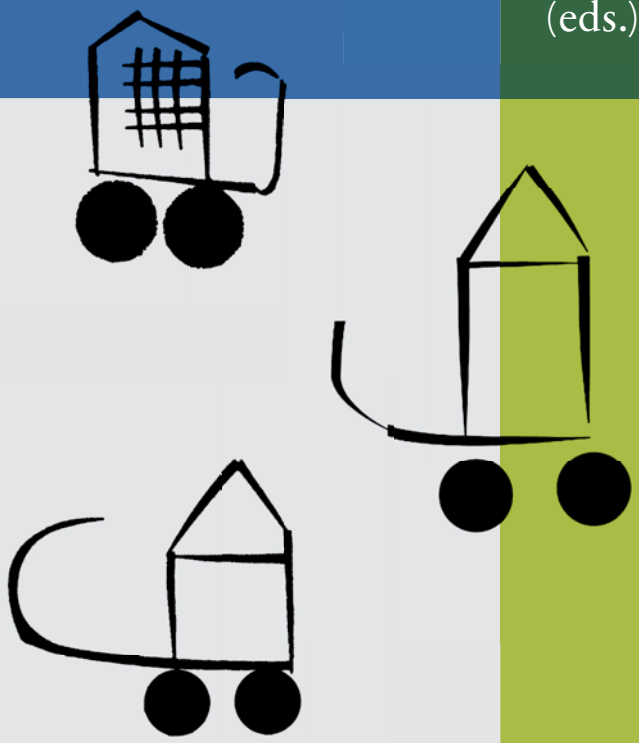
The Interplay of People and Technologies

ARCHAEOLOGICAL CASE STUDIES ON INNOVATIONS

Stefan Burmeister
Reinhard Bernbeck
(eds.)



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HISTORIES OF INNOVATION are prototypical success stories. The advent of the wheel, of writing, printing, the steam engine or computers: where would we be without these path-breaking technological innovations and their global consequences? At least retrospectively, innovations appear as linear, straightforward processes. However, this view is too simplistic. Innovations are not self-evident new elements of life but meet social and technological resistance. In accounts of past innovations, we also often forget that their price is always an irremediable loss of knowledge and practical skills.

This collection of essays shows that innovations, both ancient and more recent ones, are located in a network of pre-existing life-worlds. The authors elucidate the wide and often unrecognized impacts of innovations on social structures and cultural practices. Case studies from ancient Mesopotamia, Egypt, central Europe and the modern world highlight the preconditions and oft-ignored secondary effects of innovation. They address the complex social negotiations and the multitude of unforeseen and unplanned changes which accompany the New, rather than focusing on intended changes, which are usually understood as improvements and ways to broaden possibilities for action. Our ultimate goal is to investigate the complex entanglements of innovations in past and present worlds and deepen our understanding of mechanisms of cultural change.

43 BERLIN STUDIES OF
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BERLIN STUDIES OF THE ANCIENT WORLD · 43

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CONTENTS

Reinhard Bernbeck and Stefan Burmeister

Archaeology and Innovation: Remarks on Approaches and Concepts

Summary

This introduction to a set of papers on innovations in ancient societies discusses an overview of crucial issues raised in the collected contributions. It is evident that the esteem for innovations in different societies was highly uneven. Most of the contributions collected here argue that in non-modern circumstances, innovations had to be inserted into existing cultural traditions with utmost care to be successful.

Keywords: Archaeology; innovation; entrapment; technology; Actor-Network Theory.

Diese Einleitung zu Innovationen in vormodernen Gesellschaften gibt eine Übersicht über die grundsätzlichen Fragen, die in den folgenden Einzelbeiträgen angesprochen werden. Deutlich wird, dass die Bewertung von Innovationen in unterschiedlichen Kulturen stark variierte. Die meisten der hier versammelten Artikel deuten darauf hin, dass Innovationen in nicht-modernen Gesellschaftszusammenhängen nur dann erfolgreich waren, wenn sie mit großer Sorgfalt in existierende kulturelle Traditionen eingeschrieben wurden.

Keywords: Archäologie; Innovation; Verstrickung; Technologie; Akteur-Netzwerk Theorie.

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In archaeology, innovations have traditionally been treated as a part of a development process in which smaller or larger bundles of technological and other inventions have changed entire cultural and social entities. V. G. Childe's conceptualization of human history as marked by a Neolithic, an Urban and an Industrial Revolution is a paradigmatic example of this concept. Over time, further research has led to the recognition that Childe's historic 'revolutions' were complex, regionally specific processes rather than broad innovations with an almost global reach. Still, most research on innovation in archaeology focuses on the presumed functional advantages that lead to the widespread adoption of new technologies. However, even successful innovations are located in a network of pre-existing lifeworlds and have a wide, often unrecognized impact on social structures and cultural practices. In research on innovation, it is imperative to focus not just on the intended consequences of technological changes, but also on the unintended ones. While the former are mainly conceptualized as 'enabling' effects for social actors, an over-emphasis on them misses the full range of the consequences of innovations that Michael Schiffer has appropriately called a "cascading" process.[1] Beyond these enabling factors, the complex web in which innovations are situated also contains elements that constrain social practices, or that produce new ones that on the surface appear to be separate from the innovations themselves. Our primary goal with this collection of essays is to investigate these complex entanglements of innovations in past cultural-social worlds.

Wolfgang Schivelbusch's book *The Railway Journey* is a brilliant case study of the entanglement of innovations, albeit from recent history. He shows that the development of trains was not just an important step in industrial technological development, but also affected perceptions of time, led to the appearance of new literary forms, the recognition of psychic trauma as a disease, among a myriad of other consequences. Our book, based on a conference in Berlin and supported by the Excellence Cluster Topoi, explores the often unrecognized preconditions and particularly the consequences of innovations in the realm of archaeology. These may be functional, cultural, purely aesthetic, or practical.

One crucial issue for archaeologists that Schivelbusch did not need to consider is ontological difference between the researchers' and the researched world. The lifeworld of 19th century train travelers was substantially different from our own, but basic ideological underpinnings were similar. Archaeological investigations of innovations, however, must always face the likelihood or at least the possibility that we are dealing with a world in which actors/agents were conceptualized radically differently than we do today. A consequence may be that 'innovation,' a term that for us is firmly anchored in a materialist worldview, may not be seen as positively as it is in the realm of Western

1 Schiffer 2005.

academic disciplines, such as archaeology. The import of this issue comes through in some of the papers in this volume: the 'new' is not necessarily perceived as desirable in all cultures and societies, and in specific cases, an introduction of new items or technologies may be prevented by taboos (see contribution by de Silva and Jung). Ontological difference can play a significant role when the researchers' worldview completely objectifies non-human beings and things, as is the case in our modern science and economy-based world, whereas they may be understood as 'sentient beings' in many non-capitalist worlds. The changing relation between humans and animals in the course of neolithization is a case of ontological change itself. The adoption of lifeways that are strongly intertwined with herd animals is not necessarily best conceptualized as the appearance of 'management strategies', and draught animals may be more than a 'living motor' for a plow or a cart. A recognition of ontological difference, recently discussed intensely in anthropology, forces us to think in terms of symbioses in which specific animals may not even be conceived of as substantially different from human beings (see contributions by Dittrich and Reinhold).[2]

Can the recent development of *Science and Technology Studies,* and in particular of Actor-Network Theory (ANT), lead us out of the trap of universalizing enlightenment values and their associated ontology, out of the narrow modernist dichotomy of subjects and objects, and a world that consists of active humans and passive things? ANT and related paradigms dissolve a 'user' (human) versus 'used' (world) distinction. These categories are considered to be no longer suitable for an analysis of technical processes. In ANT, humans and things blur into a complex technological entity capable of acting. In Latour's vocabulary, they form collectives, hybrids, assemblages, networks, and actants. Things and techniques become actors in their own right, on a par with humans. In this sense, an actor is an entity that has been considered by someone/something else to act.[3] This concept is free of the intentionality, competence and skill that are fundamental elements for traditional worldviews, which presuppose the existence of knowledgeable human users in the case of any technology. Latour separates action from a rational, autonomous subject; it is no longer the prerogative of thinking beings. With this basic shift ANT attempts to dissolve the very foundations of a traditional sociology of technology. In our set of papers, it is mainly Burmeister who comes close to such an approach.

But can a technological collective be reduced to a web of social relationships connecting people and things? This would neglect the specific functional connections of technologies, namely the "technical schemas" addressed in Gilbert Simondon's theory of machines.[4] These schemas are rooted in self-referencing characteristics of technology,

2 Descola 2013; Viveiros de Castro 2004; for archaeology see Watts 2013.

3 Latour 2005, 70–74.

4 Simondon 2012 [1958].

not in a common social background of devices and humans. The importance of Simondon's ideas lies in his insistence on the internal logic of things and techniques. This can be expressed in the notions of *affordance* – put simply: their enabling characteristics – and *Eigensinn* or 'obstinacy', those properties that limit the variability of their use and restrict the potential to integrate them into compounds of beings/things. It is precisely this relationship between affordances and *Eigensinn* as part of an internal logic of things that can be responsible for innovation processes as well as obstructions to their course (see contributions by Burmeister and Hahn).

But affordance and *Eigensinn* are also at the origin of power relations between complex things and humans. These power relations run counter to Latour's claim of an even distribution of power in thing-human hybrids. Günther Anders maintains that human beings display a tragic "Promethean shame" in their desperate and incompetent bid to mimic perfected machines that they themselves developed in wave after wave of innovations: things have taken over the lead, and our power over the technological world is a mere phantasm.[5] In Anders' sense, one could say that Latour's ANT provides the ideological background for a technology-driven world. The interests of technology and innovation need to be taken seriously, and Latour's stance turns these interests into universal ones, although they are in fact particular. In this connection, it is important to acknowledge that archaeological studies of innovation run the risk of providing a firm (pre-)historical foundation for a highly specific relation between humans and technologies they created. The representation of innovations as the emergence of new and historically relevant human-thing relations de-historicizes these changes by turning the advent of the exceptional (the brand new) into normality. The result is the familiar story of progress in human (de facto, European) history. Despite all the criticism of civilization and culture, so the background idea goes, who would want to exchange their conditions of life and the associated comforts for those of a Neolithic society and its (rudimentary) technologies? Even if the promise of capitalism increasingly inverts itself into a dystopia, we still side with the more or less outspoken hope that present problems induced by a technological world of atomic bombs and other massive threats will be solved in the medium to long-term by the same means that brought us to our catastrophic global state: technological change.

This fundamental belief deeply influences our understandings of prehistoric societies and their innovations. We think that we know from historical as well as our own experience what things are made for. We assess the cultural significance of sedentary lifestyle, metallurgy or wheeled vehicles, for example, in a retrospective fashion and construct naively their 'obvious' benefits, whereas innovations of that sort were open-ended changes that could have borne connotations that extended from existential threat

5 Anders 1956.

to alluring attraction. Our functionalist perspective, turned into a narrative of progress, provides cultural and historical explanations that fit seamlessly into the genesis of our own world. Such a mindset overlooks the fact that innovations represent not only a gain, but also usually loss: new technologies lead to the abandonment of old ones and an erosion of associated embodied skills. In her contribution, Sabine Reinhold describes the innovation of standardized architecture as limiting the variability of possible practices and therefore as limiting innovations; Florian Klimscha notes the decrease in types and technological variability in the production of lithic tools with the advent of (functionally underperforming) copper axes; Susan Pollock mentions the loss of interest and skills in decorating vessels that came about with the advent of the fast potter's wheel; most papers in this volume refer to similar effects. To take an example closer to the present: crafting skills are on the decline since the age of industrialization, and sensory skills follow suit in the age of computers. We have almost entirely lost the capacity to read the signs of 'nature', i.e. to recognize traces and relations of animals and plants in forests; instead, we refer to scientific knowledge from books or websites. More and more, practical competence is delegated to machines at the cost of our own competence – one has just to think of the use of navigation systems in cars and the accompanying loss of one's own orientation. These 'success stories' are also always stories of loss.

Many contributors to this volume argue that in non-modern, pre-capitalist societies, relations between technology and human beings had a different outlook than today. People neither aspired to become impeccable copies of technological items, nor did they conceptualize the world from the point of view of subjects who are clearly set apart from objects that serve human desires. Rather, many, if not most innovations, whether functional, symbolic, practical or other, had to be inserted carefully into pre-existing social and cultural relations so as not to upset traditional lifeworlds. Only in recent history may the new be so desirable that its contrast with older things transforms the latter into shameful reminders of antiquated, obsolete worlds. Hans-Peter Hahn, whose contribution illuminates these oppositions, also claims that the habitus of a strict conceptual separation of an older material culture from items unequivocally identifiable as 'new' is at the core of consumerist mentalities. The strong distinction between old and new together with the high value placed on the latter induces us moderns to actively seek out innovations and abandon used items – epistemologies included! The stunning pace of changing paradigms in archaeology, from Latour's ANT to object-oriented ontologies and a 'multiple-ontologies' approach illustrates this well. Who would still cling to a constructivist paradigm in present circumstances, an epistemology that came to dominate archaeological discourse after many years of dispute (but see Bernbeck, this volume)? If archaeological studies of innovation remain strangely immune to the sirens of constructivism, this might also be due to the very theme of innovation and the skepticism

evinced in many studies of technology towards a way of thinking that emphasizes the power of language.

