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Parchment in Byzantine Manuscripts of the 11th and 12th Centuries: Characteristics and Use

Summary: An examination of the various qualitative characteristics met with in the parchment of a sample corpus composed of 700 Greek manuscripts dating from the 11th and 12th centuries sheds light on the working practices of Byzantine book manufacturers, in comparison to those employed by their Latin 'colleagues'. The first section of this study reveals the existence of a close relationship between the quality of parchment and the fundamental characteristics of any manuscript, i.e. date, origin and content. The second section describes the methods devised by book manufacturers in order to limit or conceal defects in parchment surfaces by positioning them, whenever possible, outside the written area, or alternatively by 'hiding' them in the inner bifolia of quires. A close analysis of the parchment also makes it possible to reconsider Léon Gilissens's well-known theory on the composition of quires.

Scholars of medieval paper and its use in books have at their disposal ensembles of sheets of standard dimensions and regular weft and warp that can yield precise information on the manufacture, date and provenance of the material. Conversely, parchment is, naturally, a far less homogeneous material, being the product of a series of artisanal operations handed down over the centuries, even if such processes underwent various changes over time (the precise details of which are unknown). This resulted in the production of a wide range of parchment types that differ greatly in appearance and quality. Nevertheless, parchment also presents several characteristics which, largely speaking, lend themselves quite well to systematic surveying, quantification and classification, an awareness of which has grown in recent years. Such characteristics include the animal species from

The earliest draft of this article dates to the autumn of 1996; the bibliography takes into account, as far as possible, the results obtained from subsequent research projects [until 2000].

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which the parchment was derived, its colour, surface attributes (i.e. porosity, consistency, transparency, elasticity, etc.) and, above all, the size of the skins and their thickness. In addition, irregularities and defects of various kinds are highly relevant, since they could compromise the aesthetic quality and/or functionality of a book, and always reduced its value.

It is natural to suppose that in the world of the medieval book the perception of 'defects' in parchmented skins—to the extent they were actually regarded as such, which is of course difficult to establish—was not consistent across all categories of texts and at all levels of production. Even so, we can still hypothesise the existence of—in certain settings and for certain types of book, at any rate—artisanal practices aimed at minimising the visual impact of the most conspicuous irregularities typically encountered in parchment.

The aim of the present contribution is to verify the general criteria and specific manner of use of parchment employed in a predetermined context, namely Byzantine manuscript production in the 11th and 12th centuries.² For practical reasons, only the most conspicuous, immediately quantifiable and least ambiguous irregularities, which is to say holes and *lisières* (i.e. natural, untrimmed edges of the skin),³ will be focused on. This approach excludes, on the one hand, an analysis of the disadvantages that resulted from the support's incapacity to receive writing and retain in it an unaltered state (i.e. the interaction between parchment and inks), and on the other a phenomenon—the presence of stitches—which is of relatively low occurrence and is difficult to interpret. In fact, such stitching equates to a 'repaired defect' (originally a tear or a hole), and it is not easy to ascertain which of the two characteristics prevailed in the minds of the artisans⁴ during their initial evaluation of the raw material, without taking into account the fact that the repairs themselves are not always very aesthetically pleasing and are

¹ The selection criteria applied to parchment in relation to its main characteristics (animal species, thickness, defects) for the manufacture of medieval books are comprehensively described in Bischoff 1993. The most up-to-date current knowledge on parchment (its history, manufacture, histology, preservation and restoration) can be found in Rück 1991; the book is supplemented by a sizable and well-thought-out bibliography (415–476).

² Remarks on the parchment of Latin codices of the 13th and 14th centuries can be read in Casagrande Mazzoli / Ornato 1999, 240–243.

³ The French word is currently used by all those concerned with the study of parchment.

⁴ Here, the term is employed in a generic way to mean anyone—from the scribe (this would have been the norm in the historical period concerned) to any other artisan other than the scribe—who participated in the selection of raw materials for, and subsequent planning and fabrication of, a volume.

never perfectly functional. The decision, instead, to focus our attention on holes and *lisières* can be justified by the following considerations:

- 1. As soon as holes and *lisières* cannot be ignored and the disadvantages they present become obvious,⁵ both phenomena can (without ambiguity) be classified as 'defects'. In contrast to the way in which other peculiarities were appraised (for example, variations in the structure of quires or the *mise en page*, which can be the result of deliberate choices whose interpretation is not immediately obvious),⁶ the presence of holes and/or *lisières* was always perceived as a disadvantage, hence their absence implies careful judgement at the time of the procurement or selection of skins. The purchase of unmarred skins would have involved additional financial outlay; it therefore seems reasonable to suppose that the number of holes and/or *lisières* present on sheets represents a reliable gauge of the overall quality of the parchment, and by extension of the codices in which the sheets served as a writing support.
- 2. The presence of holes and *lisières* is a phenomenon that provides a wealth of statistical information, since they can be observed in almost all codices, albeit at highly variable rates. Furthermore, both types of defect are readily classifiable into specific categories, and can therefore also be the subject of simple counts, even if such reckonings are not entirely free from classification uncertainties. Furthermore, both holes and *lisières* can be observed in a wide range of different positions and situations within codices and quires and on the surface of each page.

⁵ Quite apart from the negative aesthetic issue, a hole located within the writing area not only causes an interruption in the written line's continuity but also introduces the possibility of confusing the affected text with that on underlying page. *Lisières* reduce the space reserved for margins, which in theory should provide space for glosses and annotation.

⁶ For example, one thinks of many Evangelaries—both Latin and Greek—in which the end of a text partition is intentionally made to coincide with the end of a quire, which as a result often presents a structure that deviates from that of the overall volume: see Bischoff 1994. More recently, I have analysed the use of an analogous 'modular' structuring technique in a group of so-called 'giant' Latin Bibles dating from the 11th to 12th centuries (Maniaci 2000, 47–60). In addition, I have been able to identify occasional recourse to the same practice in various Greek Evangelaries dating from the 9th to 12th centuries, which I intend to analyse in a systematic way. Purely as examples, I would point towards a number of codices held in the Biblioteca Apostolica Vaticana, Pal. gr. 220, 9th–10th centuries; Vat. gr. 1159, 10th century; Ott. gr. 297, 10th–11th centuries; Pal. gr. 227, 12th century; and the manuscript held in Rome at the Biblioteca Vallicelliana, B 133, 12th century. The noteworthy variations in the parchment sheets contained within a single volume, which correspond to the different uses to which pages were put (text or illustration), could be intentional: see Bischoff 1991, 127–129, and Bischoff 1993, 77–82.

When the holes and *lisières* were examined it made sense to record, albeit in an approximate way, an additional parameter, namely the thickness of the parchment. Even if this feature does not, in and of itself, represent a defect, it is closely related to the definition of the 'quality of the support'. In fact, it can be presumed that parchment that was considered either too thick or too thin—in relation to one or more standards which will have to be predefined —was considered detrimental to the aesthetics and/or functionality of a volume. The same is also true of variations in thickness found within the same codex or on the surfaces of individual bifolia.

The results presented here are the fruit of surveys carried out as part of a wider research project on the material characteristics of Byzantine book production in the 11th and 12th centuries. The manuscripts that form the main group total 385, approximately two thirds of which date from the 11th century, with the remaining third dating from the 12th century.

1 Holes

1.1 Distribution of holes and typology of manuscripts

A truly exhaustive observation of the typology, frequency of occurrence and distribution of holes should be both qualitative and quantitative in relation to all the ways in which they can present. Accordingly, the following characteristics have to be assessed:

⁷ This connection previously emerged during an examination of a corpus of Lucchese parchments produced before the year 800: see Bianchi et al. 1994, 175–183.

⁸ It is necessary, at the outset, to hypothesise the existence-both synchronically and diachronically-of different standards (contingent on the era concerned) in relation to dimensions and the intended use of the material.

⁹ The reference regards a doctoral thesis on Greek and Latin palaeography developed over a three-year period (1995–1998) at Rome's Sapienza University. The text is currently being revised for inclusion in a monograph [editor's note: appeared as Maniaci 2002]. The realisation of this work was made possible in large part by the kind cooperation of the Direction of the Biblioteca Apostolica Vaticana—in particular, by the then Prefect, Father Leonard E. Boyle, and his deputy Monsignor Paul Canart, who enabled me to acquire the necessary data, a task which entailed consulting, over a relatively short period of time, a huge number of manuscripts. I would like to emphasise my gratitude to Monsignor Canart, who generously provided me with access to his personal card index of Greek manuscripts in order to help me assemble my own sample corpus.

- 1. The number of holes present in each bifolium, taking into account their positions within the quire and within the codex.
- 2. The position of each hole in relation to the writing area (outside, inside, straddling, distant).
- 3. The occasional repair by stitching of all or some of the holes.
- 4. The occasional demarcation of holes inside the writing area by the copyist by means of unbroken lines, series of dots or sketches of various kinds.¹⁰
- 5. The diameter (and hence 'surface area') of each hole, which is a useful datum for quantifying the severity of damage and determining the precise extent of a holed 'surface' on the overall writable surface.

The surveying protocol ultimately decided on—within the framework of a wider research project, as already mentioned—turned out to be rather less thorough than the theoretical framework described above. Indeed, instead of counting all the holes present on each bifolium, only the number of bifolia presenting with at least one hole was determined, regardless of the number of holes concentrated on individual bifolia and their dimensions. Nevertheless, a systematic survey of the coordinates of all the holed bifolia was not foregone (i.e. their positions in quires and in codices), neither was the recording of the positions of holes on pages, based on whether they were located inside or outside the writing area. In all cases, counts were carried out on the entire codex.¹¹

Needless to say, a basic count of the holed bifolia present in a manuscript has no value *per se*; indeed, such a count only becomes significant when placed in relation to the total number of bifolia a volume is composed of.¹² Hence the number of holed bifolia will always be expressed in relative terms (i.e. as a percentage of holed bifolia with respect to the total number of bifolia).

The distribution of manuscripts in relation to the percentage of holed bifolia is shown in Chart 1.

¹⁰ As has been noted previously, this practice was particularly common among insular scribes: see Brown 1991, 62 and footnote 27.

¹¹ This surveying procedure differs from a rudimentary one adopted more than 10 years ago as part of an investigation of Italian book production in the 11th century, the results of which are presented in Bianchi et al. 1993b. Given that the research only entailed the calculation of the total number of holes and *lisières* on three quires in each codex, it is not possible to use such data to make a direct comparison.

¹² It is obvious that the calculation would be more accurate if it were based on the *original* number of constituent bifolia in the manuscript. Nevertheless, the distortion can be considered tolerable, given that it was decided to limit the research—as far as possible—to practically intact volumes, the bulk of which have only lost, at most, a few initial and/or final bifolia.

