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Mnemonics in the Mouseion: Considerations on spatial mnemonics as a tool for classification and retrieval

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Considerations on spatial mnemonics as a tool for classification and retrieval

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Abstract

Purpose – Mnemonics was a tool in classification and information seeking processes in pre-print libraries. The purpose of this paper is to study the role of spatial mnemonics in Hellenistic libraries, including the one in Alexandria.

Design/methodology/approach – Since library- and information science has not explored this subject in depth, philology, rhetoric, book-history and archeology constitute the core literature. From this literature, the role of mnemonics in the libraries is discussed.

Findings – A new description of the practice of classification and retrieval in Hellenistic libraries, based on spatial mnemonics.

Originality/value – This paper is a new analysis of spatial mnemonics in the Hellenistic libraries. As will become clear, they blend easily and logically with each other.

Keywords Library history, Library in Alexandria, Library in Pergamum, Memory art, Mnemonics, Pinakes

Paper type Research paper

Introduction

Generally speaking, mnemonics was a part of classification and retrieval processes in all libraries before print. Mary Carruthers (2008) writes in *The Book of Memory* about this, and with great clarity demonstrates how it worked. Figures, illuminations, notes, numbers and the overall structure of books – and collections of books; libraries – constituted a mental grid, that scholars after intense mnemonic practice could browse in their memory. Carruthers (2008) focusses on memory techniques in medieval books and libraries, but she argues several times (p. 129) that the relation between them date back to antiquity. One of her many and convincing examples deals with the Canon Tables of Eusebius, a concordance added to almost all medieval bibles (see Plate 1):

> The tables are laid out in columns (one meaning of in pagina), the numbers listed one after another vertically, and architectural columns are drawn to separate the four [*in the case of Plate 1; three*] vertical spaces of the page, together with other architectural elements representing a classical façade. It has been suggested that, in this context, an arcade motif may derive from the ancient mnemonic advice to use buildings – including intercolumnia, the spaces between columns – as backgrounds for things to be remembered (Carruthers, 2008, p. 118).

The table in Plate 1 is a grid, showing occurrences of the same passages in the Gospels. Relying on testimony from medieval scholars Carruthers (2008) clearly demonstrates (p. 118) that such a layout was used to navigate using mnemonics, simply by browsing the architecture of the concordance in memory with ease. This is just one of her many examples that give clear evidence of this mnemonic practice.

Carruthers (2008) emphasizes that mnemonics linked to books and collections of books emerged in antiquity. On this topic, Christian Jacob (2013) provides excellent

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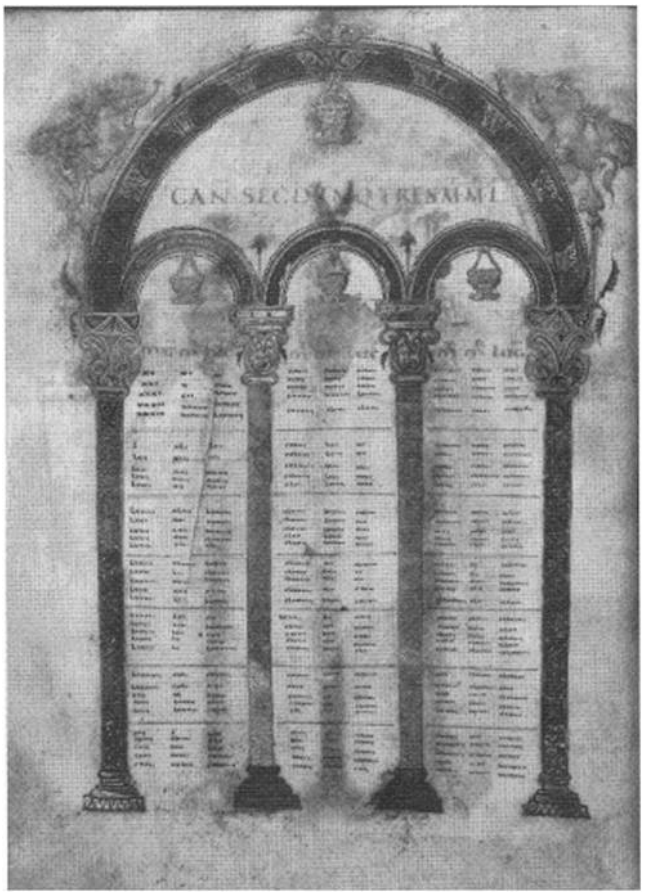


Note: The intercolumnar structure, as it will play a central part in the following

Plate 1.
This figure shows a table with concordances in three of the four Gospels, from the monastery of St. Martin in tours

insight in his recently published *The Web of Athenaeus*. Decoding the enormous and complex structure of the *Deipnosophistae* by Athenaeus (second century AD) with great originality, he describes the correspondence and interrelatedness of the literature stored both in the scholars memory and in physical libraries. Jacob (2013, p. 57) argues that even though his object of study is a gathering of scholars over food and wine in second century AD Rome, such practices emerged already in Hellenistic Alexandria (Jacob, 2010). It is these considerations that are continued in the present paper.

A central testimony on this subject is Vitruvius' treaty on architecture (Jacob, 2010). Vitruvius explains how the memory of Aristophanes of Byzantium (ca. 260-185 BC) is a sort of mental construct that matches the library in Hellenistic Alexandria (Jacob, 2010, p. 11). But how, and indeed to what extent, mnemonics played a role in classification and retrieval in the Hellenistic libraries, is a matter that remains open for discussion. This paper engages in that discussion.

