek cosmogony: its sonnets are scrambled and it ends with the death of Cupid—a rather ridiculous end for a collection of Petrarchan love poems. Not only does Nature hide but art does too in this Silenic text. The Heuristic System must be used to repair the text, step by step. The Precision System monitors the reader and excludes false repair. The Puzzle—through the use of these two tandem Systems—are the reader's toolkit for repairing the text.

The course of this study

In the next chapter, we begin our solution of the *Hekatompathia*'s Puzzle, a long labyrinth that requires 12 chapters and 11 addenda to navigate and document each step in our journey. Most of this study's readers have expertise either in literature or cryptography but not both, and therefore it would have pleased most readers if I had fully separated out the literary arguments from the cryptographic work. However, I had no choice but to present the Puzzle linearly, navigating this strange labyrinth along the narrow path that its poet defined long ago. Although I have separated literary and cryptographic arguments wherever possible, the path through the labyrinth (as laid out by the poet) alternates between the two disciplines. Thus I have no

choice but to treat literary and cryptographic discoveries as they arise in the step-by-step solution to the Puzzle.

True, this requires that the reader follow the threads of two disciplines, but in many ways, this is the point of the Puzzle. The *Hekatompathia* is scientific poetry, that is, poetry built upon a highly ordered cosmological model in the tradition of Lucretius's *The Nature of Things*. The process of solving the puzzle instructs the puzzle-solver in how to find order within disordered material. It also teaches an intensive reading process by which significance is distilled from a poetic text that is often obscure. Thus the comingling of a literary journey, the restoration of sonnet order, and the deciphering of cryptographic messages serves the poet's pedagogical purposes, as discussed above and in this study's final chapter.

This does not necessarily prevent the deciphering and validation of cryptograms from being evaluated independently, especially in the later Stages. However, it would have been extremely awkward to present decryptions outside of their context—that is, the point in the Puzzle at which they occur. Furthermore, this study cannot skip ahead to later Stages because they are entirely dependent upon the discoveries of earlier Stages. The Puzzle's solution path is locked into a singular set of successive steps; as in a labyrinth, only one path leads toward the exit.

In the next chapter, we solve the Puzzle's first Stage and decipher its encrypted message. The third chapter then takes up the ramifications of this message. It also discusses the *Hekatompathia*'s rhetorical practices, examines its first 17 unscrambled sonnets, and describes the sequence's structure and underlying cosmological model. The fourth chapter considers the traditions and methodologies found in the poetics of ruin and restoration. We then return to the Puzzle, and in Chapters 5 through 13, we solve the Puzzle's second through seventh Stages. Chapter 13 solves the seventh Stage, which reveals Bacon's authorship of the sequence. Chapter 14 then examines the philosophical story that the sequence unfolds. The final chapter considers the *Hekatompathia* in the context of the poetics and intellectual history of the early modern period.

This study's front matter includes a Reader's Guide that provides a description of this study's organization, reference conventions, and other practices. This is essential reading due to the uniqueness of this study's subject: the *Hekatompathia* and its Puzzle.

2

Stage 1: The Puzzle Sonnet

The *Hekatompathia*'s title page declares that the work is *divided into two parts*, which this study refers to as "Subsequences." The title page describes the second Subsequence as a *long farewell to Loue and all his tyrannie*. The headnote of the last sonnet of the first Subsequence, Sonnet 79, states that the sonnets that follow *are all made vpon this Posie, My Loue is past*. This poesy appears in bold capital letters (MY LOVE IS PAST), blazoned at the top of every sonnet in the second Subsequence and also the Epilogue. The term "MLIP Subsequence" is used to refer to this blazoned second Subsequence, which includes the Epilogue. The first Stage of the Puzzle appears on the first three pages of the MLIP Subsequence: the poet's decision to place it at this, the work's critical dividing point, elevates the importance we attach to it. Solving the Puzzle's first Stage reveals the foundation of the cryptographic system that is utilized in all 7 Stages and produces an 18-letter message that is essential to further progress in the Puzzle.

The first three pages of the MLIP Subsequence consist of Sonnets 80 through 82, one on each page. However, Sonnet 80 (Fig. 2.1), though labeled as if it were the 80th sonnet, is not actually a sonnet but the Puzzle's prose instructions. Read literally, the work's title, *Hekatompathia*, promises 100 (*hekatón*) passions (*pátheia*) but actually delivers 99, as Sonnet 80 is not a poem. Two headnotes appear to bolster this contradiction.[1] This violation of decorum also alerts us to the significance of these instructions. A further suggestion of its significance is found in the illumination of its first letter; only two other illuminated letters appear in the work: the dedication to de Vere and the *To the frendly Reader* preface. For convenience, Fig. 2.2 shows Sonnet 80 reset in modern type and reformatted so that its five enumerated "Points" are distinctly set off (the numbers 1 through 5 appear at the left margin in the original).

LXXX.

MY LOVE IS PAST.

ALL ſuch as are but of indifferent capacitie, and haue ſome ſkill in Arithmetike, by viewing this Sonnet following compiled by rule and number, into the forme of a piller, may ſoone iudge, howe much art & ſtudy the Author hath beſtowed in the ſame. Where in as there are placed many preaty obſeruations, ſo theſe which I will ſet downe, may be marked for the principall, if any man haue ſuch idle leaſure to looke it ouer, as the Authour had, when he framed it. Firſt therefore it is to be noted, that the whole piller (except
1 the baſis or foote thereof) is by relation of either halfe to the other Antitheticall or Antiſillabicall. Secondly, how this poeſie (Amare
2 eſt inſanire) runneth twyſe through out ye Columne, if ye gather but the firſt letter of euery whole verſe orderly (excepting the two laſt) and then in like manner take but the laſt letter of euery one of the ſaid verſes, as they ſtand. Thirdly is to bee obſerued, that euery
3 verſe, but the two laſt, doth end with the ſame letter it beginneth, and yet through out the whole a true rime is perfectly obſerued, al-
4 though not after our accuſtomed manner. Fourthly, that the foote of the piller is Orchematicall, yt is to ſay, founded by tranſlition or ouer ſkipping of number by rule and order, as from 1 to 3, 5, 7, & 9: the ſecret vertue whereof may be learned in * Trithemius, as namely by tables of tranſlition to decypher any thing that is writ-
5 ten by ſecret tranſpoſition of letters, bee it neuer ſo cunningly conueighed. And laſtly, this obſeruation is not to be neglected, that when all the foreſaide particulars are performed, the whole piller is but iuſt 18 verſes, as will appeare in the page following it, Per modum expanſionis.

* Polygraphiæ ſuæ lib. 5

Fig. 2.1 Sonnet 80: The Puzzle Sonnet instructions
(Reproduced from the 1869 edition)

ALL such as are but of indifferent capacitie, and haue some skill in Arithmetike, by viewing this Sonnet following compiled by rule and number, into the forme of a piller, may soone iudge, howe much art & study the Author hath bestowed in the same. Where in as there are placed many preaty obseruations, so these which I will set downe, may be marked for the principall, if any man haue such idle leasure to looke it ouer, as the Authour had, when he framed it.

1. First therfore it is to be noted, that the whole piller (except the basis or foote thereof) is by relation of either halfe to the other Antitheticall or Antisillabicall.

2. Secondly, how this posie (Amare est insanire) runneth twyse through out ye Columne, if ye gather but the first letter of euery whole verse orderly (excepting the two last) and then in like manner take but the last letter of euery one of the said verses, as they stand.

3. Thirdly is to bee obserued, that euery verse, but the two last, doth end with the same letter it beginneth, and yet through out the whole a true rime is perfectly obserued, although not after our accustomed manner.

4. Fourthly, that the foote of the piller is Orchematicall, that is to say, founded by transilition or ouer skipping of number by rule and order, as from 1 to 3, 5, 7, & 9: the secret vertue whereof may be learned in *Trithemius, as namely by tables of transilition to decypher any thing that is written by secret transposition of letters, bee it neuer so cunningly conueighed.

* Polygraphiae suae lib. 5

5. And lastly, this obseruation is not to be neglected, that when all the foresaide particulars are performed, the whole piller is but iust 18 verses, as will appeare in the page following it, Per modum expansionis.

Fig. 2.2 Sonnet 80: Puzzle Sonnet instructions reformatted for clarity

LXXXI.

MY LOVE IS PAST.

A Paſquine Piller erected in the deſpite of Loue.

A 1 At
2 laſt, though
3 late, farewell
4 olde well a da: A
m 5 Mirth or miſchance ſtrike
a 6 vp a newe alarM, And m
7 Cypria la nemica
r 8 miA Retire to Cyprus Ile, a
e 9 & ceaſe thy waRR, Els muſt thou proue how r
E 10 Reaſon can by charmE Enforce to ſlight thy e
s 11 blindfolde hatte & thee. So frames it with mee now, E
t 12 that I confeſS, The life I ledde in Loue deuoyde t
I 12 of reſT, It was a Hell, where none felte more then I, I
n 11 Nor anye with lyke miſeries forlorN. Since n
s 10 therefore now my woes are wexed leſS, And s
a 9 Reaſon bidds mee leaue olde wellaDA, a
n 8 No longer ſhall the worlde laughe mee
i 7 to ſcorN; I'le chooſe a path that n
r 6 ſhall not leade awrie. Reſt i
5 then with mee from your
4 blinde Cupids carR r
e. 3 Each one of
2 you, that
1 ſerue,
3 and would be
5 freE. H'is dooble thrall e.
7 that liu's as Loue thinks beſt, whole
9 hande ſtill Tyrant like to hurte is preſte.

Huius Columnæ Baſis, pro ſillabarum numero & linearum proportione eſt Orchematica.

Fig. 2.3 Sonnet 81: Puzzle Sonnet in "pillar" format
(Reproduced from the 1869 edition)

LXXXII.

MY LOVE IS PAST.

Expanſio Columnæ præcedentis.

A		At laſt, though late, farewell olde wellada;	A
m		Wirth for miſchaunce ſtrike vp a newe alarm;	m
a		And Ciprya la nemica mia	a
r		Retyre to Cyprus Ile and ceaſe thy warr,	r
e		Els muſt thou proue how Reaſon can by charme	e
E		Enforce to flight thy blyndfold bratte and thee.	E
s		So frames it with me now, that I confeſſ	s
t		The like I ledde in Loue deuoyd of reſt	t
I		It was a Hell, where none felt more then I,	I
n		Nor any with like miſeries forlorn.	n
s		Since therefore now my woes are wexed leſſ,	s
a		And Reaſon bids me leaue olde wellada,	a
n		No longer ſhall the world laugh me to ſcorn:	n
i		I'le chooſe a path that ſhall not leade awry.	i
r		Reſt then with me from your blinde Cupids carr	r
e.		Each one of you, that ſerue and would be free.	e
	,,	* Hy'is double thrall that liu's as Loue thinks beſt	
	,,	Whoſe hand ſtill Tyrant like to hurt is preſt.	

τόν τόι τύρα-
νον ἐυσεβεῖν
οὐ ῥάδιον.
Sophoc. in
Aia. flagell.

Fig. 2.4 Sonnet 82: Puzzle Sonnet in customary format
(Reproduced from the 1869 edition)

Sonnet 81 (Fig. 2.3) is a sonnet whose shape has been strangely distorted. It is labeled *A Pasquine Piller erected in the despite of Loue*, a reference to a statue in Rome that was used to post anonymous messages, as later discussed. Sonnet 82 (Fig. 2.4) shows the same text as Sonnet 81, though reformatted into the sonnet's customary form. In Point 2 (Fig. 2.2), the instructions state that *if ye gather but the first letter* of each line of the sonnet (referring to it in its customary form) except the last two, reading vertically downward yields this poesy: *amare est insanire* (to love is madness). The same is true for the last letters of each line, making this sonnet a double acrostic poem.

The purpose of these three pages (Figs. 2.1, 2.3, and 2.4) is not specified, but they include several strong suggestions that a message is somewhere encrypted. Point 4 of the Puzzle's instructions (reformatted for clarity in Fig. 2.2) makes several references to secret writing: the phrase *tables of transilition*—a likely reference to cryptographic tables; the declaration that there is something to *decypher* by *secret transposition of letters*; the allusion to something *cunningly conueighed*; the sidenote that references Trithemius's *Polygraphia* 5—a well-known cryptography manual. Indeed, this fourth point introduces two key words that Trithemius uses repeatedly to describe his enciphering process: *transposition* (*transpositionem*) and *Orchematicall* (*orchemate*).[2] The title of *Pasquine Piller* (Fig. 2.3) refers to a monument used for the secret transmission of messages. Wendy Phillips addresses the possibility of a hidden message:

> It seems extraordinary that Watson should have referred the reader to Trithemius merely to draw attention to the syllabic count of each line increasing by odd instead of consecutive numbers [in the base], and it is tempting to look for a message encoded along the lines of Trithemius's principles. But, given the existing complexity of the poem, it would be even more extraordinary had Watson managed to include yet another arcane device.[3]

Phillips is skeptical that the poet could add a secret message ("yet another arcane device") to a sonnet that is already severely constrained by its double acrostic. For example, it is hard to imagine that the direct application of Trithemius's tables to the acrostic *amare est insanire* would yield another short text.[4] Nevertheless, as we will discover, Bacon, by means of a clever trick, succeeded at this exactly. Indeed, he boasts in the first sentence of the instructions of *howe much art & study the Author hath bestowed* upon this Puzzle Sonnet.

Roland Greene argues that the Puzzle is an appropriation of a "ritual event for fictional purposes." However, he does not specify what ritual is

being appropriated, making it difficult to test his assertion.[5] Nor is there much reason to expect a "ritual event," given that rituals are not found elsewhere in the *Hekatompathia*. On the other hand, there is every reason to read the prose instructions literally. Its five Points are delivered in simple declarative sentences that do not suggest any mystical or other nonliteral interpretation. The references to *Orchematicall* tables (Point 4 and Sonnet 81's sidenote), deciphering (Point 4), and Trithemius's *Polygraphia* 5 (Sonnet 80's sidenote) are details that are unlikely to have any purpose other than cryptographic. The specificity of the instructions and their prominent position invite the diligent reader to undertake the challenge they present.

Puzzle-solving: an inductive process

Puzzle-solving requires an inductive reasoning process that begins with inferences and ends with a hypothesized solution that is quickly recognized as being the correct solution (assuming the puzzle is well-designed). This recognition of a puzzle's validity is based on the solution providing a sense of coherence—puzzles begin in contradiction or disorder, but end in order. The following riddle, perhaps the most prolific folk riddle in the twentieth century, illustrates this point:

> What is black and white and rɛd all over?

This riddle is meant to be delivered orally: the word pronounced "rɛd" may be either the color red or its homophone, a participle of the verb "to read." To answer the riddle, one must recognize rɛd as "read." The riddle's solution is a newspaper, whose print is black on white paper and "read" all over. The earlier mention of two colors causes the homophone red/read to be discerned as "red" rather than "read." This is known as a riddle's "block" or "distraction" because it impedes the recipient of a riddle from finding the solution. Once the block is recognized, the incoherence of how something can be black and white and "rɛd" dissolves and we feel confident that we have arrived at the correct solution to the riddle.

At the outset of tackling a puzzle, the puzzle-solver must adopt this fundamental assumption: the puzzle was designed in such a way as to allow the puzzle-solver to find its unique solution. This is true for virtually all puzzles because if a puzzle is not solvable, then it provides nothing more than frustration, and if the solution is not unique, then the puzzle is inelegant, with its multiple answers providing no sense of completion. This fundamental assumption is essentially a hypothesis that coherence can be found, and it is often the starting point in an inductive reasoning process.

Scientists begin with a similar assumption: they presume that their observations of nature will cohere to some model.

Typically, a puzzle's rules are sparsely elaborated (if at all), and this leaves the puzzle-solver with many—indeed, too many—degrees of freedom. Therefore, the puzzle-solver seeks reasonably simple solutions, that is, he or she follows a heuristic process based on a straightforward model. In this case of a cryptographic puzzle, the correctness of the solution is guaranteed by the coherence of the deciphered message.

We now begin our solution to the Puzzle's first Stage. Our attention is likely to be drawn to Point 4 of the Puzzle instructions, which promises that something may be deciphered using Trithemius's tables. Indeed, ultimately it will be possible to decipher a short message. However, the usual starting place for a puzzle is its block, and we should therefore defer the process of deciphering until we have found the block. This will likely be found among the five points of the Puzzle instructions. We must recognize this block or contradiction and then resolve it.

The misordered Puzzle Sonnet

If one examines the Puzzle's instructions, the Points listed in Fig. 2.2, a contradiction is immediately evident in Point 3, which states that *through out the whole a true rime is perfectly obserued, although not after our accustomed manner*. "Accustomed manner" must refer to the work's standard ababcc/dedeff/ghghii rhyme scheme. This rhyme scheme is followed in all of the work's 94 English-language sonnets, excluding only the Puzzle Sonnet.[6] The Puzzle Sonnet does not adhere to any sort of rhyme scheme. However, as Wendy Phillips has observed, it does include potential rhymed endings for every line:

> The meter is impeccably maintained but the rhyme conforms neither to his "accustomed manner" nor to any recognizable scheme. … Yet if one admits the pronunciation of *mia* with a long "a" no end-word remains without its rhyming counterpart, although that may be considerably separated from it: a,b,[a],c,b,d,e,f,g,h,e,a,h,g,c,d,f,f.[7]

In the worst case, the distance between the "c" rhyme of *warr* and *carr* stretches from line 4 to line 15, an absurdly long gap between rhymed lines. I have calculated the average gap between rhymed lines in this sonnet to be 4.7 lines.[8] This is surely unsuitable for any rhyme scheme, per se, because the human ear generally will not pick up a rhyme after three or four unrhymed lines are heard. Indeed, if one calculates what the gap

would be if the poem's lines were ordered by a random process, the average gap would be 4.2 lines.[9] Thus the actual average gap of 4.7 lines is slightly worse than random. In the rhyme pattern given in the above Phillips quotation, there are 6 pairs of rhymed endings (b, c, d, e, g, h) and 2 triplets (a, f), accounting for all 18 lines. The triplets make it impossible for this sonnet to follow the *Hekatompathia*'s customary rhyme scheme, which requires 9 pairs of rhymed endings and permits no triplets. This is acknowledged in Point 3 (*although not after our accustomed manner*). Thus, the Puzzle Sonnet is unique among the sequence's English sonnets, failing to adhere to the rhyme scheme of the other 93 English sonnets. Yet, curiously, the instructions insist that throughout the Puzzle Sonnet, *a true rime is perfectly obserued* (Point 3). This is clearly contradicted by the worse-than-random gap between rhymed lines. Such a large gap between rhymes is well outside of any known practice, and further, it could not possibly fulfill the purpose of the rhyme, an enhanced sense of flow and rhythm.

