

Pursuing the desire for cattle or attacking the followers of heresy:
A numerical analysis of different factors influencing strategies adopted in large
group interactions involving
nomads or holy war

Volume 2 of 2

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Appendix 1 ESTIMATE OF COMPARATIVE PURCHASING POWER (Purchasing Power Parity)

Although information on the exchange rate between currencies is widely available in modern times, it is accepted that even at the present time, it is difficult to compare the true worth of the currency in different countries.¹ Even within the European Union, while “A euro is a euro is a euro”, the goods that can be purchased for a given number of euros will vary from Ireland to Greece. The problem is compounded when different currencies are involved.² Economists use a variety of methods to overcome this problem, by seeking to adjust the exchange rate in the various countries by their purchasing power parity (PPP), i.e., the relative cost of a basket of goods of comparable quality in each country. The price of a McDonald’s burger provides a very simple yet quite informative method for doing this, but more complex and rigorous methods have been devised. One of these is the Geary-Khamis dollar, which uses as its base the US dollar to which all PPP-adjusted currencies may be converted. Maddison expresses his estimates of the per capita Gross Domestic Product for parts of the Roman empire, for its neighbours, and for other parts of the world historically, in 1990 Geary-Khamis dollars,³ and this is accordingly used as the benchmark for this study.⁴

Part of the comparison problem is the availability of goods and services. Even in these days of globalisation, Irish goods are not available as readily or cheaply in Greece as they are in Ireland and the same applies for Greek goods in Ireland. In earlier periods, the cost and difficulties of transporting silk and spices from China and the spice islands converted relatively cheap and abundant commodities at the point of production into rare and expensive luxuries at the point of

¹ The problems, theoretical and practical, of exchange were a matter of scholarly attention even during the period covered by this study. See Kaye, J. (1998) *Economy and Nature in the Fourteenth Century: Money, Market Exchange and the Emergence of Scientific Thought*. Cambridge, Cambridge University Press, p.17, p.68.

² The problems of fluctuating exchange rates across territories which possessed a single coinage was encountered during the crusades, with crusaders securing a better rate in Constantinople for their French money than was possible on the Hungarian and Asiatic borders of the Byzantine empire. Exchange rates fluctuated more generally over time and space. See Murray, A. V. (2018) 'Money and Logistics in the Forces of the First Crusade:' in Pryor, J.H. (ed.) *Logistics of Warfare in the Age of the Crusades*. Abingdon: Routledge, pp. 229-250. Also see Spufford, P. et al. (1986) *Handbook of Medieval Exchange*. London: Offices of the Royal Historical Society.

³ The Purchasing Power Parity-adjusted Geary-Khamis 1990 dollar expresses the value of non-US currencies in terms of the 1990 US dollar, adjusting for the prevailing exchange rates and price relativities in the two economies. For example, in 1805 West Africa, one cowrie shell equated to 0.000525 grammes of gold, which amounts to \$GK 0.0096 (approximately one cent). A West African cow costing 15,000 cowries in 1805 thus cost \$GK 145 (or, by a further computation which is not applied elsewhere in this study, 313 euros at Irish prices in 2014: Feenstra, R. C., Inklaar, R., Timmer, M. and P. (2015) 'The Next Generation of the Penn World Table', *American Economic Review*, 105(10), pp. 3150-3182). By similar calculation, an English cow in 1300 cost \$GK154 and an Irish medieval cow cost \$GK140, but an Indian cow in 1330 cost \$GK 293, i.e., twice as much. For a variety of reasons, eating beef in India was much more expensive than in Europe or West Africa.

⁴ Maddison, A. (2013) *Contours of the World Economy, 1-2030AD*. Oxford: Oxford University Press, p.5.

consumption.⁵ Nonetheless goods were moved considerable distances, albeit slowly,⁶ although some goods were simply not available in some periods, due to the lack of the technology required to produce them. For instance, iron and iron implements were not produced prior to the start of the Iron Age, a date that varied according to the location in question.⁷ Furthermore, as the capacity of a society to produce goods and services increases, the prices charged for them tend to decline.⁸ Thus, the use of iron in war became cheaper.⁹

A range of prices and wages have been collected from a variety of sources. These have been adjusted to allow for the variety of units used in measuring weight, volume and length. The currency has been adjusted to the equivalent quantity of precious metal in the coins, taking account of the fact that both silver and gold are precious metals and the ratio of their values is not constant over time and space. The balance of developing ore extraction with deposit exhaustion was a major control of change, but the ability of merchants to move metals from place to place also played a part. At times when trade became easier through areas where nomads tended to be dominant, precious metals could be moved more readily through Afro-Eurasia.¹⁰ The preferences and practices of various cultures also played a part. In particular, the Chinese used paper currencies and valued silver more highly relative to gold than did the West, where gold was less abundant. In India, Hindu principalities used gold coinage, while their Muslim rivals used silver coinage and exported gold to the northwest to buy horses.¹¹ The balance of warfare between the two thus influenced the relative prices of precious metals.

⁵ A pound of silk in China in the sixth century was equivalent to 60 kg of rice. The price of an equivalent weight of grain would have been somewhere between 6 and 180 \$GK (typically, say 90 \$GK) in the Mediterranean area dependent on place, date and circumstances. The Emperor Justinian set the price of silk at the equivalent of \$GK 3,314 per pound, a mark-up of at least 18 and possibly as much as 36-fold. This is the measure of the cost of importation and of the imperial monopoly. See Jackson Bonner, M. (2020) *The Last Empire of Iran*. Piscataway, New Jersey: Gorgias Press, pp. 222-223.

⁶ For instance, a Viking Age hoard of the late ninth century in Galloway included silk and a cup decorated in the style of Sasanid Persia, several hundred years earlier. See Goldberg, M. (2021) 'Unwrapping the Galloway Hoard: Secrets of a Unique Viking Age Collection from South-West Scotland', *Current Archaeology*, 376, pp. 20-27.

⁷ Aspects of the spread of technology can be put to service in historical analysis. The reference to iron extraction in Job (28, 1-4) implies that the writer was aware of iron and so the book was written in the dawn of the Iron Age of Israel or later. The reference in I Samuel 13, 19-21, to Philistines trying to force Israelites, during the time before the accession of King Saul, to bring their tools to Philistine ironworkers for sharpening (at a price of \$GK 9.3 for a plough, and \$GK 4.7 for an axe) implies that access to iron-making technology was not something to be taken for granted.

⁸ Thus, in the millennium following Hammurabi (C18th BCE, Babylon), the price of copper, expressed in silver, fell by 18.2%, but the price of iron declined by 82.2%, taking it from more than three times the price of copper to 60% of the price of copper. The implications for the price and availability of metal weapons were great. Childe, V. G. (1957b) *What Happened in History*. Harmondsworth: Penguin, p.183.

⁹ Iron Age armies were bigger than Bronze Age armies, due to larger population and cheaper weapons. Gabriel, R. A. (2018) *On Ancient Warfare: Perspectives on Aspects of War in Antiquity*. Barnsley: Pen and Sword Military, pp. 7, 11, 19.

¹⁰ In the early Middle Ages, silver from Afghanistan, eastern Iran and Transoxiana became more available to the Near East in the wake of the Arab conquests. Much passed on across the nomad-controlled steppes to Russia. In the fourteenth century, gold coming from West Africa to the Mediterranean might travel via the Nile to Alexandria or direct to the Maghreb. Both routes passed through the territory of nomads. Increased gold production, probably from the Urals, passed to the Black Sea through the territory of the Mongols' Golden Horde, and Venice imported "oro cumano", possibly from Transylvania which was controlled by nomad Cumans. See Lane, F. and Mueller, R. (2019) *Money and Banking in Medieval and Renaissance Venice. Volume One: Coins and Money of Account*. London: Johns Hopkins University Press, p.135, pp. 374-379.

¹¹ See Lane, F. and Mueller, R. (2019) *Money and Banking in Medieval and Renaissance Venice. Volume One: Coins*. op. cit. p.370.

From Maddison's work, it is possible to calculate a standard price in Geary-Khamis dollars for one gram of gold, one gram of silver and one hectolitre of wheat.¹² This allows the prices that have been collected to be expressed in terms of Geary-Khamis dollars and subsistence units (\$GK 300 per year or the food equivalent required to support one person for a year).¹³

Wages, fees and incomes can also be expressed in similar terms,¹⁴ and this allows the calculation of real prices. Table A1.1 shows that for people with the income of an English man at arms or Indian cavalry trooper, on the basis that these are of similar status, the real price of a cow in India was 2.37 times that of a cow in England. A similar kind of disparity (2.32), for different reasons, no doubt, occurs between the price of horses in 19th century USA and 14th century England, as shown by Table A1.2. This may help to explain the relatively greater abundance of mounted infantry and cavalry in 14th century English armies.

Item (\$ GK)	England 1300	India 1300
Cow	154	293
Cavalry trooper salary p.a.	5,119	4,108
Ratio of price (adjusted for salary difference, England = 100)	100	237

Table A1.1 Relative Real Prices of a cow in 14th century England and India

Item (\$ GK)	England 1300	USA 1860
Horse	307	162
Infantry soldier pay per month	71.1	16.2
Ratio of price (adjusted for salary difference, England = 100)	100	232

Table A1.2 Relative Real Prices of a horse in 14th century England and 19th century USA

¹² Maddison's implied prices (in Geary-Khamis dollars) are:

1	hectolitre wheat	51.2
1	gm gold (Iran and West)	18.2
1	gm gold (Turkestan and East)	15.2
1	gm silver	1.6

The implied bimetal ratio of gold to silver here is 11.3 (West) or 9.3 (East). At times of crisis, the price of gold could rise radically in the short term, e.g., in 614-618, its price rose by 50% in Egypt as the threat of Persian invasion grew. See Howard-Johnston, J. (2021) *The Last Great War of Antiquity*. Oxford: Oxford University Press, p.128.

