



# Memorizing numerical data in the 17<sup>th</sup> and 18<sup>th</sup> centuries. Technical innovations and new practices

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## Abstract

Because the classical art of memory was part of rhetoric, Latin authors did not develop detailed techniques for memorizing numbers. During the Renaissance, some methods for memorizing numerical data were added to the *ars memoriae*, partly due to the growing readership of memory treatises among merchants. However, the memorization of numerical data remained a marginal topic in memory manuals, and the available techniques were cumbersome when dealing with multiple long numbers. As numerical thinking became prevalent in the “outillage mental” of the time, a specific mnemonic technique was devised in the 17th century. By converting numbers into consonants and then forming words by adding vowels, mnemonists could employ mental images to represent these words and effectively memorize the corresponding numbers. This paper aims to trace the spread of this new technique from France to the Holy Roman Empire and, in the 18th century, to England. Additionally, it will show how new fields of knowledge were incorporated into treatises of the 17th and 18th centuries. Thus, this paper will shed light on how the Scientific Revolution led to the development of new mnemonics by practitioners with sociological backgrounds different from those of Renaissance humanists and orators.

## Keywords

art of memory, mnemonics, mathematics, numeracy, textbooks

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## Article data

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Thinking of a ram's testicles in order to remember how to talk about witnesses in a trial: this is one of the examples given by the anonymous author of the *Rhetorica ad Herennium* to explain how memory techniques can be used to retain discourses.<sup>1</sup> Here the mnemonic is based on the phonetic similarity between “testiculos” and “testes”. To be more precise, the user of this “Ciceronian art of memory” must store images such as the ram's testicles in a mental building, into which he can enter to look at the images and retrieve the information they encode.<sup>2</sup> Since the Latin sources that refer to this *ars memoriae* are found in rhetorical manuals (the *Rhetorica ad Herennium*, Quintilian's *Institutio Oratoria*, Cicero's *De Oratore*), their authors focus on explaining how these techniques can help to memorize a speech. The scarcity of sources does not allow us to rule out the possibility that the Romans used the art of memory to retain numerical data, but there is no evidence that the *ars memoria* was ever used for this purpose.<sup>3</sup>

Two millennia later, the English vicar Richard Grey explained in his *Memoria Technica* (1730) how to memorize data such as the date of the creation of the world, the length of Mercury's revolution around the sun or the number of English feet in a Roman mile. Moreover, he doesn't rely on visualising mental images or on familiarity with a mental storehouse, but on learning and deciphering cryptic words such as “Ro-miloktu”. Neither Richard Grey nor his followers explained how to memorize discourses.

The difference between the classical *ars memoriae* and the eighteenth-century *Memoria Technica* is a striking example of the transformation of European “outillage mental”. Lucien Febvre, one of the two fathers of the French *Annales*, had the visionary idea of studying the intellectual tools of a given period. He set out to make a detailed inventory of the mental material available to the men of the era, because to understand what they thought, it was necessary to understand how they thought.<sup>4</sup> This paper aims to document how the so-called “scientific revolution” and the mathematization of human knowledge led to the creation of a new mental tool: the mnemonic substitution of numbers by letters. To do so, it will focus on three main authors: the mathematician Pierre Hérigone, the polygraph and cryptography enthusiast Johann Justus Winckelmann, and the pastor and Hebraist Richard Grey. The three of them seem to have discovered this method independently, by adapting cognitive patterns used in mathematics, cryptography, and Hebrew studies to mnemonics. Besides retracing the multiple origins of the numbers-letters equivalence technique, this article aims to suggest that the success of this method is rooted in the so-

<sup>1</sup> *Rhetorica ad Herennium*, III, XIX-XX.

<sup>2</sup> The expression is from Yates, “The Ciceronian Art of Memory”.

<sup>3</sup> The author of the *Rhetorica ad Herennium* used images as ordinal numbers, e.g. visualizing a golden hand to indicate the fifth images (III, XIX).

<sup>4</sup> Lucien Febvre called his readers to “inventorier d'abord dans son détail, puis recomposer pour l'époque étudiée, le matériel mental dont disposaient les hommes de cette époque”. Febvre in Wallon, *L'Encyclopédie Française*, vol. 8, 8'12-7.

ciological backgrounds of its users, which were different from those of the Renaissance humanists and orators who used the *ars memoriae*.

### 1. Memorizing numerical data in the Renaissance

Medieval monks developed a “craft of thinking” which included several mnemonics based on similar principles to the Ciceronian art of memory.<sup>5</sup> When the *Rhetorica ad Herennium* was discovered in the 12th century, the ancient *ars memoriae* was considered an inferior method of memorizing information to the medieval techniques.<sup>6</sup> This position evolved in the 13th and 14th centuries, particularly under the influence of Albert the Great and Thomas Aquinas, but also to meet the demand of the mendicant friars for techniques to facilitate their preaching. The medieval monastic tradition and the ancient rhetoric tradition merged together in treatises such as the *Ars praedicandi* by Francesc Eiximenis (c. 1327-1409).<sup>7</sup> Hundreds of manuscripts from the 14th and 15th centuries explain how to use this new version of the art of memory. The invention of the printing press led to the publication of memory manuals included in rhetorical treatises or as stand-alone books. Dozens of these manuals included a chapter on memorizing numbers.

The most common technique is to associate a mental image with each digit from 0 to 9 and with the tens. The most famous Renaissance memory teacher, Peter of Ravenna, used to imagine a Guelph for the number 1, a Jew for the number 3 and a cross for the number 10. So, to remember 11.3, he imagines a Guelph holding a cross (10+1) which a Jew is trying to snatch from his hands. Although the images chosen by Ravenna were not necessarily adopted by other mnemonists,<sup>8</sup> the possibility of combining tens and units within the same mental scene to signify a number made up of several digits was a common practice from the early Renaissance onwards. The image could be chosen for its resemblance to the shape of the digit (a stick for 1, a snake for 3), for its symbolic relationship to a digit, or for its association with a letter whose alphabetical rank corresponds to the digit (Anna for 1, Barbara for 2).<sup>9</sup>

If the images associated with the numbers can vary from one manual to another, the techniques used continue from the late Middle Ages to the mnemonists in our corpus. The Franciscan Filippo Gesualdo (1550-1618) used a dagger for the number 1, a pair

<sup>5</sup> Carruthers, *The Craft of Thought*, 10.

<sup>6</sup> Carruthers, “Rhetorical ‘memoria’ in Commentary and Practice”, 223-224.

<sup>7</sup> The manual is edited in Carruthers and Ziolkowski, *The Medieval Craft of Memory*, 189-204. See also Rivers, “Memory and Medieval Preaching”, or Rivers, *Preaching the Memory of Virtue and Vice*, 161-185.

<sup>8</sup> I will use the word “mnemonist” to refer to the users of the traditional, rhetorical art of memory.

<sup>9</sup> Matteoli, *Nel tempio di Mnemosine*, 158-159.

of scissors for 2, a triangle for 3, a pumpkin for 8, etc.<sup>10</sup> Similarly, the Dominican Juan Velázquez de Azevedo proposed a list based on the similarity between the shape of the object and that of the number, but he also gives a list of equivalences based on a symbolic relationship: the phoenix, a unique bird, refers to the number 1, shoes to 2, a glove to 5, and so on.<sup>11</sup> The association is sometimes based on the phonetic similarity between the name of the imaginary object and that of the number: the Franciscan Girolamo Marafiotto suggested using a chair to remember the number 7, since the word “sedem” is similar to “septem”. Similarly, an apple, which he calls “mila” in Italian, can represent the number 1,000.<sup>12</sup> The Theatine Paolo Arese suggests using people whose names evoke the number (the Count of San Secondo (near Parma) for 2, an “Ottavio” for 8, etc.)<sup>13</sup> It should be underlined that these techniques were not taught alone but alongside much more developed methods to retain concepts, words, sentences. Memory manual keep focusing on the memorization of discourses.<sup>14</sup>

Even if the techniques changed little, their use evolved in parallel with the role of numbers in the society. The Italian Renaissance is a perfect example of this phenomenon. The numerical mentality developed among the merchant and bourgeois elite, notably through the production of hundreds of handwritten or printed mathematical manuals, known as *libri d'abbaco*, which contained the mathematical know-how needed by merchants.<sup>15</sup> At the same time, several Italian memorization treatises explained how to memorize banking and commercial operations.<sup>16</sup> For example, a given price could be broken down into different coins: ducats in the right hand, lire in the left, sol (solidi) in the mouth and denarii on the head.<sup>17</sup> The change in mathematical practice by part of the audience for memorization treatises thus led mnemonists to provide techniques for memorizing prices, transactions, and so on.

