

# Bronze Age Metalwork

Techniques and traditions in the  
Nordic Bronze Age 1500-1100 BC

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To my husband and my two perfect girls,

Thank you

„Seht ihr den Mond dort stehen?  
Er ist nur halb zu sehen,  
und ist doch rund und schön!  
So sind wohl manche Sachen,  
die wir getrost verlachen,  
weil unsre Augen sie nicht sehen.“

*(Matthias Claudius, 1790)*



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## Preface

This book presents the slightly reworked version of my PhD dissertation entitled 'Craftsmanship and Metalwork in the Nordic Bronze Age: Craft Organisation, Craftspeople and their Areas of Contact', submitted in December 2014 at Aarhus University.

Due to the vast topic and range of potential approaches to the subject, this study is divided into four main parts – an introductory section, two methodological sections, and an evaluation of the material and data. In order to allow the reader to individually choose preferences, while structuring the work, much attention was paid to ensuring that each part (the analysis as well as the theoretical background) in itself is coherent. As such, each part has a separate introduction and history of research, in order that the basic literature on each of the three main parts (material, craft and theory) can be quickly established.

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# Introduction

This study has its roots in a source-critical classification of Nordic Bronze Age collars, from which was born the question as to the extent to which a formal typological classification of objects would allow statements about the actors behind such artefacts. Knowing that occasionally workshops are determined using typological studies (i.e. Jockenhövel 1991: 51; also Aner 1962; Torbrügge 1965: 98; Jankuhn 1969: 89) a pertinent question was how far ranging the significance of a formal type-classification could be, and if more information than just the chronological and regional distribution might be extracted from classificatory studies. Consequently, a series of questions was formulated, centred around the possibility of tracing the acting agent behind the material culture bequeathed to us from the Bronze Age in northern Europe.

After consulting selected anthropological and sociological literature, which aroused my interest, partly due to my background as a trained goldsmith, the core questions were developed: is it possible, by an intensive study of the material remains of the Bronze Age in northern Europe, to reconstruct the production of metal artefacts, and to determine the workshop in which these artefacts were made, as well as their area of influence? Can an identification of the acting agent be of use in regard to the organisation of metalcraft in the Nordic Bronze Age (NBA)?

The fact that the basic physical properties of the materials under study are not subject to any change in time allows a reconstruction of craft techniques based on traces left on the object. The aim of the study was not to ascertain a name and 'telephone number' to the acting agent, but rather to show that knowledge of the individual and his/her actions can make a large contribution to the understanding of broader social groups, an opinion different to that the one expressed by Marcia-Anne Dobres: 'attributing some identity to a past social dynamic...is not necessarily going to help us understand how such practices were part of social tradition' (2000: 142).

The material to be examined was defined quickly. In order not to manipulate the interpretation of possible traces or decorative elements through utilising artefacts falsely interpreted as being of Nordic origin, the source material needed to be critically examined, for example the neck collars of the NBA periods II and III (Nørgaard 2011). In addition, all bronzes discovered in the same context were considered potentially suitable for investigation, so that the material selected included the majority of the magnificently decorated ornaments within the chosen area, such as neck collars, belt discs

and plates, pins, fibula, tutuli and, occasionally, arm and leg ornaments.

In archaeology it has long been a common assumption that stylistic similarity is equal to technical similarity and, thus, that the dissemination area of typological groups can be related to workshops. With the understanding that formal similarities can actually arise independently of their production, and that they should, therefore, be considered separately, it was noted that workshops can only be detected by the exact knowledge of all objects of a formal group and then only by technical comparison. This statement can be restricted even more: a determination of a prehistoric workshop is only possible if the production traces, metal compositions and other production-related properties of the object match.

The term 'workshop' in the modern sense, as defined in the Oxford Dictionary, is 'a room/ building in which things are made or repaired using tools' (Phillips *et al.* 2010: 1779). A very different meaning applies in art history to the term 'workshop'. Beyond the simple description of the workplace, the workshop concept involves a close relationship between the living and working space of the artist (also potentially several people), and the work area should meet specific requirements. Workshops are compared with handicraft production facilities and the training of apprentices is included in the same manner under this term, as art schools and 'Meisterhäuser' are equated with workshops (Strauss *et al.* 1987). Art produced in one workshop is not necessarily made by one artist, rather, it should be seen as work that was done by several persons working for the specific artist (Strauss 1994). As for prehistory, a direct correlation should not be made, the workshop concept needs to be redefined in our sense. Thus, one needs to define between workplace and workshop. A workplace includes the working space of one or several craftspeople as well as those who are involved in the crafting operations, for instance helping hands or apprentices. A workshop, on the other hand, is defined by the people, the close technical interaction between craftspeople, and not the physical location where these actions are executed. As such, this study introduces the term of an *analytical workshop*, to determine the closest interaction group of craftspeople and a probable location where these craftspeople operated, solely based on the material culture investigated. Within this study it will be outlined that within a workshop the individuals are in close relationship (physically and technically), and thus, the term 'analytical workshop' will be used to describe the specific way in which the objects were made.

The foundation for a successful identification of workshops is based on the knowledge that each craftsman's intuition leaves its mark, like fingerprints. The choice of the tool, the way in which a decorative element is introduced and combined, and the various techniques used, are individual decisions that make the object of a craftsman unique and allow us to assign artefacts to specific individuals. A similar approach is a common tool in art history as a means of determining the artist through a chain of individual characteristics (Gell 1998). Specific face types, a small mouth and small pointed noses, may be assigned to the Cologne Master. The way in which the ornamental foliage and brocade fabrics are made can be used as a clear indication of the influence of Broederlam<sup>1</sup> and their simplification might indicate the development of these forms by his apprentices (Panofsky 1981: 87-89).