¹³ It should be noted that in famine years, the actual cost of one subsistence unit of food could rise well above the normal and notional cost, by a factor of seven or more. Urban prices tended to be higher at all times.

¹⁴ For the period 1800 BCE – 1300 CE, the daily wage of an unskilled labourer has been calculated to lie in the range of 4-10 litres of wheat (i.e., \$G-K 2-5 per day). See Scheidel, W. (2010) 'Real Wages in Early Economies: Evidence for Living Standards from 1800 BCE to 1300 CE', *Journal of the Economic and Social History of the Orient*, 53, pp. 425-462.

Table A1.3 lists sources consulted in compiling the prices used in this study.

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Ancient Egypt: Muhs (2016)¹⁶
Ancient Iran: Dandamaev & Lukonin (1989)¹⁷
Ancient Middle East: Drews (1993)¹⁸
Ancient Near East: Liverani (2014)¹⁹
Ancient Near East: Manco (2019)²⁰
Ancient Nubia and Egypt: Morkot (2000)²¹
Ancient Greece: Van Wees (2007)²²
Ancient Greece: Ober (2015)²³
Ancient Greece: Cunliffe (2019)²⁴
Ancient Parthia: Ellerbrook (2021),²⁵ Sinisi (2018)²⁶
Ancient and Medieval Turkestan: Andrianov (2016)²⁷
Early Byzantium: Simocatta (1986)²⁸
Early Medieval France: Fredegar (1960)²⁹
Early Medieval France: James (1988)³⁰
Early Medieval France: Williams (2010)³¹
Early Medieval Italy: Heather (2013)³²
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 Imperial Rome and Han China: McLaughlin (2014),³⁹ (2016)⁴⁰
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 Late Antiquity Byzantium: Pohl (2018)⁴²
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 Late Antiquity Iran: Pseudo Joshua (2000)⁴⁴
 Early Medieval Britain: Grigg (2018)⁴⁵
 Medieval Arabia: Mackintosh-Smith (2019)⁴⁶
 Medieval Byzantium: Hendry (1985)⁴⁷
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Nineteenth Century USA: Griffith (1999)¹⁰⁸
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Various places and times: Maddison (2013)¹¹⁰
Various measures: Gyllenbok (2018)¹¹¹
Various exchange rates: Spufford (1986)¹¹²

Table A1.3 List of sources consulted in compiling prices (continued)

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¹¹¹ Gyllenbok, J. (2018) *Encyclopaedia of Historical Metrology, Weights and Measures Volume 1*. Cham, Birkhäuser;
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Appendix 2 ESTIMATE OF CLAUSEWITZIAN FRICTION IN WAR

Dupuy offers an assessment of the effect of Clausewitzian friction in progressively larger units on casualty rates, adjusting for exposure to action, as presented in Table A2.1.¹ As will be seen, multiplying the size of the unit by a factor of 2,000 increases the friction effect by a factor of 10. The present author has undertaken a linear regression of Friction Effect against the log of the number of company equivalents (where a company = 200 men), yielding the following statistically significant equation.

$$\text{Friction Effect} = 0.773 + 1.278 \times \log (\text{Number of company equivalents})$$

Unit	Size	Company Equivalent (200 men)	Friction Effect
Company	200	1	1.0
Battalion	800	4	1.9
Brigade	3,000	15	4.5
Division	15,000	75	6.3
Corps	90,000	450	9.2
Army Group	400,000	2,000	10.0

Table A2.1 Friction effects in combat

Based on Dupuy (1992, Chapter 14, Tables 14-2 and 14-4)

Assuming that the Friction Effect applies to movement and manoeuvre as well as to casualties, it will be seen in Table A2.2 that the assessment of Delbruck to the effect that “*A movement that is made by an organization of 1,000 men without complications becomes an accomplishment for 10,000 men, a work of art for 50,000 and an impossibility for 100,000*” seems apt.² The effort of the movement doubles for a force of 10,000 and trebles for a force of 100,000. It is not for nothing that Philippe de Commynes, the fifteenth century French courtier, suggested that in certain circumstances, a force of 10,000 could have the advantage over one of 60,000.³ If the numbers reported by chroniclers are accurate (which is probably not always the case – see Appendix 3), the ability to field very large numbers of troops, with all the concomitant effort needed to ensure that they are fed, is not an unmitigated advantage. From the comments of Gibbon it may be deduced that it was a long held view that weight of numbers becomes of ever less significance compared to military skill and organisation as the magnitude of the conflict increases,⁴ for “*it is better to be present with ten men than absent with a thousand*” (a saying attributed to Timur Leng).

¹ Dupuy, T. (1992) *Understanding War: History and Theory of Combat*. London: Leo Cooper, Chapter 14.

² Delbruck, H. (1990a) *Medieval Warfare: History of the Art of War Volume III*. Translated by: Renfroe, W. London: University of Nebraska Press, p.33.

³ Commynes suggested that a single ruler with 10,000 men would have the advantage over an alliance of ten rulers each with 6,000 men. In this postulate, the considerable numerical superiority of the latter would be lost in the problems of co-ordination. See de Commynes, P. (1972) *Memoirs: the Reign of Louis XI 1461-83* Trans. Jones, M. Harmondsworth: Penguin Classics, p.113.

⁴ Gibbon, E. (1910) *The Decline and Fall of the Roman Empire (six volumes)*. London: Everyman’s Library, Volume 1,

According to the Lanchester square law equation,⁵ 10,000 men are 100 times as effective as 1,000 men which is the same ratio that applies for 100,000 against 10,000 men). Adjusting for the effect of friction, the larger force is actually only 50 times as effective when 10,000 men face 1,000, but 67 times as effective when 100,000 face 10,000, although the raw odds are the same in both cases.⁶

Organisation Size	Company Equivalents (200 men)	Friction Effect	Friction Effect normalised to 1,000 men
1,000	5	2.84	1.0
10,000	50	5.77	2.0
50,000	250	7.83	2.8
100,000	500	8.72	3.0

Table A2.2 Friction effects for varying sizes of group

Based on Dupuy (1992, Chapter 14, Tables 14-2 and 14.4)

pp.116-117.

⁵ The Lanchester square law equation provides an estimate of casualties inflicted. For further details, see Footnote 11, Excursus 11.

⁶ If Dupuy's estimate of the relative lethality of the reflex and short bow is accepted, further adjustment for combat effectiveness shows that a larger force of 10,000 (armed with short bow) could be only about 32 times as effective as a smaller force of 1,000 (with reflex bow).

Appendix 3 ESTIMATING NUMBERS

This study attempts to use numbers to assess conflicts, but there is much debate concerning the accuracy of figures quoted by ancient and medieval historians, which often seem implausibly high to modern historians (and to some medieval historians as well). As the fourteenth century historian, Ibn Khaldun, put it,

“[Historians] strayed from the truth and found themselves lost in the desert of baseless assumptions and errors. This is especially the case with figures, either of sums of money or of soldiers, whenever they occur in stories. They offer a good opportunity for false information and constitute a vehicle for nonsensical statements. They must be controlled and checked with the help of known fundamental facts.”¹

It was known to Byzantine generals that:

“most people are incapable of forming a good estimate if an army numbers more than twenty or thirty thousand, particularly if they are Scythians who are mostly horsemen.”²

When it came to legal practicalities, King Ine of Wessex clearly operated on a totally different scale to Byzantine generals, with his laws saying:

“We call up to seven men ‘thieves’, between seven and thirty-five a gang, after that it is a here [invading or raiding army].”³

Given that certain modern presidents of the USA have been known to experience problems in arriving at a robust estimate of the numbers attending an event at which they themselves were present, it is hardly surprising that the problem of estimating numbers arises in historical sources. These problems arise from a number of biasing factors:

- a. Biases and deliberate distortion. There are many reasons why a witness may inflate, deflate or simply invent an estimate. These include the wish to tell a story more pleasing to the witness or others, or to secure benefits such as rations and pay, or to avoid the effort involved in producing a correct estimate. On the other hand, the witness may simply be scared. A general and historian of the late medieval period, Mirza Haida, records an instance when a counted army of perhaps 4,700, was mistaken for 50,000. He comments

¹ Ibn Khaldun (1958) *The Muqaddimah: Volume I*. New York: Bollingen Foundation, p.11.

² Maurice (1984) *Maurice's Strategikon: Handbook of Byzantine Military Strategy*. Translated by: Dennis, G., Philadelphia: University of Pennsylvania Press, p.103.

³ Quoted in (1996) *The Anglo-Saxon Chronicle*. Translated and edited by Swanton, M., London, J.M. Dent, pp. xxxiii-xxxiv. It is worth noting that in this context, one shipload of raiders would probably constitute an army. *Soboli* raids by troops of about forty cavalry and *jada* brigandage by bands of ten to twenty warriors in eighteenth and nineteenth century Segu Bambara (West Africa) match these numbers quite well. Roberts, R. (1987) *Warriors, Merchants, and Slaves: The State and the Economy in the Middle Niger Valley, 1700-1914*. Stanford: Stanford University Press, pp. 36-37. The numbers cited by King Ine are also quite akin to the size of bands of bandits and police groups hunting them in early 20th century NE Brazil. Findlay and Lundahl suggest that the leaders of such groups did not maximise their strength as it would reduce the income that they could extract from operations. Possibly such considerations applied at the early time and place as well. Findlay, R. & Lundahl, M. (2017) *The Economics of the Frontier: Conquest and Settlement*. London, Palgrave Macmillan, Chapter 11.

