European Journal of Archaeology 20 (2) 2017, 280–316

Hunting Warriors: The Transformation of Weapons, Combat Practices and Society during the Bronze Age in Ireland

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Warfare is increasingly considered to have been a major field of social activity in prehistoric societies, in terms of the infrastructures supporting its conduct, the effects of its occurrence, and its role in symbolic systems. In the Bronze Age many of the weapon forms that were to dominate battlefields for millennia to come were first invented—shields and swords in particular. Using the case study of Ireland, developments in Bronze Age warfare are traced from the Early to the Late Bronze Age. It is argued that during this period there was a move from warfare that made use of projectiles and impact weapons to warfare that used both defensive and cutting weapons. This formed the basis for a fundamental reorganization in combat systems. This in turn stimulated change in the social organization of warfare, including investment in material and training resources for warriors and the development of new bodily techniques reflecting fundamental changes in martial art traditions. Metalwork analysis of bronze weapons and experimental archaeology using replicas of these are used to support this position. The article explores how developments in fighting techniques transformed the sociality of violence and peer-relations among warriors and proposes that these warriors be regarded as a category of craft specialist exerting significant social influence by the Late Bronze Age.

Keywords: Bronze Age warfare, prehistoric Ireland, combat archaeology, swords, spears, shields, warrior elites

Introduction

In this article I explore the development of combat practices over the course of the Bronze Age and how these related to evolving social attitudes to martial violence using the case study of Ireland. To do this, I will assess the functions of prehistoric weapons using data obtained through primary artefact studies, metalwork wear analysis, and experimental tests with replica weapons. The results are used to consider performative aspects of warrior identity and through this address evolving social traditions enabling combat. The focus is on Ireland because a wide range of weapon forms were employed there at various times during the Bronze Age and the preservation of these is typically excellent. Many arguments presented can have relevance for understanding similar material culture traditions in Europe more widely.

Historical Setting

Copper metallurgy marks the beginning of the Bronze Age and occurs in Ireland alongside the partial adoption of aspects of the well-known Beaker tradition of objects used in continental Europe and parts of

doi:10.1017/eaa.2016.8
Manuscript received 23 November 2015,
accepted 20 June 2016, revised 16 March 2016

Britain (Roberts, 2013). The influence of social traditions associated with this material culture are visible throughout Ireland, though strong continuity exists with earlier practices and places of significance, perhaps best exemplified by the Early Bronze Age activity at Newgrange (Waddell, 1998: 117–18; Carlin and Brück, 2012; O'Brien, 2012). A brief fluorescence of single inhumations during the Early Bronze Age (EBA hereafter) represents a particular emphasis on the individual in those burials, which may mark the beginnings of a shift from mortuary traditions of the Neolithic; however, a dominance of cremations suggests parallel adherence to established practices, and older mortuary monuments were frequently reused. The first metallurgy in Ireland, at Ross Island (O'Brien, 1996, 2015), emerges at approximately the same time as the first Beaker-type pottery is adopted. It is notable that the commonest object forms produced are axes and halberds, and daggers to a lesser degree, and we can also observe that Irish metal was probably being exported eastwards in this period (Bray & Pollard, 2012). While subscribing to certain European trends, such as the increasing use of copper metallurgy, EBA social practices in Ireland are in many regards dominated by insular traditions.

By the Middle Bronze Age (MBA hereafter), Ireland can be considered part of the general 'Atlantic Bronze Age' tradition (Briard, 1965; Cunliffe, 2001; Harrison, 2004: 11), which includes dispersed settlement with isolated roundhouses (but see Ginn & Rathbone, 2012), hillforts in some areas (Grogan, 2005), mortuary practices with poor archaeological visibility (Schulting & Bradley, 2013), and a predisposition towards 'male' objects in the bronze industry (Sørensen, 1998: 262; Harrison, 2004). The island has the densest concentration of Bronze Age swords in Europe, and probably weaponry more generally, and a high proportion of the bronze consumed went into weapons and tool-weapons (Chapman, 1999; Harding, 2006, 2007; Becker, 2013). The visibility of settlements in Ireland has always been problematic, primarily because they are dispersed and village sites are exceptional (Ginn & Rathbone, 2012). A major shift in settlement focus took place by the thirteenth century BC, when hillforts began to be constructed in parts of the country, some at least being habitation sites. The importance of these may relate to their role in physically demarcating central places in prominent topographic locations that visually dominate the landscape and river courses (Grogan, 2005). The archaeological record for MBA and Late Bronze Age (LBA hereafter) Ireland is poorly suited for analyses of social differentiation of (specific) individuals and hierarchization of society, but this may be tempered by the evidence for a growing complexity in traditions of warfare and the emergence of defensible central places. Magnificent individual items, such as large gold gorgets, and the capacity to assemble and deposit the Mooghaun hoard of gold personal ornaments, also imply the existence of archaeologically ephemeral elites (Waddell, 1998: 273–75).

Extensive typo-chronological work has been conducted on Irish bronze weaponry for over a century, though critical analysis of linked social practices is rare (Wilde, 1863; Coffey, 1894; Eogan, 1965, 2000; Harbison, 1966, 1969). Analyses of depositional contexts and environments have proven fruitful (Eogan, 1983; Bradley, 1990, 2007; Becker, 2013), although work has rarely addressed the social conditions of the routine use of these things or considered them as parts of a package of complementary material culture linked through social practices. Despite the quantity of weaponry and the quality of its survival, therefore, the history of research into Irish Bronze Age warfare is negligible.

https://doi.org/10.1017/eaa.2016.8 Published online by Cambridge University Press

The picture has become quite different for other parts of Europe in recent years (e.g. Osgood, 1998; Osgood et al., 2000; Otto et al., 2006; Harding, 2007; Uckelmann & Mödlinger, 2011; Horn, 2013a, b, c; Melheim & Horn, 2014). Harding (2007) has addressed some general implications of the conduct of warfare for understanding Bronze Age societies by drawing together material remains and anthropological data. He considers warriors to have been well provisioned and to have held considerable sway in society since the inception and acceptance of warriorhood as a recognized identity (Vandkilde, 2006; Harding, 2007: 143–44; Kristiansen & Larsson, 2007). Warfare is considered to be small-scale and very much a local affair, with war bands of modest size, numbering in the tens, surrounding a war leader (Harding, 2007: 169). Thorpe's analyses (2005, 2013) largely mirror this perspective of small-scale conflicts operating within local power dynamics. Kristiansen (2002; Kristiansen & Larsson, 2007) considers warrior 'culture' to have been a more mobile affair, with warriors moving long distances and linking into extensive trade routes that were moving copper and tin over long distances (see also Earle et al., 2015). In our case, this begins with the movement of metal from Ireland to Britain and beyond (Bray & Pollard, 2012). It is notable that, by the middle of the second millennium BC, the direction reverses and copper travelled to Britain and Ireland along trans-European land and sea routes (Northover, 1988). In both cases, communities in Ireland need not have been passive participants but active members of these networks, which would require knowledgeable mobility over long distances to obtain metal from sources (be they geological places or trade intermediaries).

Kristiansen and Larsson (2005) consider warriors to have been intrinsically linked into the hierarchization of society in LBA Europe of around 1200–700 BC, a position recently advocated by Earle et al. (2015: 17) who argue that the warriors' 'use of metal for weapons and personal display increased the value of metal wealth that they helped monopolize'. Brück and Fontijn (2013) contest the evidential basis for such chiefdom-type societies hinging on warrior culture and argue that metal, as wealth and as an element in identity construction, was used in more varied ways. Vandkilde (2006, 2013) has argued that denying hierarchies in the Bronze Age risks flattening society into an egalitarian peasant utopia devoid of conflict and warriors; instead, she sees warrior identity as a key element in society that was variably negotiated. Roberts (2013) similarly argues that uncritical views of generic warrior elites is as methodologically problematic as modelling worlds without skilled warriors in Bronze Age Britain and Ireland. Our challenge, it seems, should be to better explore warriors as physical and ideological constructs operating within (and thereby linking) several fields of social discourse—from smithing to depositional practices—within particular societies. In this way, warriors, weapons, and warfare are not products of random malfunctions when normal social processes fall apart, but were integral to specific intra- and inter-societal interactions that were fully expected and planned for (Pinker, 2002; Molloy, 2012; Vandkilde, 2013). This article outlines some possible ways of addressing this perspective using artefact research.

For dating I use the somewhat archaic Early (2400–1600), Middle (1600–1200), and Late (1200–800) conventions because these are largely based on metalwork and so facilitate the basic discussion of material herein with more ease than some newer and more nuanced chronologies (Bradley, 2007; Roberts et al., 2013).

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Method

This article presents some interpretations of the results of morphometric analyses of bronze weapons, which essentially use appearance, dimensions, and weights to consider the link between form and function. This is complemented by selected data from metalwork wear analyses conducted on these same artefacts. Data were obtained through primary study of the collections in the National Museum of Ireland and the Ulster Museum, and involved a preliminary study of swords, spearheads, and shields in their collection and detailed cataloguing of pieces that had specific use-wear features of interest (see: 3D model of sword NMI W93 with marked-up wear analysis: https://skfb.ly/NT7O). The method included detailed documentation of the distribution of use-wear on 130 swords, 138 spearheads, five shields, and preliminary study of over fifty axes. Documentation consisted of the descriptive characterization of the morphology of wear typical to these artefact types and recording the intensity of its occurrence in terms of the degree of damage and the frequency of instances. Quantitative analyses of use-wear on Irish LBA swords were used very effectively by Bridgford (1997) to assess the relationship between degrees of damage and depositional context. Such quantitative analyses are, however, poorly suited to analysing combat traditions because the proportion of damaged weapons reflects choices made when selecting material for deposition and not the material consequences of bellicose events. For this reason I prefer to use the results of my analyses qualitatively to illustrate the kinds of damage we can expect on the categories of object discussed.