There are other indications that the lines are misordered. The sonnet lacks any recognizable structure, and sonnets are invariably a highly structured form.[10] Another difficulty is that its order of events appears to be inverted: it begins with a dismissal of love (*farewell olde wellada*; 1) and ends with love's hand pressed upon and hurting the speaker (18). Given that the Subsequence describes a *fall from Love and all his lawes* (79.HN), the sonnet ought instead to start with the speaker being pressed by love's power and end with love's dismissal. The sonnet's final couplet, in which love presses upon the speaker, is at odds with the other ending couplets of the MLIP sonnets, virtually all of which affirm the speaker's freedom from love. It is surprising that the concluding couplet of this first sonnet of the Subsequence contradicts the Subsequence's overall theme.

The apparently counterfactual statement that the Puzzle Sonnet exhibits *true ryme … perfectly observed* is an obvious block. Riddles, popular in this period, are usually built upon a series of contradictions. Archer Taylor writes:

> The literary riddle ordinarily contains a long series of assertions and contradictions. … The first assertion and its denial are almost certain to conflict with the next pair. Yet the author goes on and on, while his conception becomes more and more incoherent.[11]

Riddles are solved by resolving their stated contradictions. In word riddles, this is often accomplished by changing the context in which the riddle's words are understood, as in the above folk riddle. In the case of the Puzzle Sonnet, the putative rhyme scheme will only appear if we reorder the sonnet lines. True, the instructions do not explicitly tell the reader to

reorder the sonnet lines. However, it would have been inelegant and contrary to the style of puzzles for this to be stated directly. And yet, the instructions hint at this demand in Point 5:

> That **when all the foresaide particulars are performed**, the whole piller is but iust 18 verses, as will appeare in the page following it, *Per modum expansionis*. [bold added]

These *foresaide particulars* refer to the prior 4 Points, which include descriptions of work done by the poet in framing the Puzzle: the two matching acrostics; the inverse relationship between the top half and bottom half of the pillar (excluding the base); and the syllable count of the base (1, 3, 5, 7, 9). Yet, these *foresaide particulars* also leave work for the reader: *the secret vertue* that may be learned from Trithemius that allows for deciphering (Point 4) is not disclosed. But first we must see that *all the foresaide particulars are performed*, which includes Point 3: *through out the whole a true rime is perfectly observed*. Thus, we begin the first step of the Puzzle's first Stage, the reordering of the Puzzle Sonnet.

Reordering the Puzzle Sonnet

The reordering of the Puzzle Sonnet requires that we find an order that has a reasonable flow from line to line, adheres to a reasonable but unknown rhyme scheme, and is generally consistent with the style and themes of the overall sequence. The task of reordering a poem's scrambled lines is not only difficult, but in some circumstances would be impossible; for if the flow from line to line resembles free association, then multiple orders might be equally valid. At first, the task appears daunting because 18 lines may be reordered in 6,402,373,705,728,000 (18 factorial) permutations. However, sonnets are a structured form, and this significantly eases the task of reordering its lines. If, for example, the sonnet is clearly structured as two 9-line halves, then each half would have a more manageable number of permutations: 362,880 (9 factorial). A principle of computer science can be applied here. Reordering is essentially sorting, and one well-known method of sorting is the so-called "bucket sort." In this procedure, a rough sort into buckets (subsets) is first performed, followed by independent sorts within each bucket. This procedure will be applied in our reordering of the Puzzle Sonnet.

Before attempting to discover the Puzzle Sonnet's true order, we should enumerate the conditions that we expect to be met by the sonnet in its reordered state. These conditions or "Rules" are:

1. It must adhere to a plausible rhyme scheme.
2. The flow from one line to the next must be logical and grammatical, as is the case in the work's other sonnets.
3. For each line, the division of syllables must respect the boundaries of the Pillar Sonnet. That is, multisyllable words cannot overgo the end of any of the Pillar Sonnet's 28 lines.
4. Sonnets are a structured form, and the instructions state that one half of the Puzzle Sonnet is antithetical to the other (Point 1). Thus, our reordered sonnet should exhibit structure, a requirement of the sonnet genre.
5. The reordered sonnet, which is the lead sonnet of the MLIP Subsequence, must be thematically consistent with that Subsequence it introduces.

Of course, there is no simple algorithmic process for applying these Rules. It is a problem akin to cracking the combination of a safe, where one must guess at a series of numbers, and only after dialing in every number of the series can one check to see if the safe will open. It would be relatively easy to crack a safe if after dialing in each number individually, one could determine whether that single number is correct (e.g., by hearing a tumbler fall). Similarly, the challenge in reordering the sonnet lines is difficult because one cannot determine whether the position of any one line is correct independently from the others. Only with a complete reordering of all lines is it possible to fully test the validity of the reordering.

In my attempt to reorder the Puzzle Sonnet's lines, I spent endless hours unmethodically trying countless possibilities until finally one strategy for reordering the sonnet emerged. Point 1 states that *the whole pillar (except the basis or foote thereof) is by relation of either halfe to the other Antitheticall or Antisillabicall*. The opposed relationship of the first 12 lines of the Pillar Sonnet (81) to the next 12 lines is clearly visible in its syllable counts, which increase from 1 to 12 and then decrease from 12 to 1. The relationship between these two halves is thus obviously *antisillabicall*, but the instructions also apply the adjective *antitheticall*. The OED lists the *Hekatompathia* as the first to use "antithetical" and defines it as the use of "antithesis," that is, the "opposition or contrast of ideas" (OED 1). Although the use of *antitheticall* may be merely redundant of *antisillabicall*, it is also possible that it is intended as a hint that the sonnet is structured as two thematically opposite halves. This would hardly be surprising because Petrarchan sonnets are structured around two opposing views, one presented in the octave and the other in the sestet. Adopting

this hypothesis seemed warranted given the instructions' probable hint and the dialogic nature of the sonnet form. In any event, following the inductive process that puzzles require means, at some point, one must undertake assumptions, and this one seemed to be a reasonable one with which to start.

The instructions exclude the base of the sonnet from the two halves: *except the basis or foote thereof.* The base consists of 24 syllables (3 + 5 + 7 + 9), a little more than two lines of 10 syllables each. We can only reorder whole lines and therefore must assume the base to be either 2 or 3 lines. We make the more likely assumption of a base of 2 lines because this fits best with the sonnet form, which often ends in a rhyming couplet. This base of only 2 lines is too small to introduce a third theme, or even deliberate between the opposing themes of the 2 halves. Indeed, a structure, consisting of two large halves of 8 lines each, followed by a couplet that injects a new idea or attempts mediation, would be an unbalanced structure.[12] More likely, and consistent with the sonnet form, the couplet ought to provide a strong conclusion, but not introduce any new ideas.

We begin by considering what thesis might divide the sonnet into two antithetical halves. This sonnet is located at the boundary of the two Subsequences, the first of which describes the speaker's suffering under love's power, and the second describes the speaker's escape from love. From this, we might hypothesize that the sonnet's two antithetical themes are (1) the speaker still living under love's tyranny and (2) the speaker being free of love's tyranny. This is consistent with a cursory review of the sonnet's lines: some depict the speaker suffering under love while others show him free from love. We might further hypothesize that the order of these two halves is consistent with the order of the two Subsequences: the speaker first suffers under love and then escapes it. We now adopt this as our working assumption.

We next consider the base, the sonnet's ending couplet. The final couplet in the published order is as follows:

> **H'is double thrall that liu's as** Loue **thinks best**
> **Whose hand still Tyrant like to hurt is prest.** (17–18)

This depicts the speaker as still living under love's thrall and therefore, under our working assumption, belongs in the first half of the sonnet and not at its end. Moreover, this couplet, as it stands, is inconsistent with the other concluding couplets in the MLIP Subsequence, virtually all of which indicate that love has been dismissed. Finally, these two lines are part of a triplet rhyme (with line 8), an uncommon way of ending a sonnet. The

Puzzle Sonnet contains 6 rhyme pairs and 2 rhyme triplets, as previously discussed. These rhyme groups are assigned numbers in Fig 2.5. The assigned Pair numbers and Triplet numbers are arbitrary; the order in which the lines are presented is also arbitrary.

It was a Hell, where none felt more then I,	Pair 1
I'le choose a path that shall not leade awri.	(9, 14)
So frames it with me now, that I confess	Pair 2
Since therefore now my woes are wexed less,	(7, 11)
Rest then with me from your blinde Cupids **carr**	Pair 3
Retyre to Cyprus **Ile and cease thy warr,**	(15, 4)
Each one of you, that serue and would be free.	Pair 4
Enforce to flight thy blyndfold bratte and thee.	(16, 6)
Els must thou proue how Reason **can by charme**	Pair 5
Mirth for mischaunce strike vp a newe alarm;	(5, 2)
No longer shall the world laugh me to scorn:	Pair 6
Nor any with like miseries forlorn.	(13, 10)
The life I ledde in Loue deuoyd of rest	Triplet 1
H'is double thrall that liu's as Loue **thinks best**	
Whose hand still Tyrant like to hurt is prest.	(8, 17, 18)
At last, though late, farewell olde wellada; *	Triplet 2
And Ciprya la nemica mia †	
And Reason **bids me leaue olde wellada,**	(1, 3, 12)

*wellada: a lamentation (OED A) †translation: "Venus my enemy"

Fig. 2.5 Puzzle Sonnet rhyme groups

Next, we try to find a good candidate for the concluding couplet among the 6 rhyme pairs in Fig. 2.5. In Pair 1, the speaker has yet to leave love; in Pair 2, he is about to make a confession—no way to conclude a sonnet; Pairs 3 and 4 call out to others—neither sounds conclusive; Pair 5 is deliberative; in Pair 6, however, the speaker makes a bold declaration that applies both to himself and others, striking a note of finality. We now adopt the working assumption that Pair 6 is the concluding couplet in the restored order.

We will now divide the sonnet into two halves, as best we can, in accordance with our hypothesized thematic division. In performing this division, we reorder pair and triplet rhymes as a unit because presumably these lines are proximate to each other. However, this assumption is only adopted on a preliminary basis: it may not hold because a rhyme group could transcend the two halves of the sonnet. In the first half of the sonnet, we might expect to find lines that look back at the speaker's sufferance under love, his condition in the first Subsequence. One rhymed pair and one triplet show the speaker reflecting upon his past condition and therefore ought to fall in the first half of the sonnet:

It was a Hell, where none felt more then I,	Pair 1
I'le choose a path that shall not leade awri.	(9, 14)
The life I ledde in Loue deuoyd of rest	Triplet 1
H'is double thrall that liu's as Loue **thinks best**	
Whose hand still Tyrant like to hurt is prest.	(8, 17, 18)

Fig. 2.6 Lines assigned to first half of the Puzzle Sonnet

In Pair 1, the first line describes the speaker's most intense pain (*Hell*) in the past tense, and its other line (*I'le choose a path*) indicates that he has not yet made the decision to leave love—both reasons to assign Pair 1 to the sonnet's first half. Similarly, Triplet 1 describes intense pain (*devoyd of rest*) in the past tense; continued pain in the present (*to hurt is prest*) seems to indicate that the speaker is not yet free of love. For these reasons, we assign this triplet to the first half. All 5 lines in Fig. 2.6 appear to come before the speaker's complete abandonment of love and therefore ought to fall in the first half. This leaves us 3 lines short of the 8 lines needed for the first half. Later we will discover that these lines are part of a transition between the two halves.

The 5 lines in Fig. 2.6 look back to the prior Subsequence and therefore they seem to be good candidates to occupy the first 5 line positions of the reordered sonnet. After giving consideration to logical sense, likely rhyme schemes, and the restrictions on syllable boundaries, we find only one possible order:

The life I ledde in Loue deuoyd of rest	(8; Position 1)
It was a Hell, where none felt more then I,	(9; Position 2)
H'is double thrall that liu's as Loue **thinks best**	(17; Position 3)
Whose hand still Tyrant like to hurt is prest.	(18; Position 4)
I'le choose a path that shall not leade awri.	(14; Position 5)

We now consider which lines are likely to fall in the second half of the sonnet, in accordance with our working assumption that the second half of the sonnet depicts the speaker as free from love's tyranny. There are 3 rhymed pairs that fit this criterion:

Rest then with me from your blinde Cupids **carr**	Pair 3
Retyre to Cyprus **Ile and cease thy warr,**	(15, 4)
Each one of you, that serue and would be free.	Pair4
Enforce to flight thy blyndfold bratte and thee.	(16, 6)
Els must thou proue how Reason **can by charme**	Pair 5
Mirth for mischaunce strike vp a newe alarm;	(5, 2)

Fig. 2.7 Lines assigned to second half of the Puzzle Sonnet

In Pairs 3 and 4, the speaker also calls on others to abandon love: *Rest then with me from your blinde Cupids carr* (15); *Enforce to flight thy blyndfold bratte and thee* (6). Presumably, these calls to others to join the speaker in a love-free state ought to occur only subsequent to the speaker's departure from love and thus fall in the second half. Pair 5 asserts that the speaker is bound to Reason and therefore has some immunity from the temptation (*newe alarm*) to return to love. Of course, this must refer to a time subsequent to the speaker winning his freedom from love. All 3 pairs are consistent with Pair 6, our assumed final couplet, in which the speaker vows that he will never again suffer under love, and neither will others if they heed his call to abandon love.

We have now assigned 5 lines to the first half, leaving 3 unassigned places; and 6 lines to the second half leaving 2 unassigned places. These 5 unassigned places must be filled with our 5 unassigned lines, the one remaining triplet and the one remaining pair:

At last, though late, farewell olde wellada;	Triplet 2
And Ciprya la nemica mia	
And Reason **bids me leaue olde wellada,**	(1, 3, 12)
So frames it with me now, that I confess	Pair 2
Since therefore now my woes are wexed less,	(7, 11)

Fig. 2.8 Lines that remain unassigned

Assuming our work to this point is correct, these 5 lines must span the two halves, with 3 lines falling in the first half and 2 in the second half, as shown in Fig. 2.9.

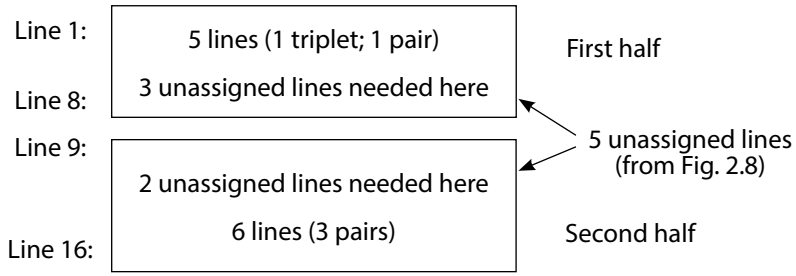

Fig. 2.9 Division of Puzzle Sonnet into halves

Returning to Fig. 2.8, in line 1 of Triplet 2 the speaker bids farewell to love (*wellada*). This avowal in the present tense belongs in the second half of the sonnet because the speaker's mind is finally resolved. Line 12 belongs in the first half because the speaker is still contemplating leaving love in the future. Line 3's position cannot be distinguished based on its content. We now consider Pair 2 in Fig. 2.8. One of its lines, *Since therefore now my woes are wexed less* (11), depicts the speaker still deliberating about leaving love, and therefore it belongs in the first half. Pair 2's other line, *So frames it with me now, that I confess* (7), includes the significant word, *confess*. *Confess* in the present tense implies that the moment of avowal or conversion is at hand. The use of *now* adds to the sense of immediacy of this confession. The speaker is here announcing his farewell to love, making this line a good candidate to be positioned as the first line of the second half. This position is known as the *volta* in a Petrarchan sonnet. The first line of a Petrarchan sonnet's sestet (the second stanza) is thought of as a *volta* (jump) from the octave (the first stanza).

Where does this leave us? We have assigned line 12 (Triplet 2) and line 11 (Pair 2) to the first half, filling 2 of the 3 open positions. We have assigned line 1 (Triplet 2) and line 7 (Pair 2) to the second half, filling both of the 2 open positions. The one line whose position could not be distinguished, line 3 (Triplet 2), can now be assigned to the only open position, which is in the first half. This summarizes our sorting of these 5 lines into the two halves (the position of lines within each half is arbitrary):

First half:
Since therefore now my woes are wexed less (11)
And Ciprya la nemica mia (3)
And Reason **bids me leaue olde wellada,** (12)

Second half:
At last, though late, farewell olde wellada; (1)
So frames it with me now, that I confess (7)

The number of permutations is now vastly reduced. For the two second half lines, there are only two possible orders. *Confess* (7), meaning "avow," indicates that this line ought to precede the speaker's dismissal of love: *At last, though late, farewell olde wellada* (1). This is consistent with the prior discussion in which line 7 was determined to be the *volta*, the first line of the second half. Then, the order that begins the second half is:

So frames it with me now, that I confess (7)
At last, though late, farewell olde wellada; (1)

We now consider the 3 lines above that end the first half. There are 6 possible orders for these three lines. We begin by considering which line might precede line 7, the first line of the second half. *So frames* (7) limits the choice of the preceding line. "Frames" (*OED*, 5c, "to shape the action, faculties, or inclinations of a person") refers to the forces acting upon the speaker's mind prior to the speaker's avowal. Neither line 11 nor 12 fits prior to line 7, but line 3 fits perfectly: placing it before line 7 specifies Venus, or love's painful effects, as the force that *frames* the speaker's mind to depart from love. Now only the order of lines 11 and 12 must be determined. If line 11 is placed first, then the rhyme scheme is an awkward abbba—a triple repetition of a rhyme; if line 12 is placed first, then the rhyme scheme is a reasonable ababa. We now have reordered lines 6 through 10 of the sonnet:

And Reason bids me leaue olde wellada, (12; Position 6)
Since therefore now my woes are wexed less, (11; Position 7)
And Ciprya la nemica mia (3; Position 8)
So frames it with me now, that I confess (7; Position 9, the *volta*)
At last, though late, farewell olde wellada; (1; Position 10)

We now turn our attention to line positions 11 through 16, the remainder of the second half of the sonnet. From Fig. 2.7, Pairs 3, 4, and 5 provide the 6 lines that we must now order. A careful examination of Pair 5 will show

that it is a continuation of the speaker's avowal, *At last, though late, farewell olde wellada*. Pair 5 is presented as contiguous and in its likely order:

> **Els* must thou proue how** Reason **can by charme** (Position 11)
> ****Mirth for[13] mischaunce strike vp a newe alarm;** (Position 12)
>
> [*for it to be otherwise; **only then might...]

The speaker declares that his vow will hold unless you can *proue* to him that *Reason* can once again be overtaken by (a lover's) *charme*. Only then might pleasure (*Mirth*) or ill-luck (*mischaunce*) initiate a new war (*alarm* means a call to arms). The implication is that the speaker has embraced Reason, and he is safe as long as Reason is immune from a beloved's charm.