Mnemonics enabled scholars to store and organize substantial amounts of knowledge in their memory. When needed, this knowledge could be recollected.

Mnemonics from Greek and Roman antiquity has already been described in great depth (e.g. Blum, 1969; Yates, 1965; Carruthers, 2008). It worked partly on the basis of words and sound, partly on the basis of imaginary space(s), as visual mental constructs. It is spatial mnemonics that will be discussed in the following. As centuries passed, mnemonics got more refined and evolved to a point where scholars in their memory were laying roads, erecting houses by it, with rooms in them, arranged them with furniture, were they would finally place pictures of words or things of what they wanted to remember. This gradually turned out to be a perfect system for remembering many things at the same time; many more, than if the scholars did not organize their memory in a logic manner.

On spatial Hellenistic mnemonics

But first, the existence of spatial mnemonics in the Hellenistic era must be ascertained. It is a question that still today divides scholarship. Accordingly, Jocelyn P. Small (1997) thoughts on the emergence of spatial mnemonics will be discussed below. In her book *Wax Tablets of the Mind* (1997) she presents a persuasive assumption on the reason why spatial mnemonics emerged, but she places it in the wrong era.

Small differs between Greek and Roman mnemonics. She argues that the main reason why the romans developed spatial mnemonics was the increase of written text:

> In adopting the art of memory from the Greeks, the Romans had to make adjustments to the system, because basic organizational skills were not increasing at the same pace as the quantities of written matter, with the result that the need for good memory skills had increased dramatically from the time of Plato and Aristotle. To get some idea of the quantity that a highly literate Roman could produce, consider that 914 of Cicero's letters have survived. It was imperative for the Romans to improve the Greek art of memory (Small, 1997, p. 95).

Mnemonics simply had to be refined due to the increase of things the scholars had to remember, since written matter – as opposed to oral – expanded memory substantially. To back up this argument, she explains that the Greek word *topoi* and the Roman word *loci* differed, arguing that *topoi* refers to a somewhat fuzzy mental topology and not a distinct, perceivable architecture (Small, 1997, p. 97), like the Roman *loci* in her view does. Small's argument is both precise and original, but she claims that text became more frequent as time passed. Is that indisputably so? In fact, it was not necessarily the case.

Small supports her idea with Cicero's 914 personal letters. This is quite a limited perspective: actually, the exact same argument has been made about Callimachus of Cyrene's (305-240 BC) organization of his personal notes, his *hypomnemata* (Blum, 1991, p. 137) – and he lived in the Hellenistic era. Accordingly, one might consider other factors that could have had more impact than personal writings. The emergence of libraries as massive gatherings of texts is an obvious one; it is by far a more indicative testimony of the mass of written matter in a society than merely a collection of personal letters. By the time Cicero and his anonymous college taught, there were no libraries in Rome open to the public. Not in Cicero's entire life (Casson, 2001). None! That city was yet to come: only from 28 BC did libraries become part of Roman public life, when imperial might was for the first time reflected in a library holding vast collections of books. But even by the end of the first century AD the capacity of those libraries did in not match the largest of the Hellenistic ones, the Mouseion in Alexandria and the Attalid library in Pergamum – if we are to accept the testimonies on the content of these libraries (Staikos, 2004, p. 284). One can justly wonder if Cicero and the author of *Rhetorica* […] were ever confronted with as enormous amounts of text, as their

Hellenistic predecessors. Keeping track of say a 1,000 personal letters is obviously less complex than keeping track of the massive collections of texts that were gathered in Hellenistic libraries. Therefore, Smalls assumption – that it was written matter that provoked the evolution of complex spatial mnemonics – simply makes more sense, if such an evolution is placed in the period prior to the one postulated.

Furthermore, Cicero and the author of *Rhetorica* […] are both very brief, explaining mnemonics. Frances A. Yates (1965) believes this reveals that the mnemonics these Roman teachers presented for their students were in fact well known by the audience, that it had been practiced likewise for centuries or at least decades (p. 5). Such an assumption seems likely, since mnemonics already in the Hellenistic era was officially a part of the educational curriculum for rhetoricians (Blum, 1969, p. 105). This being the case, it indeed seems impossible that the Romans did not invent the spatial dimension in the mnemonics they taught, since this is exactly so briefly and knowledgeably explained.

Also, it can be argued that it is a very interesting linguistic distinction Small makes, it is truly original, but it can reasonably be questioned, if the difference between the *topoi* and *loci* is that important. The Greek sources on mnemonics also describe architecture, both in the case of Simonides and in the Dialexis. It seems unlikely, that the only sources we are given – dealing with this specific subject, and not mentioning it *en passant* like Aristotle in his *De Memoria* (Rossington and Whitehead, 2007, p. 35) – would set their system in an architectonical frame without having to. In that case, why not chose a beach, a plain or some similar surface, that enables an easier overview of topological relations?

A final argument can be added. There are three sources of Roman mnemonics: Cicero (106-43 BC), *Rhetorica ad Herrenium* (written between 86 and 82 BC, previously ascribed to Cicero, see e.g. Blum, 1969, p. 135) and finally Quintilian (ca. 35-98 BC). There are no exhaustive sources on mnemonics between Aristotle and the first century BC Roman ones, only ephemeric ones (Blum, 1969, pp. 123-128). This 200-year period was the Hellenistic era, and Greek (Koine) was indisputably the *lingua franca* in the Mediterranean. Did these Greek speaking cultures develop complex, spatial mnemonics? Since these would have been *topoi*, Small (1997) argues against such a possibility. But that complex, spatial mnemonics was known in the Hellenistic era is beyond dispute: Callimachus composed a long epigram on Simonides, the inventor of mnemonics. Its theme is a refined play with the possible dangers of not preserving the memory of Simonides, when his tombstone is wrecked. Besides being a literary critique against Simonides, Callimachus demonstrates insightful awareness on spatial mnemonics.

