See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/339628883

A New Halberd Typology (1500-1800): Based on the Collection of the National Military Museum, The Netherlands

Article in Arms and Armour \cdot March 2020

DOI: 10.1080/17416124.2020.1728905

citations 0

1 author:

Casper Johann van Dijk Leiden University

2 PUBLICATIONS 0 CITATIONS

SEE PROFILE

READS 1,964



Arms & Armour



ISSN: 1741-6124 (Print) 1749-6268 (Online) Journal homepage: https://www.tandfonline.com/loi/yaaa20

A New Halberd Typology (1500-1800): Based on the Collection of the National Military Museum, The **Netherlands**

Casper J. Van Dijk

To cite this article: Casper J. Van Dijk (2020) A New Halberd Typology (1500-1800): Based on the Collection of the National Military Museum, The Netherlands, Arms & Armour, 17:1, 1-26, DOI: 10.1080/17416124.2020.1728905

To link to this article: https://doi.org/10.1080/17416124.2020.1728905

© 2020 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



0

Published online: 02 Mar 2020.

_	
Γ	
-	_

Submit your article to this journal 🗹

Article views: 188



View related articles

View Crossmark data 🗹



a OPEN ACCESS

A New Halberd Typology (1500-1800): Based on the Collection of the National Military Museum, The Netherlands

CASPER I. VAN DIIK

Independent Researcher, Vrijheidslaan 820, 232DX, Leiden

European halberds as the subject of research has been partly neglected in mainstream historical academic discourses. The research that has been primarily focused on trends in development of halberd design from the 14th to the 18th century. However, this research does not provide insight into the large variety of halberd design present in collections around the world. To examine this variety, this article offers a classification system for halberds and provides insight into the factors influencing their design during the 16th and 17th centuries. The first part of the article presents a halberd typology based on the collection of 131 examples in the National Military Museum, the Netherlands, to provide a system to classify and simplify communication. This typology is based on a hierarchical system, from classes, based on the design of the point and socket of the halberd, to types and subtypes, based on the blade and beak design. In total 4 classes, 14 types and 5 subtypes could be recognised. The second part of the article provides insight into the dating and use of the recognised types based on art and historical texts. Using this method, a trend could be recognised in halberd design: straight-edged halberds were presumably being used by larger groups of individuals, for example during battles. While concave edged halberds were probably used by smaller groups, for example personal guards, and were designed to control the opponent's weapon and inflict trauma primarily with the point.

KEYWORDS halberd, typology, development, weapon use, National Military Museum, Netherlands, medieval, pollaxe

Introduction

When examining late medieval and early modern European art depicting warfare, or even social events, the halberd is ubiquitous. For example, in the famous 16th century

(http://creativecommons.org/licenses/by-nc-nd/4.o/), which permits non-commercial re-use, distribution, and reproduction in any

medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way.

pen drawings by Hans Dürer, or the 16th and 17th century *Schutterstukken*, such as *The Night Watch* (1642).¹ Halberds are not only often depicted in art but the term halberd is also often mentioned in historical documents, especially those from the 16th century. For example, Frisian muster rolls state that half of the combatants in the Peoples Armies were armed with halberds (*hallebart*) during the first half of the 16th century, and in his dictionary the landsknecht soldier Paul Dolnstein (pre-1513) mentions 45 halberdiers (*halbartn*) as part of a 400 man field army.² Many of the types of halberds depicted or possibly mentioned in historical documents have survived the ravages of time and are presented in museum collections around the world.

Even with the ubiquitous presence of halberds during the later middles ages and the early modern period, and the large collections of them surviving to our modern times, research and literature concerning halberds is scarce. Often, literature concerning historical weapons only devote a short chapter on halberds or staff weapons, whereas swords, for example, receive far more attention.³ Nevertheless, a great variety of halberd designs existed. The few examples of literature dealing with halberds more in depth, such as the works *Hafted Weapons* by Waldman (2005), *The Halberd and other European Polearms* 1300-1650 by Snook (1998), or *Le Armi in Asta* by Troso (1988), predominantly provide a general overview of the development of them through time. These overviews can be a tool to quickly observe the development but lack the scope to do justice to the vast number of differences in halberd design, and often only partly cite the sources used to determine the provenance or dating of the examined halberds.

The first step in the continuation of halberd research should be recognising the variety in their design. The creation of a typology can be the basis to recognise this variation. A typology can be used to identify different designs of halberd, classify them and can condense large amounts of data to a few pages within an article or book.⁴ Furthermore, the recognition and classification of different types can be the starting point for dating halberds, it can provide insight into local variations, and it can provide insight into the use of halberds. Therefore, the primary aim of this article is to create an initial typology to map out the different designs of halberds and create a system simplifying communication on these different designs. The typology only encompasses the head of the halberd, due to the high variety in halberd head design.

Creating a typology can be a daunting task. In order, to facilitate the creation of this typology, it has been based on a single collection: the collection of 131 halberds stored in the National Military Museum (NMM) in the Netherlands. This collection of halberds has primarily been established through the purchase of examples from collectors or receiving them as gifts, and is not based on a single or several large historical collections, such as the acquisition of arsenals or noble collections. Consequently, a large array of different halberd designs, possibly originating from all over Europe, is present in the collection. Because the typology presented in this paper is only based on a single collection it should be considered as a basis or incipiency for future expansion and research, and probably needs to be extended with more types

present in other collections. It can be best viewed as a framework within which future data can be lodged.

Before data can be used by social or humanistic scientists for larger societal research, it should be placed in a context of time and space; where and when was an object made and used.⁵ However, these are precisely the two elements often missing with historical artefacts such as halberds. Because this data is not usually contained within the objects themselves, placing these objects within a defined context of time and space is based on supporting evidence.⁶ For example, the dating of a halberd according to the appearance of a similar halberd in a work of art, or dating an archaeological excavated example using other dateable material culture from the site. Since these interpretations are often contingents on different opinions or new data, I have opted to differentiate between the objects, i.e. halberds, and interpretations concerning the placement of the object in time and space. Therefore, this article is split into two. The first part (PART A) will merely describe the physical shape of the halberds in the collection of the National Military Museum and classify them without the use of interpretative terms. While the second part (PART B), will provide some interpretations of the described types in terms of dating and use.