In our modern world it is almost impossible within all the mass-produced products to identify the individual character of an object. In the Bronze Age, however, above all between 1700-1100 BC, it is very likely that the ornaments and weapons were unique. Thus, the uniqueness of an object depends to a large extent on the technology with which it was produced. The Nordic Bronze Age is characterised by large, massive bronze ornaments, some of which are extensively decorated. Nevertheless at the beginning of this period, simple weapons appear, as well as mainly undecorated ornaments. This stylistic difference is based on the technique used to craft the artefacts. Ornaments, between 1800-1600 BC, were mostly made by forging. Only weapons and tools were cast in clay and stone moulds, and later also via *cire perdue*. The metalworkers of NBA IB were true masters of their craft, as demonstrated by the neck ring set from Tinsdahl (Drescher 1953).

Conversely, the large bronze ornaments of NBA II and III were mainly made via casting. The 'new methods', such as the *cire perdue* cast, allowed a much finer decoration, since the individual motifs were introduced into a wax model. On forged objects individual tracks are easily recognisable as the metal, once deformed, cannot be returned to its original form without leaving a trace. Artefacts produced by casting in reusable moulds may resemble each other strongly, and since all errors and peculiarities of the original or the form are passed on here, additionally the possibility exists of an identification of related artefacts (see Jantzen 2008). However, objects that are made via *cire perdue* are inevitably individual pieces. In this situation, where the

final form is already defined in the wax model and the design applied using specially made tools it might be possible to identify the Bronze Age smith and his/her area of influence.

As such the artefacts with similar or identical tool-traces shall be related to an individual craftsperson. Artefacts mirroring similar techniques or ways of doing may also be made by one and the same person, however, they can also derive from a closely related group of craftspeople, from a workshop. A workshop, as used in this work, displays the smallest interaction group in metalcraft (after Redman 1977: 44), based on the concept that craftspeople working in close interaction are able to share tacit knowledge and, thus, parts of their *habitus* will be similar. As the artefacts within this study are assigned to a specific workshop solely by their residues of the crafting process, the predicted location of this specific workshop is fictive. Only occasionally are physical workshops preserved, which can be explained through the invisibility of the stationary tools in settlements, although, this study relies on the material culture to define these workshops. As a result, these workshops should be seen as 'analytical workshops' and stay as such until further studies will reveal the actual location where the artefacts might have been crafted. Hereafter, the defined analytical workshops are indicated as (AW), however, within the text the term workshop will still appear and is to be understood in the above-defined way. All physical excavated sites related to metalwork will be named working or metalworking places.

### Definition of terms

In the following, the terminology is discussed in order to provide an understanding of key terms and to demonstrate how the perspective of the author relates to the methodologies and analyses employed in the study.

### Technique and technology

Technique and technology should be considered as two independent concepts. Yet their meanings have undergone change over the centuries, with the result that both terms are interpreted in a modern perspective in a very different way than contained in the origin of the word (Ingold 2000: 312ff.).

Regardless of modern views (see Ingold 2000: 312-313), technique as well as technology should (in the study of prehistoric communities) be understood through a return to the roots of the respective terms. Thus the word technology originates from the Greek *tekhnē* and *logos*. *Tekhnē* is the pictorial representation of an inseparable combination of art, skill, craft, law, as well as knowledge, attitudes, understanding and

<sup>1</sup> Melchior Broederlam von Ypern (from 1387 to 1409 named in the account books at the court of King Phillip of Burgundy) was one of the greatest Pre-Eyckian panel painters. His most important works are the paintings on the wooden altar created by Jacques de Baerze (1394), including the 'Adoration of the Magi' and the 'Childhood of Christ' cycle (Panofsky 1981: 83-88).

awareness (see Phillips *et al.* 2010; Dobres 2000: 50-59; Ingold 2000: 316). *Logos* in its original meaning is not only reason, the structure of reality, but also language and accountability. Interestingly, the term *technikos* in its original meaning includes the ability, the art and practicality, and thus all things *tekhne* means (see Dobres 2000: 52).

What, then, is technique? The definition in the German Language Dictionary *Duden* 'die Gesamtheit der Maßnahmen... die dazu dienen, naturwissenschaftliche Erkenntnisse praktisch nutzbar zu machen' (Wermke *et al.* 2001: 981), demonstrates clearly the controversy concerning the origin of the word.

The Oxford Dictionary defines technique as 'a way of carrying out a particular task, especially the execution or performance of an artistic work or a scientific procedure' (Phillips *et al.* 2010: 1589). However, when defining the word technique Ingold remembers its Greek origin (whether classically interpreted by Aristotle or non-Aristotelian) and describes technique as 'personal skills and capabilities where the person ... applies motor force, guides the movement of the tool' (Ingold 2000: 315).

Nevertheless, why should technology and technique be considered independently if indeed the origins of both words contain similar meanings?

According to the state of the art in the humanities, technology can be considered as an embodied form of social practice (Dobres 1999a; 1999b: 126; Mauss 1973; Lemonnier 1993: 3; Ingold 2000: 314) and is in this not just limited to craft activities, because technologies are the driving forces in material, as well as in social change, and serve as a medium through which views are expressed (see Dobres 1999b: 128; Berg 2007: 234; Zagal-Mach 2008: 197; Coupaye 2009: 434). Technologies are thus man-made processes that offer a way for further development and are 'a major causal motor of cultural evolution...(and it) is said to underline and thus shape most other aspects of culture' (Dobres 2010:103).

Technology can first and foremost be viewed as an agglomeration of different choices that express the cultural environment, and not a process driven by a single individual. The triggers are 'the satisfaction of various needs' (Mahias 1993: 166; see also Berg 2007: 234). Technology is born from the knowledge of what is possible (Sillar and Tite 2000: 9; Zagal-Mach 2008: 197; Ingold 2000: 315).