All in all, Small (1997) is quite certainly right in assuming that it was an increase in text that led scholars in antiquity to develop complex spatial mnemonics. But she is wrong, when she places this evolution in the earliest times of the Roman era. The enormous libraries of the Hellenistic era seem more obvious to have provoked such an evolution. Furthermore, it can be seriously questioned, if mnemonics was not spatial from the beginning – even though this must have been in a less complex version than the later Roman one. To sum up, Roman mnemonics was not the first to be spatial; Hellenistic mnemonics must also have been so.

The unlikely 1:1 relation between mnemonics and entire libraries

As discussed above, Small (1997) suggests that spatial mnemonics was developed to control written matter that would otherwise have remained a mess of unorganized knowledge on papyrus. It has been argued, that contrary to her own view, this took place in the libraries of the Hellenistic era. As mentioned in the introduction – and also

argued by Carruthers (2008) and Jacob (2013) – mnemonics and the organization of these libraries were interdepending. Nevertheless, the actual library architecture could not have mirrored the spatial (imaginary) mnemonics perfectly. A 1:1 relation between them could not have been the case. Below follows why.

The first basic rule about spatial mnemonics is that real existing architecture can very well be transformed into imaginary architecture, and as such it can therefore serve as a mnemonic tool. This is clearly stated in Part XVI of the *Rhetorica* […] (Rossington and Whitehead, 2007, p. 44). Accordingly, the library architecture could of course be used as memory architecture.

As all architecture, the library buildings of the Hellenistic past were not static; they grew, changed and finally died. This seems at first to blend nicely with the possibility of redefining memory architecture: one could expand the virtual architecture in one's memory if necessary. But considering the evidence of library architecture from the Hellenistic era, expansion was dominated by pragmatic measures, and not, as the virtual architecture of the mind, ideal measures. Furthermore, memory architecture had to be logic and perceivable according to Cicero in his *De Oratore* (Rossington and Whitehead, 2007, p. 41). This was not reflected in the libraries of the Hellenistic era. These were not erected – as buildings – with the purpose of serving as libraries. Their holdings were scattered about in storage rooms certainly disposed in a logic manner, but not as perceivable architecture (Hoepfner, 2002, p. 41).

In other words, spatial mnemonics did not reflect the architecture of the entire library. The scholars did not carry a mental representation of the library's architecture in their mind, a 1:1 relation was impossible since library architecture was not fitted to be memory architecture.

On the use of mnemonics in the Hellenistic libraries

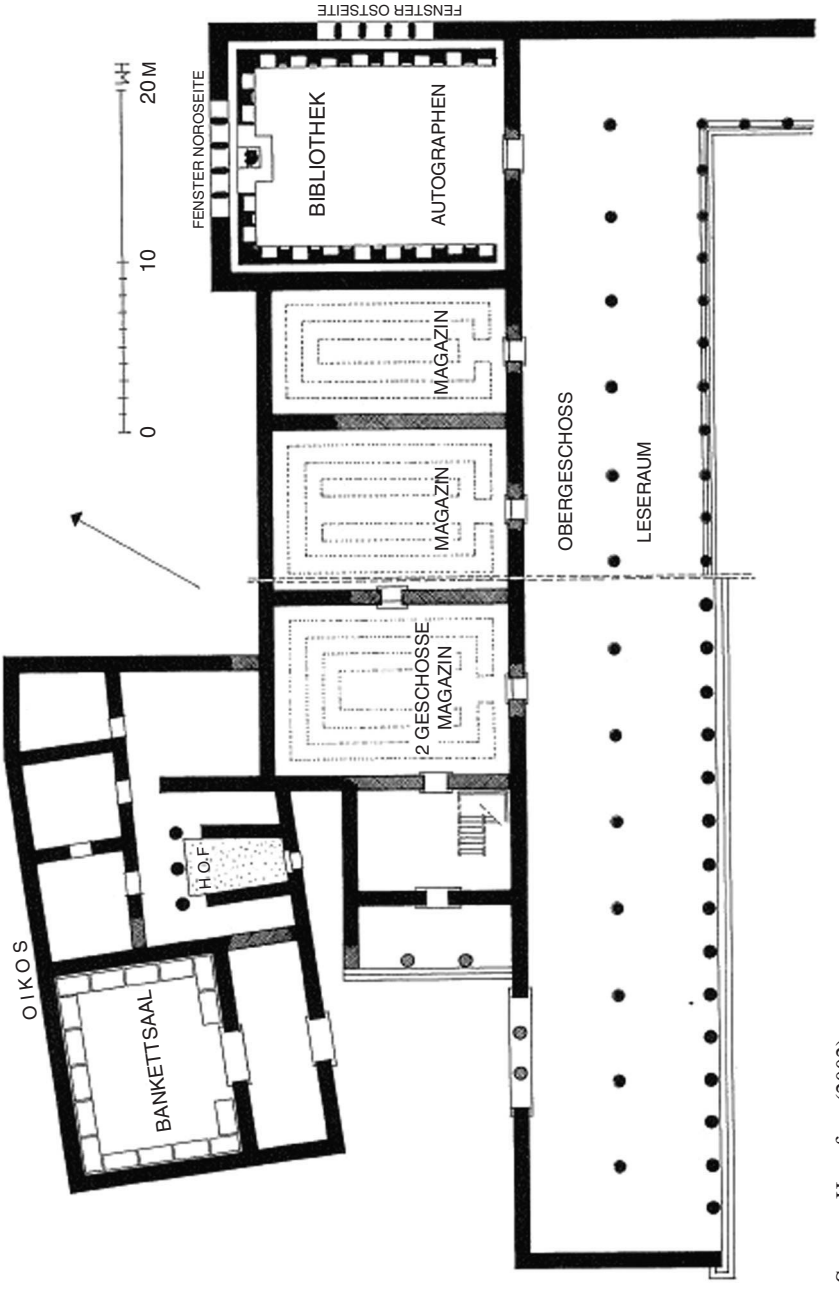
As just mentioned, the entire architecture of Hellenistic libraries could not have been reflected in mnemonics. But a certain part of the library architecture could indeed. In the following, the architecture of the Attalid library in Pergamum is discussed as basis for spatial mnemonics.