However, even in our times, discourses rely on patterns of familiarity and recognition. Nowadays, the word 'ontology' has become a sign denoting a specific outlook on the discipline of archaeology, even though it is used loosely and often carelessly. It has become a marker of the cutting edge, but it is in no way an entirely new concept itself. In his conference contribution (not included here), Gerd Graßhoff showed the great extent to which new techniques in modern laboratory research rely on well-known older ones. The new is only partially new. Important for any innovation is the extent to which new procedures or technical objects can be derived from already existing ones. But even if an innovation confronts its users with completely new ways of acting, it must have the potential to be inserted in a pre-existing horizon of experiences. This leads away from the technical, internal logic of the new to its cultural context and to social practices in which innovations are always embedded, and which they themselves help to shape.

In general, a successful innovation has as a prerequisite an integration into existing practical routines and structures of meaning, even if any innovation also leads at least in part to a disruption. This distinguishes the genuinely innovative from simple historical change. But the tendency to isolate the disruptive/new elements in archaeological and other studies of innovation produces a one-sided unrealistic account of the superceding of older traditions. Innovation is a process of cultural negotiation with many parameters, most of which are related to continuity and particularly with the insertion of the new into existing routines, techniques and ways of thinking. In our collection of papers, Klimscha maintains that Levantine copper axes were an innovation of the Chalcolithic age, albeit a dysfunctional one (they were less efficient than the traditional stone axes). Their inclusion in a material assemblage was a mix of an old form made from a new material. Visually, the recognition of a shape was likely associated with surprising aesthetic properties of shininess. Klimscha claims that these axes had only symbolic value and could only 'succeed' because they were embedded in the dynamics of gift giving. It was this positioning of new objects in a ritualized circulation of gifts that had wide-ranging consequences for other objects. Constance von Rüden provides another example of a negotiated integration of the new into specific contexts. Aegean-style fresco paintings in Middle Bronze palaces in Syria depended on previous forms of Aegean cultural elements that introduced this set of cultural symbols to Syria in earlier times. Even the advent of writing in Mesopotamia was no *ex nihilo* invention but had a millennia-long history of precursors (Bernbeck). Not a break from tradition through innovations, but rather the integration of innovations into pre-existing traditions seems to have been a

crucial preoccupation in the past. As Schivelbusch shows so clearly, this process depends on patient negotiations that may produce their own unexpected consequences.[6]

The cases of innovation analyzed in this volume do not form a coherent set of phenomena. The papers variously take as their point of departure production technologies and their materializations, particularly metal (Meyer, Klimscha, de Silva and Jung), productive and other practices such as herding, moving, building, writing (Dittrich, Burmeister, Reinhold, Bernbeck), or abstract issues such as repetitiveness (Pollock) or an identity of "Aegeanness" (von Rüden). It is clear from such variability that the term innovation is not necessarily tied to technologies but ranges between attempts at solving a specific problem with new means and changes in whole lifeways. Nevertheless, we find a number of shared concerns in these contributions.

One of the most important issues relates to the question of whether the combination of an invention and its imitation forms the core of any innovation,[7] or whether imitation might not itself be the cause of innovations. The traditional view puts the new prior to imitative practices and leads to a search for the origin of changes in one specific place and moment in time. Most innovation modeling insists on this scheme and sets up stages leading from inventions to their acceptance and an ensuing spatial diffusion. In this collection, two papers problematize this sequence of invention and imitation. Dittrich invokes Gabriel Tarde's work, arguing that routines, understood as daily, repetitive imitations of practices lead to small-scale variations.[8] It is these variations that are at the origin of innovations, not some stunning one-time idea. Variation is an unintentional effect of routines, and many concurrent, interconnected variations may lead to major innovations such as the Neolithic 'revolution'. However, such variation-producing imitative processes themselves can undergo change. Pollock argues that we witness exactly that in 4th mill. BCE Mesopotamia. The inner workings of repetitiveness in many fields of practice change at approximately the same time, and this bundle of changes induces a streamlining in the sphere of production; variations in routinized daily practices decrease.[9] One might conclude from such a constellation that the rate of innovations would radically decrease. However, that is not the case; instead, a proliferation of new categories of things and institutions ensues, likely the unintended consequences of an innovation on this meta-level of imitative practices. The old suspicion of 'more leisure – more creativity' (mentioned by Klimscha and first proposed by Robert Braidwood) seems to be a highly unlikely explanation for these connections. In her contribution, Reinhold claims that architecture changes communities substantially by anchoring relations between people and their material environment. But new buildings are more than

6 Schivelbusch 2000.
7 Schiffer 2005.
8 Tarde 1903.
9 Latour foresees such a change in our times when he says that „it is up to us to change our ways of changing" (Latour 1993, 145).

technical dwellings. They change conditions of coexistence within a group by rigidifying its social fabric. Contrary to Pollock's case of an acceleration of innovations, Reinhold describes sedentarization as a serious impediment to innovations.

Several papers address the dynamics of innovations as long-term processes. It may not be particularly surprising to find such a pre-occupation in a set of archaeological papers, as archaeologists seem to be well-disposed to discover long-term trends and changes. But can innovations be the result of shifts in the long term? That would mean, in Marxist parlance, that such changes are not 'innovations for themselves', but only 'innovations in themselves'. They remained outside the consciousness and intentions of those who pursued them. Instances of innovation would not necessarily have been perceived as sudden breaks with older routines. However, these innovations were changes that could also not be easily inserted into existing cultural routines. They produced a kind of disruption that was minor, required cultural negotiation but did not pose insurmountable problems. Reinhold presents such a case when she argues that sedentarization and remaining in one location over long durations have far-reaching consequences that manifest themselves in full only with time: hygiene, waste management, a reorganization of domestic activities, new forms of intimacy because of tight spatial conditions, and other similar effects. But these outcomes should not be conceived as occurring simultaneously; problems appeared only slowly. Long-term innovations often are an *enchanement* of changes, not a specific event. The adoption of specific domesticates from southwest Asia was not necessarily a simple takeover of a whole package either (Dittrich), and the development of a documentary gaze was the cumulative effect of writing, then writing while moving, and finally of writing, moving and observing all at the same time (Bernbeck). This raises once again the question of what distinguishes routine cultural change from innovations. Must the aforementioned disruptions have been felt by those who integrated themselves into an innovation, or could it not have been disruptive only for those who remained on its edges – in Dittrich's case, those who continued a Mesolithic lifestyle beyond the advent of the Neolithic, in Bernbeck's, those who were the object of the documentary gaze? This question becomes more complex when we consider Michael Meyer's insistence on the singularity of rhythms in the development of iron smelting in different subregions of central Europe.

Several papers see innovations as strongly tied to communication and networks of communication. Hahn's discussion of the introduction of a new photocopy machine and its lack of success is a prototypical example of a lack of communication, a missing 'affiliative' relation between (new) things and people; it can also be read as an instance of a badly negotiated integration of the new into older practices and traditions. A look at the processes of 'appropriation' of material culture highlights a central problem in innovation research: the quasi-axiomatic assumption that a successful innovation results from

technological and economic advantages that obey purely instrumental reasoning.[10] New technologies develop rather against the background of a foregoing historically specific rationality that is part and parcel of each innovation process. Several contributions argue for an investigation of specific rationalities of those who deal with new technologies – or what traditional innovation literature would consider cultural 'irrationalities' that can come in conflict with the rationalities inherent in technical innovations. Innovations can fail because of a mismatch of contextual rationalities and technical instrumentality, for reasons that were less technical than social (Hahn, de Silva and Jung). The reasons for acceptance or rejection of new technological possibilities are related to the potential of people to build a relationship with technical objects. The creation of such affiliations, however, does not usually lie in the innovation itself. Various case studies in this volume (Hahn, de Silva and Jung, Dittrich) illustrate the precarious situation in which innovations may end. They have to prove themselves and are always in danger of being rejected. Affordances and the *Eigensinn* of new objects and techniques determine the longer-term development of processes of innovation.

The well-known case of the introduction of the steel axe among the Yir Yoront of Australia shows the ambivalence of innovations.[11] This case demonstrates that technical devices cannot be reduced to simple technical rationalities, but include often affordances of social agency. In Yir Yoront society, polished stone axes were traditionally a versatile and widespread tool employed in many activities. But even though all members of the group used them, their ownership was subject to the exclusive control of older men. Whoever needed an axe but did not have one, needed to borrow it, even for everyday tasks. And borrowing followed strict rules. The possession of an axe and the act of lending one were manifestations of the complex social fabric of the community, including relations between different age and gender groups. In addition, regional contacts were established and maintained through the transfer of these axes. This web of social dependencies and power relations was torn apart by the introduction of steel axes by a nearby missionary station. The missionaries distributed axes to women, children and young men who had previously been excluded from their possession. The new steel axes did not have real technical advantages over the old stone ones. Instead, they broke the tight social dependencies, as old men lost their social and political power that was tied to the distribution of stone axes. The dissolution of traditional patterns of gender and age roles eventually led to the collapse of the whole community. Contrary to general expectations, the historical and social impact of this innovation was not determined by its technological characteristics but by its social consequences, which – depending on one's perspective – can be seen as devastating (the elders) or as progressive (the missionaries).

10 Schreiber 2013.

11 Sharp 1952.

If these issues relate to the communication between people and things, communication also plays a different role in contexts of innovation. Klimscha and von Rüden present cases of pre-existing networks of human communication that are essential for the spread of new technologies of copper smelting and of *al fresco*-painting techniques, respectively. In the case of copper production, the network was not only a pre-condition for the spread of copper objects but was itself touched by the circulation of these new items and a tendency to include places of exchange related to raw material sources. Von Rüden's account presupposes maritime travel with a large, eastern Mediterranean network of interconnected ports. Burmeister's example is more complex. Wagons appear almost simultaneously over huge swaths of territory, from Mesopotamia to northern Europe. However, the synchrony of this change remains mysterious. In the case of the wagon, innovation concerns communication networks themselves as wheeled vehicles seem at first sight to have been their own medium of dissemination. However, this will hardly ever have been the case. The effect of this innovation is often overestimated, and the reason is a misunderstanding of the four-wheeled vehicles' limited ability to manoeuver. Their rigid front axle meant that they were hardly steerable.

A notion that shines through in some of the papers but would have merited more elaboration is entrapment as a result of innovations. Dittrich refers to threshing as one of the traps – more work – while Klimscha reminds us of severe health problems stemming from noxious fumes deriving from the smelting process. Bernbeck sees in the documentary gaze a matter of political control over the victims of this innovation. Pollock interprets the meta-innovation of repetitiveness in the Uruk period as a major entrapment for entire lifeways. These consequences of innovations can be intended, but are more often located in the realm of unintended consequences, referred to by Pauketat as the "tragedy of the commoners".[12] More in line with a discourse about innovation is Hodder's use of the terms "entanglement" and "entrapment" in his analysis of the long-term consequences of the relation between humans and things.[13] One can read Hodder's works as a pessimistic counter-discourse to Childe's progressivist *Man Makes Himself*.

The contributions in this collection abstain from a purely technical or object-centered perspective. Instead, they analyze innovations as part of socio-technical practices that result from already existing practices. As pointed out, innovations as disruptive changes are part of a process of cultural negotiation that can be, but are not always manifest in material culture. A purely technological perspective would restrict itself to surface phenomena and hide modifications in the routinized structural dynamics of a society. In our view, innovations are not just interventions that impose a renegotiation

12 Pauketat 2000.

13 Hodder 2012.

of practices and meanings, but can also result in new distributions of resources. For instance, Meyer and de Silva and Jung expose the social components of metallurgy. They show that innovations in the field of metallurgy can result in a kind of democratization of essential resources, thus altering the very social fabric of a society. The Levantine and Mesopotamian examples (Klimscha, Pollock, Bernbeck) display the opposite effects, with a trend towards hierarchization and mounting inequalities. Both change and denial of access to resources may have been perceived in the past by those concerned as more crucial than the mere technological side of innovations.

The integration of new features into the cultural habitus of a community usually leads to new forms of routine. A cascade of further innovations is often the result. We remain usually unaware of the multiple connections that emerge out of innovations that we perceive as major changes in our lives. Our intent was originally to assess whether Schivelbusch's approach could be applied to archaeological innovations. His goal was to trace the far-reaching consequences of train travel as technological change, consequences that have less to do with the steam engine than with a technique of moving as a socio-cultural practice. Our accounts may look modest when compared to Schivelbusch's dense story of changing lives in the 19th century. But considering the knowledge that can be gained from archaeological sources, this may not be a surprise. We still hope that the resulting perspective leads to significant new insights.

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Innovation as a Possibility. Technological and Social Determinism in Their Dialectical Resolution

Summary

This paper analyzes the specific conditions of the innovation of the prehistoric wheeled vehicle innovation according to affordance and *Eigensinn* of this new technology. The use of wheeled vehicles is a social practice that results from the interests and capabilities of their users, but also from their technical affordances and *eigensinn*. Wheeled vehicles/wagons expand and restrict their users' potentialities of action. The realization of possibilities of action is linked to specific interests and technical requirements. Today, wheeled vehicles are the symbol of mobility. However, this is an affordance that was realized only late in history and was not the starting point of this particular innovation.

Keywords: Innovation; affordance; *Eigensinn*; Actor-Network Theory; wagon; chariot.

Die spezifischen Bedingungen der Innovation des Wagens werden hinsichtlich Affordanz und Eigensinn der neuen Technologie untersucht. Wagen sind eine soziale Praxis, die zum einen aus den Interessen und Fähigkeiten der Nutzer, zum anderen aus der technischen Affordanz und dem *Eigensinn* der Wagen resultiert. Wagen erweitern ebenso die Handlungsmöglichkeiten der Nutzer wie sie sie beschränken. Die Umsetzung von Handlungsmöglichkeiten ist mit spezifischen Interessen und technischen Anforderungen verknüpft. Für uns sind Wagen heute ein Symbol von Mobilität. Diese ist jedoch eine Möglichkeit, die erst spät in der Geschichte realisiert werden konnte; sie war nicht der Ausgangspunkt der Innovation des Wagens..