The origin of both words contains the direct reference to an individual's ability to create. This does not

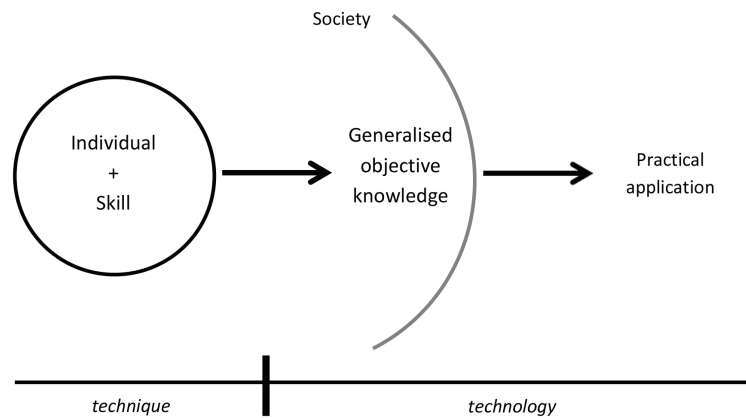


Figure 1.001: Schematic illustration of the difference between technique and technology.

require any equipment or tool, in contrast to modern definitions. Ingold underlines the difference clearly when he shows that ability and knowledge come from the individual and a possible tool is to be regarded as the extension of limbs: 'if all technical activity is tool-using activity, it is because the technique is seen to reside, outside the user, in the tool, and to come "packaged" – like the instruction manual for a piece of modern machinery – along with the tool itself... to the contrary... technique is embedded in, and inseparable from, the experience of particular subjects in the shaping of particular things' (Ingold 2000: 315).

Thus, the basis of both terms is the ability of the agent, his knowledge and the practical exercise (Dobres 2000: 52; Ingold 2000: 316). The fundamental difference between technique and technology lies therefore in the integration of the social (Figure 1.001). With the objective knowledge of the society, techniques become technologies (see also Martín-Torres 2002: 35).

In this work, the term 'technology' is defined as follows: a certain way to carry out a practical action (a technique) that is controlled by society. In this, the knowledge of individuals and the knowledge in which way such an action is to be executed is to be seen as the basis - the knowledge of the possible. The society that controls this knowledge directs the processes and decides when and what action seems appropriate. Technology is to be regarded as a social process; as a whole grown from the group, which builds on the knowledge and skills of individuals. Technique, however, should be understood as the individual's ability to create an object in combination with his knowledge, skill and will.

### **Craft or craftsmanship**

The term 'craft' is shaped by our modern society. Jantzen explains in regard to the German term 'Handwerk', that: 'der Begriff „Handwerk“ eine Organisationsform

bezeichnet, die sich erst im Mittelalter und in der Neuzeit herausbildet' (Jantzen 2008: 6).

Craft was considered as a counterpoint to pre-industrial production. Craft in this sense describes commercial products based on production by hand. However, this does not mean at all that a use of the term in prehistory is not possible (in contrast: Jantzen 2008: 6).

To further extract the meaning of the discussed term, both the English and German word is examined. The German word consists of two parts, 'Hand' and 'Werk'. A definition of the first term is not necessary because of its unambiguity. The second part, however, should be considered in more detail. A 'Werk' is equated with work or activity. Interchangeably the term 'creation' can be used. In its basic meaning 'Handwerk' is therefore the work of the hands. Viewed in this way, the term does not include any reference to the modern industrial world. It just describes an activity exerted by hand.

In English, the term craft is accompanied by two similar terms. One is craftsmanship and the other handicraft. The latter similarly connects to the German concept of an activity executed by hand. The first term is somewhat more informative. The *Oxford Dictionary* explains craftsmanship as: 'the level of skill shown by somebody in making something beautiful with their hands', and craft is 'an activity involving a special skill at making things with your hands' (Phillips *et al.* 2010: 354).

In this explanation, the ability to create something is the main point. Moreover, in the combination of hand and activity, the qualitative aspect within this combination is of importance. Craft is therefore qualitative work executed by the hand. The term craftsmanship should thus be used by referring directly to extremely skilled work. Understood in this respect the term can be applied within this work without compromise, since the objects presented here are considered to be of high quality and definitely created by hands.

However, what makes craft? What does it take to be a craftsman? According to Sennett 'The craftsman is a more inclusive category ...he or she represents in each of us the desire to do something well, concretely, for its own sake' (2008: 144). Sennett describes as a decisive factor for craftsmanship the desire to do a good job for its own sake (2008: 9). For this, the executive agent requires skills. These are acquired through practical exercise and give the artisans, combined with the necessary knowledge (which can be acquired through learning), the ability to create objects.

On the origin of these skills, there are two different views. One is represented by Sennett and says that 'we

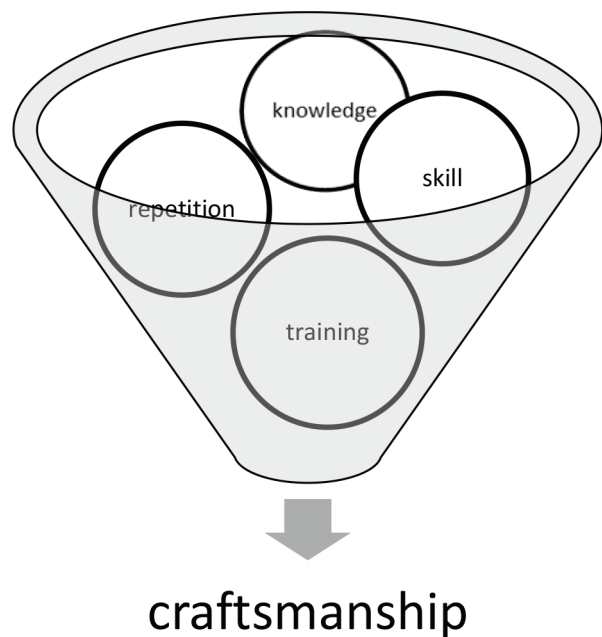


Figure 1.002: Pictured craftsmanship.

share in common and in roughly equal measure the raw abilities that allow us to become good craftsman' (2008: 241) and '... skill is trained practice' (2008: 37). Others see within the abilities of a person an innate 'ability to use one's knowledge effectively and readily in execution or performance' (Bamforth and Finlay 2008: 1). Unity lies, however, within the fact that skills are deepened and expanded through knowledge and practice (Bamforth and Finlay 2008: 19; Berg 2007: 244).