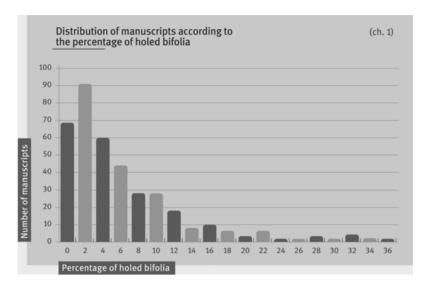


Chart 1: Distribution of manuscripts according to the percentage of holed bifolia

A general tendency to maintain, within certain limits (a figure that can be termed 'reasonable') the number of holes is clear: 69 codices—roughly one fifth of the total—were found to be completely free of holes, whilst in the largest group a rate of between 0 and 2% was observed. 13 Conversely, the codices presenting with holes at a rate in excess of 12% totalled 48, whilst those with holes occurring at a rate exceeding 22% numbered just 17.14

Even if it is not possible to know the holing rate in the skins that the artisans handled from time to time, it seems reasonable to suppose that, based on the situation examined, there was a widespread desire to select, as far as possible, skins affected by the least number of defects. If this were not the case, one would not encounter many codices that are entirely hole-free.

¹³ This means-to provide a concrete example-that a manuscript composed of 200 leaves would entail only two bifolia affected by holes. It is important to note that the distribution pattern-which is to say the individual or combined recurrent values that occur most often-is lower by far than the average, which is 5.76%, whereas the median (i.e. the mid-value) is 3.06%. Definitions of the main 'position parameters' or 'central trend measurements' (mean, median, trend...), together with information on their application can be found in the opening chapters of any primer on statistics: see, for example, Blalock 1984², 83–105.

¹⁴ Returning to the previous example, such a threshold corresponds to a rate of 22 holed bifolia per 200 leaves.

If, then, parchment holes contribute to determining (in a negative way) the perceived quality of a codex, it is likely that their distribution within the corpus will not be uniform, but instead related to various other typological and qualitative characteristics.

Naturally, when it comes to typologies, the fundamental categories to consider are (a) content and writing, and (b) dating and geographical origin. However, it should be borne in mind that while the application of a 'blanket' classification approach in relation to content typology should not result in any serious problems (provided that a certain number of ambiguous cases can be tolerated and, to a certain extent, overlapping of the fringes of one class with another). ¹⁵ when it comes to the writing, the formation of broad groups which are at one and the same time both relevant and methodical would likely create difficulties, and therefore render such an approach impractical. ¹⁶ Similarly, with respect to dating and geographical origin, it is far easier to correlate manuscripts on a simple chronological grid—conveniently divided into successive centuries—than it is to attribute their provenance to precise geographical locations. Indeed, in the Byzantine context, based on our current codicological and palaeographic knowledge, the only group whose features can (largely speaking) be said to be clearly definable is that which encompasses manuscripts originating from southern Italy, which therefore represents the only sizable and statistically applicable geographical cluster.

¹⁵ Needless to say, one is referring to a classification system that functions purely in the context of our statistical investigation of parchment defects. Clearly, the problem would have been more complicated if the research had directly concerned the content of the relevant codices. For our purposes, it seemed sufficient to adopt (whilst consolidating some of the smaller categories of minimal effect) the classification system proposed in Sautel 1995, which represents a valuable source of information on almost 4,000 Greek manuscripts, many of which have not (as yet) been catalogued in a scientific way.

¹⁶ The scribal landscape in the 11th and 12th centuries is very diverse: it is marked—as is widely known—by the predominance and progressive dissolution of scripts that can be placed in the so-called 'Perlschrift' category (an definition devised by Hunger 1954), and by the establishment of cursive scripts employed by learned men, as well as the emergence of new styles based on them. Within each category the intertwining of local variants with different execution levels is still (broadly speaking) rather difficult to 'disentangle', and seems destined to remain so. An attempt to define a script typology for the 11th and 12th centuries can be found in Canart / Perria 1991. The authors expressly state (102–103) that the limit of this operation consisted in the superimposition of a rather rigid scheme (one which is to a certain extent removed from the living reality of the scribes and their graphic forms). Suffice to say that some groupings are exemplified by a very small set of codices (or even by a sole example!), and therefore have a purely classificatory value.

The average percentage of holes varies greatly between one category of text and another (Tab. 1). 17

Percentage of	Percentage of holed bifolia in relation to textual typology			
	Average	Deviation	Median	
Ascetic	10.31%	7.07	9.24	
Bible	4.62%	8.02	1.42	
Biblical	5.22%	6.42	2.11	
Hagiography	3.89%	3.28	3.31	
Homiletical	4.28%	5.70	2.56	
Liturgical	6.35%	8.70	3.53	
Patristic	4.50%	4.68	2.93	
Secular	8.68%	19.74	5.23	
Theology	6.46%	9.28	2.76	
Total	5.67%	17.44	3.68	

Tab. 1: Percentage of holed bifolia in relation to textual typology

The parchments of ascetic and secular manuscripts show a conspicuous number of holes, whereas on the other end of the quality scale we find Bibles, homilaries, hagiographies and patristic works, in which roughly half as many holes are seen. Although the differences between one typology and another seem to be quite clear, it should be noted that the individual items within the groups are not at all homogeneous, as can be deduced from the generally high standard deviation (SD) value. In fact, it is obvious that the same textual content can be found in codices of varying quality, depending on the readership and their intended use. In such a situation, there is a danger that the sporadic presence of codices that are highly anomalous (in one way or another) in relation to prevailing trends within the reference group will result in a significant distortion of the average profile, to the extent of invalidating its representative value.

As a control, it can be helpful to establish a second parameter to place alongside the average figure, namely the median, which is less sensitive to the input of

¹⁷ The line displaying the totals represents the average value for each column.

extreme values. Calculation of the median, whilst leaving unchanged the first rank position held by the ascetic and secular works, highlights the premium quality of the parchment support normally reserved for Bibles¹⁸ and related commentaries. The discrepancy between the average and median values leads us to suppose that, coexisting within the two textual typologies in question, there were two distinct sub-groups. It is surely not by chance that an in-depth analysis demonstrated that almost all codices of poorer quality can be localised within the Western Greek context.¹⁹ More broadly speaking, the quality of the Italo-Greek volumes is shown to be of distinctly poorer quality in comparison to the average value, with a holing rate of 10.65%, in contrast to a value of 4.11% for all the other manuscripts.

Based on the observations made up to this point, the existence of very strict criteria for the selection of the writing support in relation to textual typologies has emerged. Such criteria were applied consistently, regardless of the range of qualitative values observed within each type.

If it has emerged that the presence or absence of parchment holes represents an important factor that should not be neglected when assessing a codex not solely from an aesthetic viewpoint, it is also clear that characterizing quality cannot be limited to appraising the artisan's choice of parchment. Rather, the definition of quality is dependent on a combination of multiple elements that the artisan knew how to adapt to the particular content of a volume and its potential end users. It is altogether likely, however, that the assessment criteria of the period were at least in part different from those applied today, and so it is no simple task to identify all the qualitative aspects that might have appeared relevant to the eyes of a medieval craftsman, commissioner or reader, and even less so to reconstruct the hierarchy²⁰ and evolution over time of such aspects. Therefore, in order to shed some light on the occurrence of parchment holes and the overall quality of

¹⁸ Here, this 'blanket' term indicates, in line with convention, all manuscripts that contain any part of the biblical text without annotation. In our case, codices containing the four Gospels are also included.

¹⁹ The average percentage of bifolia affected by holes is 10.53% for Italo-Greek manuscripts and 2.25% for non-Italo-Greek volumes.

²⁰ The hierarchy varies probably in relation to the 'style' concerned, which is to say a precise combination of material and formal elements used to define a certain kind of presentation, thereby distinguishing it from others. This is somewhat similar to what happens today (although only in relation to formal aspects) with the predefined—or individually definable—styles offered by the most widely employed electronic publishing and word processing systems.

a codex, we must confine ourselves, in such circumstances, to the application of a very rough indicator, namely the presence or absence of gilding in decoration.²¹

In effect, when gold is present, the quality of the support is (as a rule) clearly superior, with an average holing rate of 2.38% per bifolia, in contrast to a rate of 6.89% per bifolia in volumes without any gilding. The difference—which is quite clear—is reflected in all the textual typologies where the use of gold is sufficiently documented (Tab. 2).22

	MSS without gold	MSS with gold	Total		
Ascetic	11.98%	6.55%	10.31%		
Bible	6.90%	1.49%	4.62%		
Biblical	6.35%	2.98%	5.22%		
Hagiography	5.65%	1.26%	3.89%		
Homiletical	5.38%	2.35%	4.28%		
Liturgical	8.73%	2.18%	6.35%		
Patristic	4.74%	1.28%	4.50%		
Secular	8.66%	8.89%	8.68%		
Theology	6.92%	0%	6.46%		
Total	17.01%	2.40%	₁ 5.67%		

Tab. 2: Presence of gold according to textual typologies

²¹ As a differentiating factor, gold has an advantage: that of either being present or absent. However, it also presents a disadvantage because whilst its presence normally identifies a manuscript of superior quality, its absence does not necessarily indicate the opposite-in fact, there are numerous codices in which the absence of gilding can be interpreted as a carefully considered stylistic choice. Even without gilding, such volumes stand out on account of the high quality of their decorative elements. The same problem arises, and further complicates matters, where colours are used: one has only to think of the diffusion, in the Byzantine context, of monochrome decorations that were realised exclusively in deep red (carmine) in a wide range of styles and levels of skill.

²² The calculation of medians instead of means produces analogous results, for which reason it was considered unnecessary to report the latter in the table. The shaded background indicates intersections of a statistically insufficient value (fewer than five volumes).

An analysis of Tab. 2 clarifies two issues: the presence of gold, which implies, in and of itself, a higher standard, is necessarily accompanied by an overall improvement in quality, which attenuates differences related to content. On the other hand, in the groups of manuscripts which do not include gilding, a clear hierarchy persists among the various textual types whose modalities are not very dissimilar—albeit to a lesser extent—to those observed at a general level. In other words, a biblical codex which is not embellished with gold is still, on average, of superior quality (at least in relation to the support employed) compared to, on average, a secular codex.²³

The quality of the support is also subject to changes with the passage of time: in fact, the overall holing average rises from 4.57% in the 11th century to 7.39% in the 12th century. The phenomenon traverses, more or less uniformly, the textual partitioning previously examined, with the exception of the Bibles—which maintain their superior²⁴ quality—and the patristic works (Tab. 3).

