

Situating ciphers among alchemical techniques of secrecy

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Abstract

This paper offers a contextual framework for the historical analysis of alchemical ciphers. It argues that they differ from other ciphers due to their unique context: the alchemical tradition embodies a performative culture of secrecy, which employs a variety of techniques to achieve this performance. This paper contends that the distinction between ‘secret as content’ versus ‘secrecy as practice’ presents a useful framework for understanding alchemical rhetorics of secrecy and their relationship to alchemical cryptography. Additionally, it demonstrates how these principles can be applied in interpreting several examples.

1 Introduction

Alchemical ciphers are something of a *terra incognita*. While some are known in alchemy research circles, most have not received the detailed attention they deserve. However, they distinguish themselves from other contexts in which ciphers were utilized, as the communicative traditions of alchemy are steeped in intricate techniques of secrecy, of which ciphers constitute only a single facet. The alchemical tradition is rife with practices of secrecy. Yet because of its distinctiveness, it is hard to integrate conceptually with other more well-known practices of secrecy such as diplomatic ciphers.

On the surface, it may seem that cryptography, which is quantitative and highly systematic, has little in common with other alchemical techniques of secrecy, which are qualitative in nature and often used creatively. However, when looked at in their historical contexts, it becomes obvious that these superficially disparate traditions actually share the same historical backdrop and

are, most likely, used for the same reasons by alchemists and chymists. Seen through this lens, non-quantitative methods of encipherment, which are not strictly cryptography, are closely related. In essence, both pertain to what Katherine Ellison has termed ‘cipher literacy’ (Ellison, 2017): alchemists and chymists constituted a group of historical individuals in which methods of secrecy (including ciphering) flourished, and those alchemical experts defined themselves significantly by their hermeneutic abilities and mastery of a high degree of ‘cipher literacy’. Many alchemists were scholars “trained in the topological interpretation of texts” who demonstrated spectacular command of their encipherment techniques (Newman, 1996, 188).

To gain a proper understanding of alchemical cryptography, it is crucial to possess a basic understanding of what we can define as cryptographic stylistic devices. Among the most well-known of these devices are the so-called alchemical *Decknamen* (see section 10). Consequently, the cryptographic community should not only be interested in alchemical ciphers but the entire arsenal of encipherment techniques used by alchemists and chymists. Within the alchemical tradition, these encipherment devices, whether qualitative or quantitative, share a common purpose and cannot be understood in isolation.

Historians of cryptology may question how alchemy rife with qualitative methods of linguistic and iconic obfuscation is relevant to their interests. For once, as shown by the study by Bean et al. (2022), one of the earliest known Bellaso/Porta/Vigenère ciphers outside of a cipher manual was part of an alchemical scribal culture and textual recipe tradition, firmly embedded in the intricate cultural context of alchemical techniques of secrecy (Piorko et al., 2023). This single example alone has yielded a gold mine of historical insights. Piorko et al. (2023) show just how

rich a historical close reading of an alchemical cipher can be, particularly given how few alchemical ciphers have been studied in detail so far. The polyalphabetic Bellaso cipher (Buonafalce, 2006) discovered in Sloane MS 1902 (Lang and Piorko, 2021) is a rare and early example of this type of cipher outside of a cipher manual (Kahn, 1996, 151).

Despite its prevalence in the tradition, alchemical secrecy, particularly regarding the use of cryptography, is understudied and not yet well understood. As of yet, there is no framework for the systematic study of alchemical techniques of secrecy. This paper presents an initial attempt to establish a theoretical foundation and framework for their interpretation and classification, as well as provide context for the historical analysis of alchemical ciphers. It argues that the distinction between ‘secret as content’ and ‘secrecy as practice’ provides an effective framework for interpreting alchemical rhetorics of secrecy and how they relate to alchemical cryptography.

2 Alchemy in the history of cryptography

Alchemy still lacks contextualization and adequate representation in cryptographical contexts: David Kahns *The Codebreakers*, a classic reference for cryptography studies, only mentions in passing that “[m]ysterious symbols were used in [...] astrology and alchemy [...] just as they were in cryptology. Like words in cipher, spells and incantations [...] looked like nonsense but in reality were potent with hidden meanings” (Kahn, 1996, 91). B. Láng conjectures, like many others have probably found, that alchemical or chymical encipherment does not seem to function in the same way as other types of secrecy in science do (Láng, 2018, 163, 165–166). He also remarks that “only a few ciphers applied in alchemical texts from before 1600 are known” (Láng, 2018, 165). Agnieszka Rec laments that alchemical ciphers remain a seriously understudied topic, especially given the abundance, even omnipresence of such devices in alchemical literature (Rec, 2014).

