The Secrets of the Copiale Cipher

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The Secrets of the Copiale Cipher

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Abstract

The Copiale Cipher is a 105-page, hand-written encrypted manuscript from the mid-eighteenth century. Its code was cracked and the text was deciphered by using modern computational technology combined with philological methods. We describe the book, the features of the text, and give a brief summary of the method by which we deciphered it. Finally, we present the content and the secret society, namely the Oculists, who were hiding behind the cipher.

Keywords: cipher, decipherment, masonry, oculists

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Introduction

The manuscript, beautifully bound in a green-golden brocade paper, is hand-written on high-quality paper with two different watermarks: one containing the letters IDAM in a rectangle, and the other representing a horn in a shield. The manuscript is completely written in cipher except for an owner's mark 'Philipp 1866' on the first page, and a note 'Copiales 3'—from which we named the cipher—together with an abbreviated signature on the last page. Apart from the above mentioned notes, there are also page numbers in plain script on the left and right top corners. The upper part of some of the page numbers are missing, indicating that the cipher was written on separate paper arks at first, then cut and bound. On the basis of cover, binding, paper quality and ink, the book can be dated to 1760–1780.[4] The manuscript emanates from Germany, probably from Berlin, and is privately owned. The book is digitized and freely available on the Copiale cipher's website: http://stp.lingfil.uu.se/~bea/copiale

The Cipher Text

The manuscript consists of 105 pages, amounting to approximately 75,000 characters, and is meticulously written, probably by several persons. The cipher text is encoded using eclectic characters from Roman and Greek letters to abstract symbols without any word spacing. The lines are left- and right-justified and some lines are centred. Section titles and paragraphs are indented and begin with Roman capital letters. Some parts of the text begin with double quotation marks ("), some lines end with full stops (.), dots (...), or colon (:). The latter is also used within lines. The document does not contain any illustrations, and only a few author corrections. In order to validate the stacking of pages, the bottom of the left hand pages also contains catchwords, which copy the first few characters of the next page. Figure 1 shows an extract of the book.

The cipher script is a combination of 26 unaccented Roman letters (a-z), also in capitalized forms (A-Z), circumflexed vowels (â, ê, î, ô, û), underlined variants (m̲, n̲, r̲, u̲), letters with a dot on the top (ċ, ṁ, ṅ, ȯ, ṗ, ṙ, ṡ, ẋ), or with an umlaut (ÿ). Some consonants appear also in fancy forms (ð, f, g, h, ħ, η, p, ſ, z). There are also Greek letters (σ, Δ, Λ, γ, ι, π), eclectic symbols (ǂ, +, ⱬ ⊠, †, ↗, ♀, ♁, =, ɂ, ʒ, ǂ, ſ, ∞, |, ▦, ⫪, ⚓, ⌈) and different types of parenthesis ({, }, (:, :)). Out of 75 000 characters,

