Proc Soc Antiq Scot 152 (2023), 289–303
https://doi.org/10.9750/PSAS.152.1365

A comparison of ligatures on gravestones in Scotland, Northern Germany and the French Basque region

George Thomson FSAScot*

ABSTRACT

Although ligatures have a long history and can be found on a range of artefacts, they are particularly characteristic of gravestone inscriptions of the 17th and 18th centuries in several parts of Western Europe. The grouping of two or more letters as a ligature can be attributed to minimising mason's costs and workload, or stone brittleness, but it is suggested that their function was primarily a space-saving device. This research, based solely on statistical analysis, suggests that there may be other, possibly more common, reasons as to why they were employed in gravestone inscriptions. Ligatures have an uneven distribution throughout Western Europe. They are especially frequent in gravestone inscriptions from north and south-west Scotland, Northern Germany and the French Basque region. These areas were selected for analysis. Ligatures were recorded from 36 sites in northern and south-western Scotland, 35 sites in Northern Germany and 24 sites in the French Basque region. Frequencies at each site were calculated. The most common ligature in Scotland and north Germany was HE and in the French Basque region it was DE. All ligature frequencies were compared with the frequencies of bigrams in English, German and French to determine whether or not this influenced their frequency in gravestone inscriptions. It was found that there was no evidence of correlation between gravestone ligatures and bigrams in any of the three languages. The possible reasons for the use of ligatures are discussed.

INTRODUCTION

Although ligatures occur on various artefacts, they are particularly characteristic of inscriptions on early gravestones in several parts of Western Europe, notably in some parts of Scotland, Northern Germany and the French Basque region (Thomson 2001, 2010, 2011a, 2016). The grouping of two or more letters together as single units in the form of ligatures is a practice that can be traced back to the earliest days of our alphabet, possibly even before. The Romans occasionally used ligatures with their incised capitals (Bischoff 1990). They were extensively used in gothic *textura* inscriptions, in which letter combinations could be achieved easily with the straight verticals (Drogin 1980). In Western Europe their first post-medieval appearance was at the end of the 15th and beginning of the 16th centuries. Ligatures then increased in frequency over the next 200 years, being most common in the second half of the 17th century (Thomson 2009).

Ligatures should not be confused with monograms which are groups of interwoven letters, usually made from a person's initials, and can often be found on tombstone memorials as established family emblems. The use of ligatured AE

* School of Humanities, University of Glasgow, University Avenue, G12 8QQ george@georgethomsonlettering.com

in Latin was integral to the written language but it was also employed as a feature of the inscriptional design in English and other languages. The number of ligatures on any one grave marker varies considerably. The most found in this study was 20 on a gravestone in Elgin Cathedral Kirkyard.

Obviously a ligature could minimise masons' costs or workload. Masons could decrease the amount of carving (and therefore stress) on more brittle stone types. It is suggested here, however, that its primary function was a space-saving device. In Scotland it would not be difficult to find many examples where it would appear that the mason has used ligatures to be more economical with space for the inscription on the stone (Illus 1 & 2). Nor would it be hard to find cases where the mason has used a ligature to ensure that a line of lettering would fit and where the only alternative would be to split the word. It is clear, however, that this was not necessarily the reason, or even the most common reason for the use of the device and there is little evidence that it was employed for this purpose in Northern Germany or the French Basque region. Many of the letter combinations would have been easy for the mason to contrive. However, some inscriptions exhibit some ingenuity in the way the letters have been put together. Ligatures are far less common in cursive or script inscriptions than in those cut in roman capitals, and only a few exist in lower-case lettering. Ligatured numerals are also very rare (Thomson 2011a, 2011b).

Throughout Western Europe the occurrence of ligatures on gravestones and other grave markers is extremely patchy. Even within what appear to be unitary cultural areas, there are significant differences. In Scotland, ligatures are most common in the far north and south-west of the country, and are relatively rare in central, north-eastern and south-eastern districts (Thomson 2005). In Northern Germany there are noticeable differences in the occurrence of ligatures between those in Lower Saxony and Schleswig-Holstein (Thomson 2010). In the Basque region ligatures are far less common in Basse-Navarre than in Labourd and are almost absent from Soule (Thomson 2011c).