Some dedicated studies exist on the 17th century secretive practices and ciphers of chymists Robert Boyle (1627–1691) who is known as a public advocate for open communication in chymistry (Principe, 1992; Hunter, 2016) and the ones in George Starkey’s (1628–1665) laboratory notebooks (Starkey, 2004) who therein “employs the

full panoply of traditional alchemical cover-names – *Decknamen* – to describe the veiled processes that he employs” (Newman and Principe, 2003, 25). The goal of this article is to give context on alchemical techniques of secrecy as an explanation for why alchemical ciphering may be different from other kinds of historical cryptography. It proposes the distinction between ‘secret as content’ and ‘secrecy as practice’ as a fruitful explanatory framework for alchemical practices of secrecy.

3 Current trends in the historiography of alchemy

The switch from alchemical language to chemical nomenclature is generally considered a pivotal turning point in the history of chemistry. Some even argue that it is only with the *Méthode de nomenclature chimique* (1787) that modern chemistry was born during the ‘Chemical Revolution’ (Lefèvre, 2018). The long-held opinion that there was a ‘Scientific Revolution’ in the seventeenth century during which the scientific method emerged and amongst other things, secretive and obscure language in science was replaced by scientific openness is now widely contested within the history of science (Principe, 2011; Vermeir and Margócsy, 2012). The scholarly movement called ‘The New Historiography of Alchemy’ pioneered by Lawrence Principe and William Newman (Martinón-Torres, 2011) has demonstrated that the caesura between alchemy and chemistry is an artificial one (Newman and Principe, 1998; Newman, 2006). Importantly for the discussion of alchemical language, they have shown that most of the *Decknamen* which were formerly read as nonsensical products of the unconscious in Jungian and occultist interpretations of alchemy could, in fact, be translated to actual chemistry and the recipes they are contained in tested experimentally in a modern laboratory (Newman, 1996; Principe and Newman, 2001). This changed the historiography and public perception of alchemy so drastically that some have called it an ‘Alchemical Revolution’ in analogy to the metaphor of revolutions in earlier historiography of science (Reardon, 2011). While some have initially contested certain opinions expressed by Principe and Newman, the methods and theories of the ‘New Historiography of Alchemy’ have laid the foundation for what has become the *de facto* standard for alchemy research today and substantially contributed to its revival.

As part of this new historiographical turn, scholars have opted to be more deliberate in their use of terminology surrounding the alchemical tradition: For example, practitioners in the early modern period tended to call themselves ‘chymists’ rather than ‘alchemists’ which had become a slur. It is for that reason that the term ‘chymist’ and ‘chymistry’ shall be used for the early modern period, which is situated between Ancient to Medieval alchemy and modern chemistry, which only begins in the 18th century. It is, however, still appropriate to speak of an alchemical tradition when speaking of alchemy as a whole (as opposed to modern chemistry) which is why this article speaks of cultures of alchemical secrecy. These persisted well into the period when chymists were publicly calling for the abandonment of alchemical secrecy in favour of open language as part of a ‘rhetoric of openness’ (Golinski, 1990) demonstrated, famously, by individuals such as Robert Boyle, author of the 1661 *The Sceptical Chymist* (Principe, 1992). “The portrayal of chemical language as having recently freed itself from the obscurities of the past became a central feature of chemists’ rhetorical presentation of their discipline” (Golinski, 1990, 375). To help make sense of these contradictions, an interpretation framework from the field of secrecy studies will be used in this article.

4 Attempts at analyzing (alchemical) secrecy

Theoretical foundations have been laid by G. Simmel who established the secret’s sociological role as a tool for structuring hierarchy in a society (Simmel, 1908), and S. Bok, showing the secret’s difference from privacy as well as its philosophical and ethical implications (Bok, 1983). In the recent secrecy studies research of the history of crafts and science, Long has followed Bok and defined the secret as ‘intentional concealment’ different from the private or the unknown, focusing on the secret ‘as content’ (Long, 2001), whereas Vermeir follows Simmel in investigating secrecy as a practice and social phenomenon as well as its implications for group dynamics: Secrecy and openness, according to him, form a range rather than polar opposites, challenging scholarly work on the ‘Scientific Revolution’ which has implied a teleological move from secretive unscientific traditions to the openness of science (Vermeir, 2012). Vermeir and Margócsy also pointed out that not