“When a nervous person counts the enemy, he mistakes a hundred for a hundred thousand.”⁴

- b. Counting problems. It is not always easy to obtain accurate counts, for people, animals and even objects move, or else they are hidden in dead ground⁵, behind other things, or by dust, smoke and cloud.⁶ Enumerators lose count or get confused.⁷ Figures are mis-recorded, mislaid, recorded in the wrong place or added in the wrong number of times (i.e., more than once or not at all).
- c. Difficulties of extrapolation. The whole of the population is not necessarily in sight at once, even to a king or a president on a dais, and the reliability of the method used to correct for this is key for the accuracy of the estimate. Assuming that the land over the horizon or behind the hill or inside the wood is empty (or crowded with enemies) carries the potential for major inaccuracy.⁸
- d. Changing circumstances. Even an accurate estimate is valid only for the time and place it is taken. The numbers at another time and place may well be different.⁹
- e. Failure to apply plausibility tests. An estimate that appears odd in the light of other known facts is likely to be wrong (although it is not *necessarily* wrong). Ibn Khaldun’s call for checking against known facts (quoted above) is apposite.

Plausibility tests are important. An analysis of numbers deployed in the combats of the French Revolutionary and Napoleonic Wars (Table A3.1) shows that although very large numbers of troops were recruited in aggregate, and the numbers increased over the duration of the wars, the numbers actually deployed in any given action by the two sides combined tended in general to be quite modest. The average involved was c.26,000 in total (13,359 on each side) in 1792-96, with 52% of combats under 20,000 in total, and in 1813, c.33,000 (16,568 on each side)¹⁰ with 64% of

⁴ Mirza Muhammad Haidar, D. (1972) *Tarikh-i-Rashidi*. Translated by: Ross, E.D. London: Curzon Press, pp.305-310.

⁵ Dead ground is terrain that is invisible from a given viewpoint, being concealed by an undulation in the ground. In some instances, groups of troops may be concealed behind something that is itself quite noticeable, like a copse of trees, a ridge of high ground or a village. Dead ground is often something less obvious, like a bulge in the curve of the ground. Tanks can go “hull down”, concealing the bulk of their mass in the safety of dead ground, with no more than their turret (and gun) visible. An ambush of cavalry may be placed in dead ground, with a single dismounted scout to watch events. At Myriocephalum (1176), the Byzantines took heavy losses when rallying on a hill in full view of Turkish horse archers, rather than following the advice of their own horse archers to seek cover from the arrow rain in the dead ground of gullies.

⁶ Counting is easier where naval activity forms an important part of warfare, since boats and ships are fewer in number than men and animals, and often move more slowly across open terrain. Their capacity, even when large, has a maximum that is often known.

⁷ In conditions of gloom and cloud, scouts can report seeing large numbers of lancers, when what they have seen a clump of giant thistles. During the stress of a battle, troops can flee Cossacks, who turn out to be actually a herd of bullocks. See de Comynnes, P. (1972) *Memoirs: the reign of Louis XI 1461-83*. Trans. Jones, M. Harmondsworth: Penguin Classics, pp.101-102. See Zamoyski, A. *Warsaw 1920: Lenin’s Failed Conquest of Europe*. London: William Collins, p.88.

⁸ The computer game *Medieval Total War* greatly simplifies its depiction of battle while providing much more timely and precise data than any general of the period ever had. Nonetheless, anyone who has played the game will vouch for the ease with which one can lose an overall understanding of what is happening across the field. Even “facing” the wrong way carries the potential for losing perspective. This kind of problem impacts on the value of even the general as an informant for chroniclers of the time. See Courroux, P. (2020) ‘What Types of Sources did Medieval Chroniclers Use to Narrate Battles (England and France, Twelfth to Fifteenth Century)?’ *Journal of Medieval Military History* XVIII, pp. 117-141.

⁹ Disease, famine and war could deplete a population quite rapidly. Bachrach, B. S. (2014) ‘Some Observations Regarding Barbarian Military Demography: Geiseric’s Census of 429 and its Implications’, *Journal of Medieval Military History*, XII, pp. 1-38.

¹⁰ This includes the Battle of Leipzig when 560,000 men were deployed in a three day battle.

combats under 20,000 in total. In the U.S. Civil War, about 60% of approximately 10,500 combats may be described as skirmishes and 1% as battles or campaigns, with 80% of combats with recorded casualties having a level of casualties that did not logically demand a force size in excess of 100 (Table A.2).¹¹

If generals of the Modern period, 1792-1865, were mostly deploying forces of such comparatively small size in combat, it seems unlikely that Classical and Medieval generals were any better able to deploy larger armies into combat. The numbers quoted by Thucydides regarding the Peloponnesian war suggests that 43% of the contingents fighting on the Athenian side were less than 1,000 men in size (Table A3.3). Braasch finds that there were 161 skirmishes recorded for the Hundred Years' War in four chroniclers, and only 24 battles.¹² This ratio of skirmishes to battles (6.7 : 1), compared to the U.S. Civil War ratio (60.4 : 1), suggests that the process of chronicling biases the record towards larger actions.

Given the relatively low level of urban population supported by the surplus production of agriculture prior to the agricultural and industrial revolutions (medieval towns were not self-sufficient in people or food,¹³ and 60,000 people consumed 120 wagon-loads of grain daily),¹⁴ the support of armies by the transfer of these surpluses was always problematic. The size of urban communities of the time and area gives a plausibility check on reported army sizes.¹⁵

The impact of changing scale is important. Thus, Herodotus describes a method for enumerating the Persian army of Xerxes in 480 BCE. which was certainly plausible for counting an army of perhaps 50,000 or 100,000,¹⁶ but in order to count the 1,700,000 supposedly in the army would have taken the better part of a week devoted to doing nothing else.

¹¹ A force recorded as suffering 100 casualties must be deemed to have numbered at least 100 to start with. A force with 1,000 casualties was at least 1,000 strong initially.

¹² Braasch III, R.W. (2018) 'The Skirmish: A Statistical Analysis of Minor Combats during the Hundred Years' War, 1357-1453' *Journal of Medieval Military History* XVI, pp.123-157.

¹³ Halperin, C. (1987) *Russia and the Golden Horde: The Mongol Impact on Medieval Russian History*. Bloomington: Indiana University Press, p.79.

¹⁴ Bachrach, B. S. (2003) 'Some Observations on the Role of the Byzantine Navy in the Success of the First Crusade', *Journal of Medieval Military History*, I, pp. 83-100.

¹⁵ Marching with some medieval armies must have been very like passing through a town on market day. Something of the flavour of the experience is conveyed in Livingston, M. (2019) "Note: An Army on the March and in Camp – *Guillaume Guiart's Branche des royaus lignages*" *Journal of Medieval Military History* XVII pp. 259-272

¹⁶ Delineating an enclosure round ten thousand men and repeatedly filling the enclosure with troops. There is no description of how the first ten thousand were counted accurately (possibly a counted and disciplined unit such as the Persian Immortals (ten thousand strong) was deployed in 100 ranks x 100 files drawn up on a convenient level sandy plain). Herodotus (1965) *The Histories*. Translated by: de Selincourt, A. Harmondworth: Penguin, p.438.

Date	Total in combat (both sides)				Average per side	Number of combats
	Under 20,000	20,000, under 40,000	40,000, under 60,000	60,000 or more		
1792-1796	51.9%	23.9%	14.9%	9.3%	13,359	289
1813	64.1%	17.9%	6.0%	12.0%	16,568	117
All	55.4%	22.2%	12.3%	10.1%	14,284	406

Table A3.1 Totals engaged in combats of the French Revolutionary and Napoleonic Wars

Source: combats recorded in Smith (1998)¹⁷

Combat	Number	Per cent	Minimum Possible U.S. Force Size	Per cent
Skirmish	6,337	60.6	1-9	42.3
Intermediate Actions	4,013	38.4	10-99	37.8
Battle & Campaign	105	1.0	100-999	14.1
			1,000 or more	5.8
Total	10,455	100.0	Total	1,901

Table A3.2 Size of Combats in U.S. Civil War 1861-65

Source: combats recorded in Dyer (1959)¹⁸

Contingent size			
1-99	100-999	1,000-9,999	10,000 or more
2	24	30	5
3.3%	39.3%	49.2%	8.2%

Table A3.3 Athenian and Allied troop contingent sizes mentioned in Thucydides

Source: analysis by Morpeth (2006)¹⁹

In fact, the nomad numbers quoted as involved, whether they are accurate or not, in various enterprises are often quite small.²⁰ In Mongolia, several hundred or a thousand households (up to

¹⁷ Smith, D. (1998) *The Greenhill Napoleonic Wars Data Book: Actions and Losses in Personnel, Colours, Standards, and Artillery, 1792-1815*. London: Greenhill.

¹⁸ The estimate of the minimum possible U.S. force size is based on the casualties that are recorded for about 1,900 combats (given that the number of casualties logically cannot exceed the size of the force present, but will of course usually be substantially less, even in defeat). See Dyer, F. (1959) *A Compendium of the War of the Rebellion: Volume II Chronological Record of the Campaigns, Battles, Engagements, Actions, Combats, Sieges, Skirmishes, etc., in the United States, 1861 to 1865* New York: Thomas Yoseloff, pp. 582-594.