Keywords: Innovation; Affordanz; Eigensinn; Akteur-Netzwerk-Theorie; Wagen; Streitwagen.

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Innovation has always been a central theme in archaeology – so it seems not very innovative to address this issue again. The grand narratives of human history are success stories, primarily of technical developments. Through increasingly differentiated technical requirements and solutions we have arrived where we are today: in a highly technological world that is able to feed seven billion people and exterminate multiples thereof at the push of a button. Archaeology has written a large part of the chapters of this "success story."

The diachronic perspective is a great strength of archaeology, but it also reveals one of its weaknesses. The largely fragmented archaeological record leads to long periods in which a historical depth of field is attained only through an accumulation of individual observations, though their coherence cannot usually be adequately clarified. The single picture obtained through the archaeological evidence has a low resolution and it hardly shows contours. Relying on several pictures with the same or similar representations compresses the evidence and increases the resolution of the historical picture. And yet, the individual observations remain disparate phenomena, separated from each other by a large spatial and temporal distance. This finds its clearest expression in the classical archaeological distribution map: The find spots suggest a contemporaneity and an inner coherence.

Zenon's arrow paradox, which states that a flying arrow is located at a clearly defined place at a particular time and therefore does not move, seems completely valid here: Individual static observations are combined and seen in their entirety as if in movement. Zenon's arrow paradox can be resolved mathematically, but this is not possible for an innovation process. The unity of the process is not given and a find spot cannot causally be deduced from the position of a preceding location. Connections between individual observations remain hypothetical, discontinuations are rarely recognized.[1] The overall process of a particular technical development is only visible in its totality, and also only from its end. Models that are constructed in this way are inevitably teleological and success-based. Functional benefits are at the core of archaeological representations of technical developments. In retrospect this is easy to justify. Zooming in, however – which is indeed possible for individual processes, especially in their early stages – one can see, as in the case of iron technology, the pitfalls of such assumptions. At first, the new iron technology was in technical terms a step backwards compared to the established bronze technology: The tensile strength of forged iron is well below that of those bronzes that have already been made in the Bronze Age. Only through the advancement of iron technology was an increase in quality achieved, which made iron a superior material with respect to hardness.[2]

1 See in contrast Müller and Lohrke 2012.

2 Maddin, Muhly, and Wheeler 1977; Wheeler and Maddin 1980.

Something else also determines the archaeological investigation of innovation processes: Archaeological evidence consists exclusively of materializations of various kinds and origins, i.e., objects and findings (or matter and substances). The purely material-based access to the past prefigures our view of the history of mankind. It is no coincidence that an early – and still common – classification of prehistory is based on material groups: stone, bronze, iron. And the developmental phases of civilization identified later by Gordon Childe – neolithic, urban, and industrial revolution – are similarly determined by material parameters. It is not surprising that the socio-typological stages, like those identified by neo-Evolutionists, are barely able to gain a foothold at the operational level in archaeology.[3] With the given archaeological record, the sociological and ethnographic criteria for socio-typological classifications of pre-modern societies present a huge challenge that is hardly resolved in a satisfying way.[4]

The logic of the archaeological record promotes a technological perspective on social development and this development follows – at least as far as the traditional narrative goes – a teleological, functionalist logic. I go even further here and suggest that our concepts of the relationship between technology and society indirectly affect our understanding of innovation processes. The banishment of God from the sciences and the Cartesian view that both the human mind and matter determine the reality of the world fundamentally changed the modern world view. On the one hand, natural science and natural laws placed emphasis on the autonomy of the material world; on the other hand, the consciousness of the creative powers of the human spirit emphasizes the human being as an acting subject. This leads to two conflicting viewpoints which have ever since significantly influenced the discussion: To simplify matters, they can be referred to as technological determinism and social determinism.

From the viewpoint of technological determinism, technology exists outside of society and follows an internal logic. Technological rationalities cause changes that directly or indirectly impact society and result in social and cultural change. The US-American sociologist William Ogburn, for example, postulated that, at least in the current Western world, societal development is lagging behind technical advancement.[5] Also, in current technology debates, the demand for assessments of the consequences of technology draw their legitimacy from the *cultural lag* and the social problems arising from it.

In contrast, social determinism considers technology to be an integral part of society. Here, technology loses its autonomy. Without a life of its own, it is degraded to a mere instrument to fulfill human purposes. As Arnold Gehlen stated, following Herder, humans are deficient beings, using technology as a prosthesis for lack of bodily abilities to act and deficient sensory organs.[6] However, technology is more: It is a medium to

3 E.g. Feinman and Neitzel 1984.
4 E.g. Yoffee 1993.
5 Ogburn 1969.
6 Gehlen 1940, 77–78.

enforce social interests just as much as it is the result of societal interests and individual actions – and it consequently follows a social logic of interests.

There are a vast number of empirical studies that offer good arguments to confirm both points of view. Neither the technical rationality (and resulting causality) nor the logic of social agency are to be dismissed. The suppression of either the technical rationalities or the acting human subject leads to significant flaws in our understanding of innovation processes.

1 The railroad as multidimensional innovation generator

At this point I would like to return to the book by Wolfgang Schivelbusch, "The Railway Journey."[7] Schivelbusch's study played a significant role in adjusting the thematic focus of our workshop. The innovation "railway" and its diverse impacts on society are considered here in an admirable way – and with remarkable insights. The fact that the railway was an extremely profound innovation in the 19th century is indisputable. It gives modernity its public face. The inland distribution of industrial goods would not have been possible to the required extent without the railway. As a means of transport and a supplier of jobs, for example in railroad construction, the railway was an essential driving factor of the economic development of the emerging industrial nations. It is also the symbol of the expansion of the frontier into the North American "Wild West." The railway was thus not only an economic factor, but also a means of imperial penetration. Less known are the pompous plans of the European colonial powers to domesticate the African continent by covering it with a widely ramified railway network – plans that have thoroughly failed.[8]

The introduction of the railway was carried out with economic considerations: The coal fuel was cheaper than the feed for draft animals. Adam Smith calculated that a horse needs as much feed as eight workers. By eliminating a million draft animals in England, extra food could be rationed to another eight million workers. And the industrial demand for workers rose steadily. The railroad was the economic solution to an economic problem. However, one does not do justice to the phenomenon alone with economic expediency.

I would like to highlight two central aspects of Schivelbusch's study that already in the 19th century were perceived as essential to the railway: the annihilation of time and space. Both resulted from its speed, which initially was about 40 kilometers per hour, thus exceeding the usual travelling speed of stagecoaches three times. Passengers were confronted with unfamiliar sights and insights. Victor Hugo described the view from

7 Schivelbusch 1986.

8 E.g. Maggi 1997; Sunderland 2002.

the window of a moving train in 1837 as follows: "The flowers by the side of the road are no longer flowers but flecks, or rather streaks, of red or white; there are no longer any points, everything becomes a streak; the grain fields are great shocks of yellow hair; fields of alfalfa, long green tresses".[9] An illustrator of the time sketched his view of the landscape in the following way: Like a projectile – as it was described by many contemporary commentators – the railroad shot through the countryside, while the landscape vanished. Especially the nearby things faded away; the foreground dissolved into vague schemes. The landscape lost its depth of field and the travelers' relationship to the landscape changed: they were no longer in it, they were not part of it, but rather outside observers. The train travelers found themselves in an idle position while barely recognizable landscapes were carried past them like a scenery. The viewing habits of travelers changed.

Furthermore, art changed. In 1844, the picture *Rain, Steam and Speed – The Great Western Railway* by the English painter William Turner (Fig. 1) visualized the speed in a specific way. Again, forms dissipate; the static is converted into dynamic movement. Turner's later landscape pictures in particular lose their objectives as the contours blur. He inspired the French Impressionists with this style of painting that he had developed. The Impressionists' paintings had to do with capturing sensual appearances, the volatility of momentary impressions, and the transitory world.[10] A linear path from the impressions of railway passengers to the new forms of representation in painting cannot be demonstrated. However, one thing is obvious: The late Turner and the Impressionists codified the perception of volatilization and were for this reason well in the trend of the time.

Time is the next aspect that I would like to briefly touch upon with reference to Schivelbusch. The previously unknown speed of the railway ensured that routes were completed in a much shorter time. Distances fused together, and places grew closer. This means that space was compressed. Travel distances were often measured in hours traveled by foot: An average travel hour corresponded to 3.7 km or 2 miles. The train voided this measurement, and in 1850 the Ludwig's Railway Company could boast of having mastered the one-hour distance between Nuremberg and Fürth in 10 minutes. Now there were different time equivalents.

That was one side of the coin, while the other was the standardization of time. Up to this point every place had its own local time that historically depended on the position of the sun. Regional time differences between places disappeared in the course of travel. But with the new travel speed problems arose: As variations between local times became perceivable, national schedules were no longer meaningful. England took a pioneering role and in the 1840s began to standardize time. Each railway company initially

9 Quoted from Schivelbusch 1986, 55.

10 Güse 2001; Wagner 2001.

Fig. 1 Joseph Mallord William TURNER: Rain, Steam, and Speed – The Great Western Railway (Turner Bequest, 1856; © The National Gallery, London).

introduced a uniform and compulsory time on its route. The procedure to standardize time on the track was new, unfamiliar and – from today's perspective – idiosyncratic. The problem was that time in those days could not be passed on and communicated in real time. For the mail train of Grand Junction, it went like this: In order to ensure a uniform and compulsory schedule, each morning a messenger of the admiralty handed over a clock to a railway staff in London who rode on the train to Holyhead, the ferry port to Ireland, where it was given to an employee of the Kingston ferry. He brought it to Dublin, from where the clock was immediately returned to London and handed back to the messenger of the admiralty in the evening.

After the various railway companies connected their individual rail networks to each other, a common time, Greenwich Mean Time, was agreed upon. At first, it was solely a railway time that existed in addition to locally operating times. The more the regions were incorporated into the railway network, however, the more noticeable did the discrepancies between local time and railway time become. In 1880, the decision was taken to make railway time the universal time in England. Other countries soon followed the British example.

Why these examples that have rather anecdotal character for us today? I have only mentioned a few effects that resulted from the innovation of the railway. Many more could be added.[11] These effects are profound and extremely long lasting in their impact. However, there are also effects that do not initially come to mind when we think of the innovation of the "railway". If we were to examine these processes like an archaeological case, we would actually have problems, or even fail, to bring them into a causal connection with the introduction of the railway. The railway should not only be understood from its surface phenomenon "transport". It is important to identify the other effects as well, to make them visible in their causal connection, and to investigate them accordingly. This involves interactions and processes that remain so far outside the scope of innovation research, but that should be brought to light. Innovation processes usually have a main narrative which is considered particularly powerful. However, that is not the whole story; as the example of the railways shows, it is just a fragment.

2 Hybrid networks and affordances as a possibility of action

The example of the railway shows very pointedly that neither technologically nor socially deterministic views can sufficiently explain a bundle of processes of innovation. Technical constraints and the intrinsic logic of technical phenomena caused changes in many ways. The unprecedented speed in particular put more innovation into transition. The viewpoint of technological determinism will put forward good arguments that this technological aspect entailed numerous cultural, social, and political consequences. There were, however, social actors who ultimately enforced these changes due to specific new experiences. New styles of painting are not logical consequences of railway journey, they are an opportunity that was identified and realized by certain individuals. Without social acceptance and civil requirements for mobility – to spend the weekend by the sea, for example – the railway would not have experienced this triumphant success. It is social actors and social interests, as the social-determinist position argues, that pushes the innovation process.

Since both technology and social actors determine the form and course of innovation processes, both sides have to be included in the analysis. As Werner Rammert emphasizes, a clear dividing line between a cultural world of socially constituted meanings and a technological world of blind rule-following can no longer be maintained.[12] Overcoming unproductive front positions of technological and social deterministic approaches could be achieved through the Actor-Network Theory (ANT).

11 See Schivelbusch 1986.

12 Rammert 2007, 51.

ANT is inextricably linked to the French sociologist Bruno Latour, but also his colleagues Madeleine Akrich, Michel Callon, and John Law.[13] Strictly speaking, Actor-Network Theory is not a theory in the sense of the word, because it was developed as an analytical tool to examine the actions of social actors. According to Latour, the purpose of this approach is explicitly not to explain anything, but rather to 'thicken' the description.[14] Once the description is saturated, the explanation of social phenomena crops up automatically. I am not going to elaborate on this assumption here despite the fact that such an understanding of the field of sciences needs critical assessment.

Another aspect is noteworthy: In network-like contexts of action, things join forces with human actors. The old humanistic opposition of person and object is eliminated; according to this understanding, people and things rank equally and they jointly shape the result of social action. Things become actors.

An example that leads us back to the controversy between technological and social determinism may explain this.[15] Who kills? The firearm or the one who pulls the trigger? The apologists of the National Rifle Association rely on the social argument and say: the person, of course. The critics advocate technology and recognize the weapon as responsible for murder – innocent citizens become murderers only through the weapon. To Latour, both are wrong; the basic error lies in the approach to look at only one side of each situation: weapon or person. The weapon does not kill by itself, the person perhaps may also not want to kill; however, the weapon offers him/her the possibility to realize an action. The person and the weapon fuse together and become one actor: a weapon-human or a human weapon. The relationship is symmetrical since without each other both would be something else – with an entirely different outcome. Neither weapon nor person act by themselves, the action is carried out by one actor, fused from the two: The actor is a hybrid player, an assemblage, a network.[16] Here, unlike in technological and social determinism, action does not have anything to do, figuratively speaking, with action and reaction, but rather interaction.