only the ‘contents’ of secrets are interesting, but maybe even more so is the act of secrecy, its related social practices, and psychodynamics (Vermeir and Margócsy, 2012, 153). Benedek Láng has recently criticized the fact that secrecy studies and cryptology studies have, thus far, seldom been connected (Láng, 2018). Cryptology studies have mostly focused on solving ciphers and revealing their algorithms. Rarely have they asked about the socio-historical contexts and reasons why ciphers were used and from whom information encrypted using a specific cipher was actually hidden because, ultimately, “secrecy can only be defined in relation to a community with which one wishes to share the secret information” (Láng, 2015, 126). Similarly, secrecy studies have neglected the concrete results of secretive practices, that is ciphered texts. His claim is particularly relevant to alchemy since earlier existing theories on alchemical language, such as Umberto Eco’s ‘hermetic semiosis’ and ‘alchemical discourse’, consist of claims which are historically intangible in that they cannot be verified or validated using concrete examples of historical texts (Eco, 2016). Furthermore, their explanatory value for historical remnants of alchemical secretive practices, such as cryptography or other forms of veiled communication, is minimal.

5 The topos of the ‘alchemical secret’

Alchemy has a tradition of guarding secrets (Bachmann and Hofmeier, 1999, 9). The assertion that secrecy is a central aspect in the perception and discussion of alchemy is widely agreed upon in secondary literature (Ebeling, 2001; Principe, 1992, 63). Ebeling stresses that the concept of the secret itself has to be clearly distinguished from the reasons given for concealment practices (Ebeling, 2001, 63–64) which are themselves part of a ‘rhetoric of secrecy’. Principe, on the other hand, puts special emphasis on the question *from whom* a secret was supposed to be hidden, and conversely, for which audience it was intended to be comprehensible (Principe, 1992; Principe, 2000, 141). The type of secret most commonly associated with alchemy is the ‘hermetic secret’ or ‘empty secret’ as popularly criticized by Umberto Eco (Eco, 2016). However, this theory cannot stand any longer after the scholarly movement referred to as the ‘New Historiography of Alchemy’ has been able to show that, in fact, many of those

supposedly ‘empty secrets’ were not empty at all – historians of chemistry were able to read the secretive alchemical language chemically and recreate the processes described in the recipes in their modern laboratories (Martín-Torres, 2011). The encipherment of alchemical language was thus decrypted by means of ‘practical exegesis’ (Rampling, 2020, 63–64, 97–99, 354).

B. Láng suspects with regard to ciphers that, in some cases, a historical actor “might simply have regarded encrypting as a playful activity. He seems to invite readers for a game” (Láng, 2018, 159). Eamon called this the game of *venatio* (Eamon, 1994). Alchemical texts, too, tend to use encipherment in playful ways (Bilak, 2020), yet this is probably more pronounced in allegorical or emblematic contexts than with actual cryptography. As explanations for alchemical secrecy, scholars further cite the type of knowledge communicated or the fact that alchemical transmutation revolved around money and power (Eis, 1965) or stress that alchemical rhetoric of secrecy doesn’t differ from the oaths of secrecy present in other *artes* (Telle, 1978, 211). Vermeir notes that “alluding to secrecy might be the best way to disseminate your ideas” (Vermeir, 2012, 188) and “secrets publicized in print were often viewed as less valuable or proprietary than those confined to manuscripts” (Leong and Rankin, 2016, 15) or those confined to oral transmission altogether. Self-promotion was likely a strong motivation for engaging in theatrical performances of secrecy (Leong and Rankin, 2016, 13). Vermeir stresses that such rhetorics of secrecy were a powerful aspect of patronage and salesmanship:

To understand such phenomena, it is important not to be misled by the actors’ categories and not to take the rhetoric of secrecy at face value. There is nothing paradoxical, per se, in the dissemination of secrecy or the values of secrecy, and many of the secrets transmitted in the books of secrets were ‘open secrets’ that were already widely known and applied. [...] Cunning use of the rhetoric of secrecy was a powerful means of building a reputation, by advertising that one has a secret as widely as possible and at the same time carefully controlling access to the content of the secret (Vermeir, 2012, 180).

By framing their knowledge as precarious knowledge (Mulsow, 2012) and through self-fashioning as professors of this exclusive knowledge, entrepreneurial alchemists could make their knowledge and products seem more valuable in the ‘economy of secrets’ (Jütte, 2011). However, any alchemical techniques of secrecy have a dual function: not only do they promote their user as someone who may be in possession of valuable secrets, they also represent “performances of expertise in the marketplace” of entrepreneurial alchemy (Nummedal, 2007, 170–172).