¹⁹ Morpeth, N. (2006) *Thucydides' War: Accounting for the Faces of Conflict*. Hildesheim, Georg Olms Verlag. Column II, Table III, pp.270-301.

²⁰ For instance the Biblical account suggests that Abram deployed 318 men to battle (Genesis 14, 14) and Esau brought 400 to a situation where battle was possible (Genesis 32, 6). Applying the proportion of one quarter fighting men to these numbers suggests that the total population in their communities might have been 1,200-1,600 people (perhaps 200-300 households). This is of the same order of magnitude as modern and historical tribes, and the counts are wholly plausible.

6,000 people, perhaps) have their own chief. Barfield refers to 42 branches of Ordos numbering between 1,000 and 3,000 each.²¹ A realm of 58 tribes (which might be about 50,000 households and 300,000 people) suffered defections of 200,000 people. On the other hand, 2,500 soldiers were led by A-ku-ta against Liao in 1114CE and a year later, he was emperor.²² The Uighur with nine tribes were a powerful ally of the T'ang and yet they sent an army of 4,000 against the An Lushan uprising.²³ Since this might have been as much as 7% of their total population, it was hardly a niggardly contribution, but even so, the number was small. In 962, the Turk Alptigin deployed about 3,000 men against 16,000 in his conflict with the Samanid amir Mansur that led to the establishment of the Ghaznavid realm.²⁴ The Seljuk rulers of Iran were advised by their vizier to maintain 200 elite guards and 4,000 rapid response troops at court and on the rolls.²⁵ Chinggis Khan himself had 105,000 men in 1206CE, and 129,000 on his death in 1227CE,²⁶ suggesting they were drawn from a population of between three-quarters of a million (1 warrior per household) and 2.6 million (5% recruitment) and yet the Secret History of the Mongols describes Chinggis in 1202CE, conducting a campaign following a victory, with 2,600 men in his army.²⁷ Wei's introduction to his translation of the Secret History suggests that after early successes, Chinggis had an army of four thousand, about a fifth of the Kerait army.²⁸ The account of 30-40,000 Mongols defeated in 1305CE by the Delhi sultanate suggests that larger forces were possible,²⁹ but in a somewhat later period, the Manchu initially deployed four banners of 7,500 households, subsequently doubling the number of banners.³⁰ These forces were more efficient than their Ming foes, with 2,000 Ming defeated by 700 Manchu and 40,000 Ming defeated by 20,000 Manchu. The Ottomans (sedentary Turk) deployed only 2-3,000 palace guards.³¹

Examination of one of the writings of the time suggests that many of the counted numbers are at least plausible and quite possibly accurate, e.g., 300 scouts, 1,000 reinforcements, armies of 6,000.³² They are in line with a detailed contemporaneous analysis of an army of 4,700 described in the *Tarikh-i-Rashidi*,³³ and not far different from the numbers in Thucydides. A great proportion of the estimates, however, are given in terms of tumens, a military unit that notionally numbers ten thousand men (or ten mingghan). The Mongols took rigorous measures to ensure that warriors assigned to a given tumen stayed with it, but these measures clearly could not apply to the dead or to those detached on approved duties, and it is not clear how recruits (whether young

²¹ Barfield, T. (1989) *The Perilous Frontier: Nomadic Empires and China*. Oxford: Basil Blackwell, p.247.

²² Franke, H. (1990) 'The Forest Peoples of Manchuria: Kitans and Jurchen', in Sinor, D. (ed.) *The Cambridge History of Early Inner Asia*. Cambridge: Cambridge University Press, pp. 400, 415.

²³ Mackerras, C. (1990) 'The Uighurs', in Sinor, D. (ed.) *The Cambridge History of Early Inner Asia*. Cambridge: Cambridge University Press, p.317.

²⁴ Nizam al-Mulk (2015) *The Book of Government or Rules for Kings: the Siyar al-Muluk or Siyasat-nama*. Trans Darke, H. Abingdon, Routledge, pp. 110-111.

²⁵ Nizam al-Mulk (2015), *The Book of Government* op. cit. p.93.

²⁶ Cunliffe, B. (2015) *By Steppe, Desert, and Ocean: The Birth of Eurasia*. Oxford: Oxford University Press, p.418.

²⁷ Anonymous (2006) *The Secret History of the Mongols*. Translated by: de Rachewitz, I. Leiden: Brill, p.95.

²⁸ Anonymous (1957) *The Secret History of the Mongol Dynasty. Publications of the Department of History Muslim University of Aligargh*. Translated by: Wei, K.S. Aligargh: Department of History Muslim University of Aligargh, p.25.

²⁹ Chandra, S. (2013) *Medieval India from Sultanat to the Mughals Part One: Delhi Sultanate 1206-1526*. New Delhi: Har-Anand Publications PVT p.70.

³⁰ Lorge, P. (1999) 'War and Warfare in China 1450-1850', in Black, J. (ed.) *War in the Early Modern World 1450-1845*. Boulder: Westview Press, pp. 87-104.

³¹ Aksan, V. (1999) 'Ottoman war and warfare 1453-1812', in Black, J. (ed.) *War in the Early Modern World 1450-1845*. Boulder: Westview Press, pp. 147-176.

³² Al-Din, R. (1971) *The Successors of Genghis Khan*. Translated by: Boyle, J. New York: Columbia University Press.

³³ Mirza Muhammad Haidar, D. (1972) *Tarikh-i-Rashidi*. Translated by: Ross, E.D. London: Curzon Press.

Mongols or conquered tribesmen) were assigned to individual tumens. Added to this, the prestige of commanding a tumen is likely to have resulted in the formation of units for which there was no realistic prospect of filling the ranks. Thus, there can be no certainty that the notional presence of a tumen equates precisely to the presence of ten thousand men. Actual strength may have been 70-80% of nominal, with fewer than ten mingghan, and 'tumen' meaning no more than 'large number'.³⁴

The lower numbers relating to nomads are broadly comparable with other figures for peoples both sedentary and nomadic. In Europe, the Herules numbered 5-10,000,³⁵ while raiding parties numbered 1,600-6,000 and larger Slav units might be 10,000, with elite groups of about 5,000. Szadeczky-Kardoss suggests that 20,000 Avar warriors originally fled west in the sixth century,³⁶ and he argues that 60,000 Avars were available against the Slavs and some 10,000 Cutrigurs. Linder presents calculations indicative of the likely number of horse-borne Huns, once they were established in Hungary.³⁷ He assumes that 25 acres of pasture are needed to support a horse,³⁸ then more than halves the carrying capacity of the Hungarian pasture to allow for the presence of other animals, and assumes 10 horses per man. As he has quoted 5 per man in Syria (and the Mongols in China seem to have allowed a similar proportion (see Jagchid & Bawden³⁹), this is perhaps a generous provision, but it still indicates that there were 15,000 (possibly 30,000) mounted Hunnic warriors in this period, presumably supported by auxiliaries levied from their subject peoples. Bowles argues for even smaller numbers of Magyars in the same area, on the basis that the horses that could be used for war formed only about a quarter of the entire herd.⁴⁰

The Fatimids' first army in North Africa numbered 700 horse and 2,000 foot,⁴¹ while the Almoravid army deployed against Aghmat in 1058 numbered only 400 horse, 800 camels and 2,000 foot.⁴² The Almohads were able to deploy an army of 6,000 cavalry and 6,000 infantry.⁴³ The Banu Merinids returned from the desert edge in 1244, after initial defeat by Almohads, with some 500 warriors.⁴⁴ A Moroccan army of 4,000 fighting men and 600 engineers was sent in 1590 across the Sahara where it defeated a Songhai army estimated at 30,000 infantry and 12,500 cavalry near Timbuktu.⁴⁵

³⁴ Sverdrup, C. (2010) 'Numbers in Mongol Warfare', *Journal of Medieval Military History*, VIII, pp.109-117

³⁵ Heather, P. (2009) *Empires and Barbarians: Migration, Development and the Birth of Europe*. London: Macmillan, p. 251.

³⁶ Szadeczky-Kardoss, S. (1990) 'The Avars', in Sinor, D. (ed.) *The Cambridge History of Early Inner Asia*. Cambridge: Cambridge University Press, p.206.

³⁷ Linder, R. (1981) 'Nomadism, Horses and Huns', *Past & Present*, 92, p.1.

³⁸ This is plausible enough. See Section 4.11.

³⁹ Jagchid, J. and Bawden, C. (1964) 'Some notes on the Horse Policy of the Yuan dynasty', in Lahn, K. & Sinon, D. (eds.) *Proceedings of the VIIth Meeting of the Permanent International Altaistic Conference*. Oosterbeck, p.246.

⁴⁰ Bowles, C. R. 'The Early Hungarians as mercenaries', *Mercenaries and Paid Men: The Mercenary Identity in the Middle Ages*, Swansea, 2008. Leiden: Brill, pp.193-205.

⁴¹ Hamdani, S. (2006) *Between Revolution and State: The Path to Fatimid Statehood*. London: Institute of Ismaili Studies & IB Tauris, p.6.

⁴² Messier, R. (2010) *The Almoravids and the Meanings of Jihad*. Santa Barbara: Praeger, p.35.

⁴³ Brett, M. and Fentress, E. (1996) *The Berbers*. Oxford: Blackwell Publishers, p.115.

⁴⁴ Julien, C.-A. (1970) *History of North Africa: Tunisia, Algeria, Morocco From the Arab Conquest to 1820*. Translated by: Petrie, J. London: Routledge & Keegan Paul, p.147.