Only Pairs 3 and 4 remain unassigned, and only positions 13 through 16 are open. Pairs 3 and 4 have this in common: they call upon others to join the speaker in his avowal to forswear love: *Each one of you, that serve* love should remove yourself from *Cupid's carr*, and *enforce to flight thy blyndfold bratte* [Cupid]. Restrictions of rhyme order, logical flow, and syllable boundaries allow for only one ordering of these 4 lines from Pairs 3 and 4:

> **Retyre to** Cyprus **Ile and cease thy warr,** (Position 13)
> **Enforce to flight thy blyndfold bratte and thee.** (Position 14)
> **Rest then with me from your blinde** Cupids **carr** (Position 15)
> **Each one of you, that serue and would be free.** (Position 16)

The reordering of Sonnet 82, now complete, is presented in Fig. 2.10. It follows a reasonable rhyme scheme, abaab cdcdc eefgfg hh.[14] The speaker progresses from a life led subject to love to one led free from love. This progressive development allows for some confidence in our reordering. (Full confidence will come after deciphering the message that results from this reordering, later in this chapter.) The first 4 lines describe the torments of living under love's influence, which include restlessness (1), being subject to a double thrall (3), and painful oppression (4). In the next 4 lines, the speaker declares that he will leave love (5) and then gives reasons for leaving: Reason has led him to this decision (6); he is now in less pain (7); Venus has in some way affected his thinking (8). The second half begins with the *volta*, a declaration that he is now making a confession (9) and his declaration that he has at last left love (10). In the next two lines (11–12), anticipating an (unstated) objection that he might yet return to love someday, he explains that his adherence to *Reason* will likely prevent any such possibility. In the next 4 lines, he calls for others to follow his lead in abandoning love. In the sonnet's final 2 lines (the base section), he concludes that love will no longer control his life or that of others.

The life I ledde in Loue deuoyd of rest
It was a Hell, where none felt more then I,
H'is double thrall that liu's as Loue **thinks best**
Whose hand still Tyrant like to hurt is prest.
I'le choose a path that shall not leade awri.
And Reason **bids me leaue olde wellada,**
Since therefore now my woes are wexed less,
And Ciprya la nemica mia
So frames it with me now, that I confess
At last, though late, farewell olde wellada;
Els must thou proue how Reason **can by charme**
Mirth for mischaunce strike vp a newe alarm;
Retyre to Cyprus **Ile and cease thy warr,**
Enforce to flight thy blyndfold bratte and thee.
Rest then with me from your blinde Cupids **carr**
Each one of you, that serue and would be free.
No longer shall the world laugh me to scorn:
Nor any with like miseries forlorn.

Fig. 2.10 Reordered Sonnet 82

The sonnet exhibits both a logical and chronological flow. The speaker begins by telling us of his past pain in love, an obvious starting point. Moving forward in time, using the present tense, he declares his departure from love. Finally, looking to the future, he calls on others to follow his course. Any change to the order of these sections would break the logical flow of the poem. The progressive development of the reordered Sonnet 82 fits perfectly with its role as the lead sonnet of the MLIP Subsequence. As we will discover in Chapter 5, the MLIP Subsequence follows roughly the same course set by Sonnet 82: beginning with sonnets that describe the woes of love, followed by sonnets that scoff at love, and lastly sonnets that call for others to abandon love. Thus the course of topics in Sonnet 82, the lead sonnet of the Subsequence, foreshadows the course of topics presented in the Subsequence.

Although we reordered the sonnet using a procedure whose starting point was a division into halves plus a closing couplet (the base), other procedures may have produced the same result. For example, a recognition of the sonnet's chronological and logical flow without first dividing it may have achieved the same result. The task of reordering turns the puzzle-solver into a quasi-poet—a "maker" in Sidneian terms. The puzzle-solver becomes engaged with the text at a detailed level in order to understand its structure and even its line-to-line ordering. The reader is made to wander through this labyrinthine Puzzle, and perhaps this makes for some affinity with the sonnet speaker, who is also a wanderer.

How can we be sure that our reordering is exactly the reordering intended by the poet? Ordinarily we would have no way of knowing whether our reordering is the uniquely correct solution; however, because the sonnet hides a cryptogram, and that cryptogram depends upon the sonnet being correctly reordered, the reordering can be verified. Next, we will decipher the cryptogram, and if it produces an intelligible message rather than gibberish, then our reordering is correct (although it will still be subjected to a mathematical test, as later described). Bacon has set before the reader a literary problem—the sonnet reordering—along with a cryptographic system that allows for the definitive verification of whether the reader has correctly performed the reordering task.

The cryptography of the *Polygraphia*

Prior to resuming our efforts to solve the Puzzle's first Stage, a brief description of the *Polygraphia* 5's cryptography is required. This section does not assume that the reader has any prior knowledge of cryptography. The term "ciphertext," introduced in the first chapter, refers to an enciphered text that usually appears to be gibberish. Ciphertexts often lack word boundaries and are therefore conventionally presented in groups of 5 letters as shown:

XJCDA BAEZW KLURD

"Plaintext" refers to the original message, a plainly readable text. A plaintext is enciphered to produce a ciphertext; a ciphertext is deciphered to produce a readable plaintext, as shown in Fig. 2.11.

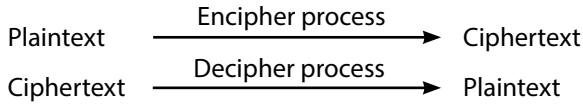

Fig. 2.11 Encipher and decipher processes

The deciphering of a ciphertext may either be authorized—as when an official legitimately has access to the tables needed to decipher a message—or unauthorized—as when someone uses cryptographic techniques to crack a cipher. An unauthorized person who discovers cipher tables by technical tricks (e.g., cracking a cipher by frequency counting or other means) is known as a cryptanalyst.

Ciphering and deciphering in the Renaissance were typically performed using tables that substitute one character for another. For example,

whenever an "A" appears, it is substituted with a "K"; whenever a "B" appears, it is substituted with a "T," and so on. Trithemius refers to such a substitution scheme as a "table" (*tabula*) or "Alphabet" (*alphabetum*), and the process of enciphering or deciphering as "transposition" (*transpositio*). The Puzzle's instructions (Point 4) also use the term "transposition," and in the same manner as Trithemius does. However, in modern terminology, "transposition" refers to an altogether different form of encryption, the rearranging of the order of the letters of a text. So, to avoid confusion with this modern usage, I use "Transform" rather than "transposition" to describe the enciphering and deciphering processes employed in the *Polygraphia* and the *Hekatompathia*.

During the Renaissance, most cryptography used only a single Alphabet (monoalphabetic substitution) to Transform all the letters of a text. However, single Alphabetic substitution was vulnerable to cryptanalytic techniques, and this led to the invention of more sophisticated cryptographic techniques. In the fifteenth century, Leon Battista Alberti invented a system that used multiple tables (or Alphabets) in a method known as "polyalphabetic substitution." Trithemius uses this method in his *Polygraphia* 5: the advantage of using multiple tables (or, in our terminology, Transforms) is that it makes for a stronger cryptographic system (meaning that it is hard to crack). The virtue of polyalphabetic cryptography is that one letter is not always Transformed into the same letter, which would otherwise be a vulnerability.

Polygraphia 5 provides three types of tables for implementing polyalphabetic Transforms: Recta, Aversa, and Orchema. The Recta Transforms are the simplest of cryptographic tables and are known as a "Caesar shift." In a Caesar shift, one letter is enciphered into another by shifting a fixed number of letters within an ordered alphabet. Fig. 2.12 shows the *Polygraphia*'s master Recta Transposition Table,[15] which is a collection of 23 Recta tables: each column represents one Recta table. I have inserted column numbers 1 to 23 into Trithemius's master table so that each of the 23 Recta tables may be easily referenced (nothing in the original is obscured). The *Polygraphia*, on subsequent pages, disperses this master table into the 23 Recta tables that appear as 23 pairs of columns: the left-hand columns of each pair repeat the leftmost column of the master table; the right-hand columns of each pair duplicate the 23 columns of the master table in sequential order. The first table implements a Caesar shift of 1, the second a Caesar shift of 2, and so on. In total, Trithemius presents 23 Recta tables, each table shifting between 1 and 23 places in a 24-letter alphabet (a shift of 24, equivalent to no shift at all, is omitted).[16]

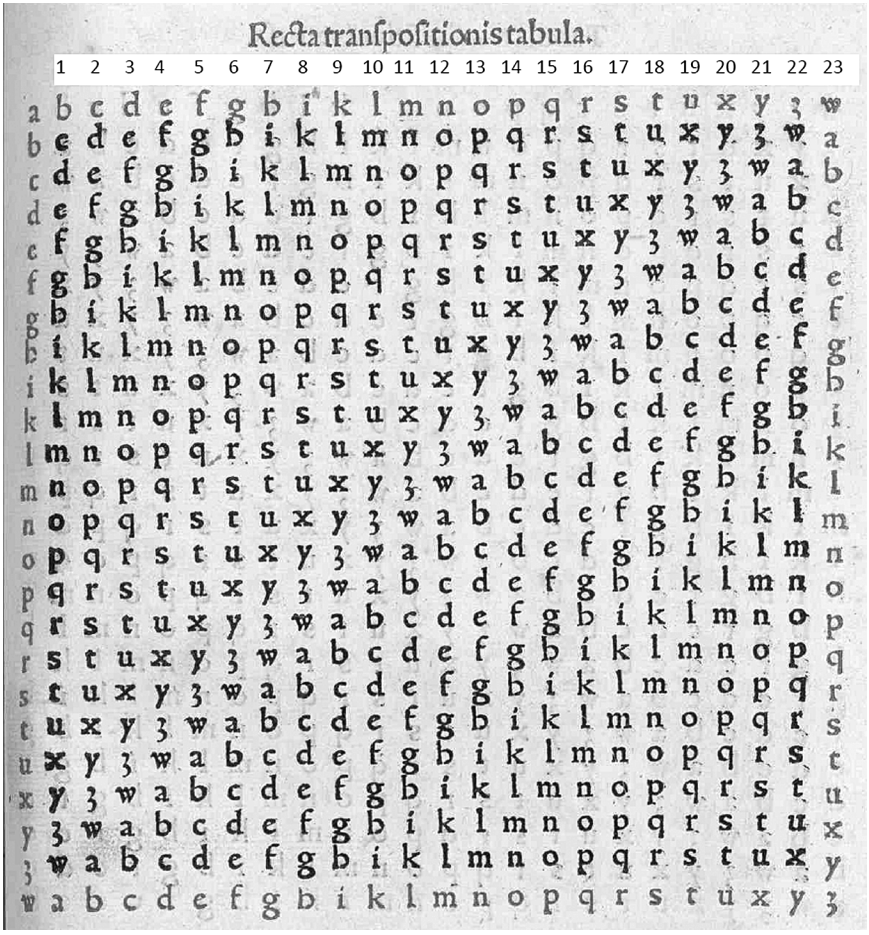

Fig. 2.12 "Recta transposition table" from Trithemius's *Polygraphia* 5 (Numbered row added.) Courtesy of Library of Congress.

A polyalphabetic cipher may be implemented through the use of multiple Recta tables. Trithemius suggests the following simple procedure to produce a polyalphabetic cipher: use the first column (labeled "1") to encipher the first letter of a message (a shift of one letter), then use the second column (labeled "2") to encipher the second letter of the message (a shift of two letters), and so on. This pattern is continued until all 23 columns of Fig. 2.12 are exhausted, at which point one cycles back to the first column.

Trithemius's Recta tables (Fig. 2.12) could, in practice, be treated as either enciphering tables or deciphering tables. The Puzzle treats these tables as deciphering tables: the ciphertext letter is the far-left column, and the plaintext letter is one of the 23 numbered columns to the right. In

	1	2	3	4	5	6	7	8	9	10	11	12
A	B	C	D	E	F	G	H	I	K	L	M	N
B	C	D	E	F	G	H	I	K	L	M	N	O
C	D	E	F	G	H	I	K	L	M	N	O	P
D	E	F	G	H	I	K	L	M	N	O	P	Q
E	F	G	H	I	K	L	M	N	O	P	Q	R
F	G	H	I	K	L	M	N	O	P	Q	R	S
G	H	I	K	L	M	N	O	P	Q	R	S	T
H	I	K	L	M	N	O	P	Q	R	S	T	U
I	K	L	M	N	O	P	Q	R	S	T	U	W
K	L	M	N	O	P	Q	R	S	T	U	W	X
L	M	N	O	P	Q	R	S	T	U	W	X	Y
M	N	O	P	Q	R	S	T	U	W	X	Y	Z
N	O	P	Q	R	S	T	U	W	X	Y	Z	A
O	P	Q	R	S	T	U	W	X	Y	Z	A	B
P	Q	R	S	T	U	W	X	Y	Z	A	B	C
Q	R	S	T	U	W	X	Y	Z	A	B	C	D
R	S	T	U	W	X	Y	Z	A	B	C	D	E
S	T	U	W	X	Y	Z	A	B	C	D	E	F
T	U	W	X	Y	Z	A	B	C	D	E	F	G
U	W	X	Y	Z	A	B	C	D	E	F	G	H
W	X	Y	Z	A	B	C	D	E	F	G	H	I
X	Y	Z	A	B	C	D	E	F	G	H	I	K
Y	Z	A	B	C	D	E	F	G	H	I	K	L
Z	A	B	C	D	E	F	G	H	I	K	L	M

Fig. 2.13 Recta tables

contrast, Trithemius's explanation and examples use the Recta tables as enciphering tables. This minor variation between the Puzzle's and *Polygraphia*'s treatment of the Recta tables is not surprising. Indeed, Trithemius advises his readers that his tables can be used flexibly and that many variations are possible.[17] Fig. 2.13 reproduces the first 12 Recta tables from Fig. 2.12 (called transpositions or Alphabets by Trithemius) in a more easily readable format. Only 12 of the 23 Recta tables or Transforms are reproduced because the Puzzle only uses the first 12, as later discussed. Also, a minor change has been made to the alphabetic order in Fig. 2.13: the position of the letter "W" is made consistent with the English ordering of the alphabet, as opposed to Trithemius's German ordering, in which

"W" is the last letter.[18] The Recta table in Fig. 2.13, which is used throughout this study, is replicated for convenience in Appendix B, Fig. B.1.

To illustrate the use of the Recta tables, we encipher the arbitrary word LOGOS (the plaintext). The Recta tables, following the Puzzle's method, are deciphering tables, so we need to perform a reverse lookup when enciphering. We encipher the first plaintext letter, "L," by looking for that letter in column 1. The letter that appears to its left in the row header is the letter "K." This is the ciphertext letter used to encipher the plaintext letter "L." Column 2 is used to encipher the next plaintext letter, "O," and so on. This process generates the ciphertext KMDKN, as shown below. Note that unlike a monoalphabetic cipher, the letter "O," which appears twice in the plaintext, is transformed into two different ciphertext letters, M and K, which defends against the usual frequency counting technique used to break ciphers. The use of different Transforms for different letters is the defining characteristic of polyalphabetic cryptography.

Plaintext:	L	O	G	O	S
Transform column:	1	2	3	4	5
Ciphertext:	K	M	D	K	N

Deciphering is accomplished by the same process in reverse. We simply find the ciphertext letter among the row headers and its deciphered value in the appropriate column. Alternatively, enciphering and deciphering operations can be performed without tables, using simple arithmetic (the instructions mention arithmetic). The standard practice was to assign a numerical value to each letter in a standard 24-letter alphabet based on their normal order, as shown:

Numeric values of the letters of the Elizabethan alphabet

A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S	T	U	W	X	Y	Z
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

To encipher, one simply subtracts the Transform number from the plaintext letter's numeric value. To decipher, one adds the Transform number to the ciphertext letter's numeric value. The deciphering operation, used frequently in solving the Puzzle, is performed using the Recta Deciphering Formula that appears below. "Mod" refers to modular or clock arithmetic: if the sum obtained by adding the Ciphertext to the Transform number ever exceeds 24, then following the rules of modular arithmetic, one must subtract 24 and use the remainder. For example, if a ciphertext letter T (19) is to be deciphered using a Transform value of 10, then a sum

of 29 is obtained. Then applying modular arithmetic, one must subtract 24, which yields 5, which is E. The arithmetic formula for Recta deciphering is given below:

Plaintext = (Ciphertext + Transform number) (mod 24)

Recta Deciphering Formula

	1	2	3	4	5	6	7	8	9	10	11	12
A	Z	Y	X	W	U	T	S	R	Q	P	O	N
B	Y	X	W	U	T	S	R	Q	P	O	N	M
C	X	W	U	T	S	R	Q	P	O	N	M	L
D	W	U	T	S	R	Q	P	O	N	M	L	K
E	U	T	S	R	Q	P	O	N	M	L	K	I
F	T	S	R	Q	P	O	N	M	L	K	I	H
G	S	R	Q	P	O	N	M	L	K	I	H	G
H	R	Q	P	O	N	M	L	K	I	H	G	F
I	Q	P	O	N	M	L	K	I	H	G	F	E
K	P	O	N	M	L	K	I	H	G	F	E	D
L	O	N	M	L	K	I	H	G	F	E	D	C
M	N	M	L	K	I	H	G	F	E	D	C	B
N	M	L	K	I	H	G	F	E	D	C	B	A
O	L	K	I	H	G	F	E	D	C	B	A	Z
P	K	I	H	G	F	E	D	C	B	A	Z	Y
Q	I	H	G	F	E	D	C	B	A	Z	Y	X
R	H	G	F	E	D	C	B	A	Z	Y	X	W
S	G	F	E	D	C	B	A	Z	Y	X	W	U
T	F	E	D	C	B	A	Z	Y	X	W	U	T
U	E	D	C	B	A	Z	Y	X	W	U	T	S
W	D	C	B	A	Z	Y	X	W	U	T	S	R
X	C	B	A	Z	Y	X	W	U	T	S	R	Q
Y	B	A	Z	Y	X	W	U	T	S	R	Q	P
Z	A	Z	Y	X	W	U	T	S	R	Q	P	O

Fig. 2.14 Aversa tables

We use the Recta Deciphering Formula and the numeric values of the Elizabethan alphabet (given above) to decipher the ciphertext, KMDKN of our previous example, as shown below:

Ciphertext:	K	M	D	K	N
Numerical value of letter:	10	12	4	10	13
Transform number to add:	1	2	3	4	5
Sum:	11	14	7	14	18
Plaintext:	L	O	G	O	S

Trithemius also provides tables that he calls *Tabulae Aversae*; a master Aversa table, as implemented in the Puzzle, appears in Fig. 2.14.[19] The Aversa table, which is used throughout the study, is replicated for convenience in Appendix B, Fig. B.2. Trithemius called these tables "*aversa*" because of the descending alphabetic order in each column, rather than the ascending order found in the Recta tables. The arithmetic formula for Aversa deciphering, which may be used instead of looking up values in the Aversa table, is given below:

Plaintext= (50—Ciphertext—Transform number) (mod 24) — Aversa Deciphering Formula

The Pillar Sonnet: a map of cryptographic tables

If the Puzzle is to decipher something, as the instructions state in Point 4 (Fig. 2.2), then it must perform a deciphering operation on a ciphertext. But where is the ciphertext located? The obvious answer is in the Puzzle Sonnet's pair of acrostics—in part because there is no other demarcated text elsewhere in the Puzzle Sonnet. These acrostics, composed of the first and last letters of each line of Sonnet 82, also appear as added letters in the left and right margins of Sonnet 81, placing further emphasis upon them. They are further distinguished by their odd (though not consistent) capitalization in Sonnet 81, as discussed below. Moreover, these acrostics display a Latin sententia (*amare est insanire*), distinguishing this text from the other text in the Puzzle Sonnet, which is in English. Given these accentuations of the acrostics, it is natural to hypothesize that they are the intended ciphertext (indeed, no other possibilities are apparent). Moreover, there is a tradition of placing secret texts in acrostics: an acrostic in a 14-line prefatory poem spells out THOMAS SEBILLET, the only evidence for the work's attribution.[20]

We now turn to the pointed reference to Trithemius's tables (Instructions, Point 4). Which table should be applied to each letter of the

acrostics? As discussed above, Trithemius's assignment of tables to ciphertext letters is simple: he assigns the first Recta table (offset of 1) to the first letter of the message, the second Recta table (offset of 2) to the second letter, and so on. The Puzzle Sonnet assigns the Transforms or tables in a different manner, which is specified by the Pillar Sonnet. We carefully examine this oddly shaped sonnet (Fig. 2.3). Its first line contains a single syllable, and each line that follows has one more syllable than the prior line, reaching a maximum count of 12. This process is then reversed as the pillar tapers downward, the syllable count declining from 12 to 1. This is consistent with Point 1, in which the instructions state that *either halfe to the other* [is] *antisillabicall*, excluding the base. The base has syllable counts of 3, 5, 7, and 9. Why does this double acrostic sonnet appear twice, first in this strangely shaped pillar and then in the normal sonnet format on the following page? Has the poet included the Pillar Sonnet merely for its ornamental value? Although Sonnet 81 is nominally a pattern poem, there is no obvious relationship between its visual properties and the poetic text, as one would expect in a pattern poem. Furthermore, its shape barely resembles that of the pillar specified in its title. What column has such girth in its middle and a pointed top? Rather, the poem's shape follows a numerical pattern based on the syllable count: 1 to 12, 12 to 1, 3, 5, 7, 9. What is the significance of this sequence of 28 numbers?