By creating a hybrid actor, the deeply rooted barrier in humanism between the subject and the object is lost. To what extent artifacts really have agency will, however, not be discussed further here. Their potency is indisputable, as Latour demonstrates with the example of the 'Berlin key'.[17] This key relentlessly determines the actions of its users when passing a door. Each artifact has its script, its demanding character, its potential to make people act accordingly.

A similar idea was previously developed by the American psychologist James J. Gibson.[18] Influenced by Gestalt psychology, he developed the concept of "affordances", a

13 For review see Belliger and Krieger 2006.
14 Latour 2007, 237–238; 252–257.
15 Latour 2006.
16 Latour 2006, 488.
17 Latour 1996.
18 Gibson 1982; for review see e.g. Greeno 1994; Jenkins 2008.

neologism that he derived from the English verb "to afford". In his understanding, the affordances of an environment are what it offers a living being, what it provides or furnishes.[19] Already in the Gestalt psychology of Kurt Lewin, things had *Aufforderungscharakter*;[20] Kurt Koffka spoke of "demand character".[21] However, the thingly effect was not seen as emanating from the thing itself but rather from the recipient. It was conceptualized from the recipient's perception and needs. The demand character was not an independent value of things. Gibson, however, saw that affordances exist even without the potential users, therefore affordance is a property inscribed in things.[22] Regardless of the viewer, the affordance of a thing is present, even if it is not perceived as such and also if it does not meet the current needs of the viewer.

Gibson's concept of affordance leaves open how the potential user realizes the possibilities of a given affordance. Possibilities or offers alone will not lead to action; an action evoking demand also does not emanate from the object. Moreover, since the exclusive focus on the thingly side excludes the actor, critics emphasize the importance of the specific situation of an action in which things and users converge. According to Chemero[23] and Knappett[24], affordances are not properties of things but of specific situations in which things and potential users meet. The object is thought of in accordance with its user.

While Gibson stressed that affordances open possibilities for action, Withagen et al. expand this idea: They define affordances as action possibilities "that can invite".[25] An object usually allows different ways of use, but not all affordances also invite to take action. The actions a user feels invited to depend on several factors. These include the user's specific skills, her or his experience and needs, but also the respective social context, which facilitates or hinders specific actions. The focus on the invitation character of things puts them into a mutual relationship with their users. Possibilities for action and potentials for use are realized only in specific situations; symbioses of things and users, hybrids, are the focal point of action. For both sides, a potential use arises in the situation of an action: The user can achieve the objective of the action in the action itself while the thing, in enabling the user, realizes one of its potentials that results from the affordance. The gain for things here, however, is only to be understood in a figurative sense, since objects have neither objectives nor interests, so that the realization of an affordance is not an aspired gain of things.

19 Gibson 1982, 137.
20 Lewin 1926, 353; Lewin 1935, 77.
21 Koffka 1935, 345–347; 355–357.
22 Gibson 1982, 150.
23 Chemero 2003, 187.
24 Knappett 2004, 46.
25 Withagen et al. 2012, 255.

3 *Eigensinn*

In order to realize potential uses of objects, the user must comprehend them. Following a concept by Hans-Jörg Rheinberger, Hans Peter Hahn refers to "epistemic things".[26] The user must assess potential and reasonable uses; the epistemic approach to the object is the prerequisite for its use. Known to everyone from experience, objects occasionally refuse epistemic access and the possibilities of their application cannot always be recognized.[27] Things often do not 'behave' as desired: On the one hand, they break down or fail us and on the other, their complexity bars the users from their use. They are – overstrained – unable to grasp the potential uses or retrieve them as planned: Things have *Eigensinn*, or obstinacy.[28]

Taking the obstinacy of things into consideration, the controversy described above between the technological and social deterministic approaches gains a new dimension. The interplay between the objective possibilities of things and the actual application by users bridges the artificial divide between the interests of the acting individual and the constraints of technological rule enforcement. As much as things have their obstinate objective possibilities that enable or constrain actions, users also have *Eigensinn*. Their skills and expertise in application, as well as their interests, likewise determine options for action in the use of things. Just as users 'overstrain' or 'understrain' the used items with their possibilities and objectives, they are 'overstrained' or 'understrained' by the affordances of things. Things break through wear and improper use, and they escape their intended use, thus limiting options for action. However, because of their affordances they also offer options for action that are not requested or recognized by the users. Due to the objective possibilities of both sides and the users' specific target of action, users and things exist in an antagonistic relationship that is pushing for a balance in each specific application.

But let us return to the actual topic at hand here: the investigation of innovation processes. The ongoing discussion about the relationship between technology and people, or, as commonly discussed more recently, the relationship between things and users, suggests that things, their scripts and their logic must be involved in the analysis.

4 Innovation as reason for change

Innovation as social appropriation of the new has to be clearly separated from invention, the actual creation of the new.[29] The origin of inventions may be sought in the

26 Hahn 2013, 17–19.

27 See, e.g., with impressive examples Norman 1989; likewise Hahn, this volume.

28 Hahn 2013.

29 Burmeister and Müller-Scheeßel 2013.

need to overcome restrictions that are determined by things or techniques and are seen as obstacles for action. New features can also broaden options for action and produce entirely new targets of action. Becoming aware of new areas of action eventually leads to the appropriation of a new feature, the actual innovation. It is easy to imagine that these new features confront users with their *Eigensinn* and put their specific affordances up for disposal.

New solutions often create new problems, however, and innovations usually entail unintended consequences and unforeseen side effects. Schivelbusch's survey clearly demonstrates this. The history of the railway is more than the planned enhancement of the efficiency of mobility and transport services. The teleological perspective of innovation research with its causalistic view that is centered on intention-orientated development processes falls short here, because it produces blind spots. The unexpected consequences of an innovation become invisible even though they affect cultural practices and configure social life. They are, therefore, a genuine subject of investigation. Innovation is, as Michael Schiffer accurately put it,[30] a cascading process that continuously triggers further developments.

In the workshop that is at the origin of this book, it was our goal to bring into view innovation processes and to do so within their broader context, that is, to examine the interdependence of innovations and their wider social framework and track their possibly unintended, unforeseen consequences. As stated in our call for papers for the workshop, we can imagine this kind of impact in a number of social fields of action.

Embodiment: Technological innovations require new skills and motor habits; altered manual activities can lead to the formation of new body techniques; the embodiment of new forms of knowledge and habitual techniques can produce not only new skills, but also limit the scope of established skills. Consider, for example, the development of fine motor skills which is required for the use of fine ceramics; or, in the negative case, the loss of capabilities to orient oneself today without modern navigation systems.

Perception: The acquisition of new technologies can change the perception of the material and immaterial environment; for example, it can be assumed that through domestication, human beings changed their relationship with animals substantially, or that the self-perception of humans has been re-shaped through the control of water or fire.

Practice: The manipulation of the natural environment may have an impact on procurement strategies, production, and consumption; these changes entail new cultural practices that can and should be explored.

30 Schiffer 2005.

5 The innovation of the wagon – possibilities and limitations of a new technology

In the following, I briefly discuss some of the broader aspects presented here with reference to a specific case: the innovation of the wagon. Despite numerous detailed studies, the history of the wagon is still underexplored and – in my opinion – carries some crucial misunderstandings. As with any archaeological case study, the beginnings of this technology are in the dark and thus escape systematic examination; much remains speculative and hypothetical. However, this should not prevent us from approaching the case intellectually, to encircle it, and – as I want to show – not only continue to illuminate but to understand this new technology in terms of affordances and *Eigensinn*.

Function and importance of the wagon in prehistory are usually thought about from today's perspective. For us a life without wagons is hard to imagine; the possibilities offered by vehicles with regard to mobility and transport are so obvious that this potential is projected back into the past. The wagon is an integral part of the influential concept of the Secondary Products Revolution first formulated by Andrew Sherratt – but here we need to be exact: Sherratt stressed the importance of the use of animal traction which is clearly evidenced by early wagon finds.[31] Compared to the plough, however, the wagon appears to remain quite insignificant, although its potential for transport and mobility is widely accepted.[32] Is this the reason for the resounding success of the wagon? Hardly any other innovation has spread so rapidly in prehistoric times. In the middle of the fourth millennium BCE, we see the first archaeological evidence for the existence and use of the wagon emerging simultaneously in Northern Europe, the Caucasus, and Mesopotamia.[33] This astonishing and wide-ranging simultaneity provoked criticism of diffusionist models and led to the formulation of alternative polycentric development models – which can, however, hardly explain the phenomenon in better terms.[34] Just as impressive as the simultaneous first appearance of the wagon in different regions of the world is the diversity of the societies adopting it – just consider the contrast between the Funnel Beaker culture of Northern Europe and the early city-states of Mesopotamia!

We will not solve the problem via a positivist reading of archaeological distribution maps. Of course, we can assume that an innovation must be widely established before it manifests itself in the archaeological record. The origins of the wagon and its early spread likely go back a number of generations before their first appearance in the archaeological record. Expanding the scope of observation and looking for possible channels and networks of distribution, we notice the spread of the prestigious, heavy copper tools and jadeite axes after about 4,600 BCE which geographically matches that

31 Sherratt 1981.
32 Vosteen 1999 denies this potential.
33 For review, see Bakker et al. 1999; Burmeister 2011.
34 See Burmeister 2012.

of the early wagons.[35] It is in this environment that we may find, if not the origins of the wagon, at least the mechanisms of its distribution. Making use of these networks, it appears that primarily prestigious objects were traded and prestigious knowledge was communicated. If the wagon and its early success story can be seen in this context, does this also foreshadow its social significance?

In order to answer these and other questions, we must first look at the technological and physical characteristics of the wagon. As simple as the early wagons may seem to us today, their construction and mode of operation was complex. It was a composite technology that essentially consisted of three functional components: 1) the principle of rotation, which either involved a wheel rotating on an axle or an axle rotating beneath the carriage; 2) the body of the wagon that was attached to the chassis, which allowed the transport of persons and goods; 3) the use of animal traction. If only one of these parts is missing, there is no functioning wagon. In Central America, for example, the technological requirements for wagons were available, but the appropriate draft animals were not, so that wagons were not used before the arrival of European colonizers. It is unlikely that all individual components of the wagon were developed from scratch. Spin-off effects from already available technologies seem to be more likely. Ann Brysbaert refers to them as "cross-craft interaction".[36]

We can only speculate from where the functional components of the wagon technology had been adopted. Possible sources of inspiration for this innovation disappear in the mists of prehistory. The principle of rotation as well as the basic technical principles of the wheel can be found in the potter's wheel and in spindle whorls. Timber rollers are suspected to have been a common means of transporting megaliths. While the timber rollers can only be deduced hypothetically, however, the spindle whorls are contemporary with early wheels. And yet, since they are a secondary product of wool processing, they belong within the sphere of the Secondary Products Revolution. In contrast, the potter's wheel already existed in Iran and Mesopotamia in the fifth millennium.[37] In fact, it may have been a role model for the wheel.

The body seems to have been the least original feature of the wagon. We may assume that sledges and travois were already known, although definitive evidence from regions of early wagon use is lacking. The principle of a platform or a box as a load bearer or load container, however, is as simple as it is obvious. In general, it should be noted that the technological expertise of manufacturing the body of a wagon was available in all Neolithic and Copper Age societies: The long-established practice of house construction was a prerequisite for the craftsmanship needed for wagon building.

35 References see Burmeister 2012, 86.

36 Brysbaert 2011.

37 E.g., Fazeli Nashli et al. 2010; Moorey 1994, 146.

The outstanding and revolutionary feature of vehicles is the use of external energy for locomotion. This energy is usually obtained from the use of draft animals, but human draft power is also a possibility, similar to later vehicles in China. The novelty in the use of animal traction lies less in the technical than in the ideological realm: the subjugation, in the double sense, of animals to people. The subjugation and exploitation of animals generates a new quality – a quality that most certainly had an impact on the worldview and self-perception of people. In what context animal power was used for the first time remains entirely unclear. It is one of the essential characteristics of the Secondary Products Revolution and is therefore closely linked to the wagon. The actual importance of animal traction, however, lies less in its function as an engine for the wagon than in enabling plough cultivation and enhancing crop yields. So far it cannot archaeologically be determined what came first: wagon or plough. While earlier evidence for the use of animal traction can be identified based on pathological changes in animal bones, it is unclear what was towed here. It is conceivable that heavy loads, such as tree stumps were initially pulled directly by animals.

Normally oxen were used as draft animals. For this purpose, they had to be trained, which was a tedious process, and they could not be used as food resource for many years. Their maintenance costs are considerable as well:[38] Draft animals are a means of production with high investment costs. This is echoed in the Code of Hammurabi, which states that two-thirds of the rent for a four-wheeled wagon (*ereqqu*) went towards the draft animals and associated driver.[39] Fields are usually only ploughed once or twice a year, but the necessary draft animals must be fed throughout the year. For economic reasons, it is hard to imagine that the plough was the starting point for the use of animal traction. Since harnessing techniques are a prerequisite for power transmission for wagons and ploughs alike, a *spin-off* effect or a reciprocal influence can be assumed.