The definition of a halberd

Before a typology can be devised the concept of a halberd should be defined, and especially a differentiation should be made between the historical and the modern concept. Commonly within modern literature, and not only in the Anglo-Saxon tradition, a halberd is a weapon composed of a three-part head. This consists of an axelike blade, surmounted by a spike or point with a beak on the back, the head being fastened to a staff with two or more langets, a socket, or two eves on the back edge (Figure 1).⁷ This definition is based on the work of 19th or early 20th century scholars. Historically the term halberd is derived from the Middle-High German words halm and baerd/bart. The word halm refers to a long shaft, for example, the shaft of a straw, while the word *baerd* refers to a large axe type, often translated in English as broad or side axe.8 Consequently, the original term refers to a large axe on a long staff. Generally, a poem written by Konrad of Würzburg (?-1287) on the Trojan War is recognised as the first time the term *hallenbarten* is mentioned,⁹ but similar terms were used throughout the late middle ages and early modern period. For example: *helnbarten*, is mentioned in 1348 by the Franciscan John of Winterthur describing the battle of Mortan (1315).¹⁰ In the Zeugbuch of Emperor Maximilan (1502) the term *Helmparten* is used to describe a depiction of a halberd-like object.¹¹ In 1590 Cornelis Ghijsbetsz, a citizen of Utrecht, Netherlands, purchased 100 hellebaarden as part of a large order of weapons.¹²

What form of object was implied by these different historical terms, and whether they match the modern definition of a halberd, is problematic. For example, the *helmparten* depicted in the Maximilian Zeugbuch do seem to match the modern



FIGURE 1. Definition of a halberd, (C) The author.

description of a halberd; however, it is unclear what objects both Würzburg and Winterthur were describing. Possibly the object they referred to would not be recognised as a halberd by modern scholars. Obviously, the historical term was applied to different objects over time, and the term could have implied different objects in different geographical areas.

To overcome the possible discrepancy between the historical term *hallenbart*, and all its derivatises, and the modern definition of a halberd, I propose a clear distinction between research into the surviving halberds and the historical concepts, according to the research methodology used within archaeology; *getrennt marschieren, vereint schlagen*.¹³ This methodology, originating from historical-archaeological research, proposes that historical objects and historical texts should be researched apart from one another before systematically comparing and combining individual aspect of both sources.¹⁴ For example, this would mean not directly linking the term *helmbart* to an object that according to our modern definitions is a halberd and dates to the same period the term is used in, without clear evidence linking the object and term together. For the term *helmbaert* could merely refer to an axe on top of a long shaft, and not the weapon with a three-part head, we define as a halberd. Therefore, within this article when the term halberd is used, I will refer to the modern definition of a



FIGURE 2. Definition of a pollaxe, (C) The author.

staff weapon composing of a three-part head presented earlier, unless I specifically mention historical terms or concept concerning halberds.

Pollaxe versus halberd

Another weapon closely resembling the halberd in design is the pollaxe. The pollaxe, and its close derivative the Lucerne hammer, is also described within modern literature as a weapon with a three-part head, composed of an axe blade or hammer surmounted by a spike or point, with a spike or hammer on the back of the head.¹⁵ It differs from a halberd due to the hammer or the hammer/spike on the back. Again, as with the halberd a historical object called the *pollax* existed. For example, in 1386 Geoffrey Chaucer mentions the use of a *pollax*.¹⁶ Conforming to the earlier distinction proposed between historical and modern concepts, I propose to create a precise modern definition for the pollaxe and differentiate it from the historical concept of the *pollax*.

My definition: a pollaxe is a staff weapon also consisting of a three-part headwhich comprises an axe-like blade or hammer surmounted by a spike or point, with a beak, spike or hammer on the back, and fastened to a staff with two or more langets and/or a socket (Figure 2). The construction of the head of a pollaxe differs from that of a halberd. While, the head of a halberd is composed of a single piece of metal (although exceptions exist), pollaxe heads are composed of at least two pieces of metal, and usually three or more. The first piece is the spike or point of the weapon and the langets, while the second piece is the blade/hammer and the back spike/hammer. The first metal piece (the point or spike) can either be placed over the second piece, then the hammer/axe also functions as a form of socket, or the second metal piece can be placed over the first piece. The first piece then functions as a socket. A third piece often passes horizontally through both pieces in the form of a double-ended spike. This piece than functions as a large rivet, fastening the first and second metal pieces together (Figure 2).

PART A - the typology

The typology is based on a hierarchal system from more general classes to more detailed types and subtypes. Because a halberd is, by definition, based on the presence of a blade, point, and beak placed on top of a wooden shaft, these elements are the primary distinctions between different types. Therefore, the most fundamental classification should be based on one or a combination of these elements. The first classification is based on different types of sockets and points and their interrelationship, as there is the least variation in these two elements. Four classes could be recognised.¹⁷ These four classes are linked to different types of sockets. The four classes are (Figure 3):

- 1. Class I has a socket with a rectangular profile. It develops into the blade and the blade in turn develops into the point. In some examples, the end of the socket and the beginning of the point touch. Often, the point is not located directly in line with the socket. In addition, the point can consist of a spike with a diamond-shaped profile or can consist of a flat top spike with no thickening. Socket types: S.I and S.II.
- 2. In Class II the socket and point are in line with one another, and the socket directly transforms into the point, instead of transforming first into the blade as with Class I. Often, the socket becomes thinner before thickening towards the point. The point consists of a spike with a diamond-shaped profile, and the socket itself has a rectangular or hexagon-shaped profile. Socket type: S.III.
- 3. In Class III the socket transforms into a medial ridge running along the halberd point. From this ridge, the point flattens out to the sides and forms a spear-like point. Often, the point has sharp edges and is hollow ground. A number of halberds have a thickening at the end of the point. Socket type: S.V.
- 4. In Class IV the socket has either a rectangular, hexagonal, octagonal, or circular shaped profile. The point is in line with the socket and can be of spike or spear point design. A defining feature is a transitional element, for example, a sphere, between the point and socket. Commonly, the head is not constructed from one piece of metal but two. The blade and beak form one piece, while the socket and point form the second piece, although, examples exist constructed from one piece of metal. Socket type: S.IV.



FIGURE 3. The different classes and their respective socket types, (C) The author.