The Attalid library in Pergamum

The library in Pergamum rivaled with – and reflected – the one in Alexandria. The Attalid library has been preserved to an extent that has permitted archeologists to study and theorize on its potential architectonical layout. It is unreasonable to believe that the library in Alexandria differed substantially from the one in Pergamum, simply because actual discovered libraries from this era have were built the same way (e.g. Staikos, 2004).

The Attalid library in Pergamum was erected in the royal quarters around 200 BC. It was part of the sanctuary dedicated to Athena – Goddess of wisdom. It consisted of three connected storage rooms in two levels, attached to a main hall on the north-eastern side of them. The latter has been interpreted as an exclusive setting for festivities, and as such a place without books, but it has also been argued, that it did in fact contain books (Callmer, 1944) (Figure 1).

The archeological dispute on whether or not the main hall (the room most to the right on Figure 1) contained books is caused by one single element: The plinth in stone found *in situ* in the main hall. What could have been its function? Did it serve as a base for statues, or wooden cupboards with scrolls in them? The archeologist Wolfram



Source: Hoepfner (2002)

Figure 1.
The Attalid library in Pergamum

Hoepfner (2002) argues that the plinth held books. This claim is solid, since a similar structure containing books has been found in a library from the Roman era, in the city of Philippi in eastern Macedonia (Tønsberg, 1976). The plinth looked like this (Figure 2).

Even though Hoepfner (2002) argues carefully about the library in Pergamum, his view on the content of the cupboards that he believes was placed in the main hall, on top of the plinth, can be questioned. First of all, he is right in assuming that each such cupboard must have contained an autograph – an authorship, and not several different authors. But he goes on, and claims that each of these persons must have been a *Dichterpersönlichkeit* (Hoepfner, 2002, p. 49). This term translates badly into English, embedded in the universe of *sturm und drang* – writers as it is. A poetic or artistic personality – that writes – is what is meant. Quite certainly Hoepfner is merely addressing that these persons were considered as outstanding writers whatever their specialty. But the term does perhaps blur the fact that these writers must have represented all sorts of specialties. Would a historian be considered a *Dichterpersönlichkeit*? This seems unlikely. And it is important, since the basis of the bust of the historian Herodotus (ca. 480-420 BC) is amongst the archeological remains. As is remains of bust bases of Homer, the lyric poet Alcaeus of Mytilene (ca. 620 BC) and the musician Timotheus of Miletus (ca. 446-357 BC) (Callmer, 1944, pp. 150-151). These remains leave no doubt that several genres of literature were represented in the main hall. This strongly suggests that each cupboard must have represented a literary genre, and that altogether, they represented the entire universe of knowledge. This seems in accordance with the fact that the main hall also contained the statue representing wisdom – Athena. The presence of Athena blends oddly with a room merely containing *Dichterpersönlichkeiten*, in the strict sense of the word.