Illus 1 Gravestone in Banff, Aberdeenshire, Scotland, early 18th century. Note ligatures HE and THE. (Photograph by George Thomson)

Illus 2 Gravestone in Annan, Dumfriesshire, 1720. Note ligatures HE, TH, THE and VE. (Photograph George Thomson)

AIMS OF THE RESEARCH

With a few exceptions, most studies of gravestones focus on iconography, epitaphs, social/historical significance or family history aspects of inscriptions, rather than the lettering per se. The aims of the research were to record the occurrence of ligatures on gravestones from a selected sample of burial grounds in north and south-west Scotland, Northern Germany and the French Basque region. From these data relative frequencies were to be computed to determine which two- and three-letter ligatures were the most common and why. Also, a comparison of these frequencies between the three areas was to be made to identify similarities and differences. The data from each area were to be compared with the frequency of the bigrams and trigrams in the principal languages of the areas, namely English (including variants in Scots), German and French, to determine to what extent, if any, this influenced the use and choice of ligatures on gravestones. Although Latin inscriptions on Scottish gravestones could be of interest, most are outwith the period and scope of this paper (Davidson & Reid 2017). The source of ligatures on 17th- and 18th-century gravestones was to be considered. This paper, based on statistical analysis, does not consider more empirical issues relating to inscriptions on gravestones and other mortuary memorials.

METHODS AND MATERIALS

Regions and sub-regions where ligatures are most frequent were selected for this study. These comprised 36 sites in northern and south-western Scotland, 35 sites in Lower Saxony, Bremen and Schleswig-Holstein in Northern Germany, and 24 sites in Labourd, Basse-Navarre and Soule in the Basque region of south-western France (Tables 1a, 1b, 1c). Although several other sites were examined in all three areas, they were not included if no ligatures were identified on the gravestones. All sites included in the study in Scotland and Northern Germany were visited and photographed by the author. Most Basque region sites were also visited and photographed. The condition of many gravestone inscriptions in that region was very poor and additional data were extracted from the drawn illustrations in Louis Colas (1923), which were made when the stones were in a much better state. Frequencies were based on the occurrence of each ligature at each site and not the total number of ligatures, and calculated as a decimal fraction of the total. This was considered to be more representative than the actual number of each ligature, as the number of gravestones in each burial ground varied considerably. Both two- and three-letter ligatures were recorded, although the latter were relatively rare. In Scotland only English-language inscriptions were used. In Germany all inscriptions were in German. In Labourd most inscriptions were in French with some in Basque. In Basse-Navarre most inscriptions are in Latin with a few in French. In Soule inscriptions are in French or Latin. Only French inscriptions from the Basque region, which comprised the majority, were used. Inscriptions from the period 1700–1800 inclusive were used in all cases. The ligature AE was recorded only in a non-Latin context.

All recorded inscriptions in Germany and the Basque region were in relief. Inscriptions both incised and in relief were recorded from Scottish gravestones. Both sides of the gravestones were recorded. Only ligatures in roman capitals were included. Examples of ligatured numerals and those in lower-case, cursive or script inscriptions were excluded because of their rarity, and analyses of these would not provide statistically significant results.

The frequencies of bigrams and trigrams in English, German and French were extracted from data supplied by Lexical Computing (https://www.lexicalcomputing.com) for a comparison of the frequencies of ligatures on gravestones with those in the three languages.

Statistical analysis was undertaken using the statistics software package PAST 4 (Hammer et al 2001).