A strange heritage in Bronze Age research is that the burden of proof lies on analyses that argue that the damage on weapons was inflicted through their use as weapons. Prognoses have *a priori* more commonly been biased towards non-combat or ritual causation until proven otherwise and, hence, reflection on damage to elucidate the social activities that combat practices constitute has been rare. This article advocates prioritizing the analysis of how weapons could be used for fighting and how this may reflexively inform primary artefact studies, including metalwork wear analysis (Dolfini and Crellin, 2016). This is supported by experimental tests, published in more detail by Molloy (2007, 2008), which includes test cutting with replica Bronze Age swords against specially prepared straw mats, the limbs and torso of a recently slaughtered pig, replica armour (made of leather, linen, and bronze), shields (leather, copper, and bronze), and other bladed weapons. This allowed for both quantitative analysis, by counting the layers cut on the straw mats, and qualitative analysis of cutting efficacy, and made it possible to compare the resulting patterns of damage with those observed on ancient weaponry.

The Early Bronze Age

The first metal bladed weapons were used in the EBA alongside percussive stone weapons and most probably bows and arrows using lithic arrowheads. While new object types developed, the deviation from Neolithic combat traditions appears relatively limited. Without extant bows and a dearth of arrow-shafts, little can be said about the role of archery in combat, although the continued use of lithic arrowheads demonstrates that projectiles may have been used in interpersonal combat. A find of an arrowhead embedded in a human hipbone at Poulnabrone, Co. Clare, is good evidence that archery played a role in conflict in the Neolithic to EBA

https://doi.org/10.1017/eaa.2016.8 Published online by Cambridge University Press

in Ireland (Waddell, 1998: 50; Schulting, 2013: 23; Lynch, 2014). More can be said of the better-preserved close-quarter weapons, and so the focus will be on these.

Daggers

Many copper and copper-alloy dagger forms, differentiated by typological niceties, are known from Europe in the late third to early second millennium BC. As general purpose tools they would have had many uses including, but not restricted to, fighting. The earliest daggers in Ireland had quite flat cross-sections in the general 'Beaker' tradition and ranged from pieces with blades a few centimetres long to examples with blades over 20 cm, constituting serviceable weapons. While little edge wear is visible on any daggers from this period (Thorpe, 2013), blade-on-blade impacts are unnecessary for dagger combat and, because flesh and bone are not prone to causing damage, it can be difficult to measure their functions in combat.

In general terms, with no reason to expect a complex martial milieu surrounding their use, daggers could have been used in a manner broadly equating with open-hand/unarmed strikes with the fist (Peatfield, 1999). While the increased lengths of early metal daggers afforded new combat possibilities, the general pattern of use is correlated in the lithics industry, particularly with regard to flint daggers/spearheads (Frieman, 2014). Metal daggers were less susceptible to breakage than lithic ones, yet should the latter snap in a wound this could lead to secondary injury or subsequent infection (Frieman, 2012: 446). A midrib develops on metal daggers by the end of the EBA, which served to strengthen them for combat use and paved the way for crafting swords in the MBA.

Halberds

With 186 known examples from Ireland, halberds were in use from *c.* 2400 to 2000 BC and can be divided into three types: Carn, Cotton/Clonard, and Breaghwy (Harbison, 1966; O'Flaherty, 2007; O'Flaherty et al., 2011). Halberds are triangular or slightly curved triangular blades that were fixed at right angles to a wooden shaft (Figure 1). Only one example of a full shaft has been recovered, from the site of Carn, Co. Mayo, and this measured around 1.10 m. The halberds' relationship to earlier weapons in Europe and their development in north-western Europe has recently been re-assessed by Needham (2015).

O'Flaherty (2007) tested the possible combat functionality of these weapons using an experimental replica. He demonstrated that a halberd could pierce the skull of a sheep when struck correctly and that it required less percussive force than may be expected. The comparative thinness of a human cranium, particularly in areas such as the face, suggests that a strike to the head could be fatal. If a strike could penetrate the skull it would also inflict severe injury to other areas of the body, particularly those less protected by bone. If used in a thrusting attack, the curved forward-facing blade edge would facilitate slicing unprotected flesh. The inner curve can also be used to hook the head, legs, or the opponent's weapon, for example, as seen with medieval weapons of similar form (O'Flaherty, 2007; Horn, 2014: 179–82). The shaft could also be used in percussive attacks, making this a composite weapon capable of inflicting blunt trauma, lacerating, and penetrating injuries. O'Flaherty's use-wear analyses of ancient Irish artefacts and experiments with replicas revealed little evidence for edge damage; this is a result of the targeting of flesh and bone by this type of blade

https://doi.org/10.1017/eaa.2016.8 Published online by Cambridge University Press

Figure 1. *Stone axe and halberd from the river Shannon at Athlone.* By permission of the National Museum of Ireland.

in his experiments as opposed to other blades. This has implications for the relationship between wear and use on ancient halberds which exhibit a similar dearth of evidence for damage.

Nonetheless, it is clear that there are occasional cases of minor damage consistent with blade-on-blade impact, demonstrating that these were suitable combat weapons (Horn, 2013b). Halberds were clearly designed for interpersonal combat and, while they may have had symbolic roles, they may be considered the first artefact type in Ireland created for the primary purpose of fighting and killing people. Halberds would be effective in single combats and are often considered to have been intended for this primary purpose (O'Flaherty, 2007: 89); though they could no doubt also have been suitable for small group combats using loose formations.

Axes

The examination of Neolithic skulls from Britain and continental Europe leaves little doubt that stone axes and mace-heads were used as weapons in the Neolithic (Smith et al., 2011; Schulting & Fibiger, 2012). Similar forms of violence were likely to have occurred in EBA Ireland, where a range of often exquisitely carved stone battle-axe heads are known (Simpson, 1990). These are socketed to accept a shaft and weigh around 500–1000 g. We do not know the length of the shaft, and hence these objects may been mounted as simple maces or battle-axes on

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short shafts or more substantial weapons like pole-arms, which had long shafts. Damage is rare on the artefacts I have examined though their weight and morphology would make them very effective weapons that relied more on percussive force than the near-contemporary sharp copper-alloy halberds. These axes may have served as tools, though the wide angle of the cutting edge would make them quite ineffective at cutting wood, and their decoration may indicate a less prosaic function.

The earliest copper-alloy axes come in a variety of generally flat and triangular shapes. These were followed by the common Derryniggin type which, being the earliest (slightly) flanged axe form, deviated significantly from its lithic predecessors when it emerged in the second quarter of the second millennium BC (Harbison, 1969; Waddell, 1998: 125–29). When it comes to determining function, early—and indeed late—axes have ambiguous traces of wear related to use (Roberts & Ottaway, 2003; personal observation) and so individual pieces could have been used as tools and/or weapons. As with halberds, striking flesh and bone would not typically mark cutting edges, blade-on-blade contact would not be expected, and strikes against a wooden shaft or shield may create similar damage to woodworking. Considering them as tool-weapons (Chapman, 1999) may be appropriate because even a single object could be used efficiently in more than one capacity. For the EBA, we thus have a situation where stone axes were well suited to interpersonal combat and metal axes had the potential to be used as both weapons and tools.

Spearheads

The earliest bronze spearheads had kite-shaped blades; they were typically 15–20 cm in length and rarely weighed over 150 g (Ramsey, 1989, 1995; Davis, 2006, 2012). One variety has a simple tang while another has a socket that runs to the base of the blade and two loops on either side (these are called end-looped spearheads). The loops may have been intended to aid in holding the spearhead onto the shaft or to tie decorative elements to the spearhead, or perhaps both. Depending on the thickness, length, and weight of the shafts of the EBA spears, they could have been used as light throwing javelins, throwing spears, thrusting (i.e. hand-held) spears or lances, and so on (Tarot, 2000; Thorpe, 2013). Be that as it may, we should be cautious of making such divisions on the basis of spearheads alone because function is significantly defined by the length and weight of the now-missing spear shaft. Both the shaft and the spearhead, and combinations of these, could vary on the basis of the social context in which the spears were used (Anderson, 2011; Horn, 2013c).

Discussion

Halberds and contemporary axes require arcing attack motions. Some thrusting attacks are possible, but curvilinear trajectories appear more common. The importance of this lies in the more instinctive movement patterns of the human body, particularly in a combat environment. Swinging the arms or using a weapon with two hands requires less coordination than single-handed uses that include thrusting motions because, for example, the possibility of the arc meeting a target is greater than a linear movement (Turney-High, 1971; Grossman, 1995). Many of the weapons suited to interpersonal combat in the Irish EBA could also have served other social or functional purposes, to the extent that familiarity of use was not of necessity linked to violence (Schulting, 2013) or martial art practices, and their visual presence in society need not

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demarcate a person as a warrior. Guilaine and Zammit (2005: 192–94) consider such combatants to be 'proto-warriors' because they had many other specialisms within society; they used objects that overlap with those used for hunting, and these weapons require few if any sophisticated combat skills.

To return to the individual using the weapon, it is well-established that combat induces physiological changes that reduce the capacity of a person to operate effectively without significant prior training (Marshall, 1947; Grossman, 1995; Bourke, 1999; Shephard, 2001; Grossman & Christensen, 2008). Such training provides stress inoculation and the development of embedded responses or 'muscle memory' that enable individuals to better use weaponry in psychologically stressful environments. This has been studied in relation to prehistoric combat by Molloy and Grossman (Molloy & Grossman, 2007; Molloy, 2008) and relates to Warnier's (2011) and Melheim and Horn's (2014) discussion of a warrior's body techniques, following Mauss (2006). Confrontational situations have a physiological effect on virtually all people which inhibits fine motor control, while strength and gross motor movements are retained or even enhanced (Grossman & Christensen, 2008). Thus, it may be difficult to press a small button with a finger, but hammering it with a fist is possible. In prehistory, halberds and axes could be used effectively through sweeping motions that required gross motor control, but fine motor control was not instrumental. The spears in this period strongly prioritized penetration over cutting and so could be used in a limited number of ways, irrespective of shaft weight or number of hands used. While dagger combat can be elaborate, in its basic form, strikes follow trajectories similar to empty-hand punches.

The relatively unsophisticated nature of EBA combat practices has ramifications for understanding the transformation of weapons and their users as the Bronze Age progresses and more complex complementary panoplies of weapons emerge. This human perspective is crucial for connecting the growing technological capacity to make new weapon forms in metal that were not practicable in stone with a social desire to do so. The fundamental issue here is how the affordance of bronze as a material (Knappett, 2004), and the objects that became possible by using this technology, reflexively transformed social practices.