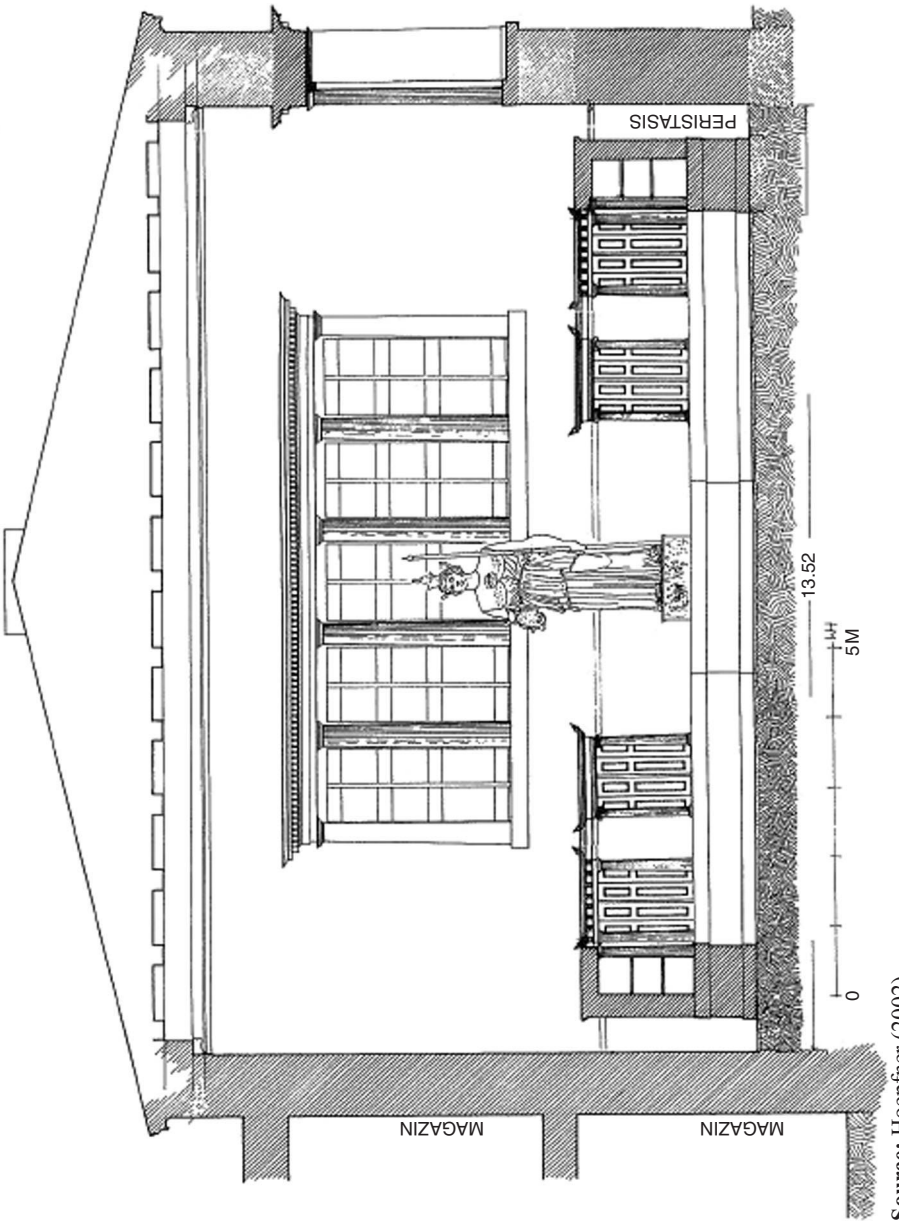
The fact that the *Pinakes* by Callimachus was used in Pergamum as the catalog – or at least as inspiration for the *Pinakes* compiled in Pergamum by unknown scholars, that could alternatively have served as the Pergamum catalog – supports this view. The difference between these *Pinakes* could not have been one of structure, but merely of esthetic judgments about authors (Pfeiffer, 1968, pp. 133-34; Casson, 2001, p. 52). Both were organized in genres/classes of literature, compiling long lists of writers within these classes. Each cupboard must have represented writers from every class (the number of classes is unknown). Consider the title of Callimachus' *Pinakes*: *Πίνακεςτῶνἐνπάσῃπαιδείᾳδιαλαμψάντων* (Pfeiffer, 1949a), that translates like this: tables of those who distinguished themselves in all branches of learning (and their writings). It seems reasonable to consider, that the plinth in the library would reflect all the braches of learning, so as to demonstrate the rich *paideia* the library contained.

A closing argument in this respect must be mentioned. Creating groups of statues each representing different arts and sciences in this way would not have been a strange and bizarre feature. Quite the contrary, in front of the Mouseion was a statue group of the nine muses – each representing an art or science (Small, 1997, p. 78).

Hoepfner (2002) believes that the bust of the writer was placed on top of the cupboard containing that writers collected works. This is a common view concerning the architecture of the library cupboards of antiquity (e.g. Tønsberg, 1976, p. 21). The cupboards looked like those as shown in Figure 3.

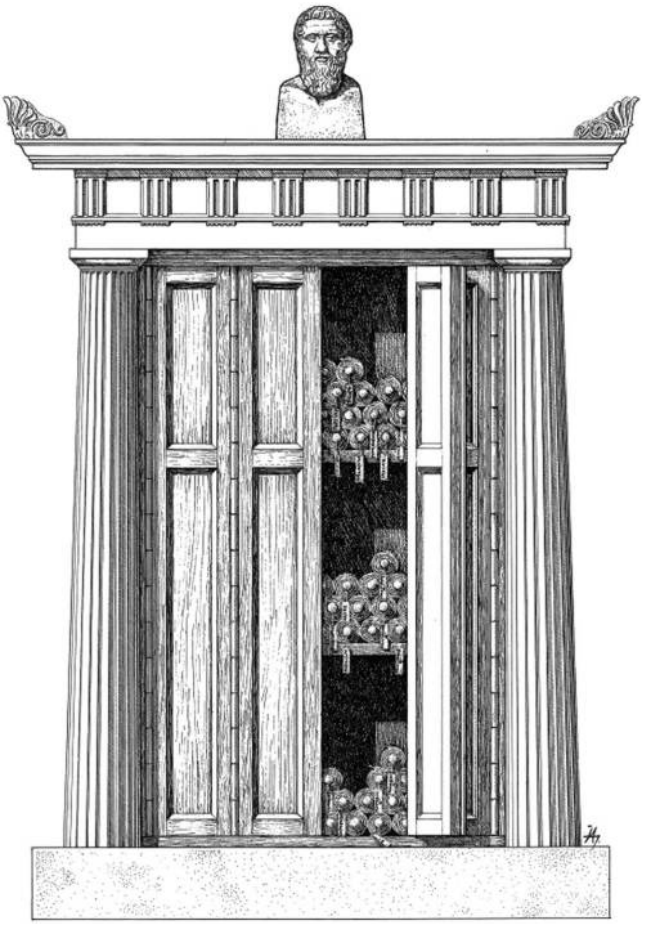
Mnemonics in the existing library architecture

Contrary to the rest of the library, the plinth in the main hall had a distinct and permanent architecture. The plinth would have been a perfect mnemonic tool. In the following, a suggestion on how it could have worked is presented.