Table 1a
Sites used in this study: Scotland

South-west		*North*	
Site	*NGR*	*Site*	*NGR*
Alloway	NS 330 180	Alves	NJ 135 628
Beattock	NT 082 011	Alvie	NH 864 094
Canonbie	NT 395 764	Cawdor	NH 844 499
Dundrennan	NX 751 474	Croy	NH 797 495
Ecclefechan	NY 191 743	Daviot	NH 720 392
Gretna	NY 317 682	Dornoch	NH 801 896
Hoddom	NY 185 735	Duffus	NJ 175 687
Kells	NX 632 5782	Dunnet	ND 220 712
Kirkconnel Lea	NY 003 668	Durness	NC 604 669
Kirkconnel (St Conal's)	NS 729 23	Elgin	NJ 220 638
Kirkcudbright	NX 693 511	Inverness	NH 666 454
Portpatrick	NX 002 543	Kirkhill	NH 549 456
Stoneykirk	NX 089 532	Latheron	ND 203 334
Straiton	NS 389 050	Michaelkirk	NJ 189 684
Sweetheart Abbey	NX 964 664	Petty	NH 736 499
Wigtown	NX 436 555	Reay	NC 967 649
		Spynie	NJ 229 655
		Thurso	ND 117 683
		Tongue	NC 591 571
		Wick	ND 363 509

Table 1b
Sites used in this study: Germany

Lower Saxony	*Schleswig-Holstein*	*Bremen*
Accum	Bederkesa	Ritterhude
Bobens	Busum	
Bockhorn	Fohr	
Eilverson	Hattstedt	
Fedderwarden	Heide	
Middoge	Itzehoe	
Neustadtgodens	Katherinenheerd	
Sande	Kirschwistedt	
Scheessel	Kuhstedt	
Siddessen	Lamstedt	
Varel	Loxstedt	
Wasserhorst	Lunden	

TABLE 1B
Continued

Lower Saxony	*Schleswig-Holstein*	*Bremen*
Wiarden	Neibull	
Wiefelstede	Nordstrand Odenbull	
Zetel	Schiffdorf	
	St Peter-Ording	
	Tating	

TABLE 1C
Sites used in this study: French Basque region

Labourd	*Basse-Navarre*	*Soule*
Ahetze	Armendaritz	Tardets
Ainhoe	Behaune	
Arbonne	Beyrie	
Arrauntz	Charritte	
Cambo	Helette	
Espelette	Irissary	
Guethary	Maharin	
Itxassou	Orsanco	
Larressore	Saint-Étienne-de-Baïgorry	
Saint-Pée-sur-Nivelle	Saint-Étienne-de-Lantabat	
Ville Franque	Saint-Martin-d'Arrossa	
	Uhart	

GRAVESTONE STYLES AND INSCRIPTIONAL CONTENT

A characteristic of gravestones in Great Britain and Ireland is the scale of morphological variation (Burgess 1965). Arguably, this feature is even more marked in Scotland (Willsher 1985). The variation is seen not only in the basic form of the memorial but also in the size, which ranges from no more than about 30cm, to tall slabs more than 2 metres high. It has been said that Scottish gravestones are unique in being inscribed on both sides with memorial inscriptions, but this is not so (Willsher 1996). On vertical slab markers of the 17th and 18th centuries, especially the earlier ones, the most common arrangement is the inscription or epitaph on one side and 'MEMENTO MORI' on the other, sometimes with a second epitaph. Scottish gravestones have been studied extensively and much has been published on the richness of these cultural artefacts (see Thomson 2011a for a bibliography).

Most gravestone inscriptions in Scotland are incised. Relief (raised) inscriptions are far less common. The mean frequency of ligatures in incised inscriptions was calculated as 0.059 compared with 0.061 for relief inscriptions (this study). The different inscriptional methods potentially could have impacted on the analysis but the difference was so little that both incised and raised forms in Scotland were utilised.

The northern part of Lower Saxony is blessed with a wealth of large and impressive vertical slab gravestones, most of which are in a

remarkably good state of preservation (Illus 3). In Oldenburger Land alone there are at least 434 gravestones of this type, ranging in date from the earliest stone of 1614 to well into the 19th century (Runge 1979). Even more are found in Bremen and Schleswig-Holstein. Their longevity is due, in part, to the use of particularly hard and impervious Obernkirchner sandstone and the fact that they were often re-inscribed, rather than being consigned to the scrapheap. In common with the gravestones in the state of Hesse further south, they are carved on both faces. One face (front) has the epitaph and, usually, a pediment sculpted with a religious scene. The reverse has a biblical text, most frequently from the Apocrypha or the Psalms, often preceded with the words 'LEICHEN TEXT', and a pediment with religious or secular iconography. The inscriptions are usually in German, although some earlier ones in the northern part of Schleswig-Holstein are in Danish, as are the inscriptions in Denmark itself, including the island of Rømø, where there is a remarkable collection of similar gravestones. The front text-area of the stone is frequently divided into panels, often with consecutive inscriptions relating to a sequence of deaths within a family.