The Middle Bronze Age

A fundamental change took place sometime in the sixteenth century BC leading to the development of swords, shields, and spears that were created primarily for interpersonal violence. These weapons enabled the independent but coordinated use of both hands when fighting and the capacity to do this in confined spaces. This in turn made more cooperative styles of fighting with closely spaced combatants possible, including the potential for formations such as shield walls. The possibility of greater dependence on peers using a broadly similar range of weapons was to have dramatic effects on warfare several centuries later in Greek hoplite warfare (van Wees, 2004). While the situation in MBA Ireland was materially and socially somewhat less complex, it is nonetheless salient that the complementary evolution of technology and techniques for fighting profoundly changed the ways people could materially engage with weaponry and one another, thereby transforming the sociality of training for and practice of violence. In the Irish MBA, the changes were contingent on developing particular skillsets to effectively use weapons which required the body to move and react, and, therefore, appear, in particular ways (Warnier,

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2011). This was performed with types of material culture that had little or no precedent in the course of human development up to that point. This may be seen as part of a broader phenomenon of transformations in weaponry taking place across many parts of Europe soon after 1600 BC, including the development of a very similar range of swords (Vandkilde, 2014).

Swords

Burgess and Gerloff (1981) define four main types of sword for this period that overlap in their currency. They are typically called dirks and rapiers, though for reasons elaborated elsewhere (Molloy, 2011) they will be referred to here as MBA or grip-plate swords (Figure 2). Differences in the length of these weapons provide no clear boundary between a dagger and a sword (O'Connor & Cowie, 1995: 347), suggesting graduated rather than bilateral divisions of functions, and perhaps names, in the past. For simplicity, I discuss swords below since the structural features are similar for all such weapons and the general functional characteristics of daggers has been discussed above.

The typical Group I–IV swords have wide blades that taper to a point from the hilt and have well-defined cutting edges. When hafted, many were sizable weapons (for Bronze Age standards), usually in excess of 45 cm (many over 70 cm) when allowing an additional *c.* 10–12 cm for the handle. The vast majority of these were therefore (like the LBA swords) shorter than the historic short-sword *par excellence* — the Roman *gladius* (Bishop & Coulston, 2005). MBA swords were usually quite thin too, with a typical cross-section of *c.* 3–6 mm. Weights were variable, and, though rarely exceeding 400 g, they often fell below 200 g (without their hilts), making them light and manoeuvrable weapons. Within these general parameters, they are an eclectic mix of short to long, wide to narrow, and light to (comparatively) heavy weapons. This lack of uniformity reflects variability in fighting styles and scope for personal expression or preference in martial traditions. The underlying cause for variation may range from the availability of metal to craft preferences, but, with respect to the life-and-death context in which the weapons were to be used, this variability must have been acceptable within the prevailing martial art systems.

Wear from use is common on these swords (For example, NMI W107, 3D model of blade section: https://skfb.ly/HxtY), though evidence for blade-on-blade impacts is frequently in the form of shallow knocks and nicks, occasionally deeper nicks and notches (Molloy, 2011: 75–76; Molloy, 2006: 4–5 for terminology) (Figure 3), and in exceptional cases blades are cut through or fractured entirely. There is no identifiable distribution pattern for instances of wear along blades that could indicate specific trends in fighting practice (Molloy, 2006: 19–57). A similar irregularity of damage is noted by York (2002) for contemporary swords from the Thames, and by Matthews (2011) for Middle–Late Bronze Age Chelsea and Ballintober swords in Britain. The typically light character of the damage implies that it occurred commonly when both blades were either in motion, or one was stifling the other (i.e. not blade-on-blade contact at full force). Indeed, it is commonly preferable in sword fighting to avoid contact with an opponent's blade by controlling the space and movement rather than engage in direct contact (Clements, 2007). Defensive interventions could also be provided by shields, as discussed below. The relationship between damage observed and the mechanical properties of the swords (Molloy, 2011:

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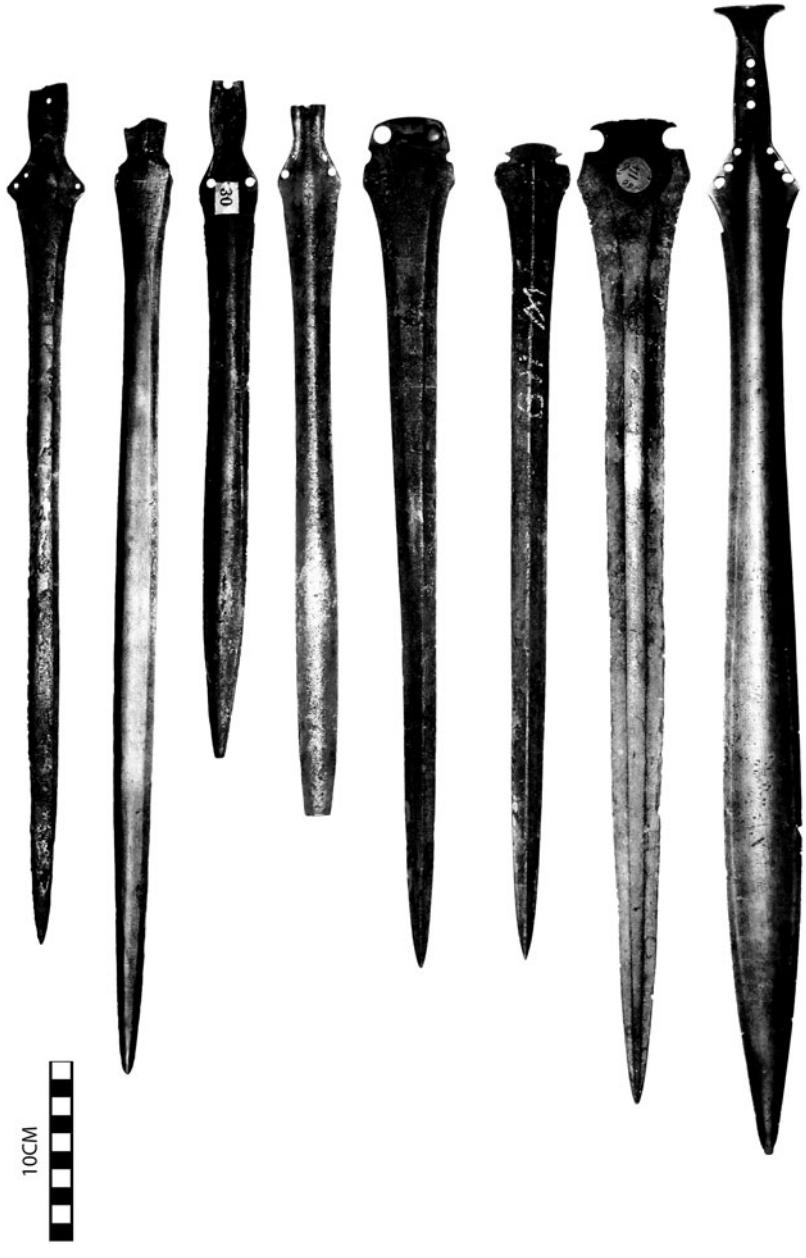

Figure 2. *Selection of Irish Middle and Late Bronze Age swords. From left to right: Class 5, Class 5, Class 4, Class 4, Group IV, Group II, Group IV, Class 4.* By permission of the National Museum of Ireland.

74–77) implies that the users of these weapons possessed considerable skill and knowledge of the balance between cutting mechanics, delivery styles, the material qualities of bronze, and those of the human body. This enabled them to avoid forceful and potentially destructive blade-on-blade impacts.

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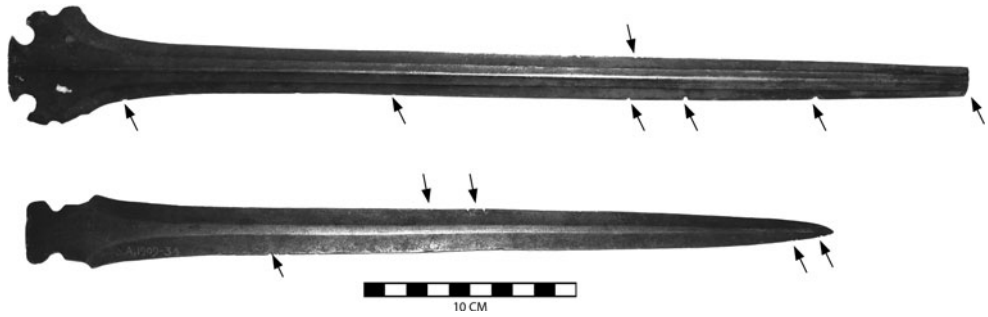

Figure 3. *Middle Bronze Age swords with damage to the blades.* By permission of the National Museum of Ireland.

Experiments were conducted by the author using a long Group II and a short Group IV blade (Molloy, 2006 and 2007). The Group II sword had a thin cross-section and well-defined cutting edges whereas the Group IV example was very narrow with a central rib and poorly-defined/shallow cutting edges. Test cutting on pig carcasses demonstrated that the former could easily cut the flesh of arms or legs down to the bone and could, for example, thrust through the rib-cage, whereas the latter type could make light cuts and was very effective for stabbing. The complexity and variability of the use of grip-plate weapons clearly extends beyond generalizations interpreting them as thrusting weapons, which undermines the common follow-on assertion that they were primarily designed for duelling or single combats (Heath, 2009: 98; Thorpe, 2013: 236). Most of these swords were well suited to battlefield use, particularly if used in conjunction with a shield, though we have no reason to presume unique contexts for their use because many could be effectively used in different ways.

Shields

The shield former from Kilmahamogue, Co. Antrim, dates to 1943–1538 cal BC (Hedges et al., 1991: 128) and the wooden shield from Cloonlara, Co. Mayo, dates to 1633–1164 cal BC (Hedges et al., 1993: 316). Together they indicate that both leather and wooden shields were in use at the same time as the earliest swords. Ireland is unique in Europe because wooden shield formers for leather shields as well as an actual leather shield and wooden shields survive (Coles, 1962; Uckelmann, 2012). Recent dating places most of these into the later second millennium BC (Needham et al., 2012: table 5). This suggests that the inhabitants of the island may have been involved in innovative developments in warfare—such as the invention of round shields—that spread quite rapidly across Europe in the middle of the second millennium BC. The functions of such shields will be discussed in the Late Bronze Age section.