Presence of h	(tab. 3)			
	Average 11 th c.	12 th c.	Median 11 th c.	12 th c.
Ascetic	10.45%	10.10%	9.70	6.99
Bible	4.47%	4.76%	1.38	1.56
Biblical	3.59%	8.20%	1.14	6.53
Hagiography	3.96%	3.53%	3.83	0.77
Homiletical	3.94%	5.60%	12.06	4.67
Liturgical	4.07%	9.09%	1.75	5.94
Patristic	4.46%	4.61%	3.13	3 35
Secular	7.08%	10.67%	4.91	6.58
Theology	₁ 7.38%	5.08%	2.48	6.58

Tab. 3: Presence of holes according to textual typologies

²³ When the Italo-Greek volumes are subtracted from the two, the difference becomes much more pronounced (2.21% of holed bifolia, as opposed to 8.41%).

²⁴ Also in this case, the premium quality of the Bibles becomes much clearer if one considers the median rather than the mean. Using this indicator reduces the 'hefty' influence of the poor quality Italo-Greek volumes.

If the quality of parchment declines over the two centuries in question, one can safely assume that this phenomenon was accompanied by a reduction in various other qualitative parameters, the use of gold included, which in theory ought to be seen less often. ²⁵ In effect, the frequency with which gold is employed in our sample manuscripts undergoes, proportionately, a decline, although the reduction in its use is less pronounced than one might expect: a gilding rate of 33.6% in the 11th century declines to a rate of 20% in the 12th century. However, as regards the quality of the support, in the 12th century the number of codices in which gold was still used remains at the same level as was seen in the previous century, whilst the deterioration in support quality occurs only in volumes where the use of gilding is absent (Tab. 4).

Percentage	Percentage of holes according to the presence of gold				
	MSS without gold	MSS with gold	Total		
11 th c.	5.71%	2.31%	4.62%		
12 th c.	8.66%	2.55%	7.52%		
Total	7.01%	2.40%	5.67%		

Tab. 4: Percentage of holes according to the presence of gold

It is quite clear that in the category of texts where decorated volumes that include the use of gilding are greater in number, the reduction in their numbers in the 12th century determines a clearer imbalance in the occurrence of holes between the averages of the two centuries. Even so, a separate analysis of the distribution of manuscripts in which gilding is absent leads one to conclude that the imbalance that disadvantages the 12th century is not dependent on the lower number of gilded codices that are found in the different groups: on the contrary, the reduction in the number of such volumes fits into an overall picture which shows a decline in the quality of the codex, and represents a particularly striking aspect of the same.

One can therefore quite reasonably conclude that the deterioration in qualitative standards does not appear to correspond to a general decline in

²⁵ And/or quantitatively less plentiful or qualitatively less refined (our surveying criteria precluded verification of these two possibilities).

the quality of the parchment produced, but rather to a crisis that made it rather costly to produce and to purchase parchment of superior quality (and therefore probably also reduced the demand for it). Quality standards only remain unchanged in the finest volumes, for which a support of optimum quality clearly represented an indispensable feature.²⁶

The decline in the writing support's quality from one century to the next does not spare, when viewed at an overall level, the Italo-Greek manuscripts included in the sample, although in the antecedent centuries these already exhibited (as observed when analysing the Bibles) a much higher occurrence of holed bifolia.²⁷

The problem raised by the relationship between the presence of gilding and the rate at which holes occur does not arise in the case of Italo-Greek manuscripts, where the use of the precious metal remains highly sporadic in all periods.

²⁶ The diminution of qualitative standards is, in fact, a phenomenon of more global proportions that affects other aspects of codex manufacture, including (in particular) their dimensions, which undergo a considerable reduction, and the use of available page space, which increases. A survey carried out on dated codices and on those attributable (on a firm basis) to the first and second halves of the 12th century leads one to believe that the worsening of qualitative standards is in fact concentrated towards the end of the century, during a phase of increasing difficulty and grave economic crisis that presaged the fall of Constantinople into Latin hands. It is surely not by chance that this period marked the advent, albeit a gradual one, of the production of paper codices, which only in the second half of the following century became solidified (Prato 1984, 75).

²⁷ This result is skewed by a distortion in the sample due to the composition of the Italo-Greek fund held in the Vatican Library which, for the 12th century, is more representative of the scriptorium associated with Grottaferrata than of the more advanced Siculo-Calabrian book manufacture inspired by Constantinopolitan models. For example, many of the Sicilian and Calabrian volumes of larger dimensions and superior quality are concentrated in the Biblioteca Regionale Universitaria at Messina, where the rich collection originating from the Monastery of San Salvatore *in lingua Phari* is held (see the monograph by Foti 1989; one notes, for example, that the average height of the codices that the author attributes to the 12th century is 502.17 mm, which is greater than the overall average height of codices in our sample corpus, which is 490 mm). In addition, with respect to the support, the quality of the Siculo-Calabrian volumes of the 12th century is usually superior to that of codices dating from earlier periods (Canart 1978, 115).

Percentage	Percentage of holes according to manuscripts' origin				
	Italo-Greek	Other	Total		
11 th c.	9.14%	3.84%	4.57%		
12th c.	11.59%	4.80%	7.39%		
Total	10.63%	4.11%	5.58%		
			-H-H-		

Tab.5: Percentage of holes according to manuscripts' origin

To confirm the hypothesis that a general decline in the quality in Byzantine manuscripts took place between the 11th and 12th centuries, an analysis of a parameter less conspicuously linked to the sumptuousness of a codex, but nonetheless closely linked to consumption of raw materials, can be helpful. The parameter in question is the filling of pages, which can be quantified by establishing the proportion of so-called 'blackness' (French *noir*, i.e. the percentage of the surface area written on in relation to the overall surface area of a page). In effect, the degree of 'blackness' underwent an average increase of roughly 6% between the 11th and 12th centuries, shifting from 0.421 to 0.445. In order to evaluate the relationship between the relative number of holed bifolia and the filling of pages it is necessary to subdivide the 'blackness' into a series of separate classes of ascending average values (in our case five quintiles) (Tab. 6).²⁹

²⁸ In practice, the 'blackness' value is obtained by dividing the surface occupied by the writing area (excluding the portion taken up by the intercolumnium in the case of pages of two-column volumes) by the total page area.

²⁹ A quintile is defined as a submultiple of a distribution divided into five equal parts of equal value and of growing average (in a sufficiently regular way, according to the trend set by the distribution concerned). More generally speaking, subdivisions can be made in the form of percentiles or quantiles of equal size (Blalock 1984², 102).

Per	centage of hol	es according	to blackness	5		(tab. 6)
	Blackness a (0.33)	Blackness b (0.39)	Blackness c (0.43)	Blackness d (0.46)	Blackness e (0.53)	Total (0.43)
11 th c.	2.63%	3.77%	4.98%	5.84%	6.28%	4.57%
12th c.	6.63%	7.55%	7.09%	8.61%	7.11%	7.39%
Total	3.63%	4.81%	5.95%	6.77%	6.67%	5.58%

Tab. 6: Percentage of holes according to blackness

The difference in the trend revealed by the figures compels us to consider the two centuries separately. In the 11th century an undeniable correlation existed between the filling of the page and the percentage of bifolia marred by holes, in the sense that the volumes made using materials of inferior quality also contain pages with a greater surface area filled with script (or, stated more precisely, pages with the narrowest margins). This correlation wanes in the following century, when the quality of the support—as we have already seen—definitely declines, whilst the opposite occurs in the case of page filling. As soon as parchment that is less marred by holes becomes scarcer and/or costlier, its use is apparently reserved for the manufacture of products of superior quality. On the other hand, the decline of quality standards is so extreme—the worst parchment of the 11th century is of better quality than the best parchment of the 12th century—that it reaches, even in carefully made codices (i.e. those with pages which are less filled) the minimum acceptable standard, and therefore prevents the use of an even poorer quality support in the 'shoddiest' volumes.

1.2 Distribution of holes on individual pages and throughout quires and codices

Before focusing our attention on the distribution of holes throughout individual volumes, we can safely assume that when the quality of a book is sullied by the presence of defects two consequences arise, as follows:

1. All defects have a negative impact on a book's functionality, given that they affect its material structure and the way in which individual pages and the writing on them appear.

2. Visible defects will result in an unfavourable reaction to the page on the part of readers, and therefore have an overall negative impact on the way a volume is adjudged.

If the book craftsman is conscious of these two issues, he will act to limit the most serious drawbacks and try to conceal from the eye's view any defects which cannot be entirely eliminated. In the case of holes, it is obvious—as has already been pointed out—that their presence is, objectively, far more detrimental when they are located within the confines of the writing area, not only because they impede the progress of writing instruments on the surface of a page, but also because they expose the text on the underlying page, which raises the possibility of misreading.³⁰

From a subjective standpoint, a displeasing impression will be all the more pronounced when holes are visible to the eye of the reader: this occurs—above all—when holes appear in the opening leaves of a codex, which are often those which are seen when a volume is consulted for the first time.³¹ On the other hand, since individual quires were perceived as complete structural units in themselves (above and beyond serving as part of a greater whole), it is altogether likely that the visual impact of the outermost bifolia was considered more important than that of successive ones, so an effort was made to ensure that the former were as defect-free as possible.³²

As regards the distribution of defects on leaves, the bifolia with holes located in the writing area amount to a little less than half of those in which holes appear solely in the four marginal areas (29.8%, as opposed to 55.81%).

With an occurrence rate of 3.18%, the bifolia that present with holes both within and without the writing area represent a small minority. This figure seems all the more modest when one considers that it is some five times lower than the theoretical

³⁰ This was (in all probability) the practical, rather than purely aesthetic, reason which led copyists to 'fence in' with ink the contours of holes situated within the writing area (see above, 107 and footnote 10).

³¹ In general, the first part of a book is the most heavily consulted: one can call to mind, for example, the widespread phenomenon of volumes that are heavily annotated in the first few chapters, but whose leaves gradually become almost free from marginal notes in successive ones.

³² For that matter, it is surely not by chance that in the Late Middle Ages it was still considered a good idea to improve the presentation of (and to protect) certain paper codices by enclosing each quire within a bifolium of parchment (and sometimes even adding another one at the centre of the quire). The ways of presenting and geographical diffusion of this peculiar 'mixed support' quire typology—also met with, albeit very seldom, in the Greek context—are illustrated in Bianchi et al. 1994.

³³ All percentages are calculated with respect to the total number of holed bifolia, without taking into account those which are free of holes.

probability.³⁴ In practice, bifolia affected by holes both within and without the writing area—or at least, their defective halves—were condemned and rejected.

The variation in the proportion of holes lying within and outside the writing area (i.e. in a leaf's margins) varies in relation to the overall incidence of holed bifolia within the manuscript volume as a whole. In order to better understand the phenomenon, the total percentage of holed bifolia in relation to the total number of bifolia has been divided into five sub-classes which reflect the imbalance in proportions, ³⁵ arranged thus: codices entirely free of holes (obviously absent from the table); codices with up to 2% of leaves affected by holes; codices with up to 5% of leaves affected by holes; and finally, codices with more than 10% of leaves affected by holes.