Curiously, the title above this sonnet refers to it as a *Pasquine Piller*. From Elyot's *Dictionary* we learn that Pasquino is "a statue in Rome on whom all libels, railings, detractions, and satirical invectives are fathered."[21] In 1501, a truncated Greek statue was discovered, and after being placed near the Orsini Palace, it was used, under the cover of darkness, to post anonymous messages. From this, the tradition of *sonetti caudati* (tailed sonnets), sonnets that sport an extra half line that delivers a satirical sting, developed. Printed anthologies of these works were called *pasquinate*. Authors of such poems include Serafino, a favorite of Bacon's.[22] The implication of calling this sonnet a *Pasquine Piller* is that some "tail" or message is posted on it. Sonnet 81 might perhaps be thought of as having two tails, the two acrostics that read *amare est insanire*. However, the tailed sonnet tradition suggests something clandestine appearing only after the cover of darkness. Is there a hidden tail, as well?

We begin by examining the numerical sequence that defines the Pillar Sonnet's 28-line pattern: 1 to 12, 12 to 1, 3, 5, 7, 9. These syllable counts are emphasized by their appearance at the left of each line of the Pillar Sonnet. Although the instructions say nothing about the first 24 syllable counts (1 to 12, 12 to 1), they do tell us that the *foote* or base of the pillar is *Orchematicall*. The instructions define *Orchematicall* as the *ouer skipping of number by rule and order, as from 1 to 3, 5, 7, and 9* (Point 4).

This is further emphasized by a sidenote to the right of the Pillar Sonnet: *Huius Columnae Basis… est orchematica* (The base of this pillar… is orchematical). Point 4 reads:

> Ouer skipping of number by rule and order, as from 1 to 3, 5, 7, and 9: the secret vertue whereof may be learned in *Trithemius, as namely by tables of transilition to decypher any thing that is written by secret transposition of letters, bee it neuer so cunningly conueighed.
>
> [The asterisk links to the sidenote: *Polygraphiae suae lib. 5*]

Bacon thus reveals the significance of the last four numbers of his syllable counts (3, 5, 7, and 9): they somehow relate to the Orchema tables in *Polygraphia* 5. If these last 4 syllable counts point to cryptographic tables, it is a modest extrapolation to infer that the first 24 numbers (on which the instructions are silent) are also associated with the *Polygraphia*'s cryptographic tables. *Polygraphia* 5 contains three sets of cryptographic tables, the previously mentioned Recta and Aversa tables, and the Orchema tables, which are presented in that order. When the instructions state that the Orchema tables are related to the base of the pillar (the last 4 syllabic counts), the puzzle-solver will naturally speculate which tables might be applied to the first 24 syllable counts (1 to 12 and 12 to 1).

A straightforward extrapolation is presented in Fig. 2.15, which is a reproduction of the Pillar Sonnet (Fig. 2.3). It shows the Pillar Sonnet consisting of three regions, an upper half of the pillar (excluding the base) in which the syllable count increases, a lower half of the pillar (excluding the base) in which the syllable count decreases, and the base of the pillar. The solid chevron is drawn to show the assignment of the base to the Orchema tables. Then what tables are to be used above the base? The natural answer is to assign the three depicted Pillar Sonnet regions to the *Polygraphia* 5's three table types in the order in which they appear (Recta, Aversa, Orchema). This is also the natural assignment of the tables, given their names: the Recta (proper) tables are assigned to the increasing numerical sequence (1 to 12, a normal upward count), and the Aversa (turning back) tables to the decreasing sequence (12 to 1). The checkered chevrons in Fig. 2.15 show this inferred assignment of the first two regions to the Recta and Aversa tables.

Fig. 2.16 is another reproduction of the Pillar Sonnet. As in Fig. 2.15, the acrostic letters (the first and last letters of each line in normal sonnet form) are emphasized using large, bold capital letters. This follows the Puzzle's practice of using capital letters in the Pillar Sonnet to emphasize the acrostic letters. For example, as shown in both Fig. 2.3 and 2.16, "alarM," which appears in the sixth line, has its final letter capitalized. The

Puzzle further emphasizes these acrostic letters by replicating them to the left or the right of the Pillar Sonnet. We notice that each of the acrostic letters fall on one of the Pillar Sonnet's 28 lines. In some cases, such as the second and third lines of the Pillar Sonnet, no acrostic appears; on other lines, 1, 2, or 3 acrostic letters appear. Figure 2.16 is annotated to the right of the sonnet with a list of the acrostic letters that appear on each of the Pillar Sonnet's 28 lines. These are the first and last acrostic letters for each of the Puzzle Sonnet's 18 lines (in customary sonnet format, Fig. 2.4). The suffix "F" is used to designate the "First" letter; the suffix "L" is used to designate the "Last" letter. Thus, 7F refers to the first letter of line 7 of the sonnet in its customary form.

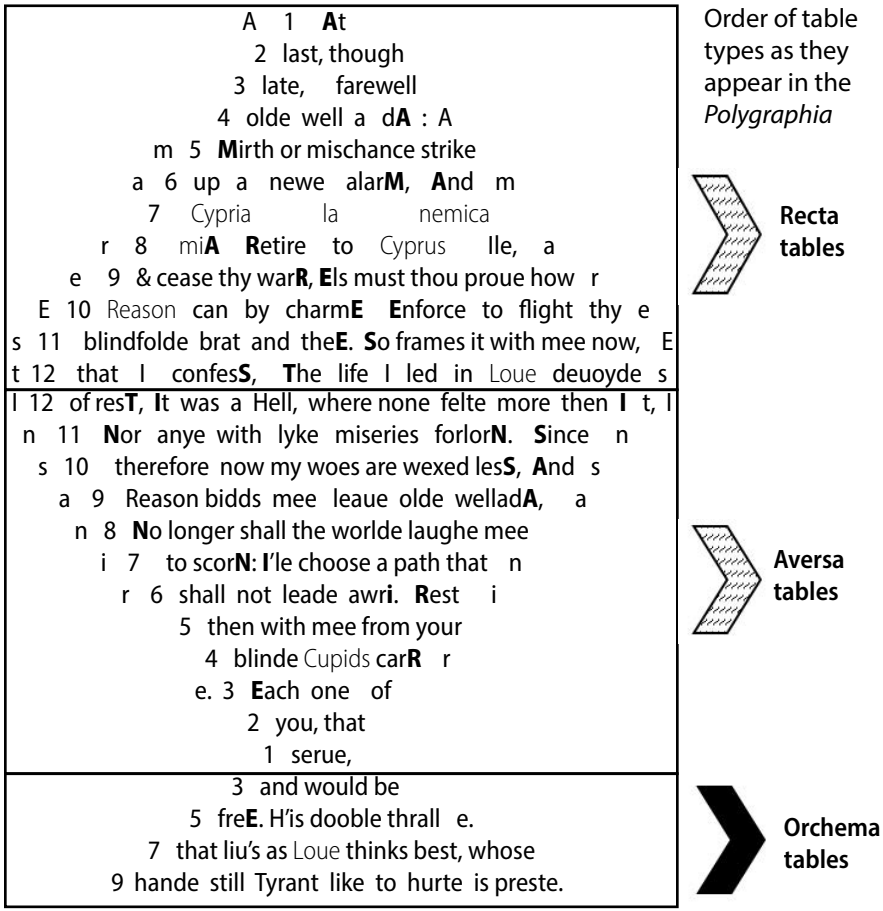

Fig. 2.15 Pillar Sonnet: Table type alignment

A 1 **A**t	1F
2 last, though	--
3 late, farewell	--
4 olde well a d**A** : A	1L
m 5 **M**irth or mischance strike	2F
a 6 up a newe alar**M**, **A**nd m	2L, 3F
7 Cypria la nemica	--
r 8 mi**A** **R**etire to Cyprus Ile, a	3L, 4F
e 9 & cease thy warR, **E**ls must thou proue how r	4L, 5F
E 10 Reason can by charm**E** **E**nforce to flight thy e	5L, 6F
s 11 blindfolde brat and the**E**. **S**o frames it with mee now, E	6L, 7F
t 12 that I confes**S**, **T**he life I led in Loue deuoyde s	7L, 8F
l 12 of res**T**, **I**t was a Hell, where none felte more then **I** t, l	8L, 9F, 9L
n 11 **N**or anye with lyke miseries forlor**N**. **S**ince n	10F, 10L, 11F
s 10 therefore now my woes are wexed les**S**, **A**nd s	11L, 12F
a 9 Reason bidds mee leaue olde wellad**A**, a	12L
n 8 **N**o longer shall the worlde laughe mee	13F
i 7 to scor**N**: **I**'le choose a path that n	13L, 14F
r 6 shall not leade awr**i**. **R**est i	14L, 15F
5 then with mee from your	--
4 blinde Cupids car**R** r	15L
e. 3 **E**ach one of	16F
2 you, that	--
1 serue,	--
3 and would be	--
5 fre**E**. H'is dooble thrall e.	16L, 17F
7 that liu's as Loue thinks best, whose	17L, 18F
9 hande still Tyrant like to hurte is preste.	18L

Fig. 2.16 Pillar Sonnet: Table to acrostic letter mapping

The Pillar Sonnet acts essentially as a map or table: it assigns acrostic letters to cryptographic tables (i.e., Transforms). Each acrostic letter falls on one of the Pillar Sonnet's 28 lines, which effectively assigns each acrostic letter to one particular number in our 28-number sequence of left margin numbers (1 to 12; 12 to 1; 3, 5, 7, 9). In Fig. 2.15, we assigned each region of the Pillar Sonnet to a table type. We further assume that the left margin numbers provide additional information concerning the assignment of cryptographic tables (which might be inferred from Point 4). The simplest assumption would be that the numbers that were placed at the left margin designate the particular Recta, Aversa, or Orchema table to use. Thus, for the Recta table region of Fig. 2.15, these left margin numbers specify the column number of the master Recta table shown in Fig. 2.13, which is equivalent to the shift value. In other words, a left margin number

of 1 specifies the first Recta table (the first column), which shifts by 1. A left margin number of 2 specifies the second Recta table (the second column), which shifts by 2, and so on. Similarly, for the Aversa table, a left margin number of 12 (the 13th line of the Pillar Sonnet) would indicate column 12 (a shift of 12), a left margin number of 11 would indicate column 11 (a shift of 11), etc. The numbers 3, 5, 7, and 9 would make assignments to various Orchema tables. The foregoing assumptions are not only natural, but it is difficult to come up with many reasonable alternatives.[23]

Pillar Line Number	Margin Number	Table Type	Table Name	Acrostic Letter
1	1	Recta	R1	1F
2	2	Recta	R2	--
3	3	Recta	R3	--
4	4	Recta	R4	1L
5	5	Recta	R5	2F
6	6	Recta	R6	2L, 3F
7	7	Recta	R7	--
8	8	Recta	R8	3L, 4F
9	9	Recta	R9	4L, 5F
10	10	Recta	R10	5L, 6F
11	11	Recta	R11	6L, 7F
12	12	Recta	R12	7L, 8F
13	12	Aversa	A12	8L, 9F, 9L
14	11	Aversa	A11	10F, 10L, 11F
15	10	Aversa	A10	11L, 12F
16	9	Aversa	A9	12L
17	8	Aversa	A8	13F
18	7	Aversa	A7	13L, 14F
19	6	Aversa	A6	14L, 15F
20	5	Aversa	A5	--
21	4	Aversa	A4	15L
22	3	Aversa	A3	16F
23	2	Aversa	A2	--
24	1	Aversa	A1	--
25	3	Orchema	O3	--
26	5	Orchema	O5	16L, 17F
27	7	Orchema	O7	17L, 18F
28	9	Orchema	O9	18L

Fig. 2.17 Pillar Sonnet map in tabular form

Fig 2.17 presents the salient information from Fig. 2.16 in tabular form: the first column gives the Pillar Line number (1 to 28); the second column reproduces the number that appears to the left of each sonnet line (the number of syllables); the last column reproduces the annotations from the right side of Fig. 2.16. The assignment of table type, made in Fig. 2.15, is shown in the third column. The fourth column contains an abbreviated table name using R to indicate Recta, A to indicate Aversa, and O to indicate Orchema. Those letters are concatenated with the margin number (the column number, equivalent to the shift value) to produce a concise designator for the table. This fourth column, in conjunction with the last column, shows the mapping of tables to acrostic letters. It is not a one-to-one mapping: some rows in the final column have no values while others have up to 3 values (there is no reason to expect it to be a one-to-one mapping). What is important is that it provides us with a Transform, a cryptographic table, for use with each acrostic letter.

For the purposes of deciphering, it is more convenient to have the information of Fig. 2.17 indexed by acrostic letter rather than by Pillar line number. Fig. 2.18 is a re-indexed version of Fig 2.17; there is no difference in its content. For example, the first letter of line 1, designated as "1F" in Fig. 2.17, has a Transform value of R1 (fourth column of Fig. 2.17). In Fig. 2.18, Acrostic Line Number 1, the first row, shows a Table Name value of R1 for the first letter. Changing the index of a data table or directory is a common practice: for example, reverse-lookup phone directories.

Assigning a different Transform for different letter positions in a text (or as here, for an acrostic letter) is the defining feature of polyalphabetic cryptography. Trithemius's implementation, which uses the overly simple method of assigning consecutive letters to consecutive tables, is not cryptographically robust (it can easily be attacked by a cryptanalyst). Indeed, more sophisticated schemes predate the *Polygraphia*. For example, Alberti's cipher-wheel (ca. 1466) employs a far more complex mechanism to assign tables to ciphertext letters.[24] In the case of the Puzzle, the Pillar Sonnet assigns each letter position of its two acrostics to a Transform or table, in accordance with Fig. 2.18 (which is equivalent to Fig. 2.17).

Naturally, all puzzles require that some inferences be made. I've made some inferences in building the Transform Assignments of Fig. 2.18, but they are minimal. Nevertheless, inferences made in attempting to detect a cryptographic system should be explicitly enumerated.[25] We assumed that the ascending numbers of the Pillar Sonnet (1 to 12) specify Recta tables and that the descending numbers (12 to 1) specify Aversa tables. This assumption was a natural extrapolation of the Puzzle's instructions, which state that the base specifies Orchema tables. We then assumed that the Pillar Sonnet numbers of 1 to 12, which appear at the

head of each Pillar Sonnet line (Fig. 2.3 and Fig. 2.16), correspond to the first through twelfth Recta tables, respectively. We made a corresponding assumption for the Aversa tables: the numbers from 12 to 1 at the left margin specify the twelfth through first Aversa tables, respectively. Having given us the cryptographic tables, the Puzzle makes us—after a few minor inferences—essentially authorized decipherers rather than codebreakers (i.e., cryptanalysts).

Acrostic Line No.	Table Name First Letter	Table Name Last Letter
1	R1	R4
2	R5	R6
3	R6	R8
4	R8	R9
5	R9	R10
6	R10	R11
7	R11	R12
8	R12	A12
9	A12	A12
10	A11	A11
11	A11	A10
12	A10	A9
13	A8	A7
14	A7	A6
15	A6	A4
16	A3	O5
17	O5	O7
18	O7	O9

Fig. 2.18 Pillar Sonnet map indexed by acrostic position

Deciphering the reordered sonnet and polyphonic ciphers

We will now attempt to decipher the reordered Puzzle Sonnet based on the assignment of cryptographic tables implied by the Pillar Sonnet. The left and right acrostics of the reordered Puzzle Sonnet (Fig. 2.10) provide our ciphertext. This ciphertext has been copied into Fig. 2.19's two ciphertext columns (under Left Acrostic and Right Acrostic). The Transform tables

for each acrostic line number (from Fig. 2.18) have also been copied into Fig. 2.19, in the two Transform table columns. We now apply these Transform tables to the ciphertext, for both the left and right acrostics. The deciphered results appear in the two plaintext columns of Fig. 2.19. Reading these results downward, we are disappointed to find that there is no discernable message. Clearly, there is at least one more step to finding the solution to the Puzzle's first Stage.