Arithmetic practices kept evolving those of the 17th century were no longer those of the 15th century: mathematical recreations spread among the nobility and the urban elite; the use of numerical probabilities was developed at the end of the 17th century; the use of Arabic numerals became more widespread, in contrast to that of the abacus; the teaching

<sup>10</sup> Gesualdo, *Plutosofia*, 50r-51r.

<sup>11</sup> Azevedo, *El Fenix de Minerva y arte de memoria*, 88r.

<sup>12</sup> Marafiotto, *Ars Memoriae*, 63.

<sup>13</sup> Arese, *Arte di predicar bene*, 712.

<sup>14</sup> Poupard, “La méthode des loci”.

<sup>15</sup> In *Practical Mathematics in the Italian Renaissance*, Warren van Egmond inventoried 300 manuscripts and 150 printed editions of *libri d'abbaco* written between 1476 and 1600. On the arithmetical practices of Italian merchants before the 15th century, see e.g. Swetz, *Capitalism and Arithmetic*.

<sup>16</sup> For ex. Pack, “‘Artes memorativae’ in a Venetian manuscript”.

<sup>17</sup> Kemper, “*The Art of Memory as Cultural Transfer*”.

of mathematics spread in Jesuit colleges, and that of history included more chronological data represented by Arabic numerals, etc. This new numeracy could perhaps explain the success of a new mnemonic device, the numbers-letters equivalence.<sup>18</sup>

## 2. Pierre Hérigone and the substitution table

The numbers-letters equivalence is a technique that is radically different from previous methods of memorizing numbers because it does not necessarily rely on mental imagery and memory construction. The first known occurrence of this method is in a mathematical manual, the *Cursus mathematicus. Cours mathématique* (published between 1632 and 1642, with a reprint in 1644). Its connection with the traditional art of memory seems to be non-existent. It is difficult to be more specific, because the author of the *Cursus mathematicus* is Pierre Hérigone, whose name is clearly a pseudonym, the attribution of which is problematic. He has sometimes been identified with Baron Clément Cyriaque de Mangin or Denis Henrion (or even both at the same time).<sup>19</sup> It is true that many of the figures used by Hérigone in his manual can be found in Euclid's *Quinze livres des Eléments géométriques*, published by Denis Henrion in 1632. However, as the title page of the latter work states that these books were sold by the widow of the said Henrion, it seems that Henrion was not Hérigone.<sup>20</sup> Whatever the identity of Hérigone, he invented an "arithmetique memoriale" based on the substitution of numbers for letters.<sup>21</sup> He thought that names were easier to remember than numbers and and "that it would not be useless to make an alphabet by means of which any proposed number could be changed into easily pronounced names. For this change could be of some use in memorizing more easily the great numbers of epochs, & other things".<sup>22</sup>

As shown in Fig. 1, this technique is based on a table of equivalences between numbers and letters. Each digit corresponds to a consonant and a vowel. This double equivalence

<sup>18</sup> On these topics, see respectively Budnik, "Plaisir et récréations mathématiques en France au XVII<sup>e</sup> siècle", 57-67; Hacking, *The Emergence of Probability*, 2013; Schärli, *Du Zéro à la virgule*, 2010; de Dainville, "L'enseignement des mathématiques dans les Collèges Jésuites de France du XVI<sup>e</sup> au XVIII<sup>e</sup> siècle"; Romano, *La Contre-Réforme mathématique*, 187-206; Bruter, *L'Histoire enseignée au Grand siècle*.

<sup>19</sup> O'Connor and Robertson, "Pierre Hérigone", <https://mathshistory.st-andrews.ac.uk/Biographies/Herigone/>.

<sup>20</sup> These books "se vendent en l'Isle du Palais, à l'Image S. Michel, par la veuve dudit Henrion".

<sup>21</sup> Hérigone, *Cursus mathematicus*, 136-141.

<sup>22</sup> "Ce ne seroit chose inutile de faire un alphabet par le moyen duquel on peust changer tout nombre proposé en des noms faciles à prononcer. Car ce changement pourra avoir quelque utilité à retenir par cœur plus facilement les grands nombres des epoches, & d'autres choses", Hérigone, *Cursus mathematicus*, 136. By "grands nombres", Hérigone refers to numbers with several digits.

ARITHMET. PRACT. CAP. XVII. 137				
nr;	conson;	vocal;	vocal;	
1	p	a		In hoc alphabeto R non est littera, sed est nota, qua quinque posteriores vocales distinguuntur à quinque prioribus.
2	b	e		
3	c	i		
4	d	o		
5	t	u		
6	f	ar	ra	En cet alphabet R n'est pas une lettre, mais elle sert seulement de note, pour distinguer les cinq dernières voyelles des cinq premières.
7	g	er	re	
8	l	ir	ri	
9	m	or	ro	
0	n	ur	ru	
Idem autem numerus potest transmutari in diuersa vocabula, vt 1632 mutatur in <i>parce, prace, &amp; aface.</i>			Or le mesme nombre se peut changer en diuers noms, comme 1632 se change en <i>parce, prace, &amp; aface.</i>	

Fig. 1 – Hérigone, *Cursus mathematicus*, 2, 137.

allows the user to form sounds similar to French words for any number. This technique makes it possible to memorize numerical data specific to mathematics (as indicates the author, 3,14159, i.e. pi approximated to the first five decimal, is memorizable through the word “catador”), as well as chronology (the conquest of Rome by the Gauls in 389 is transformed into “ilor”). These examples did not prove that this technique has actually been used by the readers of the book or by Hérigone himself – who did not use it in the part of the *Cursus* devoted to chronology.<sup>23</sup>

The lack of reliable biographical information makes it impossible to study the genesis of his mnemonics. Nevertheless, I would like to propose a hypothesis based on Hérigone’s mathematical practice. The *Cursus mathematicus* was part of the “symbolic revolution” that took place at the end of the sixteenth and the beginning of the seventeenth centuries, which saw the codification of unknown measurements by letters and the introduction of symbols to denote algebraic operations.<sup>24</sup> In this context, Hérigone introduced a symbol-

<sup>23</sup> Hérigone, *Cursus mathematicus*, 159-254.

<sup>24</sup> Serfati, *La Révolution symbolique*; Dhombres, “De l’écriture des mathématiques en tant que technique de l’intellect”, 157-197 (page 171 focuses on Hérigone).

ic language that could be used in all branches of mathematics, and regularly used letters to represent unknown numbers.<sup>25</sup> It is possible that his habit of using letters instead of numbers gave him the idea of creating a mnemonic system based on the equivalence of numbers and letters. If this hypothesis is correct, Hérigone created a new intellectual tool without being influenced by the traditional, rhetorical art of memory.

### 3. *The numbers-letters equivalence in memory manuals*

Despite Hérigone's wide reception among French, Italian and English mathematicians, his "arithmetique memoriale" does not seem to have convinced his readers. In any case, it does not appear in the memory treatises of these countries. On the other hand, a similar technique appeared in the Holy Roman Empire, in the manual of Johann Justus Winckelmann (1620-1699 – not to be confused with the art historian). Winckelmann may have been introduced to mnemonics at an early age, as his father knew about the art of memory (he attended an exhibition of mnemonics held in Marburg in 1602 by the famous memory teacher Lambert Schenckel).<sup>26</sup> Otherwise, Winckelmann discovered the *ars memoriae* at the University of Marburg, which he entered in 1634. There, he studied history and rhetoric under Johann Balthasar Schupp, the author of a memory treatise.<sup>27</sup>

After completing his studies by travelling around Europe, Winckelmann published a manual under the name of Stanislaus Mink von Weinsheun entitled *Relatio novissima ex Parnasso de Arte Reminiscentiae* (1648), in which he set out both the memory palace method and a system of numbers-letters equivalence or, more precisely, number-consonant equivalence, as indicated in Fig. 2. The mnemonist, using this system, chose the vowels that enable him to form the words best suited to memorize the desired information.