Distribution	<u>Distribution</u> of holes on the page according to their frequency				
	Internal	External	Int. + Ext.		
0-2%	24.81%	76.85%	1.67%		
2-5%	37.09%	64.73%	1.83%		
5-10%	40.59%	63.23%	3.82%		
+10%	44.70%	65.53%	9.72%		

Tab. 7: Distribution of holes on the page according to their frequency

The table makes clear that as the number of holed sheets increases, so too, does a certain indifference on the part of the craftsmen to holes lying within the writing area, with the said holes not being avoided as before. Indeed, more than 10% of the holed bifolia are accepted, with the inclusion of even the worst affected bifolia marred by the presence of holes both in the writing area and in the margins.

³⁴ The theoretical probability, obtained by calculating the sum of the two occurrence rates (and dividing the number by one hundred), is 16.6%. Actually, this is a commonly agreed on reference figure and is only valid if one supposes that every affected bifolium contains at least two holes; in our case, since we did not envisage a count of individual leaves, we were not able to determine the theoretical rate at which holes appear in each bifolium.

³⁵ The classes are of unequal size because they take into account the true distribution of holes which, as the reader will recall, is skewed towards the lowest values.

One can readily imagine that the degree of attention paid to the position of holes on pages also varied in relation to content and script types, and to chronological and geographical factors. This hypothesis is fully confirmed in Tab. 8.

Internal External Int. + Ext. Ascetic 32.81% 67.19% 3.97% Bible 37.08% 62.92% 2.31% Biblical 28.14% 71.86% 3.08% Hagiography 29.19% 70.81% 5.72% Homiletical 33.09% 66.91% 0.98% Liturgical 31.91% 68.09% 2.94% Patristic 38.13% 61.87% 3.33% Secular 45.57% 54.43% 4.28% Theology 35.49% 64.51% 6.75% 11th c. 33.59% 69.63% 3.21% 12th c. 40.06% 65.18% 4.96% Italo-Greek 40.11% 58.77% 7.88% Others	<u>Distribution</u> o	f holes on the page ac	cording to textual typology	(tab. 8)
Bible		Internal	External	Int. + Ext.
Biblical 28.14% 71.86% 3.08% Hagiography 29.19% 70.81% 5.72% Homiletical 33.09% 166.91% 0.98% Liturgical 31.91% 168.09% 2.94% Patristic 38.13% 161.87% 3.33% Secular 45.57% 54.43% 4.28% Theology 35.49% 164.51% 16.75% 11th c. 33.59% 169.63% 3.21% 12th c. 40.06% 165.18% 4.96% 14.96%	Ascetic	32.81%	67.19%	3.97%
Hagiography	Bible	37.08%	62.92%	2.31%
Homiletical	Biblical	28.14%	71.86%	3.08%
Liturgical 31.91% 68.09% 2.94% Patristic 38.13% 61.87% 3.33% Secular 45.57% 54.43% 4.28% Theology 35.49% 64.51% 6.75% 11th c. 33.59% 69.63% 3.21% 12th c. 40.06% 65.18% 4.96% 14.96% 14.06% 158.77% 7.88%	Hagiography	29.19%	70.81%	5.72%
Patristic 38.13% 61.87% 3.33%	Homiletical	33.09%	66.91%	0.98%
Secular	Liturgical	31.91%	68.09%	2.94%
Theology	Patristic	38.13%	61.87%	3.33%
11th c. 33.59% 69.63% 3.21% 12th c. 40.06% 65.18% 4.96% 1talo-Greek 40.11% 58.77% 7.88%	Secular	45.57%	54.43%	4.28%
12 th c.	Theology	35.49%	64.51%	6.75%
	11 th c.	33.59%	69.63%	3.21%
	12 th c.	40.06%	65.18%	4.96%
Others 21 /50/ 71 170/ 2 /70/	Italo-Greek	40.11%	58.77%	7.88%
Others 31.45% /1.1/% 2.4/%	Others	31.45%	71.17%	2.47%

Tab. 8: Distribution of holes on the page according to textual typology

The imbalance between holes located within and outside the writing area remains virtually invariable in the overwhelming majority of subdivisions. The only exceptions, on account of an almost complete lack of concern in relation to the position of holes, are volumes containing secular texts and Italo-Greek texts, both of which—as the reader will recall—are particularly affected by holes.

The clearest tendency to discard bifolia marred by holes located within the writing area is found—needless to say—in the highest quality production contexts. This tendency can be demonstrated by applying the presence of gilding as a discriminating factor (Tab. 9).

Distribution of I the presence of		age according	to	(tab. 9)
	Internal	External	Int. + Ext.	Total
MSS without gold	39.29%	65.54%	4.68%	7.01%
MSS with gold	26.64%	74.90%	1.54%	12.40%

Tab. 9: Distribution of holes on the page according to the presence of gold

The same attitude can be observed if one applies the filling of pages as a reference gauge: a lack of concern in relation to holes within the writing area increases commensurately with the amount of the surface it occupies in relation to the total area. Realistically, we cannot exclude the possibility that part of the phenomenon is 'automatic' in origin, in the sense that an expansion of the area intended for writing on will lead to an increase in the probability that a good number of the holes will appear within it. Even so, the occurrence of this 'automatic' factor does not represent the chief cause of the observed phenomenon, inasmuch as enlargement of the writing area is, overall, limited in scope, and the actual increase in holes proportionately greater than the anticipated theoretical increase (Tab. 10).³⁶

³⁶ The extreme variations seen in the distribution of holes both within and outside the writing area are attributable to the non-uniform distribution of the codices within the various classes. In essence, this is a 'structural effect', which is to say a result that is only seemingly significant—and therefore difficult to 'unmask' as such—produced by the particular characteristics of the sample corpus. This means that the seemingly direct link between the two variables does not in fact exist, or alternatively is induced by a third variable not identified as being the one which is truly responsible (see Maniaci / Ornato 1993, 22).

<u>Distribution</u> of h	<u>Distribution</u> of holes on the page according to blackness				
	Internal	External	Int. + Ext.	Total	
Blackness a (0.33)	29.66%	73.60%	3.26%	3.63%	
Blackness b (0.39)	27.45%	74.32%	1.77%	4.81%	
Blackness c (0.43)	35.35%	67.10%	1.93%	5.95%	
Blackness d (0.46)	43.05%	65.88%	8.93%	16.77%	
Blackness e (0.53)	43.73%	59.89%	3.61%	6.67%	

Tab. 10: Distribution of holes on the page according to blackness

Still to be examined is the thinking behind the way in which artisans distributed bifolia marred by holes within guires.³⁷ An examination of the distribution of holed bifolia in each of the four possible positions—external (1), intermediate (2, 3), and internal (4)—makes it possible to identify the existence of a 'rule' of a negative kind, namely the holed bifolia were not normally assigned the outermost position, but instead distributed in a roughly uniform way in the other three positions. The 'rule' is less closely adhered to when the parchment is particularly marred, which is to say in codices that contain holed bifolia at a rate in excess of 10%. This abatement phenomenon also characterises, as the reader will recall, the other tendencies brought to light, and—in this case as well—can be explained by hypothesizing a growing lack of concern on the part of artisans who, just as they adapted to using parchment of lower quality, worried less and less about concealing defects in the material.³⁸ On the other hand, it is not possible that the overabundance of holed bifolia will, for purely 'automatic' reasons, impede application of the 'rule', inasmuch as it is in theory always applicable, provided that the percentage of holed bifolia does not exceed 75%. This is a very high value and is never attained in the manuscripts included in our corpus (Tab. 11).

³⁷ Only the complete and regular quires were examined, all of which are quaternions.

³⁸ It is impossible to ascertain whether or not this apparent indifference to defects was 'voluntary', or instead due to a paucity of artisanal skill (i.e. an inability to plan, in a competent way, the work to be carried out), or perhaps even to a total ignorance of the 'rule'.

Distribution of ho the bifolium with	(tab. 11)			
Percentage of holes	Bifolium 1	Bifolium 2	Bifolium 3	Bifolium 4
10-2%	10.56%	30.37%	32.41%	26.67%
2-5%	13.30%	30.67%	30.04%	25.99%
15-10%	12.85%	29.69%	29.01%	28.44%
+ 10%	17.20%	28.00%	29.80%	25.52%
Total	13.20%	29.80%	30.41%	26.70%

Tab. 11: Distribution of holes according to the position of the bifolium within the quire

Verification of a widespread awareness of this new 'rule' in relation to the usual typological subdivisions provides us with some new assessment criteria (Tab. 12).

No category exists in which the rule was totally ignored. Moreover, the degree to which it was applied appears to have been quite generalised and remained relatively constant over time, which leads one to believe that the practice was more widely diffused than was a tendency to prevent holes from being located within the writing area. The difference between the two phenomena is also confirmed by the fact that the repositioning of holed bifolia within a quire did not conform to the same criteria as those applied for the selection of bifolia affected by holes both within and outside the writing area. In fact, if we consider secular codices, which contain many holes and betray an apparent lack of concern on the part of the artisans as regards the position of the holes on pages, there appears to be a much greater propensity to 'hide' defective bifolia within quires. The same is true, but to a lesser extent and for different reasons, in the production of biblical, liturgical and homiletical typologies.

Distribution of textual typolog	(tab. 12)			
_	Biyofur 1	Bifolium 2	Bifolium 3	Bifolium 4
Ascetic	20.04%	25.27%	29.26%	25.44%
yāldā:	K. 1998	25.02%	31.13%	32.23%
Biblical	13.08%	29.23%	33.06%	24.63%
Hagiography	17.94%	31.71%	32.77%	18.12%
Homiletical	12.45%	26.30%	32.48%	28.77%
Liturgical	10.46%	33.74%	29.81%	25.99%
Patristic	20.43%	32.34%	27.45%	19.78%
Secular	7.22%	27.18%	29.93%	35.67%
Theology	18.71%	33.97%	21.19%	26.13%
111th c.	14.22%	28.06%	30.43%	27.29%
12th c.	11.49%	32.71%	30.37%	25.71%
Italo-Greek	13.06%	35.38%	26.99%	24.56%
Others	13.24%	27.86%	31.60%	27.44%

Tab. 12: Distribution of holes within the quire according to textual typology, date and origin

It is particularly interesting to establish that the percentage of holed bifolia occupying the first position (i.e. the outermost bifolium of the quire) does not exhibit noteworthy variations within the subdivisions based on the usual indicators of overall codex quality—i.e. page filling and the presence or absence of gilding—which, on the contrary, exerted a very discriminating effect on the distribution of holes over the surface of the page (Tab. 13).