Wheel and wagon exist in a socially embedded technological context. Technology neither emerges nor functions on its own. These interconnections are circumscribed rather vaguely in Ian Hodder's concept of entanglement.[40] In a preliminary article, he discussed the wheel that was, as he emphasized, not a product of the 14th millennium but of the fourth millennium BCE. He stressed that it is the task of archaeology to work out through contextual analysis, "why the wheel did fit so that it became selected in the fourth millennium".[41] It is common place that every thing needs a social context in which it becomes effective; every innovation, consequently, needs to occur in the right place at the right time to be realized. And yet, Hodder's argument is justified in every respect. The willingness and ability to adopt wheel and wagon reveals itself only

38 See Ebersbach 2002, 153–155.
39 Salonen 1951, 30.
40 Hodder 2012.
41 Hodder 2011, 185.

in retrospect and based on the knowledge of their social context. For this reason, it is essential to take a closer look at the *Eigensinn* of this new technology.

Wagons consisted of various joint wooden parts; individual components were sometimes kept in position by ropes, but many construction elements were also attached by connectors. This required a precise treatment of the wooden parts as well as a permanent protection of the wood from drying out. Moisture loss caused the parts to shrink, preventing their exact fit. The result could be premature wear and breakage. The untroubled wagon ride demanded precise manufacturing techniques and regular maintenance. In order to prevent the wood from drying out, wagons were kept moist, whether in their entirety or in parts. The frequent finds of wagon parts along lakeshores or on the edge of bogs may likely be explained by the "watering" of wagons.[42] Consequently, the wagon was a device that required regular "service".

Numerous archaeological examples exist that demonstrate how breakdowns were a regular aspect of wagon rides[43]: As axles ran hot, they could set axles and wheels on fire, a secure fit and the greasing of the moving parts were necessary precautions – but they did not guarantee protection. Due to wear and overstraining, axles broke at the weakest point; damaged components had to be replaced on the spot. Since the repair parts could not be crafted readily on the spot – and spares were rarely carried – the operating range of wagons was limited.

Seen from today's perspective, certainly the most peculiar feature of early wagons is that they were not steerable. We have to distinguish two basic modes of construction: the single-axle, two-wheeled cart and the two-axle, four-wheeled wagon. The former can be turned around the axle and was thus steerable, the latter was not. The wagon requires a king pin or pivot plate, so that the front axle is turnable; however, these were apparently not developed until the first half of the first millennium BCE.[44] Thus, it took nearly three millennia from the first appearance of wagons for the steerable wagon to emerge.[45] Bearing in mind that two-axle wagons had a wide distribution and, according to the archaeological record, were in many regions the only wheeled vehicles, we have to question the functionality of the wagon. Numerous finds with traces of wear and repairs at wheels and axles suggest that they were used in everyday life. The unwieldy wagons seem to have been primarily suitable for driving straight, which is even more surprising given that the landscape of, for example, Northern and Central Europe was barely open until the Bronze Age.

This technical limitation had serious implications for the use of the wagon as it meant that wagon rides required linear routes or straight paths. In the Northern Alpine

42 Burmeister 2004, 334.

43 Burmeister 2003.

44 See Burmeister (in press) for discussion and references.

45 See Burmeister 2012, 87–88; for discussion see Burmeister 2010.

region, the first tangible use of wheeled vehicles goes hand in hand with a transformation of settlement structures. The formerly scattered settlement plans turned into more linear settlement patterns where houses stood close together with their gables aligned and facing a paved village street.[46] This new type of settlement was better suited for the use of wagons than the previous one. However, whether this change can be causally related to the use of wheeled vehicles is difficult to determine based on archaeological evidence alone. While the carts common in this region may not have required such an adjustment, it was certainly conducive to traffic within the settlement. Such a redesign of settlement layout would have also impacted the organization of village life.

The wagon thus offered potential in terms of mobility and transport, which expanded the options for action by people. However, in order to exploit this potential, several conditions had to be met. Above all, these concern the operability of the wagon itself and the operational readiness of the draft animals. The limited steerability, in contrast, considerably restricted the potential use of wagons. Driving off-road requires a largely unobstructed landscape, which certainly only existed in the vicinity of settlements. Supra-regional transport requires a good road system; roads must be kept clear, which requires regular maintenance; a functioning supra-regional road network needs overarching coordinating entities, which likely did not exist in most pre-Iron Age societies. It is therefore hardly surprising that the first evidence of road construction originates from the first millennium BCE.[47] The social context of the Neolithic and Chalcolithic cultures obstructed the functional use of wagons for supra-regional transportation.

Our ideas of mobility and fast coverage of spatial distances can hardly be applied to the wagon in prehistoric times. This technology had its *Eigensinn* which practically restrained the realization of the potential use of wagons that is so familiar to us today. *Eigensinn* reduced the operating range of wagons to the immediate environment of settlements. If the wagon offered an economic benefit, it was the transport of harvest and leaf fodder into settlements.[48] Purely utilitarian considerations can therefore hardly explain the triumphant success of the wagon in the fourth millennium BCE. At least from today's perspective, its practical utility was kept within limits; additionally, it required high maintenance costs for draft animals. Therefore, we have to ask for the affordances of the wagon beyond transport and mobility. The early archaeological record can give us a first hint here: From the beginning, the wagon was also a stately and divine vehicle – a function that was likely encouraged by the economic obstacles of using the wagon on an everyday basis. The wagon also granted people a completely new kind of movement: self-movement – or automobility – which physically lifted the driver out of the crowd. Sitting or standing on top of the wagon, one experienced a kind of movement

46 Schlichtherle 1997, 93–95; Zeeb 1996, 101.
47 See Burmeister 2012, 91–92.
48 Burmeister 2012, 93.

Fig. 2 Chariot drawn by a team of oxen in the entourage of the Nubian prince Hekanefer.

that was virtually abstracting from the body: One did not arrive, one appeared. We can easily imagine that this spawned a new sense of self.

This sense was developed further with the introduction of the horse-drawn chariot. In the second millennium BCE, this vehicle allowed riders to reach the previously unknown speed of up to 40 kilometers per hour. Speed was depicted, for example, in contemporary Near Eastern and Egyptian epigraphy and iconography, where it was ideologically exaggerated. The driver experienced a veritable thrill of speed; driving the chariot also placed special demands on the driver's dexterity. Again, we see a new kind of movement that exceeded the former everyday experience. For this reason, the mural in the grave of a high Egyptian official with the presentation of a Nubian princess on a chariot drawn by oxen (Fig. 2) functions as a propagandistic representation of a world upside down and, from the Egyptian point of view, of a re-establishment of the ethnic order, which had begun to sway due to the Egyptianized Nubian elite.[49] Affordance here becomes caricature.

49 Burmeister 2013.

In summary, it can be said that the wagon enabled new forms of movement and we may assume that this exerted a great fascination. We can imagine that prehistoric people might have reacted in a way similar to the visitors of the Paris Motor Show of 1955 when the Citroën DS was presented for the first time to the public. Roland Barthes has analyzed the encounter with a car that was considered futuristic and revolutionary at the time, as the magic of the new object and its appropriation.[50] Fascination, admiration, and a quasi sacral magic of objects also need to be considered alongside the innovation of the wagon – without these factors, an understanding of this technology would hardly ever be possible.

The brief consideration of *Eigensinn* as well as affordances of the early wagon demonstrates the possibilities and limitations of this technology; it shows that both social context and actors on the one hand, and technical prerequisites on the other contribute to our understanding of this innovation; it cannot be understood – and, consequently, cannot be investigated – solely from the perspective of acting subjects or from that of technical rationality. Wagons are a social practice that results from the aims and capabilities of the users just as much as from the technical affordances and the *Eigensinn* of the wagon. Thus, wagons have their particular place that is tied to a specific cultural and historical context.

Taking *Eigensinn* and affordances into consideration, we learn more about the technical and social changes that lie beyond the obvious aspects of mobility and transportation. Some are introduced here: production technologies in wood processing, investment in animals as a means of production, shaping of landscape and settlement structure, new forms of movement, and changing self-perception; others are yet to be discovered and discussed.

Affordance and *Eigensinn* of wagon technology expand the options of action available to the user, and they limit others, against all expectations, such as mobility. The example of mobility in particular demonstrates clearly that affordances can only be realized under specific cultural conditions. Today's importance of mobility stems from making use of further affordances of the wagon – affordances that could not yet have been realized in prehistoric times.

50 Barthes 1972, 88–90.

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Innovation and Inertia: Questioning Paradigms of Consumerist Object Fetishism

Summary

Consumer societies position innovation in a framework that essentializes the new. The assumed need for innovative technologies, life-styles and fashion is based on an internalized reversal of the relationship between 'needs' and 'motives'. Primary needs are replaced by the desire for the new. The implicit assumption about consumers' self-understanding relates to their interest in the new and their willingness to be informed about novelties. However, ethnographies of quotidian handling of innovation show the importance of reliable conduct. The readiness 'to learn new things' is limited. Innovation depends less on the degree of novelty than on the context in which it occurs.

Keywords: Needs and desires; technological innovation; consumerism; ethnography; appropriation; ignorance.

Konsumgesellschaften setzen Innovation in einen Rahmen, der das Neue essenzialisiert. Das angenommene Bedürfnis an innovativen Technologien, Lebensstilen und Mode basiert auf einer verinnerlichten Umkehrung des Verhältnisses zwischen ‚Bedürfnis' und ‚Verlangen'. Primäre Bedürfnisse werden durch den Wunsch nach dem Neuen ersetzt. Implizite Annahmen über Verbraucherselbstverständnis beziehen sich auf ihr Interesse am Neuen und ihre Bereitschaft, über Neuheiten unterrichtet zu sein. Allerdings zeigen Ethnographien die Bedeutung des adäquaten Alltagsumgangs mit Innovationen. Die Bereitschaft, ‚neue Dinge zu lernen', ist begrenzt. Innovation hängt weniger vom Grad der Neuheit als vom Kontext ab, in dem sie auftritt.

Keywords: Bedürfnisse und Verlangen; technologische Innovation; Konsumismus; Ethnographie; Aneignung; Ignoranz.

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1 Introduction

In the world of consumption and consumerism, the public presentation of new electronic gadgets, promoted through the media, as for example by Steve Jobs, figure among the top events for technology enthusiasts, but also for the wider public. Doubtlessly, it is legitimate to call Apple's electronic devices 'emblematic items' for the popular understanding of 'innovation' in our times. For many years and in regular intervals, engineers, product developers and marketing experts from Apple have defined the meaning of innovation and how innovations should change everyday life. The "IPhone", "IPad" and similar devices and terms are setting the standards of what should be the core of the most up-to-date technology in the respective sectors.

During his public presentations, Steve Jobs himself repeatedly used the terms "invention" or "re-invention"; he was speaking about this particular feature of Apple's products by using the imperative form: "Innovate!" Usually, within a short time after his presentation the competing producers of electronic devices started to imitate Apple's innovations and presented devices with similar properties. Tests provided differentiated information for consumers, whether this or that device may legitimately claim to be on the same level as the initial innovation from Apple. Obviously Apple's activities represent more than just the reference to innovation as a core feature of marketing. Regularly, popular computer journals discuss whether those devices, labelled "innovations" do constitute true and sustainable novelties or not.[1] Are these things real improvements or are they just something with an appeal of being fashionable, but in the long run condemned to be forgotten? As these questions make clear, Apple products are a good example for the questionable status of innovations. The questions also point to the central topic of this contribution, which can be expressed as follows: The ambiguous character is very often underestimated, and it is hardly ever the innovation itself that decides about its relevance but rather the context. As these assumptions apply very well for this initial example, I shall come back to it several times.

2 Innovation and the enforced backwardness of 'old things'

The fetishist appraisal of Steve Jobs' 'innovations' contains some important lessons about the logic of innovation. His claim about newness imbues an implicit statement about the 'backwardness' of other electronic stuff in possession of people and in current use. From the moment of the presentation, the users of electronics will consider those things

1 These debates and product tests legitimately may be subsumed under the heading of "innovation management", as described extensively by Trott 2012.

differently. Independent from the question of whether they are already owners of innovative Apple devices, they will check whether the goods already in their possession do have the presumably highly desirable features. They will ask themselves whether they will be able to make it without these new features in the future, and how much they will suffer from the 'emerging backwardness'.[2]

This shift of perspective, the experience that something becomes different in the presence of the innovation without changing materially is the first argument in my discussion of innovation. In the following paragraphs I will explain in more detail how the consideration of these things someone already owns changes due to the presence of an innovation. On a more general level, one of the aims of this contribution is to criticize the presumed objectivity of innovations.

In the perception of a consumer and user, innovations enforce a change in the way someone looks at material possessions of common usage, and which were serving well up to that moment. This is an argument already adopted by Theodor Adorno more than forty years ago, when he referred to the "authority of the new".[3] This assumed authority is not as much a question of the eventual advantages of the new, as merely a question of our sensibilities of perceptions of the changing evaluation of our possessions, as soon as something new appears on the horizon. Recently, the economists Güliz Ger and Russel Belk found more drastic words on the changing value of already existing possessions. They state: "One threat is the loss of confidence and pride in local goods and material culture."[4]

There is another, much older study that already considered an argument similar to Adorno's as a challenge for a proper understanding of innovations. The philosopher Christian Garve published a book about fashion in 1792.[5] Reflecting about the nature of the emergence of new fashions, Garve was a forerunner of Veblen (1899). One of his key arguments refers to well preserved and highly useful things that may become an annoyance and a source of shame for their owners in the presence of an innovation. Lasting objects, acquired by their owner a long time ago, may change their meaning from the moment of the appearance of a novelty. The reason for this is that in the public they are compared with the new and fashionable object. Once an innovation is declared desirable, it creates disastrous effects on the material possessions in a wider sense. This

2 Ragnar Nurkse 1955, 58–59, also pointed to this phenomenon: "When people come into contact with superior goods or superior patterns of consumption, with new articles or new ways of meeting old wants, they are apt to feel after a while a certain restlessness and dissatisfaction. Their knowledge is extended, their imagination stimulated, new desires are aroused".