Sonnet Line Number	Left Acrostic			Right Acrostic		
	Transform table	Cipher-text	Plain-text	Transform table	Cipher-text	Plain-text
1	R1	T	U	R4	T	Y
2	R5	I	O	R6	I	P
3	R6	H	O	R8	T	C
4	R8	W	E	R9	T	D
5	R9	I	S	R10	I	T
6	R10	A	L	R11	A	M
7	R11	S	E	R12	S	F
8	R12	A	N	A12	A	N
9	A12	S	U	A12	S	U
10	A11	A	O	A11	A	O
11	A11	E	K	A10	E	L
12	A10	M	D	A9	M	E
13	A8	R	A	A7	R	B
14	A7	E	O	A6	E	P
15	A6	R	C	A4	R	E
16	A3	E	S	O5	E	?
17	O5	N	?	O7	N	?
18	O7	N	?	O9	N	?

Fig. 2.19 Puzzle Sonnet deciphered

Cryptographic systems in this period attempted to guard against unauthorized deciphering (cryptanalysis) using a variety of techniques. One method is to assign two ciphertext characters to represent a single high frequency plaintext letter, such as the letter "E," in order to thwart frequency counting. Another less common practice is to assign two plaintext letters to a single ciphertext letter. Such ciphers, known as "polyphonic ciphers," force

even an authorized decipherer to select the true plaintext letter out of two or three possibilities for each character. Although on rare occasions this allows for ambiguity in the deciphered message, it usually does not because the constraints of language are too strong, as will be discussed later. The advantage of polyphonic ciphers is that they are very difficult to crack.

A modern-day example of such enciphering is found on telephone keypads, where each number is assigned to multiple letters. This allows telephone numbers to be specified as words as well as numbers. For example, a plumber might acquire the phone number 800-758-6237 and then advertise it as 800-PLUMBER. However, enciphering in this manner can lead to ambiguity, as shown in the example below. The telephone number 794-6437 can be deciphered as two valid words, PYGMIES and SWINGER. However, there are very few phone numbers that would generate multiple seven-letter words; surely much effort was required to discover this example.[26]

Dialpad Numeric:	**7**	**9**	**4**	**6**	**4**	**3**	**7**
Dialpad Encoding 1:	P	W	G	M	G	D	P
Dialpad Encoding 2:	Q	X	H	N	H	E	Q
Dialpad Encoding 3:	R	Y	I	O	I	F	R
Dialpad Encoding 4:	S	Z					S
Possibility 1:	P	Y	G	M	I	E	S
Possibility 2:	S	W	I	N	G	E	R

Aloys Meister documents various polyphonic ciphers used in the sixteenth century. The polyphonic cipher that appears below was used in 1583 by Cardinal Jacobus Sabellus (1540–87).[27] I have slightly modified it to facilitate my example (e.g., a "W" was added—Sabellus's Italian alphabet lacks that letter). In the table below, every number from 0 to 9 is assigned to two alphabetical characters. This table is used to both encipher and decipher messages.

0	1	2	3	4	5	6	7	8	9	Ciphertext
N	S	R	M	H	U	E	F	A	I	Plaintext1
G	Z	T	P	W	L	C	O	B	D	Plaintext2

We now encipher the name Thomas Watson (the plaintext) using the above polyphonic cipher:

T	H	O	M	A	S	W	A	T	S	O	N	Plaintext
2	4	7	3	8	1	4	8	2	1	7	0	Ciphertext

Next we decipher the above ciphertext, 247381482170. We must examine the two possible plaintext letters for each character of the message as shown below.

2	4	7	3	8	1	4	8	2	1	7	0	Ciphertext
R	**H**	F	**M**	**A**	**S**	H	**A**	R	**S**	F	**N**	Plaintext1
T	W	**O**	P	B	Z	**W**	B	**T**	Z	**O**	G	Plaintext2

Looking at either the Plaintext 1 or Plaintext 2 row alone, the text is gibberish. The cipher can only be read if, for each character, we select one plaintext letter from either one row or the other, depending upon whichever one will produce a coherent message. The letters that allow for a valid message appear in bold, yielding the original plaintext: THOMAS WATSON. Unlike nonpolyphonic ciphers, which produce a definitive plaintext, even the authorized decipherer must select among plaintext alternatives solely based on the coherence of the resulting message.

This might seem to allow for a great deal of indeterminacy in the true plaintext message, but it does not. To understand why, it is helpful to consider such games as "hangman" or the TV show *Wheel of Fortune,* in which a contestant must guess an incomplete short text, often a familiar phrase or aphorism, prior to all letters of the text appearing. The contestants are often able to guess the text with half or even fewer of the letters present. If half the letters are missing, 50% of the text is presented, and 50% is indeterminate. In the case of our polyphonic cipher, the decipherer must make a binary choice between two letters. A simple calculation shows that this is equivalent to 78% of the message being present and 22% being indeterminate.[28] With 78% of the message present, ambiguities are rare. The remaining indeterminacy of 22% will prove to be a modest factor in our validation of the solution to the Puzzle Sonnet's cipher, as discussed later in this chapter.

This inherent indeterminacy, the defining feature of polyphonic ciphers, presents a great hindrance to anyone trying to crack the cipher. When an unauthorized decipherer is examining possible keys, they look for unlikely or wrong letters: the letter K in Latin, rare letters such as Z, or an unlikely trigram of consonants, for example. This allows many hypothetical keys to be eliminated, an essential step in cracking cryptograms. However, if there are *two* possible plaintext letters for each character, rarely will it be possible to eliminate a particular hypothetical key, because usually one of the two plaintext letters will be common rather than rare. Thus, polyphonic ciphers are far stronger. However, this comes at the expense of introducing an additional step for the authorized decipherer.

The double acrostic sonnet subtly hints that a polyphonic cipher is present. The two unconcealed acrostic messages (*amare est insanire*) suggest that both acrostics come into play in the enciphered message. Yet for each acrostic to produce one transparent message in the original order, and also produce an enciphered message in the reordered sonnet, is far too great a constraint to ever be realized. Even for one of the two acrostics to do so would probably be impossible (it would also beg the question of why the unconcealed message appears twice). Indeed, only by means of a polyphonic cipher, with one acrostic or the other coming into play on a per character basis, are the constraints loose enough to allow a third message to be present in the reordered acrostics.

As we will discover, the Puzzle Sonnet's cryptogram is indeed polyphonic (in addition to being polyalphabetic). Polyphony was well suited to Bacon's purposes because without it, the Puzzle would have been fairly easy to solve. If Bacon had enciphered his message in a nonpolyphonic single acrostic, then the puzzle-solver might easily test each sonnet line in different positions, frequently determining that a particular position was unlikely because a rare character was generated, or conversely, fairly likely because a common letter, such as a vowel, was generated. This would have eliminated countless permutations. When combined with other restrictions such as rhyme pattern and logical flow, the Puzzle would be solved quickly by the practiced cryptanalyst. Bacon's use of a polyphonic cipher makes any cryptanalytic attack almost impossible. His clever defense forces the puzzle-solver to instead attack the Puzzle by the only remaining option, a reordering based on poetic sense. As we shall see, polyphonic ciphers are also employed in the other Stages of the Puzzle. The strength of polyphonic ciphers blocks most, if not all, cryptanalytic paths to solving those Stages, and instead the puzzle-solver must follow the path toward a solution that the Puzzle's design allows: the Heuristic System. The Puzzle's cryptography, the Precision System, is a tool used to enforce a unique (i.e., deterministic) solution to the poetic problems that the *Hekatompathia* presents to its readers. At the same time, the Puzzle's design—Bacon's clever use of polyphonic cryptography—prevents the puzzle-solver from operating the Precision System in reverse, that is, using cryptanalytic techniques instead of poetic sense to solve the Puzzle. This essential element of the Precision System forces the puzzle-solver to think creatively like a poet in their effort to reconstruct the work's text.

The Puzzle thus practices the probative mode of communication, as discussed in the "Poetry and pedagogy" section of the first chapter. Yet it addresses the danger inherent in any obscured text: that the exegete will err in his or her construction or interpretation of the text. The Precision System directly addresses this danger, and at the same time, prevents any

"cheating"—operating the Precision System in reverse—that would undermine the probative mode of communication. Thus, it alerts the reader to any errors in reconstructing the text but cannot be used as an alternative to the Heuristic System. This forces adherence to the probative mode: the puzzle-solver must engage in a full exploration of the poetic text. Thus, the puzzle-solver is informed of wrong answers, but has no access to the right answers, and must then reconsider wrong answers, find an alternative, and then retest it.

The use of polyphony was also a practical necessity. Phillips, in the passage quoted earlier, questions how the poet could possibly add "yet another arcane device" into this already complex double acrostic sonnet. She is right. To overlay another determinate single acrostic (containing a secret plaintext) onto the original double acrostic (*amare est insanire*) creates so many constraints as to make the inclusion of an enciphered message impossible. Alternatively, allowing either the first or last letter of each line to produce a secret plaintext message produces a less constraining set of conditions.

Deciphering the Puzzle Sonnet's secret message

We now reexamine the two columns of deciphered letters, both labeled "Plaintext," in Fig. 2.19, which for convenience are replicated side by side in Fig. 2.20. Treating the plaintext columns as a polyphonic cipher, we choose one letter from either column for each row. We might first consider whether the cryptogram is more likely to be in English or Latin (the two languages in which the *Hekatompathia*'s poems are written). Latin seems more likely of the two in that the original acrostics are in Latin, and the greater compactness of Latin would make it a more attractive choice for a short message.

In Fig. 2.20, the selection between the two plaintext alternatives in each column is designated by boldface type. This selection is based on finding a coherent Latin expression. We are restricted to 15 of the 18 characters because we have not yet determined the Transform values for the Orchema tables. The first 13 characters produce these words:

VOCES ME. NUO LEA...
(May you invoke me. I waver under the influence of the lioness.)

Our deciphered text begins appropriately enough by addressing the reader, VOCES ME. The poet is exhorting the reader to call upon or invoke the poet himself. An invocation frequently occurs at the beginning of an authoritative text, such as in the *Iliad*'s first line, which includes "Sing goddess."

Homer invokes a muse to allow him to tell a story from centuries prior. The conceit is that he is merely lending his voice to the muse. In this case, the puzzle-solver, as in Homer's conceit, is delivering not his own words, but those of the *Hekatompathia*'s poet, the author of the secret text. The poet is exhorting the decipherer to invoke himself and deliver his message—an encouragement to continue the process of solving the Puzzle.

Sonnet Line Number	Left Acrostic Plaintext	Right Acrostic Plaintext
1	**U**	Y
2	**O**	P
3	O	**C**
4	**E**	D
5	**S**	T
6	L	**M**
7	**E**	F
8	**N**	**N**
9	**U**	**U**
10	**O**	**O**
11	K	**L**
12	D	**E**
13	**A**	B
14	O	P
15	C	E
16	S	?
17	?	?
18	?	?

Fig. 2.20 Puzzle Sonnet deciphered: A polyphonic cipher

Indeed, an invocation is a particularly fitting way to begin any ciphered text. Katherine Ellison discusses a notorious "incantation" in Trithemius's *Steganographia*, which involves "the summoning of angels to deliver encrypted messages." While some of Trithemius's contemporaries read this incantation as evidence of black magic, later commentators in the seventeenth century may have understood that his incantation was "itself a secret message for expert readers."[29] This use of incantation or

invocation as a prelude to cryptography suggests that *Voces me* follows this convention, signaling the beginning of an enciphered message.

Of course, invocation occurs frequently in sacred texts and liturgy. When Christ is invoked in the sacrament of the Eucharist, it is to make God and His Word present. Invocation is found in 1 Corinthians 1.2, which is here translated from the Vulgate:

> To the church of God that is at Corinth, to those sanctified in Christ Jesus, called (*vocatis*) to be saints, with all that invoke (*invocant*) the name of our Lord Jesus Christ in every place of theirs and ours.

Here the verb *vocare*, in two different forms, is used bidirectionally: to show God or the Church calling upon man, and man invoking the name of God. *Voces me* is also bidirectional. With remarkable concision, the poet calls upon the reader to call upon the poet (*voces* is the second person hortatory subjunctive). Bacon appears to be calling upon the solver-decipherer to continue his work. This cooperative interaction between poet and reader may be an example of what Mary Carruthers calls "hermeneutic dialogue," in which an active reader must complete the work of an absent author.[30]

The next word of the secret text, the verb *nuo* (also written *nuto*) can mean "I nod or command by a signal or other non-verbal means" (*OLD* 1). *Nuo* may also mean "I sway/totter, or I waver in my opinion" (*LS* II). The next word, *lea*, means lioness (ablative case). Therefore, *nuo lea* might be translated in either of the following ways:

> I waver/sway under the influence of the lioness.
> I indicate by means of the lioness.

Just below the Puzzle Sonnet, we find a Design that looks very much like a lion or lioness (see Fig. 2.4), which does much to confirm the validity of our deciphered message. Moreover, there is a link to the closing couplet of Sonnet 82. To the left of that couplet, next to an asterisk, is a curious sidenote in which Bacon quotes Sophocles: τόν τοι τύρανον εὐσεβεῖν οὐ ῥᾴδιον (it is difficult for an absolute monarch to show piety). This line occurs very near the end of his play, *Ajax*: Odysseus is making the case to Agamemnon that Ajax should be given a proper burial, despite Agamemnon's continued anger. Of what possible relevance could this be to Sonnet 82, or anything else in the *Hekatompathia*? The only connection is τύρανος, cognate to the English word tyrant, which appears in the final couplet:

***H'is double thrall that liu's as** Loue **thinks best**
Whose hand still Tyrant like to hurt is prest. (82.17–18)

Τύρανος can mean either a "tyrant," or "autocrat" or "absolute monarch" without the pejorative sense of "tyrant." It seems that Bacon is providing the reader with a gloss. Of course, this *tyrant* (*whose hand* is pressing upon the speaker *to hurt*) who is also a monarch can only refer to one thing in the context of the *Hekatompathia*—love. Throughout the work, love is portrayed as the highest power, a supreme god, and a cruel tyrant. Thus, this Design that looks like a lion or lioness—which we shall call a "Lioness Design"—conveys the symbolism of kingship and the image of fierce tyranny. (The identification of lions and monarchy is a symbolism that dates from antiquity.) This connection between the English word "tyrant," glossed as "absolute monarch" by the sidenote, and the proximate Lioness Design, indicates that the placement of this Design was almost certainly an authorial choice and not the arbitrary decision of a printer. The deciphered message, which has the speaker "swaying" (NUO) under pressure from a "lioness" (LEA), is perfectly cognate with what is plainly visible in the text: the Lioness Design, sidenote, and the Puzzle Sonnet's final two lines. This provides strong confirmation of the authenticity of the deciphered message. Moreover, the image of the speaker suffering under love's tyranny is not one of many possible images, but the central image employed by the *Hekatompathia*.

The androgynous lion

The deciphered message identifies the significance of the Lioness Design: it is a symbol of personified, tyrannical Love. Spenser also chose a lion to represent love as a great power in his *Shepheardes Calender* (published three years prior to the *Hekatompathia*), in which Colin says:

And Sommer season sped him to display
(For loue then in the Lyons house did dwell)
The raging fyre, that kindled at his ray.
A comett stird vp that vnkindly heate,
That reigned (as men sayd) in *Venus* seate. (December, lines 56–60)

"Lyons house" refers to the astrological sign Leo (July 23–August 22). The embedded commentary of E. K. in Spenser's *Shepheardes Calender* glosses "Lyons house" with "He imagineth simply that Cupid, which is loue, had his abode in the whote [hot] signe Leo, which is in middest of somer; a pretie allegory, whereof the meaning is, that loue in him wrought an extaordinarie heate of lust." Given that both Spenser and Bacon were

members of the Leicester literary circle, Bacon would have likely read the *Shepheardes Calender* and thus be aware of the metaphoric link between Spenser's astrological lion and love, and perhaps of the same metaphor in other sources as well. As I will argue in the next chapter, the Lioness Design, whose semiotic value is love, is the most important of the 18 Design types that appear in the *Hekatompathia*. Sonnets with a Lioness Design play a critical role in the reordering of the *Hekatompathia*'s sonnets, as described in the next chapter, and in the seventh Stage, where they are used to reveal Bacon's name.

Examining the Puzzle Sonnet's final couplet and the deciphered message, we notice a contradiction in the specification of the lion's gender: *H'is* (82.17) versus LEA (feminine). At first glance, the lion or lioness in the Lioness Design seems to have something of a mane (Fig. 2.4), and if this indicates the male of the species, it would conflict with our deciphered *lea* (lioness). However, love in the *Hekatompathia* is sometimes masculine, as when personified by Cupid, at other times feminine, as when personified by Venus. The work's closing apothegm characterizes love as feminine: *The Labour is light, where Loue is the Paimistres* [pay-mistress]. The Puzzle Sonnet's final couplet (situated near the Lioness Design and linked to the sidenote) begins with the contraction *H'is*, an apparent reference to love as masculine. The uncommon contraction, *H'is*, is unlikely to be a misprint of "His" because it appears four times, in both formats of the Puzzle Sonnet (Sonnets 81 and 82), and again twice in the manuscript. This contraction might mean "He is," in which case line 17 reads:

> [He is] **double thrall that liu's as** Loue **thinks best**

"He is double thrall" makes little sense because it equates Cupid with his powers, which seems odd and is not consistent with the treatment of Cupid elsewhere in the sequence.[31] Our attention is next drawn to another odd contraction, *liu's*, which given the context of *double thrall*, cannot mean "lives," as thrall does not "live." It almost certainly means "livers": Cupid livers (i.e., delivers) his arrows—his thrall—capriciously, a prolific trope found in the *Hekatompathia* and elsewhere. Indeed, in Sonnet 63, Cupid delivers *double thrall* by means of two kinds of arrows, one gold and one lead: each type corresponds to one of love's two powers, as discussed in Chapter 8. Line 17 might then be read as "Cupid (He) is double thrall that livers as Love thinks best." In this reading, Cupid personifies love's delivery mechanism, as opposed to love itself. This would be analogous to the Renaissance conception of personified Nature (feminine) as a demiurge, carrying out God's orders. Line 17's (somewhat awkward) construction allows for independence between *H'is* and *Loue*, and this permits *Loue* to be read as either androgynous or feminine, despite the masculine *H'is*.

An alternative reading of the contraction *H'is* is suggested by the value of the omitted letters in the line's other contraction, *liu's*, which is "er." If we take the value of the apostrophe in *H'is* to also be "er," the result is "Heris." This might be taken as an androgynous pronoun, hiding a "Her[is]" within the orthographically masculine *H'is*, or it might be "heris," an archaic pronoun that means "hers" or "theirs" (OED, "hers," poss. pron. 1 and 2). *H'is* would then be an orthographic "his" that hides a "hers." If this is true, then Bacon created a gender-ambiguous pronoun meaning "his/her," presumably because neither "his" nor "her" is appropriate to love itself, which is androgynous. If this was Bacon's intention, then it would be the second time that he created an androgynous pronoun in the *Hekatompathia*: in Sonnet 25, he fabricated a gender-ambiguous pronoun because the sonnet required it.[32] Thus, the deciphered LEA (feminine) is not contradicted by *H'is* (82.17), which might at first be taken to be masculine.