Most characteristic of these grave markers is the lettering which dominates the memorials. It is almost always in relief roman capitals. Capitals with lower-case letters are extremely rare and, when they occur, they are almost always incised. On these 17th- to early-19th-century gravestones the same forms of some relief roman capital letters and numerals are used on almost all the inscriptions. The W is always of the form comprised of two Vs. The numeral 1 is almost always carved with the distinctive splayed base terminal. The capital G usually has a splayed (bifurcated) and extended terminal vertical stroke. This is frequently flourished, ending in a circular dot.

Although there is some variation in the design of the inscriptions from one group of gravestones to another and throughout the period when the raised roman style was being used, as well as those mentioned above identical very distinctive interpretations of the individual letters recur throughout the region. The flourished form of A, and the extension of the vertical descending line of the G, already mentioned, are just two examples. This indicates that the masons carving the stones were well aware of what was being cut elsewhere. A close examination of the cut of the letters shows that, in most cases, not only are the letters cut with considerable accuracy, but usually the lines of the letters are finished with bevelled sides and not simply left raw after the removal of the background. Such work requires considerable skill. A few of the character attributes show a pattern of change between 1551 and 1850, although mostly this was slight.

Illus 3 Gravestone in Wiefelstede, Lower Saxony, Germany, 1680. (Photograph George Thomson)

Illus 4 Discoid gravestone, Larressore, Labourd, France, 1624. (Photograph by George Thomson)

Illus 5 *Stèle tabulaire*, Itxassou, Labourd, France, 1669. (Photograph by George Thomson)

There are several gravestone forms in the French Basque region (Illus 4 & 5), the most common and most characteristic of which are discoid (Labat 2004). There are also very distinctive *stèles tabulaires*, crosses and grave slabs (ledgers). All are carved with inscriptions in French, Basque or Latin. The other carvings on the gravestones include trade symbols of the deceased, Christian ciphers, especially 'IHS' and the Seal of Solomon, as well as uniquely Basque iconography. The Basque cross or *lauburu*, perhaps surprisingly, is less common than many other symbols. Commemorative or other text is usually inscribed on one face or, more rarely, on the edge of the head of the discoid. The small rectangular *stèles tabulaires* are probably unique to the French Basque region and are restricted to a few sites in Labourd. The dominant features of these markers are the inscriptions, although some decoration or symbolism also occurs.

There has long been argument about whether 'Basque lettering' is a valid concept (Thomson 2011c; Viguillas 2020). Certainly, some letter-forms are more commonly found in Basque inscriptions than elsewhere (Illus 6). None of the alphabetic characters, however, is exclusive to the Basque region. The forms of capital A with a horizontal crossbar and V-shaped central stroke, and H with a circle on the horizontal stroke are not uncommon in Scotland and Ireland in the late 16th and 17th centuries. The small-sized capital O with offset counter and R with a shortened leg are rare elsewhere. Mirrored letters, flipped horizontally, are not uncommon. The Basque inscriptions were almost exclusively carved in relief. The carving of these raised capital letters was very similar to that found on North German

Illus 6 Some distinctive Basque letters from gravestones. (Image by George Thomson)

markers, sometimes with similarly bevelled sides and almost identical 'roman' serifs.