Spearheads

Spearheads develop in the MBA that have both kite-shaped and rounded blades with side-loops on the socket, showing continuity with earlier forms (Ramsey, 1989; Davis, 2012). Within a limited set of groups, the metric range of spearheads expands considerably by *c.* 1500 BC. Spearheads as an umbrella term include objects almost small enough to be arrowheads and others that are larger than contemporary swords (Figure 4). Ehrenberg's (1977) 'rapier-headed' spearheads are

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Figure 4. *A variety of long Middle to early Late Bronze Age spearheads. From left to right: basal-looped, long* Fiarlann, *short* Fiarlann, *protected-loop variant 1, protected-loop variant type 3.* By permission of the National Museum of Ireland.

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particularly striking because they look like contemporary swords, and for the Irish material they are included in what I have loosely called a *Fiarlann* group of side-looped spearheads comprising particularly long and fine side-looped pieces (Molloy, 2006: 100; see also Ramsey's 1989 types Gara, and Derrygill and Davis's 2012 Types 6D and 7E). These are quite large in comparison to other side-loop varieties, in the region of 28 cm in length, and have more acutely pointed blades. The 'rapier-headed' examples form a small set of pieces which are in the region of 50 cm in length and weigh up to 570 g (more than most contemporary swords). As a general group, they represent a significant development in military terms because particular spears become full combat weapons and not tool-weapons. Edge damage occurs on a variety of different sized side-looped spearheads, and several longer examples have bent tips indicating they struck a hard target, perhaps a wooden shield.

Appearing slightly later, but still contemporary with the *Fiarlann* group, were basal-looped spearheads (Ramsey, 1989; Needham et al., 1997; Becker, 2012; Davis, 2012). These come in two broad forms, one with an oval blade and one with a triangular blade with straighter edges, though there is no regional or chronological patterning and they were used from around 1500 BC to 1100 BC (Needham et al., 1997; Becker, 2013). The relative frequency of finds suggests that these became something of the spearhead *par excellence* for a time, with the type ranging from small javelins progressively through to pieces that match the longest of the *Fiarlann* group for length. Use-wear occurs on several of these, including long variants often considered to be non-functional 'parade' weapons (e.g. W16 from Toome Bar, W82 from Athlone, or W9 from Coleraine). The size range is very wide, from *c.* 10 cm to nearly 60 cm, and weights span from 40 g to in excess of 600 g. The scope for different functions within this size range is clear, particularly as the longest pieces have blades that are equivalent to contemporary swords and have use-wear consistent with striking blade-on-blade, which is generally lacking on the smallest examples (which are considerably harder to intercept).

Alongside the basal-looped spearheads, protected-loop varieties developed later in the MBA. This type can broadly be divided into two groups or trends based on proportions—long and thin ones and short and wide ones. The first group has little to differentiate it functionally from the basal-looped spearheads. The second group, however, has very wide blades which emphasize their potential use for cutting attacks. These are generally late in the sequence of looped spearheads, probably beginning by the fourteenth century BC, and a late form from England is dated to 1260–980 BC (Needham et al., 1997: 72).

Traditionally, spearheads are considered to have been hafted on long wooden poles, though some may have been mounted on shorter shafts similar to a Zulu *assegai* (Molloy, 2007: fig. 28), perhaps reflected in the similarity between grip-plate swords and certain *Fiarlann* spearheads. They could, however, also have been mounted effectively on long and heavy shafts. All longer varieties of spearheads have well-defined sharp edges, indicating that cutting attacks were employed in MBA combat techniques. The spear had come to no longer be a weapon intended to injure through penetration/stabbing attacks alone, but could now be used for a wide variety of attacking trajectories. This exponentially increases the utility and martial techniques of spearmanship (Molloy, 2006; Anderson, 2011; Horn, 2013c).

By the MBA, the socket was cast to nearly the tip of the blade on all

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typological groups. From a technological perspective, maintaining a socket wall *c.* 1 mm thick over a length of as much as 60 cm was a dramatic development in bronze smithing. Indeed, for Ireland and Atlantic Europe, the longest spearheads may be seen to be as close to the pinnacle of the smiths' technical capabilities. Far from being solely parade weapons, the spearheads' advanced technology and use-wear evidence indicate that their visual and martial qualities were potentially both important and linked. Access to such accomplished feats of craftwork and the environment to obtain skills to use them effectively resulted in novel opportunities for spears to be linked to the acquisition of prestige by their users.

Discussion

EBA weapons took little advantage of the craft and functional affordances of bronze. This changed dramatically in the MBA when long, thin, slightly flexible and light swords were created alongside visually striking and technologically complex spearheads and robust shields. For these innovations in fighting to be effective, a user must be cognisant of the trade-off between inflicting injury and damaging the weapon. To address this, we can briefly return to the issue of inhibited motor functions in a stressful combat environment. MBA swords and certain longer 'spearheads' required the retention of a greater degree of fine motor control than was necessary for EBA weapons. This is because it was far easier to make ineffective strikes and/or to damage the weapon itself in the process; bronze was suited to making long, sharp weapons, but it was still susceptible to breakage. It is unlikely that warriors would routinely execute meticulous strikes in the heat of a confrontational engagement, and so this bodily knowledge must be differently obtained and constituted. The development of muscle memory through repetitive task execution could help to offset the impact of the physiological changes that occur in combat. This requires prolonged engagement with the tool so that it can be perceived as an integral component of certain movements, representing specific techniques of the body or non-reflective knowhow (Malafouris, 2008; Molloy, 2008; Farrer & Whalen-Bridge, 2011; Warnier, 2011; Kuijpers, 2013; Melheim & Horn, 2014). Picking a sword up and using it for battle with little physically grounded knowledge would lead to extreme damage and breakage patterns that are the opposite of the pattern we find archaeologically. Of course, intentional damage or 'killing' of weapons did occur and this is generally identifiable through the regularity, locations, density, and intensity of this damage (Bridgford, 2000).

Changes in the use of spearheads were particularly pronounced in the MBA. Firstly, cutting attacks became prominent alongside stabbing attacks. Secondly, they required a high investment in skill and material resources and so, rather than constituting a rank-and-file weapon subordinate in status to swords (Schulting & Bradley, 2013: 50), spears may have come to be held in equal esteem. Thirdly, diversity of form and function was not random and represents intentional choices that were neither spatially nor temporally bounded. Different and specific shapes and sizes were recognized, appreciated, and retained over time. Function could vary widely within our typological groups, while at the same time similarities of function occurred across groups.

A watershed development that was to affect warfare for millennia took place in the MBA when swung percussive and long-range weapons (e.g. archery) were replaced by those requiring coordinated, independent two-handed fighting techniques that needed less physical space and

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less forceful attacks to inflict injury. These particular two-handed fighting techniques were considerably more complex than controlling a single object using one or both hands because each hand was required to operate in distinct ways with quite different motion paths. This effects not only the arms, but how the whole body moves, notably in the legwork that corresponds to the alternation between which hand is leading the actions using sword, spear, axe, or shield. At the same time, the complementarity of the use of these objects meant that a warrior could be using or facing different combinations of weapons which required distinct actions—slicing attacks with long spears held in two hands, axes swung in the long-established manner, short swords cutting in very close proximity, large shields controlling space, etc. Within this milieu, the open swinging trajectories of earlier weapons, which required space and used percussive force for penetrating flesh and bone, were largely replaced. The new bladed weapons could operate effectively in more confined conditions and they required cutting in a controlled manner by deploying the blade in a tight arc and linear thrusting motions that used edge and point sharpness to slice and pierce the flesh (Molloy, 2007, 2008). Indeed, experiments show that percussive attacks with a sword were incapable of cutting test media and that pulling or drawing motions were required.

In consideration of the social investment (materially and skill-wise) in weaponry, the life-and-death contexts of its use, and the challenging new body techniques required to use them, it is reasonable to argue that time, energy, and resources were invested in developing the requisite martial art skills. This was a significant change in social practice, representing an intentional regime of preparation for conflict in times of relative peace that also required specialized practitioners. This further served to make the performance of warriorhood a very specific and visible social phenomenon that deviated in its practice, material culture, and symbolism from virtually all preceding combat systems. The use of metals essentially enabled missile and brute force percussive-shock weapons to be replaced by weapons that required skilful and controlled strikes at very close range. The impact of this development was amplified by the capacity to deploy cooperative and defensive lines of battle that focused offensive strikes to a defined frontal direction. This in turn can be seen to have implications for the sociality of training for, undertaking, and recovering from battle among peer groups.

The Late Bronze Age

Changes to weaponry in the LBA were perhaps less dramatic than those of the MBA because traditions of smithing and fighting developed within established contexts of social practice using existing categories of objects. Nonetheless, the refinement of earlier ideas led to the institutionalization of long-lived martial traditions rather than ongoing cycles of invention (Roberts & Radivojević, 2015). Specific innovations included the combination of robust short swords and/or spears suited to single and two-handed use alongside light but large torso-sized round shields and small buckler-type shields.