Numbers	Letters	Numbers	Letters
1	B, P, W	6	M
2	C, K, Q, Z	7	N
3	F, V	8	R
4	G	9	S
5	L	0	D, T

Fig. 2 – Winckelmann, *Relatio novissima ex Parnasso de Arte Reminiscentiae*, s.l., s.n., 1648, 122.

<sup>25</sup> Esteve, "Symbolic language in early modern mathematics".

<sup>26</sup> Paëpp, *Schenkelius detectus*, 38.

<sup>27</sup> Schupp, *Mnemonica Ciceroniana*. It was published by his son in 1660. See Strasser, *Emblematik und Mnemonik*, 99.

Winckelmann illustrated this technique by explaining that we can remember that the University of Leipzig was founded in 1409 by Frederick I of Saxony thanks to the phrase “der Leib ziehet und WaGeTS wegen des Friedens”. The sentence itself is difficult to understand. It can literally mean “the body draws [something towards itself] and dares to do so because of peace”. If “ziehet” is considered metaphorically and poetically, it is also possible that the phrase means that “the body dies [literally: goes away, separates] and dares to do so thanks to peace”, which could be a proverb reminding us of the need to live in Christian peace and warning us against temporal vanities. Anyway, the technical process behind this phrase is much easier to understand. The word “Leib” phonetically recalls the name of Leipzig and “Friedens” the name of Frederick (“Friderico”). “WaGeTS” indicates the date 1409 according to the table of equivalences above. Other examples do not use phonetic similarity but rely on the meaning of the phrase to provide the information. For example, Winckelmann explains that it is possible to remember the founding of the University of Strasbourg by the city council in 1538 by learning a sentence that says that angry bourgeois (the inhabitants of the city) shot at the city hall using “PuLVeR” (powder). The last word indicates the year, while the story involves both the inhabitants and the representatives of the city authorities, reminding us that the University (then Jean Sturm’s *Haute École*) was founded by the Free City of Strasbourg.<sup>28</sup>

Was Winckelmann inspired by Hérigone’s “aritmétique memoriale”? Nothing is less certain. Although the German author does not hesitate to cite numerous bibliographic references, he says nothing about the *Cursus mathematicus*.<sup>29</sup> The plot of the *Relatio novissima ex Parnasso* may offer a clue to the origin of Winckelmann’s figures-consonants equivalence. The protagonist of the novel, Stanislaus, complains to his friend Memoratus about his health and his memory. Memoratus informs him of the existence of the art of memory and advises him to go to Mount Parnassus to learn it. Stanislaus travels to Greece, persuades Appolon to take him into his palace, meets divinities, plays chess, solves riddles and, three quarters of the way through the book (page 106 out of a total of 140), Mr Puschthom, a memory teacher, finally agrees to teach him mnemonics.

The choice of Mount Parnassus is, of course, symbolic, since “the mountain of the chosen ones of letters, like the land of the shepherds [Arcadia], is reserved only for disinterested and contemplative spirits who have turned their backs on the world of passions and vulgar interests and have devoted themselves to the *otium literatum*”.<sup>30</sup> Given the limited space devoted to technical instruction, it is clear that Winckelmann’s aim was not just to explain memory techniques – although this is emphasized in the full title of his book.

<sup>28</sup> Winckelmann, *Relatio novissima ex Parnasso de Arte Reminiscentiae*, 124-126.

<sup>29</sup> *Ibid.*, 90 and 111-113. It is possible that the authors did not read all the authors cited and only gave their name to impress his readers by accumulating a large number of references to prove his erudition.

<sup>30</sup> Fumaroli, *L’École du silence*, 38.



He also wanted to entertain his readers with a motley collection of intellectual ingenuity, playing a full part in the “aesthetics of technè” inherited from the sixteenth century.<sup>31</sup> To this end, he explained a number of cryptographic techniques.

He refers to Trithemius (from whom he reproduces a cipher table) and Gustavus Selenus, the pseudonym under which Duke Augustus the Younger wrote his *Cryptomenytices*.<sup>32</sup> Winckelmann might have found the idea of an equivalence between letters and numbers in one of these two authors. This technique can be found in the *Cryptomenytices*.<sup>33</sup> In fact, this idea is so fundamental to cryptographic methods that it can be found everywhere, for example in the explanation of the functioning of combination padlocks by Jean Borrel (also known as Butéo, c. 1492-c. 1572), an explanation reproduced by Duke August and by authors of books of secrets.<sup>34</sup>

Because of its narrative form, it is difficult to know whether the readers of the *Relatio novissima ex Parnasso* used it as a manual for practical purposes or simply as an entertainment. Only one of the seven copies I have studied presents traces of reading that can reasonably be dated to the early modern period.<sup>35</sup> It is no exception: Ian Maclean has shown that philosophical fiction is an inconsistent literary and publishing category, with texts used by a diverse readership.<sup>36</sup> Although its reception by the general public is uncertain, Winckelmann’s book enjoyed great success in the mnemonic tradition. His method of numbers-consonants equivalence became part of the common baggage of the mnemonists.

When Christian Knorr von Rosenroth described the memory palace method in his pedagogical treatise *Anführung zur Teutschen Stats-Kunst* (1672), he included this method to remember numbers. As showed in Fig. 3, his explanation differs a little from Winckelmann’s as he added the letter “X” and the sound “Sch”. Futhermore, unlike Winckelmann, who did not specify exactly how to learn the phrase signifying the number to be memorized, von Rosenroth explicitly used mental images. For example, he indicated that the number 930 can be replaced by “SaFT”, i.e. juice, “und stelle mir an einen Ort ein Glaß mit Safft” (placed in a mental place as a glass with juice in). Similarly, 325 becomes “FaKeL”, a torch to be visualized.<sup>37</sup>

<sup>31</sup> Klein, *L’Esthétique de la technè*.

<sup>32</sup> Winckelmann, *Relatio novissima ex Parnasso...*, 130. On this way to encrypt a text by Trithemius, see Strasser, *Lingua Universalis*, 53-55.

<sup>33</sup> Augustus II The Younger, *Cryptomenytices*, s.l., s.n., 1624, 316-320, 426-427. About Augustus II the Younger’s cryptography, see Strasser, “Herzog August Handbuch der Kryptographie” and Strasser, “Die kryptographische Sammlung Herzog Augusts”, 83-121.

<sup>34</sup> Augustus II The Younger, *Cryptomenytices*, 489-493; Schwenter, *Deliciae physico-mathematicae*, 548. About these padlocks, see Coumet “Un texte du XVI<sup>e</sup> siècle sur les cadenas à combinaison”.

<sup>35</sup> The copy of the Bayerische Staatsbibliothek, 4 [Paed.pr.](#) 46, shows pen strokes in front of bibliographical references relating to mnemonics.

<sup>36</sup> Maclean, “The Readership of Philosophical Fictions”, 7-15.

<sup>37</sup> Rosenroth, *Anführung zur Teutschen Stats-Kunst*, 36-37.

Numbers	Letters	Numbers	Letters
1	B, P, W	6	M
2	C, K, Q, X, Z	7	N
3	F, V	8	R
4	G	9	S, Sch
5	L	0	D, T

Fig. 3 – Rosenroth, *Anführung zur Teutschen Stats-Kunst*, Nuremberg, Johann Hofmann, 1672, 36.

The court preacher (*Ober- and Hofprediger*) Michael Wiedemann (? – 1719) adopted von Rosenroth's system but made slight changes to the equivalence table (see Fig. 4). Wiedemann, too, stressed the importance of choosing words that refer to things that can be perceived by the senses.<sup>38</sup> The same applies to the German memory teacher Johannes Henricus Döbel, who quoted Wiedemann several times, and whose table of equivalences is almost identical, except that he transforms the number 4 into both "G" and "J".<sup>39</sup>

Numbers	Letters	Numbers	Letters
1	B, P	6	M
2	C, K, Q, X, Z	7	N
3	F, V, W	8	R
4	G, J	9	S, Sch
5	L	0	D, T

Fig. 4 – Wiedemann, *Nützliche Gedächtniß-Kunst*, 74-75.