Types and subtypes

These four classes can be further divided into types, and subtypes. Types are based on overlapping elements in blade and beak design, often linked to a particular socket or point type. Subtypes are defined by one or more elements present in types. For example, it can be based on the presence of a certain protrusion, or cut-out in the blade or beak. However, it should be realised classifications of historical artefacts are often not defined by absolute boundaries, but by stated norms and an ideal type. The deviation from the stated norm differentiates between different types, from types with almost no deviation to types with a largely known deviation from the stated norm or ideal type.¹⁸ The same applies to this typology. It is derived from halberds serving as archetypes. The halberds illustrated here are these archetypes. Some types are homogeneous in design, while others are far more heterogeneous with more variations within the same type.





Class I (Figure 4):

- Type I.A halberds are composed of a large blade with an angled edge, forming a point on top of the blade. The beak is triangular in shape and is relatively short, approximately 3/4 length of the blade. Type A halberds have a type SI socket.
 - Subtype I.A-1 is defined by half round cut-outs on the top and bottom of the halberd blade.
- Type I.B halberds are composed of a triangle-like blade forming a sharp point on top of the blade with a slightly concave edge, and type SII sockets. Defining type B halberds are the half round cut-outs at the beginning of the point at both the side of the blade and the beak. Some

examples have a similar half round cut-out on the attachment between the socket and the blade on the bottom of the blade (Figure 4).

Class II (Figure 5):

- Type II.A halberds are defined by a large blade with a concave shaped edge. Both at the top and bottom of the blade edge two points are formed. The point on top of the blade protrudes forward compared to the bottom point, placing the blade edge at an angle. From these points on the blade, the blade narrows towards the socket, following largely the shape of the blade edge, forming a crescent shape. Type C halberds have a type SIII socket.
 - Subtype II.A-1 is defined by a wide blade with straight lines and slightly concave edge. Subtype II.A-1 halberds have a type SIIIa socket. This subtype has a triangle shaped beak, pointing downward, and ending in a sharp point.
 - Subtype II.A-2 is similar in design to subtype II.A-1. It has, however, a far more concave shaped blade edge and has small protrusions on the corner of the blade, where the blade narrows down towards the socket both on top and bottom. Furthermore, round cut-outs are present in the blade and beak. Two groups of three cut-outs are present inside the blade near the points on the blade. Between these two groups of cut-outs, one group of cut-outs is present, placed in a circle shape with one cut-out in the middle. Within the beak cut-outs are placed in a straight line following the socket.
 - Subtype II.A-3 halberds are similar in design to II.A-2 halberds. However, they are more slender in design, have more curved lines, and can have any type of SIII socket. Just as II.A-2, II.A-3 subtypes they have protrusions, but they are larger and often have one or several round cut-outs inside these protrusions. The point of the beak, and the top and bottom point of the blade of the halberd can be thickened. The beak of the halberd is longer and narrower than in subtype II.A-1, but also points downward. The halberd can be decorated with etching or engraving, or can have large cut-outs inside the blade and beak. Most II.A-3 examples have a long spike of square section.
- Type II.B halberds have a small, shallow crescent-shaped blade, with long protrusions on top and bottom of the blade formed by a large half round cut-out. They have a type SIIIb socket, and a long downward sloped beak, often with a small protrusion on top of the beak. Commonly, round cut-outs are present in the blade and beak. Furthermore, the halberds can have round cut-outs in the blade and have a thickening at the bottom of the spike, for example in the shape of a sphere.
- Type II.C halberds are a homogenous group of halberds, with a wide crescent-shaped blade and a narrow attachment with the socket. The



FIGURE 5. Class II and its respective types and subtypes, © The author.

point of the beak points almost directly downwards, parallel with the shaft. The halberd has round cut-outs inside the blade and beak, often grouped in geometrical shapes. Type II.C halberds have long spikes.

- Type II.D halberds are a homogeneous group of halberds. They have a concave-like blade edge composed of two straight lines forming sharp points on top and bottom of the blade. The attachment of the blade to the rest of the halberd is narrow. The angle of the blade differs between halberds, with several examples having the top point protruding forward, while in other examples the bottom point of the blade protrudes forward. The beak of the halberd has a large pointed protrusion on top, curving towards the spike of the halberd. They have a type SIII socket.
- Type II.E halberds are defined by their straight lines. They have a concave blade edge composed of two straight lines, forming a sharp point



FIGURE 6. Class III and its respective types and subtypes, © The author.

on top and bottom of the blade. They have a type SIVd socket. On top and bottom of the blade, two protrusions are present. The most defining feature is the split beak. The beak is composed of two points. The top point points forward towards the point of the halberd while the bottom point points downward.

• Type II.F halberds are a heterogeneous group, composed of examples with a blade wider than it is high, and a deep concave blade edge. Defining type II.F halberds are the large number of protrusions coming out of both the blade and beak. These protrusions differ in shape and size. The beak is as wide as the blade, or often even wider, and the point of the beak curves downward. Between the socket and spike a thickening is often present in the shape of a sphere or diamond. They have a type SIII socket (Figure 5).

Class III (Figure 6):

- Type III.A halberds have a large blade with a concave blade edge, a downward pointed beak, and a type SIV socket. Both on the rim of the blade and the beak half round cut-outs are present. The halberd can be covered in etched decoration, and round cut-outs can be present in the blade or beak.
- Type III.B halberds are composed of a crescent-shaped blade, with a protrusion present on the top and bottom of both the blade and beak. At the base of the point of the halberd two 'wings' can be present. Type III. halberds have a type SIV socket and a round shaft.
- Type III.C halberds are defined be an S-shaped edge and a type SIV socket.
- Type III.D halberds have a blade resembling subtype II.A-1, with a crescent- shaped edge, and small protrusions on the top and bottom of the

11



FIGURE 7. Class IV and its respective types and subtypes, © The author.

blade. The point of the halberd is leaf shaped, with two small protrusions on the base of the point. The beak is simple in design and points downward (Figure 6).

Class IV (Figure 7):

- Type IV.A halberds are composed of two pieces of metal. The socket and the point form one construction, while the beak and blade consist of a single piece of sheet metal. The edge of the blade is straight and parallel with the shaft. The beak curves downward, also in line with the shaft. On the rim of the blade and beak half round cut-outs are present. The shaft of the halberd is round in diameter, and the socket can be hexagonal, octagonal, or even ten-sided in shape. At the bottom and top of the socket metal ridges are present. Type IV.A halberds points are triangular in design and resemble a spearpoint, and have a round shaft.
- Type IV.B halberds are almost identical in design to the type IV.A halberd. They, however, have four wave-like protrusions, two on the top and bottom of the blade, and two on the top and bottom of the beak. Moreover, the beak has more straight lines than type IV.A halberds (Figure 7).