ANALYSIS

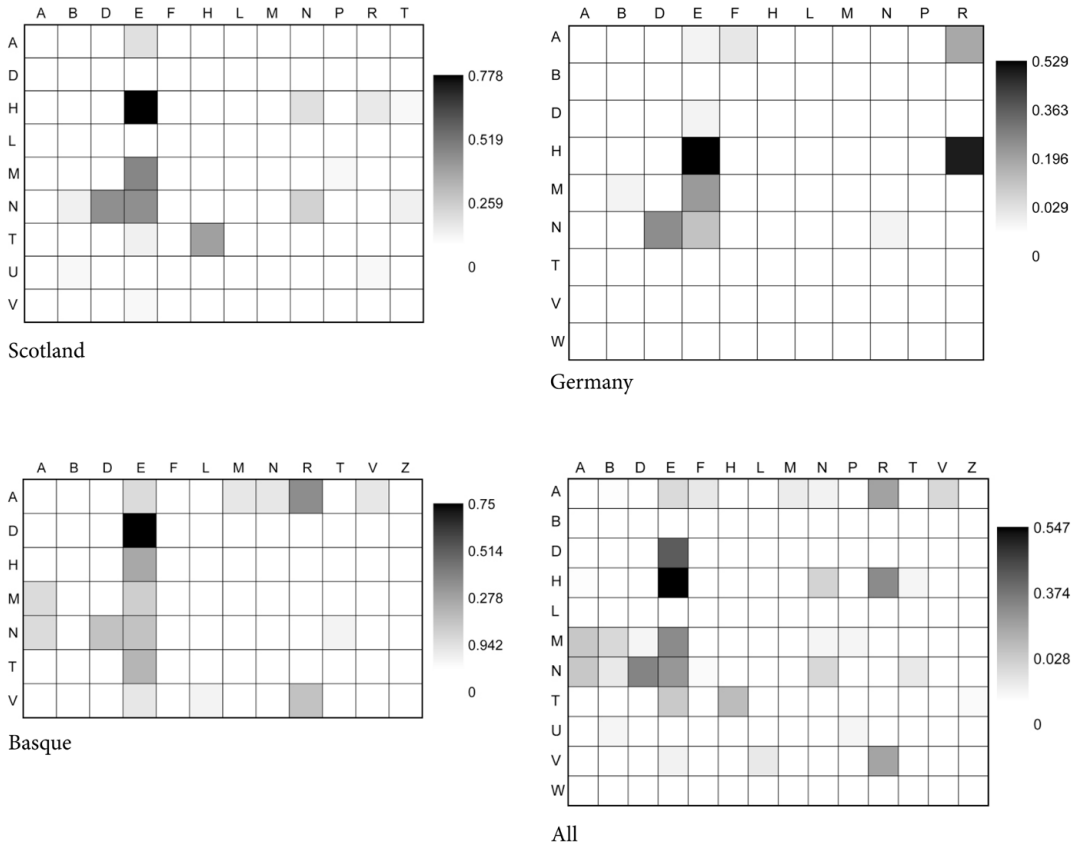
The configuration of letters in ligatures, that is how they are joined together, was extremely consistent throughout the three areas. Only one ligature was found in two forms. This was DE at Itxassou in Labourd. In the analysis it was considered to be a single ligature. A count of five three-letter ligatures was recorded from Scotland (THE, NNE, UNE, UME and MNE), three from Germany (AHE, HME and HNE) and three from the Basque region (ANE, MAR and NNE). As this totalled only 11 different ligatures they were no longer included in this study.

From the Scottish sample 35 two-letter ligatures were identified. This represents 67% of all bigrams identified in a massive study by the author (unpublished). The most common ligatures were HE (frequency 0.778), ME (frequency 0.444) and NE/ND (equal frequencies 0.417). From the German sample of 26 ligatures the most common was also HE (frequency 0.529), followed closely by HR (frequency 0.500) and ND (frequency 0.294). DE (frequency 0.750) was the most common in the French Basque region (from 21 ligatures), followed by AR (frequency 0.417) and HE (frequency 0.333) (Illus 7 and Tables 2a, 2b & 2c). Some ligatures are unique to Scotland, Germany or the Basque region, being found only within one of the three areas. Scotland had the most with 19, Germany had 11 and the Basque region had 9 (Table 3). The matrix plots (Illus 8) clearly show graphically the relative frequencies of each ligature in the three areas and those overall. As well as demonstrating the dominance of HE in Scotland and Germany and DE in the Basque region, the plots also show preferred use of the letter H, and to a lesser extent N, in ligatures.