To sum up, the numbers-letters equivalences technique circulated throughout the Holy Roman Empire from 1648 until the early 18th century.<sup>40</sup> Despite the popularity of this technique, memory manuals authors continued to describe more traditional ways of memoriz-

<sup>38</sup> "Etwas sichtbares bedeuten": Wiedemann, *Nützliche Gedächtniß-Kunst*, 74-75. This advice, common in the mnemonic tradition, hints that Wiedemann did create mental images to memorize numbers (unlike, maybe, Winckelmann).

<sup>39</sup> Döbel, *Collegio Mnemonico*, 88, 89, 95.

<sup>40</sup> In addition to the examples already cited, Leibniz copied a table of this type, corresponding to Winckelmann's but removing the letter "T", Rossi, *Clavis Universalis*, 272. The memory teacher Erich Christoph Lübbern proposes the same table as Winckelmann's, but without the W and Z. Huldrich Sigmund Rothmaler, *Kanzleidirektor* of Stolberg, copied Lübbern's manual including the equivalences table. Lübbern, *Artificium memoriae, d. i. eine Gedächtnis-Kunst*, 18; Rothmaler, *Stolbergischer Garten-Bau*, 526.

ing numbers. This is particularly true of Winckelmann who, probably to astonish his readers with the sheer number of tricks he knew, presented no less than ten methods for memorizing numbers.<sup>41</sup> Similarly, Döbel suggested that if a reader finds that the table of equivalences does not suit him, he can use mental pictures, each of which represents a particular number. He then provided the reader with a traditional list of such pictures (a candle or knife for number 1, a fork for number 2, a triangle for number 3, a hand for number 5 and so on).<sup>42</sup>

In this way, the numbers-letters equivalences table is presented alongside, and even used in conjunction with, more traditional ways of memorizing numbers. Moreover, the memory manuals in which it is included contain lengthy explanations of how to memorize discourses and other textual information. If Hérigone developed the numbers-letters equivalence as a new tool for a readership interested in mathematics, the German authors presented this method as a tool that can be used in a variety of contexts and did not link it to a specific branch of knowledge.

#### 4. *The replacement of the Ciceronian art of memory by the numbers-letters equivalence in 18<sup>th</sup> century England*

A radical break in the use of the table of equivalences occurred in 18th century England. This innovation was the work of the pastor Richard Grey (1696-1771). Secretary to Lord Crewe, Bishop of Durham, until his death in 1721, he then became rector of several parishes. A Hebraist, he became interested in the numerical values assigned to each letter of the Hebrew alphabet and transposed this system to the English language. It therefore seems that he invented a table of numbers-letters equivalences independently of the continental mnemonists. The only source documenting the creation of this technique is Grey's own account in his manual, *Memoria Technica* (1730), and should therefore be taken with a grain of salt. He explains that his method differs from the rhetorical memory technique and seems to have consulted English treatises on memorization, whose jargon he uses ("places", "images" and, a term peculiar to English, "repository" to mean a large place).<sup>43</sup> There is no evidence that he read German treatises or the *Cursus mathematicus*. Since his method is closer to rabbinical mnemonics than to Winckelmann's, it is likely that his account is true.

Grey not only transposed the Hebrew numbers-letters system into English, but also modified it to memorize numeric data. While "the Representation of Numbers by Letters of the Alphabet hath been a Thing in Practice, more or less, almost in every Language", the

<sup>41</sup> Winckelmann, *Relatio novissima ex Parnasso...*, 112-129.

<sup>42</sup> Döbel, *Collegio Mnemonico*, 13-14.

<sup>43</sup> Grey, *Memoria Technica*, XII-XIII. I will use the 1732 edition as a reference, as successive reeditions are based on it.

substitution of letters for numbers was often lacking “in such Manner and Proportion, that any Number might be form’d into a Word capable of being articulately pronounced, and consequently more perfectly remember’d”.<sup>44</sup> This innovation led him to create the table of equivalences given in Fig. 5.

Numbers	Letters	Numbers	Letters
1	A, B	6	AU, S
2	E, D	7	OI, P
3	I, T	8	EI, K
4	O, F	9	OU, N
5	U, L	0	Y, Z

Fig. 5 – Grey, *Memoria Technica*, 1732, 1-2.

As with Hérigone, the equivalence of each number with a phonetic vowel (formed by one or two graphic vowels) and a consonant allowed Grey to mechanically form words whose pronunciation resembles the sounds of his native language.<sup>45</sup>

Grey combined this equivalence with another technique he discovered while studying Hebrew: the use of what he called “Artificial Words” such as “*Rambam* for R-abbi M-oses B-en M-aimon”. He understood how to organize information by means of acronyms, and precised, “I am not certain whether I owe not to Observations of this Kind the first Hint of this Method, which I have carried so far”.<sup>46</sup> In fact, it was by combining the acronyms with the equivalences table that Grey gave shape to his system. For example, he took the date of the Flood, set at 2348 B.C., and transforms it into “etok”. He then combined the numerical data (etok) with the qualitative information (it is the date of the Flood) and synthesized the two into a single “artificial word”, “*Deletok*”.<sup>47</sup> Anyone who knows the equivalence table and remembers *Deletok* can deconstruct this word and retrieve the thematic (the Flood) and numerical (2348) information it contains.

These two mnemonics are well known to Kabbalists. Numbers-letters equivalence, or “gematria”, makes it possible to assign numerical values to words in the Torah (by adding the numbers corresponding to the letters of which they are composed) and to exchange them for other words of the same value, while “notarism” consists in transforming a word

<sup>44</sup> *Ibid.*, XII-XIV.

<sup>45</sup> This double equivalence gives rise to polysemy, since 325 can be written as “tel” as well as “idu”, *ibid.*, 4.

<sup>46</sup> *Ibid.*, XV.

<sup>47</sup> *Ibid.*, 6.

into an acronym whose letters form the initials of the words to be found.<sup>48</sup> These exegetical techniques have existed since antiquity, and as the reading of Hebrew developed in the early modern period, it is possible that other scholars had already developed methods similar to Grey's.<sup>49</sup> Nevertheless, the Englishman was the first to have his memory manual printed. The book was reprinted many times because it met a relatively widespread need: it provided a key for easily memorizing a large number of numerical data.

Most of this data consists of dates. Grey made it clear on the first page of his preface that “men of reading” complained that they do not retain everything they read, and that “in no Part of Literature is there greater Room for this Complaint than in *History*”, the study of which requires “a distinct and accurate Knowledge of *Chronology* and *Geography*”. The first part of his textbook is therefore devoted to memorizing chronology, beginning with the sacred history, various ancient dynasties, the kings of England, and so on. When Grey wanted to remember that Tarquin the Superb (“Tarquinius Superbus”) reigned from 532 (i.e. “lid”), he condensed this information into “Superlid”.<sup>50</sup> He sometimes explained the choice of dates to memorize. For example, he specified that he dated the beginning of Caesar's reign from the death of Pompey, and that of Augustus from “the full Establishment of his Authority by the Senate and People”.<sup>51</sup> He also gave dynastic indications when a title or succession is in question, for example, noting that “Darius the Mede” is also called “Cyaxares” and is the uncle of Cyrus.<sup>52</sup> Each chronological table is followed by “Memorial Lines” which are a few lines of text containing all the “artificial words” that indicate the dates to be memorized. The example of the table of the judges of Israel (Fig. 6) shows how the page layout structures the various pieces of information.

The chronology is the most annotated part of the textbook. Of the 19 annotated copies of the *Memoria Technica* that I have consulted, 12 bear reading marks in the chronological section. Some readers corrected one or several “artificial words” distorted by typographical errors, such as the owner of the copy now in the Wellcome Library under the shelfmark EPB/A/25735/1, who corrected “Ibcake” to “Ibzake” (to refer to the judge of Israel Ibzan, 1182). A reader of the copy in the JJ Memory Systems box at the Bodleian Library corrected what he believes to be a factual error regarding the date of the invention of printing, stating that “printing was discovered Anno 1440, or rather invented then, and kept secret till 1449”. This kind of factual corrections is the most common type of reading annotation, appearing in five of the examined copies.<sup>53</sup> This type of annotation is much

<sup>48</sup> Busi, *La Qabbalah*. In Jewish tradition, the creation of acronyms also exists as a mnemonic device. Gerhardsson, *Memory and Manuscript*, 155-156.