PART B – interpretation, dating, and use

The second part of this article presents interpretations about the appearance of several halberd types in time and space. Due to the close relationship between design, use, and dating I will also provide some insight into the development of the use of the halberd. Similarly to the typology, the information presented here is not definitive but should be observed as a starting point for future research. It is far from complete end merely portrays possibilities.

Makers' marks

One of the more accessible types of information on halberds are marks on the halberd head or shaft. These marks consist of a small sign, often a geometrical shape, that conveys information. Probably these marks carry information concerning the maker of the halberd head. In two articles J.A. Meier could link marks present on halberds in Swiss collections to a particular smith or producer.¹⁹ Consequently, marks can be a powerful tool in dating halberds and in determining local variations. In total 38 different marks could be recognised on halberds in the collection of the National Military Museum. However, many of the marks were poorly defined; therefore, I have opted to present the 15 marks present on halberds that could be classified to a particular type and were of sufficient quality to be photographed (see Figure 8).

Unfortunately, it was impossible to link them to any particular producer or arsenal. Nevertheless, some general remarks concerning the marks can be made. Three type I.A-1 halberds (NMM object number 014804, 14807 and 014868) have an M.I mark, but also a type II.A-1 halberd has the same mark. The homogeneous type II.C halberds have a large variety of marks. All four halberds composing of the II.C group have different marks (M.7 to M.10). A similar trend is observable in type I.B (NMM object number 014855 and 014886) and II.D (NMM object number 0147684 and 017684) where two halberds from the same type have different marks. This probably implies either different workshops or masters produced the same style of halberds. However, far more research is needed to make a more decisive conclusion concerning the meaning of makers' marks. A larger database or collection of marks is needed to advance research.

Dating

The dating of an objects is not a singular concept. It is composed of several elements. For example, the dating of an object could refer to the active use of an object during everyday life, or the term could refer to the production date of an object. What precisely is dated, is determined by the sources used to date the object. Absolute dating techniques, for example C¹⁴-dating, can date the construction of a halberd. Archaeological finds can date the deposition of a halberd. Artistic representations can date a large variety of different aspects depending on the intention of the artist.



 $_{\mbox{FIGURE}}$ 8. The makers' marks recognised on halberds that could be classified into a type, ${\rm (C)}$ The author.



FIGURE 9. The dating of several halberd types. Based on the evidence presented in this article, © The author.

In addition, several halberds have information imprinted on them, such as the marks discussed earlier, dates or decorative edging that can provide insight into their production. For dating halberds their depiction in works of art is the most readily accessible source and will, therefore, be primarily used in this article.

Art does have several challenges which need to be considered before it can be used to date objects. The major problems are the intention of the artist, the depicted scene and the art style. When an artist depicts a 'fantasy' scene it can be safely assumed that more fantasy inspired weapons or armour are depicted. The same principle applies to contemporary scenes, with contemporary armour or weapons depicted. Another problem is how detailed an art style is; some styles enable better recognition of halberd types than others. To solve these problems, I have chosen to use detailed art works depicting contemporary events, or art depicting historical scenes using contemporary material culture. I have tried to use artists with martial experience, increasing the probability for the real depiction of historical weapons. For example, the artists Albrecht Dürer, who created a fight book for Emperor Maximilian, and the artist Urs Graf, who served as a landsknecht.²⁰

The dating is based on the types presented in the typology, and, as with the typology, the dating goes from general to more precise forms; from classes to subtypes.



FIGURE 10. The artworks depicting halberd types described in the text. Period 1500-1550; 10.1) *Het beleg van Rhenen* (c. 1500), Meester van Rhenen, ©Rijksmuseum; 10.2) *Hellebaardier in liefde onstoken voor een naakte vrouw* (1517), Urs Graf, © Rijksmuseum.

However, dates are only offered for the few types that could be dated exactly (Figure 9). The dates are presented chronologically and are grouped in three periods.

1500-1550

The first period starts in 1500. Halberds had already been in use during the 14th and 15th centuries; however, their designs usually had two 'eyes' as a socket on the back of the head and are absent from the collection of the National Military Museum. The single- socket halberd starts to appear around 1500 in art, especially in the Low Countries and Germany. Earlier single- socket halberd-like staff weapons do appear in art, but they have a more pollaxe-like construction. One of the first depictions of a single- socket halberd is in *Het beleg van Rhenen* (ca. 1500) by the Meester van Rhenen.²¹ Throughout the period 1500-1550 both class I and II halberds are depicted, although they all have straight edged or convex edged blades (Figure 10).²² Only type I.A could be identified in art, with the earliest depiction of the type in the Maximilian *Zeuchbuch* (1502) and again in 1517 by Urs Graf.²³

1550- са. 1600

In the period 1550-1600, primarily class II or III are shown, and I could not find an image of a true depiction of a class I halberd in art during this period. Furthermore, around 1550 a new development started to appear: the concave- edged blade. The earliest depictions I could find was in an Italian fight book (1553) of a type II.A-1 halberd and a depiction of a soldier holding a type II.A halberd (1562), but throughout art from the second half of the 16th century concave halberds are depicted (see Figure 11).²⁴ Furthermore, a general class II halberd, with a slightly concave edge, could be dated using a maker's mark to approximately 1560.²⁵ Four types and subtypes of class II and one type of class III could be recognised in art: the earlier mentioned depiction of an II.A-1 type; two images from 1582 depicting a group of halberdiers holding type II.C halberds; a sergeant holding a type III.C halberd (1587); and an incomplete Dutch fight book depicting two individuals both fighting



FIGURE 11. The artworks depicting halberd types described in the text. Period 1550-ca. 1600; 11.1) *Trattato Di Scientia d'Arme, Con vn Dialogo Die Filosofia* (1553), p. LX; 11.2) *Allegorische voorstelling met hellebaardier, schildknaap en vrouw* (1560), Monogramist AM, ©Rijksmuseum; 11.3) *Aankomst van de hertog van Anjou te Antwerpen en ontvangst door de prins van Oranje* (1582), Abraham de Bruyn, ©Rijksmuseum; 11.4) *Sergeant* (1587), Jacob de Gheyn, © Rijksmuseum; 11.5) *Schermkunst* (VAULT Case MS Fol.U.423.792) (1594), f.14r., The Mulberry Library, ©Reinier van Noort; 11.6) Object Number NG-NM-7702 (1596), © Rijksmuseum.