Regardless of which of the foregoing readings is accepted, *Loue* is independent of the contraction *H'is*, and this allows *Loue* to be taken as masculine, feminine, or both. Moreover, the Puzzle Sonnet itself includes both masculine and feminine representations of love based on Cupid and Venus.[33] Thus, *Loue*, the ultimate source of the *double thrall* (17), is treated as neither purely masculine nor feminine (a Platonist attitude), and so the appearance of the feminine *lea* in the deciphered message does not contradict the sonnet's text. Indeed, any reference made to the leonine Design that appears below the Puzzle Sonnet (82) must be either masculine or feminine: there is no such word as "*leum*" (a neuter lion) in Latin. Bacon, faced with an arbitrary choice of whether to refer to the lion as masculine or feminine, probably chose *lea* (feminine, ablative) because of its decided advantage: it is significantly more compact than *leone* (masculine, ablative).

This conception of love as androgynous or hermaphroditic is prevalent in Platonism and found elsewhere in Elizabethan literature. For example, an important Platonist doctrine states that *contradictoria concidunt in natura unialis* (contradictions are reconciled in the nature of the one). Derived from the ancient idea that strife between opposites results in a harmony, in Platonist thought, opposites are resolved in the Plotinian "the One." This coincidence of opposites (*coincidentia oppositorum*) can be found in Spenser's *Faerie Queene*, where Venus is described as hermaphroditic:

> But for, they say, she hath both kinds in one,
> Both male and female, both under one name:
> She syre and mother is her selfe alone,
> Begets and eke conceives, ne needeth other none. (IV.x.41)

For some Platonists, not only might Venus represent both sexes, but God, too, may contain the principles of male and female within his self in a higher unity. That is, because God is the Cause of All, he must himself be comprised of both sexes.[34] C. S. Lewis writes:

> I think that Spenser's Nature is really an image of god himself. … As Nicholas of Cusa reminds us, the ancients call God Nature. … So Spenser's Nature is veiled, some say, to conceal her terror, 'for that her face did like a Lion shew.' (VII.vii.6)[35]

Alastair Fowler, citing the above passage, says that "in the *Mutability Cantos*, Natura herself, the creative Logos, reconciles order and mutability in a veiled mystery uniting solar splendor [the masculine Apollo] and leonine terror."[36] Bacon's hermaphroditic, terrifying Lioness Design is the perfect emblem for love in the *Hekatompathia*. Moreover, elsewhere in the sonnet sequence, love is portrayed as an all-powerful god whose presence is known by the coincidence of opposites, as later discussed.

The final letters of the deciphered message

Returning to our deciphering task, we consider the final letters of the plaintext message, which are enciphered by Orchema Transforms. However, we as yet have insufficient information to decipher these letters because the Orchema Transforms, unlike the Recta and Aversa Transforms, are broadly defined in the *Polygraphia*.[37] The 5 pairs of plaintext characters that follow LEA, found in lines 14–18 of the Puzzle Sonnet, are shown in Fig. 2.21 (these values are taken from Fig. 2.20). The first 5 plaintext values are deciphered from Aversa Transforms; the next 5 values are unknown because they derive from Orchema Transforms and are therefore marked with a question mark.

From Fig. 2.21, we can see that the final word of the plaintext message is 5 letters in length. Examining the first two pairs of polyphonic plaintext letters, the final word in the message may begin with either OC, OE, PC, or PE. The second and third possibilities are unlikely beginnings for Latin words. Although the letters OC might begin a Latin word, no 5-letter word beginning with those letters comes to mind. When we consider the letters PE, or PES (a 50/50 chance), the possibilities narrow. If we assume the word begins with PES, then only two unknown letters remain. In this case, the final word is almost certainly PESUS, a late Latin spelling of the classical Latin *pensus*.[38] It is the masculine singular perfect passive participle of *pendere* (to weigh). *Pesus* means "to be weighed upon," and the now

complete second sentence of the deciphered message, NUO LEA PESUS, may be translated:

> Weighed upon by the lioness, I waver.

NUO LEA PESUS fits with the conceit that the speaker suffers under tyrannical love, which is found throughout the *Hekatompathia*, as well as in the Puzzle Sonnet's final line: *Whose hand still Tyrant like to hurt is prest*. The notion that the speaker is being pressed (*prest*) upon fits well with *pesus* (weighed upon). However, this guess at the plaintext's final word is uncertain without knowing the value of the Orchema Transforms.

Sonnet Line Number	Left Acrostic Plaintext	Right Acrostic Plaintext
14	O	P
15	C	E
16	S	?
17	?	?
18	?	?

Fig. 2.21 Puzzle Sonnet deciphered: The final five letters

Validating our deciphered message

How can we be sure that our reordered sonnet is in the order intended by the poet? Given the millions of possible line orders, perhaps there are other possibilities that satisfy the five Rules, generate a coherent Latin message, and render a sonnet that has a fine-grain internal structure appropriate to its role as the MLIP Subsequence's lead sonnet. Perhaps—but the foregoing constraints, coupled with several of those imposed by the Rules, are so restrictive that it seems very unlikely, especially given the additional restrictions that the sonnet progress both chronologically and logically. A further constraint, the most critical of all, is that the deciphered plaintext message must be sensible and relevant—all but one among billions of permutations will generate gibberish, as discussed in the mathematical validation section below.

The deciphered message is remarkable in its concision and astonishingly pertinent. It perfectly articulates the relationship between poet and

decipherer in its first sentence, VOCES ME. Its second sentence, NUO LEA PESUS, is extraordinary in several respects. LEA matches up with the Lioness Design that appears beneath Sonnet 82, and there is further corroboration by the Greek sidenote about absolute monarchs, lions being a symbol of kingship. This second sentence must have been very carefully chosen by Bacon because it is descriptive of virtually every one of the *Hekatompathia*'s sonnets: the speaker is always affected by love, wavering under the weight of its awesome power. Indeed, these three words might be taken as a hypogram[39] for the entire work.

The validity of NUO LEA PESUS becomes apparent when comparing each of its words to the Puzzle Sonnet's final line in the original order, as shown below:

Deciphered words	***Whose hand still Tyrant like to hurt is prest*** (18)
nuo (I waver/totter)	*hurt* (OED 1: to knock or collide violently)
lea (symbol of kingship)	*Tyrant* (monarch gloss in sidenote)
pesus (to be weighed upon)	*prest*

Both NUO LEA PESUS and the sonnet's final line express the conceit that *Love* (17) is a king who physically pressures the speaker. Thus we have near-perfect alignment between the deciphered message and the Puzzle Sonnet's final line, which provides overwhelming evidence of its validity.

To supplement this qualitative evaluation, a quantitative analysis is now performed. Excursus 3, "Cryptanalysis and the validation of deciphered texts," provides an introduction to the quantitative validation of cryptographic solutions. Two other such validations appear in this study, and this excursus is intended for those readers without prior knowledge of the validation process. It includes a brief description of Shannon's Information Theory (see Fig. E3.3).

The process that produced the deciphered message is depicted schematically in Fig. 2.22. After reordering the Puzzle Sonnet, the acrostics were stripped away, treated as numeric values, and shifted by an arithmetic formula (the Transforms indicated by the Pillar Sonnet). The resulting polyphonic plaintext was then resolved to produce a single plaintext.

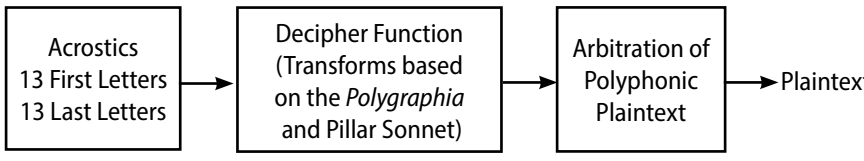

Fig. 2.22 Summary of Puzzle Sonnet deciphering process

As discussed in Chapter 1, three factors must be considered in validating a cryptogram: the absolute rate of language (the full range of the ciphertext), the number of valid messages, and the range of the key. To validate our 13-letter plaintext solution (VOCES ME. NUO LEA...[40]) to the Puzzle Sonnet, we must first calculate the probability that a coherent and relevant plaintext message is produced by what is effectively a random process (apart from the context of the Puzzle). We estimate the number of valid 13-letter plaintext messages, using a Shannon information value of 25% pure information and 75% redundancy.[41] The number of possible valid texts is equal to $24^{(25\% \text{ of } 13)} = 24^{3.25} \approx 30{,}600$. We now divide the number of valid texts by the absolute rate of language, which for our 13-letter ciphertext is 24^{13}, or approximately 8.8×10^{17}:

$$\text{Ratio of valid texts to all possible texts} \approx 30{,}600 / 8.8 \times 10^{17} \approx 1 \text{ in } 29 \text{ trillion}$$

The probability that a valid text has been serendipitously generated is extremely remote; however, we have yet to account for the indeterminacy in polyphonic ciphers, which requires a choice between one of two plaintext letters. For each of 13 lines, a binary decision is required, which makes for 2^{13} or 8,192 permutations. Multiplying 8,192 by the probability calculated above (1 in 29 trillion), we obtain a probability of approximately 1 in 3.5 billion—still extremely remote.[42] This is the probability that any given ciphertext—the reordered acrostics—would generate a coherent plaintext message after polyphonic resolution.

We must now consider the reordering of the Puzzle Sonnet: are there many valid reorderings, and if so, might one of these produce a different plaintext message? In the course of solving the Puzzle, I came up with only one valid reordering to test, and from this perspective, it does not matter if there are many other valid reorderings because, in practice, I only tested one reordering. The probability that the single reordering that I found would produce a coherent plaintext message is the calculated probability that any given ciphertext produces a coherent plaintext: one in 3.5 billion. True, there may be other valid reorderings, but as I discovered and tested only one reordering, the probability that the one I discovered is valid can be considered independently of any other valid reorderings that may exist. Given the improbability of a one in 3.5 billion chance, the coherent plaintext that I found must be the result of my reordering the sonnet as intended by the poet and applying the correct deciphering procedure to its acrostics (the ciphertext).

True, this is dependent upon my testimony that I did not discover and test other valid reorderings. Of course, it would be preferable that the validation be independent of my testimony. This requires that the number of

poetically valid reorderings be estimated, which is difficult to do because of the complexity of the constraints in reordering the sonnet: logical flow from line to line, appropriateness to the sonnet's poetic meaning, and adherence to a reasonable rhyme scheme. My estimate of the number of valid Puzzle Sonnet reorderings, really an upper limit, is 16,000.[43] From the many hours I spent attempting to find a valid reordering, I believe that this significantly overestimates the number of valid reorderings. The requirement for a sensible and grammatic flow from line to line, which is extraordinarily restrictive, is difficult to estimate but I believe that the likely number of valid reorderings is orders of magnitude less than this estimate. We now factor this estimate of the number of valid reorderings into our probability calculation. The probability that one of these 16,000 reorderings might produce a coherent 13-letter plaintext is 16,000 ($1/3.5 \times 10^9$) ≈ 1 in 200,000. This is the probability, at the estimated upper limit of possible reorderings, that our 13-letter plaintext message was produced serendipitously.

One other aspect of this validation requires discussion. Was my restoration of the sonnet's order aided by cryptanalytic techniques, that is, did I eliminate reorderings that would not have generated coherent plaintexts by employing cryptanalytic techniques? This would alter the probability calculation of one in 3.5 billion because applying cryptanalytic techniques is equivalent to testing additional reorderings. Said another way, my claim to have tested only one reordering of the Puzzle Sonnet would be inaccurate because that reordering would have been biased by having restricted my examination of reorderings to only those more likely to produce a coherent plaintext message. However, Bacon's design makes such cryptanalytic techniques difficult to apply due to the Puzzle's polyphony, as previously discussed. The polyphony prevents the puzzle-solver from working backward, that is, in the opposite direction of the arrows shown in Fig. 2.22. If a nonpolyphonic cipher had been used, one could test the plausibility that particular lines would work at particular positions in the Puzzle Sonnet by rejecting alternatives that produced a rare letter and favoring alternatives that produced a common letter.

Indeed, having some technical skills, I attempted a cryptanalytic attack, which I applied to smaller sections of the Puzzle Sonnet of about 4–6 lines each. I tested these smaller sections cryptographically, with the hope that I might eliminate some positions for some sonnet lines, and thus obtain some help in the reordering process. However, I was frustrated by the polyphonic cryptography, which never produced a pair of rare letters (which would allow elimination), and always produced a plausible letter sequence for the groups of 4-6 letters that I tested. I was forced to abandon my attempt and the reordering of the sonnet was accomplished without the use of any cryptanalytic technique.

Thus we have now validated the message deciphered in the Puzzle's first Stage: VOCES ME. NUO LEA PESUS (May you invoke me. Weighed upon by the lioness, I waver.). The probability of serendipitously obtaining a valid and contextually relevant message for my single reordering of the Puzzle Sonnet was calculated to be only one in 3.5 billion. Further, it was demonstrated that even if one somehow uncovered 16,000 poetically valid reorderings of the Puzzle Sonnet, the probability that one of those reorderings would result in a valid message is still extremely remote. Nonmathematicians may prefer the qualitative analysis discussed above. The message's second sentence, NUO LEA PESUS, thematically matches the Puzzle Sonnet's closing couplet and the appearance of love's emblem, the Lioness Design, directly below the couplet. Moreover, "I waver under the weight of the lioness (love)" might aptly serve as a hypogram for the sequence: nearly every sonnet describes the speaker struggling under love's influence.

There is one further piece of evidence: given the amount of work required to solve the Puzzle's first Stage, one would expect some significant revelation. The Puzzle's first Stage must either reveal some great secret (such as the identity of the beloved, if she were a historical person), which it does not, or suggest how next to proceed. Indeed, we have been given the key to the Puzzle's next Stage. NUO, besides meaning "I sway," can also mean "I nod" (or gesture or indicate). This second meaning renders the following: "I indicate by means of the lioness." This is an essential clue, for as we will discover in the next chapter, it provides critical information needed to reorder the sequence. The phrase NUO LEA PESUS exhibits extraordinary concision and polyvalence: it both mirrors the Puzzle Sonnet's final couplet and provides the essential clue for us to advance through the Puzzle. Open questions about the purpose of the Designs below each sonnet and the Orchema tables propel us toward the Puzzle's next Stage.

We have now fulfilled the challenge set by the Puzzle's instructions to decipher something using Trithemius's tables. Although it might seem that there are multiple valid rearrangements of the Puzzle Sonnet, the poetic constraints are highly restrictive. Further, the restrictions imposed by the cryptographic generation of a valid deciphered message guarantee the uniqueness of our rearrangement because the probability that another rearrangement would produce a valid plaintext message is infinitesimal (1 in 3.5 billion). We can now be certain that the *Hekatompathia*'s literary-cryptographic Puzzle is genuine and move forward to its next Stage.

The Puzzle tests our literary skills: this Stage required us to reconstruct a poem from its scrambled lines. This first Stage follows a model

similar to the one presented in Fig. 1.4 (which applies to Stages 2 through 7), except that each line of the Puzzle Sonnet generates one letter in the deciphered message. In this Stage, the heuristic challenge was to reorder the Puzzle Sonnet's lines; in Stages 2 through 4, the challenge will be to reorder the sonnets themselves.

3

The *Hekatompathia*'s Foundation: Sonnets 1–17

The *Hekatompathia*'s first 17 sonnets define the work's fundamental concern, which is to discover the nature of love. Love is depicted as a two-pronged cosmological force that operates in two independent realms, one earthly and the other heavenly: a physical world associated with the body and a nonmaterial world associated with the mind or soul. These two realms correspond to two epistemic modes, one sensory or aesthetic, and the other noetic. Love is the center point of a cosmological/epistemological model that is applied throughout the sequence.

The nature of love is explored both scientifically as a physical phenomenon and as the emotional plight that afflicts the speaker. Love is represented poetically as the two forces that imprison the speaker, as for example, in the Puzzle Sonnet's *double thrall* (82.17). The speaker's capture by love is initiated by aesthesis, the sight of the beloved, and then love embeds itself in his heart through noesis. This division between aesthetic and noetic apprehension is a grammar and fundamental structuring mechanism. This is evident in the first 17 sonnets, which divide as follows: the first 6 define the work's subject matter following the precepts of rhetorical invention; the next 4 treat love's first power, the aesthetic or visual episteme; the next 7 treat love's second power, the noetic episteme. This grammar is an essential tool used by the puzzle-solver to reorder the work's sonnets, which are scrambled subsequent to the first 17 sonnets.

The Christian God is difficult to spot in the *Hekatompathia*, and instead, love is the speaker's god. Love resembles the cosmic flux described by pre-Socratic philosophers (e.g., Heraclitus) and Eryximachus in Plato's *Symposium*. This flux is a pathway that connects the physical and noumenal realms, an essential point made by Diotima in her speech in the *Symposium,* as related by Socrates. This fits perfectly with the sonnet genre, especially its core conceit that the beloved is an intermediary

Notes (Vol. I)

Chapter 1 » Introduction: A Systematically Concealed Text

1 "Deciphering and the Exhaustion of Recombination," in *A Material History of Medieval and Early Modern Ciphers: Cryptography and the History of Literacy*, ed. Katherine Ellison and Susan Kim (New York: Routledge, 2018), 202.

2 *The Shakespearean Ciphers Examined: An Analysis of Cryptographic Systems Used as Evidence That Some Author Other Than William Shakespeare Wrote the Plays Commonly Attributed to Him* (Cambridge: Cambridge University Press, 1958).

3 I am aware of only one systematic cryptographic claim among those claiming an alternative authorship of the works of Shakespeare. However, this system did not actually operate on a Shakespearean text but employed Bacon's biliteral cipher invention to recognize supposed differences in the fonts used in printing the First Folio. The so-called "Gallup cipher" is described and debunked in Friedman and Friedman, *Shakespearean Ciphers Examined*, 188–278.

4 Rollett presents his claim on two occasions, in "The Dedication to Shakespeare's Sonnets," *Elizabethan Review* 5.2 (1997): 93–122, and later in "Secrets of the Dedication to Shakespeare's Sonnets," *Oxfordian* 2 (1999): 60–75. In the first publication, he assessed the probability that his deciphering could arise serendipitously at 1 in 270,000, for which he does provide a calculation. In the second publication, he assessed the probability at 1 in 20,000, without providing a calculation. Apparently, he realized that he had missed some of the possible variations (they are easy to overlook). In my analysis, the additional variations I found made a serendipitous deciphering very probable, which thoroughly undermines the validation.

5 See note directly above. My calculation, with the necessary explanations, would require a dozen pages, far beyond the space available here. Suffice it to say that the degrees of freedom that I have identified (called variations in the above note) produce a high probability of a serendipitous deciphering.