<sup>49</sup> Neusner, *The Memorized Torah*; Gerhardsson, *Memory and Manuscript*.

<sup>50</sup> Grey, *Memoria Technica*, 38.

<sup>51</sup> *Ibid.*, 40.

<sup>52</sup> *Ibid.*, 27.

<sup>53</sup> Toronto, Thomas Fisher Rare Book Library, B-11 09271 (2); BoL, 70 b.45; BoL, JJ Memory

T A B L E IX.  
*The Judges of Israel from the Death of Moses  
to Samuel.*

	Bef. Chr.
MOSES moritur [Mof-mola]	1451
JOSHUA [Jóshfol]	1445
OTHONIEL [Othózu]	1405
EHUD [Ehutel]	1325
DEBORAH [Debodeil]	1285
GEDEON [Gedol]	1245
ABIMELECH [Abmets]	1236
THOLA [Thlett]	1233
JAIR [Jáidaz]	1210
JEPHTA [Jephtakk]	1188
IBZAN [Ibzáke]	1182
ELON [Eloboil]	1175
ABDON [Abdonafó]	1164
ELI [Elíbuþ]	1157
SAMUEL [Sambap]	1117

*The Memorial Lines.*

Mof-mola Jóshfol Othózu Ehutel Debodeil Gedol  
Abmets.  
Thlett Jáidaz Jephtakk Ibeáke Eloboil & Elíbuþ.  
Abdonafó Sambap ———

Fig. 6 – Grey, *Memoria Technica*, 1756, 21.

rarer among manuals of the Ciceronian art of memory.<sup>54</sup> English history is of particular interest to readers. For example, the annotator of the copy of the 1732 edition now in the Bodleian Library, shelfmark 70 b.45, numbered the English rulers from William the Conqueror onwards and indicated that Henry II was a “Plantagenista” - he was indeed the first king of England from the House of Plantagenet.

Many readers added the year of the coronation of George III (1760-1820). Since *Memoria Technica* was published during the reign of George II (1726-1760), it is logical that George III (1760-1820) does not appear in the chronology of the Kings of England. Thus, the owner of the copy now in Manchester University Library, Spencer Collection 4165, added a line below that of George II. He gave the date of the coronation and the artificial word he used to commemorate it. He also added the latter to the “memorial line” at the

Systems 1; BL, 1030.c.20; Cambridge University Library, 7180.d.121.

<sup>54</sup> There are some counterexamples, such as the copy of De Azevedo’s *Fenix* held at the Biblioteca Nacional de España, R/21921, which contains the rectification of a quotation from saint Augustine.

bottom of the page. Subsequent editions of the manual, up to and including 1799, do not include George III's name along with a mnemonic to help remember 1760.<sup>55</sup> However, I have found no other record that can be reasonably dated to the 18th century making up for this omission. For example, the user of a copy of the 1790 edition, whose spelling suggests that his notes date from the late 18th or early 19th century, added contextual information on Roman history but left the incomplete list of English rulers untouched.<sup>56</sup> His interest was solely in ancient history. Sometimes the lack of interest seems to concern George III alone. For example, the annotator of 7180.d.121 in the Cambridge University Library (1781 edition) corrected the biographical data for Sophocles (p. 37) and Mary Stuart (p. 15) but did not add the date of George III's coronation.

When readers of the *Memoria Technica* decided to update Grey's chronology, they were not so much concerned with the addition of George III as they were with the correction of dates they considered erroneous. Thus, a blank page at the beginning of copy 1030.c.20 in the British Library contains a note on the chronology of the Maccabees written by a certain "S. Wilton" in 1769, while an anonymous reader, dating his note to June 1790, summarizes the table of equivalences in two lines and added that he has corrected Grey's dates on the basis of John Blair's *Chronology and History of the World*. For example, he changed the date of the destruction of Troy (1184 instead of 1183), the artificial word ("Troyabeif" instead of "Troyabeit") opposite the date, and in the "Memorial Line" at the bottom of the page. The date corrections are accompanied by a capital "B", clearly indicating that the new date comes from Blair's chronology.<sup>57</sup> Despite this interest in Grey's mnemonics (the corrections continue on subsequent pages), the unknown annotator did not add George III to the list of English monarchs. He clearly did not wish to memorize the history of European dynasties, but only sacred and/or ancient history.<sup>58</sup>

Not every copy contains such interesting *marginalia*. Indeed, I have also consulted 41 copies with no reading marks datable for sure from the early modern period, and librarians I contacted through mail assured me that 24 others included no traces of reading. Moreover, some *marginalia* remain difficult to interpret: a copy in the Thomas Fisher Rare Book Library, B-11 09271 (2), Toronto, contains chronological corrections probably made by an 18<sup>th</sup> century reader. This reader did not change the corresponding artificial words. Did this reader use Grey's method, or did he prefer to use the *Memoria Technica* as a chronological table to consult when needed? It is impossible to answer this question definitively.

<sup>55</sup> Grey, *Memoria Technica*, 1799.

<sup>56</sup> BoL, (OC) 260 g.364.

<sup>57</sup> See Grey, *Memoria Technica*, 1737, copy of the BL, 1030.c.20, 9. For the date of Troy's destruction, see Blair, *The Chronology and History of the World*, C1v.

<sup>58</sup> On the importance of classical erudition in early modern Europe, see the numerous works by Anthony Grafton and Scott Mandelbrote.

The second part of the *Memoria Technica* is devoted to geographical information. With 45 pages, it is also an important part of the manual, although it has received less attention from the annotators than the chronology.<sup>59</sup> It contains no figures and is based entirely on the acronym principle. Grey suggests learning three acronyms to memorize French geography: P Nor-I-cham, Bret-O-BuL, Gui-La-DaP, meaning “P-icardy, Normandy, I-sle of France, and Champagne” for northern France, “Bretagne, O-rléanois, Bourgogne, and L-ionnois” for central France, and “Guienne with Gascony, Languedock, Dauphiny, and P-rovence” for southern France.<sup>60</sup> It includes a few numerical data, such as the distance of major English cities from London, but mostly relies on the acronym method.<sup>61</sup>

The last three parts, devoted to memorizing astronomical dates, weights, measures and coins, and miscellaneous information, seem to have been of much less interest to readers.<sup>62</sup> The indications on how to memorize the diameter of the moon, the distance of the earth from the sun, the table of revolutions around the sun, etc., did not generate any notes.<sup>63</sup> It is true that the practical application of astronomical data is the subject of special manuals containing other mnemonic devices, such as “zodiac songs”.<sup>64</sup> Weights, measures, and coins are rarely more popular, perhaps because most of the figures given concern units used in antiquity and not in the 18th century. However, at least one reader was sensitive to this section, and in a copy bequeathed to the College by David Hughes, Vice-President of Queen’s College, Cambridge, on his death in 1777, several marginal notes indicate and/or organize information to be memorized. An artificial word is also corrected.<sup>65</sup>

Chronology and geography represent the lion’s share of the manual, which can be ex-

<sup>59</sup> It is difficult to date the reading marks on the National Library of Wales copy BF383 G84, as they consist of red lines underlining certain names in the chronological and geographical sections. As this copy of the 1732 edition belonged to a certain William Miles Junior from 1735 or 1736, it is likely that they date from the 18th century. Though the copy in the National Library of Ireland, J.154.GRE, contains a cross near the memorial line for learning the geography of Libya and Palestine, but since this is a copy of the 1796 edition for which we have no ownership mark, it is safer to assume that it dates from the 19th century.

<sup>60</sup> Grey, *Memoria Technica*, 1732, 54-55.

<sup>61</sup> *Ibid.*, 74.

<sup>62</sup> A possessor of the copy now preserved at Indiana University, The Lilly Library, BF383. G84 1732, underlined “Geography” and “Astronomy” on the title-page of the *Memoria Technica*.

<sup>63</sup> Grey, *Memoria Technica*, 1732, 99-109.

<sup>64</sup> Gent, “Het Sterrenlied in het Hollandse Zeevaartonderwijs”; Schotte, *Sailing School*, 56-57.