with a type II.F halberd (1595).²⁶ Besides art several class III halberds have dates etched in the blade. For example, a decorated type III.D halberd (NMM object number 014823) has the date 1580 etched on it, and two type III.A (NMM object number 011511 & 018383) have the date 1578 etched on them. In addition to these two types III.A examples in the collection of the National Military Museum with dates



FIGURE 12. The artworks depicting halberd types described in the text. Period ca. 1600-1800; 12.1) *Het korporaalschap van kapitein Dirck Jacobsz Rosecrans en luitenant Pauw* (1588), Cornelis Ketel, © Rijksmuseum; 12.2) *Officieren en andere schutters van wijk III in Amsterdam* (1632), Thomas de Keyser, © Rijksmuseum; 12.3) *Schutters van de Compagnie van Kapitein Reinier Reael en Luitneant Cornelis Michielsz* (1637), © Rijksmuseum.

edged on them, two halberds in the collection of the Kunsthistorisches Museum, Vienna, have the date 1563 etched on them and are associated with to the bodyguard of the Emperor Ferdinand I.²⁷ The appearance of concave edged bladed halberds does not imply that straight edge bladed halberds were no longer in use. For instance, on the lower righthand corner of the painting *Massacre of the innocents* (1565-1567) by Pieter Bruegel, a soldier holds a straight edged bladed halberd, and one excavated from the Zembla Nova expedition from 1596 is also straight edged.²⁸ Although, compared with earlier straight edge examples, it appears that the blade size of halberds dated to the period 1550-1600, shrinks, particularly in the width of the blade.

Ca. 1600 - 1800

The third period sees the appearance of Class IV halberds. Class IV halberds are most famously depicted on *Schuttersstukken* (civic guard paintings) from the late 16th century onward. The first *Schuttersstuk* depicting a class IV halberd is in 1588.²⁹ The first type IV.B halberd I could find in a *Schuttersstuk* is dated to 1632 and the first depiction of a type IV.A I could find is dated to 1637 (Figure 12).³⁰ Both types of halberd are continuously depicted in *Schutterstukken* up to the mid-17th

Dating	Amount of Soldiers	Amount of Halberds		Source	Reference
1512	400	40	(10%)	Diary Dolnstein	Skjelver, 40
1535	232	77	(33%)	City accounts, Hasselt	Benders,21
1552	965	219	(23%)	City accounts, Alkmaar	Mol, 98-100
1570	400	50	(25%)	Ordinance, German Emperor	Van Nimwegen et al, 119
1572-77	150	8	(6%)	Muster-roll, Holland companies	De Jong, 472
1573	100-260	20-24	(5%-15%)	Muster-roll, English companies	Van Nimwegen et al, 120-21
1587	97-145	7-15	(6%-13%)	Muster-roll, Frisian companies	Van Nimwegen et al, 127
1588-98	134	12	(9%)	Model company, Holland	Van Nimwegen et al, 127
1598	92	5	(5%)	Muster-roll, Zeeland companies	De Jong, 472

FIGURE 13. The number of halberdiers present in companies during the 16^{th} -century in the Low Countries.⁴⁰

century.³¹ Class IV halberds were not only used in the Low Countries during the 17th century. A halberd similar to type IV.B was excavated at Fort Ticonderoga, USA, and has been linked with the French and Indian War (1754-1763), while a halberd similar to type IV.A has been excavated in the USA bearing the date 1758.³² Drawings of the 18th century Dutch army, show an officer with a similar halberd, implying use of them well into the 18th -century.³³ This does not denote other types of halberds were not in use. Interestingly, after 1656 Swiss cities ordered straight or slightly convex edged halberds which could be either placed in class I or II, as part of the city armoury.³⁴ These are known today as Sempach type (Figure 12).

Combat and tactics

Weapon use can be differentiated between being intended for violent interactions, i.e. combat, or for symbolic functions. Obviously, it was possible for a halberd to serve more than one function, and these functions were furthermore dependent on the context in which the weapon was used in. The historical use of halberds can be researched by examining the design features of the halberd and making an interpretation of their use. For example, the size of the blade or spike, or even the suitability of a halberd to withstand the force of combat. Alternatively, historical documents describing the use of the halberd or art depicting the use of the halberd can be analysed. However, before historical documents mentioning halberds can be used it is essential, as stated in the introduction, to establish a link between the historical term and the object implied by it. At least from the 16th century onwards it appears that the modern concept of the halberd and the historical terms overlap. The Maximilian Zeugbuch (1502) mentioned earlier describes modern halberds as Helmparten.³⁵ In his diary landsknecht Dolstein (pre-1512) draws a formation of soldiers armed with pikes and halberds, and describes the formation as armed with *Spieß* (pike) and Halbarten.³⁶ In his fight book Joachim Meyer describes the use of the helleparten (1570) and portrays the use of the halberd.³⁷ The earlier mentioned drawings from 1582 of the Aankomst van Hertog van Anjou portrays a group of halberdiers as

19



FIGURE 14. Examples of examples halberdiers as bodyguards. 14.1) *Ruiterportret van Augustus keurvorst van Saksen* (1555-1562), Virgilius Solis, © Rijksmuseum; 14.2) *Intoch van Matthias te Brussel* (1578-1580), Frans Hogenborch, © Rijksmuseum; 14.3) *Intrede van Cosimo I te Rome in 1569* (1582), Philips Galle, © Rijksmuseum; 14.4) *Processie voor intocht van paus Clemens VIII in Ferraraz* (1598), Antonio Tempesta, © Rijksmuseum.

Helbardiers de son Exelence (Figure 11.3).³⁸ Therefore, I assume the historical term *halberd* and the modern concept of halberd approximately correspondences from the 16^{th} century onward.

The halberd – a weapon of war

To examine the use of the halberd as a weapon of war I will analyse several historical sources describing the use of the halberd in the Low Countries as a case study. I have chosen to examine the 16^{th} and 17^{th} century due to the direct link between the historical and modern concept of the halberd. In Figure 13 the number of halberds presumably carried by a group or company of soldiers in the Low Countries has been presented. The data has been based on research describing the use of halberds within armies. A declining trend can be observed in the percentage of halberdiers present in companies. Starting in the first half of the 16^{th} century halberdiers formed 20% to 30% of the soldiers in a company, but after 1570 they formed roughly only 5% to 10% of the soldiers in companies while, after 1598, halberdiers were no longer used in companies of the county of Holland.³⁹ This disappearance of the halberd in the armies seems to partly overlap with the introduction of the concave blade edge, for

example, halberds of type II.A and its subtypes. This possibly implies that halberds with concave blade edges were not designed to be used by formations of men during war or grand-scale battles. However, the decline of halberds in army compositions could also possibly be explained by the even greater emphasis on firearms during warfare.