Distribution of presence of gol	(tab. 13)			
	Bifolium 1	Bifolium 2	Bifolium 3	Bifolium 4
MSS without gold	13.45%	29.70%	30.45%	26.55%
MSS with gold	12.48%	30.10%	30.29%	27.13%
Blackness a	11.18%	27.65%	27.31%	33.86%
Blackness b	11.42%	33.73%	31.01%	23.85%
Blackness c	12.00%	31.33%	27.86%	29.33%
Blackness d	15.31%	28.91%	31.36%	24.42%
Blackness e	15.81%	27.30%	34.06%	22.83%

Tab. 13: Distribution of holes within the quire according to presence of gold and blackness

Finally, the regularity with which the bifolia most severely compromised by holes are found in the second or third positions, rather than at the centre of the quire, merits some attention:³⁹ indeed, one can discern the existence of a more complete rule—albeit one which is less clearly established, and above all too 'watered down' within the corpus to make it possible to identify the concrete ways in which it was applied. This additional rule can be explained when one pauses to remember that the internal bifolium is the only one in which one of the sides is fully visible (when the volume is open).⁴⁰ The rule does not exclude the existence of an alternative practice for the handling of the most defective bifolia which envisages 'concealing' them innermost within quires. The preference for this second solution is particularly evident in volumes that contain sacred texts.

A final verification step concerns the distribution of holed bifolia within the manuscript, which is to say between the first and second halves of a volume,

³⁹ Of 2,024 holed bifolia, 310 occupy the first place, 571 the second, 588 the third, and 527 the fourth. Taking into account a deficit of 12% in the first rank, the theoretical distribution for the three other positions should be 29%, which equates to 587 bifolia. The difference with respect to the true value is significant for the fourth place ($\chi^2 = 6.3$; using Pearson's chi-squared test, which makes it possible to compare the compliance of an observed distribution to a theoretical one; see Blalock 1984², 349–364. **40** In hindsight, it is to be regretted that the surveying of holes was carried out on bifolia rather than on individual leaves, since it would have been interesting to confirm the possible existence of a 'rule' aimed at avoiding the simultaneous presence of holes on two facing leaves.

calculated on the basis of the collected data. The average value for the two halves (respectively 47.06 and 52.93) turns out to be roughly equal, ⁴¹ and there is no significant variation in this ratio among any of the typological subdivisions.

2 Lisières

2.1 Lisières and skin structure

The detailed survey of the *lisières* posed, from the outset, problems of greater magnitude than those presented by holes, due to uncertainties stemming from the following three factors:

- 1. *Lisières* which only appear along the three 'open' edges of a codex, were subject to being trimmed (precisely on account of their being 'open'), an operation which could result in their partial or complete removal. In the event of partial removal, residual traces of a *lisière* can easily be confused with other kinds of irregularities (e.g. stiffened areas of the parchment, folded and split corners, etc.) attributable to events following the manufacture of volumes, and their present-day state of preservation.
- 2. The exact location of a *lisière* along any of the three 'open' edges of a codex is not always easy to describe in a precise and unambiguous way.
- 3. Different kinds of irregularities correspond to different areas of a skin (i.e. flank, neck, axillae) and are often indistinguishable because of the way in which they manifest themselves along the edges of a bifolium, and also on account of a dearth of precise information on the relationship between the entire skin and the portion represented by a single bifolium. Problematic issues of this kind become particularly apparent in the event of irregular edges situated in proximity to the corners of a bifolium.

Taking into account all of the above problematic factors, the *lisières* were surveyed, just as were previously the holes, in all the bifolia of each volume composing the corpus. As in the case of the holes, the survey encompassed all the bifolia affected by *lisières*, rather than individual irregularities present on each bifolium (Chart 2).

⁴¹ Student's t-test, which verifies hypothetical parity between the averages of two small samples (see Blalock 1984 2 , 241–247) for paired up samples gives a result of 1.27, which is insignificant (the bilateral t threshold being 1.97).

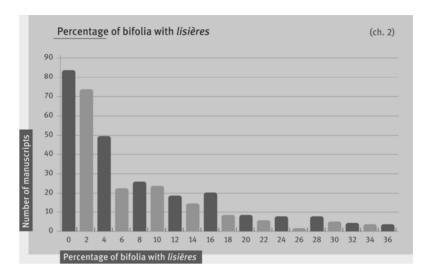


Chart 2: Percentage of bifolia with lisières

The average percentage of bifolia presenting with *lisières* was found to be 7.8%, and their distribution within the corpus proved to be very similar to that of the holes.

Although the average value for the *lisières* is higher than that of the holes, the majority of codices affected fall into the 0-2% range, as was also the case with holes. The disparity between the two averages relating to *lisières* and holes respectively is attributable to a wider dispersion of the distribution of *lisières*: indeed, if the number of manuscripts entirely free of *lisières* is higher than the number of those without holes (85 volumes, equating to 22%), more than 12% of the *lisières* are met with in 96 codices (23.8%), and in another 40 volumes (10.3%) 17% of sheets are affected. The difference between the two distribution rates can be accounted for, at least in part, by the fact that *lisières* are necessarily situated along the edges of codices; for this reason, if desired, they can easily be eliminated, albeit at the cost of slightly reducing a volume's size. On the other hand, such irregularities can also be tolerated without resulting in any serious impact on writing or reading functionality.

2.2 Distribution of lisières and manuscript typologies

As we have already done in relation to holes, the problem of identifying the existence of possible relationships between the rate of occurrence of *lisières* and the different textual typologies included in our study now has to be addressed. Once again, we shall start out by subdividing the sample corpus into different textual classes (Tab. 14).

<u>Distribution</u> of <i>lisières</i> according to textual typology			
Textual typology	Average	Median	
Ascetic	7.90%	16.09	
Bible	6.79%	1.15	
Biblicat	6.27%	2.21	
Hagiography	5.20%	2.09	
Homiletical	6.95%	3.28	
Liturgical	9.93%	4.55	
Patristic	8.10%	4.58	
Secular	10.13%	5.75	
Theology	8.21%	1.24	
Total	8.04%	3.34	

Tab. 14: Distribution of lisières according to textual typology

Overall, the distribution of *lisières* is more uniform than that of holes. The distribution of *lisières* is, however, consistent with the distribution of holes when it comes to their distinctive characteristics. In particular, if one considers the median value relative to each group, it can be seen that Bibles and theological codices on the one hand, and secular texts on the other, stand apart respectively for defects and for a profusion of bifolia affected by *lisières*.

In contrast to holes, *lisières* are not subject to variations over the course of time. Indeed, between the averages relating to the 11th and 12th centuries—respectively 7.23 and 8.74—no significant difference can be seen.⁴² Additionally, cross referencing of date and textual types produces—unlike in the case of holes—inconsistent results (Tab. 15).

	Average 11 th c.	12 th c.	Median 11 th c.	12 th c.	Total
Ascetic	8.26%	7.32%	4.42	8.55	7.90%
Bible	7.86%	5.82%	1.41	10	6.79%
Biblical	5.68%	7.35%	1.06	3.39	6.27%
Hagiography	4.84%	7.24%	2.40	1.53	5.20%
Homiletical	6.86%	7.29%	3.27	3.75	6.95%
Liturgical	5.68%	15.03%	2.25	9.28	9.93%
Patristic	8.57%	6.84%	4.58	4.25	8.10%
Secular	13.28%	6.19%	10.58	3.46	10.13%
Theology	5.86%	11.74%	1.25	7.57	8.21%
Total	₁ 7.14%	9.62%	3.13	4.04	8.04%

Tab. 15: Distribution of lisières according to century and textual typology

Unlike the chronological factor, the localisation of codices—once again limited to the East-West antithesis—represents an effective discriminating factor, inasmuch as codices originating from southern Italy reveal, with respect to *lisières*, a broadly speaking far more careless attitude.⁴³ As has already been ascertained at a global level, the distribution of *lisières* in Byzantine southern Italy was not subject to significant variations with the passage of time (Tab. 16).

⁴² Student's *t*-test result = 1.22 (the bilateral *t* threshold being 1.97).

⁴³ For example, also in this instance one observes an enormous difference between non-Italo-Greek biblical manuscripts (average percentage of *lisières* 2.79%) and Italo-Greek ones (16%).

Distribution	of <i>lisières</i> according to century and origi	n (tab. 16)
	Italo-Greek	Others
11th c.	16.16%	_] 5.80%
12 th c.	15.26%	4.72%

Tab. 16: Distribution of lisières according to century and origin

As regards the relationship of *lisières* with other qualitative aspects of the codices, one notes, above all, that they—just like holes—were more sedulously avoided in manuscripts whose decoration was embellished with gold than in those without any gilding (Tab. 17).

Distribution of century and t	Distribution of <i>lisières</i> according to century and the presence of gold			
	MSS without gold	MSS with gold		
11 th c.	9.23%	3.27%		
12th c.	10.29%	2.87%		
_				

Tab. 17: Distribution of lisières according to century and the presence of gold

Conversely, the partitions created on the basis of the page filling rate result in only slight and insignificant variations. ⁴⁴ However, it should be noted that there is a positive correlation—limited to the 11th century—between the number of *lisières* and the expanse of ink coverage. This correlation does not, however, apply to the most 'filled' codices. One explanation—albeit partial—for this phenomenon could lie in the fact that the presence of *lisières*, which 'eat' into the edges of a leaf, hampers the unfettered expansion of ink coverage (Tab. 18).

⁴⁴ Student's *t*-test applied to the *a-b* classes of 'blackness' on the one hand and the *d-e* classes on the other (so as to maximise any possible differences) gives a result of 0.68, which is much lower than the bilateral *t* threshold of 1.97.

<u>Distribution</u> of <i>lisières</i> according to century and blackness							
	Blackness a (0.33)	Blackness b (0.39)	Blackness c (0.43)	Blackness d (0.46)	Blackness e (0.53)	Total	
11 th c.	5.63%	5.66%	7.58%	9.57%	8.25%	7.23%	
12 th c.	8.02%	12.29%	6.65%	8.94%	8.99%	8.74%	
Total	6.22%	7.49%	7.15%	9.36%	8.60%	7.77%	

Tab. 18: Distribution of lisières according to century and blackness

All things considered, the comparison of the distribution of the holes and the *lisières* reveals the existence of similarities and differences in the way in which bifolia affected by the two types of blemish were selected. If it cannot be doubted that *lisières* constitute, objectively, defects in the raw material and were perceived as such, at the same time they do not share the same (negative) categorisation as holes—indeed, their presence, given that it is common to all skins, does not diminish *per se* the quality of the raw material, and therefore should not be included among the criteria applied when appraising the value of skins. This probably accounts for a greater indifference on the part of artisans—as well as owners and readers of volumes—when confronted by a, so to speak, natural feature of the writing support. Furthermore, since *lisières* necessarily coincide with the outermost edges of a book, they do not have a negative effect on its functionality, apart from in a few exceptional cases.