<sup>65</sup> Grey, *Memoria Technica*, 1732, the copy is in the Old Library of Queen’s College, Cambridge, A.19.11, 117-137. A “1” added in a margin resembles the “1” on David Hughes’ bookplate (“Col. Regii apud Cant. Socii 1734”). While this is a rather weak paleographical clue, the proximity of the date of the bookplate to that of the textbook’s publication suggests that the annotations were indeed made by David Hughes (or by a member of Queen’s College after Hughes’ death). It should be noted that Hughes also owned the *Mnemonics delineated in a small compass and easy Method* from Salomon Lowe, today held in the same library with the shelfmark P.129(12).



plained by the audience Grey had in mind when writing his textbook. He stressed the importance of accustoming “Young Minds” to his mnemonics, which would give them “no small advantage in the Course of their future Studies”. The youth of the students to whom Grey disseminated his technique implies that his real audience was “those who have the Education of young Students in the Universities and Public Schools”.<sup>66</sup> In other words, Grey was addressing teachers who needed to give their students a classical background.

### 5. Teachers’ view of the *Memoria Technica*

During the 18th century, this classical education – and the way it was taught – came under increasing criticism. Although grammar schools varied in status (completely free, private or semi-free, depending on the background of the pupils), they all offered a broadly similar education until the second half of the 17th century.<sup>67</sup> Pupils were usually divided into eight classes.<sup>68</sup> The most basic lessons were reading, catechism, and psalms. Grammar (Latin) was taught, followed by simple texts (dialogues, fables, collections of epigrams). Only the oldest students learned to read classical Latin prose, poetry, and occasionally Greek and Hebrew.<sup>69</sup>

Teachers and educators who wanted to change the curriculum often combined the acquisition of grammar and ancient culture with rote learning. Memory overload became a negative *topos*, while the importance of knowing how to think rather than memorize was frequently emphasized.<sup>70</sup> The lack of practical usefulness of traditional teaching was highlighted.<sup>71</sup> In this context, the ubiquitous memory exercises are seen as tedious and unhelpful, and some teachers, such as John Clarke, Master of Hull Grammar School, believed that the strength of memory depended solely on nature and not on training, making these exercises even more useless.<sup>72</sup>

The information contained in the *Memoria Technica* was part of the teaching that requires a great deal of memorization. For example, J. Girard, who insisted on the usefulness of memory, explained the importance of teaching children “in the Parts of Knowl-

<sup>66</sup> Grey, *Memoria Technica*, 1732, [A]2, X.

<sup>67</sup> Watson, *The English Grammar Schools to 1660*. This uniformity is due in particular to the state control exercised over teachers and part of the curriculum from Elizabeth 1 onwards. Lawson and Silver, *A Social History of Education in England*, 100-101.

<sup>68</sup> Tompson, “Classics and Charity: the English Grammar School in the 18th Century”, 57.

<sup>69</sup> On the content of the teaching provided in the *grammar schools*, see Watson, *The English Grammar Schools to 1660*.

<sup>70</sup> For ex., respectively, Butler, *An Essay upon Education*, 42-44 and Evans, *An Essay on the Education of Youth*, 31.

<sup>71</sup> For instance, Stevenson, *Remarks on the Very Inferior Utility of Classical Learning*. The book’s title sums up its thesis perfectly.

<sup>72</sup> Clarke, *An Essay upon the Education of Youth in Grammar-Schools*, 52.

edge of such Things [...] which require little more than Memory, such as Geography, Astronomy, Chronology, and History”.<sup>73</sup> Similarly, historical dates, in addition to Greek and Latin, were sometimes considered a burden on children’s memory.<sup>74</sup> In other words, whether teachers were for or against teaching the classics, there is a consensus that history, chronology, and geography were subjects that required memory.

From then on, some moderate reformers found in the *Memoria Technica* a way to teach classical, historical knowledge more easily than by imposing rote learning on their students. This was the case of George Croft, a teacher at Beverley Grammar School from 1768, who defended the classical curriculum (including basic Hebrew) while wanting to open it up to the rudiments of algebra and geometry.<sup>75</sup> He noted that “if the pupils could be made to repeat Gray’s *Memoria Technica*, it would be of great service, but I have heard of few instances where this was practicable”.<sup>76</sup> The polymath Joseph Priestley, who taught modern languages and rhetoric at Warrington for several years, was enthusiastic about pedagogical innovations that promoted the learning of history. The *Memoria Technica* was one such method, and he found it so useful that he considered “all persons of liberal education inexcusable who will not take the little pains necessary to make themselves masters of it”. Only its application to geography seemed to him “unnatural and useless”, perhaps because it did not rely on memorizing numerical data.<sup>77</sup>

Several authors compared the traditional *ars memoriae* to Grey’s novelty. Some were convinced by the innovation, such as John Holmes, master of the grammar school at Holt (Norfolk) and author of a treatise on rhetoric, who criticised the Ciceronian art of memory and cited Grey’s and Lowe’s manuals as improvements.<sup>78</sup> Others, such the philosopher and educator Isaac Watts, concluded that whichever mnemonics are of little use.<sup>79</sup>

As *Memoria Technica* became a long-seller (it was republished in 1732, 1737, 1756, 1778, 1781, 1790, etc.), works derived from its content were also published. Thus, Solomon Lowe (? – 1750), “master of a private academy at Hammersmith, and an accurate grammarian” published a *Mnemonics delineated in a small compass and easy Method* (1737) based on Grey’s manual.<sup>80</sup> Lowe was a prolific educator in the 1720s and 1730s, and his *Mnemonics* is one

<sup>73</sup> Girard, *Practical Lectures on Education, spiritual and temporal*, 169.

<sup>74</sup> Turnbull, *Observations upon Liberal Education*, 273.

<sup>75</sup> Tompson, “Classics and Charity”, 90.

<sup>76</sup> Croft, *A Short Commentary*, 189.

<sup>77</sup> Priestley, *Lectures on History and General Policy*, 156-157.

<sup>78</sup> Holmes, *Art of Rhetoric Made Easy*, 4.

<sup>79</sup> Watts, *The Improvement of the Mind*, 274-275. Watts He explained the classical art memory, supposedly based on the treatise of Marius d’Assigny (1643-1717), as he precised how to use animals as a spatial structure to store information and give similar examples of images as in Assigny, *The Art of Memory*.

<sup>80</sup> *The Gentleman’s Magazine*, 580.

of many treatises he published to summarize a discipline for his students or to promote his pedagogy.<sup>81</sup> This short manual (14 pages, 18 including paratext) gives the equivalence table of Grey's system without explaining how it works, which prevents readers from using it independently. In addition, Lowe condenses a lot of information from the *Memoria Technica*, making his mnemonics much denser and less readable than the original version. It's possible that he used his booklet as a means of advertising: the narrow lines filled with cryptic words were intended to attract the reader's attention, who would then discover the wide range of teachings Lowe offered, from mathematics to chronology, astronomy, geography, and some physical experiments. The addition of the lunar and epact cycles, as well as the solar cycle and the Sunday letters, orient the astronomical section toward more detailed information.<sup>82</sup>

The publication of *Selected Parts of Grey's Memoria Technica* (1786) confirms the importance of the school audience in the publishing history of Grey's textbook. Indeed, the title page states that this book is "for the use of the GRAMMAR-SHOOL at WOLVERHAMPTON", where it was published. The circumstances of its publication are rather vague, since the *Selected Parts* were published at a time of crisis: the Board of Directors was renewed on October 13, 1784, but its members had no teaching experience. The beginnings were inglorious, the organization debated by disgruntled parents, and the situation stabilized only with the arrival of Professor William Lawson in 1778.<sup>83</sup> During this period of uncertainty, it's possible that the publisher, Joseph Smart, decided to publish this book on his own initiative to sell to the students of Wolverhampton Grammar School. It is also possible that he was commissioned by the school's trustees.<sup>84</sup>

Smart explained his approach to making the textbook more suitable for grammar schools: "the probable Reasons why Grey's *Memoria Technica* has not been more generally received in Grammar Schools [...] are, that it abounds with Matter which has not strict Relation to Classical Authors, and that it is extended to Branches of Knowledge, such as Geography, Astronomy, &c where the Necessity of the Art is not so evident, and the Difficulty of Application is much greater."<sup>85</sup> He therefore lightened Grey's examples, retaining only ancient history and that of the kings of England and the United Kingdom, as well as

<sup>81</sup> This was common practice in his day. See Tompson, "Classics and Charity", 91-93. Three of the six copies I was able to consult are bound with at least one other of his treatises (BL, 1568/1298 (1); BoL, Johnson e.705 (1); Cambridge Queen's College, P.129(12)). Copy 95 of the Fondo Young in San Marino has lost the list of books published by S. Lowe. This is the only salient material feature I was able to observe. None of the six treatises consulted contains any trace of reading.