Source: Hoepfner (2002)

Figure 2.
The plinth in the main hall, seen from the side



Source: Hoepfner (2002)

Figure 3.
The cupboard in the main hall

On each side of the statue of Athena were ten cupboards containing writers, 20 all in all. These could have been 20 *topoi*/*loci*. In Part XVI in the *Rhetorica* […] intercolumnar spaces are mentioned as well suited as *loci* (Rossington and Whitehead, 2007, p. 44), it was also mentioned in the introduction above. Each *locus* was like wax, meaning that one could "erase" its content and place something new in it, as stated in XVIII *Rhetorica* (Rossington and Whitehead, 2007, p. 44). This corresponds with the relation between the permanence of the architecture and the possibility of reevaluating if the writer should keep his or hers place in it. Furthermore, it is advised to add a picture to the locus, in order to succeed in remembering its content. All cupboards were decorated with a bust it could easily have had such a role.

The line of 20 faces, divided by Athena in the middle, placed in a distinct architecture – one at each locus. This gave the architecture a specific order, representing literary genres. But the architecture itself provided the basis for yet another order. Relying on later evidence, Hoepfner (2002) assumes that the columns in the cupboards change, so that one cupboard had columns in Doric order and the next one Ionic order. Such a shift had

mnemonic potential, each cupboard becomes distinguishable; it has a different order than the two next to it. Not only is this in accordance with the advice on arranging many intercolumnar spaces by letting them differ in form, as advised in Part XIX of the *Rhetorica* (Rossington and Whitehead, 2007, p. 45) it also seems to connect the plinth with more complex mnemonics, since each locus becomes a midpoint.

In his book *Aristotle on Memory* Richard Sorabji (2004) interprets passage 452a17-24 in Aristotle's *De Memoria*. This passage deals with mnemonics – but it is very brief: Aristotle wants to define memory, not teach mnemonics already well known by the listeners. The passage has puzzled many scholars, but Sorabji (2004) quite impressively analyzes it to be a technique of midpoints (pp. 31-34). In order not to lose clarity, I will now briefly explain Sorabji's view using Latin letters. Consider the alphabetic order ABCDEFGH. What Sorabji proves, is that letters ADG is enough to remember all the letters ABCDEFGH, and that this is the point Aristotle is making in that passage. What is needed is a hierarchy: each letter is in fact a triplet, so that if one looks at, for example D for some time, C and E also occur. If you were looking for B, and did not find it via D, move on to A and so on. Triplets speed up recollection, a feature that will be dealt with that below. For now, it is enough to mention that the plinth contained the possibility such usage. Actually, the statue of Athena blends perfectly into such a system, since the plinth could be browsed like this: triplet-triplet-triplet-ATHENA-triplet-triplet-triplet. All the writers – providing access to their collected works – could have been browsed by seven triplets, in the scholars' mind.

I now want to turn my attention to each locus, each cupboard. The scrolls containing the authors work must have been organized in some way, most likely alphabetically, but the specific order is of minor importance: what is important is that there must have been order. The content was fixed by this order. Accordingly, this order could be pictured. The scholar could picture how the scrolls were placed in the cupboard. Such a picture resembles the picture of the whole matter, on the first *locus* described in Part XX of the *Rhetorica* […] (Rossington and Whitehead, 2007, p. 45). All the scrolls were in fact equivalent to arguments and that the scholars could recite them – in this case their title or incipit – by looking at the picture placed within the locus. The plinth in the main hall could hold up to 3,200 scrolls – in Hoepfners reconstruction – and each single scroll could have been retrieved mentally as well physically via mnemonics. Seven triplets gave access to 20 pictures of authors that again could be observed (remember: both in thought and reality) as were they whole matters.

Nevertheless, this imaginary architecture, that did indeed have a 1:1 relation with this specific part of the library, was in fact the less important part of the mnemonic tool to retrieve literature. The plinth could have opened an entirely imaginary architecture – that was not reflected in the physical architecture, but linked to it in a precise way. This imaginary architecture had a far larger potential, than what have just been described.

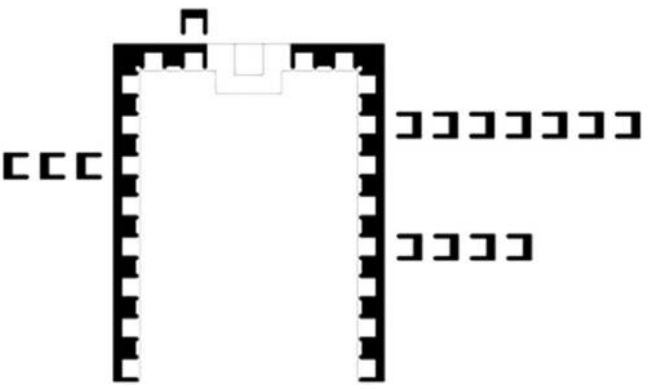
Mnemonics in imaginary library architecture

The busts on top of the plinths cupboards not only represented a careful selection of writers, but all the genres of the paideia, contained in the *Pinakes*. So far, focus has been on them as representing the width of the universe of knowledge. Now let us focus on each writer, as representing a specific part of the universe of knowledge, a specific genre. Parsons (1952, p. 226), contemplating on the presence of Herodotus, imagines that all busts might in fact represent a distinct canon of writers. I am uncertain of the canonical aspect, but it is reasonable to assume, that each bust represents a group or perhaps even a list of writers, only present for the inner eye.