Swords

In the LBA, swords developed that have the blade and the hilt cast as one, making them more robust than earlier forms (Figure 5). Hilt plates were made of wood or bone and riveted to the tang, and the blades were typically leaf-shaped. The 'grip' incorporates the shoulders of the sword to prevent the hand sliding forward onto the cutting edges and enables both a

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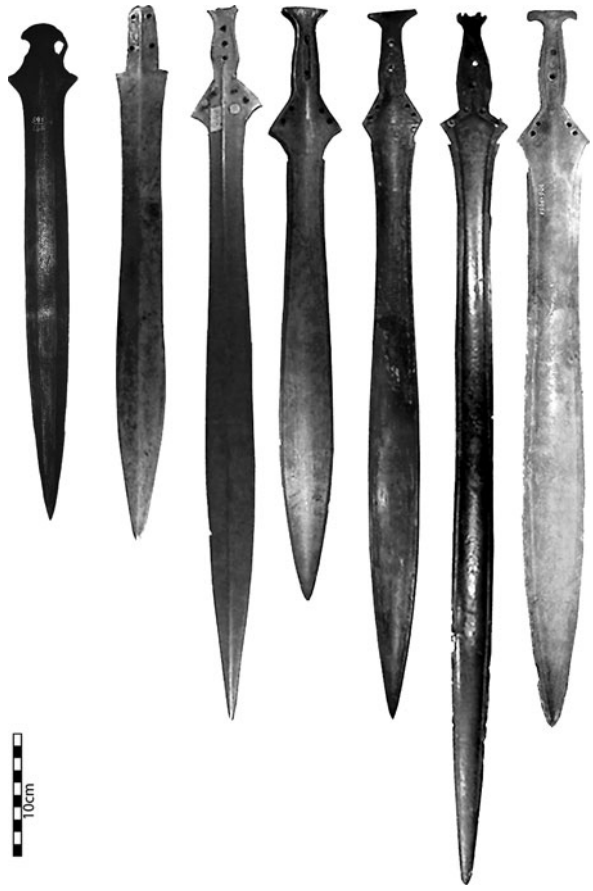

Figure 5. *Irish Late Bronze Age swords. From left to right: Group IV Type Cutts, Class 1, Class 2, Class 3, Class 4, Class 5, Class 6.* By permission of the National Museum of Ireland.

sabre and a hammer grip (Molloy, 2008). Six types have been defined, which Eogan (1965) dubbed Classes 1–6, most of which have close similarities in Britain and north western France, but under other names (Colquhoun & Burgess, 1988).

The transition from MBA to LBA swords requires some remarks without venturing too far into the complexities of Bronze Age typo-chronologies, because these reveal choices, innovations, and retention of traditions in Ireland (and Britain) that have previously been cast in terms of the receptivity of foreign ideas. The final development in grip-plate swords (Group IV, Type Cutts) shares many affinities with the earliest (proto-) grip-tongue swords of the LBA tradition (Eogan Class 1/Type Ballintober). The latter predate the first true grip-tongue swords (Eogan Classes 2 and 3) by around a century (Colquhoun & Burgess, 1988: 21; Waddell, 1998: 225; Becker, 2013: fig. 1), though some have close affinities in blade geometry. With the Class 1 sword, we appear to have a local (British and Irish) innovation that has affinities with native MBA swords at one end of its period of currency and with continental style grip-tongue swords at the other, irrespective in each case of which influenced which.

Swords related to continental Erbenheim and Hemigkofen grip-tongue forms come into use in Ireland from the twelfth or

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perhaps eleventh century BC, which Eogan respectively calls Class 2 and 3. The former are comparatively long, but rare, and the latter have squatter and wider proportions and, while relatively rare, have a wider distribution. Chronologically and typologically it is not entirely clear in which direction the influence between the Group IV Type Cutts, Class 1, and Class 2 moved, and how Class 4 relates to any of these or to its closer Class 3 relative. A greater role for indigenous development including the *particular* leaf shape/geometry of the blades, or indeed entangling of traditions (Hodder, 2012; Stockhammer, 2012), within the workshops of Ireland and Britain may simplify the local sequence and relate to bilateral east-west exchanges of technology and martial traditions in Europe (Cunliffe, 2001).

In terms of functional characteristics, some Class 1 swords appear to share similar proportions with Class 2, whereas others (more commonly) share features with Classes 3, 4, and 6 swords. Class 1 swords were *c.* 45–55 cm long and weighed *c.* 450–550 g, Class 2 were 60–67.5 cm long and weighed 600–800 g, and Class 3 were 48–60 cm long and weighed 400–500 g, suggesting a general move away from MBA swordsmanship with lighter weapons between the thirteenth and eleventh centuries BC. This deviation, if it is real, appears to be reversed when the distinctly local Class 4 sword develops by the eleventh century BC (Needham et al., 1997) when virtually all trace of Class 2 disappears and a distinct bias towards short and light swords emerges. Class 4 incorporates the vast majority (over 70 per cent) of swords recovered from Ireland and these were notably shorter and lighter than the typical European (and British) LBA sword (Waddell, 1998: 237–38; Colquhoun, 2011; Molloy, 2011). Within this general framework it also becomes clear that regional preferences existed within the island in terms of length and weight of swords (Molloy, 2011: figs 1–3), which broadly reflect 'provinces' identified through other artefact research (Grogan, 2005: 169–72), though North Munster is divided.

When we link this back to the messy transition phase from MBA swords, we are reminded of the comparative preference for swords of the shorter Class 1 and 3 tradition over and against the longer Class 1 and 2 pieces. The short, light, and rapidly deployed Class 4 swords may be seen as having a close functional link, if not continuity, with the fighting traditions of the MBA. Following Melheim and Horn (2014: 5), we should bear in mind that it is insufficient to analyse the adoption of a new object form without giving due recognition to the transformations in body techniques required to use it effectively. Craft and martial art traditions may thus be seen to develop in tandem and to be capable of integrating established traditions and new influences in dynamic ways. This, in turn, can be reflected in developments in the functional capacities of weapons that are not visible in typo-chronological studies.

At a later stage in the LBA the Gündlingen/Eogan Class 5 sword emerges 'fully formed' by the eighth century BC. These swords have no lineage in the bronze swords of Ireland and may have been a bronze 'response' to the earliest iron swords. In length they range between 58 cm and 84 cm, the average being 67.3 cm and they are commensurately heavier than the shorter Class 4 and 6 swords. There are two main functional categories. One has a wider blade with thin and distinct cutting edges, while the other has a much shallower and oblique edge on a thin blade (Molloy, 2006: 96). For the second group, a bias towards thrusting attacks is pronounced. Nonetheless, both types were suited to cutting, but using somewhat wider arcs (on the basis of their

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length) than the typical bronze swords of the earlier LBA. Class 6 swords continue the Class 4 tradition contemporary with the use of Class 5 swords.

While LBA swords clearly used different cutting dynamics from their predecessors, the way in which they developed in Ireland indicates that the traditions of use of MBA swords remained influential and this affected the proportions of the later weapons. Notably novel features include the curved cutting edges, full hilt, and bias towards heavier blades. The curved edges enable the sword to bite deeper as it is drawn along a target by incrementally increasing the depth of the cut (Molloy, 2007). The curvature assists cutting when using either edge; the fact that having two such edges creates a leaf-shaped blade is a secondary characteristic. Supporting this, many blades have a distinct distal taper the thickness of the cross-section by 1–1.5 mm from the blade at its narrowest near the shoulders to its broadest width, so that the mass is intentionally reduced at this broadest section. I have previously demonstrated (Molloy, 2006, 2007) that these swords could potentially cut through bone, but that their main utility appears to have been to slice soft tissue targets such as muscles, tendons, and blood vessels. Effective cutting was only possible when the blade was drawn along a target because axe-like percussive strikes had little effect on the test-cutting media. This in turn requires a controlled strike that aligns the cutting edge squarely with the motion path of the blade so that a cut is executed in a smooth linear motion. Considerable practice and handling of swords is needed to achieve this, and evidence for such practice and training more generally may be seen in the wooden training sword from Cappagh, Co. Kerry (Waddell, 1998: 280; Molloy, 2007: 102; https://skfb.ly/TNRG). Length-for-length, these swords could make more effective and damaging cuts than their predecessors, but not dramatically so. As a consequence of their length, they remained very close-quarter weapons.

Bridgford (1997: fig. 7) has demonstrated that many Irish swords had combat damage, though very few had (her) level 4 or 5 damage (1 being none), a pattern I also observed when examining these swords (Molloy, 2006). Given the risk of damage at each and every blade-to-blade contact, it may be expected that LBA swordsmanship styles continued MBA traditions that minimized heavy impacts. The damage that we find on LBA swords (Figure 6), like those of the MBA, is rarely severe (except on examples that have been intentionally disfigured or 'killed') and it is common to find a variety of forms of damage along a blade, few of which were more than 1 or 2 mm deep (see: 3D models of sections of blades from NMI W93: https://skfb.ly/IKrr and NMI W14: https://skfb.ly/IKrp). It can nonetheless be observed that as many as one in six swords has a broken hilt (Eogan, 1965), which could indicate in some cases that material fatigue or failure from training or fighting occurred even when edge-on-edge type damage is absent.

Let us briefly turn to the issue of production and ownership to better assess the role of these weapons and their users in society. Kristiansen (2002) has emphasized the potential individualization of swords and their capacity to 'obtain' a biography of their own. Accepting the individualization of some pieces, it may be expected that most were less personal and that many were simply broken down for recycling. It is worth considering, therefore, whether swords were made for individuals or whether individuals chose swords which were produced without their direct input. Combinations and common ground between these alternatives could occur, but here we shall focus on the plausibility of