⁴⁵ Hunwick, I. (1971) 'Songhai, Bornu and Hausaland in the sixteenth century', in Ajayi, J. & Crowder, M. (eds.) *History of West Africa*. London: Longman, p.237.

Chinese figures are of an order of magnitude greater. In China, armies increased steadily in size as the population grew and the number of states decreased. In the seventh century BCE, armies were in the order of 10,000 in size, by the sixth century BCE, it was 50,000, and in the fifth century BCE, the warring states deployed armies of 100,000.⁴⁶ Fiefs with 5-20,000 households and a 5,000 strong army were established in the Inter-dynasty period.⁴⁷ In 624, the Tang army consisted of 633 units of 800-1200 (say 630,000 in total)⁴⁸ at a time when a prefecture contained 25,650 households and 146,800 population (5.72 Mean Household Size). Wei's introduction to the Secret History quotes regional figures suggesting a mean household size of 3.18 in the North and 4.55 in the south during the Yuan period (Table A3.4).⁴⁹ The Song commentator Zhang Yu suggests that to send supplies for 100,000 men four hundred miles takes the strength of 700,000 households.⁵⁰ In other words, an army equivalent to no more than about 3% of the population can be maintained in the field at such a distance.

Yuan	Total	North	South	% in North
Family	12,831,269	1,435,360	11,395,909	11.2
Persons	56,386,886	4,558,235	51,828,651	8.1
Mean Household Size	4.39	3.18	4.55	

Table A3.4 Family Size, North and South China during the Yuan

Source: Wei's 1957 introduction to the Secret History of the Mongols (p.31)

In 1076CE, the Song maintained a register of population that contained 6.9 million people (equivalent to 1 person from each of 46% of households) liable for service in the militia,⁵¹ with 568,000 regulars also in service. While such numbers were present on paper, it is unlikely that they ever served in the same time and place. When the Song deployed against the Tangut realm of Hsia Hsia, they quickly suffered casualties greater than their entire regular force. Armies of this size proved more effective in generating losses due to the inability to feed them in the field, than in winning battles.

Table A3.4 shows that in general, the Chinese of the earlier Han period estimated that with four major and more remote states excepted, the minor polities of the western areas had small populations and averaged barely 1,000 households, with a population of about 7,500 and 1,700 armed men. The four major states seem to have been assessed as having household sizes (4.00-5.25) which are comparable to the Tang Chinese mean household size (5.72), while the household sizes for the smaller, closer polities are estimated to be markedly greater (7.65).

⁴⁶ Lewis, M. (2007) *The Early Chinese Empires: Qin and Han. History of Imperial China* Cambridge, Massachusetts: Belknap Press of Harvard University Press.

⁴⁷ Lewis, M. (2009a) *China between Empires: the northern and southern dynasties. History of Imperial China* Cambridge Massachusetts: Belknap Press of Harvard University Press, p.61.

⁴⁸ Lewis, M. (2009b) *China's Cosmopolitan Empire: the Tang dynasty. History of Imperial China* Cambridge Massachusetts: Belknap Press of Harvard University Press, p.31.

⁴⁹ Anonymous (1957) *The Secret History of the Mongol Dynasty*, p.31.

⁵⁰ Quoted in Sun-tzu, (2003) *The Art of War*. Translated by: Miniford, J. London: Penguin Press, p.126.

⁵¹ Kuhn, D. (2009) *The Age of Confucian Rule: the Song transformation of China. History of Imperial China*. Cambridge, p.56.

Unit	Households	Population	Armed men	Mean Household Size	% Armed men	Armed men per household
Small realms (47)	46,570	356,192	80,824	7.65	23	1.74
Ta Yueh-Chih	100,000	400,000	100,000	4.00	25	1.00
K'ang-chu	120,000	600,000	120,000	5.00	20	1.00
Ta Yuan	60,000	300,000	60,000	5.00	20	1.00
Wu-sun	120,000	630,000	188,800	5.25	30	1.57
All	446,570	2,286,192	549,624	5.12	24	1.23
Mean value of the small realms	991	7,579	1,720			

Table A3.5 Summary of Former Han estimates for Central Asian states

Source: Chapters 61 and 96 of the History of the Former Han dynasty (Hulsewe, 1979)

It is reasonable, therefore, to assume that tribes generally were able to deploy about 25 per cent⁵² of their population for battle. This is borne out by an estimate from a very different environment which suggests 26-27% for rather smaller groupings.⁵³ When the problems of remote supply are taken into account, the Ta Yueh-Chih could match in numbers of armed men deployable, a Chinese population, four hundred miles away, of 7.5 times the size of the Ta Yueh-Chih.⁵⁴

Table A3.5 provides an estimate of the armed forces and population of the Caliphate of Sokoto, in West Africa during the nineteenth century, based on a similar population but an assumed lower proportion of 10% available to the armed forces.

⁵² Or thereabouts. An early estimate of the Magyar warriors at the time of settlement suggested 21.5 per cent. Godkin, E. L. (1853) *The History of Hungary and the Magyars from the earliest period to the close of the late war*. London: J. Cassell.

⁵³ Estimates of the number of warriors and overall population of forty-three Native American tribal groups to the west of the United States Frontier in 1817 suggests an average population of 3,104 with 812 warriors (26-27%). Brown, S. (1817) *The Western Gazetteer or Emigrant's Directory*. Auburn, New York: H.C. Southwick, Reprinted in Facsimile (1971) Arno Press Inc, pp.207-215, p.242, p.245.

⁵⁴ On the definition of King Ine (see note 3 above), in order to be able to deploy a minimal *here* [raiding army], a community would probably need a population of about 150 (say 25-30 households) in the context of a tribe, or 1,260-1,520 in the context of the Song empire.

Emirate	Cavalry			Infantry (est)	Total Troops	Population (est)
	List 1	List 2	Average			
Sokoto	10000	5000	7500	48750	56250	562,500
Kano	7000	6000	6500	42250	48750	487,500 ⁵⁵
Bauchi	2000	1750	1875	12188	14063	140,625
Zaria	3000	3000	3000	19500	22500	225,000
Adamawa	2000	2000	2000	13000	15000	150,000
Katsina	1000	1000	1000	6500	7500	75,000
Missau	1000	1000	1000	6500	7500	75,000
Katagum	1500	1200	1350	8775	10125	101,250
Marmar	700	500	600	3900	4500	45,000
Shira	500	500	500	3250	3750	37,500
Boberu	600	600	600	3900	4500	45,000
Daura	400	400	400	2600	3000	30,000
Kazaure		200	200	1300	1500	15,000
Hadejia	2000		2000	13000	15000	150,000
Zamfora	3500		3500	22750	26250	262,500
Ilorin	5000		5000	32500	37500	375,000
Nupe	2000		2000	13000	15000	150,000
Total	42200	23150	39025	253663	292688	2,926,875

Table A3.6 Estimate of Armed Forces and Population in Caliphate of Sokoto, Nineteenth Century West Africa

Based on Smaldone (1977, p.60)

Mean ratio of
Infantry: Cavalry

6.5 : 1

Troops form
10% of
population

⁵⁵ Johnston (1970, p.156) suggests a population of 500,000 for Kano.

Appendix 4 MORALE, SURPRISE AND SHOCK

Du Picq, writing in the nineteenth century, suggests that “*the effect of an army, one organisation on another, is at the same time material and moral. The material effect of an organisation is its power to destroy, the moral is the fear it inspires.*”¹ This had been long known, and moral, or morale, was often given the pre-eminence. Soldiers could face death in different ways,² so the effect of destruction varied. Castillo quotes Xenophon: “*I am sure that not numbers or strength bring victory in war, but whichever army goes into battle stronger in soul, their enemies cannot withstand them.*”³ General Montgomery provided a definition of morale as “*endurance and courage in supporting fatigue and danger*”.⁴ Fennell describes morale as poorly defined, though recognised when encountered, and multi-dimensional in nature.⁵ This is plainly so, for there are two levels to morale, fortitude and courage.⁶ Fortitude operates at the strategic level and relates to the long term perseverance of an individual with the manifold tasks, problems and hardships that arise in a campaign over a period of days, weeks, months or even years.⁷ As noted by Goodman, low pay or the absence of pay, rough terrain, sickness, shortage of food and water and the impact of various forms of severe weather, together with the degree of past successes and failures, are all factors which reduce the ability and willingness of people to attempt necessary tasks.⁸ They may even lead to them absenting themselves from the army as stragglers or deserters.

Courage operates at the tactical level which arises in the immediate period of days, hours and minutes that the individual copes with the fears and exultations of combat on the battlefield. It builds on the strategic level of morale, but also relates to expectations (both by self and others) of behaviour,⁹ and it can manifest itself in very short-term and sometimes almost spontaneous

¹ Du Picq, A., (1921) *Battle studies: ancient and modern battles*. Trans: Greely J. and Cotton, R., ed Judet, E. Great Britain: Amazon, p.78.

² Stephenson, M. (2013) *The last full measure: how soldiers die in battle*. London: Duckworth Overlook.

³ Castillo, J.J. (2014) *Endurance and War: the national sources of military cohesion* Stamford Stamford University Press, p.17.

⁴ Cited by Fennell. See Fennell, J. (2019) *Fighting the People's War: The British and Commonwealth Armies and the Second World War*. Cambridge: Cambridge University Press, Appendix 4.