In summary, craft can be defined as follows: The base of craft is the skill of the individual person. A motivation resting within the interest in craft favours the acquisition of skills through practice and learning. The goal is quality work (Figure 1.002).

However, upon a consideration of craft in prehistory a restriction must be made. Schlesier in 1981 first categorised artisanal activities, to facilitate their handling in prehistory. He tried to divide craft with respect to the varying degrees of specialisation, the underlying motivation and its quality, into categories that in the following discussion will help to make statements regarding its integration into a community (Figure 1.003).

Basically, Schlesier distinguished between housecraft and handicraft and defined a third form of craft, the so-called 'subsistence-craft'. This term should describe the intermediate step between homecraft (the items crafted in a household for one's own use) and full-time crafting (Schlesier 1981: 13; see also Santley and Arnold 1986: 2-4; Olausson 1997: 269; Zagal-Mach 2008: 190). Craftsmen doing subsistence craft produce both for their own use and on demand for others, but without

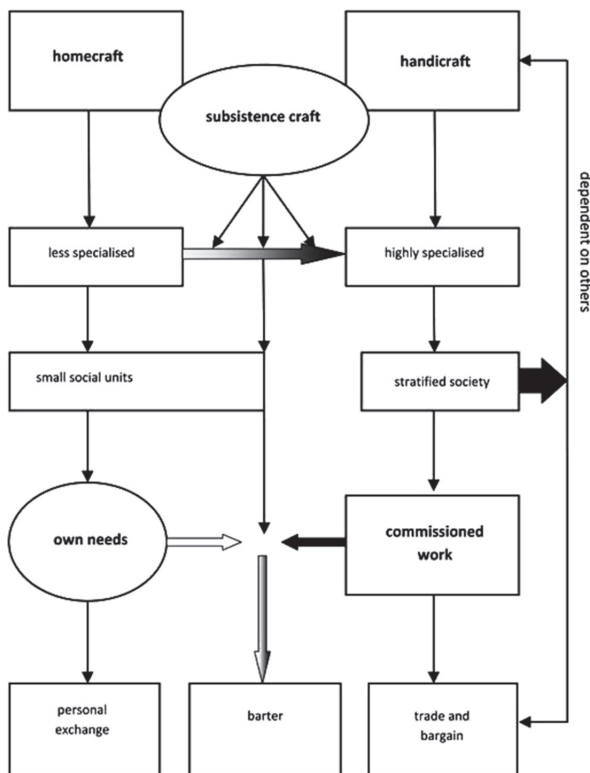


Figure 1.003: Diagram shows the different categories of craftsmanship explained in the text (based on Schlesier 1981).

the intention of selling. Items change hands as barter goods. With this definition, Schlesier created a direct link to the specific market demand and enabled in the same way a statement regarding the 'employment' of the craftsman. Schlesier's separation of the term craft should initially clarify if the described craft was seen as a full-time activity or a part-time craft, where, in addition, normal economic activities were carried out.

A study of craftsmen activities in prehistory inevitably raises the question of full-time or part-time craft. To get a better picture of the intensity of prehistoric craft it is necessary to be aware of the economic factors required for the performance of a full-time craft. Then a correlation with the possible situation during the Early and Middle Bronze Age can be executed to make an assessment as to whether full-time employment of Bronze Age craftsmen was within the realm of possibility.<sup>2</sup> It is only in surplus-economies that the community is able to provide for other members' food and living in exchange for specialised work (Rowlands 1971: 212). The ethnography, however, displays additional possibilities for the existence of full-time specialists. The majority of published research on this issue has shown that full-time craftsmanship is commonly related to privileged minorities, or, in other

<sup>2</sup> In this case, the assumption applies not only to metalcraft, but to prehistoric crafts in general.

words, elites (Rowlands 1971; 1980; Brumfiel and Earle 1987; Peregrine 1991; Olausson 1997; 1993).

Additional examples demonstrate the exclusion of the metalcraftsman from social obligations due to religious views. This results in an extension of the craft repertoire to other materials such as wood or ceramic. The execution of the described wide range of activities is thus a full-time activity on a low-quality level. In addition to various craft works in wood, the metalworkers of the Margi and Dogon in West Africa operate in the same way as an undertaker or a priest. In return, the population supply these craftsmen with the necessary food and goods (Neipert 2006: 69).

However, the vast majority of ethnographic studies deal with craftsmen who commonly participate in the general economy in addition to their profession. Ethnographic examples, such as that of the Celebes in Indonesia (Marschall 1968: 143), show special forms of part-time metalworkers. They are especially needed before or after the harvest. During this period, customers come with broken or worn tools to be repaired. The otherwise only part-time activity is strongly focused on demand and can thus be applied as a seasonal full-time activity.