2.3 Distribution of lisières within volumes and quires

On account of their categorisation as 'defects' (albeit of a particular kind), artisans were sometimes tempted to conceal *lisières*, just as in the case of holes, within a volume or quire. It should be interesting, then, to determine whether or not the strategies followed by artisans in this regard coincided with their attitude towards holes, with which up until now *lisières* have shown themselves to be only partly comparable.

In effect, the division of a codex into a first (I) and second (II) half reveals a tendency to concentrate *lisières* in the bifolia positioned after the midpoint of a

⁴⁵ See Denis Muzerelle's analogous reflections, in Bianchi et al. 1993b, 403.

volume, although only in codices with a limited number of *lisières*. 46 Gradually, as the percentage increases, one notes a progressive lack of concern on the part of artisans in relation to *lisières*.⁴⁷ This attitude seems to coincide with a tendency to select the best skins among those available, leaving to last, if possible, the use of the most blemished ones (Tab. 19).

5.59%
55

Tab. 19: Distribution of lisières in the two halves of the codex according to their frequency

In any event, cognizance on the part of artisans concerning lisières, up to this point addressed in a rather broad way, was not expressed in a sufficiently marked form so as to warrant a more in-depth analysis. All the investigations carried out—in relation to text type, date, geographical origin and codex quality—yielded non-contradictory results with respect to the underlying tendency, although they present a certain number of inconsistencies of unclear cause.

⁴⁶ The *lisières*, like the degree of 'blackness', were divided into classes of ascending percentages (listot a, b, c, d, e). The lisière-free codices, for obvious reasons, are not shown in the table.

⁴⁷ The total χ^2 is 6.93 (significant, with a 2% margin of error). As regards the individual classes, the χ^2 value is significant for class c. Also in class b a difference is observed between the two halves of the codex, which follows the same trend, even if it is not statistically insignificant.

Distribution of <i>lis</i> the bifolium with	(tab. 20)			
Percentage of lisières	Bifolium 1	Bifolium 2	Bifolium 3	Bifolium 4
0-2%	6.80%	39.91%	27.85%	28.07%
2-5%	9.88%	28.82%	25.59%	35.97%
5-10%	7.17%	37.25%	28.91%	27.13%
>10%	10.05%	30.38%	28.52%	27.96%
Total	6.79%	26.35%	21.76%	23.09%

Tab. 20: Distribution of lisières according to the position of the bifolium within the quire

Still to be confirmed—as was done in the case of holes—is a possible tendency to 'conceal' bifolia affected by *lisières* towards the innermost part of a quire, instead of locating them in the outermost position. Such a tendency is effectively shown to be more marked than it was for holes, above all in codices affected by a limited number of *lisières*. However, the trend shows a slight attenuation when the percentage of *lisières* is higher, even if the descending progression is not altogether consistent. All the bifolia positioned after the first have an average percentage of *lisières* which is slightly higher than the random distribution, even if one can discern a slight propensity—analogous with that revealed for holes—to shift to the second position the *lisières* removed from the external position (Tab. 20).

In the case of *lisières*, too, the tendency to spare the outermost bifolium of a quire represents a widespread and generalised practice. Indeed, the practice extends across all the customary typological subdivisions, without showing any significant variation.

Distribution of <i>lisières</i> within the quire according to tab. 2 textual typology, date and origin					
	Bifolium 1	Bifolium 2	Bifolium 3	Bifolium 4	
Ascetic	6.95%	34.99%	20.51%	37.55%	
Bible	9.16%	32.18%	26.45%	32.22%	
Biblical	10.87%	37.93%	23.47%	27.73%	
Hagiography	1.44%	39.57%	38.46%	20.53%	
Homiletical	18.80%	35.69%	27.78%	29.23%	
Liturgical	19.60%	35.57%	24.99%	129.84%	
Patristic	9.15%	28.06%	32.30%	₁ 30.48%	
Secular	15.65%	33.87%	35.91%	24.56%	
Theology	11.85%	15.75%	37.52%	34.89%	
11 th c.	8.32%	35.10%	26.16%	29.97%	
12 th c.	9.35%	31.10%	30.82%	28.66%	
Italo-Greek	7.95%	33.75%	30.53%	26.09%	
Others	₁ 8.96%	33.66%	26.79%	30.78%	
MSS without gold	8.63%	32.61%	28.52%	29.46%	
MSS with gold	8.87%	37.30%	25.41%	29.69%	
Blackness a	7.94%	39.72%	25.77%	26.32%	
Blackness b	14.28%	34.70%	26.15%	22.78%	
Blackness c	8.02%	34.61%	25.82%	33.54%	
Blackness d	16.06%	27.69%	32.05%	32.70%	
Blackness e	8.08%	33.02%	28.59%	30.18%	

Tab. 21: Distribution of lisières within the quire according to textual typology, date and origin

2.4 Lisières, quire construction and codex format

The very considerable imbalance between *lisières* situated in the first and successive positions within the quaternions raises the problem concerning the utilisation of skins in the construction of the bifolium. As is well known, a successful hypothesis—formulated by Léon Gilissen—attributes to the late medieval Latin artisans the practice of creating medium-sized quaternions by juxtaposing two skins folded in two perpendicular to the spinal axis, and then folded a second

time in parallel with the same axis.⁴⁸ More recent research—based on a direct examination of the traces of the original morphology of the skin, which are often still visible in parchment—has cast doubt on the possibility of adopting, wholesale, the Belgian codicologist's conclusions and using them to automatically extrapolate information from different historical periods and contexts.⁴⁹

In reality, whatever the actual extent of its diffusion might have been, the procedure hypothesised by Gilissen, despite having (in theory) the merit of rendering the construction of quires a more rational and ergonomic process, presupposes the availability of whole skins of virtually identical dimensions, in addition to being free of defects that would prevent them from being fully utilised. As is well known, this certainly was not the norm in the context of medieval manuscript production. Indeed, as anyone possessing the slightest familiarity with manuscripts knows, the skins, on the contrary, presented in a wide range of sizes and often, because of their poor quality, could only be partially utilised. Furthermore, Gilissen's hypothesis contains an additional flaw: starting with a single skin, its systematic application would result in the automatic creation of bifolia all of which are of the same size and, starting with a group of identically sized skins, the creation of manuscript volumes likewise all of the same size, or alternatively conforming to a descending geometric progression in relation to the size of the skin in question.

Instead, it seems quite reasonable to suppose—given on the one hand the size variations seen in animal skins and in the manuscript volumes that have come down to us, and on the other the need on the part of medieval craftsmen to utilise to the maximum the available material, wasting as little as possible—that quire construction techniques were far more varied and subject to improvisation according to specific needs and the characteristics of the available material. This supposition has, moreover, been further validated by the results obtained from a sample of Greek and Latin codices dating from different historical periods, which have shed light on a variety of relationships—albeit

⁴⁸ See Gilissen 1977, 14–122. In effect, the favourable reception the hypothesis has enjoyed and continues to enjoy up to the present (with its consequent blanket application) far exceeds the bounds and purpose of its original formulation.

⁴⁹ See Bischoff / Maniaci 1996, a work, with respect to the Greek section, based on the results obtained from the doctoral thesis mentioned in footnote 9, and therefore on the same data employed for the production of the present article. Doubts in relation to the universal validity of Gilissen's hypothesis had already been raised independently, in a brief intervention by Dennis 1993, 166–173; however, the examples furnished by the author are not altogether convincing from the methodological standpoint. To the problematic issue of folding, with specific reference to Greek manuscripts, I have dedicated an in-depth analysis (Maniaci 1999).

not always easily interpretable—between the surface represented by the bifolium and the original animal skin from which it was derived. In particular, with respect to Byzantine production, the existence of a method of subdividing skins different from that described by Gilissen has come to light, namely an approach that consists in cutting the skin twice in a 'T' form,⁵⁰ a procedure that yields three bifolia, two of which are created by the division of the skin along its dorsal axis, and the third resulting from a further subdivision parallel with it.

As might be expected, the positioning and orientation of bifolia on a skin's surface affected the position in which any (possible) *lisière* would be situated. Graph 3 shows the overall distribution of *lisières* throughout the examined sample corpus. It is quite striking that the vast majority are located in the lower margins of leaves, whereas the percentage of those located in the upper margins appears to be very small.

(ch. 3)

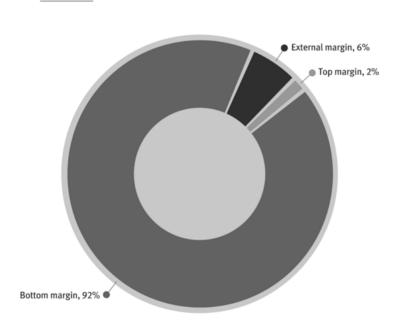


Chart 3: Distribution of lisières on the bifolia

Distribution of lisières on the bifolia

The unequal distribution of *lisières* along the open edges of bifolia (Chart 3) confirms, above all, the existence of a very widely diffused tendency to place them (preferably) on the tail edge of a volume. This practice, picked up on by Gilissen in order to prove the construction of bifolia by folding is, in reality, too generalised to allow for its attribution wholly to 'automatic' causes. However, it is true that the phenomenon appears to be in line with the habit—quite recently noted—of dividing skins in two along their dorsal axes, a practice which up to the present only Byzantine book craftsmanship has provided us with evidence of. The scarcity of laterally positioned *lisières* would instead suggest an approach favoured by Byzantine artisans that consisted in the subdivision of skins perpendicular to their spinal axes, thereby generating two bifolia from each skin.

Conversely, the remarkable rarity of codices—a sum total of 17—which present with *lisières* on both the upper and lower margins⁵¹ is quite surprising. This should in fact be the norm in the bulk of large codices of in-folio format, each of whose bifolia were produced using one entire skin. To account for this incongruity, we can hypothesise that the rectification of a skin's edges was carried out above all on the upper margin of a the rectangle that was destined to become a bifolium, positioning—if deemed necessary in order to economise on the material—any *lisières* on the lower margin, which was normally somewhat wider. It is more likely, however, that the scarcity of *lisières* situated along the top edge of volumes simply reflects an almost total absence of in-folio manuscripts in the sample corpus studied. Therefore, the largest of the Greek volumes should be of in-quarto format obtained from large skins.⁵²

3 Holes and lisières

If, by now, we have ascertained that holes and *lisières* belong—albeit in different ways—to one and the same category (i.e. defects), we have yet to establish the kind of relationship in which the two phenomena coexist in manuscripts. In more specific terms, we have to ask whether or not it is possible to confirm that, in general, the rate at which holes occur evolves in parallel with that of *lisières*.