On this basis, the plinth could have served as a mnemonic aid to access the literature of the storage rooms. Put simpler, the point is this: the entire library could be browsed via the plinth. As already discussed, the plinth is the only part of the library that had a static and perceivable architecture. The force of mnemonics was the possibility of browsing an enormous amount of *loci*, fast, one after the other. This was perfectly possible swapping from cupboard to cupboard on the plinth. But if such a system was in place, would the scholars really have restrained themselves to the 3.200 scrolls contained (Hoepfner, 2002) within them in the main hall? Or would they have expanded such an efficient system to the possibly 200.000 scrolls (Staikos, 2004, p. 284) of the entire library? From a functional perspective, there is reason to believe they would. The *Rhetorica XIX* (Rossington and Whitehead, 2007, p. 45) clearly encourages the scholar to create more *loci*, if he or she is not happy with the ones already at hand. Given that each genre could have been represented, the order of such *loci*, in the architecture merely existing in the mind of scholar, would have departed from each cupboard in the plinth, in an already known order: The *Pinakes*. It was a list of authors, divided by genres. And as mentioned, the *Pinakes* provided the organizing principles for the library.

Below are visualized four strolls in the imaginary architecture. The plinth is seen from above, and each cupboard provides the possibility of wandering along cupboards containing authors in that same genre. Four cases are shown merely to illustrate that each cupboard could serve as a point of departure (Figure 4).

If, for example Plato is placed in the cupboard to the left on Figure 4, with three imaginary cupboards behind him – and a potential endless amount after those – these would also be philosophers, placed in similar cupboards. Only, these cupboards were purely imaginary. In reality, the philosophers would have been located in the crammed storage rooms next to the main hall that were not fitted for mnemonics. But could such imaginary cupboards and the actual locations on the shelves have been linked? Yes. Each *locus* could very well have had a call number, since Part XVIII in *Rhetorica* (Rossington and Whitehead, 2007, p. 44) advices the scholar to give *loci* call numbers, the golden hand for five, Decimus for ten. In fact, Aristotle, as mentioned above, probably also meant numbers with ABCDEFGH, in arcrophonic counting, this simply being $A = 1$, $B = 2$, etc. (Small, 1997, p. 65). Call numbers were most likely also present on the physical shelves, (Small, 1997, p. 48) and so, if mnemonics was implemented, the



Source: Author of this paper

Figure 4.
The plinth as basis for imaginary architecture

numbers must have matched – why on earth have two different systems, when one in all ways would have worked better?

So basically, instead of trying to memorize haphazard library architecture, without distinguishable features, to recollect the exact location of an author, the scholars could have built up an imaginary architecture, departing from the sole element that was architectonically clear and stable, untouched by the changes that took place around it (adding of storage rooms, redefining of their organization, and so on). The plinth contains the potential of being "program" this way, according to the sources on mnemonics. One can consider it to be the heart of the library, with veins stretching out into the library's entire body of literature.

On the effectiveness of mnemonics in the Hellenistic libraries

In the following the reader will get an impression of the effectiveness of such spatial mnemonics. The first feature that I would like to discuss is – I believe – the most important in all great collections of written knowledge.

Stability

As mentioned, library architecture in the Hellenistic era was not static. Hellenistic libraries grew constantly – in fact both as architecture and as collection. One must think of them as endlessly being written (Dahlström, 2006, p. 36) and thus rearranged. This implies that texts were moved about, when they passed from the scribe's area to the shelves and perhaps back and forth several times for revisions, like, for example Aristophanes' literary revisions (Nagy, 2000). Furthermore, changes within storage rooms and even adding of new storage rooms also changed the overall architecture of the library. It would seem as a very difficult task to try to memorize such a crammed, tortuous structure with a more or less permanently changing and expanding organization. But this *eo ipso* also suggests the need for an overall view, creating a safe haven in high seas. Such a haven was of course provided by the *Pinakes*. And an imaginary architecture of the library would unquestionably have reflected the *Pinakes*. They both enabled stability, but in terms of effectiveness, the *Pinakes* would lack a vital feature, in comparison with an imaginary architecture.

Speed

Mnemonics was fast. Imagine looking up the location of a work in the *Pinakes*. It was 120 scrolls long. Looking up works in it required time – each time! The fact that the *Pinakes* consisted of scrolls is often ignored when it is compared with modern, analog reference tools (e.g. Casson, 2001, p. 41), looking up something in a scroll is significantly slower than in a codex, book. It seems like a process that did not encourage looking up works more times than necessary. This could be avoided by reflecting the *Pinakes* in mnemonic architecture that could be browsed in the mind, way faster than the scrolls of the *Pinakes*. The plinth reflected all the literary classes of the *Pinakes*, and they could perhaps even be browsed as triplets. Each class would provide the access to a long list of authors, organized in intercolumnar spaces – cupboards – one after the other. All of them were accessible by the speed of thought, and not the cumbersome, time-consuming looking up in the *Pinakes*. As new authors were added to the lists, the physical storage rooms became ever more crowded and boundless, with an order that must have been increasingly difficult to grasp. This was not the case in mnemonics that also permitted.