The latest thinking on Bronze Age society is that it is considered as a hierarchical society with a complex structure made up of smaller to medium-sized chiefdoms connected through an intensive interaction (i.e. Artursson 2009; 2010; Kristiansen and Larsson 2005; Vandkilde 1996; and with a critical touch also: Johansen *et al.* 2004). In such a society craftsmen bound to an elite would be in the same way imaginable as housecraft and subsistence craft (to stay with Schlesier's terms). Additionally, the organisational form of village-dependent metalworkers who perform duties according to demand was also highly probable in the Bronze Age. It seems, concerning the question of full-time or part-time activity, that there is no either/or, rather a more varied picture emerges.

### **Craftsmen and artists**

Today the difference in art and craft seems to be quality related, assuming that artists have no knowledge about technical activities and craftsmen no sense for artistic features. Some researchers tend to project this modern separation on prehistory: 'In terms of practice, there is no art without craft' (Sennett 2008: 65).

This postulation brings the scientific debate about art and craft to the fore, because the crucial point is whether there is craft without art in terms of prehistory. However, the Greek philosophers saw the craftsman as inferior next to the artist, so Plato linked the skills in craft with *poiein*, the root word for 'making'. This

same word is the parent word for poetry, which even in Homer is seen as craft activity (Sennett 2008: 24).

What then is the difference between art and craft, or more precisely between artists and craftsmen? It seems that art and craft are closer together than are artists and craftsmen. This seems to be general and valid across time, which could also answer the question on the presence of artists in the history: 'Art seems to draw attention to work that is unique...whereas craft names a more anonymous, collective, and continued practice; (Sennett 2008: 66).

Additionally, in regard to the agent involved in the action a similar difference appears:

'art and craft are distinguished first by agency: art has one guiding or dominant agent, craft has a collective agent...and by time: the sudden versus the slow' (Sennett 2008: 73).

Due to the agent and his/her motivation, the fundamental difference between an artist and a craftsman is the agent his or herself (see also Harriman 2007: 5). If one were to ask an artist within a work process as he/she decides the next step, so the answer might be 'While making the object there are nearly no thoughts, just the making'.<sup>3</sup> On the other hand, one sees traditional crafts, where within a workflow each step is directed towards the aim of creating the desired object. Each object requires a specific sequence of work guided by tradition so that it meets expectations. Even unique objects demand a prescribed sequence due to the used technique. It seems as if only the artist is free to create just 'because' (see also Ingold 2010: 97). Exactly this statement leads to another important difference – the group of consumers. An artist is, at best, free in his actions. Even when the artist works on demand, the client is interested in the artist's own facets and therefore in a picture or object of exactly this person. A craftsman is integrated in the social community and rarely independent in his work. From him, made objects serve a purpose and the purpose is of a higher priority than the name of the craftsman. Thus, also in regard to the sales market the agent is the decisive criteria. The products of an artist become valuable because of the artist (Gell 1998: 13), the products of a craftsman are valuable because of their quality. An artist puts *himself* in the forefront (signed works), a craftsman the *object*.

Additionally, Ingold could clarify another difference with respect to the created objects:

'(Art) does not, in other words, seek to replicate finished forms that are already settled, whether

as images in the mind or as objects in the world... It seeks, rather, to join with those very forces that bring form into being' (2010: 91).

To what extent is this distinction relevant for prehistory? There is no doubt that a definition of the discussed terms is not related to the skills of the people. Based on the statement that there is no art without craft (Sennett 2008: 65; Ingold 2000: 350), the two respective kinds of creation are based on skills (*poiein*). To this end, a distinction between an artist's or a craftsman's work should not be made based on the quality of the object. Rather it should be oriented on the ideas described above. However, so far the use of such elaborate bronzes, as investigated in this work, and the organisation of metalcraft in the Bronze Age is only partially reconstructed. A definitive statement on the existence of artists and craftsmen as opposite poles is thus hardly possible. However, a few facts can be collected that will help to define arts and crafts in prehistory. An important factor is the representation of the actor behind the created object by using signatures. The overall majority of Bronze Age artefacts in northern Europe have no features that can be understood as a signature of the producer. Furthermore, even the most ambitious bronze ornaments are part of an object group (such as belt plates) and thus, according to Ingold, not to be categorised as art (Ingold 2010: 91). Nevertheless, they show a high degree of artistic skill and inspiring action. However, as already noted in the introduction, the weight of the distinction is not on the skills necessary for the production.

With respect to the issue addressed in this work, and possibly generally transmittable to metalcrafting in prehistory, I want to distance myself from the concept of the artist. I would like to even go as far as to assert that within the metalwork of the Bronze Age there was no distinction between artists and craftsmen, just very talented craftsmen. This is based on the fact that a craftsman, who creates such detailed bronzes, can only achieve this result if he/she is familiar with all operations within the operational sequence. From the moment the object develops in the mind of the craftsman until its completion, a qualified craftsman is able to perform all steps of the necessary sequence: alloying the required alloy, forming the best possible mould, decorating the model or the cast piece, the casting itself – all these steps can be performed by the same agent. Only one who knows how the red-hot metal flows and what problems could occur can also decide how the model must be shaped so that the casting succeeds. Even if in the production of many objects several actors might be involved, the production of such an object must be controlled by one person. Modern ethnographic sources indicate that the production of bronzes, made by the lost-wax process, in India is the result of a very effective division of labour

<sup>3</sup> This information is taken from a personal comment by the craftsperson Helen Marton (Cambridge, 10 April 2013).

(Levy *et al.* 2008). However, the production is guided and monitored by the master of the workshop. To transfer such a structure to the Bronze Age, however, would be too hasty. The extent to which a division of labour and cross-craft activities in metalcraft existed will be examined in the course of this work. However, it can be assumed that a division into craftsmen and artists, one being responsible for the metallurgical processes<sup>4</sup> and the other for artistic work, is not conceivable. Much more likely is a breakdown by skills, should there have been a division of labour in the Bronze Age. In no case, however, can it be assumed that the respective metalcrafter saw himself as an artist (or according to today's definition is regarded as an artist).