3 "The authority of the new seems to take on the form of the historical inevitability. To that extent, the authority of the new is an objective criticism of the individual as the vehicle of the new" (Adorno 1984, 30). I suggested an interpretation of this observation highlighting the inherent process of alienation (Hahn 2008).

4 Ger and Belk 1996, 283.

5 Garve 1982.

argument directs the focus away from an innovation as such and rather addresses the question of shifting contexts due to innovations.

With this it becomes clear that the contextual side of innovation may carry reverse connotations to novelty or desirability. This contribution intends to shed more light on the contextual side of innovations and its eventual re-evaluation imbued by contextual factors. In order to substantiate this claim, I shall present two further arguments in the following sections. The next paragraphs will deal in a more critical manner with the underlying assumptions of the initial example and question the difference between needs and desires. As I shall explain, there is a historical evolution of the meaning of these terms.

In the subsequent section I will come back to the more general question of the term 'innovation'. Stepping beyond the questionable public presentations of Apple and its implicit normative understanding of innovation as something totally new, a more appropriate definition will be presented in connection with a reference to the seminal work of Lucy Suchman. Much in line with Suchman, I argue that 'innovation' is never just the 'emergence' of a new form or a new technology, but rather a question of context. The conclusion combines the three arguments: First the shifting of context of all material possessions as mentioned above, second the changing perception of desires and needs, and third the reformulation of the definition of innovation. In this way, innovation can be conceptualized beyond the norms of consumerism.

The aim of the article is to contribute to the development of a broader notion of innovation that is appropriate for contexts beyond western societies.

3 Innovations and needs

Innovations can only be successful if they meet already existing needs. This is the reason why needs, desires and their historical evolution are useful starting points to reflect on the definition of innovations. Seventy years ago the psychologist Abraham Maslow presented an elaborate model of a hierarchy of needs that is nowadays widely accepted in economics as well as in the humanities.[6] His definition of needs refers to the popular metaphor of the "pyramid of needs", differentiating between needs and desires on different social levels. In its visualized form, the baseline is constituted by the so-called fundamental needs (Fig. 1). Fundamental needs refer to a concern for all people worldwide. The seemingly objective character of these needs is rooted in the idea that the physical needs are assumed to be the same for all humankind. Furthermore the supposed objectivity corresponds to the objective character of the material world as such.

6 Maslow 1943.

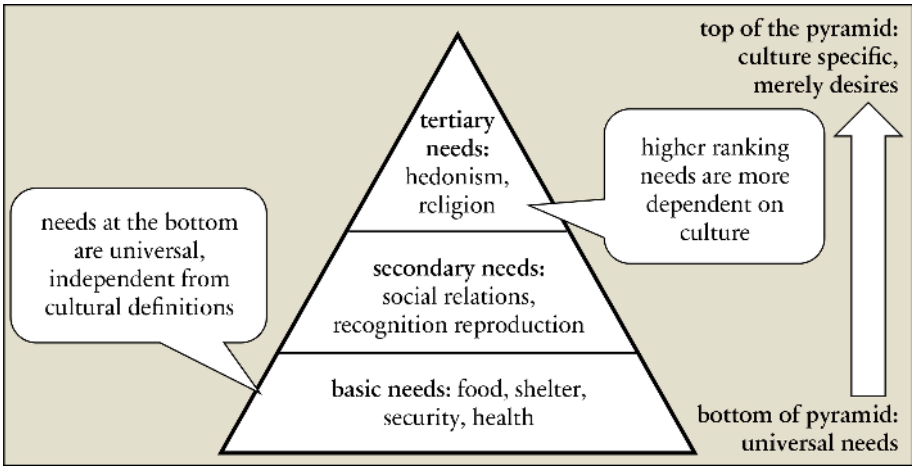

Fig. 1 The hierarchical 'model of needs', following Abraham Maslow. This model is currently widely accepted as a standard, although it has serious shortcomings. A basic stratum of culture-independent needs cannot exist in the light of ethnographic evidence from non-European cultures.

The needs on the higher levels of the pyramid are only acquired during the lifetime of people, and they depend on the surrounding culture that the people live in. It is in particular these higher levels of needs that engender an interest toward new consumer goods. The need – or, more precisely: the desire – for all the items that define a particular culture, society or religion is located on the medium and top levels of the pyramid. These objects merely refer to what is desirable, but are not inevitably necessary to survive. The infinite expansion of material possessions in modern consumer societies happens only on the upper levels. It is only through social learning that these needs become a subjective reality. Provisionally I accept some authors' suggestion to call the needs of the upper levels "consuming motives".[7]

However, in the light of ethnographic evidence, the shortcomings of this model are obvious. The first problem concerns the hierarchies: it is not plausible to argue that people will always give food a priority over religion. In particular, specific food taboos may be stronger (more immediate) than hunger, and prevent people from eating particular things. The question of shelter is even more contradictory: is individual housing always more important than the building of a temple? There is simply no universal answer to this and therefore skepticism towards the idea of a universal Bottom-of-Pyramid-needs is in order.[8] As Marilyn Strathern convincingly shows, any definition of health, and the question of what is needed to maintain a healthy status are culturally defined.[9] Health

7 Müller 1971.
8 Morgan and Trentmann 2007.
9 Strathern 2004.

is not simply a physical status but the result of both physical and cultural norms. This model is Western-centric and biased by an image of consumerist egos as culture-free actors.

With this it has become clear that there are no universals with regard to food, religion or shelter. Ignoring this fact, the presumed universality of basic needs is widely acknowledged in the innovation debate, and it has led to a particular kind of innovation, called "BoP-Innovations". The multinational enterprises producing such items claim that their new products are designed for the 90 % of the world's population who live "at the bottom the pyramid", which means in conditions of poverty.[10] Aneel Karnani has rightfully pointed to the shortcomings of such innovations, because they are biased by assumptions about the existence of populations that are barren of culture and are reduced to creatures with only physical needs.[11] This cannot be true: every innovation is embedded in cultural settings and social conditions and the simple "fulfilment of basic needs" is never sufficient for the success of innovations. The so-called "BoP-Innovations",[12] referring by definition to the presumed universal needs of the poorest, are a phantasmagoria of the multinational enterprises, and they hardly ever work.[13]

Innovations may contribute to a better life of many, on every stage of the pyramid of needs, if we provisionally accept the existence of such a pyramid. However, in a consumer society, innovations meet merely desires (unless one categorizes wireless communication as a basic need). In this perspective, the creation of new desires that may be perceived as important needs sometime after their appearance is a fundamental precondition of innovation.

The consequences for the consideration of the example – the Apple products mentioned at the outset of this article – are obvious. Innovations of this kind have one important precondition: the identification of new desires or needs. The "creation of desires (and needs)" and their diffusion through social learning is a prerequisite for successful innovations.[14] This is a central aspect of many current theories about consumer culture, and also a substantial extension of Maslow's model of the pyramid of needs.[15] In a polemical manner, it is possible to say that the more recent theories about consumer culture reverse the pyramid, putting the broader level at the top, while narrowing the bottom. More precisely, it is not the pyramid which is reversed, but the modes of identifying needs and their relevance (Fig 2).[16]

10 Bloemink and Smith 2007.
11 Karnani 2009.
12 www.bopinc.org (visited on 17/01/2017).
13 For a more differentiated understanding of the role of Innovation in BoP-products, cf. Beers, Knorringa, and Leliveld 2012.
14 Ruprecht 2004.
15 Arnould and Thompson 2005.
16 In Jaron Lanier's terms, consumer society has managed to "crash down" the Maslow pyramid (Lanier 2010, 78).

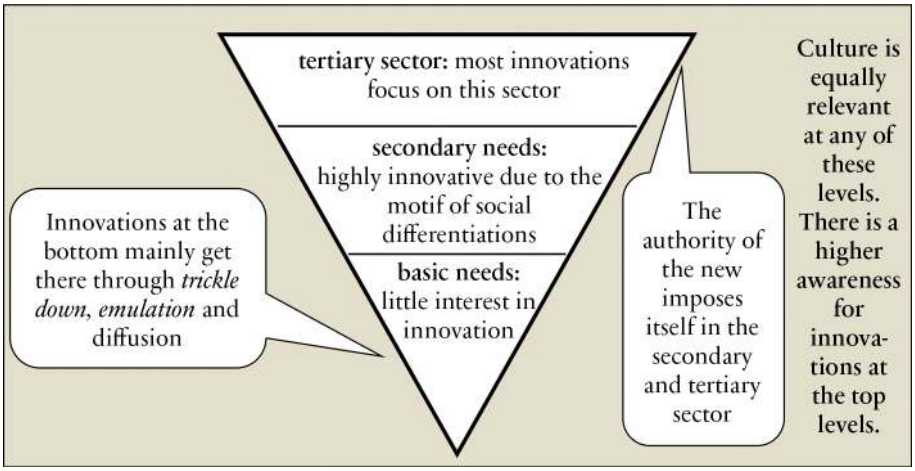

Fig. 2 The reversed model of Maslow's pyramid. This model integrates the findings of social research, in particular social processes of adaptation and appropriation (Bringéus, Veblen, Tarde and Adorno). Most innovations are perceived at the top level, although they may occur at any of the three levels. The readiness to locate innovations at the top levels is related to the mechanisms of social learning.

4 Questionable innovations

Concepts of the adoption of innovation through changing consumer behavior include a wide range of terms like "emulation"[17], "trickle down"[18] and also "diffusion of innovation"[19]. Without going into the detail of these notions, it is worth pointing out a common element. These theories share the following assumptions (1) innovations do happen, and (2) consumers take them seriously. These assumptions imply objectivity of innovations, which is – as explained in the previous sections – highly questionable. In this context, the question emerges how the eventual rejection of consumption can be explained at all. The questionable objectivity of innovations is not taken into account in these theories. This section will give further examples for the mixed outcome of innovations, underlining their context-dependent character.

A poignant example for the fragmented information and the emerging contradictions during and after the adoption of an innovation is the history of the refrigerator. At a first glance, the diffusion of refrigerators may be considered a typical example for the trickle-down theory. The first electric refrigerators were part of the upper class lifestyle. Subsequently, the technology diffused to the middle class, only in order to become a ubiquitous appliance within a few decades.[20] However, forty years later, the more dan-

17 Veblen 1899.
18 Bringéus 1983.
19 Rogers 1995.
20 Giedion 1948; Hellmann 1990.

gerous character of some of its components attracted the awareness of many consumers. Millions of owners started to worry about the environmental threat from CFC (i.e., chlorofluorocarbons), which is contained in the cooling system. The sudden change in perception and the rise of ambivalence were definitely not the result of any kind of marketing but of more complex information policies. More detailed information about the inherent dangers of this technology led less to new forms of consumption than to a more critical perspective on existing household devices as such. Today, there is another issue in the public debate, and once again, theories of consumption have not been able to foresee it: the problem of energy consumption of refrigerators.[21]

What happened here is the rejection of a consumer good some decades after its introduction. In spite of the fact the new technology as such and context seem to fit perfectly, the discovery of new contradictions led to a partial rejection. I could also say, the fate of an innovation can change, even after its usage has achieved the status of an ubiquitous item.

Following mainstream consumer theories, consumption patterns, differences in taste and related differentiations of lifestyle are rooted in processes of identification and the constitution of the consumers' social identity.[22] However, in some contexts, this does not apply. This is the case for the refrigerator, because its rejection is not so much a question of patterns, tastes or lifestyles, but rather a consequence of new information.

On the basis of this example, the model of the individual who improves his/her way of living by the acquisition of new and improved consumer goods should be questioned. This model falsely assumes that the consumer is an autonomous and well informed actor. As shown, both conditions are not always present. An appropriate interpretation has to take into account potential errors of the consumer, his/her ignorance, and also his/her doubts about the consequences of an innovation.[23]

The outcome of these reflections is the deconstruction of the idea that innovations always represent a driver for new forms of consumption and contribute to an improved standard of life. Such assumptions may be true in the framework of a consumerist ideology, and most probably in Steve Job's self-understanding. But the opposite may also apply for innovations: in the consumers' perspective, its practical uses are not always what they are expected to be. The fact that sometimes the unforeseen consequences emerge

21 Stender 1993; Wölfel 2009.

22 Bourdieu 1979.

23 Amartya Sen distinguishes between the possession of consumer goods and their actual function for the owner. Particularly in contexts of poverty and innovations, great differences in functions may appear (Sen 1987). In many African countries, wealthier people are able to buy powdered milk and use it in similar ways as it is used in Western countries. However, in the hands of the poorer the function is different. If they can afford this luxury good at all, it has a quite different role. Instead of serving as a healthy food, it becomes a threat of life for the babies. The reason for this change is not the milk powder as such, but rather the water used to reconstitute it (James 2000). Only if the quality of the water is according to western standards, can the food be used without harm to the child.

only some time after the innovation and its adoption does not counter this argument if for example the new context leads to the abandonment of the novelty. The value of an innovation and the plausibility of its adoption depend on factors that are sometimes beyond the producers' control.

5 Innovation and lethargy

These interpretations lead directly to the third argument of my contribution. Much in line with the first and second argument, it intends to focus on the consumer who is also the user. It is these men and women on the streets and in their apartments who decide about the acceptance and the future role of any innovation.