6 Alchemical rhetorics of secrecy

Because one “cultural function of secrecy is to establish boundaries” (Eamon, 2006, 234), the content of the secret is sometimes secondary. Rather it is the fact *that* there supposedly is an information gap between different actors that matters. The intentional concealment needs to be made known to all parties involved and aims at generating a hierarchical imbalance of power. The rhetoric of secrecy is the strategic game that creates this asymmetric relationship between the one who has and the one who seeks knowledge (Lochrie, 1999, 93). Not all contexts where secrecy is performed involved actual secrets (Vermeir and Margócsy, 2012, 164). Early modern secrecy is theatrical and performative, oscillating between hiding and revealing; the secrets often only become meaningful when seen as performative acts: “[S]ecrecy and openness are norms or values that regulate behaviour” as well as “characteristics of practices” (Vermeir, 2012, 166). Vermeir criticizes a strong focus of past historiography on the contents of secrets while simultaneously disregarding their performative value in practices:

In many instances, what is kept secret is not even relevant for studying the dynamics of secrecy, i.e. the practices of simulation and dissimulation, the rhetoric of secretiveness, or the strategies of hiding and revealing that are employed. [...] As objects of desire, secrets accrue a special value, even if their content would in itself be valueless. They hide the real value of the content by keeping it hidden (Vermeir and Margócsy, 2012, 160, 162).

Like Vermeir stresses, a “rhetoric of secrecy communicates not facts but certain expectations,

attitudes, and feelings – it creates a fascination, a certain thrill – and invites certain behaviour.” It should therefore be kept separate from the assumed ‘contents’ of secrets (Vermeir, 2012). A rhetoric of secrecy doesn’t have to imply the presence of actual ‘secrets as content’. In the same vein, only because authors publicly call to abandon traditional alchemical means of communication does not mean that they themselves stop using alchemical stylistic devices or cryptography in their texts – despite promoting the opposite of calls to secrecy and rhetoric of keeping the alchemical secrets, calls to openness are part of the same theatrical tradition (Golinski, 1990). Even public advocates for the abandonment of the obscure alchemical language such as Robert Boyle were still using ciphers and code in their notes or correspondence (Principe, 1992, 63–67).

7 ‘Books of secrets’ and secret as content

A genre especially relevant to the question of alchemical secrecy are so-called ‘books of secrets’ (Eamon, 1994). When the term ‘secret’ is interpreted outside of its historical context, it can be misleading because we tend to associate meanings with it that may not have been as dominant historically as they are today: In the contexts of these so-called ‘books of secrets’,

the word ‘secret’ could also refer more specifically to a set of procedures known only to a select group of initiated individuals – in other words, craft or trade secrets. [...] This kind of secret was more about technical know-how, or ‘how to’, than hidden knowledge (although the two concepts were by no means mutually exclusive). [...] A secret could [...] be a physical object (a remedy) as well as the knowledge required to make it. (Leong and Rankin, 2016, 8–9, 12).

‘Books of secrets’ were a historical form of ‘how-to’ literature which usually contained all sorts of recipes describing processes that ultimately consist of “a set of operations known to any metalworker or distiller” (Smith, 2016, 48), yet they are marketed towards a popular audience as instructional manuals of didactic value (Eamon, 1994; Eamon, 2016). These books are a material container for crafts knowledge which had been viewed

as proprietary knowledge in Medieval times but became more profane with the advent of print, making techniques previously reserved to a select group available to anyone who was literate and thereby reducing the meaning of what used to be a ‘secret’ to a mere technique (Davids, 2005, 342–343). In the sixteenth century, the book market started to become flooded with *alchemica* and ‘books of secrets’, culminating in wide popularity during the seventeenth century, indicating that such books weren’t only interesting to a narrow group of experts and their potential customers. Books claiming to share the most secret of secrets often became instant bestsellers (Eamon, 2013, 60).