Selecting only the ligatures that were common to all three areas, and calculating the frequency differences between each pair, revealed that the greatest mean difference was between Scotland and the Basque region, with the frequencies of HE between these areas being the greatest for a single ligature (Table 4).

It was suspected that the frequency of bigrams in the English, German and French languages would, in some way, affect the frequency of ligatures in gravestone inscriptions. Differences between the frequencies of gravestone ligatures and language bigrams were computed and compared. In the case of Scotland the mean difference was 0.23. Frequency differences for individual ligatures were HE (0.778), followed by ME (0.444) and NE (0.417). The mean frequency difference from the German sample was 0.157, with HE at 0.529, HR at 0.500 and ND at 0.294. The comparative figures for the Basque region were a mean of 0.189 with the individual frequency differences of DE 0.747, AR 0.407 and HE 0.308 (Table 5). The difference between the mean frequency differences shows that there is a greater difference between Scotland and Germany (a frequency difference between differences of 0.073) than between the other areas. As before, only ligatures that were common to each sample (inscriptions and language from each area) were included.

Illus 7 The three most common ligatures on gravestones – HE (left, Scotland), HE (centre, Northern Germany) and DE (right, French Basque region). (Photographs by George Thomson)



ILLUS 8 Matrix plots of ligature frequencies from Scottish, Northern German and French Basque gravestones. (Image by George Thomson)

Many ligatures that are common on gravestones rank (ordered bigram frequency in the language) very low in language bigram frequency. For example, NN and MB are the sixth and seventh most common ligatures on Scottish gravestones but rank only twenty-fifth and twenty-eighth in the English language. HR was the second most common ligature on German gravestones but ranks only seventeenth in German. DE is by far the most common ligature on Basque gravestone but comes only twelfth in French (Tables 2a, 2b and 2c). The analysis demonstrates that the selection of ligatures was not influenced in any significant way by the frequency of bigrams in any of the three languages.

CONCLUSIONS AND DISCUSSION

It was originally planned to include inscriptions on gravestones in North Brittany. Only four ligatures were identified from the 23 sites studied. These were AP on a lintel at Louvigné-du-Désert, AP at Saint-Brieuc, and MME and NP at Fougères, the latter three on grave slabs within churches. As the number of ligatures was so small, it was decided not to include the area as part of this study. Similar studies of ligatures in other parts of Scotland, Ireland and elsewhere in Europe may be useful. The author's extensive research in these areas, however, suggests that because of the relatively infrequent occurrence of ligatures there, it is unlikely that the results

TABLE 2A
Frequency of ligatures on Scottish gravestones and bigrams in English, with relative frequency ranks

Ligatures on gravestones			*Bigrams in English*		
Ligature	*Frequency*	*Rank in English*	*Bigram*	*Frequency*	*Rank on stones*
HE	0.778	2	TH	0.033	5
ME	0.444	12	HE	0.030	1
NE	0.417	13	AN	0.018	31
ND	0.417	7	ND	0.015	4
TH	0.361	1	NT	0.011	13
NN	0.194	25	NG	0.009	35
MB	0.194	28	TE	0.008	8
TE	0.167	10	AR	0.008	12
HN	0.139	35	ME	0.007	2
AE	0.139	37	NE	0.007	3
HR	0.111	26	AL	0.006	33
AR	0.111	11	ML	0.006	28
NT	0.083	8	MD	0.004	19
NB	0.083	24	LA	0.004	30
UP	0.056	22	UR	0.004	22
UB	0.056	29	UL	0.003	23
MP	0.056	23	HT	0.003	20
MN	0.056	33	AM	0.003	32
MD	0.056	16	UP	0.002	15
HT	0.056	20	MP	0.001	7
VE	0.028	35	MT	0.001	25
UR	0.028	18	NN	0.001	6
UL	0.028	16	HR	0.001	11
NR	0.028	28	NB	0.001	14
MT	0.028	21	MB	0.001	7
MR	0.028	32	UB	0.001	16
MM	0.028	27	MM	0.001	27
ML	0.028	15	NR	0.000	24
MF	0.028	34	MR	0.000	26
LA	0.028	17	MN	0.000	18
AN	0.028	3	MF	0.000	29
AM	0.028	21	HN	0.000	9
AL	0.028	11	AA	0.000	34
AA	0.028	33	AE	0.000	10
NG	0.000	6	VE	0.000	35