Flexibility

Each list of authors in the *Pinakes* was ordered alphabetically, but only by the first letter (Casson, 2001, pp. 37-40). This had the important advantage that the entire list was not to be rewritten each time an author was added. The ease of adding writers at the end of the list was most likely not similarly simple when their scrolls were to be placed in the storage rooms. Lack of space when genres physically touched each other, or when overall parts of space ran out, must have caused the scholars to organize the scrolls in alternative manners, the best way they could. Mnemonics could very well have maintained an order broken in the actual architecture. In an imaginary architecture, the spaces could be reorganized when needed. The newly added authors – that in the storage rooms were perhaps referred to illogical locations – could be neatly placed in a prominent cupboard, carrying the call number of the physical location.

Mnemonics as a tool

To sum up, stability, speed and flexibility were features that would have made mnemonics a functional tool for both classification and (perhaps most importantly) for retrieval in the Hellenistic libraries. At first hand, it might seem contradictory to claim that mnemonics (besides being fast) was both stable and flexible. But the physical libraries were forced to being unstable, since rooms could suddenly change functions, disappear or be enlarged: this was not the case with mnemonic architecture that could remain the same – stable – even if the physical architecture it was related to, changed. But if the scholars wanted to, they could expand the imaginary architecture for ideal purposes, and thus it had a functional flexibility. This was not at all the same sort of flexibility that the scholars were forced to practice, when rules were broken and principles bend in order to squeeze yet another author into the already quelled storage rooms.

Mnemonics as a support tool among other tools

Finally, before concluding, a point about the Hellenistic library tools must be mentioned. This paper has discussed mnemonics, but the human voice (Havelock, 1986) and the esthetics of the Alexandrian avant-garde, as literary theory (Bing, 2008), were also such tools. Mnemonics has to be understood working together with both of them.

Mnemonics has to be considered as a tool that supported the human voice. Literature in antiquity was sung or at least read out loud or mumbled, and this goes for reference tools as well, like the *Pinakes* (Manguel, 1996, p. 43) Reciting the *Pinakes* would simply have been easier if the scholar imagined a picture of the author (the bust and/or cupboard) while doing so. As if the scholar sang what he saw, wandering about in the mnemonic architecture. Such singing is actually – in my view – connected to literary theory. Callimachus – the author of the *Pinakes* – was also a poet, a writer of epigrams. The function of a traditional sepulchral epigram (Bing, 2008) share nature with entries in the *Pinakes* (Blum, 1991). A person/author was named, including his origins, his achievements was praised, first in a short text, then by listing his/hers works in a bibliography (bibliography occurred merely in the *Pinakes,* not in epigrams). Epigrams were in the classic era written on monuments, tombstones and the like. In the Hellenistic era, when epigrams became entirely literary, written on papyrus, the monuments they were supposedly fixed upon became imaginary. Bing (2008) talks of *literary landscapes* (p. 40) consisting of imaginary tombstones set to commemorate authors. Well, singing what one saw doing a stroll in such an imaginary landscape of tombstones could very well have been – mentally – looking up something in the *Pinakes*.

Conclusion

The purpose of this paper has been to consider how mnemonics could have played a role in the libraries of the Hellenistic era, initially by introducing thorough studies proving the existence of mnemonics in libraries in antiquity. Then Small (1997) point of view, that it was only Roman mnemonics that was spatial, was argued against and refuted. Nevertheless, her idea that it was the increase in written matter that caused complex spatial mnemonics to occur was accepted. It was argued, that Hellenistic library architecture and mnemonic architecture could not have had a 1:1 relation between them, since library architecture simply changed too much and was dominated by pragmatic measures and not ideal ones, like mnemonic architecture.

The reconstruction of the Pergamum library by Hoepfner (2002) served as the basis of discussion. It was argued, that the plinth in the main hall not only represented and contained the works of significant authors, but that the evidence that has reached us actually suggests that the plinth reflected the literary classes of the *Pinakes*. Furthermore, it was argued that this particular part of the library – the plinth – could in fact have been a perfect, in the sense complete, mnemonic architecture. It contained pictures (busts and the works of authors) in intercolumnar spaces (cupboards) changing in shape (between Doric and Ionic order), so to facilitate memory. This system – combined with the statue of Athena in the middle – furthermore enabled a system of triplets, as Sorabji (2004) suggested Aristotle taught in his *De Memoria*. Then followed a discussion on the plinth as a key to the entire library. Each genre/literary class could have continued as imaginary architecture behind the real, existing cupboard on the plinth, this would have been completely in scope with the mnemonic practice. Since both mnemonic pictures and library shelves had call numbers, so each imaginary cupboard could easily have been linked with a physical location in the storage rooms. Altogether, this analysis framed the plinth as the "heart" of the library.

Finally, the effectiveness of mnemonics in Hellenistic libraries was discussed. Three features made it a very effective tool. The first one was stability, since the mnemonic architecture could remain untouched by the changes of the physical library. The second one was speed, because mnemonic architecture could be browsed a lot faster than the physical scrolls of the *Pinakes*. And finally the third was flexibility, since a perceivable order could be maintained in the imaginary architecture, contrary to the physical one it was linked to. Finally, the other "library tools" that were at least as important were mentioned, these being the human voice and literary theory, that both seem to express the presence and potential of spatial mnemonics.

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