8 Secret publications

Beyond practices and performances of secrecy within alchemical texts, alchemical techniques of secrecy can also pertain to the mode of publication itself: Books with missing publication information are not a rarity in the alchemical context. Sometimes the secrecy even pertains to the physical books themselves: While we today assume that all books of one edition must be the same, in the context of hand-press print, this is often not the case. Parts of books are missing or added in some copies which were not included in the main issue – this is especially true for all materials in the front matter! –, publication information is left out. There is even the curious case of Arthur Dee publishing a ‘Rosicrucian issue’ of his 1631 *Fasciculus Chemicus* (1631) which would have gone unnoticed if detailed bibliographical analysis had not been performed on it (Piorko, 2019). The unicity of copies is thus another crucial element to be taken into account when dealing with alchemical print culture. In other cases, alchemists themselves admit to publishing their books as if they had not been published (to avoid sharing alchemical secrets with too big an audience, or so they claim). As an example, let’s consider alchemist Michael Maier’s (1568–1622) first printed book *Coelidonia* (Maier, 1609): He states that the book was published as though it had not been published.¹ The publication date (1609) and publication place (Prague) are encrypted on the back of the title page. In

¹Latin text: “Editus est enim hic liber, quasi non esset editus, cum nusquam publicatus aut vulgo prostitutus sit, sed in doctrinae filiorum gratiam, rarissimis exemplaribus inter privatos parietes conservetur.” Maier (1609), [*r].

his 1614 book *Arcana Arcanissima* ('Most Secret of Secrets'), Maier offers an introductory poem containing anagrams of his name (Maier, 1614; Tilton, 2003, 82). He also often contributed to the front matters of his friends' publications under the name anagram 'Hermes Malavici', highlighting the alchemists' tendency to publish anonymously. In the case of the anagram, Maier writes under a pseudonym, thus hiding his true identity from all except an initiated few. But it is also quite common in alchemy to publish eponymously, i.e. attributing one's work to an earlier authority to make it seem older than it is and more venerable. This is, for example, the case in the large corpus attributed to the 9th-century Arab alchemist Jabir ibn Hayyan (Principe, 2013, 33–45). A famous Western contribution to this corpus is so-called Pseudo-Geber who was actually a late 13th-century Italian monk (Newman, 1991).

9 Alchemical language and terminology

Now that we have seen rhetorics and practices of secrecy in advertising alchemical books, we will investigate the most prominent form of alchemical secrecy: its characteristic language and cryptographic stylistic devices employed by the alchemists. When creating terminology for the sciences today, scientists aspire to create unambiguous terms. However, most alchemical *Decknamen* are highly dependent on their context, even more than normal words. This is why alchemists and chymists can use them creatively to suit their own needs and occasionally also as an effective method of hiding the true meaning of their recipes from the uninitiated. This may initially seem arbitrary, however, the word substitutions are usually based on common properties of what they actually mean and the word they use in its place. Lawrence Principe shows an example of such concealment in Robert Boyle's laboratory notes.² Similarly,

²“Name substitution is ubiquitous in alchemical treatises where common words like *mercury* or *sulphur* cause endless confusion by their broad application to a myriad of different substances. Boyle uses this standard technique, for example, in a laboratory account dated 29 April 1657. The text describes a process wherein copper is dissolved, distilled, and extracted into a tincture which, when digested with tin, is able to tinge that metal with a yellow colour. [...] In three of the four cases where the word *copper* appears, it has been crossed through and the alchemical symbol for gold written above it (in the fourth case the metal copper is actually meant). Wherever *tin* occurs, that word has been replaced with either *Silver* or *Lune*. Boyle's corrections reveal the text as a receipt for the transmutation of silver into white gold. This

Michel Butor (Butor, 1990) and William Newman have stated that “[...] *Decknamen* are not arbitrary, they change their meaning with context” (Newman, 2018, 33). In the historiography of alchemy, those word substitutions or cover names omnipresent in alchemical texts have come to be referred to as ‘*Decknamen*’. The term is meant as a neutral term, thus the use of a German loan word. The problem with understanding alchemical language as terminology (*termini technici*) is that this does not adequately reflect its nature, as can easily be seen in the example of *Decknamen*. Our modern understanding of terminology is that of fixed unambiguous meanings, it evokes thoughts of chemical nomenclature, yet this is not at all what we encounter in alchemy.³ It shall be argued here, that it is more fruitful to conceptualize alchemical language as a specialist sub-language and its specificities as (cryptographical) stylistic devices.

Many older publications and lexica on ‘alchemical symbols’ actually refer mainly to iconic symbols, e.g. Lüdy (1928). While these undoubtedly range amongst the particularities of alchemical texts, they are only one characteristic aspect beside many others such as *Decknamen*, technical terms which do not match the criteria of being *Decknamen*, stylistic devices, rhetorics of secrecy, allegorical images, riddle conundrums and even cryptographical encipherment. While iconic symbols catch the eye immediately, it is still alchemical *Decknamen* which are the most typical alchemical devices. And although *Decknamen* may have their epistemological advantages for communicating chemistry in an age where many chemical phenomena were hard to quantify or analyze, many chemists themselves felt frustration with their ambiguous terminology. A whole range of alchemical lexica testify to this impetus which increasingly took off during the seventeenth century (Ruland, 1612; Sommerhoff, 1701).

substitution scheme is undoubtedly founded upon the similarity between copper and gold – the only coloured metals – and between tin and silver – the most brilliantly white metals. Word substitution is Boyle's most common method of concealment” (Principe, 1992, 64).