TABLE 2B
Frequency of ligatures on North German gravestones and bigrams in German, with relative frequency ranks

Ligatures on gravestones			*Bigrams in German*		
Ligature	*Frequency*	*Rank in German*	*Bigram*	*Frequency*	*Rank on stones*
HE	0.529	5	DE	0.023	9
HR	0.500	17	ND	0.019	3
ND	0.294	2	TE	0.019	23
ME	0.265	12	NE	0.012	6
AR	0.235	11	HE	0.010	1
NE	0.176	4	AN	0.010	15
AF	0.088	20	BE	0.010	17
AE	0.059	9	HA	0.007	19
DE	0.059	1	AE	0.006	8
MB	0.059	23	AL	0.006	14
NN	0.059	14	AR	0.005	5
AB	0.029	16	ME	0.005	4
AH	0.029	19	WE	0.005	26
AL	0.029	10	NN	0.004	11
AN	0.029	6	VE	0.004	25
AP	0.029	25	AB	0.003	12
BE	0.029	7	HR	0.003	2
DL	0.029	24	MM	0.002	21
HA	0.029	8	AH	0.002	13
HF	0.029	26	AF	0.002	7
MM	0.029	18	TH	0.001	24
NP	0.029	22	NP	0.001	22
TE	0.029	3	MB	0.001	10
TH	0.029	21	DL	0.001	18
VE	0.029	15	AP	0.000	16
WE	0.029	1	HF	0.000	20

TABLE 2C
Frequency of ligatures on French Basque region gravestones and bigrams in French, with relative frequency ranks

Ligatures on gravestones			*Bigrams in French*		
Ligature	*Frequency*	*Rank in French*	*Bigram*	*Frequency*	*Rank on stones*
DE	0.750	12	HE	0.025	3
AR	0.417	4	ND	0.012	5
HE	0.333	1	NT	0.011	16
TE	0.292	5	AR	0.010	2

TABLE 2C
Continued

Ligatures on gravestones			*Bigrams in French*		
Ligature	*Frequency*	*Rank in French*	*Bigram*	*Frequency*	*Rank on stones*
ND	0.250	2	TE	0.009	4
VR	0.250	18	HA	0.008	18
NE	0.250	7	NE	0.006	5
ME	0.208	11	MA	0.006	9
AE	0.167	18	NA	0.005	9
MA	0.167	8	VE	0.005	12
NA	0.167	9	ME	0.005	8
AM	0.125	15	DE	0.003	1
VE	0.125	10	AB	0.003	18
AN	0.125	15	AV	0.002	12
AV	0.125	14	AM	0.002	12
NT	0.083	3	AN	0.002	12
VL	0.083	18	NF	0.000	18
NF	0.042	17	VR	0.000	5
HA	0.042	6	VL	0.000	16
AB	0.042	13	TZ	0.000	18
TZ	0.042	18	AE	0.000	9

TABLE 3
Ligatures unique to each area

Scotland	*Germany*	*Basque region*
AA	AF	AV
HN	AH	HA
HR	AP	MA
HT	BE	NA
LA	DL	ND
MD	HA	NF
MF	HF	TZ
ML	HR	VL
MN	NP	VR
MP	VE	
MR	WE	
MT		
NB		
NG		
NR		

TABLE 3
Continued

Scotland	*Germany*	*Basque region*
UB		
UL		
UP		
UR		

TABLE 4
The differences between the frequencies of ligatures from Scotland, Germany and the Basque region