4. Per Cullhed, Carolina Rediviva Library at Uppsala University. Personal communication, 2011.

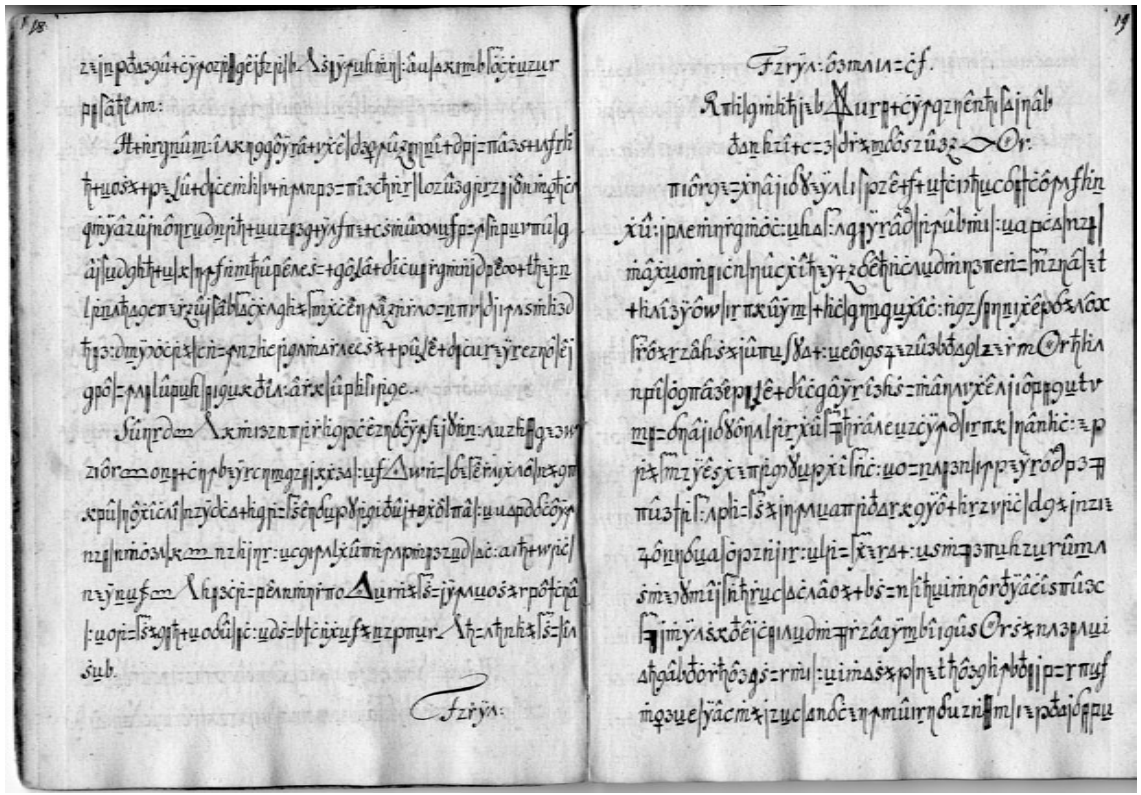

Figure 1. Encoded Text with Cipher Letters and Symbols (pages 18 and 19).

450 represent larger symbols, which can be divided into the following types: ƛ, ⊚, ⍙, ✗, ⌔, ∦, ⊓, ⌓, L, and scissors. There are 97 different cipher characters in the document.

Decoding the Cipher

Transcription

A transliteration scheme was developed[5] to produce a machine-readable format of the text by assigning a unique unaccented letter combination (ascii code) to each symbol. For example, the symbol ♁ is transcribed as `mal`, ♀ as `fem`, and ⌔ as `lip`. In the transliteration, all cipher characters are separated by spaces, and line breaks are marked with blank lines. Figure 2 below illustrates the transliteration of the ciphertext.

Ciphertext: J û ṙ ſ ô | ϰ ʌ ι ʌ = ċ ʑ.
Transliteration: `J uh r. hk oh j k lam iot lam ni c. zs .`

For the decoding, we transliterated the first 16 pages according to the transliteration scheme.

Breaking the Code

The cracking of the code, described in detail in Knight *et al*. (2011), was carried out by using traditional methods in cryptography such as frequency analysis, tools developed for natural language processing tasks, combined with philological skills.

Traditional frequency analysis was the starting point for the decipherment, i.e. counting how many times individual letters, letter pairs (digraphs), and the combination of three letters (trigraphs) occur in the cipher text. The analysis showed that the most commonly occurring letter was ʌ, and the most frequent letter combinations were:

digraphs: ɔħ, ċ:, ħʌ, :u̲, z▦
trigraphs: ɔħʌ, ċ:u̲, ɳɔħ, ÿɔħ, ɦċ|

Another task was to investigate which letters behave similarly in the cipher by analyzing the letters' context similarity using a tool for clustering. The results showed that Roman unaccented letters, the underlined letters, and the circumflexed vowels form clear groups.

To find out the language from which the cipher was encoded, we used an automatic method that combines decipherment and underlying

5. Kevin Knight, Beáta Megyesi, and Christiane Schaefer, 'The Copiale Cipher', in *Proceedings of ACL 4th Workshop on Building and Using Comparable Corpora (BUCC)* (Portland, Oregon, USA, 2011), 2–9.

language identification,[6] assuming first that only the Roman letter sequences carried information and tested those against 80 different languages, such as German and English. As the method did not give any preference for any particular language, a new assumption was made, where any cipher letter could be a letter in the underlying language. The program did not give any understandable decoded text, but gave at least a slight preference for German. Knowing this and the facts that the manuscript comes from Germany, and the inscription 'Philipp' on the first page of the book has German spelling, we assumed that the underlying language is German.

To break the code, we combined the information given by the frequency analysis of the cipher letter combinations, the results from the clustering, and compared the various frequencies to the frequencies of letter combinations in modern German. By focusing on frequently occurring German digraphs and trigraphs and using the grouping of the cipher letters given by the clustering, we could make progress. After decoding half of the cipher letters a text fragment could appear, and it became clear that the Roman non-accented letters serve as space, and the colon (:) has the function of doubling the previous letter.