³Incidentally, terminology as a science in the modern sense began only with Eugen Wüster (1898–1977), see Wüster (1991). It thus makes no sense to apply present-day standards for terminology to alchemical language which originated even long before the early modern lexicographical and terminological endeavour of the emerging natural sciences.

10 (Re-)Solving *Decknamen*

The term *Decknamen* originally stems from an early 20th-century German Arabist tradition (von Lippmann, 1919; Ruska and Wiedemann, 1924) and was reclaimed as a neutral *terminus technicus* in the context of the ‘New Historiography of Alchemy’ by Lawrence Principe and William Newman (Principe, 1992; Newman, 1996).⁴ Contrasted with the somewhat related tradition of cryptography, *Decknamen* can be defined as symbol words employed as a substitute to avoid publicly naming which substances a recipe contains or to signify a specific chemical phenomenon for which there was no other adequate description. While some created neologisms or used somewhat consolidated terms to gesture to a certain substance or phenomenon with a relatively stable connotation (such as the ‘green lion’ for vitriol), others used allegories or figures from mythology creatively. This specific practice is referred to as mythoalchemy.⁵ *Decknamen* and other related phenomena are better thought of as cryptographical stylistic devices rather than terminology. This term acknowledges that they are not quantitative ciphers but are often used to conceal, too, albeit using a qualitative substitution logic.

Through the use of so-called performative methods in the history of science, the research tradition called the ‘New Historiography of Alchemy’ pioneered by Lawrence Principe and William Newman (Principe and Newman, 2001) was able to show using historical-critical replicative experiments that alchemy and chymistry’s peculiar language is a deliberate style, achieved by the use of encipherment techniques which, beyond merely hiding knowledge, also serves to appropriately communicate the multi-sensory experience which is chemical experiment. Like a cryptographical system, alchemical tropes such as *Decknamen* are employed in a way that may seem confusing, even inscrutable to outsiders, yet has a logic to it that can be utilized to get at their hidden

⁴They intentionally claimed this German term to avoid having to use an English one which might have a pejorative connotation, even though one might argue that the term ‘cover names’ entails a notion of intentional concealment in either case. This was actually a connotation Principe and Newman sought to avoid because many *Decknamen* function like simple *termini technici* and it would be misleading to assume that they are always employed with the deliberate intention of concealment.

⁵There is a whole research tradition on mythoalchemy (see Forshaw (2020)).

meaning. Cryptography is a less embellished and more practical way of hiding information, in contrast to the playfulness of *Decknamen* which is a performative gesture (secrecy as practice) as much as it is a means of encrypting information (secret as content). The importance of hermeneutics as a key skill of the able alchemist was already stressed by Zosimos who insisted that “only a correct interpretation of the earliest writings and of their hidden meaning could disclose the right way to perform alchemical procedures.” (Martelli, 2016, 227). Newman argues that showing off one’s ability to decode and write complicated alchemical language, thus the adept’s hermeneutic skill, served to establish credibility in an alchemist’s practical skills, establishing authority and showing that one had a righteous part in the tradition of older alchemists. He writes:

Alchemical writers delighted in announcing that they were going to explain a riddle – only to give the answer in the form of a conundrum. [...] The alchemists themselves maintained that a diligent reader could decipher their language to arrive at a correct alchemical *praxis*. [...] But there is another element that the reader was meant to derive from his alchemical sources. This was the aura of authority that a contemporary figurative text acquired by employing the metaphors utilized by older authors (Newman, 1996, 164).

It further offers certain epistemic advantages which is why, for example, in the plaintext decoded by Bean et al. (2022), alchemical texts may still contain their paradigmatic *Decknamen* despite being encrypted in a second layer of ciphertext. This shows that they serve a function complementary to mere encryption.