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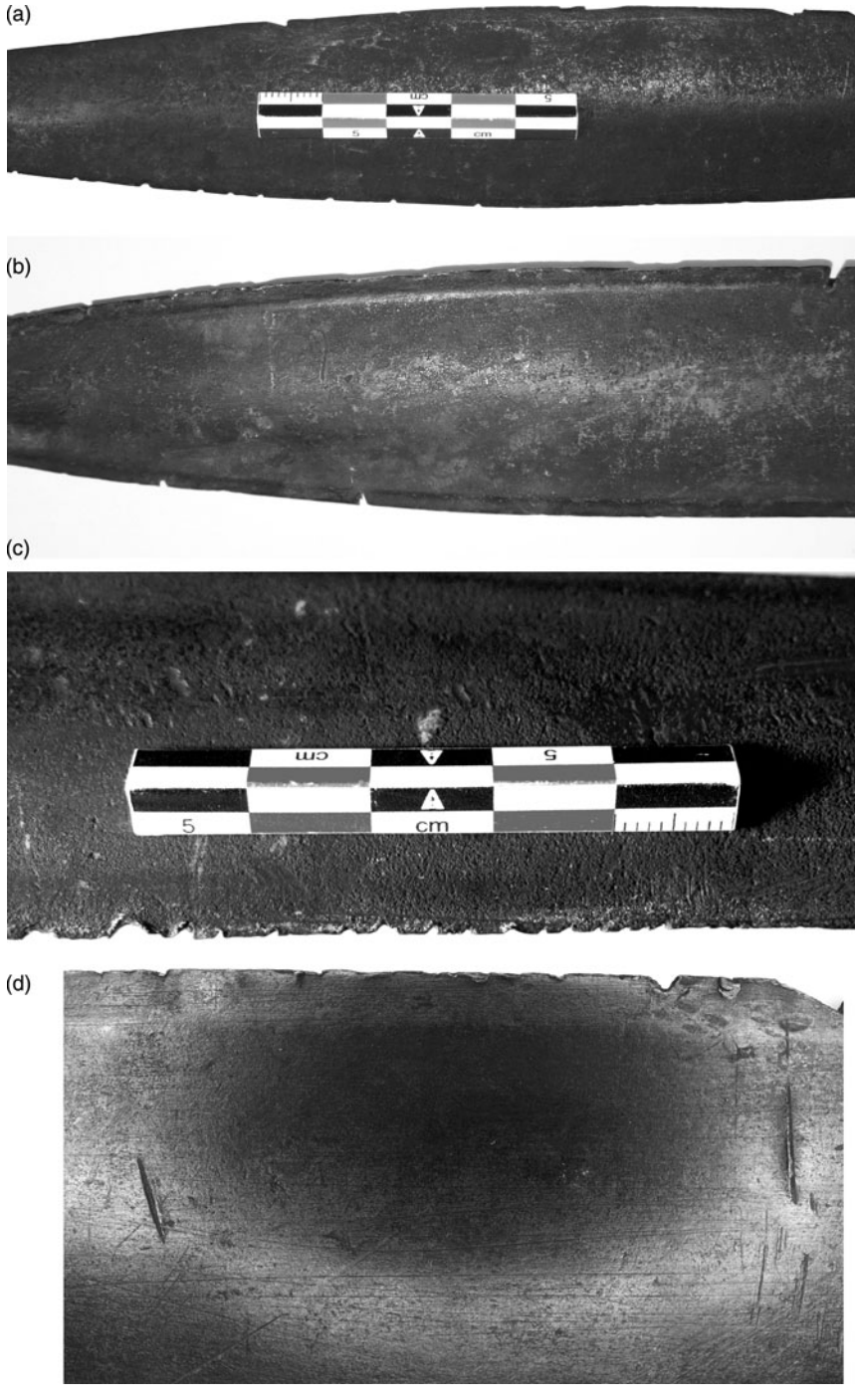

Figure 6. *Late Bronze Age swords with damage to the blade. (a) and (b) to same scale, (c) and (d) to same scale.* By permission of the National Museum of Ireland.

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the latter impersonal situation. We have at least three examples of possible batch production of swords in Ireland. Three swords at different stages of completion were recovered from Ballycroghan, Co. Down; they were allegedly cast using the same template (Jope, 1953). Distinctive features on their hilts suggest that either the templates or moulds were modified in each casting run. At Relagh in Co. Tyrone (Figure 7a), three swords were found (Eogan, 1965: nos. 267, 268, and 269); two have similar dimensions and look very similar (62 and 62.8 cm, and 825 and 876 g respectively). A third sword has an identical blade but a slightly different hilt (62.3 cm and 786 g), suggesting that two were made from the same template and a third from a modified version. From Co. Offaly, two virtually identical swords (Figure 7b1) featuring identical miscast rivet holes (Figure 7b2) were purchased at auction in 1962. One is either a composite of two swords or a single piece that had been broken in two and repaired after it was found. Its length may suggest the former scenario. If the swords are authentic (as they appear to be), then at least two and probably three had been cast using the same template. The complete and the composite swords are 48.7 and 50 cm long and weigh 576 and 602 g respectively.

This batch production has ramifications for understanding the relationship between the makers and users of swords, and potentially who had access to them. Some swords at least appear not to have been made to the personal requirements of users but to common parameters set either by the smith or by a party commissioning sets that would look the same and function in the same way, indicating occasional standardization in production. Given that the number of swords surviving today is the 'tip of the iceberg', it is possible that within the narrower timeframes of a smith's or a commissioning party's life there was a degree of uniformity among weapons produced for a group of users in a given area. That need not be exclusive, but rather it could reflect a defined range of preferences rather than the eclectic mix we see when we take all Irish swords together. A functional cause of this uniformity may be as simple as the re-use of a single wooden template, though even this must have been considered socially acceptable—i.e. there was not an inherent need for distinct and individual pieces.

We can also briefly consider badly made swords that were improbable prestige objects. For example, a sword from Slievenalargy, Co. Down, has casting pores so large that they pass from one side of the blade to the other, yet it exhibits clear damage from use against another sword or spear. The handle is also badly cast, but there are rivet holes and it was presumably hilted. It is hard to see this as the product of a highly skilled smith or the proud possession of a warrior of high status. The equation of swords with elite warriors and spears with the rank-and-file does not find an easy material correlation in Ireland, where swords and spears occur in roughly the same numbers and similar efforts may be invested in the manufacture of many of both categories.

Shields

Three main materials were used for making shields: wood, leather, and metal. The MBA tradition of leather shields continues, seen in the shield former from Churchfield, Co. Mayo, dating from the fourteenth to twelfth century BC, and the leather shield from Clonbrin, Co. Longford, dating from the twelfth to tenth century BC (Needham et al., 2012). Alongside these is a wooden shield found at Annadale, Co. Leitrim, dating from the thirteenth to eleventh century BC (see: 3D model: https://skfb.ly/NYyA). At least four metal shields are also known from

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Figure 7. *(a) Swords from Relagh, Co. Tyrone. Inventory number: 1938: 35–37. (b) Swords from Offaly (?). Inventory number: 1962: 123–24.* By permission of the National Museum of Ireland.

Ireland, two large and two small, dated stylistically to the LBA.

Shield functionality has been discussed in depth elsewhere (Molloy, 2009; see also Needham et al., 2012; Uckelmann, 2012), and here it is sufficient to restate that these were defensive weapons used to deflect or intercept attacks and also to control space—both between a warrior and their opponent and between warriors on the same side. A shield can also be used to strike an enemy, either by buffeting them with the flat or using the very thin, often blade-like, edge to strike directly. As with armour, a shield is not intended to stop the user from being injured, but rather to combine a reduction in the chances of being injured with the ability to inflict injury.

Leather shields were effective for combat, being light but durable (Coles, 1962). Cuts to the face of the shield only cause minimal scratching, but my experiments show that repeated striking to the quadrant where a right handed attacker would hit most frequently can lead to material degradation and eventual bending of the shield. The edges are also susceptible to being cut into. All three forms of damage are clearly visible on the surviving leather shield from Clonbrin (Molloy, 2009). The fibrous composition of the shields and the fact they pivot on a single holding point behind the boss makes it difficult to penetrate them with a spear, though it is, of course, possible; hence, despite the *c.* 5 mm thickness of the Clonbrin shield, a second sheet of leather is stitched across the boss to protect the hand. It is probable that making a single-layer leather shield of a larger diameter would be increasingly susceptible to bending and the Clonbrin shield is close to the maximum diameter possible for this design.

There is no clear evidence for use-wear on the wooden shields from Ireland. The Annadale shield was a functional wooden example, being 10–20 mm thick and just under 2 kg in weight. It was made of alder, a softer hardwood that absorbs blows without cracking easily and is relatively light for its size. It is noteworthy that the metal shields from Lough Gur, Co. Limerick, and Barry Beg, Co. Roscommon, had diameters and weights similar to those of the Annadale piece, indicating that there was a relatively standardized level of coverage and manoeuvrability

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for this larger shield type, irrespective of the material used. On the basis of its size to weight ratio, it is unlikely that the Cloonlara wooden shield was a functional weapon (Molloy, 2009).

Experimental work (Molloy, 2009) and metallographic examination (Needham et al., 2012) suggest that metal shields had the capacity to be used in combat, a contention supported by metalwork wear analyses. The Type Yetholm bronze shields from Barry Beg and Lough Gur have damage to their face consistent with a blade thrust/stab (Uckelmann, 2012: nos. 31 and 38 respectively). The location of the suspension tabs on these shields indicates that top and bottom were distinct, with the handle held vertically. On the Barry Beg shield, weapon-inflicted damage (probably from a sword) occurs on the inside half when held in front of the chest (the right-hand side when looking from the back), and possibly just above the handle. On the Lough Gur shield, it is not possible to ascertain the nature of the damage because corrosion has exacerbated ancient damage and this was conserved following recovery in the nineteenth century. It is worth noting, however, that the damage is located in the same areas as on the Barry Beg shield. Because only two examples survive from Ireland, we can look to the British Yetholm shield series for comparison. Examples from Burringham Common, Langwood Fen, London (two shields), and Sutton have damage that is notably biased towards the same zones as the Irish shields (Uckelmann, 2012: nos. 36, 40, 41, 42, and 46 respectively). The two London shields have what appear to be both spear- and sword-inflicted damage to the face and in the same region as the Irish shields, though instances of deliberate damage are also clear on at least one of the London shields (Uckelmann, 2012: 173–78).

A Yetholm shield would cover the torso from the throat to the groin. At a thickness of around 0.7–1 mm, the body of the shield was quite thin, balancing the provision of spatial coverage with maintaining a weight of around 2 kg. The edge of the shield was rolled around a wire to provide a surface of some 4–6 mm to ward off cutting attacks to the edge. It is difficult to land an effective cut to the face of the shield due to its width being capable of creating a large contact area which distributes the force of cutting attacks (Figure 8). A cut would, therefore, preferentially (but not exclusively) need to lead with the point rather than the edge to gain purchase and damage the shield. Penetrative attacks by spear or sword thrusts would be effective, and reflect the main form of damage seen on surviving metal shields in Ireland and Britain. We may predict such damage to be biased towards the area covering the throat and chest for such thrusting attacks, particularly if used cooperatively in a set formation (such as a shield wall). Damage biased towards this location is noted on Figure 9.