As the graph analysis was based on Modern German, while the underlying language showed to be an older variant, German language competence and philological methods helped correcting the hypothesized decipherment, and finally establish a text. The only symbols that remained encrypted were the logograms. Although some logograms appeared frequently in the 16-pages text used for decipherment, the content of the pages did not reveal enough information about the secret society for us to draw any firm conclusions about the meaning of most of the logograms. However, as it became clear that the decoded text could be of historical value and the meaning of the logograms could not be solved on the basis of 16 pages, we transcribed and decoded the entire manuscript.

Codewords

Apart from the 83 different cipher letters used to encode the German eighteenth-century alphabet, 11 logograms are used to encode whole words. The 11 logograms listed with their frequencies are:  (231),  (116),  (34),  (25),  (17),  (15),  (7),  (2), tribig (2), L (1), scissors (1). The following example illustrates how the logograms appear in context first in German as automatically decoded from the cipher, then

6. Kevin Knight, Anish Nair, Nishit Rathod, and Kenji Yamada, 'Unsupervised Analysis for Decipherment Problems', in *Proceedings of ACL-COLING* (Sydney, Australia, 17–21 July, 2006), Association for Computational Linguistics, 499–506.

in English translation. The original line breaks are not kept so that words that are split over two lines in the cipher are not marked. The decoded German text neither contains punctuation marks, nor capitalization, as it is given by the cipher. However, we chose to add punctuation and capitalization in the English translation for easier readability.

> ceremonieN der aufnahme.
> wenn die sicherheit der ⍙ durch deN ältern thürhüter besorget und die ⍙ vom dirigirendeN ⍲ durch aufsetzung seines huths geöffnet ist wird der candidat von dem jüngern thürhüter aus einem andern zimmer abgeholet und bey der hand ein und vor des dirigirendeN ⍲ tisch geführet dieser frägt ihn : erstlich ob er begehre ⌔ zu werdeN zweytens deneN verordnungeN der ⍟
>
> Ceremonies of initiation.
> If the security of the ⍙ is ensured by a doorkeeper and the ⍙ is opened by the conducting ⍲ by putting his hat on, the candidate is taken from another room by a younger doorkeeper and lead by hand to the table of the conducting ⍲, he asks him: first of all if he desires to be ⌔, secondly to subject himself to those regulations of ⍟

Since the logograms represent whole words, not single letters, the deciphering is (completely) dependent on context analysis. The contents of the surrounding text in combination with morphological clues, such as suffixes immediately following logograms, or logograms being parts of compound words, made it possible to uncover the meaning of the majority of the logograms. In some cases, the surrounding words in the text itself revealed the meaning. The logograms encode special terms related to the secret society: titles and ranks, organizational terminology ('lodge', 'grand lodge', 'society'), names of secret societies ('masonry', 'oculist'), etc. The most frequently occurring logogram (231 occurrences) is the symbol ⍲, transcribed as *nee* and used to encode the word 'master'. This logogram appears not only in context with the adjective *dirigirende* ('conducting') ⍲, but also in the compounds *ceremonie* ⍲ ('ceremonial master'), ⍲*huth* ('master hat'), ⍲*ornat* ('master's ornat') and ⍲*stück* ('master piece'). Another frequently occurring logogram is ⌔, transcribed as *lip* that—as it turned out—symbolizes an eye and denotes the Oculist Society, the society to which the Copiale cipher belongs.

Other logograms, occurring only once or twice, remain yet unsolved. In the case of the logogram shaped as scissors (*sci*), the text itself reveals the meaning: 'What does the *sci* mean? God, who has neither beginning, nor end' (p. 74). From the German original we know that the word hiding behind *sci* ends in an *-on*: '*was bedeutet das *sci* on gott der weder anfang noch eNde hat*', but still, the actual wording is not clear. Here we hope for the help of experts in religious studies, history of ideas and

/or in Masonic texts and symbolism. In the example below, the same text as above illustrates the usage of codewords with their translation.

> Ceremonies of initiation.
> If the security of the ◬/LODGE is ensured by a doorkeeper and the ◬/LODGE is opened by the conducting 𐤀/MASTER by putting his hat on, the candidate is taken from another room by a younger doorkeeper and lead by hand to the table of the conducting 𐤀/MASTER, he asks him: first of all if he desires to be ◇/OCULIST, secondly to subject himself to those regulations of ⊙/ORDER.

The Content

The manuscript consists of three clearly distinguishable parts, two of them concluded by the plain text word 'copiales'.