William Newman has provided descriptions of and names for the most common alchemical stylistic devices such as *Decknamen*, *parathesis*, *syncope* and *dispersio* (Newman, 1996, 159–188). The most important stylistic devices of the alchemical tradition are the ‘dispersion of knowledge’, that is spreading information over multiple passages or even books (which can be reunited if one pays attention to certain signal words), part of which can be the use of *syncope* (“the elliptical description of an alchemical process” as found in highly abbreviated recipes) or, on the other hand,

parathesis (“the heaping-up of synonyms for a given process, substance, or apparatus, again with the intention of bewildering the reader [. . . as] in the profusion of names used” for one single concept) (Newman, 1996, 187). These more complex stylistic devices usually also make use of the most basic element of alchemical style – its *Decknamen*. Table 1 presents a non-exhaustive list of alchemical techniques of secrecy.⁶

Technique	Example/Reference
<i>Decknamen</i> , specialist terminology	Newman (1996)
word/name substitution	Principe (1992)
dispersion of knowledge (<i>dispersio</i>)	Principe (1992, 65)
<i>parathesis & syncope</i>	Newman (1996)
monoalphabetic ciphers	Principe (1992, 67)
polyalphabetic ciphers	Bean et al. (2022)
iconic symbols & codes	Gaede (2017)
alphanumeric knowledge charts	Clucas (2017)
astrological horoscopes	Piorco et al. (2023)
cabbalistic mysticism	Forshaw (2013)
Lullian diagrams	Forshaw (2013)
emblems	Maier (1617)
(mythoalchemical) allegories	Forshaw (2020)
omitted or enciphered publication information	Maier (1609) Piorco (2019)
pseudonomia	Newman (1991)

Table 1: Non-exhaustive list of alchemical techniques of secrecy

11 Alchemical secrecy in practice

Bean et al. (2022) and Piorco et al. (2023) have presented a decrypted alchemical recipe called the *Marrow of Hermetic Philosophy*, found in a medical manuscript (British Library Sloane MS 1902), which contains astrological and alchemical predictions for health and death written by John Dee (1527–1608) and his son, Arthur Dee (1579–1651). Decoding the alchemical cipher within Sloane MS 1902 and tracing its copying in additional manuscripts have shed light on the dissemination of alchemical secrets within Anglo-Scottish knowledge networks of the seventeenth century. This manuscript, previously largely ignored in scholarly literature, came back into the public eye after the cipher contained in it had been

⁶Please note that alchemical symbols are only sometimes secretive when used in codes and ciphers. They most often have specific and fixed meanings or, if not, are used creatively by authors rather than with the intention to conceal necessarily.

decrypted in 2021 (Bean et al., 2021). The cipher used in the manuscript is an early example of a polyalphabetic Bellaso cipher, a strong encryption method, which was historically deemed undecipherable. By exploring the manuscript context in which the cipher was copied and transmitted, we gain invaluable insights into alchemical practices of secrecy and how alchemical secrets were shared. It also provides evidence for the dissemination of this cipher as part of a larger alchemical knowledge network. The same encrypted recipe, along with the Latin plaintext, was subsequently found in a manuscript at the University of Edinburgh (MS DC 1.30), archived with it dated laboratory notes describing the process in practice. An additional reference to the unique passphrase used to decrypt the ciphertext can be found in yet another alchemical manuscript at the Bodleian Libraries (MS Ashmole 1423). Corrections were made to MS Dc 1.30 between rows of ciphertext and in the margins, with some corrections appearing in both manuscripts. The likely author of this manuscript is Patrick Ruthven c. 1629. The evidence from mistakes in both manuscripts supports the argument that neither Ruthven nor Dee was responsible for the original encryption of the recipe.

The key phrase for the ciphertext, “Sic alter Iason aurea felici portabis uellera Colcho,” is adapted from the last lines of Giovanni Aurelio Augurello’s poem “Chrysopoeia Minor” (Soranzo, 2020, 35–39, 86–88, 110–121) which refers to the myth of Jason and the Golden Fleece in its last lines. Thus, in addition to the strong polyalphabetic encryption and the *Decknamen* present throughout the recipe, obscuring significant parts of the process to readers not deeply familiar with alchemical experiments, a mythoalchemical allegory is added to the mix. Augurello’s poem is not a retelling of the traditional myth of Jason and the Argonauts (as Jason is only mentioned in the last lines in the form of name-dropping), but most likely interprets the Golden Fleece as a mythical animal skin that could be used to create a book containing alchemical recipes. The encrypted recipe’s key phrase is an exceptionally long one, chosen likely to point readers to Augurello’s poem. If one interprets this as a signal for the stylistic device of *dispersio*, omitting relevant information in one place which the reader has to gather from another text, it may also be a clue as to why the encrypted recipe seems to be-

gin after a significant part of the experiment has already been completed. *Hermeticae Philosophiae Medulla*, thus, contains an encrypted mythoalchemical allegory that obscures a practical recipe shared via manuscript among a group of physicians seeking alchemical knowledge – or performing before other colleagues that they were in possession of such rare sought-after knowledge.