⁵ Fennell, J. (2014) 'In search of the X Factor: Morale and the Study of Strategy', *Journal of Strategic Studies*, 36(6-7), pp. 799-828,

⁶ “MAXIM LVIII. The first qualification of a soldier is fortitude under fatigue and privation. Courage is only the second; hardship, poverty and want, are the best school for a soldier” Guide, Officers'. (1862) *Napoleon's Maxims of War*. Richmond: West & Johnston.

⁷ As described by Charles Stewart in 1809 (Knight, 2014, p. 417) of the British soldier: “heroic in action, full of spirits in advance and when he is well fed, but in retreat where subsistence is short, he becomes cross, unmanageable and too much disposed to give the thing up.”

⁸ Goodman, A. (2006) *The Wars of the Roses: The Soldiers' Experience*. Stroud: Tempus, p.183, p.195.

⁹ For example, Spartans stand and die, obedient to their orders, and sick Spartan soldiers rejoin the standards to die with their comrades (Herodotus (1968) *The Histories* op.cit. p.494).

incidents such as routs and unordered charges, as well as in ongoing and firm stands or determined advances in the face of severe odds. In many ways, the two levels are akin to the medical concepts of “chronic” (strategic) and “acute” (tactical) conditions. Both can be influenced by a wide range of factors such as: technology and firepower; quality of manpower available; environment and provision; welfare and education; leadership and command; and training.¹⁰

Strategic morale is more amenable to long-term research, as there is more opportunity to observe and record what is happening. Modern assessment of organisational morale tends to focus on the psychological aspects of strategic morale, looking at factors such as feeling valued, openness, conflict management, ownership, motivation, feedback and difference management. While such matters were certainly not without some relevance in the context of antique or medieval warfare,¹¹ they were mostly subordinate to physical conditions that endangered life, or to the failure to pay troops.¹²

Fennell is able to monitor strategic morale in the British army during the Second World War, using a range of indicators that were either unavailable or irrelevant for the pre-modern period (e.g., the reports of the Censors charged with checking troop correspondence – although troops, the minority probably, who could write, did so and there is archaeological evidence for this, there is no evidence that they were expected to submit their correspondence for scrutiny by authority). The scale of measurement used is, however, likely to be relevant. Dupuy also provides a scale for the assessment of the impact of morale on combat effectiveness.

Table A4.1 shows the numeric assessment of morale devised by Fennell, and a revaluation to align it with Dupuy’s assessment scale for morale. The key difference is that Dupuy’s scale is shorter and it is not continuous, with a substantial gap occurring between Poor morale and Panic. This suggests that Dupuy’s scale is more directed towards measurement of tactical morale, and Fennell’s scale is directed towards strategic morale. Panic is an immediate response to a sudden and intense fear-inducing situation. It may be set in contrast to shock, which tends to occur in more prolonged exposure to fear-inducing situations where responding is not possible or seems unlikely to be effective. Shock inhibits the ability of individuals and groups to respond at all.¹³

¹⁰ As in the chapter headings used by Fennell. See Fennell, J. (2013) *Combat and Morale in the North African Campaign: The Eighth Army and the Path to El Alamein*. Cambridge: Cambridge University Press.

¹¹ Kostick, C. (2013) 'Courage and Cowardice in the First Crusade 1096-1099', *War in History*, 20(1), pp. 32-49.

¹² A modern corporation that expected its staff to work while sick and unpaid would probably find an excellent 'difference management' system counts for little in such circumstances.

¹³ Rowland, D. (2019) *The Stress of Battle: Quantifying Human Performance for Historical Analysis and Wargaming*. Ed Curry, J. Milton Keynes: The Wargames Project, p.189, p.194.

Fennell	Basic	Revalued	Dupuy	Value
Excellent	3	1.1		
High	2	1.0	Excellent	1.0
Good	1	0.9	Good	0.9
Satisfactory	0	0.8	Fair	0.8
Severely tried	-1	0.7	Poor	0.7
Low	-2	0.6		
Very low	-3	0.5		
			Panic	0.2

Table A4.1 Numeric Assessments of Morale

Source: Dupuy (1992), Fennell (2014)

Revaluation of Fennell: $0.8 + \text{Score} / 10$

Lawrence suggests that in modern conventional war, superior situational awareness and surprise add very considerably to combat effectiveness. Poor situational awareness on the part of the defender improves the chances of surprise by the attacker twenty-four fold, and surprise enhances the probability of success six-fold.¹⁴ Surprise may be defined as the achievement of the unexpected in timing, place or direction of an initiative.¹⁵ There is some variation in the effects of this, dependent on circumstances. Attacks by armour (and cavalry) are fifteen to sixteen times more likely to achieve a state of shock (with attendant degradation of performance) in the defenders if the attackers can achieve surprise (and if they also attack in poor visibility, and they are perceived by the defenders as invulnerable,¹⁶ the likelihood of shock can be increased a further twenty-four-fold). Fast moving cavalry are more likely to achieve shock. Infantry attacks are rather less likely to reduce the defenders to shock, needing to achieve surprise whilst attacking in poor visibility or against defenders of poor morale in order to enhance the chances of shock six-fold.¹⁷

The performance of an army is rarely at the theoretical optimum achievable, but there is evidence that while the majority of fighters (50-75%) generally perform at a sub-optimal level with a tail of more timid or less competent individuals who perform at well below that sub-optimal level, there is also an equal tail of braver and more competent individuals who succeed in performing at the theoretical optimum. They may be described as heroes.¹⁸ Panic and shock effectively change the proportions in each category.

Although the above precise evaluations are modern, there is no reason to suppose that the general implications do not more or less hold in earlier periods. It is less clear, however, just how

¹⁴ Lawrence, C. A. (2017) *War by Numbers: Understanding Conventional Combat*. Lincoln, Nebraska: Potomac Press and University of Nebraska Press.

¹⁵ Rowland, D. (2019) *The Stress of Battle*, op. cit., p.176.

¹⁶ Tanks in modern times are sometimes perceived as invulnerable, although they are not. In earlier times, cataphracts and knights in full armour may have been seen in rather the same way, for as the twelfth century Byzantine historian, Anna Comnena, expressed it, "A mounted Kelt [Norman] is irresistible. He would bore his way through the walls of Babylon." See Comnena, A. (1969) *Alexiad of Anna Comnena*. Translated by: Sewter, R. Harmondsworth: Penguin, p. 416.

¹⁷ Rowland, D. (2019) *The Stress of Battle*, op. cit. pp. 176-203.

¹⁸ Rowland, D. (2019) *The Stress of Battle*, op. cit. p. 153.

such matters might be assessed in the classical and medieval period. In battle, the commander might be able to see an unplanned charge of enthusiastic knights against lowly burghers or archers, or the disintegration of a formation into a host of panicked fugitives, gaining some sense of the morale of the armies. Strategic morale is rather less obvious to a commander, who will need to investigate the response of his troops to a situation which is complex. Whilst it is reasonable for the commander to be aware of the pay and rations that he has ordered for his troops, he can hardly systematically know the outcome of such orders or the state of other matters, save through personal inquiries or reports from subordinates who may have a vested interest in concealing the situation, either because it is partly their fault or because they fear to be blamed anyway. The circumstances of the enemy are likely to be even less clear. One possible quantitative framework of unit morale is given in Table A4.2.¹⁹ If validated, such a framework could be aligned quite readily to Fennell's scale.²⁰ Again, this assessment applies to troops, rather than decision-makers.

While it may often be the case that morale determines the outcome of the tactics and strategies that are being implemented,²¹ it is less clear that the decisions that are made concerning the broad policies to be implemented are much influenced by a conscious assessment of morale among the two parties. What is more likely is that the (frequently unassessed) morale of the decision-makers will be reflected in their decisions. Sometimes this is reported, especially when over-confidence prompts some quotable expression of *hubris*, but often there is nothing substantial.

¹⁹ Taylor, A. (2015) 'Arthur Taylor's Rules for Wargaming', in Curry, J. (ed.) *The Discovering Wargames Series and Bill Lammings's Medieval Campaign Rules: Early Wargaming Rules Volume 5*. www.wargaming.co: History of Wargaming Project, p.74.

²⁰ By deducting 2, giving a basic range of 3 to -2, and the possibility of a score of -3 in bad conditions.

²¹ e.g., Themistocles implemented his preferred strategy at Salamis by using the over-confidence of Xerxes, in pretending that Greek morale was collapsing, to lure the Persian king into blocking the route of those Greeks who preferred an alternative strategy (Herodotus (1968) *The Histories* op.cit. pp.522-3).

Score	Unit Quality	Confidence in Leadership	Physical Condition	Mental Condition
5	Elite	Use Leadership Index	Peak (up to 5 actions)	Confident
4	Veteran line (previously in action)		Average (6-10 actions)	
3	Inexperienced		Campaign tiring (11-15 actions)	Willing
2	Heavy losses in last action		Very tired (over 16 actions)	Not very confident
1	Failed in previous action			Failed in previous action through failure of morale, e.g., ran from the field
0	Failed in all previous actions			Failed in two previous actions through failure of morale, e.g., ran from the field
Basic Score is the average of the four factors, rounded down				
+1	Commander present <u>or</u> high morale (5,4) unit nearby <u>or</u> in defences <u>or</u> with standard			
+2	Overall Commander present			
-1	Bad weather (heavy rain, snow, fog, intense heat) <u>or</u> unit alone <u>or</u> without support			

Table A4.2 Framework for Morale Assessment

Source: Taylor (2015)

Appendix 5 BIASES IN MODEL EMPHASIS

The explanatory performance of any model is enhanced by including significant factors and thus much depends on which factors are considered likely to be most significant, hence the wide range of the literature review in the thesis. This Appendix looks at the range of possible factors identified, in the context of an external model of battle.