In order to answer this question, it is necessary to cross-reference the percentage of bifolia that are affected by *lisières* with the percentage of bifolia that

⁵¹ Furthermore, many of the *lisières* recorded as being situated on the upper margin are, in fact, located on corners (where the upper and outer margins meet).

⁵² Maniaci 1999, 110–121.

are affected by holes by grouping the two variables in five classes in order to compare them. The percentage of volumes corresponding to each of the intersection points is reported in Tab. 22 in the individual boxes, as follows:

Distribution of manuscripts according to the frequence of holes and <i>lisières</i> (tab. 2						
	Percentag	e of bifolia wi	th <i>lisières</i>			
	a (0)	b (0-2%)	c (2-5%)	d (5-10%)	e (>10%)	Total
Percentage of holed bifolia						
a (0)	10.4%	4.7%	1.6%	10%	1.3%	69
b (0-2%)	8.0%	6.5%	4.4%	12.8%	1.6%	190
c (2–5%)	12.6%	5.7%	4.7%	₁ 3.9%	4.9%	84
d (5–10%)	1.3%	4.1%	1.8%	4.7%	8.5%	₁ 79
e (>10%)	10%	3.1%	2.3%	2.1%	11.4%	64
Total	86	84	57	52	107	386

Tab. 22: Distribution of manuscripts according to the frequence of holes and *lisières*

The diagonal series of figures that links the two most extreme situations—i.e. a total absence of holes and lisières/maximum number of holes and lisières—corresponds to cases where there is a perfect correlation between the two variables. This diagonal captures 37.7% of the corpus-140 manuscripts—and no other linear combination of five boxes results in a similarly high value. Conversely, the opposite diagonal series—where cases of maximum dissociation between holes and lisières are situated-captures only 12.9% of the total, equating to 50 manuscripts.⁵³

The 'correlation diagonal'-taken as a reference point and excluded—divides the table into two opposing triangles, with the upper representing the evolution of holes in relation to lisières, and the lower representing the

⁵³ The second diagonal does not possess the same discriminating power of the first, since it is not exclusively composed of homothetic cases; one notes, among other things, that the central box is shared by the two diagonals. It should also be pointed out that the highest value of all of any combination of five boxes (bold figures in the table) is symmetrically concentrated at the extreme limits of the table, in proximity to the correlation diagonal.

evolution of *lisières* in relation to holes. The two triangles equate to 33.7% and 32% of the total, respectively. This result provides us with the definitive answer to our initial question: the evolution of holes and *lisières* can be considered symmetrical, which means that neither of the two phenomena received preferential treatment on the part of artisans when they were selecting skins to utilise in the making of manuscripts. Unfortunately, as soon as data relating to holes and *lisières* are registered separately, it is impossible to examine in detail the attitude adopted by the artisans towards bifolia which presented with both *lisières* and holes simultaneously.

4 Parchment's thickness

Given that parchment is naturally a rather uneven material, its thickness can be subject to considerable variations. For this reason, in order to obtain a reliable estimate, it is necessary to calculate the average thickness value of a large number of spot measurements, instead of relying on a single spot value. Therefore, for each manuscript, the thickness of the parchment in all the constituent bifolia of three complete quires was ascertained by measuring each of them at ten different points scattered along its four sides.

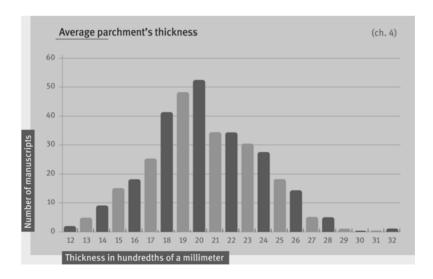


Chart 4: Average parchment's thickness

The 4,632 bifolia measured (for a total of 46,320 points), when taken as a whole, yielded an average overall parchment thickness value of 20.80 hundredths of a millimetre. Needless to say, this average value conceals considerable variations, even if extreme values do not occur very often: in fact, the minimum thickness determined in the corpus was 11.98 hundredths of a millimetre, while the maximum value was found to be 36.55 hundredths of a millimetre.⁵⁴

Chart 4—where average thickness is calculated for all the bifolia contained in the three quires measured for each manuscript volume—shows that the distribution is relatively symmetrical and presents a single peak between 20 and 21 hundredths of a millimetre.

Research carried out to determine systematic factors capable of influencing in a consistent way choices made by the craftsmen in relation to parchment thickness proved entirely fruitless, as documented in the breakdown of typologies investigated (Tab. 23).

It is clear that parchment thickness is entirely unaffected by chronological and geographical divisions. On the other hand, the absence of variations attributable to the content and quality of the codex⁵⁵ suggests that the thickness of skins did not constitute a discriminating criterion in the fabrication of codices of different types and qualities, and that, as a result, a differentiated supply (i.e. a range of quality grades) did not exist.

⁵⁴ These absolute values can usefully be compared with those relating to other groups of manuscripts: 11th-century Greek and Latin volumes of Italian origin (average thickness 22.7, with values ranging from 14.2 to 32); 14th- and 15th-century Latin volumes of Italian origin, 18.16 and 18.47, respectively see Bianchi et al. 1993b, 390, and Bianchi et al. 1993a, 109.

⁵⁵ In actual fact, there is no significant difference in the thicknesses also when the size of the codices varies. However, we forwent looking further into this problematical issue, given that it lies behind the relationship–far from being clarified–between the dimensions of bifolia, skin sizes and animal species.

Distribution of thickness according to textual typology, presence of gold, defects, origin, century (tab. 23				
	Average			
Ascetic	19.32			
Bible	21.81			
Biblical	20.62			
Hagiography	20.69			
Homiletical	20.34			
Liturgical	20.91			
Patristic	20.35			
Secular	21.37			
Theology	22.08			
11th c.	20.81			
12th c.	20.79			
Italo-Greek	21.24			
Others	20.68			
MSS without gold	20.84			
MSS with gold	20.74			
0 defects ⁵⁶	20.38			
>25% defects	20.89			

Tab. 23: Distribution of thickness according to textual typology, presence of gold, defects, origin, century

The wide range of thicknesses borne witness to in the manuscripts should not exclude, at the outset, the existence of a certain degree of skin selection based on thickness within each manuscript volume. However, if, on the part of the artisans, there existed any desire to select (from time to time) batches of skins of

⁵⁶ The 'blanket' definition 'defects' refers to the percentage of bifolia presenting with holes and/or *lisières* in relation to the total number of bifolia. The two classes included in the table correspond to the extremes of the distribution, represented, respectively, by 39 and 58 manuscripts. The absence of significant differences exempts us from presenting the data relating to the codices affected by an intermediate percentage of defects.

equal thickness, the average variation⁵⁷ in thickness of the inner bifolia of each manuscript should prove to be significantly smaller than the overall variation in thickness observed throughout the entire corpus. On the contrary, the variation turns out to be almost identical in both cases.⁵⁸ One can therefore deduce that the artisans, as a rule, were not able to acquire batches of skins of uniform and predetermined thickness. It should be recalled, in this regard, that the same test produced completely different results for two groups of typologically homogeneous⁵⁹ Latin late medieval codices, a period and context in which it is reasonable to suppose that parchment was marketed in a different and quite likely more highly developed way.

Based on these findings, it would be a mistake to suppose that on the part of artisans there was a total indifference to the thickness of the parchment they used. That this was clearly not the case can be gleaned from the results of a second test conducted on the variations in thickness of individual manuscripts and individual quires—indeed, the average variance in the latter is significantly smaller. 60 The very clear result of the test is explained only in part by the fact that bifolia belonging to one and the same quire can originate from the cutting up-inquarto or in-sexto-of only two skins, and implies, on the part of the artisans, a desire to achieve uniform thickness. This provides confirmation of the fact that the organisation of a codex into quires was not a purely material operation aimed at structuring a volume based on its writing, reading and future storage. In fact, in addition to this primary function—as already ascertained in relation to defects in the support material—there were secondary aesthetic functions or motivations whose existence is not immediately perceptible (upon first inspection of a volume), and whose significance is not always easy to interpret with certainty.

If the preferential distribution of holes and lisières in certain bifolia of a quire can be accounted for by the desire to conceal imperfections from the eye

⁵⁷ The variance-definable as the average of squared differences from the mean-is a measurement of the degree of variability (in other words, of the dispersion) of a distribution: see Blalock 1984², 114.

⁵⁸ The average variance in the group of three quires examined in each manuscript volume is 21.97, whereas the overall variance within the corpus is 22.28.

⁵⁹ The reference is to two corpora of codices of Italian origin-one composed of 14th-century law codices originating from Bologna, and the other composed of volumes of humanist inspiration prepared at Cesena for Malatesta Novello-analysed in Bianchi et al. 1993a.

⁶⁰ The average variance is 21.97 for the manuscripts, and 16.87 for the quires. When one is not dealing with variances, but instead with means of variances, Student's t-test can be applied, which yields a result of 4.13, which is highly significant. The two Latin corpora mentioned in the previous footnote exhibit, largely speaking, the same characteristics.

of the reader, it is altogether less easy to identify the rationale behind another of the artisans' practices, the diffusion of which has already been well investigated in relation to Latin manuscripts,⁶¹ namely the tendency to distribute bifolia within a quire according to parchment thickness. In this case, too, our corpus attests to a similar 'rule': average thickness varies in a systematic way when the bifolia are distributed according to the 'rank' they hold within a quire (Tab. 24):

Distribution of thickness the position of the bifoliu	(tab. 24)	
	Average	
Bifolium 1	21.14	
Bifolium2	20.69	
Bifolium 3	20.61	
Bifolium 4	20.78	

Tab. 24: Distribution of thickness according to the position of the bifolium within the quire

The external bifolium is thicker than the following three, among which no variation in thickness is observed. Even if the difference is fairly small, the sample is large enough to consider it statistically significant. The fact that the discrepancy, despite being significant, is quite small, clearly does not mean that it can be attributed to a greater sensitivity on the part of the artisans to even the slightest variations in thickness, but rather to the fact that the 'rule' identified was not strictly adhered to in the manufacture of all the codices.

5 Conclusions

The results presented in this study constitute a preliminary analysis of the parchments used in Byzantine codices and is aimed at fulfilling two different objectives: (a) the acquisition of a deeper knowledge of various aspects of a manufactured product whose material characteristics have received little attention; and (b) a comparison of artisanal practices employed in different contexts—in our case,

⁶¹ Bischoff 1991, 129 onwards: Bianchi et al. 1993a, 144 onwards.

Greek and Latin—with the aim of bringing to light similarities and differences, and of identifying, wherever possible, the reasons behind the same.