However, there are practical aspects of the manuscript copies of *Hermetiae Philosophiae Medulla* that remain mysterious regarding the circulation of this cipher. For instance, the cipher included in Sloane MS 1902 would have been impossible to solve with the incorrect cipher table provided, even with the key phrase. In contrast, a functioning cipher table was included in MS Dc 1.30, but with a partially incorrect key phrase. These two manuscript copies alone are insufficient for cracking the code and would have required external knowledge (likely the original copy) to use this recipe. Additionally, this cipher is unique in that there are hardly any examples of polyalphabetic ciphers from the first half of the seventeenth century, when monoalphabetic ciphering systems were still commonly used despite their cryptographic vulnerability. A second question that arises is the purpose of copying an unsolvable ciphertext and table into a medical manuscript in the first place. In the example of MS Dc 1.30, the Latin plaintext is included with the encrypted ciphertext, so the cipher has already been solved. However, in the medical notebook compiled by Arthur Dee, the broken cipher table and encrypted ciphertext, paired with the key phrase, function as a practice of secrecy independent from the practical recipe (which represents the ‘secret as content’). In both cases, the act of copying the cipher into an alchemical medical manuscript is itself a performative allusion to possessing the knowledge encrypted within the cipher, the ultimate alchemical achievement of the Philosophers’ Stone. Beyond the theatrics and performance of secrecy in the alchemical compilation networks of *Hermeticae Philosophiae Medulla*, this cipher highlights the importance placed by alchemical adepts on both the recipe obscured within the cipher (secret as content) and the practice of sharing, decoding, and obfuscating secret alchemical knowledge (practice of secrecy).

Another example for a cipher in the context of alchemy is Emperor Rudolf II’s “Alchemical Hand

Bell” (Bean et al., 2023). The cipher found on the handbell poses a significant challenge in deciphering, as there is little contextual information available. It remains unclear whether the cipher is a genuine code that has yet to be deciphered or serves some other symbolic function meaningful only to its creators. In this case, the next step is to determine whether a solution is even possible given just how short the ciphertext is.

12 Conclusion and future work

Alchemical ciphers remain an understudied field of research with much to be uncovered (Rec, 2014). As is evident from all the different techniques of secrecy described here, alchemical secrecy is a complex conundrum. It would be foolish to just look at alchemical ciphers in isolation without taking all these other phenomena into account. Alchemical secrecy is first and foremost a performance. And while some of the secrets of alchemy can adequately be described using the framework of ‘secrets as content’, many cannot. Those elements which are better described as ‘secrecy as practice’ or even ‘rhetorics of secrecy’ often provide the historical context we need to make sense of alchemical ‘secrets as content’. Ciphers are, in many ways, easier to analyze because statistics leave less room for interpretation than qualitative research. However, when the plain text does not yield much in terms of *why* the message was hidden or in which historical context, traces of all the other techniques of secrecy used by alchemists combined might yet provide us with sufficient information to ultimately make sense of the latter.

In order to advance systematic research on alchemical cryptography, it is a desideratum to create an inventory of known alchemical ciphers. In the author’s personal experience, many alchemy researchers have encountered enciphered texts in the archives before, yet they did not know what to do with them. They are also often not flagged explicitly in library catalogs: After all, many of them appear in handwritten collections which are often not cataloged in detail because there are simply not enough resources. If the cryptographical community continues to contribute valuable insights and increases the visibility of alchemical ciphers, more researchers might, in turn, come forward and share their findings in outlets such as this conference. If this venture is to be successful, we need to further nurture interdisciplinary collaboration in

which cryptologists contribute their skills in cryptanalysis and work together with historians to interpret the results. In fact, historians are needed both before the decryption, for the historical contextualization of the ciphers to narrow down possibilities in the cipher type analysis stage, and after the decryption for the interpretation of the results as well as for helping to evaluate the role of the enciphering method detected in the historical context it belonged to. Promising examples for such collaborations, such as Bean et al. (2022) and Piorko et al. (2023), have shown the gold mine of potential there is in combining the cryptanalysis of alchemical ciphers with a close reading of their historical context. The more alchemical ciphers are known and have been studied in detail, the more conclusions can be drawn about the use of cryptography in alchemy in general. The examples studied thus far have proven themselves to be exceptionally rich historical sources for both the history of alchemy and the history of cryptography.

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