6 Correctly calculated, the probability is a function of negative, not positive, instances. I have simplified the calculation, which results in an insignificant difference.

7 The 100 poem count is not exact. There are precisely 100 pages labeled with Roman numerals. However, the page marked LXXX contains the puzzle instructions, not a poem. There is also a poem labeled as the *Epilogue* that appears subsequent to the last numbered poem, and another poem, titled *Quid Amor,* consisting of 39 Latin hexameters, which is unnumbered and appears between XCVIII and XCIX. The poet refers to the poems as "passions" three-quarters of the time and as "sonnets" the remainder of the time, according to Phillips (Phillips Dissertation, 30).

8 Oddly, Bacon refers to his Neo-Latin poem 45 as a sonnet in its headnote.
9 See A. E. B. Coldiron, "Watson's *Hekatompathia* and Renaissance Lyric Translation," *Translation and Literature* 5.1 (1996): 7–8.
10 Murphy Dissertation, abstract, 5. The abstract is a separate document stored with the dissertation, available at the Harvard Archives.
11 Coldiron, "Watson's *Hekatompathia* and Renaissance Lyric Translation," 7.
12 Frank Ardolino, "Thomas Watson, Shadow Poet of Edmund Spenser," *Notes and Queries* 61.2 (2014): 225–29. Also, Phillips Dissertation, 43.
13 Heninger Edition, xvii–xviii. See also Vol. II, Appendix D, "Notes on the Text."
14 Thomas Watson, "A Looking glasse for Loovers," Manuscript: (British Library: Harleian 3277, n.d.). The British Library has available a microfilm of the manuscript from which copies may be ordered.
15 Wendy Phillips, "No More Tears: Thomas Watson Absolved," *Comitatus: A Journal of Medieval and Renaissance Studies* 20.1 (1989): 75. However, there are four lines that break metrical form: an 11-syllable line (48.9), two tetrameters (56.14; 77.1), and a hexameter (92.3). See 246–47; II 67, 109, 165, 179, 383–84.
16 Thomas Watson, *Thomas Watson Poems*, ed. Edward Arber (London: English Reprints, 1870), 3–4.
17 Murphy Dissertation, abstract, 4; xcvii. The abstract is a separate document stored with the dissertation, available at the Harvard Archives.
18 See the discussion of translation in Excursus 4.
19 "Ma il petrarchista non è un plagiario nel senso moderno della parola: è un poeta rinascimentale, e cioè un razionale imitatore di quello che egli riteneva essere il meglio delle opere che prendeva a modello." *Thomas Watson e la tradizione petrarchista*, Messina G. Principato, 1969, 266. Translation: Phillips Dissertation, 45.
20 Phillips Dissertation, 78.
21 "Watson's *Hekatompathia* and Renaissance Lyric Translation," 22, 9.
22 "Thomas Watson's *Hekatompathia* and European Petrarchism," in *Petrarch in Britain: Interpreters, Imitators, and Translators Over 700 Years*, ed. M. L McLaughlin, Letizia Panizza, and Peter Hainsworth, Proceedings of the British Academy 146 (Oxford, UK: Published for the British Academy by Oxford University Press, 2007), 223–27.
23 *Pagan Mysteries in the Renaissance* (London: Faber and Faber, 1958), 151.
24 On the influence on later sonnet sequences, see Sutton Edition, 135N3. On the influence on Shakespeare's sonnets, see. E. Pearlman, "Watson's *Hekatompathia* [1582] in the Sonnets and Romeo and Juliet," *English Studies* 74.4 (1993): 343–51.
25 Phillips Dissertation, 69–74.
26 *English Literature in the Sixteenth Century Excluding Drama: The Completion of the Clark Lectures, Trinity College, Cambridge, 1944* (Oxford: Clarendon Press, 1962), 483.
27 *The Elizabethan Sonnet Sequences: Studies in Conventional Conceits* (New York: Russell & Russell, 1966), 17.
28 Sutton Edition, vi.
29 Ibid., xiv–xv.
30 "Thomas Watson, Playwright: Origins of Modern English Drama," in *Lost Plays in Shakespeare's England*, ed. D. McInnis and M. Steggle (New York: Palgrave Macmillan, 2014), 198.

31 Ibid., 187.
32 Wendy Phillips argues that "Watson's first madrigal reads like an autobiographical account of a first meeting with Sidney, leading to a close friendship" (Phillips Dissertation, 63–66). With respect to Spenser, see Harry Morris, "Richard Barnfield, 'Amyntas,' and the Sidney Circle," *PMLA* 74.4 (1959): 318–24. Also, William Ringler, "Spenser and Thomas Watson," *Modern Language Notes* 69.7 (1954): 484–87.
33 Sutton Edition, vN2. The words "and apostle of Continental culture" appear only in the online edition.
34 Hirrel, "Thomas Watson, Playwright: Origins of Modern English Drama," 198.
35 Ibid.
36 Ibid., 199.
37 See the section titled "The Significance of Bacon's Pseudonyms" in Richard Serjeantson, "Francis Bacon's Valerius Terminus and the Voyage to the 'Great Instauration,'" *Journal of the History of Ideas* 78.3 (2017): 348–57.
38 *Works*, 10.65
39 Georg Cantor, *Resurrectio Divi Quirini, Francisci Baconi, Baronis de Verulam...* (Cura Et Impensis G.C. [Georg Cantor], 1896).
40 Opinion of James Spedding (*Works*, 8.325–26).
41 *The Anonymous Renaissance: Cultures of Discretion in Tudor-Stuart England* (University of Chicago Press, 2003), 3–4.
42 "Ignoto in the Age of Print: The Manipulation of Anonymity in Early Modern England," *Studies in Philology* 91.4 (1994): 393, 397, passim 390–416.
43 Marcy North, "Anonymity's Revelations in 'The Arte of English Poesie,'" *Studies in English Literature, 1500–1900* 39.1 (1999): 1–2.
44 Ibid., 5–7.
45 Ibid., 13–14.
46 Serjeanston, "Francis Bacon's *Valerius Terminus* and the Voyage to the 'Great Instauration,'" 348–49. Serjeanston provides this note: See Lisa Jardine and Alan Stewart, *Hostage to Fortune: The Troubled Life of Francis Bacon* (London: Gollancz, 1998), esp. 55–58.
47 *Works* 8.109.
48 *Reading Memory in Early Modern Literature* (Cambridge: Cambridge University Press, 2011), 220.
49 *Works*, 4.444-447. Bacon writes that this invention "I devised myself when I was at Paris in my early youth" (445).
50 Ibid., 445.
51 James Gleick, in *The Information: A History, a Theory, a Flood* (New York: Pantheon, 2011), identifies the first instance of Information Theory as the biliteral cipher (159–61). However, he misattributes Bacon's invention to John Wilkins, who appropriated it without attribution in 1641. Gleick writes, "The essential idea of information theory poked to the surface of human thought, saw its shadow, and disappeared again for four hundred years" (161).
52 *Works* 4.84.
53 See Benjamin Farrington, *The Philosophy of Francis Bacon: An Essay on Its Development from 1603 to 1609, with New Translation of Fundamental Texts* (Chicago: University of Chicago Press, 1966), 111.

54 *Theogony*, 27–28.
55 "Suspicion, Deception, and Concealment," *Arion: A Journal of Humanities and the Classics* 1.2 (1991): 121. Plato reference: *Republic*, III, 389b.
56 Leo Strauss, *Persecution and the Art of Writing* (Glencoe: Free Press, 1952), 57–58. I wish to thank Palle Yourgrau for suggesting this work.
57 Ibid., 61–62.
58 Ibid., 67.
59 Arthur F. Kinney, *Continental Humanist Poetics: Studies in Erasmus, Castiglione, Marguerite De Navarre, Rabelais, and Cervantes* (Amherst: University of Massachusetts Press, 1989), 46. Second quotation: Desiderius Erasmus to Justus Jonas, May 10, 1521, in *Correspondence*, 8:203.
60 See David Weil Baker, *Divulging Utopia: Radical Humanism in Sixteenth-Century England*, Massachusetts Studies in Early Modern Culture (Amherst: University of Massachusetts Press, 1999), 25–26.
61 See Martin Mulsow, *Knowledge Lost: A New View of Early Modern Intellectual History*, tr. H. C. Erik Midelfort, Bilingual edition (Princeton: Princeton University Press, 2022). Mulsow argues that historians of the early modern period have often failed to uncover the knowledge that is intentionally hidden in many texts. Indirect forms such as commentary and annotation are often used to subtly express heterodox views (14).
62 *Works*, 4.450.
63 See Rhodri Lewis, "Francis Bacon, Allegory, and the Uses of Myth," *Review of English Studies* 61.250 (2010): 367.
64 "Ethics and Politics in the *New Atlantis*," in *Francis Bacon's New Atlantis: New Interdisciplinary Essays*, ed. Bronwen Price (Manchester: Manchester University Press, 2002), 73.
65 In the *To the frendly Reader* preface, the sonnets may either be defended, or excused as *idle toyes proceedinge from a youngling frenzie* (second paragraph). In the final stanza of the *Quatorzain* preface, the personified book may either declare its worth or *confesse* that it is *a Toye*. The *Protrepticon* preface also suggests two alternative reading modes (see Chapter 6).
66 See Daniel S Russell, *The Emblem and Device in France*, French Forum monographs 59 (French Forum, 1985), 48. Russell is referring to emblems, but I believe the principle applies more generally to poetry.
67 Bartolomeo Fontius (1455–1513). Quoted from Concetta Carestia Greenfield, *Humanist and Scholastic Poetics, 1250-1500* (Lewisburg: Bucknell University Press, 1981), 288.
68 *Summa theologiae* I.Q. I, a9, r.2.
69 *On Christian Doctrine*, 2.6.8, tr. Rev. J. F. Shaw; Golding, "Too the Reader," in Ovid, *Metamorphosis*, tr. Golding (London, 1567), A2v (STC 18956).
70 His preface to Henry Savile's translation of Tacitus (1591), STC 23642.
71 *Visionary Spenser and the Poetics of Early Modern Platonism* (Oxford: Oxford University Press, 2017), 70.
72 *Boccaccio on Poetry*, tr. Charles Osgood (New York: Liberal Arts Press, 1956), 60–62.
73 *The Discarded Image: An Introduction to Medieval and Renaissance Literature* (Cambridge: Cambridge University Press, 1964), 10.
74 Erasmus's *Adages*, translated into English, appeared in 11 editions in the sixteen century. Claudia Corti argues that Erasmus was at "the very core of

the extraordinary co-textual and inter-textual experience of the English Renaissance." *Silenos: Erasmus in Elizabethan Literature*, Studi di letterature moderne e comparate 1 (Ospedaletto [Italy]: Pacini, 1998), 9–10.

75 Thomas More, *Utopia: With Erasmus's the Sileni of Alcibiades*, tr. David Wootton (Indianapolis: Hackett Publishing Company, Inc., 1999), 169.

76 Ibid., 169–70.

77 Quoted from Arthur F. Kinney, "Rhetoric as Poetic: Humanist Fiction in the Renaissance," *ELH* 43.4 (1976): 422–23. Kinney quotes the English translation of Sir Thomas Chaloner (1549): E3.

78 Ibid., 426.

79 *Utopia: With Erasmus's the Sileni of Alcibiades*, 24–25.

80 "Prologue of the Author," in *Gargantua and Pantagruel*, tr. Michael Andrew Screech (London: Penguin Books, 2006), 207.

81 Quoted from Ronald Levao, "Francis Bacon and the Mobility of Science," *Representations*, 40 (1992): 5.

82 The quotation is from Laurence Lampert, *Nietzsche and Modern Times: A Study of Bacon, Descartes, and Nietzsche* (New Haven: Yale University Press, 1993), 276. Lampert points to the first sentence of Descartes's *Discourse*, a direct quotation from Montaigne: "Good sense is most evenly distributed in the world, for each thinks himself so well endowed therewith that even those who are most difficult to please in all other things are not wont to desire more of it than they have." He argues that both Montaigne and Descartes know this declaration to be false and that to the contrary, people struggle to distinguish the true from the false. Indeed, according to Lampert, Descartes eventually tells his reader that "almost all people are deficient with respect to distinguishing the true from the false" (207). Thus, both Montaigne and Descartes brazenly state a bold lie in their rhetorical approach to argument. Bacon applies a similar rhetorical approach in both the *Hekatompathia* and his *Essays*. On his use of rhetoric in the *Essays*, see Stanley Fish, *Self-Consuming Artifacts: The Experience of Seventeenth-Century Literature* (Berkeley: University of California Press, 1972), 78–155.

83 See Stephen Clucas, "A Knowledge Broken": Francis Bacon's Aphoristic Style and the Crisis of Scholastic and Humanist Knowledge-Systems," in *English Renaissance Prose: History, Language, and Politics*, ed. Neil Rhodes (Tempe: Medieval & Renaissance Texts & Studies, 1997), 147–72. See also Lampert, *Nietzsche and Modern Times*, 19–26, for his discussion of Bacon's esoterism.

84 "Francis Bacon and the Mobility of Science," 5.

85 Ibid., on Bacon's poetics, see 5–8, passim, 1–32.

86 *Novum Organum*, civ. *Works*, 4.97.

87 "Francis Bacon and the Mobility of Science," 19.

88 The quoted words are Levao's, Ibid., 20.

89 "The Collapse of the Religious Hieroglyph: Typology and Natural Language in Herbert and Bacon," *Renaissance Quarterly*, 45.1 (1992): 112.

90 Ibid., 112.

91 "Refashioning Fable through the Baconian Essay: *De sapientia veterum* and Mythologies of the Early Modern Natural Philosopher," in *The Essay: Forms and Transformations*, ed. Dorothea Flothow et al., (Heidelberg: Universitätsverlag, Winter 2017), 25.

92 *Science and the Secrets of Nature: Books of Secrets in Medieval and Early Modern Culture* (Princeton: Princeton University Press, 1994), 288.
93 Ibid., 289–90.
94 "Francis Bacon and the Rhetorical Reordering of Reality," *Rhetor* 6 (2016), 12.
95 Quoted from *Nietzsche and Modern Times*, 277 (Daybreak, preface 5).
96 An acrostic is formed by the first letter of each chapter forming a message that includes the name Francesco Colonna; however, the identity of the author is uncertain.
97 *The Cornucopian Text: Problems of Writing in the French Renaissance* (Oxford: Oxford University Press, 1979), 181–82.
98 Ibid., 164.
99 *Works*, 4.449.
100 From "Thoughts and Conclusions," in Farrington, *The Philosophy of Francis Bacon*, 75–76.
101 David Colclough, "'Non Canimus Surdis, Respondent Omnia Sylvae': Francis Bacon and the Transmission of Knowledge," in *Textures of Renaissance Knowledge*, eds. Philippa Berry and Margaret Tudeau-Clayton (Manchester: Manchester University Press, 2003), 86.
102 *Works* 4.449.
103 "Francis Bacon, Allegory and the Uses of Myth," *Review of English Studies* 61.250 (2010): 369.
104 *Explorations in Ancient and Modern Philosophy*, Vol. 2 (Cambridge: Cambridge University Press 2012), 27.
105 See the discussion in the final chapter: Sidney's goal is not to create a Cyrus (a prototypical hero) but a maker of Cyruses.
106 "Rabelais's Realism, Again," in *François Rabelais: Critical Assessments*, ed. Jean-Claude Carron (Baltimore: Johns Hopkins University Press, 1995), 37.
107 "Francis Bacon and the Art of Misinterpretation," *PMLA* 130.2 (2015): 246, 243.
108 "Francis Bacon, Allegory and the Uses of Myth," 381.
109 "Ethics and Politics in the New Atlantis," 72.
110 "'Non Canimus Surdis, Respondent Omnia Sylvae'," 88.
111 "The Hermeneutical Anarchist: *Phronesis*, Rhetoric, and the Experience of Art," in *Gadamer's Century: Essays in Honor of Hans-Georg Gadamer*, ed. Jeff Malpas et al., (Cambridge, MA: MIT Press, 2002), 61.
112 Quoted from "The Hermeneutical Anarchist," 61 (*Truth and Method*, 116).
113 "The Hermeneutical Anarchist," 61–62.
114 Quoted from Stanley Rosen, *The Ancients and the Moderns: Rethinking Modernity* (New Haven: Yale University Press, 1989), 212.
115 See *The Ancients and the Moderns*, 213.
116 Ibid., 211.
117 Ibid., 232.
118 "Francis Bacon and the Art of Misinterpretation," 238.
119 See Pierre Hadot, *The Veil of Isis: An Essay on the History of Idea of Nature*, tr. Michael Chase (Cambridge, MA: Harvard University Press, 2006), 93, passim.
120 *Works* 6.713.

121 Sophie Weeks, "The Role of Mechanics in Francis Bacon's Great Instauration," in *Philosophies of Technology: Francis Bacon and His Contemporaries* (2 Vols.), ed. Claus Zittel et al., Vol. 1 (Koninklijke Brill NV, 2008), 140.
122 Ibid., 163–64.
123 Ibid., 180.
124 Ibid., 174, 180, 184–85.

Chapter 2 » Stage 1: The Puzzle Sonnet

1 Two poems fall outside of the *Hekatompathia*'s numbering scheme: *Quid Amor* and the Epilogue. The headnote of Sonnet 98 (which precedes *Quid Amor*) states that the poet placed *Quid Amor* on the *next page following, but not as accomptable for one of the hundreth passions of this booke*, thus excluding it from being counted. The headnote of the Epilogue also appears to exclude it from being counted as one of the 100 passions: *more like a praier than a Passion*. Thus no poem replaces Sonnet 80 in the sonnet count, and the title's promise of 100 passions falls short by one.
2 Trithemius uses "*transpositionis*" to mean the change or enciphering from a plaintext alphabet to a ciphertext alphabet ("*mutationem seu transpositionem*;" Oii). He labels both his *Recta* and *Aversa* tables (at the top of the page) as "*tabula transpositionis*" (Oii, Oiiv). In his "*Explanatio in quintum librum polygraphiae nostrae brevis*" (explanation of the fifth book; Biv), which is an appendage to the 1518 edition, he uses "*transpositionem*" a dozen times. "*Orchema*" is the title given to his irregular enciphering table (Pii, but the page number is mislabeled). "*Orchema*" appears about 10 times in his "*Explanatio in quintum librum polygraphiae nostrae brevis*." Thus the Puzzle's instructions make the reference to *Polygraphia* 5 extremely clear.
3 The reference to "the syllabic count of each line increasing by odd instead of consecutive numbers" refers to the "orchematicall" base of the Pasquine Pillar featured in Sonnet 81. Phillips Dissertation, 424.
4 In steganography, an ordinary, readable text forms the ciphertext (ciphertexts are normally gibberish), which is deciphered to produce the (secret) plaintext. Typically, only a modest percentage of the ordinary text—say the first letter of every sentence—is used in deciphering. Here, a small percentage of the letters of the acrostic (*amare est insanire*) would amount to only one or two letters, hardly sufficient for a message. In the course of this chapter, we will discover that Bacon, through his prodigious skill (*how much art and study the Author hath bestowed*; Sonnet 80), managed to utilize 50% of each acrostic, an impressive accomplishment.
5 Post-Petrarchism Origins and Innovations of the Western Lyric Sequence (Princeton: Princeton University Press, 1991), 102–6. Roland Greene recognizes correctly that the Puzzle Sonnet marks a significant turning point in the work, and such an event could be marked by ritual. However, an acrostic sonnet is neither mystical nor a sacrament.
6 Of the 100 numbered poems, 4 are Neo-Latin poems (6, 45, 66, and 90) and 3 are devoted to the Puzzle Sonnet (the instructions and the two versions of the Puzzle Sonnet). This accounts for 94 English language sonnets, counting the two Puzzle Sonnet versions as one sonnet.
7 Phillips Dissertation, 421.