The first part entitled 'The book of law of the enlightened ◇ ⊙ secret part' [*gesetz buch der hocherleuchte ◇eN ⊙ geheimer theil*] (pp. 1–27) comprises the initiation ritual of the Oculist Society, rules and regulations for the different lodges, membership requirements and descriptions of signs by which apprentices (*Lehrlinge*), fellow crafts (*Geselle*) and masters (*Meister*) recognize each other. A history of the origins and formation of the Oculist Society is given, its tasks and secret teachings are delineated and it is pointed out particularly that women were allowed to become members. (A closer look at the rules and regulations, however, shows that extra care was recommended before admitting women into the lodge and caution when unmarried women applied).

The second part of the manuscript with the title 'Reliable old news increased by new observations of the 𐤟*rey*' [*zuverlässige alte doch mit neueN observationeN vermehrte nachrichteN von der* 𐤟*rey*.] (pp. 27-68) contains descriptions and explanations of equipment and furnishing of Masonic lodges, Masonic regalia, attire, rites and practices. The extension *-rey* that appears after the logogram 𐤟 in the title on page 27 (cf. also p. 21) gives a clue for the interpretation as Masonry [*Mäurerey*], the non-cipher form appearing on the following pages (cf. p. 29 *mäurerey*, cf. also *maurer* (mason) on pp. 34, 41, 43 etc.).

The third part of the manuscript (pp. 69–105) 'Seventh chapter about the maitre eccossois' [*siebeNde capitul vom maitre eccossois*] deals with the higher ranks (Scottish master) of Masonry, again with extensive descriptions of signs, grips and passwords of the different ranks of the order and descriptions and explanations of the symbolism of furnishing, regalia and tools. Special attention is paid to the so-called *Schlüssel* ◬ (Key lodge) (pp. 100–104): it is said to 'have something special, seems to have been founded by restless idlers, is through and through despicable, and most likely basically already perished' [*hat wiederum etwas ganz*

besonders, scheinet von unruhigeN müssiggängern erdacht zu seyn, ist durch und durch verwerflich, auch vermuthlich schon grössteNtheils wieder zu grunde gegangeN]. In context with descriptions and explanations of some of the attire and rituals rather radical political ideas of the Key 🅰 are reported.

The manuscript concludes with shorter remarks on the 'Consolations 🅰', an alchemist lodge established in Halle. The goal of this lodge is reported to be 'to fix the mercury', but the lodge is 'not considered to be long-lasting and is not regarded to be worth further examination' (p. 105). Remarkably, the Copiale ends with the ciphered word 'amen'.

The Oculist Order

The somewhat startling noun phrase 'light hand' in context with the entrance requirements named in the first part of the manuscript helped to track down the secret society hiding behind the logogram 👄 transcribed as *lip*. As it turned out *eye* would have been a more appropriate transcription, since the logogram obviously represents an eye (lat. *oculus*). It stands for the 'Hocherleuchtete Oculisten-Gesellschaft' (Highly Enlightened Society of the) Oculists, a secret society attested in and around Wolfenbüttel, northern Germany, during the middle of the eighteenth century.[7]

The founding date of the Oculist Society is not documented, but the society is first mentioned in 1745, when—in the *Berlinische Nachrichten von Staats- und gelehrten Sachen*—a law book of an Oculist Society is announced to appear. This law book[8] was published in Frankfurt 1745 and contains the public part to which our Copiale represents the secret counterpart (cf. p. 1 'The book of law of the enlightened 2 @ secret part').

In the public part of the law book it is emphasized by using large print and bold letters that only persons with 'a light hand' ['*Eine leichte Hand*'] are eligible for initiation into the society.[9] The Wolfenbüttel lodge claims descent from an English lodge and that its installation was

7. For an extensive study of the Oculist Society see, Aloys Henning, Eine frühe Loge des 18. Jahrhunderts: Die 'Hocherleuchtete Oculisten-Gesellschaft' in Wolfenbüttel, in *Europa in der frühen Neuzeit. Festschrift für Günther Mühlpfordt*. Bd. 5 Aufklärung in Europa. hsgg. von Erich Donnert. Köln (Weimar, Wien: Böhlau-Verlag, 1999).

8. *Gesetz-Buch Der Hocherleuchteten Oculisten-Gesellschafft. Enthaltend Einige allgemeine Verordnungen, Pflichten und Absichten derselben. Herausgegeben Auf Special-Befehl der Grossen Loge Von einem treuen und ehrliebenden Bruder Meister.* o.O. o.D. (Frankfurt am Main, 1745).