### **Metalworker**

Having defined the term 'craftsman' and discussed the difference between craftsmen and artists, the only definition left is the metalworker. In current research, the mining, smelting and extraction of metals is associated with the metalworker in the same way as the tool-making process, *toreutics* (a process in metalcraft in which the metal is formed by hammer and anvil or through engraving), as well as specialised casting processes and highly developed model making.<sup>5</sup> Is it advisable, however, to define a term so frequently used in research literature as the metalworker so broadly? In the following section it is discussed which 'professions' the term metalworker might include and if a distinction in smaller units would be wise and realistic.

The variety of metalworking activities is commonly shown in ethnographic examples. The Awka smiths of south Nigeria demonstrate a generalised skill repertoire. They deal with iron forging as well as lost-wax casting and *toreutics* (Neaher 1979: 358). In Katanga, a southern province of the Republic of Congo, the copper mining and extraction of raw metals is performed by the villagers under the leadership of the chiefs during the three-month dry season (Rowlands 1971: 212). The actual processing of the metal, however, is executed by others. In the Swamimalei hereditary bronze manufacture in Tamil Nadu, India, individual employees (from this modern manufacture) deal exclusively with the embedding of the wax models in the clay mould (Levy *et al.* 2008: 62). These examples clearly show the range of activities that are united in metalcrafts (Figure 1.004). Barbara Ottaway has followed up which activities require specialised knowledge and therefore should be

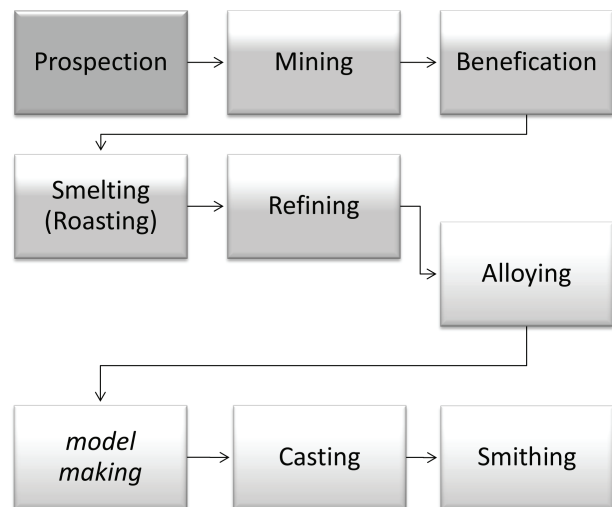


Figure 1.004: Single steps of a metallurgical chain (based on Ottaway 2001).

performed by a specially trained professional more thoroughly. She divides the 'metallurgical process' into eight fundamentally different fields of work (Ottaway 2001: 90-100). Each metallurgical process starts with the prospecting, exploring and collecting of metal-containing ores. There is no doubt that for finding the right ores a trained eye is required (Ottaway 2001: 90). However, in this process each member of a group could be involved, as illustrated by the above-mentioned ethnographic example (Rowlands 1971: 212).

Prospecting may be essential for the beginning of the metallurgical process, however, it cannot be regarded as a separate field of work, but should be seen in direct association with mining. The mining of the ores, as well as their beneficiation, requires a high level of knowledge. In particular, underground mining demands special knowledge of shaft lining, tool making, the exploration of prospective veins and the extraction and beneficiation of the ores (Ottaway 2001: 91). In comparison to the forming areas of metalwork, fundamentally different skills are needed here. A separation of these two fields into two 'professions' seems to make sense. As Ottaway (2001: 90-91; also Edmonds 1995: note 66) assumes, the people involved in mining and processing were by no means highly skilled craftsmen, but rather ordinary people. For the organisation of such an undertaking and for the training of the workers a knowledgeable person with great authority is required. The first three steps of the metallurgical process do not seem directly connected with the metalworker (the smith), they require fundamentally different skills. Additionally, the work areas just described are highly dependent on the geological conditions. In areas without, or with unused, copper deposits mining and related work is not to be expected, as might have been the case in northern Germany and Denmark (i.e. Vandkilde 1996; Gerloff 2010; Ling *et al.* 2012; Ling *et al.* 2014; but Melheim 2012).

<sup>4</sup> In this case, the processes that are concerned with the preparation of the bronze alloy, the casting mould and the casting.

<sup>5</sup> There are exceptions, however, among which M. Primas sees the directed mining of metal ores as an organised profession with specialised knowledge (Primas 2008: 135), and R. Rowlands gives several examples from ethnographic studies in which mining is not executed by the actual craftsmen (Rowlands 1971: 212; see also Vandkilde 2007: 98).

The next step in the metallurgical chain (Figure 1.004) is bound to the previous steps in the sense that the ores were brought in their raw state to the furnaces, or the already smelted and refined raw metals had to be transported (Ottaway 1994: 89). It is likely that within copper mining larger spatial distances are in between the mining area and the smelting furnaces, as for example with iron smelting. Also, archaeological evidence is known for smelting in settlements (Ottaway 2001: 93; Rothenberg 1990a; 1990b; Lippert 1992; Hauptmann *et al.* 1996).

However, smelting in turn requires other skills than the previous processes. In addition to the knowledge of the structure of smelting furnaces, the executing agent must also be aware of the particular needs of the ore metal (i.e. smelting temperature). Also great experience is needed to achieve a reducing atmosphere, which is used to separate the copper from the ore (Ottaway 2001: 93). It is likely that exercise and instructions (in the sense of training) are necessary to execute a properly constructed furnace and produce the desired temperature and atmosphere. The smelting of metals and their processing requires specialised knowledge and therefore should be seen as independent steps in the metallurgical chain (Ottaway 2001: 94-95). However, to what extent smelting can be regarded as an independent craft is uncertain, since the smelting of ores was probably a seasonal activity (see Rowlands 1971; Edmonds 1995; Ottaway 2001: 95).