<sup>82</sup> Lowe, *Mnemonics delineated in a small compass*, 6-7.

<sup>83</sup> Mander, *The History of the Wolverhampton Grammar School*, 199-205.

<sup>84</sup> The local nature of production explains the small number of manuals I have found (only three of them): National Library of Scotland, Mf.134, reel 11219, no. 08; Biblioteca Pública Municipal de Santa Cruz de Tenerife, Biblioteca Central, TF-BM, 37-4-9; BL, 9008.a.15.

<sup>85</sup> Smart, *Select Parts Grey's Memoria Technica*, π2r.

geography.<sup>86</sup> The addition of extracts from Johannes Sleidan's *De quatuor summis imperiis* reinforces the importance of ancient history in this textbook.<sup>87</sup>

Having discovered the publishing potential of the *Memoria Technica* through the publication of the Select Parts, Smart participated in the republication of Grey's Manual with W. Lowndes in 1790.<sup>88</sup> The last page of the manual is used to advertise the other books printed for Lowndes. These include dictionaries, Italian and French grammars, manuals for learning arithmetic, Latin literature and grammar, etc. In short, the books advertised are aimed at a school market, another indication that *Memoria Technica's* audience is made up of teachers, tutors and parents of students, as well as self-taught learners.

As is often the case, the analysis of ex-libris and reading traces complicates the situation, as the signs of ownership reveal a readership far removed from the academic world. Several nobles owned a copy of this book, such as John Baker Holroyd, first Earl of Sheffield, or George John (1758-1834), second Earl Spencer.<sup>89</sup> So did several members of Parliament, such as Richard Hopton and John Weyland.<sup>90</sup> These four are among the thirty or so individuals who left ownership marks on copies of the *Memoria Technica* published between 1730 and 1790. At least two of them were women. On the other hand, I have found no ownership marks that allow us to associate copies with grammar school teachers, probably because their books were less well preserved than those of England's political or economic elite.

Although the contours of Grey's audience are difficult, if not impossible, to define, the fact remains that all his readers share the same numerical mentality. The spread of Arabic numerals in England seems to have reached the mass of the literate population by the end of the 18th century. The increase in the use of Arabic numerals therefore seems to have been caused by the rise in literacy, as well as the proliferation of practical mathematics textbooks written in English.<sup>91</sup> By the end of the 17th century, textbooks were focusing less on the basics of arithmetic and more on specific applications of mathematics. This development shows that knowledge of basic arithmetic had spread throughout society

<sup>86</sup> Smart always proceeds by subtraction: he removes whole sections of Grey's manual but never adds new data to memorize, not even the date of the beginning of George III's reign.

<sup>87</sup> About Johannes Sleidan's *De quatuor summis imperiis*, see Kess, "Johann Sleidan and the Protestant vision of history".

<sup>88</sup> The collaboration between Smart, listed as printer, and Lowndes is probably more complex than a simple printer-publisher relationship. In addition to Smart's familiarity with *Memoria Technica*, it is notable that his name, and that of his city, are printed in larger type than those of Lowndes and London. Grey, *Memoria Technica*, 1790.

<sup>89</sup> Respectively, Barcelone, Biblioteca de Catalunya, R(1)-8-95 and Manchester University Library, Spencer Collection 4165.

<sup>90</sup> BL, 08311.h.125 and BoL, JJ Memory Systems 1.

<sup>91</sup> Otis, "Set Them to the Cyphering Schoole": Reading, Writing, and Arithmetical Education, circa 1540-1700". See also James, "Reading numbers in early modern England".

and was no longer considered interesting enough to justify the purchase of a book.<sup>92</sup> Nevertheless, the mentalities changed only slowly: the association of mathematical symbols with diabolical devices can be found well into the 17th century.<sup>93</sup>

This greater penetration of Arabic numerals into society was largely the result of extracurricular or technical teaching, but it began to affect grammar schools as early as the second half of the 17th century.<sup>94</sup> As arithmetic was often considered a secondary subject to Latin, it was often taught on Saturdays or in the evenings, or even as an optional subject for a fee. Given the limited choice of free schools, private alternatives were set up.<sup>95</sup> The situation improved over the next century. Of 162 schools that changed their curriculum in the 18th century, Richard S. Tompson counted 88 that added arithmetic and ten that added mathematics, while sixteen abandoned Latin. These trends accelerated towards the end of the century.<sup>96</sup> The widespread use of Arabic numerals in society explains the diversity of *Memoria Technica*'s reader profiles and its success.

This situation was not unique to England. Continental Europe was familiar with Arabic numerals before they arrived in Albion and, as explained hereabove, German authors instructed their readers how to use the equivalence between numbers and letters.<sup>97</sup> Twenty years before Grey explained how to learn the first seven decimal places of pi (3.1415929) using the word "ta-fal-oudou", Döbel had his readers memorize 35 decimal places.<sup>98</sup> The main difference between the German authors and Grey lies in their audience. While the continental mnemonists taught the Ciceronian art of memory to adults who wanted to remember numerical data as well as discourses, the Englishman tailored his technique to students in a country where memorizing discourses was less and less important.<sup>99</sup>

Grey's techniques, and therefore the cognitive processes they relied on, were no longer those of the classical art of memory. No imaginary buildings were used, nor mental imag-

<sup>92</sup> Otis, "Set Them to the Cyphering Schoole", 471-472. For specific examples of applied mathematics in England and elsewhere, see for example the collection of essays in Beeley and Hollings.

<sup>93</sup> Feingold, "Reading Mathematics in the English Collegiate – Humanist Universities", 130-131.

<sup>94</sup> Watson, *The English Grammar Schools to 1660*, 8; Tompson, *Classics or charity?*, 49.

<sup>95</sup> Vincent, *The Grammar Schools*, 74, 201-204; Tompson, *Classics or charity?*, 4, 44, 47-49.

<sup>96</sup> Tompson, *Classics or charity?*, 121.

<sup>97</sup> The absence of French, Italian or Spanish treaties exposing this technique can be explained by the declining interest to the art of memory in the second half of the 17th century, and by the languages in which the variants of the equivalence table are presented (German and English being little understood outside the Holy Roman Empire and England, it limited the diffusion of the new mnemonic).

<sup>98</sup> Grey, *Memoria Technica*, 1732, 141; Döbel, *Collegio Mnemonico*, 130.

<sup>99</sup> On the decreasing importance of mnemonics as a rhetorical tool used by English preachers, see Poupard, "La méthode des loci", chapter 12.

es. The inheritance of the old *ars memoriae* seems to consist only in the vocabulary, as this is reflected in the title of the *Memoria Technica: or, a New Method of Artificial Memory*. In addition to this reference to “artificial memory” and “artificial words”, Grey also used the word “figure”, typical of mnemonic jargon. However, these terms no longer have the same meaning as they did on the continent at the same time. These two arts of memory are no longer concerned with the same objects: the same vocabulary is used to signify completely different things. Whereas in continental *ars memoriae* a “figure” could signify a phrase or a commonplace, Grey uses it to designate a memorized number transformed it into a group of letters.<sup>100</sup>

### Conclusion

Hérigone, Winckelmann and Grey seem to have discovered the mnemonic utility of numbers-letters equivalence independently.<sup>101</sup> These discoveries can all be linked to the practice of another discipline requiring the use of mental patterns similar to those required to employ the equivalence table. Hérigone uses alphabetical notation to signify unknown measurements, Winckelmann transforms letters into numbers and vice versa to encrypt and decrypt messages, while Grey encounters this principle during his Hebrew studies. The greater familiarity with Arabic numerals on the part of the literate is both necessary for the invention of the technique and, above all, for its reception: the equivalence table only appears when potential pupils and readers of mnemonic manuals show an interest in memorizing numerical data.

In 18<sup>th</sup> century England, this new numerical mentality led to the specialisation of mnemonic tools. The Ciceronian art of memory was no longer used to memorize numbers, while the new *Memoria Technica* did not explain how to memorize texts.