8 I calculate the average number of lines that intermediate a rhyme pair or triplet: zero is the value for adjacent lines and one for alternating rhyme lines, etc. The scheme is a b a c b d e f g h e a h g c d f f. Examining the first "a" rhyme (a triplet), its first gap (one intervening "b" line) is equal to 1; the second gap (these lines intervene: c b d e f g h e) is equal to 8. The calculated gap values are: a: 1, 8; b: 2; c: 10; d: 9; e: 3; f: 0, 8; g: 4; h: 2. The average of these 10 gaps is 4.7.

9 I calculated what the average gap value would be for a randomly ordered poem consisting of 6 rhyme pairs and 2 triplets. For rhyme pairs, the maximum gap is 16 and the average gap is (1 to 16) ∑ ((1 to 16)∑ N) / (1 to 17) ∑ N = 5.33. For triplets, the maximum gap, averaged across the two gaps, is 7.5, and the average gap is .5 (1 to 15) ∑ ((1 to 15)∑ N) / (1 to 16) ∑ N = 2.5. A weighted average between the 6 pair gaps and the 4 triplet gaps yields an average gap of 4.2.

10 Examples of sonnet structure include the three-quatrain-plus-couplet Shakespearean sonnet (actually Wyatt's invention), the octave-plus-sestet Petrarchan sonnet, and the *Hekatompathia*'s three-sestet sonnet.

11 *The Literary Riddle before 1600* (Westport: Greenwood Press, 1948), 3.

12 The couplet would be forced to play some role of intermediation between the two octaves, and it is too small to do so. In a Shakespearean sonnet, the third quatrain often intermediates between the first two quatrains. In a Petrarchan sonnet, no couplet follows the two sections, the octave and the sestet.

13 "For" may be a misprint: Sonnet 81 reads "or" and Sonnet 82 "for." However, the manuscript's Sonnet 81 reads "for," and thus three of four instances read "for." Here, "for" likely means "under the influence of" (OED 20a) and thus *mirth* is said to arise from *mischance*.

14 In the reordered poem's rhyme scheme, abaab cdcdc eefgfg hh, all rhyming end words either fall in adjacent lines or are separated by only one line, with the one exception of the "b" rhymes, which are separated by two lines. But abaab is a reasonable rhyme scheme for a combined triplet and pair. Rhyme schemes of abba are, of course, common. True, the rhyme scheme overlaps the bipartite structure of the sonnet. But given the pairs and triplets with which we have to work, this rhyme scheme is certainly reasonable.

15 *Polygraphia* 5, Oii.

16 The Recta tables include 25 rather than 23 tables, but this includes 2 erroneous tables that fill up what would otherwise be empty columns on the page titled "*Quinta figura expansionis tabulae rectae*." These 2 extra tables are actually Orchema tables and are clearly out of place. Most of my references to *Polygraphia* 5 are made by page title or other means because many of the work's page numbers are misprinted.

17 *Polygraphia* 5, second page: "And if, on account of a multitude of difficulties, the family of alphabets which we have noted are not sufficient, or if some of them seem too open and too obvious, we will be able to introduce various new transpositions of which the number is large, and the mode of the secrecy remains always concealed." (The original text begins with "Quod si prae multitudine" and ends with "occultus.")

18 Trithemius uses a 24-letter alphabet that includes the non-Latin letters K and W. It is identical to the 24-letter Elizabethan alphabet except that Trithemius's

alphabetic order places "W" as the last letter of the alphabet, as was the custom in the German language. The Puzzle uses the standard order of the 24-letter Elizabethan alphabet, in which W follows U/V.

19 Trithemius's master Aversa Table, titled *Tabula transpositionis aversa* appears on the fourth page of *Polygraphia* 5. This master table is rendered oddly and is inconsistent with his expansion into the 23 tables that appear on the tenth through fourteenth pages of *Polygraphia* 5. My version uses the values from the 23-table expansion. Also, my version, following the Puzzle, is modified such that "W" is the 21st letter of the alphabet.

20 A late sixteenth-century dialogue on love, *Contramours*, was published under the pseudonym Battista Fregoso. The acrostic in a fourteen-line prefatory poem spells out THOMAS SEBILLET.

21 Phillips Dissertation, 427.

22 Ibid., 427–29.

23 In this assignment of tables, only two binary assumptions have been made. The first is the assignment of the increasing numbers to the Recta tables and the decreasing numbers to the Aversa tables, as opposed to vice versa, which would be an unnatural choice. With respect to the Recta tables, one can read them either as encryption or decryption tables, also a binary choice.

24 Alberti embedded letters in the ciphertext itself that signaled which alphabet would be used.

25 If in cryptanalysis, one makes too many arbitrary and elaborate assumptions about the cryptographic system, the validity of any deciphered message may be called into question. For example, if one's conjecture about a cryptographic system arbitrarily settles on one of a million possible systems, this reduces confidence in the validity of the deciphered message. Here we have made only a handful of assumptions; if the assumptions had instead been numerous, it would be necessary to factor this into the mathematical validation at the conclusion of this chapter.

26 Credited to mathematician David Silverman, this was reportedly published in August 1970 in *Kickshaws* (no further information is available).

27 Aloys Meister, *Die Geheimschrift im Dienste der Päpstlichen Kurie von ihren Anfänge bis zum Ende des 16. Jahrhundert* (Paderborn: Schöningh, 1906), 297. The table below provides references to some sixteenth-century polyphonic ciphers documented in *Die Geheimschrift*.

Year	**Correspondent**	**Page in *Die Geheimschrift***
1544–50	Bishop of Ajaccio	178
1579	Camillo Capozucca	296
1582	Vincenzo Vitelli	296
15??	Cardinal Sabellus	200
1583	Cardinal Sabellus	297
1585	Cardinal Sabellus	298
1585	Bishop of Amalfi	350
1586(?)	Anonymous	255

28 For each letter, the absolute rate of language is 4.6 bits ($\log_2 24$). To compare the information content of the absolute rate of language with the output of a polyphonic cipher with one bit of indeterminacy, divide the information content of each: (4.6-1) / 4.6 ≈ 78%.

29 Katherine Ellison, "Deciphering and the Exhaustion of Recombination," in *A Material History of Medieval and Early Modern Ciphers: Cryptography and the History of Literacy*, ed. Katherine Ellison and Susan Kim (New York: Routledge, 2018), 187.
30 *The Book of Memory: A Study of Memory in Medieval Culture*, 2nd ed. (Cambridge: Cambridge University Press, 2008), 230–31, 245.
31 He is depicted as either possessing powers, symbolized as arrows or a brand, or as dispossessed of these powers (Sonnets 70 and 100).
32 Sonnet 25, line 8 where the fabricated pronoun "*he" represents he or she. This is necessary in the poem to account for the change in the gender of the person referenced in the echo.
33 *Blyndfold bratte and thee* (M, F); *Blind cupids carr* (M); *Ciprya la nemica mia* (F).
34 See Clive S. Lewis and Alastair Fowler, *Spenser's Images of Life* (Cambridge: Cambridge University Press, 2013), 16.
35 Ibid., 15.
36 "Emanations of Glory: Neoplatonic Order in Spenser's *Faerie Queen*," in *A Theatre for Spenserians: Papers of the International Spenser Colloquium, Fredericton, New Brunswick, October, 1969*, ed. Judith M. Kennedy and James A. Reither (Toronto: University of Toronto Press, 1973), 54.
37 The *Polygraphia* 5's Orchema tables, printed on a single page labeled "*Orchema,*" consist of 6 tables or Alphabets. The first and second tables skip 1 and 3 letters, respectively, between entries. The third and fourth tables exhibit a wholly different pattern consisting of sequential letters with periodic reversals of direction. The fifth and sixth tables are *recta* tables, an error.
38 The OED lists *pesum* (*pensum*), the neuter gender of this masculine verbal adjective, *pesus*, in its entry for "avoirdupois."
39 A hypogram is a key word or phrase that underlies a complex network of relations within a text.
40 The final word, PESUS, was only a guess because the value of the Orchema Transforms is unknown. Therefore, it is not included in our validation test.
41 It should be noted that Shannon's figure of 25% is based on experiments he conducted in which his subjects made successive guesses at each letter of a text that was 100 letters in length. On average, they had 50 letters of prior context to help them in their guessing. This is significantly longer than our 13-letter text. As evident from Fig. E3.3, meaning, grammar, and context are implicit in this 25% information rate. The reason that I believe that the 25% rate is applicable to our plaintext message, even though it is short, is that it is meaningful, grammatically correct, and fits perfectly with its larger context, the Puzzle Sonnet from which it emerged. The Puzzle Sonnet, the circumstance of the *Hekatompathia*'s poet addressing a reader, and the necessity of giving a clue to the Puzzle's next stage, all severely limit what text we might expect to find. The plaintext message is four words forming two sentences. The compactness of Latin allows for this amazingly concise message. Despite its short length, the message exhibits grammatic structure. Most importantly, its words precisely fit the context of the Puzzle Sonnet from which it emerged.
42 The probability of an event occurring at least once if repeated n times is not actually the product of n and the probability of the event, p. However, when $p \ll 1$ and $n \ll p$, n times p is a close approximation.

43 There are 18 Puzzle Sonnet lines, which generate a 13-letter message, and thus there are 18!/5!, or approximately 5.3 x 10^{13} permutations or reorderings (without restriction). The vast majority of these will fail to maintain logical coherence, adhere to an appropriate rhyme scheme, exhibit appropriate structure, or make sense in the context of the MLIP Subsequence. I estimated the number of poetically valid reorderings by making the following judgment: for any given line in the Puzzle Sonnet, only 3 of the 17 remaining lines could appropriately follow it. This results from the need to maintain logical and grammatic flow from line to line, and the requirement that a reasonable rhyme scheme be maintained. The judgment that only 3 of 17 lines are appropriate successors is based on (1) examining each sonnet line for potential successors, and (2) knowing that the requirement for rhyme will often allow for only one possible successor line. The value of 3 possible successor lines is an average of greater and lesser values incurred during a traversal from the first sonnet line to the 13th. Of course, it is an impractical task to map out each of what are likely thousands of traversals.

This successor line estimate may now be used to estimate the number of valid reorderings. For each successive line after the first, there is a 3 out of 17 chance that that line is valid, logically and poetically. This is true even as the supply of remaining lines decreases as one progresses toward the 13th and last line. My calculation assumes that only 6 lines are appropriate to begin the sonnet, and then each of 12 successive lines has only a 3/17 chance of being valid. The probability of a valid reordering is then (6/18) $(3/17)^{12} \approx 1$ in 3.3 x 10^{9}. Multiplying this probability by the total number of permutations (5.3 x 10^{13}), we obtain approximately 16,000 valid reorderings. This estimate does not account for all restrictions on reordering the Puzzle Sonnet, as previously discussed (e.g., the requirement that the reordered sonnet exhibit structure).

Chapter 3 » The *Hekatompathia*'s Foundation: Sonnets 1–17

1 Just prior to the 1580s, Spenser's *Shepheardes Calender* (1579) used an Old English font for the poetry and a more modern font for the commentary, the same practice adopted by the *Hekatompathia*. That choice also appears to have been made in order to cast the text in an antiquarian light.

2 An exception is Spenser's *Shepheardes Calender*—its glosses perform a function similar to those found in the *Hekatompathia*.

3 The gloss that appends the December eclogue states: "This poet in his Epilogue sayth he hath made a Calendar, that shall endure as long as time etc. following the ensample of Horace and Ovid…" (folio 52). According to Patrick Cheney, Spenser imagines a poetic career patterned after Virgil (the concept of the "Virgilian wheel" in which a poet's career progresses from eclogues, to georgics, and finally to epic). See "Spenser's Pastorals: *The Shepheardes Calender* and *Colin Clouts Come Home Againe*," in *The Cambridge Companion to Spenser*, ed. Andrew Hadfield (Cambridge: Cambridge University Press, 2001), 79–80. See further discussion in this study's final chapter.

4 Exceptions include Dante's *Vita Nuova*, which includes commentary; Scève's sequence has elaborate designs.

5 Rita Copeland, *Rhetoric, Hermeneutics and Translation in the Middle Ages* (Cambridge: Cambridge University Press, 1991), 66, 70–71.

80 See Rosen, *Plato's Symposium*, 177.
81 According to Rosen, "The poetry of Agathon is an attempt to transform traditional religion into a religion of poetry" (Ibid., 200). This view has much in common with Nietzsche's religion of art (Ibid., 132).
82 Rosen's words, in the context of Aristophanes's speech (132).
83 See Bruns, "Hermeneutical Anarchist," 65. He quotes Gadamer from *Truth and Method*, tr. Joel Weinsheimer and Donald Marshall, 2nd rev. ed. (New York: Continuum, 1989), 102.
84 Bruns writes: "In Gadamer's aesthetics, the event of the work of art is not a museum event in which we simply gape at the thing" ("Hermeneutical Anarchist," 65).
85 Ibid. Bruns references *Truth and Method*, 126–28.

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The *Hekatompathia*

The *Hekatompathia* has been republished five times since its original edition in 1582 and twice reproduced in dissertation editions. All published editions are listed in chronological order, followed by the two dissertations. I abbreviate references to these editions, as shown in bold below.

Original Edition: *The Hekatompathia or Passionate centurie of loue, diuided into two parts: whereof, the first expresseth the authors sufferance in loue: the latter, his long farewell to loue and all his tyrannie. Composed by Thomas Watson Gentleman; and published at the request of certaine gentlemen his very frendes*. London: imprinted by Iohn Wolfe for Gabriell Cawood, in Paules Churchyard at the signe of the Holy Ghost, 1582. [STC 25118a]

1869 Edition: *The Hekatompathia* [Romanized form]*, or, Passionate centurie of love*. Printed for the Spenser Society, 1869.

Arber Edition: *Poems: Viz.: — The Ekatompathia [Romanized form] or passionate centurie of love 1582*. Ed. Edward Arber. London: English Reprints, 1870.

Cecioni Edition: *Hekatompathia*. Ed. Cesare Giulio Cecioni. Catania: Universitá di Catania, 1964.

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Sutton Edition: *The Complete Works of Thomas Watson (1556–1592)*. Volume 1. Ed. Dana Sutton. Lewiston: Edwin Mellen Press, 1997. An online edition is available at www.philological.bham.ac.uk/watson

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L39.A5	40	114
L39.A6	47	116
L39.B1	62	118
L39.B2	78	120
L39.B3	51	122
L39.B4	66	124
L39.B5	75	128
L39.B6	43	130
L64.H	64	136
L64.1	60	138
L64.2	49	140
L64.3	76	142
L64.4	59	144
L64.5	52	146
L64.6	38	148
L50.H	50	154
L50.1	74	156
L50.2	63	158
L50.3	70	160
L50.4	46	162
L50.5	56	164
L50.6	69	166
L73.H	73	170
L73.1	57	172
L73.2	61	174
L73.3	67	176
L73.4	77	178
L73.5	53	180
L73.6	65	182
Epilogue	Epi	78

Sonnet Number Converter: original to restored

Sonnet Number		Vol. II
Orig.	Restored	page
P1	P1	256
P2	P2	258
P3	P3	260
P4	P4	262
P5	P5	264
1	1	266
2	L2.H	268
3	L2.1	270
4	L2.2	272
5	L2.3	274
6	L2.4	276
7	L2.5	278
8	L2.6	416
9	L2.7	417
10	L2.8	418
11	L11.H	188
12	L11.1	190
13	L11.2	192
14	L11.3	194
15	L11.4	196
16	L11.5	198
17	L11.6	200
18	L18.H	220
19	L18.A5	234
20	L26.3	210
21	L26.2	208
22	L18.A4	232
23	L18.A3	230
24	L18.A2	228
25	L18.B3	242
26	L26.H	204
27	L18.B1	238
28	L18.A6	236
29	L26.5	214
30	L18.B6	248
31	L18.B4	244

Sonnet Number		Vol. II
Orig.	Restored	page
32	L18.A1	226
33	L26.4	212
34	L26.6	216
35	L18.B2	240
36	L18.B5	246
37	L26.1	206
38	L64.6	148
39	L39.H	104
40	L39.A5	114
41	L39.A4	112
42	L90.6	96
43	L39.B6	130
44	L90.1	86
45	L90.2	88
46	L50.4	162
47	L39.A6	116
48	L39.A2	108
49	L64.2	140
50	L50.H	154
51	L39.B3	122
52	L64.5	146
53	L73.5	180
54	L90.7	98
55	L39.A1	106
56	L50.5	164
57	L73.1	172
58	L90.4	92
59	L64.4	144
60	L64.1	138
61	L73.2	174
62	L39.B1	118
63	L50.2	158
64	L64.H	136
65	L73.6	182
66	L39.B4	124
67	L73.3	176

Sonnet Number		Vol. II
Orig.	Restored	page
68	L39.A3	110
69	L50.6	166
70	L50.3	160
71	L90.3	90
72	L90.5	94
73	L73.H	170
74	L50.1	156
75	L39.B5	128
76	L64.3	142
77	L73.4	178
78	L39.B2	120
79	L18.C1	250
80	L82.PS.1	34
81	L82.PS.2	36
82	L82.PS.3	38
83	L82.Scoff.2	56
84	L82.Scoff.6	64
85	L82.LD.3	72
86	L82.FL.1	40
87	L82.FL.5	48
88	L82.FL.3	44
89	L82.LD.4	74
90	L90.H	84
91	L82.LD.1	68
92	L82.Scoff.7	66
93	L82.FL.2	42
94	L82.Scoff.5	62
95	L82.FL.6	50
96	L82.Scoff.1	54
97	L82.FL.7	52
98	L82.Scoff.3	58
QA	L82.Scoff.4	60
99	L82.FL.4	46
100	L82.LD.2	70
Epi	Epilogue	78