The most robust shields of the LBA are the small buckler-type exemplars made of bronze that range from 1 to 1.5 mm in thickness. These can be around 30 cm in diameter and they are around half the weight of larger shields at about 1 kg. These Athenry-Eynesham types typically have unrolled edges, which forms a blade-like edge with which to strike. They provided virtually no 'static' coverage and, therefore, had to be used actively to engage with an opponent and their weapons. The two traditions of metal shield enable two very different ways of fighting: the large shields were suited to cooperative styles such as a rudimentary shield wall, the small ones actively discouraged this and required more mobile environments. This small collection of finds therefore implies that more than one form, and potentially context, of combat existed in the LBA.

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Figure 8. *Deflecting a cut with a bronze sword against a shield.*

Spearheads

LBA spearheads retain the tradition of intentional diversity, and the characteristic external socket loops are shed in favour of an internal peg. The nomenclature for these spearheads is diverse, with no detailed typological analyses to date. During my PhD research they were broadly divided into three groups—lanceolate, broad, and stumpy (Figure 10). The first is defined by a narrow, relatively even, elongated oval shape, quite like a willow leaf. The second (broad) group of spearheads have a socket that makes up some 25–50 per cent of the length of the entire object, and the blade is leaf-shaped. The third type (stumpy) was so named for the short sockets in relation to the flame-shaped blade, being in the region of 10–15 per cent of the entire length of the object; they have a ridged or faceted midrib. In all cases, the socket continues to just short of the tip of the blade. In general terms, the lanceolate variety tends to be around 17–27 cm long and weighs some 100–200 g, though shorter examples of around 9–13 cm occur. The broad variety falls into a range of around 10–13 cm (usually in the region of 100 g) and 20–32 cm (usually 200–350 g), with examples over 40 cm long representing exceptionally large spearheads (weighing over 500 g). The stumpy variety has the same range, though clustering around 10–23 cm and having a similar length to weight ratio as the broad spearheads, with occasional longer examples in the same metric range. Some of the more visually striking examples of LBA spearheads are the pieces with lunate openings in their blades. These are generally considered together as a distinctive group (e.g. Becker, 2013), though it is clear that the lunate feature occurs in all three general groups,

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Figure 9. *Composite figure with damage to the Barry Beg, Lough Gur and two London shields (after data and illustrations in Uckelmann, 2012).*

suggesting that it had a social meaning that cut across the distinct shapes of the spearheads.

A general functional assessment would see the lanceolate variety being geared towards light spears; the other two varieties are slightly more diverse because they include particularly long and heavy examples, though they are commonly broadly consistent with the functional length and weight ranges of the lanceolate variety. There was a general tendency towards shorter and more robust proportions compared to spearheads of the MBA tradition. It is also harder to see significant functional differences in the LBA spearheads compared to the MBA examples, but diversity of form clearly remained socially relevant. Some spears of these 'earlier' traditions no doubt overlapped with the newer tradition for a time, as illustrated in hoard associations. While there is therefore no typical LBA spear, there is a greater inclination towards pieces best suited to hafting on long shafts—reducing the possibility of *assegai*-type weapons—and appropriate for single-handed use, including throwing. The potential for cutting attacks is retained, but is perhaps less important.

Axes

The context in which some LBA socketed axes were found is useful for assessing possible functions. Irish hoards are

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Figure 10. *Complex/lunate opening varieties of lanceolate, broad and stumpy spearheads.* By permission of the National Museum of Ireland.

notoriously difficult to study because of their heterogeneity (Becker, 2013). This said, in the hoards from Blackhills, Dreenan, and Tuam (Eogan, 1983: nos. 269, 258, and 322), for example, we find a range of weapons, personal ornamentation, and tools that could represent the belongings of an individual, even if the objects

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were brought together to simply express this concept for depositional acts rather than being actual personal belongings. If there is martial symbolism relating to individual identities at work in these particular deposits, then the axe played a role. While axes remain in the category of Chapman's (1999) tool-weapons, those that belonged to warriors could have been used for acts that included combat. The long-standing tradition of stone percussive weapons in Ireland and contemporary bronze battle-axes in Europe provides a context for this assertion.

Armour

There is no direct evidence for armour in Bronze Age Ireland. A gold helmet, allegedly from Co. Tipperary (Waddell, 1998: 253) and now lost, suggests that the technology for shaping sheet metal (albeit gold in this case) to fit the head was known. Cahill's (2005) innovative study of contemporary gold gorgets suggests that body armour may have been known to the metalsmiths of Ireland. The very few suits of armour known from Bronze Age Europe (Mödlinger, 2013; Molloy, 2013) represent a mature smithing tradition, indicating that a great many more than have survived were once in circulation. It is, therefore, reasonable to argue that armour could have been known in Ireland, but that is all. The Irish leather shields remind us that organic armour may have been used, though hard evidence is lacking.

The Human Body

There are no unambiguous cases of trauma on human remains from the Bronze Age in Ireland. The problem with the expectation of finding secure evidence for warfare-related violence on bones is that, first and foremost, soft tissue areas were more effective targets for bronze weapons, which may only leave faint traces, if any at all, on bones (Molloy, 2007). The preference for cremation in Ireland makes it hard to identify weapon trauma; and, in the case of older analyses of many human remains, such faint traces of injury were not looked for. Even when they occur, it can be hard to differentiate homicide or execution, for example, from injury or death in battle. For these reasons, it is unwise to expect to find copious evidence for weapon-related injuries, but we would be imprudent to use this dearth of evidence to argue that violence was rare, ritualized, or absent.

Apart from seeking out hard archaeological evidence for marks on the body resulting from combat, this article has sought to tentatively address some aspects of the effects of such combat on mentalities of violence. While attitudes to violence and psychological repercussions are historically situated (Warnier, 2011), the personal experience of fighting is grounded in the physical and neurophysiological capacities of human beings. Fear and emotion can be culturally shaped, but they are common to all human beings. The core issue is that we cannot afford to work from an *a priori* position that killing was morally and psychologically neutral and that all people expected to kill would or could do so with the same effort and mental consequences (Grossman, 1995; ten Dam, 2015). In Grossman's analyses of historic case studies (1995, 2008), an increasing technical capacity for prolonged close-quarter violence is physically and psychologically more demanding for combatants. Thus, the changes in the proximity of violence over the course of the Bronze Age must have had an effect on the sociality of its undertaking, reflected in the

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material changes in weaponry and in how these demonstrate fundamental changes in the organization and undertaking of the acts of fighting. Tracing emotions archaeologically is virtually impossible, but the broader patterns of affordance, and techniques of killing that our analyses of weaponry reveal, provide insights into the physical performances involved in acts of killing. From this perspective, changes in the material culture enabling combat must have had correlating changes in the physical requirements of the human body and the mentalities of violence as individualism is sublimated into cooperation.

Discussion

In the MBA and LBA the majority of weapons in Ireland were consigned to liminal areas such as bogs or rivers (Becker, 2013), some of which, such as river crossing points, were probably the focus of combat themselves (Colquhoun, 2011). Bradley (2007: 200) argues that this move from mortuary contexts to 'other' contexts for the deposition of elaborate artefacts was socially meaningful, providing 'an ideal medium for flamboyant displays by the mourners' (Bradley, 1990: 197). Of the many possible reasons, an attractive explanation for weaponry is that this was part of a process of normalization or social re-integration after killing. This could potentially be linked to the dissolution of a person's identity as a warrior due to changes in circumstance ranging from death to age-related life transitions (Brück & Fontijn, 2013). This may help explain the dominance of weapons in intentional deposits of bronze in wet environments and the total absence from mortuary monuments.

There is little evidence for us to differentiate the potential roles of archery in combat between the Neolithic and the EBA. In both cases, archery provided a means to fight opponents from a distance. It has been argued above that the use of projectiles was perhaps the most common form of violent interaction at this time (Schulting, 2013) and this could potentially reduce the psychological impact of causing injury or killing. This is because distance and visibility can depersonalize the act, particularly if it involves volley-fire aiming at groups rather than individuals. In such circumstances, the archers may not be certain if they are responsible for the kill during a battle (Grossman, 1995: 99–140).

Spears throughout the Bronze Age could be thrown from close range, thus personalizing the kill without engaging intimately with an opponent. With shock-weapons, the sensory experience of smashing a skull or penetrating the flesh—and associated mess of solid matter and fluids, smells, and noise—is a much more personal experience. The act of killing can therefore have significantly different experiential and so potentially emotional/psychological aspects. This is not to suggest that up-close and personal killing was rare in the EBA and earlier periods, but that there were alternatives for individuals; furthermore, the basic character of shock weapons was more akin to those used in a brawl than a strategic fighting system. For close-quarter weapons such as axes or halberds, the movements required remain basic and can be executed with gross motor control; there is little cause to believe that organized formations of any kind were used, though this need not preclude the use of tactics. Schulting (2013) argues that, for small-scale societies, all males may be expected to engage in combat violence. Accepting this position, all past personalities were not equal and so we may envisage varying modes of participation being enabled by the range of weapons available; the proximity of violent

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acts could be physically and socially mediated.

The potential for employing holding or defensive lines of battle, possibly using shield walls, emerges between the MBA and LBA with the shield. This is significant because it becomes possible to stand at the coal-face of fighting without *of necessity* doing any of the killing. It was also at this time that distance killing in the form of archery disappears from the battlefield (Parker Pearson, 2005). Building on Grossman's extensive and diverse historical case studies, it can be argued for prehistoric combat that there are significant differences in the experience of killing when it comes to different weapon forms and combinations of these. In particular, there is a fundamental change in peer-visibility and mutual reliance in combat when cooperative lines of battle emerge. The cohesion of one's own line and its defence are as fundamental as killing opponents, and so the degree of violence enacted by combatants can become graduated.

Accepting the obvious cultural divide, it is instructive that Greek hoplite battles using shields, spears, and swords could rage for many hours yet mortality rates could be as low as 5 per cent and rarely exceeded 20 per cent (Krentz, 1985). Inverting this figure, at least 80–95 per cent of hoplites killed no-one over the course of an entire battle. This illustrates that the greatest defence can be control of distance and cohesion of battle lines. In relation to Bronze Age battles, we have no reason to suspect that combatants were typically spending protracted periods standing toe-to-toe striking vigorously at each other. This is reflected in the relatively minor character of use-wear on weapons and, indeed, it suggests that weapons with no use-wear could nonetheless have seen combat. The specialized body techniques that emerged in the MBA and LBA required warriors to coordinate the use of two hands, which in turn may lead to alternating which foot was leading (on the basis of which weapon was being proffered), thus affecting balance and movement more generally. This reflects changes in the performance, proximity, and sensuality of violence, made possible by shields as much as the very short swords, which had ramifications for both battlefield organization and the sociality of violence.