9. Gesetzbuch der Hocherleuchteten Oculisten-Gesellschaft, 9.10.21.22.25.27.

Figure 2. Eye-medallion, NLA-Staatsarchiv Wolfenbüttel, signatures VI Hs 15 Nr. 143 and 10 Slg 6–13, STAWO 10 Slg 8 and 9.

on the order of the Grand Lodge in Berlin, but there is no proof for the existence of any Oculist lodge besides the one in Wolfenbüttel.

Remains of the Oculist Society are kept in the Niedersächsisches Staatsarchiv in Wolfenbüttel.[10] It contains the ritual requisites and regalia of the society, several application forms for admission into the society in an oval (eye) form, a copy of the public part of the 'Gesetzbuch', nine identical sets of four pages each of a text on mathematical operations—partly written in cipher—and a 72-page manuscript written completely in cipher. In addition, there are two ophthalmological manuscripts: one on the anatomy of the eye, the other one on cataract operations. Both texts are written by a 'Geheimrat von Praun' and consist of extracts from contemporary medical books.[11]

To the requisites and regalia of the society belong a magnifying glass, a pair of glasses and several eye-medallions on white ribbons with green edges (in the Copiale described as '*weißes wässriges Band mit grünen Kanten*'—i.e. made of green wavy fabric).

10. NLA-Staatsarchiv Wolfenbüttel, signatures VI Hs 15 Nr. 143 and 10 Slg 6–13, STAWO 10 Slg 8 and 9.

11. Henning, Eine frühe Loge des 18. Jahrhunderts: Die 'Hocherleuchtete Oculisten-Gesellschaft', 75.

Figure 3. Picture of the Seal of the Oculist Society, NLA-Staatsarchiv Wolfenbüttel, signatures VI Hs 15 Nr. 143 and 10 Slg 6–13, STAWO 10 Slg 8 and 9.

A scalpel/needle used for cataract surgery, a pair of epilation tweezers, an anatomic model of an eye that can be taken apart, and the matrix of the seal of the Society complete the collection.[12]

The Oculist's seal—in form of a coat of arms—displays some of the regalia of the society. A pince-nez forms the crest, a cataract needle and a master hat with the eye-medallion wrapped around the lower part, and an eye-medallion on a ribbon the bottom.

An eye is depicted in the middle and the upper part of the shield shows a cat watching three mice. An inner frame contains the motto of the society '*heureux quit voit sans être vu*'. The inner frame is supported by two cats, and an outer frame contains the inscription 'Grosses Insiegel der Oculisten Gesellschaft'.

The aim, purpose and objectives of the Oculist Society are not clear. According to their public program—as laid out in the law book—the Oculists devoted themselves to ophthalmiatry or ophthalmology, and the preoccupation with eyes and seeing is reflected in the rituals, regalia, and last but not least in the logogram ⟡. A considerable part of the law book deals with the anatomy of the eye and presents extensive contemporary ideas about the origin and treatment of eye diseases. In this context the request for a 'light hand' could be interpreted as the need of an eye surgeon to have a light hand for cataract surgery.[13]

12. Henning, Eine frühe Loge des 18. Jahrhunderts: Die 'Hocherleuchtete Oculisten-Gesellschaft', 73-74.

13. Henning, Eine frühe Loge des 18. Jahrhunderts: Die 'Hocherleuchtete Oculisten-Gesellschaft', 71.

On the other hand there are no indications that the Oculists actually carried out eye procedures.[14] The secret part of the 'lawbook', i.e. our Copiale, seems to point to a different direction. The true and most secret teaching of the lodge, passed on to masters only, was knowledge about the history of Freemasonry and about Masonic rituals and activities (p. 19). However, the 'master piece' (🙏 *stück*) of a master of the Oculist Lodge, the proof of his true 'light hand', was the ability to read and write the cipher script (pp. 16, 17, 23).

Summary

We have described an enciphered manuscript from the eighteenth century, the method by which we decoded it, and have given a brief description about its content and the society that was hiding behind the document. The manuscript is digitized, transcribed, decoded and translated to English, and is available to the public at the Copiale webpage: http://stp.lingfil.uu.se/~bea/copiale

In order to throw light on our history, we hope that our study opens doors for other people to decipher the thousands of encoded historical documents that have been produced, not only by states, the military, or leaders, but also by other secret societies and private persons that used ciphers to keep their messages private.

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14. Henning, Eine frühe Loge des 18. Jahrhunderts: Die 'Hocherleuchtete Oculisten-Gesellschaft', 73, 80.