The disappearance of the halberd in armies in the county of Holland after 1598 does not imply the halberd became obsolete as a weapon of war in Europe. Well into the 17th century the halberd was still used as a weapon of war in Switzerland. As mentioned earlier, from 1656 onwards large stocks of halberds with large square straight or convex edged blades with a small point, were again commissioned for the city armouries of both Berne and Zurich.⁴¹ For example, in Bern in 1662 10% of the 13,200 city militia had to be armed with a halberd.⁴² This implies regional variations across Europe with regard to the use of halberds as a military combat weapon, or at least the use of the halberd in large groups.

The halberd – the choice for personal guards

Halberds were not only used during war. Examining 16th and 17th century drawings it is striking that numerous political or noble figures are accompanied by halberdiers, known as trabants (Figure 14). Furthermore, this correlates with the term hellebar*dier* meaning bodyguard in Dutch between the 17th and 19th century.⁴³ There seems to be a correlation between guards and type III.A halberds. Several type III.A originate from the personal guard of the Elector August of Saxony. Three type III.A have a number stamped into the langets of the head, implying a possible location in an armoury.44 The earlier mentioned dates (1563 and 1578) etched on type III.A, overlap with the appointment of a new Elector.⁴⁵ Halberds could have been a perfect guard's weapon, especially type III.A. The goal of a bodyguard is not to eliminate all enemy combatants but to protect an individual. The length of the halberd could keep enemies at bay and the multifaceted head would ensure halberds could be used against a large array of differently armed and armoured opponents. Swinging the halberd around could make space in densely crowded areas, therefore, enabling effective crowd control. Similar tactics are described by Francesco Fernando Alfieri for the use of the Montante, a large two-handed sword, to clear a street of a mob.⁴⁶ The design of type III.A halberds does lend itself well for this type of application. The slightly concave blade edge can be used to push enemy weapons to the side to make space but could also be used to strike opponents. Furthermore, the spear-like hollow- ground point has sharp edges enables its user to cut effectively with the edge of the point, especially against unarmoured opponents, those expected to attack a person of interest during a spontaneous uprising by the local populace. Of course, not only type III.A halberd could be used by bodyguards. Large- bladed halberds with a straight or slight concave blade edge are also depicted in use by bodyguards.

The halberd – a symbol of rank

As stated earlier, halberd blades appear to develop from large straight edge bladed types to those with smaller concave edged blades, with the shift in design roughly occurring during the second or third quarter of the 16th century. Several writers state that the introduction of the concave blade edge and points protruding from the head implied the end of the halberd as a true combat weapon.⁴⁷ However, I disagree with this statement. With the development of the halberd its combat function changed. The straight edge blade was primarily designed to inflict physical trauma through striking, as depicted in many of the landsknecht battles of the first half of the 16th century, but the concave edge, in conjunction with the protrusions, was used as a means to control an opponent weapon, before inflicting trauma with the point. This more thrust- orientated fighting style would explain the longer spike on many concave- edged halberds, compared to those with straight edges.⁴⁸ This fighting style is also observable in 16th century fight books. In the fight book, Gründtliche Beschreibung der Kunst des Fechtens, by Joachim Meyer, from 1570, the focus is on gaining control with the blade of the halberd and inflicting trauma principally through thrusting.⁴⁹ The same is observable with the previous mentioned Dutch fight book Schermkunst (1595) (Figure 11.5), portraying the use of the blade in gaining control of the opponent's blade or body, before ending the fight with the point.⁵⁰ The emergence of the concave edge on halberds, overlapping with the decrease in halberdiers in military companies and eventually leading to the disappearance of halberds in several armies (Figure 13), possibly characterised the slow development of the halberd becoming more focused on interpersonal combat in smaller scale engagements rather than being used in combat with larger groups. The smaller groups of halberdiers in military companies, armed with concave- edged halberds, could, for example, be used as bodyguards for the captain, the banner bearer and the musicians of the army being prime targets for any enemy.⁵¹ The reintroduction of large numbers of straight or slightly convex- edge bladed halberds in Switzerland that were intended to arm the city militia during war in the 17th century tangentially support this hypothesis.

During the 17th and 18th centuries halberds became indicators of military rank, shifting their function primarily from combat to being symbolic.⁵² The question arises if this shift in use is also observable in the design of the halberd, and vice versa; is it possible to deduce a purely symbolic function of a halberd from its design? I would argue that the differentiation between symbolic and combat use should not be seen as a dichotomy, but should be perceived as a more fluid differentiation between a 'fighting halberd' and a 'symbolic halberd', e.g. symbol of rank, is possible, but should be based on the primary function of the halberd, and context in which the halberd was used. This function can be based on its design. If a major part of a halberd's design has no combat viability it can be called a 'symbolic halberd' or symbol of rank. Nevertheless, the halberd can still partly have a combat function. Good

examples are those of types IV.A or IV.B. These have a sturdy spear-like point usable for combat, but the blade is inserted into the socket and is far thinner than other halberd blades; I to I.5 mm in thickness. Consequently, striking with this halberd would surely break its blade, although the halberd could function as a spear if the need arose. Several examples of these halberds within the collection of the National Military Museum are similar in design but are made either with a solid construction or have a thicker blade. This implies their use was more combat orientated, notwithstanding they still could function as a symbol of rank.

Conclusion

As the typology in this article demonstrates there is great variety in halberd designs. For research into halberds to advance it is imperative to recognise these different forms and marry data and interpretation with the different types. It is essential to use a sound methodological approach in connecting halberds and interpretations in their dating, use or provenance. The reader is urged, first and foremost not make the error of forcing modern and historical concepts together but to differentiate between the two and examine them separately before systematically comparing elements with each other. Using this methodology, it is possible to add interpretation to the different types of halberds and recognise overarching trends linked to the interaction between design and dating. Consider, for example, the relationship between the disappearance of the halberd as a weapon used by large military units and the introduction of the concave bladed halberd. This was probably based on a shift in focus; large straight-edge bladed halberds being designed for use in large groups, for example on the battlefield, while the use of concave- bladed halberds was focused more on personal combat. Of course, the design should be able to withstand the forces experienced during combat. For example, although type IV.A and IV.B halberd have straight-edged blades, these would surely break if used in combat.