Turning to the warriors themselves, while specific evidence for warrior elites is lacking, it is possible that access to weapons and training resources would have been restricted if a high degree of specialization was required. We can, therefore, reasonably argue that the commitment of time and resources related to warriorhood would preclude full-time specialism in other crafts or social roles (e.g. farming). The evidence can only be equivocal, yet taking an *a priori* position that warriorhood was an occasional role to be played in times of crisis is not consistent with the skill and resource investment we see in warrior practices. Much of the high volume of bronze used in Ireland appears to have been utilized for weaponry, indicating that their wielders were a focus of major investments of resources within political-economic frameworks (Earle et al., 2015). For this reason, we can expect a degree of socially meaningful differentiation between those who fought and those who did not. What we lack is evidence of hierarchical organization, and so 'expert warriors' is perhaps more acceptable than 'warrior elites', as their distinctive social status is recognized but direct authority over others is not implied or required. It may be that it was their status relative to, and potentially integrated with, other social identities that was paramount (Fowler, 2004; Brück & Fontijn, 2013: 207). It is possible that the social

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infrastructures supporting warrior specialization, as much as the activities of those specialists, stimulated a paradigm shift in Bronze Age society in Ireland. While we may struggle to attribute specific ranks or status to warriors, the evidence strongly indicates that their 'work' constituted a craft specialism in its own right.

It has not been practicable to discuss LBA hillforts in depth here, though we can briefly state that these may be seen as another important indicator of changes in the centralization and control of transferable wealth. The construction of hillforts required the existence of organized labour and a recognized social need to build spatially extensive defensible structures, whether workers operated at the behest of elites or larger social groups. We can debate the role of these places as proto-citadels but at the very least we may expect that, as major labour investments, the protection of these sites would have been a significant concern of the parties that constructed them. On the basis of interiors often in the tens of hectares, their defence perimeter would require groups in the low hundreds at least. Even the statement of permanence of place in a landscape where previously short-lived, small and dispersed settlements had dominated (Ginn & Rathbone, 2012) is significant. In relation to warfare, in the areas where they existed, hillforts introduced a practice of defending spaces and creating a focal point for aggressors to subvert hegemonies through battle and destruction.

Kristiansen and Suchowska-Ducke (2015) have suggested that by the LBA, armies in the hundreds or thousands may have come together in battle in parts of Europe. It would be premature to suggest anything similar for Ireland, but we can say that the material culture, possibly by the MBA and certainly by the LBA, was suited to massed ranks of combatants and that many of the known hillforts required forces in the low hundreds to mount effective defences. Furthermore, it is notable that the categories and character of weaponry that came into being by this time were to remain unchanged into historic times, when we know large bodies of men fought in lines of battle. The technological and tactical capacity for small armies surely existed in Bronze Age Ireland even if the archaeological record cannot be expected to reveal ephemeral gatherings of this scale. A similar picture appears in most areas of Europe, with a unique exception at the Tollense battlefield site in Germany where the emerging evidence suggests that hundreds or even thousands of warriors fought in a single battle and the bodies of the fallen were left at the site (Jantzen et al., 2014). Acts of warfare in Ireland could, of course, be highly variable, from raids involving a handful of warriors to larger conflicts at the top of a graduated scale of hostilities (Harding, 2007).

Conclusion

A core position of this article is that archaeological analyses of weaponry can provide an informative narrative without borrowing too directly from history or ethnography. Overall, the changes over the course of the Bronze Age represent a progression from an EBA impromptu warrior with basic skills to warriors with a significant degree of training and skill commensurate with a craft specialization by the LBA. The functional and symbolic potency of weaponry is mutually constructed through the persona of the warrior. This in turn places the warrior centre stage for understanding the biographies of a wide range of objects that were designed to be used together in functional 'packages' in the past. It also gives an archaeological insight into the use of a

https://doi.org/10.1017/eaa.2016.8 Published online by Cambridge University Press

significant quantity of the bronze used in Ireland in the Bronze Age.

It has been argued here that the weapons and combat traditions of the EBA mark a minor deviation from the Neolithic that required no significant shift in skill levels and, by extension, training expectations of warriors. The acts of killing were conducted both at a distance and, when up-close, using weapons that were swung in a manner that barely deviated from Neolithic techniques of the body. The development of the sword and shield, and significant changes to the use of spears in the MBA, are considered to be a major turning point in combat practices. It has further been argued that the requisite changes to bodily techniques for their effective use were underwritten by a fundamental shift in the resources commanded by warriors in terms of the social and economic infrastructures enabling the acquisition of their skills. A fundamental change also arguably took place in terms of the mental requirements, training, and knock-on social effects of the heightened requirement for warrior skills. These changes in warfare between the Early and Late Bronze Age constituted a pivotal shift in the relationship between social organization, resource management, and utilization of violence in Ireland, which in turn reflects developments across Europe more widely at this time.

Acknowledgements

I would like to thank the three anonymous reviewers for their extensive and insightful comments, which have been very helpful. Christian Horn and Marianne Mödlinger also commented on earlier drafts and offered good advice. Many of the conversations held with Alan Peatfield, Kristian Kristiansen Ioannis Georganas and Sue Bridgeford over the years have helped shape some of the ideas presented here. Aidan O'Sullivan has supported recent research into this topic at the UCD Centre for Experimental Archaeology and Material Culture in Dublin. I am grateful also to Neil Carlin for his advice on the Early Bronze Age section. Marius Wisniewski and Marina Milic provided their time and expertise in making the 3D models linked to in this paper. I am very grateful to Mary Cahill, Nessa O'Connor and Margaret Lannin of the National Museum of Ireland for their support over the years I have worked on material there and for permission to use the images in this paper. I am also grateful to Sinead McCartan and Greer Ramsey of the National Museums of Northern Ireland for access to materials in their collections. The research presented here has been funded by the Irish Research Council. Any mistakes, errors or egregious positions in this paper are of course my own.

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https://doi.org/10.1017/eaa.2016.8 Published online by Cambridge University Press

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Guerriers chasseurs : la transformation des armes, du combat et de la société au cours de l'âge du Bronze and Irlande

On envisage de plus en plus sérieusement que la guerre fut un élément majeur de l'activité des sociétés préhistoriques, sur le plan des infrastructures nécessaires à la conduite de la guerre, de ses effets et de son rôle dans le système symbolique. C'est pendant l'âge du Bronze qu'une grande partie des armes qui domineront les champs de bataille pendant des millénaires — les boucliers et les épées en particulier — a été inventée. En prenant l'Irlande comme étude de cas, cet article retrace l'évolution de la guerre au cours de l'âge du Bronze et propose que la conduite de la guerre a passé du combat faisant usage de projectiles et d'armes à impact à des stratégies utilisant des armes défensives et des armes à lames. Cette évolution est à la base d'une réorganisation fondamentale du combat, ce qui à son tour a créé les conditions pour une transformation de l'organisation de la guerre au niveau social. Ceci comprenait un investissement en ressources matérielles et dans l'entrainement des guerriers ainsi que la mise au point de nouvelles techniques corporelles qui reflétaient les transformations radicales dans le domaine des arts martiaux. L'analyse tracéologique d'armes en bronze et l'archéologie expérimentale employant des répliques sont citées à l'appui de cette thèse. Nous examinons également comment l'évolution des techniques de combat a transformé le caractère social de la violence et des relations entre pairs au sein des communautés guerrières et proposons de considérer ces guerriers comme appartenant à une catégorie d'artisans spécialistes exerçant une influence sociale appréciable à la fin de l'âge du Bronze. Translation by Madeleine Hummler

Mots-clés: âge du Bronze, Irlande préhistorique, guerre, archéologie du combat, épées, lances, boucliers, élites guerrières

Jagende Krieger: Veränderungen in den Waffen, im Kampf und in der Gesellschaft während der Bronzezeit in Irland

Es wird zunehmend anerkannt, dass der Krieg, in Hinblick auf die Infrastrukturen für die Kriegsführung, sowie seine Auswirkungen und Rolle in der Symbolik, ein bedeutender Tätigkeitsbereich der urgeschichtlichen Gesellschaften war. Viele Waffenformen wie Schilde und Schwerter, die Jahrtausende lang die Schlachtfelder beherrschen sollten, wurden erstmals in der Bronzezeit erfunden. Anhand der Fallstudie Irland wird die Entwicklung der bronzezeitlichen Kriegsführung von der Frühbronzezeit bis zur Spätbronzezeit verfolgt. Es wird hier vorgebracht, dass sich die Kriegsführung in dieser Zeit von der Benutzung von Wurfwaffen und Schlagwaffen zum Gebrauch von Verteidigungswaffen und Hiebwaffen verschoben hat. Dies bildete die Grundlage einer grundsätzlichen Reorganisation der Kampfsysteme, was wiederum Veränderungen in der sozialen Gestaltung der Kriegsführung, im materiellen Aufwand und in der Investition in die Ausbildung der Krieger und von neuen körperlichen Techniken bewirkt hat; ein erheblicher Wandel in der Kampfkunst widerspiegelt diese Lage. Die Untersuchung der Gebrauchsspuren auf Bronzewaffen und die experimentelle Archäologie mit Waffennachbildungen werden hier zur Unterstützung dieser Ansicht vorgelegt. Wie die Kampftechniken die Sozialität der Gewalt und die Beziehungen zwischen gleichrangigen Kämpfer

https://doi.org/10.1017/eaa.2016.8 Published online by Cambridge University Press

verändert haben, wird im vorliegenden Artikel untersucht; daraus ergibt sich, dass man diese bronzezeitlichen Krieger ähnlich wie spezialisierte Handwerker, die einen maßgeblichen sozialen Einfluss in der Spätbronzezeit ausübten, ansehen soll. Translation by Madeleine Hummler

Stichworte: bronzezeitliche Kriegsführung, Urgeschichte in Irland, Archäologie des Kampfes, Schwerter, Speere, Schilder, Kriegereliten