### Addendum on the material history of the *Memoria Technica*

As shown in the fourth part of this paper, the study of the materiality of the surviving copies of the *Memoria Technica* helps to better understand the audience and uses of the book. This appendix is intended for readers who want to know more about the material history of the *Memoria Technica* and the methodology used to approach reading practices.

<sup>100</sup> Grey, *Memoria Technica*, 1732, 4.

<sup>101</sup> Robert Alan Hrees doubted the bona fides of Grey and Lowe. However, it seems reasonable to assume that both authors were unaware of the German textbooks (only one surviving copy can be found in England, and it is not a stand-alone textbook but a copy of the *Dreyfache Kunst-Schnur*, which is a compilation of manuals published by Winckelmann, at BL, 1043.b.27.(2.)), and of the *Cursus Mathematicus* which is, after all, a one-century old mathematics manual, not a memory treatise. Hrees, “An edited history of mnemonics from antiquity to 1985”, 659, 689.

Studying reading practices is a difficult task. First of all, traces of reading in copies of the *Memoria Technica* are difficult to date.<sup>102</sup> I counted 19 out of 84 copies with annotations that probably date from the 18th century, i.e. about 22%.<sup>103</sup> This proportion is slightly higher than that of the classical mnemonic manuals (17.7%).<sup>104</sup> It is possible that this greater use of the *Memoria Technica* as a writing medium is due to its role as a catalogue of dates, distances and other facts to be learned. Whereas Ciceronian art of memory manuals explain a technique but rarely, if ever, list information to be memorized, the *Memoria Technica* contains the data its readers need to acquire in order to excel in school and society.

As pencil traces are more difficult to date than ink traces, especially if they do not contain *marginalia* but only lines or crosses, I have chosen not to include them in our statistics. For example, I have not counted the crosses in the margins of British Library copy 72.B.16 on pages 10-11. The same applies to the numbering of the prophets in copy Vet. A4 e.3062 (p. 24). When the copy contains marginal notes, the spelling sometimes allows us to date the pencil notes to the 19th century without too much doubt.<sup>105</sup> In addition to the problem of dating, some copies show traces that are more likely to have been caused by dirt than by a reader, although this possibility has not been ruled out.<sup>106</sup>

Sometimes the biographical information known about an owner suggests that he or she did not necessarily want to use their copy of the *Memoria Technica*. For example, that of William Vesey (1677-1755) is associated with Grey's *Method of Learning Hebrew* and Richard Parker's *An Essay on the Usefulness of Oriental Learning*.<sup>107</sup> It also contains the words "Donum Authorii" on its title page.<sup>108</sup> It is therefore likely that Grey gave this copy to Vesey, as the two knew each other through their shared interest in Hebrew. On the other hand, the absence of any trace of reading may indicate that Vesey did not share Grey's enthusiasm for mnemonics.

This is not the only donated copy. Cardiff University Library copy BF370.D2, for example, mentions that this book was given by "Mr Lee" to the "Rev. Mr Morris". Similarly, the copy now in the National Library of Wales, Aberystwyth, BF383 G84, was given by "the Right Hon[orable] Stephen Poyntz Esq[r]" one of his Majesty's most hon[orable]

<sup>102</sup> As I tried to analyze the practices of 18th century readers of the *Memoria Technica*, all the numbers given in this paper do not include *marginalia* from the 19<sup>th</sup> and 20<sup>th</sup> centuries.

<sup>103</sup> The percentage is the same for books I have consulted personally and for those for which I have obtained information via e-mail exchanges with librarians. The 19 copies in question do not include those bearing only a bookplate or personal reading notes on blank sheets. Only those with annotations in the text and/or paratext are included.

<sup>104</sup> Poupard, "La méthode des loci".

<sup>105</sup> Vrije Universiteit Library, XF.02372.

<sup>106</sup> For ex. BL 51.b.14, 69.

<sup>107</sup> Parker, *An Essay on the Usefulness of Oriental Learning*.

<sup>108</sup> Oxford, Lincoln College Senior Library, O,8,24(1).

Privy Council” to a certain William Miles Junior in 1735 or 1736. This copy was subsequently donated to the National Library of Wales by the great-nephew of the bibliophile Henry Hey Knight.

These donations provide us with snapshots of the biography of RAREWK 153.14 G8697M from the State Library Victoria. A said Harricot Smith received this book from a Mrs Ravenscroft in London in March 1794. At some point, the book arrived in Australia. There, a certain Peter Bell gave it to a said C. Evans on 26 June 1992 “on the occasion of his departure from Australia for the Antipodes”.<sup>109</sup> Evans must not have been interested in mnemonics, because the manual is still kept in Melbourne. Such intercontinental movements are rare, but not surprising. 25 of the 84 textbooks used in this survey are located in former British colonies.<sup>110</sup>

As was the case with the classical art of memory manuals, and ultimately with all early modern books, copies of the *Memoria Technica* were more likely to be found in institutional libraries or the libraries of wealthy collectors than elsewhere. This phenomenon of gradual accumulation began as early as the eighteenth century: William Vese, mentioned above, bequeathed his copy to Lincoln College. It accelerated in the modern period and continues to strengthen the influence of institutional libraries, which partly explains the presence of *Memoria Technica* outside the British Isles. For example, RAREEMM 822/11, which has been in the State Library Victoria since 2015, was acquired by the bibliophile John Emmerson around 2010.<sup>111</sup> The same is true of the eight examples (out of the 84 examined) that belonged to the American collector Morris N. Young before his collection was acquired by the University of San Marino.

Most of the movements outside the UK that I have been able to document are recent. However, one copy had already left Britain in the 18th century to reach European shores. Copy Ph.o. 825 in the Würzburg University Library bears an ex-libris from the ‘Würzburg Benedictine Abbey of St James’. The limited circulation of the *Memoria Technica* in early modern time is probably caused by the English language: rarely understood outside England and its colonies, it hinders any kind of books export.

While I have paid attention to the history of Grey’s treatise in order to understand the evolution of the “numerical mentality” led to the divergence between mental tools used to memorize numbers and texts in 18th century England, I have not studied the numerous reeditions of the *Memoria Technica* in the 19th century. The material is abundant and, as with the whole of modern memory manuals, unexplored by historians. To analyze it would be beyond the scope of this paper. I would simply like to point out that, while the tools of modern book history are rarely employed for the contemporary period,

<sup>109</sup> It simply written “26.6.92”, but the handwriting and ink suggest that it was written recently.

<sup>110</sup> Thirteen in the United States, eight in Australia, three in Canada and two in Ireland.

<sup>111</sup> We would like to thank the State Library Victoria for providing us with this information.



they would probably be useful in this particular case. Indeed, copies of eighteenth-century copies continued to be annotated in subsequent centuries, which sometimes leads to a stratification of marginalia when readers from different eras leave their notes in the margins of the same copy.<sup>112</sup> Moreover, copies produced in the 19th century are also annotated, such as this copy of the 1812 edition in which a reader has added the names of the dynasties opposite the English kings.<sup>113</sup> At the same time, a study of the editorial history of the *Memoria Technica* reveals that several authors took advantage of Grey's method (and his name) when they published adaptations of the manual focusing on the memorization of history.<sup>114</sup> Thus, it seems that interest in memorizing chronology was even stronger in the 19th than in the 18th century, while the other information contained in the *Memoria Technica* was of less interest to readers, but this provisional conclusion should be validated by further studies about 19<sup>th</sup> century mnemonics.

<sup>112</sup> For instance, the copy held at Toronto, Thomas Fisher Rare Book Library, B-11 09271 (2). While the 18<sup>th</sup> century handwritten only corrected chronological data, the modern hand has also modified the artificial words associated with the dates it corrected.

<sup>113</sup> BL, 8305.aaa.5.

<sup>114</sup> A few titles : [Anonymous], *Wilcongssau or Mnemonic Hexameters after the method of the Memoria Technica of Dr. Grey*; [Anonymous], *The historical Lines of Dr. Grey's Technical Memory*; [Anonymous], *Regdol or Mnemonic Hexameters after the method of the Memoria Technica*; Thring Phipson, *Chronology; with a Brief Outline of History and a Memoria Technica on Dr. Grey's System*.

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### Abbreviations in footnotes

BL = British Library

BoL = Bodleian Library