Table A5.1 shows an estimate of the alignment of the factors held on the GIPP database, with the broad factors identified in the Collins model as influencing victory or defeat in battle (grouped by Collins under the headings of Material, Manoeuvre, Morale).¹ Although all three factors from the Collins model are represented in the GIPP database, it is clear that there is a stronger alignment with the Material factor. This is indicative of the general tendency of statistical indicators towards wider and more accurate coverage of those things that are more easily measured and counted, and it highlights the problem of developing a balanced model of the way that conflicts work.² The impact of each factor is rated here by allocating three stars between the three components of the Collins model. With 22 factors assessed, a random allocation would have assigned a total score of 22 (33.3%) to each of the components, but in fact the factors are much more orientated towards the Material component. This bias is sufficient to approach (but not reach) low statistical significance (the table has a Chi-squared value of 2.45 at 2 df). It is not necessarily the case that the model lacks the potential for good explanatory power, but it is clearly less than perfect.³ It is helpful to have an indication of areas which are under-represented.

Other documentation can be subjected to a similar style of analysis, calling on other literature. It will also be noted from Table A5.2 that although the alignment of factors presented in Table A5.1 lies between those of two twentieth century army manuals,⁴ the alignment of GIPP factors (Material: 42%; Manoeuvre and Morale: 58%) seems to resemble rather more closely the focus of US 1941 Field Service regulations (Material: 56%; Manoeuvre and Morale: 44%) than it resembles

¹ Collins, R. (2010) 'A Dynamic Theory of Battle Victory and Defeat', *Clodynamics*, 1, pp. 3-25.

² More recent conflicts have been affected by biases in statistical systems. The Measurement of Progress system used by the USA to monitor combat progress in the 1965-1975 Vietnam war emphasised activities, kill ratios and control of places and route ways (i.e., material and manoeuvre factors), but was rated as a valid measure by only 2% of a sample of US generals who had commanded in Vietnam, with 32% rating it as "not valid" (see Kinnard, D. (1991) *The War Managers: American Generals Reflect on Vietnam*. New York: Da Capo Press, p.74) The hamlet evaluation system (HES), another US statistical system, was rather better regarded, for though it was rated as a good way to measure progress in pacification by no more than 2% of the sample, only 19% rated it as "not valid" (Kinnard, 1991, op. cit. p.108). Again, the statistical indicators showed a tendency towards material factors. All eighteen indicators in the HES were found by a Rand Corporation evaluation to align with Security and Development factors (i.e., matters better described as material factors), and the evaluator highlighted the need for a question on the willingness of inhabitants to challenge the views of communist cadres (i.e., a morale factor) (see Sweetland, A. (1968) *Item Analysis of the HES (Hamlet Evaluation System)*: Rand Corporation 17634-ARPA/AGILE, p.8). Of Kinnard's sample, 56% of generals (p.172) thought that the will and determination of the enemy [i.e., a morale factor] was not sufficiently considered prior to 1968. As Hunt noted: "In relying on numerical targets, the APC [Accelerated Pacification Campaign] was at a disadvantage before it began [... for] official statistics lacked credibility" (Hunt, R. (1995) *Pacification: The American Struggle for Vietnam's Hearts and Minds*. Boulder: Westview Press, p.159). This was hardly surprising, if the statistics were failing to measure key aspects of the campaign.

³ As indeed are all models.

⁴ van Creveld, M. (1982) *Fighting Power: German and U.S. Army Performance 1939-1945. Contributions in Military History*. Westport Connecticut: Greenwood Press, Tables 4.1, 4.2.

the focus of the 1936 German manual (Material: 25%; Manoeuvre and Morale: 75%). Converting the three models into odds ratios measured against a purely random allocation of factor weights⁵ places the model presented in this thesis (1.47) about halfway between the 1941 US model, with its higher weighting on Material factors (2.58), and the 1936 German model (0.68) orientated to Manoeuvre and Morale.

This gives an indication of the possibility that the GIPP database is orientated to factors which may be less important in battle (as opposed to other ways to pursue conflict). Van Creveld advances the view that the German army's performance in the Second World War was fifty percent better than that of the U.S. army,⁶ in which case, it is reasonable to suppose that the German doctrines and manual may perhaps have been better aligned to the realities of battle, than those of the U.S. army. The Collins model suggests that Material factors bring victory only when Manoeuvre and Morale factors do not, and the 1936 German manual seems to reflect an awareness of this. It is arguable that the German approach was developed as a response to the circumstances of the state of Prussia in the eighteenth and nineteenth century. It emphasised fighting power over administration, logistics and intelligence,⁷ and discounted approaches that were not realistically available to Prussia. On a wider scale, the approach is not a panacea.⁸

Possibly, the same is also true of the US approach.⁹ The 1941 US Field Regulations accord to Material factors a weight 3.8 times that accorded to such factors by the German approach. The model developed for this thesis accords Material factors a weight 2.2 times that accorded by the German approach.

By way of further historical comparison, further analysis of medieval pre-battle orations suggests that these orations perceived Morale and Manoeuvre as very much more important (Material: 8%; Manoeuvre and Morale: 92%) than either the US or German armies did.¹⁰ This low rating of Material, when converted to an odds ratio, suggests that the German army rated Material factors 3.8 times more highly than the composers of medieval pre-battle orations. It may be noted that on the whole, however, composers of medieval pre-battle orations probably tended to have limited experience of keeping armies in the field. On the other hand, it is arguable that by the time matters have reached a pre-battle oration, it is rather late to address matters of Material or Manoeuvre. Morale may yet be improved by a rousing speech.

⁵ Material: 33%; Manoeuvre and Morale: 67%.

⁶ van Creveld, M. (1982), *Fighting Power* op. cit. p.6.

⁷ Citino, R. M. (2017) *The Wehrmacht's Last Stand: The German Campaigns of 1944-45*. Lawrence, Kansas: University Press of Kansas, p. 9.

⁸ Citino, R. M. (2007) *Death of the Wehrmacht: The German Campaigns of 1942*. Lawrence, Kansas, University Press of Kansas, pp. 4-5.

⁹ The US approach may be characterised by some as "assemble overwhelming force and flatten the enemy". See Citino, R. M. (2012) *The Wehrmacht Retreats: Fighting a Lost War, 1943*. Lawrence, Kansas: University Press of Kansas, p.11.

¹⁰ Accounts of 360 pre-battle orations from the period 1100-1250 (see Bliese, J. (1989) 'Rhetoric and Morale: a study of battle orations from the central Middle Ages', *Journal of Medieval History*, 15, p. 201-206), as subsequently analysed by Brooks and Curry. See Brooks, R. and Curry, J. (2020) *A Practical Guide to Medieval Warfare: Exploring History through Wargaming*. United Kingdom: History of Wargaming Project, pp. 58-59. This suggest that of 604 topics mentioned, 52.2% related to justice and divine assistance, 22.2% related to Morale, 17.7% related to Manoeuvres and 7.9% related to Material (plunder). On the assumption that justice and divine assistance impacted principally on Morale, this would give a final grouping of 92% Morale and Manoeuvre, and 8% Material.

Thus, it may be concluded that the GIPP database and thesis model are somewhat directed towards the Material, but not necessarily to an inappropriate degree.

Conflict Factors		Impact on Factors in Collins model		
Factor	Sub-factor	Material	Manoeuvre	Morale
Polity structure				
	Cohesion	*		**
	Effectiveness	*		**
Polity: physical & economic				
	Size	*	**	
	Population	***		
	Terrain		***	
	Altitude		***	
	Ruggedness		***	
	Biocapacity	***		
	Land quality	***		
	Water	**	*	
	Non-aridity	**	*	
	Desert	**	*	
	Climate	**	*	
	Climate change	**	*	
	GDP	***		
	Inequality			***
	Meta Ethnicity			***
Army				
	Army quality	*	*	*
	Cavalry	*	*	*
	Artillery	*	*	*
Religion				
	Jihad			***
	Religion			***
Total	1 per * of rating	28	19	19
	Percent	42.4	28.8	28.8

Table A5.1 Provisional alignment of conflict factors to factors identified in Collins model of conflict

Note: Meta Ethnicity relates to factors generating ethnic identity (see Chapter 10)

Source: own assessment

Sub-entries in manual by subject	German 1936		US 1941		Factor alignment
	n	%	n	%	
a) Combat	211	58.4	203	35.2	Manoeuvre and morale
b) Leadership and command	60	16.6	52	9.0	Manoeuvre and morale
c) Logistics	52	14.4	145	25.2	Material
d) Technical means	20	5.5	24	4.2	Material
e) Units and arms of service	18	5.0	152	26.4	Material
Total a) - e)	361	100.0	576	100.0	
Other	385		634		
All sub-entries	746		1210		
Factor					
	German 1936		US 1941		Thesis Model
Material	25 %		56 %		42 %
Manoeuvre & morale	75 %		44 %		58 %
Odds ratio for Material factors (against a random allocation of 33.3%)	0.68		2.58		1.47

Table A5.2 Subject matter of selected 20th Century army manuals and regulations

Source: van Creveld (1982)

Appendix 6 TERMINOLOGY

It is not always easy to convert numbers to language or vice versa. In order to allow some quantification of indeterminate terms, Table A6.1 offers some terms and values derived from Curry and Young that are used as necessary.¹ It will be noted that Fennell’s Morale scale (see Appendix 4) matches this seven-way classification quite well.