With the metal ready for use, the metallurgical chain now reached a stage at which the end product of the first part is achieved – the pure metal. If only for this reason, a separation in metal extracting and metalworking crafts is a useful step. The required specialised knowledge for each part was illuminated above and the possible independent crafts highlighted.

However, the following activities demand a new range of skills. As the first step in metalworking craft, Ottaway sees the alloying of pure metals (Figure 1.004). I am well aware that in research it is highly disputed whether the expert smith or smelter is responsible for the alloying of metals (i.e. Ottaway 2001: 98). However, due to the limited tin deposits in northern Europe, a centralised alloying of the metals in a place with good tin resources is probable (see Ling *et al.* 2012; Ling *et al.* 2014). From a technical point of view, alloying is an important part of the production of an artefact, since even small differences in the alloy may have an impact on the whole process. A compromise transferable to the Bronze Age would be the dissemination of bronze (alloyed in a standard norm) from a central point. Within the specific workshops this bronze could have been transformed and adapted to the desired purposes. This would also explain the occasional very bad or unusual alloys.

Another additional step essential for the successful processing of metal to finished artefact is model making. In terms of this work the production of wax models is meant. However, it should be noted that for the production of axes, and occasionally also swords, stone or ceramic moulds are required, which require a high level of skill and should be executed perfectly. Wooden models for the ‘mass production’ of axes should be well thought through so that the result is flawless. Even simple clay moulds require intensive knowledge with regard to the material (the clay itself and the metal that should be poured in). Therefore, the construction of models must be given a separate position within the metallurgical chain. However, model making should not be considered as a working process separate from the rest of the sequence. Only with the knowledge of the properties of the metal, the casting process itself and the final shape of the object can the model can be successfully made. The following steps in the chain (the casting and working of the cast object) require a high degree of knowledge, experience and training. Nevertheless, none of the steps should be considered as an individual process, but as a series of techniques and processes, all of which are interwoven and as a result produce the finished artefact. In the same way that the first part of the metallurgical chain finishes with pure metal, the second part, in which the metal is worked, ends with the desired product.

The traditional goldsmith’s craft examined by Sennett can be used as an example of the immutability of traditional crafts. The following facts allow the drawing of conclusions about prehistoric conditions, as done previously (Høgseth 2012; 2007). The traditional goldsmith worked with a material that had ‘political and economic significance’ and was responsible for and ‘certified that the wealth of a nobleman or a city was genuine’ (Sennett 2008: 61). This craft was exposed to only a few changes over the centuries; on the one hand due to the requirements of the material – which do not change – and therefore not the techniques used. On the other hand, through the social pressure that demands honest work, a goldsmith can be viewed as a metalworker, whose task is all the steps of the second part of the metallurgical chain. Traditional goldsmithing sees no division into individual professions (see Brepohl 1996; Wolters 1991), but requires the intense involvement of apprentices and the following of a certain division of labour. Additionally, this craft seems to have been resistant to individualism across the centuries. Artists within this profession arose with the Renaissance: ‘The medieval goldsmith furnished proof of his worth through communal rituals, proof about the work’s worth through the process of proceeding slowly and carefully. These are irrelevant standards for judging originality’ (Sennett 2008: 71).

It is not my intention to make a direct comparison between the medieval goldsmith and the Bronze Age



fine smith. However, I would point out that fundamental properties have remained the same for centuries within this craft, due to the value of the material as a status symbol and the underlying character of this craft to create reliable work. I would like to venture as far as to claim that the Bronze Age metalcrafters also had to fulfil an obligation because they worked with a status indicator – bronze. Thus, if the circumstances of the craft and the setting of the craftsman are comparable, then why should the prehistoric craftsman be so much more limited in his/her knowledge and have other demands on the job?

In summary, the metallurgical chain can be divided into two parts. The term metalworker should be applied to the second part of the chain, which includes such tasks as smelting, alloying and casting, in the same way as the production of models and tools. All these processes lead to the production of the artefact and are coordinated with each other. Only the knowledge of the properties of the metal, also in its liquid state, allows the production of a successful wax model. Only one who knows how the different metals behave in liquid form can decide which alloy must be chosen and what embellishments it is possible to create. The extraction and mining of raw metals, as the above example shows, do not fall within the repertoire of the metalcrafter defined in this way (Vandkilde 2007: 98; Primas 2008: 135).

### ***Specialisation and specialists***

The previous section clearly presented the different degrees of knowledge and the possible specialisation related to a particular field of knowledge. Now this inevitably raises the question of the difference between a specialisation and ‘specialists’. The following section gives a short definition of the named terms within the context of this work and a brief presentation of the differences between them.

The concept of specialisation relates primarily to the repertoire, meaning the spectrum of the crafted goods (see Ottaway 2001: 89; Costin 2000: 378). Whereas a specialist is characterised by outstanding skills, he has mostly achieved within a limited repertoire (Primas 2008: 87). For instance, a founder is regarded as a specialised metalworker, even if his work is not of exceptional quality, only by the fact that it is limited to bronze casting. In contrast, the highly talented craftsman who has specialised in the production of richly decorated ornaments is considered to be a specialist, due to the outstanding quality of the items produced. The step from specialisation to specialists is thus mainly in terms of spectrum and number of artefacts, and thereby brought about by the experience gained during the manufacture of certain pieces by one craftsman.