The first part of the investigation was aimed at outlining a distribution typology for various parchment characteristics—holes, *lisières* and defects—in relation to three fundamental elements—chronology, geographical origin and content—which define, as it were, the identity of every manuscript. In this way, the existence (primarily) of a close relationship between book and text (understood as container and contents) has emerged. Indeed, from the moment he selected his parchment support, a manuscript craftman's subsequent choices were all made taking into account the type of text the codex would ultimately contain, its function, and its targeted readership. If it has become clear—as was foreseeable—that in all the periods investigated the least defective parchment was reserved for the finest codices, at a more general level it has also come to light that when choosing his support a craftsman respected a rather clear qualitative hierarchy in relation to textual typologies: in particular, while the best parchment was reserved for codices bearing biblical content—sacred books *par excellence*—the poorest quality material was employed for the manufacture of volumes containing secular texts.

Adherence to a basic typological criterion has been identified as an underlying constant, and one which is not obscured by the emergence, with the passage of time, of a considerable qualitative difference between the output of the 11th and 12th centuries, to the disadvantage of the latter. Indeed, considered overall, the more recent manuscripts are those which suffer the most from material defects. It is interesting to note that a decline in the quality of the support affects, albeit it in a non-uniform way, the entire production—a reflection of a growing crisis which would eventually culminate, in 1204, with the seizure of Constantinople by the Latins.

Of the three supporting columns of the typological investigation—content, geographical context, and period of manufacture—beyond doubt the most problematic remains the place of origin. In fact, as has already been noted, Byzantine book production in the period under examination is resistant to attempts to define the relevant fundamental geographic coordinates. Nevertheless, it has in any event been possible to verify, through an investigation of the way in which defects were 'managed', the peculiar character of Italo-Greek production which, in addition to belonging to the qualitatively inferior group, presents remarkable shortcomings in relation to the range of technical solutions employed, which were generally less advanced and applied in a less consistent way.

Passing from typological choices to artisans' strategies, the analysis has demonstrated that Byzantine craftsmen—who were no less capable than their Latin 'colleagues' in this regard—were aware of and applied a series of expedient measures so as to mitigate (or mask) the presence of defects. Such expedients

suggest (in a far less rigidly structured production context than the Latin one) a remarkable level of technical knowledge and widely shared *savoir-faire*. In particular, the comparison of results previously obtained from sample groups of Latin codices has made it possible to identify the existence of a comparable awareness with regard to some fundamental aesthetic and functional standards, as well as some widely shared artisanal practices—albeit characterised by different modalities—such as limiting the number of holes appearing within the writing area, hiding holes and *lisières* in the inner bifolia of quires, and using thicker—and presumably more robust—bifolia in the outermost position. The task remains, in the sphere of comparative codicology, to determine the periods and contexts in which such practices were applied, and their possible correlation with shared traditions, or alternatively their spontaneous emergence as solutions to similar problems.

Finally, the considerable imbalance seen in the distribution of *lisières* along the three open edges of bifolia has further confirmed the reservations that have been expressed, in recent studies, in relation to the generalised application of the quire construction method hypothesised by Léon Gilissen twenty years ago. Direct examination of parchment leaves dating from 11th- and 12th-century Byzantine production reaffirms the existence of more complex—and above all, less uniform—methods of creating bifolia starting out from whole skins: methods determined primarily by the need to exploit in an optimal and well-thought-out way the available raw material.

References

Bianchi, Francesco et al. (1993a), 'Facteurs de variation de l'épaisseur du parchemin italien du VIII^e au XV^e siècle', in Maniaci, Marilena / Munafò, Paola F. (eds), *Ancient and Medieval Book Materials and Techniques* (Erice, 18–25 September 1992), I–II, Città del Vaticano: Biblioteca Apostolica Vaticana (Studi e Testi, 357–358), II, 95–184 (repr. in [Ornato, Ezio et al.] [1997], *La face cachée du livre médiéval. L'histoire du livre vue par Ezio Ornato, ses amis et ses collègues. Avec une préface d'Armando Petrucci*, Roma: Viella [I libri di Viella, 10], 275–345).

Bianchi, Francesco et al. (1993b), 'La structure materielle du codex dans les principales aires culturelles de l'Italie du XI^e siecle', in Maniaci, Marilena / Munafò, Paola F. (eds), *Ancient and Medieval Book Materials and Techniques* (Erice, 18–25 September 1992), I–II, Città del Vaticano: Biblioteca Apostolica Vaticana (Studi e Testi, 357–358), II, 363–456.

Bianchi, Francesco et al. (1994), 'Les manuscrits à cahiers mixtes (papier + parchemin)', in *Scriptorium*, 48, 2: 256–289.

- Bischoff, Frank M. (1991), 'Pergamentdicke und Lagenordnung. Beobachtungen zur Herstellungstechnik Helmarshausener Evangeliare des 11. und 12. Jahrhunderts', in Rück, Peter (ed.), Pergament: Geschichte, Struktur, Restaurierung, Herstellung, Sigmaringen: Jan Thorbecke, 97-144.
- Bischoff, Frank M. (1993), 'Observations sur l'emploi de différentes qualités de parchemin dans les manuscrits médiévaux', in Maniaci, Marilena / Munafò, Paola F. (eds), Ancient and Medieval Book Materials and Techniques (Erice, 18-25 September 1992), I-II, Città del Vaticano: Biblioteca Apostolica Vaticana (Studi e Testi, 357-358), I, 57-94.
- Bischoff, Frank M. (1994), 'Systematische Lagenbrüche: Kodikologische Untersuchungen zur Herstellung und zum Aufbau mittelalterlicher Evangeliare', in Rück, Peter / Boghardt, Martin (eds), Rationalisierung der Buchherstellung im Mittelalter und in der frühen Neuzeit. Ergebnisse eines buchgeschichtlichen Seminars der Herzog August Bibliothek Wolfenbüttel, 12th-14th November, 1990, Marburg: Institut für Historische Hilfswissenschaften (Elementa diplomatica, 2), 83-110.
- Bischoff, Frank M. / Maniaci, Marilena (1996), 'Pergamentgröße, Handschriftenformate, Lagenkonstruktion. Anmerkungen zur kodikologischen Forschung am Beispiel südeuropäischer Pergamente und Handschriften', in Scrittura e civiltà, 19: 277-319.
- Blalock, Hubert M. (1984²), Statistica per la ricerca sociale, Bologna: Il Mulino.
- Brown, Michelle P. (1991), 'Continental Symptoms in Insular Codicology: Historical Perspectives', in Rück, Peter (ed.), Pergament: Geschichte, Struktur, Restaurierung, Herstellung, Sigmaringen: Jan Torbecke, 57-62.
- Canart, Paul (1978), 'Le livre grec en Italie méridionale sous les règnes normand et souabe: aspects matériels et sociaux', in Scrittura e civiltà, 2: 103-162. (Italian translation in Cavallo, Guglielmo [ed.], Libri e lettori nel mondo bizantino. Guida storica e critica, Roma-Bari 1982, 103-153).
- Canart, Paul / Perria, Lidia (1991), 'Les écritures livresques des XI^e et XII^e siècles', in Harlfinger, Dieter / Prato, Giancarlo (eds), Paleografia e codicologia greca. Atti del II colloquio internazionale (Berlin-Wolfenbüttel, 17-21 ottobre 1983), with the collaboration of D'Agostino, Marco / Doda, Alberto, Alessandria: Edizioni dell'Orso (Biblioteca di Scrittura e civiltà, 3), 67-118.
- Casagrande Mazzoli, Maria Antonietta / Ornato, Ezio (1999), 'Elementi per la tipologia del manoscritto quattrocentesco dell'Italia settentrionale', in Busonero, Paola / Casagrande Mazzoli, Maria Antonietta / Devoti, Luciana / Ornato, Ezio, La fabbrica del codice. Materiali per la storia del libro nel tardo medioevo, Roma: Viella (I libri di Viella, 14), 207-287.
- Dennis, Rodney G. (1993), 'Notes concerning "le pliage", in Scriptorium, 47: 166-173.
- Foti, Maria Bianca (1989), Il monastero del S.mo Salvatore "in lingua Phari". Proposte scrittorie e coscienza culturale, Messina.
- Gilissen, Léon (1977), Prolégomènes à la codicologie, Recherches sur la construction des cahiers et la mise en page des manuscrits médiévaux, Gand: Éditions scientifiques Story-Scientia, 14-122.
- Hunger, Herbert (1954), 'Die Perlschrift, eine Stilrichtung der griechischen Buchschrift des 11. Jahrhunderts', in Hunger, Herbert (ed.), Studien zur griechischen Paläographie, Wien: Hollinek (Biblosschriften, 5), 22-32, reprinted in Hunger, Herbert, Byzantinische Grundlagenforschung, London: Variorum Reprints.
- Maniaci, Marilena (1999), 'Suddivisione delle pelli e allestimento dei fascicoli nel manoscritto bizantino', in Quinio. International Journal on the History and Conservation of the Book, 1: 83-122.

- *Maniaci, Marilena (2000), 'La struttura delle Bibbie atlantiche', in Maniaci, Marilena / Orofino, Giulia (eds), *Le Bibbie atlantiche. Il Libro delle Scritture tra monumentalità e rappresentazione*. Catalogo della mostra, [Milano]: Centro Tribaldi, 47–60.
- Maniaci, Marilena (2002), Costruzione e gestione della pagina nel manoscritto bizantino, Cassino: Università degli studi di Cassino.
- Maniaci, Marilena / Ornato, Ezio (1993), 'Che fare del proprio corpus? I. Costituzione e descrizione di una popolazione di libri a fini statistici', in *Gazette du livre médiéval*, 22: 27—37 (repr. in [Ornato, Ezio et al.] [1997], *La face cachée du livre médiéval*. *L'histoire du livre vue par Ezio Ornato, ses amis et ses collègues*. *Avec une préface d'Armando Petrucci*, Roma: Viella [I libri di Viella, 10], 67–75).
- Prato, Giancarlo (1984), 'La presentazione del testo nei manoscritti tardobizantini', in Questa, Cesare / Raffaelli, Renato (eds), *Il libro e il testo*. Atti del convegno internazionale (Urbino, settembre 1982), Urbino: QuattroVenti, 69–84.
- Rück, Peter (1991) (ed.), *Pergament: Geschichte, Struktur, Restaurierung, Herstellung*, Sigmaringen: Jan Thorbecke.
- Sautel, Jacques-Hubert (1995), Répertoire de réglures dans les manuscrits grecs su parchemin. Base de données établie par Jacques-Hubert Sautel à l'aide du fichier Leroy et des catalogues récentes, Turnhout: Brepols (Bibliologia, 13).