Term	Quantification	Probability	Percent Chance
Excellent	+5	Certain	100%
Very Good	+3	Highly Likely	80%
Good	+1	Probable	60%
Not Significant	0	Uncertain	50%
Not Very Good	-1	Improbable	40%
Very Bad	-3	Highly Unlikely	20%
Terrible	-5	Impossible	0%

Table A6.1 Terms and values used to describe results

Source: Based on Curry & Young

Appendix 7 REGIONAL LEVELS OF CIVILISATION IN 1913

In his book *Civilisation and Climate*,¹ Ellsworth Huntington undertook a study intended to prepare a map intended to show the distribution of the “highest elements” of civilisation defined as such things as:

“The power of initiative, the capacity for formulating new ideas and carrying them into effect, the power of self control, high standards of honesty and morality, the power to lead and control other races, the capacity of disseminating ideas ... These qualities find expression in high ideals, respect for law, inventiveness, ability to develop philosophical systems, stability and honesty of government, a highly developed system of education, the capacity to dominate the less civilised parts of the world and the ability to carry out far-reaching enterprises covering long periods of time and great areas of the earth’s surface.”

In late 1913, he sought the opinions of over 200 geographers, anthropologists and others that he considered expert, from twenty-seven countries,² in order to compile a ranked assessment of one hundred and eighty-five world regions on a scale of one to ten. He explicitly requested that the assessment should relate to the previous century. The data collected was assembled into average regional scores in the notional range of 1-100. These scores were published as an appendix to the book.

¹ Curry, J. (2012) *Innovations in Wargaming Vol. 1 Developments in professional and hobby wargames*. Great Britain: Amazon; Curry, J. and Price, T.; (2014) *Matrix Games for Modern Wargaming: Development in Profession and Educational Wargames*. *Innovations in Wargaming*: Wargaming Co, p.86.

¹ Huntington, E. (1915) *Civilisation and Climate*. New Haven: Yale University Press, pp.148-182.

² The countries are not listed. Responses were received from individuals (not all native) in seventeen countries: Australia, England, Sweden, Germany, Norway, Switzerland, Russia, France, Italy, Spain, Portugal, Japan, China, USA, Canada, India, Egypt.

Huntington's definition of "highest elements of civilisation" did not command universal and unqualified approval even in 1913,³ but the data published in the Appendix serve as an objective measure of the views of some, at any rate, scholarly opinion, during the pre-World War I period, on the subject of the distribution of what they considered civilisation. The highest rated regions were England and Wales, and the New York area of the USA (both at 100) and the lowest rated regions were the Kalahari desert (12), tundra areas of Asia (13), New Guinea (15), forests of northern Siberia (16), northern coasts of North America (17) and Sahara (19). Without entering the debate of whether these numbers are a measure of worth, they may be taken as measures of perceived difference.⁴ Average scores can be calculated for the regions used in the present study, and these averages allocated to the interactions held in the GIPP database.

Although any differences in civilisation for the period 1813-1913 cannot possibly be a cause for events that occurred perhaps a thousand or more years previously, the relationship may work in the opposite direction. These previous events may be associated with the perceived differences in civilisation that were recorded. Alternatively, it is possible that the assessment correlates with other variables that do in fact have a causal effect on historic events. Table A7.1 shows that there are statistically significant relationships between the Huntington 1913 Civilisation Index and various later indices. Measures such as Otterbein Military Sophistication, Murdock & Prevoost Culture and the Seshat variables, all appear to be addressing matters that Huntington's Civilisation Index measured.

Table A7.2 shows that adding the 1913 Civilisation Index to the identified regression equation of Initiator Strategy, shown in Table 13.4, results in the Respondent 1913 Civilisation Index replacing Initiator Morale. The explanatory power of the model remains virtually unchanged, suggesting that the two variables may be describing the same phenomenon in different ways.⁵ It may be that high perceptions of the level of civilisation in the power with which they are dealing tend to inhibit Morale levels among the neighbours. The splendour of an imperial *darbar* or Byzantine throne room⁶ may prove cheaper than either armies or subsidies, at least until someone declines to be impressed and starts to test what lies beneath the splendour.

³ Huntington quotes some of the critical responses to his request.

⁴ It may be noted that this is not an estimate of the degree of adaption of the cultures in such areas to surviving in their environment, but rather an attempt to assess the cultures in terms of complexity and development, which some have sought to express "highest elements of civilisation". Whether or not such "highest elements" can serve as a legitimate measure of the *worth* of other cultures, it is reasonable to conclude the assessment does serve as a measure of the level of *differences* between cultures. It can hardly be doubted that in 1913, the peoples of New Guinea (15) or the Kalahari (12) lived in cultures more different from the people of London or New York (both 100), than did the peoples of, say, China (60-66) or Egypt (57).

⁵ The correlation of the two is -0.381 (99% significant). The Morale measure is a composite of the Jihad, Cohesion, and Aggression measures, and this correlation implies that Jihad, Cohesion and Aggression in an Initiator is likely to be lower in cases where the Initiator is confronted by a more "highly civilised" Respondent. This seems a likely enough state of affairs.

⁶ Ceremonial halls in the Byzantine imperial palace could be filled with roaring bronze lions and singing golden birds on silver trees, with ceremonies where 'Imperial power could be exercised in harmony and order, with formal processions by groups of high officials, and threefold invocations by singers and people of 'Lord, strengthen the Empire for ever.'"See Runciman, S. (1975) *Byzantine Style and Civilization*. London, Penguin, pp.67-68 and pp. 120-124.

Correlation		Otterbein Military Sophistication	Murdock and Prevost Culture	Seshat
Initiator	Huntington 1913 Civilisation	.284**	.240**	.262**
Respondent	Huntington 1913 Civilisation	0.158	.223*	.493**

Table A7.1 Correlation of Huntington 1913 Civilisation Index with other measures

* 95% Statistical significance ** 99% significance

Source: GIPP database

Original Equation	Unstandardized Coefficients	Sig.	Equation with Huntington Civilisation Measure added	Unstandardized Coefficients	Sig.
	B			B	
(Constant)	59.381	<0.001	(Constant)	60.586	<0.001
Initiator morale	0.011	0.034	Excluded by analysis	na	na
Initiator wealth inequality	-0.981	0.012	Initiator wealth inequality	-1.008	0.009
Respondent military sophistication	-1.922	0.003	Respondent military sophistication	-1.783	0.006
			Respondent Huntington 1913 Civilisation	-0.012	0.032
Initiator culture	0.024	<0.001	Initiator culture	0.023	<0.001
Initiator desert	-0.034	<0.001	Initiator desert	-0.035	<0.001
Initiator good soil	-0.037	<0.001	Initiator good soil	-0.033	<0.001
La Nina 10 year events	0.183	<0.001	La Nina 10 year events	0.183	<0.001
Northern Hemisphere temperature	-3.470	<0.001	Northern Hemisphere temperature	-3.507	<0.001

Table A7.2 Impact of including Huntington Civilisation Measure in regression equation for Initiator Strategy

Appendix 8 A METHOD OF QUANTIFYING LEADERSHIP

As noted in Chapter 8, it is difficult to assess the competence of leaders, save in terms of success which is the variable that the analyst often wishes to explain, and which is likely to be explicable in terms of a whole range of variables other than leadership competence, including “sheer blind luck”.⁷ Nonetheless, one possible framework for constructing a quantitative index of Leadership Competence is shown in Table A8.1. It is based on a suggestion by Taylor.⁸ To compile such an Index, though possible, would be a very major task, and one that is left for future work.

Factor	Rating			
Experience	1 point per battle in which involved (maximum 5 points)			
Success Rate	Running total of victories in last 5 battles (1 point per victory to maximum of 5) ⁹			
Troop handling	At previous battle:	Poor: 1 e.g. formations in wrong place at crucial times, reserves not to hand, etc.	Average: 3	Good: 5
Casualties suffered	At previous battle:	Low: 5 under 10%	Average: 3 10-50%	High: 1 over 50%
Final score is the average (rounded down) of the score for the four factors				

Table A8.1 Possible framework for creating an Index of Leadership Competence

Source: Taylor (2015)

⁷ Rowling, J.K. (1997) *Harry Potter and the Philosopher's Stone*. London: Bloomsbury Publishing, p.132 and 2001 film. Napoleon was reputed to favour lucky generals and it is arguable that those generals who are able to recognise and exploit chance opportunities as they occur, rather than adhering blindly to a pre-determined plan, are indeed more likely to be competent.

⁸ Taylor, A. (2015) 'Arthur Taylor's Rules for Wargaming', in Curry, J. (ed.) *The Discovering Wargames Series and Bill Lamming's Medieval Campaign Rules: Early Wargaming Rules Volume 5*. www.wargaming.co: History of Wargaming Project, p76.

⁹ The opportunity to build up major battle experience was more limited than might be expected. Philip II of Macedon commanded in just four major battles, and even Alexander the Great, whose entire reign was devoted to highly successful campaigning, commanded in no more than that number of major battles (Granicus, Issus, Gaugamela and against Poros). This offered limited opportunity to master the combination of troop types in large numbers. See Wrightson, G (2015) “Macedonian armies, elephants and the perfection of combined arms”, pp.59-68 in Howe, T., Garvin, E. and Wrightson, G. (eds.) *Greece, Macedon and Persia*. Oxford: Oxbow Books, Note 9. The seventeenth/eighteenth century English general Marlborough likewise commanded at four major battles (Blenheim, Ramillies, Oudenard and Malplaquet). Generals, unlike trainers at military academies and wargamers, have limited opportunities to practice and are expected to get matters right the first time.

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