A single, but striking, example in which a specialisation caused special skills in one craft direction could be found more than once in the previous sections. The exclusive preoccupation with the embedding of wax models in clay to form a mould led to the development of a specialisation, and therefore to a specialist (Levy *et al.* 2008: 62). As previously remarked, some branches of the craft require specialised knowledge but not specialised skills (Ottaway 2001: 99-100). The knowledge needed, for instance, for the successful smelting of ores is the result of a combination of interest, learning, and the specific capabilities of a person. Such specialised knowledge is part of the technological knowledge of each group and passed on through generations. However, the performing agent is not a specialist in the sense defined above. From a certain degree of specialisation (associated with an improvement in quality) and the amount of time required, the craftsman is only to a small degree able to care for his own economic existence (Primas 2008: 87; Olausson 1993: 2; Costin 1986: 344). Specialisation in the Bronze Age, as a form of production organisation (see Costin 1991: 3; Zagal-Mach 2008: 192), is hardly detectable with the available archaeological sources. As defined, specialisation limits only the spectrum of produced goods. A distinctive impact on craft organisation can be first assumed when the special abilities of a craftsman are combined with the possibility for a deeper exploration of this activity, meaning more time spent on the mentioned craft. Therefore, the craftsman will not be able to attend to daily duties and is dependent on supply by others. As such, the occurrence of specialists within a craft is inevitably linked with the economic possibilities of a society (see Apel 2007: 10). As already explained, the full-time employment of craftsmen is only possible in a surplus society (see Chapter 1.0.2) and this cannot be expected to have occurred in a regular way during the Bronze Age.

In summary, specialisation is a matter of the craftsman’s repertoire, whereas only the ability of the craftsman, in combination with an increased amount of time spent on the relevant activities, creates specialists.

### ***Methodology***

As previously mentioned, this study is divided into four parts, of which the first presents the chronological and geographical framework of the study, as well as a detailed discussion of the material under investigation.

A description of the research area, probable regional groupings and a chronological classification of the finds is the main focus of the first part, together with a survey of the available archaeological sources on metalworking and workers. Additionally, a detailed presentation of each individual artefact category, partly on the basis of previous research, and partly

newly developed by the author in regard to belt discs and belt plates, is presented.

Here, the objective is to provide a fundamental understanding of the examined material. Additionally, the first part contains a socio-cultural analysis of the material, which should be understood as a *suggestion*, perhaps to illuminate these objects based on ethnographic sources.

The second part of the study represents the core analytical part and deals with the technical investigation, which can be divided into archaeological, visual (technical) and scientific processes. The archaeological investigation – in this case the classification and presentation of the material – is examined in the first chapters. The visual/technical examination took place in museums and the analysis in this study includes a detailed metric documentation and a graphical record of the finds. The photographic recording aimed to document each piece down to the smallest detail. Through different light reflections even the smallest trace of crafting could be made visible within the photograph. The photographs were numbered consecutively to provide a better overview, and, additionally, an overview chart with the respective photograph numbers connected to the respective parts of the object was created from each object. The data gathered during the examination of the artefacts were collected in different databases that are published in a slightly abbreviated form in table 1-3 of this study. The metric data was entered into an extra database designed for this purpose, and the visual documentation was collected in another specific database. A part of the visual examination included the analysis of the images based on the expertise I gained during my training as a goldsmith (with continuing education courses for gem-setting and casting). Additionally, this background knowledge enables me to distinguish between the original crafting traces and marks left through excavation or deposition. Here, to visualise the results the artefacts were photographed with a Canon EOS 450D SLR camera and a Sigma EX 105mm1: 2.8 DG Macro lens. The images captured were thus able to reproduce the object with 2.8x magnification. With the collected data, the investigation of individual craft traces took shape.

In addition, I was able to draw on an intensively-researched database of prehistoric crafting traces, which was composed of previous research (see for example Oldeberg 1942; 1943; Herner 1987; Foltz 1979; Andersson 1995; Benner Larsen 1984; Benner Larsen 1985; Armbruster 1995; Meeks *et al.* 2001; Schwab *et al.* 2007). Characteristic details of the design and any traces of the production were stored in a photographic database to facilitate further comparisons and to ensure unbiased assessment. The collated data provides

information about the tool marks and the traces related to specific techniques.

Further scientific investigations were also carried out. The purpose of the metallographic observation was to gain a detailed insight into the changes in the crystalline structure of the metal objects, which can help to validate visual traces and establish certainty about the way in which an object has been created. A detailed description of the applied method is presented in Part 2, Chapter 7. The comparison of metallographic and macroscopic recordings of similar traces leads to a definitive statement about the technology used.

The third part of the work deals with skilled craft as a theoretical construct and is initiated by an introduction to the topic with an attached research history. A wide range of theoretical approaches to craft is reviewed with an extensive insight into the existing literature. Following this, the processes of craft action will be scrutinised, starting from the whole (the operational sequence) up to the individual element. All theories and models will be demonstrated on the material. Therefore, repetitions are possible. However, the direct connection to the material is obligatory, mainly because Bronze Age research can only draw from this source. Within this part a new model is introduced and applied using operational sequences to study prehistoric metalwork. The aim of the third part is to understand craft and to interpret the traces left in the most effective way.

Within Part 4 the knowledge gained on metalcrafting in the NBA is evaluated, with the aim of discussing the previous three parts of this study and presenting conclusions towards analytical results and theoretical considerations. In this section the focus is on answering the preliminary questions regarding the relationship of individual craftsmen to their environment, regarding possible workshops and the structure and organisation of metalcraft.

Finally, the work is appended with a Catalogue containing all the edited finds and the measuring data. All information in the catalogue that relates to the find context is well documented elsewhere and is, therefore, only given in abridged form, provided with the most relevant literature. In contrast, the Catalogue includes a detailed object description and the possible crafting techniques used.