To reiterate, this article is intended merely to form the basis for future research. More data must be added to the typology by analysing other large collections to create new classes, types, and subtypes. Especially, a new class needs to be added with halberds with 'eyes' as a socket, a recurring theme in historical artwork and examples in other collections. This typology is a framework from which to continue working and to inspire more research into the diverse and arguably undervalued weapon called the halberd.

Acknowledgements

The author would like to thank the staff of the National Military Museum, Netherlands, for the possibility to examine their halberd collection, especially Jeroen Punt, Curator, for his help, support and feedback on the research and article. I am indebted to Viktor Baltus for the digitisation of the halberds. Without his aid it would have been impossible to create the different figures in the article. Furthermore, I would like to thank Jan-Piet Puype for his feedback and opinion. All opinions presented and errors rest with the author. The author declares that he has no conflict of interest.

Notes

- ¹ J. B. Kist and J. P. Puype, 'Wapens Op Schuttersstukken', in *Schutters in Holland. Kracht En Zenuwen van de Stad.*, ed. by M. Carasso-Kok and J. Levy-van Halm (Zwolle: Uitgeverij Waanders, 1988), pp. 164–71.
- ² J. A. Mol, De Friese Volkslegers Tussen 1480 En 1560 (Hilversum: Verloren, 2017); D. M. Skjelver, 'There I, Paul Dolnstein, Saw Action'. The Sketchbook of a Warrior Artisan in the German Renaissance (Master Thesis, University of North Dakota, 2012), pp. 136–8.
- ³ E. Oakeshott, European Weapons and Armour. From the Renaissance to the Industrial Revolution (Woodbridge: The Boydell Press, 1980); C. Blair, European and American Arms, 1100-1850 (New York: Bonanza Books, 1962).
- ⁴ W. Y. Adams and E. W. Adams, Archaeological Typology and Practical Reality: A Dialectical Approach to Artifact Classification and Sorting (Cambridge, New York: Cambridge University Press, 1991), pp. 10–1.
- ⁵ Adams and Adams, p. 9.
- ⁶ Some data is present within the halberds themselves and can be reconstructed using scientific methods. For instance, using C¹⁴-dating to determine the age of the shaft, or Isotope analysis to determine the origin of the steel. However, these methods are often costly and possibly do not delivered the expected result due to contamination through time.
- ⁷ E.g. J. Waldman, Hafted Weapons in Medieval and Renaissance Europe (Leiden; Boston: Brill, 2005); G. A. Snook, The Halberd and Other European Polearms 1300-1650 (Alexandria Bay: Museum Restoration Service, 1998); Oakeshott, pp. 47–8; H. Seitz, Blankwaffen 1 (Braunschweig: Klinkhardt & Biermann, 1965), pp. 226–7; Blair; B. Dean, 'The Evolution of the Pole-Arm', The Metropolitan Museum of Art Bulletin 11.7 (1916), 152–4; O. von Kretschmar, 'Benennung Der Stangenwaffen', Zeitschrift Für Historische Waffenkunde 4 (1904), 212; D. Ash, 'The Fighting Halberd', Connoisseur, May (1950), 101.
- ⁸ Translated using <<u>http://www.woerterbuchnetz.</u> de> [accessed on 30 October 2018].
- 9 Waldman, p. 22.
- ¹⁰ R. B. F. Van der Sloot, *Middeleeuws Wapentuig* (Bussum: C.A.J. van Dishoeck, 1964), p. 54.

- ¹¹ Bayerische Staatsbibliothek. Zeugbuch Kaiser Maximilians I. BSB-Hss Cod.icon. 222 (1502) f.72r.
- ¹² The term *Hellebaard* is still used to describe halberds in modern Dutch; M. A. G. de Jong, 'Militaire Hervormingen in Het Staatse Leger En de Opbouw van Het Wapenbedrijf, 1585-1621', *BMGN-Low Countries Historical Review* 118.4 (2003), 479.
- ¹³ E.g. H. Sarfatij, Archeologie van Een Delastad. Opgravingen in de Binnenstad van Dordrecht (Utrecht: Matrijs, 2007), pp. 14, 301.
- ¹⁴ R. van Oosten, 'De Valkuilen van de Historische Sensatie', *Low Countries Historical Review* 130.4 (2015), 95–6.
- ¹⁵ E.g. R. C. Woosnam-Savage, "All Kinds of Weapons:" the Weapons of Agincourt' in *The Battle of Agincourt. The Illustrated Companion*, ed. by A. Curry and M. Mercer (London: Yale University Press, 2015), p. 146; Waldman, p. 156; Blair, pp. 29–30; Oakeshott, pp. 49–50.
- ¹⁶ Waldman, p. 155.
- ¹⁷ Due to the absence of halberds with 'eyes' as a means of attachment to the shaft within the collection of the 'National Military Museum, these are not described within the typology and should be added as another class as part of future research.
- ¹⁸ Adams and Adams, p. 187.
- ¹⁹ Jurg A. Meier, 'Sempacher Halbarten. Die Schweizerische Halbartenrenaissance Im 17. Jahrhundert', in Blankwaffen; Armes Blanches; Armi Bianche; Edged Weapons, ed. by Karl Stuber and Hans Wetter (Zürich: Gut & Co. Verlag, 1982), pp. 223-50; Jurg A. Meier, 'Stangenwaffen Aus Kempten Fur Zürich. Die Lieferung Claus Lerchlis in Den Jahren, 1585-1591', Rappart de l'institut d'armes Anciennes 3-4 (n.d.), 213-24.
- ²⁰ Oplodidaskalia sive Armorvm Tractandorvm Meditatio Alberti Dvreri (MS 26-232); Peter Murray and Linda Murray, A Dictionary of Art and Artists (Baltimore: Penguin Books, 1959), p. 139.
- ²¹ Meester van Rhenen, Het beleg van Rhenen 1500, <http://hdl.handle.net/10934/RM0001.COLLECT. 7482> [accessed 22 November 2019].
- ²² E.g. Albrecht Dürer, *Een ruiter en een soldaat* 1494-1498, http://hdl.handle.net/10934/ RM0001.COLLECT.33619>; Albrecht Dürer, *Landschap met kanon* (1518), http://hdl.

handle.net/10934/RM0001.COLLECT.33219> [accessed 22 November 2019].