The starting point for this argument is a case study from Lucy Suchman who worked for many years as an anthropologist at the Palo Alto Research Centre (PARC) for the Xerox Company.[24] Her case study deals with a particular model of a copier. At the time of its designing and production, it was naturally one of the most up-to-date models. Meanwhile the company already prepared to change its product range, steering away from copiers and focusing on computers and printers. The idea of designing this copier was to provide all the possibilities and features of a complex, fully-featured copier at a more affordable price. The innovation of this device was the recombination of existing features and a new target group of users. Up to that moment only available for professional printing shops, offices and copy-shops, the new model aimed to bring the features to non-professional users.

Thus, a technology initially only provided for professional users should now become more popular and used by a wider range of non-experts. However, the expectation to sell this highly functional device in great numbers did not become reality. Contrary to the company's expectations, the feedback of the customers reported about malfunctioning and difficulties with regular and rather simple copying tasks. Even worse, this model seemed to have the dubious renown of breaking down regularly and being difficult to handle.

This was the moment when the management asked the Palo Alto Research Centre for help. The meetings there centered around the question: What had gone wrong? Why didn't the customers recognize the new model's wide range of features? After all, this model represented the sum of all experiences of the market leader in the sector of conventional copiers at that time. In the following meetings, the engineers of the computer department presented a simple explanation: the integration of the different features had failed because the underlying concept was out of date. Only a central processing unit

24 Suchman 2005.

and a professional operating system – which means, basically, a computer – would be able to manage the new copiers' complexity and bring the extended range of options of modern copying within users' reach.

Suchman rejected this explanation. As an anthropologist, she insisted on proceeding to ethnographic research in order to understand the deficits of the current copying machines. As she found out, the basic problem was not so much the complexity as such, but merely the new range of potential users, who found this copier at first sight highly appealing. These people, who had little or no experience with copying machines, were confronted with buttons and switches of a highly complex model. Not having any experience with similar devices, they were simply not in a position to feel competent about the new copier. It was not possible for these untrained users to establish a personal relationship with the new model. Most of the features had no relevance for them, but the everyday routines of copying had become too complicated to proceed without problems. Mistakes in dealing with the machine were the consequence, and, subsequently, its malfunction.

Following her research, Suchman suggested a particular solution for the problem that turned out to be an important innovation. She focused not so much on the technology as such, but on the perceived problems of communicating technologies. Her suggestion was the following: she recommended that the factory department give the most relevant buttons a green color. What does such a color code mean? This modification left the technology unchanged, only the communication of the technology changed. The first priority of this communication principle was to separate the most important functions from all other potential modes of copying. This new strategy of 'self-explanatory' user interfaces made it possible for non-professionals to perceive the device as something safely controllable.

6 How innovations become *affiliative objects*

There are three things to be learned from this case study: the first concerns the biased evaluation of the experts. Xerox had already made the decision to abandon the conventional copying technology, and the company trusted the experts' opinion too much. The producer perspective dominated over any other way to look at the things and reached a dead end. The engineers stated that the immanent shortcomings of the old system were too fundamental to find a remedy for it. Today we know that this technological explanation was faulty. Even after that episode, conventional copiers were successful. We further know that the green button has widely diffused and is now a standard feature on most copiers.

Secondly, we can derive from this an argument about innovation more generally. The success of an innovation is not just a question of the creation, recombination and implementation of new technologies. Making plans and just applying them is hardly ever sufficient.[25] Innovation requires a successful communication of the novelty. Only by communication is it possible for users to perceive themselves as competent actors in dealing with technology. The simple presence of the innovation does not mean its acceptance, not even when consumers are willing to use these things.[26] This particular understanding is the key to the concept of *affiliative objects*, presented by Suchman a few years later.[27] With this term, she stresses the relevance of the users' capacity to create an affiliation through successful and repeated use as a prerequisite for adopting the innovation.

As explained in more detail in an earlier publication, Suchman considers "innovations" as "critical projects".[28] In this publication she also uses case studies to make her ideas clear. One of the case studies is the transformation of Xerox from producing conventional copiers to the marketing of computers and printers. The second case study concerns another company in the insurance sector that shifted from individual talk in customer support to internet-based information for clients.

In both studies, the innovation as such is not the problem. It is rather the perception of those men and women who reject the new technology or the new structure, and for whom the innovation was meant to provide an increase in efficiency and thereby an improvement of their work. The innovations in question only achieve the status of an *affiliative object* if the changed structures of work have been adopted, or in the second case, if the regular use of a computer interface for internet-based customer support has been accepted. The innovation is a "critical project" as long as there is no evidence that the users perceive the new structure and the new devices as an improvement.

Steve Jobs understood this very well when he insisted on presenting Apple's innovations himself. It may be banal to be on stage with jeans and a black jumper while holding a tiny screen in one's hand, but this precisely communicates the aura of a new object, of 'being controllable', which is important for the success of an innovation. It is of little matter how the engineers define the innovative character of any of Apple's new devices as long as Jobs manages to convince his clients of his innovation as an improvement.

I do not intend to present a plea in favor of Apple or the ideology of consumerism in general. And I do not believe that the quality of an innovation is a question of self-promotion of CEOs or of marketing. Instead, my argument critically addresses claims of the innovative character of a particular object. It has become clear that the claim of such properties is of quite little relevance. It is not so much the innovation as the capacity to

25 Suchman 1987.
26 Suchman and Bishop 2000.
27 Suchman 2005.
28 Suchman and Bishop 2000.

become an *affiliative object* that decides about the success of an innovation. Only if people become thoroughly acquainted with new things is innovation successful. Innovations do not occur as 'ready-mades', they have to go through a process of familiarization or appropriation in order to be successful.[29] Appropriated objects very often are appreciated for their multipurpose character and not so much for one specific innovation.[30]

The concept of the *affiliative object* refers to the necessity for any innovation to be manageable. The hesitating user has to be convinced and the ignorant customer needs to understand the new object's properties. Otherwise the innovation will not succeed, it will not even be acknowledged as such. Ethnographic observation makes clear that many new objects have the quality of being ambivalent at first. It is only after some time of dealing with it that users may overcome the "trickiness of the improved object", as Adolf Muschg has aptly formulated some thirty years ago.[31] And, only after these initial steps does Adorno's "authority of the new" become a reality.

7 Conclusion

The three arguments of this article shall be combined and interpreted: the first argument is about the intimidating character of the new and its authority, which may reach far beyond the evaluation of the single innovative object. It rather pertains to the material possessions as a whole. The second argument intends to deconstruct the link between innovation and needs or desires. In contrast to dominant discourse, many innovations require the generation of corresponding needs prior to their acceptance. In the terminology of the current understanding of needs and innovations, the creation of new desires happens through 'social learning'. However, the creation of desires is only one side of the process, as other information can lead to an ambivalent evaluation of innovations. The third argument is based on Suchman's case studies and deals with reluctance and hesitation as factors against innovation. More precisely, it is not the inertia of the things themselves, but the preference of the user to continue dealing with things which are well known. Dealing with things and understanding new objects are matters of communication. Suchman's notion of *affiliative objects* steps beyond the engineers' claim of an objectivity of innovations and focuses on the interface between user and technology. The degree of novelty does not decide the fate of innovations, but the experiences of the user or owner.

The production of ideology and, following from it, the logic of consumer societies tend to overestimate the isolated 'innovative technology' and to focus on the identifi-

29 Suchman, Orr, and Trigg 1999.
30 Gronow and Warde 2001, 222.
31 Muschg 1981.

able newness of a particular object. In contrast to this dominant thinking, I claim that a closer look at material possessions as a whole can contribute substantially to understanding the impact of new things. Those things in inertia, sometimes devalued through the presence of the new, teach more about the impact of an innovation than the new object itself. Furthermore, it is a shortcoming to think that users of new objects have all relevant innovation available from the very beginning. As shown with the example of the refrigerator, information is fragmented. Very often, additional knowledge about the consequences comes up with considerable delay after the adoption.

Then it may lead to a more ambivalent evaluation. Finally, innovation depends on communication. The differing knowledge of the users may lead to the rejection of innovations.

In short, my three core arguments are the following:

1. The authority of the new is questionable. This is perceivable through the devaluation of existing material possessions and the changing of their contexts.

2. The ascribed properties of an innovation do not constitute full information. People need more time and experience to fully understand an innovation.

3. The perception and acceptance of innovations depend on communication. Not the objective properties, but the potential for a bonding between innovative object and humans decide about its adoption.

Production ideology and consumerist object fetishism constitute a powerful bias in current thinking, upholding the single object as a main criterion of innovation.[32] Meanwhile, the roles of those things that remain inert, without changing, are underestimated.

On a global scale, Marshall Sahlins has pointed to this problem by speaking about "cosmologies of capitalism".[33] Following his argument, it is a consequence of the capitalist worldview that Westerners, wherever they arrive, believe not only to be superior, but also to bring along desirable goods, i.e. innovations. The classical moment of the expansion of capitalism is the scene of Europeans arriving on a remote island. Inevitably it is followed by narratives about the natives' appreciation of goods initially handed over as gifts.

The natives' quasi-prescribed role is to admire the wondrous things from the West and subsequently their readiness to trade in order to acquire as many of the new goods as possible. Sahlins insists that this supposed overwhelming appreciation of new things, i.e. innovation, is just an ideologically biased image, influenced by the core feature of the cosmology of capitalism, which is the idea of the superiority of the new. The capitalists'

32 Attfield 1999.

33 Sahlins 1988.

cosmology denies the existence of alternative approaches to new things; it also denies the fact that all cultures have their own cosmology, and many of them resist the allure of innovations.[34] By assuming that all people will appreciate their products, the BoP-Innovations are a particular example for present-day denial of culture.

In conclusion, it is of particular relevance not to understand my thoughts about innovation as arguments relevant only for present times. On the contrary, I am dealing with questions that also matter for archaeologists. More specifically, in the context of the 'diffusion of innovations' it is important to ask how people perceive a novelty and how their evaluation of material possessions changes with the adoption or rejection of the new.

In a similar vein Joanna Sofaer-Derevenski and Marie Louise Stig Sorensen reflect about innovations at the end of the Neolithic age.[35] As these authors argue, the arrival of the first metals cannot be described just by looking at an innovation and new objects. Of equal importance is the investigation of changing social practices and also of resistance. Therefore it is not the male warrior alone who is adopting the new metal weapons: there are more complex issues of re-evaluation of objects and re-organization of social structures. The increasing number of different forms of weapons at that time is not just an outcome of innovation, but also an expression of social and political competence to negotiate the meaning of the new. Against the background of a considerable number of inert objects in everyone's possession, particular forms of embodiment in the sphere of social meaning are the precondition for innovations.

There is no reality of social relationships in the world beyond the world of the material and beyond the things that people use, share, or deny to share. Things are relevant in order to make relations visible, and they are the key to the production of tradition.[36] Therefore new things are never just a question of innovation but merely an outcome of negotiations. The success of an innovation depends on the re-contextualization of the new object in the environment of the things already present, which are not always ready to change their meaning just because the new has arrived.

34 Sahlins gives some examples for the resistance against innovations. A case in point are the Chinese during the Manchu Era, where the Europeans hardly found a product that attracted the Chinese traders' interest (Sahlins 1988, 6–11). A similar experience was made by British and American traders in Hawaii, where they intended to buy sandalwood, but did not find anything to offer that attracted the interest of the local population (Sahlins 1988, 28–36).

35 Sofaer-Derevenski and Sorensen 2002.

36 Geismar and Horst 2004.

8 Summary

Consumer societies have a specific relationship to innovation. Novelties are positioned in an ideologically based framework that emphasizes the essential character of any new feature in the latest innovation. This essentialism of the novelties urges people to acknowledge an assumed 'need' for them and consequently praise them. The need for innovative technologies, life-styles and fashion is based on a widely internalized reversal of the relationship between 'needs' and 'motives'. The seemingly universal basic or primary needs are not of any relevance anymore; they are rather replaced by the perception the individual's desire for the new. Basic needs are marginalized, basic needs are relevant only in the context of other societies, which are the poor and the underdeveloped. Consumption in consumer societies is defined by the elevation of innovation and the contempt for the rest of the material world.

The implicit assumption about the consumers' self-understanding relates to his interest in the new and his willingness to be informed about innovations. Based on some examples, the shortcomings of such assumptions are clear. A careful ethnography of everyday dealings with technology and innovation shows that in high frequency routines the embedding of a technology and the expectation of reliable handling are the dominant factors for their appreciation. The readiness 'to learn new things' is limited, and often the users of new devices appear ignorant because they do not exploit the full range of their possibilities.

It can be concluded that innovation does not so much depend on the degree of novelty and of its technical advantages, but rather on the context in which it occurs. Innovation requires embedding, including the tendency of many users to critically evaluate subjective advantages and then consider a slow adaptation.

Following Marshall Sahlins, the disregard for the unchanging and the appraisal of the new is a specific expression of a capitalist cosmology. A comparative perspective sheds light on examples of societies in which the interest in innovations has been low in the moment of contact with Europeans. The disinterest in western innovations was particularly disappointing for the colonizers who believed they could convince the people on other continents of the superiority of the West by presenting innovative items or fashionable gadgets.

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Neolithization in Progress – The Advent of Domesticates in Northeastern Africa

Summary

The neolithization of Northeastern Africa is currently studied in terms of the successful incorporation of domesticates as an active response to climatic changes, by carefully dividing between pre-pastoral and pastoral modes of life or wild and domestic species, respectively. However, it becomes obvious that interest in domesticates is a long-term commitment to other species, given that numerous intended and unintended consequences arose from this particular change in human-environmental relations. According to Gabriel Tarde, innovation can be studied as an act of 'imitation' that produces 'variation'. This would defocus from the subject position of initiators of innovations and rather stress other agents in this process, both human and non-human.