Scotland/Germany		*Scotland/Basque*		*Germany/Basque*	
HE	0.248	HE	0.496	TE	0.279
NE	0.240	AR	0.295	HE	0.247
TE	0.137	ND	0.173	AR	0.171
MB	0.136	NE	0.167	MB	0.145
AR	0.124	TE	0.142	AE	0.108
ND	0.123	VE	0.095	VE	0.094
AE	0.080	AN	0.092	AN	0.090
AN	0.002	AE	0.028	NE	0.073
VE	0.002	MB	0.009	ND	0.051
Mean	**0.121**		**0.166**		**0.140**

Table 5
The difference between the frequency of ligatures in Scotland, Germany and the Basque region compared with that of bigrams in English, German and French

Scotland/English		*Germany/German*		*Basque/French*	
Ligature/ bigram	*Frequency difference*	*Ligature/ bigram*	*Frequency difference*	*Ligature/ bigram*	*Frequency difference*
HE	0.778	HE	0.529	DE	0.747
ME	0.444	HR	0.500	AR	0.407
NE	0.417	ND	0.294	HE	0.308
ND	0.417	ME	0.265	TE	0.282
TH	0.361	AR	0.235	VR	0.25
MB	0.194	NE	0.176	NE	0.244
NN	0.194	MB	0.059	ND	0.238
TE	0.167	NN	0.059	ME	0.204
AE	0.139	AE	0.059	AE	0.167
AR	0.111	TH	0.029	NA	0.161
HR	0.111	TE	0.029	MA	0.161

TABLE 5
Continued

Scotland/English		*Germany/German*		*Basque/French*	
Ligature/ bigram	*Frequency difference*	*Ligature/ bigram*	*Frequency difference*	*Ligature/ bigram*	*Frequency difference*
AL	0.028	AL	0.029	AM	0.123
AN	0.028	AN	0.029	AN	0.123
MM	0.028	MM	0.029	AV	0.123
VE	0.028	VE	0.029	VE	0.12
				VL	0.083
				NT	0.072
				TZ	0.042
				NF	0.041
				AB	0.038
				HA	0.033
Mean	**0.23**	**Mean**	**0.157**	**Mean**	**0.189**

would differ significantly from those presented here.

While it is obvious that in some, if not many, instances in Scotland ligatures were used to save space or adjust line length, the use of ligatures on Scottish, German and French Basque gravestone inscriptions appears to have been the result of creativity and tradition rather than function. We see the same ligatures recurring within each of the three areas. Some letter combinations lend themselves to easy ligature formation. For example, it is a simple matter to reuse the second vertical of a capital H, M or N as the vertical of a capital E. Even the unique Basque ligature DE, while very inventive, is an obvious solution to combining D and E. Conversely, some masons have created less obvious ligatures such as VL and TZ in Basque region inscriptions. The overwhelming evidence, however, is that almost all ligatures emanate from the relative ease by which each bigram can be united into a single ligature form.

It has already been stated that gravestones in Scotland differ considerably from those in the other two areas in terms of their far greater morphological variability and inscriptional methodology. It was also shown that, although inscriptions were both incised and carved in relief, this did not affect the frequency of ligatures. There may be evidence that the overall morphology of gravestones has some effect on the frequency of ligatures. The greatest mean difference in frequency of ligatures was between Scotland and the Basque region, a significant 15%. Why this should be is not clear.

Ligatures can be found on late medieval and early modern grave slabs with peripheral inscriptions throughout Western Europe, many located within churches or other religious buildings. Grave slabs from that period, however, are less common in Northern Germany and the Basque region and much more common in the Low Countries (Van Belle 2006). It is known that masons travelled extensively throughout Europe in the medieval period carving gravestones through the Guild system (Knoop & Jones 1947). This resulted in a degree uniformity in the design of grave slabs. While in Scotland it is possible that the use of ligatures on later gravestones is the continuation of an earlier tradition, it is hard to point to evidence of this elsewhere. Furthermore, this research demonstrates that nothing suggests that the frequency of bigrams in English, German or French is reflected in the choice and frequency

of ligatures on Scottish, North German or French Basque gravestones.

Today, the use of ligatures is a rarity in gravestone inscriptions. They are still used occasionally by typographic and other designers but not nearly to the extent that we see on 17th- and 18th-century gravestones.

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