- ²³ Bayerische Staatsbiblitohek. Zeugbuch Kaiser Maximilians I. BSB-Hss Cod.icon. 222 (1502) f.72r; Urs Graf, Hellebaardier in liefde ontstoken voor een naakte vrouw (1517), <http://hdl.handle. net/10934/RM0001.COLLECT.20598> [accessed 22 November 2019].
- ²⁴ C. Agrippa, *Trattato Di Scientia d'Arme*, Con vn Dialogo Die Filosofia (Rome: Antonio Blado, 1553), p. LX.
- ²⁵ Meier, 'Sempacher Halbarten', p. 232.
- ²⁶ Abraham de Bruyn, Aankomst van de hertog van Anjou te Antwerpen en ontvangst door de prins van Oranje (1582), <http://hdl.handle.net/ 10934/RM0001.COLLECT.447399>; Jan van der Straet, Intrede van Cosimo I te Rome in 1569 (1582), <http://hdl.handle.net/10934/RM0001. COLLECT.490961>; Hendrick Goltzius, Sergeant (1587), <http://hdl.handle.net/10934/RM0001. COLLECT.425676> [accessed on 22 November 2019]; R. van Noort, Swordplay: An Anonymous Illustrated Dutch Treatise for Fencing with Rapier, Sword and Polearms from 1595 (Wheaton: Freelance Academy Press, 2015), pp. 67–78.
- ²⁷ Seitz, p. 385.
- ²⁸ Rijksmuseum, Object Number NG-NM-7702, <http://hdl.handle.net/10934/RM0001.COLLECT. 372007> [accessed 22 November 2019].
- ²⁹ Cornelis Ketel, Het korporaalschap van kapitein Dirck Jacobsz Rosecrans en luitenant Pauw (1588), <http://hdl.handle.net/10934/RM0001.COLLECT. 8879> [accessed 22 November 2019].
- ³⁰ Thomas de Keyser, Officieren en andere schutters van wijk III in Amsterdam onder leiding van kapitein Allaert Cloeck en luitenant Lucas Jacobsz Rotgans (1632), <http://hdl. handle.net/10934/RM0001.COLLECT.8882>;
 - Frans Hals and Pieter Codde, *Schutters van wijk* XI onder leiding van kapitein Reynier Reael, bekend als 'De magere compagnie' (1637), <http://hdl.handle.net/10934/RM0001.COLLECT. 8613> [accessed 22 November 2019].
- ³¹ Kist and Puype.
- ³² B. Dean, 'On American Polearms, Especially Those in the Metropolitan Museum of Art', *Metropolitan Museum Studies* 1.1 (1928), 37–8.
- ³³ I would like to thank M. Willemsen for this suggestion; British Library, SIXTY-ONE coloured drawings of Dutch military costume and musket

exercises (Add MS 20728) <http://searcharchives. bl.uk/IAMS_VU2:IAMS032-002091074 > [accessed 25 December 2018].

- ³⁴ J. A. Meier, 'Halberte Oder Bajonett Zur Vorgeschichte Des Bernischen Sieges in Der 2. Schlacht Bei Villmergen 1712', Waffen- Und Kostumkunde I (2005), 43–7.
- ³⁵ Bayerische Staatsbiblitohek. Zeugbuch Kaiser Maximilians I. BSB-Hss Cod.icon. 222 (1502) f.72r.
- ³⁶ Skjelver, pp. 136, 155.
- ³⁷ J. L. Forgeng, The Art of Combat. A German Martial Arts Treatise of 1570 (London: Greenhill books, 2006), 260.
- ³⁸ Anonymous, Aankomst van de hertog van Anjou te Antwerpen en onvangst door de prins van Oranje (1582) <http://hdl.handle.net/ 10934/RM0001.COLLECT.447399> [accessed 22 November 2019].
- ³⁹ Skjelver, p. 36.
- ^{4°} Skjelver, p. 40; J. Benders, 'Hasselt 1521: een Overstichts Stadje in de Greep van Hertog Karel van Gelre' (Rijksuniverseit Groningen, 1992), p. 21; Mol, pp. 98–100; O. van Nimwegen, A. van Vliet and L. Sicking, 'Het optreden van leger en vloot van de opstandelingen' in *De Tachtigjarige oorlog: Van opstand naar geregelde oorlog* 1568-1648, ed. by P. Groen (Amsterdam: Boom, 2013), pp. 119, 120–1, 127; De Jong, p. 472.
- ⁴¹ Meier, 'Halbarte Oder Bajonett', pp. 43–7; Meier, 'Sempacher Halbarten', pp. 232–7.
- ⁴² Meier, 'Halberte Oder Bajonett', p. 42.
- ⁴³ Middle Dutch Dictionary <http://gtb.inl.nl/ search/> [accessed 2 November 2018].
- ⁴⁴ NMM Object number 011511, 014812 and 014825.
- ⁴⁵ NMM Object number 011511 and 018383.
- ⁴⁶ F. F. Alfieri, Lo Spadone (Padova: Per Sebastiano Sardi, 1653), p. 28.
- ⁴⁷ E.g. Blair, p. 26; Snook, p. 6.
- ⁴⁸ For example, NMM object number 014842 (type II.D) has a point of 57 cm, and object number 014857 (type II.F) has a spike of 58 cm.
- ⁴⁹ Forgeng, pp. 260–6.
- ⁵⁰ Van Noort, pp. 67–78.
- ⁵¹ In 1583 William Garrard argued that halberdiers should 'bee gards vnto Captaines & Ensignes' William Garrard, *The arte of warre beeing the onely rare booke of myllitarie profession* (London 1583), p. 83 <http://name.umdl.umich.edu/A01504. 0001.001> [accessed 22 November 2019].
- ⁵² Dean, 'On American Polearms'.

Notes on contributor

Casper J van Dijk is a Masters student of archaeology and history at Leiden University. He is also chairman of the Dutch National Historical European Martial Arts Federation (H.E.M.A. bond).

Correspondence to: Casper J. Van Dijk. Email: casper.j.vandijk@gmail.com; https://leidenuni.academia.edu/CasperJvanDijk; https://www.linkedin.com/in/CasperJvandijk/