Keywords: Neolithic; cattle domestication; human-animal relations; commitment; Nile Valley; Egypt; Sudan.

Die Neolithisierung Nordostafrikas wird gegenwärtig über die erfolgreiche Eingliederung von Domestizierten als aktive Reaktion auf Klimaveränderungen untersucht, indem ein strikter Unterschied zwischen der präpastoralen und der pastoralen Lebensweise bzw. zwischen wilden und domestizierten Spezies gezogen wird. Es ist jedoch unübersehbar, dass das Interesse an Domestizierten eine langfristige Verpflichtung gegenüber anderen Spezies bedeutet, da dieser Wandel in den Mensch-Umwelt-Beziehungen zahlreiche beabsichtigte wie unbeabsichtigte Folgen nach sich zog. Wird Innovation nach Gabriel Tarde als eine Dialektik von ‚Imitation' und ‚Variation' aufgefasst, liegt der Fokus weniger auf dem Subjekt des Urhebers, sondern schließt auch andere, menschliche wie nicht-menschliche Akteure ein.

Keywords: Neolithikum; Rinderdomestikation; Mensch-Tier-Beziehungen; Commitment; Niltal; Ägypten; Sudan.

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1 Introduction

Both southeastern Europe and northeastern Africa owe their first domesticates, a 'package' consisting of sheep, goat, pig, cattle, probably also dog, and so-called founder crops such as emmer, barley, legumes, and flax, to southwestern Asia.[1] Cattle is often excluded from this list as some researchers assume that cattle were domesticated locally from wild aurochs populations in northeastern Africa.[2] Many questions focus on the spread of related practices that in both perspectives are seen as novelties that gradually entered more distant regions. After its initial advent in northeastern Africa, probably by means of human-driven migrations from the southern Levant, the package of domesticates was split up and modified in a way that does not allow us to consider neolithization a diffusion of ready-made species and norms, except for in the very short term (Fig. 1). As some elements were chosen while others were rejected, this pathway is thought to go beyond the commonly agreed upon categories of the 'Neolithic' for other regions.[3]

While relating European history to early Holocene southwest Asian agricultural practices we seem to fail to consider the African Neolithic in its own terms.[4] From a European viewpoint, it constitutes a challenge to gain a more symmetrical understanding of local traditional African subsistence strategies and human-animal co-existence on the one hand and the attraction and impact exercised by southwest Asian domesticates on the other, because we consider the latter to be part of our own history. Some even criticize the inappropriate use of terms such as 'Mesolithic' and 'Neolithic' since they are thought to be reserved for the European scheme.[5] This raises the question of what basic terms and schemes we can still agree on to appropriately represent a global prehistoric past. Because, quite unchallenged, our archaeological writings are full of modern eco-

1 Wetterstrom 1993.
2 Gautier 2002; Wendorf and Schild 2001.
3 See comments in Arkell and Ucko 1965, 156–164.
4 See critics of Garcea 2006, 200–201; Dittrich 2013a, 45.
5 Garcea 2006, 203–204.

nomic terms indicating relationships that in pre-modern conceptions seem completely out of place.

Since the 19th century the study of the origins of domesticates has gained more and more interest. However in Europe it has remained restricted to emblematic agricultural tools (cf. Fig. 11) and the classic set of a few species, while the domesticated status of other species was and still is rejected. This discussion additionally underlined the 'inventor's' prestige gained through the successful 'diffusion' and 'adoption' of desirable 'innovations' as indicators for universal 'progress', while borrowing these and other terms from modern economy.[6] It must be remembered that in former colonial rhetoric the introduction of 'efficient' agricultural practices to large parts of Africa according to Western schemes was heavily publicized. Stigmatizing them as having remained at a past or 'primitive' stage to be overcome was one of the main arguments for interfering with and violating traditional human-environmental relations on the whole continent.[7]

The discussion of Neolithic innovations comprises an astonishingly similar and narrow range of 'ideal' categories including (biological) domestication and sedentism, 'secondary products' such as milk, traction and the plough,[8] or the emergence of property and commodities[9]. From the view of early Holocene hunter-gatherer-fisher communities, practices leading to the domestication of herd animals could be termed as novelties that would certainly have affected the way of life as previously known by both humans and animals. In most studies, exactly this change in human-environmental relations is brushed over very generally,[10] and the credit for innovations is given to quite different agents in this process.

One focus is on the question where and when biological domestication first occurred. This notion of domestication suggests innovations to be related to the change or 'improvement' of biological properties of species which led to a change in human behavior. From a purely modern viewpoint, even genetic changes are seen as innovations based on the "introduction of new breeds or varieties which have specific advantages, i.e. being higher yielding or more resistant to certain weather/soil conditions".[11] However, the validity of such functional relations formulated as retrospective instructions for the prehistoric past is questionable. Paying attention to the social practices of domestication instead would challenge our present notion of domestication and human-animal relations in general.[12] Therefore, the concept of 'innovation' will be used here to consider the supposed pros and cons as well as probable unintended outcomes of novelties imposed on existing relationships. As a result, one might ask if a unique development or

6 Rogers 1962.
7 Robertshaw 1990.
8 Sherratt 1981; Hodder 2011.
9 Gebel 2011.
10 Cf. Hassan 2002; Garcea 2004.
11 Veen 2010, 2.
12 Ingold 2000; Russell 2002; Russell 2007.

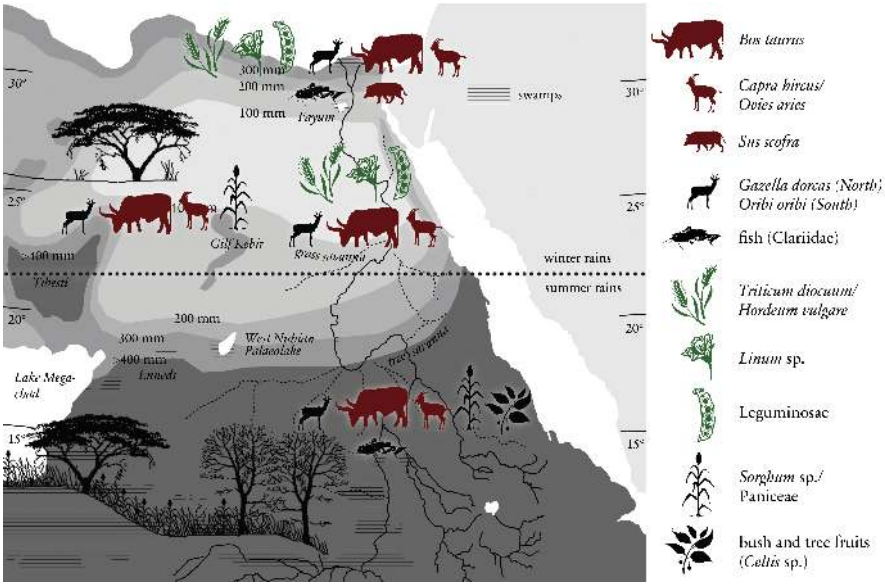

Fig. 1 Regional combinations of domesticated animals and plants introduced from the Levant (colored) and of local African species (black) around 5000 cal BCE (paleo-ecological data after Neumann 1989; Pachur and Altmann 2006; Linstädter and Kröpelin 2004).

chain of independent 'innovations' and 'entanglements'[13] formed a particular African pathway to herding and agriculture.

2 Moving species – the paleo-environmental evidence

The northeast African study area can be separated from north to south into three main ecological zones (Fig. 1): (1) Lower Egypt as part of the Mediterranean corridor but consisting almost completely of the intensely drained Nile delta, (2) Upper Egypt and Sudanese Nubia as parts of the Eastern Sahara with only marginal vegetation, and (3) the Central Sudanese Nile valley as part of the sub-Saharan savanna belt.[14] During the early Holocene, there were considerable differences in the water regimes of the Nile river basin comprising extended local drainage systems, lagoonal lakes and swamps,[15] the rain-fed lake systems covering large parts of the present-day Sahara,[16] and desert areas providing only restricted or non-permanent access to water. Furthermore, there must have been a qualitative difference between the continuous winter rains of the north and the short but more violent monsoon summer rains of the south[17] accounting for divergent ripening seasons of different grasses.

13 Cf. Hodder 2011.

With the three main ecological spheres in northeastern Africa, a striking duality can be observed in the mid-Holocene adoption of domesticates (Fig. 1). The first pattern appears around 5100/4800 cal BCE in the Egyptian Nile delta and in the Fayum basin and could be considered the adoption of the 'full Neolithic package' of domesticates, including cattle, sheep, goat, pig, dog, emmer, barley, legumes and flax.[18] The presence of these species could not signify a greater rupture of local traditions in terms of the previously unknown practice of farming and herding or linen cloth production. Nevertheless, the first farming communities of Egypt made a quite specific choice: although several varieties of barley, emmer, hard wheat and bread wheat must have been known to them from contacts to the Levant, they relied mainly on six-row barley (*Hordeum vulgare* ssp. *vulgare*) and emmer wheat (*Triticum turgidum* ssp. *dicoccon*)[19]. During the mid-Holocene period all of Egypt most likely received winter rains (Fig. 1), allowing the farming of southwest Asian crops to rely on a seasonal cycle similar to that of the Mediterranean area with harvesting in early spring.[20]

However, this kind of subsistence is still complemented by a significant amount of fish as a long-established local food component as well as by the hunting of Nile-based species and species of the circum-Mediterranean fauna including hartebeest, dorcas gazelle and hare.[21] Also the collection of wild plants such as knotgrasses, sedges, ryegrasses, and legumes (*Vicia* sp.) still persisted.[22] The swamps in the Nile delta and the Fayum supplied a further range of water-dependent species and edible plants such *Typha* sp. or Papyrus (*Cyperus papyrus*). There is weak evidence that at the same time the full package of domesticates spread as far as the Upper Egyptian Nile valley, probably with the exclusion of pig.[23]

By contrast, in Sub-Saharan northeast Africa the summer monsoon rains facilitated a tree savanna with dense grasslands during the Holocene which is found today about 800 kilometers further south (Fig. 1, 2).[24] In these areas, including the Sudanese Nile valley, a second pattern for the adoption of domesticates is found: a restriction of the faunal component that includes only cattle, sheep, goat, and dog.[25] Obviously, the 'original package' had been modified while excluding barley, emmer wheat, legumes, flax and pigs (Fig. 1).[26] Plant food was still provided through the collection of abundant

14 Neumann 1989; Barakat and Gamal el-Din Fahmy 1999.
15 Adamson, Williams, and Gillespie 1982.
16 Hoelzmann et al. 2001; Pachur and Altmann 2006.
17 Linstädter and Kröpelin 2004, 774.
18 Wetterstrom 1993, 204–220.
19 Cappers 2013.
20 Phillipps et al. 2011.
21 Wetterstrom 1993, 208, 214.
22 Wetterstrom 1993, 209, 213.
23 Wetterstrom 1993, 216–217.
24 Neumann 1989.
25 El-Mahi 1988.
26 However, recent microbotanical evidence suggests that at the same time *Triticum* sp. and/or *Hordeum* sp. spread as far south as the Dongola region (Madella et al. 2014).

and diverse wild savanna grass seeds, tree and shrub fruits as well as medicinal plants, as previously practiced during the early Holocene.[27]

The combination of animal herding and the reliance on wild annual grasses, namely millets such as *Sorghum, Pennisetum, Echinochloa, Panicum* and *Setaria* (Fig. 2), is archaeologically known as far north as the Farafra Oasis in Western Egypt[28] but extends also to the west into Libya[29]. The staple dish based on 'wild' millets instead of 'domestic' cereals reveals a culturally different dietary concept.[30] Sorghum seeds are consumed as porridge, soft bread and beer, whereas the stems are used as construction material, fuel, or fodder for herd animals.[31] Though it is highly likely that sorghum was cultivated during the Neolithic or even well before, it is presently not accepted as having been domesticated according to the biological definition.[32] Again, Neolithic subsistence in the south was complemented by hunting and also by fishing and the collection of mollusks in riverine environments. Animal bone remains represent the rich diversity of the Ethiopian fauna, including gazelles, large antelopes, elephant, giraffe, African buffalo, rhinoceros, aardvark, and warthog.[33]

Summing up the paleo-environmental evidence one could ask why different choices were initially made in the north (Egypt) and in the south (Nubia, Sudan). As a proposition, I would argue that by systematically accentuating the various causes for the acceptance and rejection of domesticates in each region, we may better understand the essential impact of neolithization. Despite the occurrence of different species we may still find similarities that could be studied as novelties. Another related question is whether animals or domestic species themselves should be viewed as innovations, or if we have to expand the methodological approach beyond the biologistic paradigm. In other words, we could ask if 'wild' or 'semi-wild' species were involved in similar practices of domestication. As it has previously been stated that cattle could have been initially domesticated in Northern Africa, namely in Egypt, it is necessary to first consider the main arguments for this and how innovation is thought to be rooted in human-environmental relations.

3 Living apart in the wild? The wild and domestic ends of cattle

Among most proponents of African autochthonous cattle domestication from aurochs (*Bos primigenius*) populations it is assumed that cattle herding evolved within mobile and

27 Magid 1989.
28 Barakat and Gamal el-Din Fahmy 1999, 43.
29 Garcea 2006.
30 R. Haaland 2007.
31 R. Haaland 1999; Mirzeler 2009, 401.
32 R. Haaland 1999.
33 El-Mahi 1988. Diet consisting of animals, however, might have been even more diversified, given the presence of land snails, reptiles such as snakes, turtles, and lizards, birds as well as rodents among the faunal remains (El-Mahi 1988).

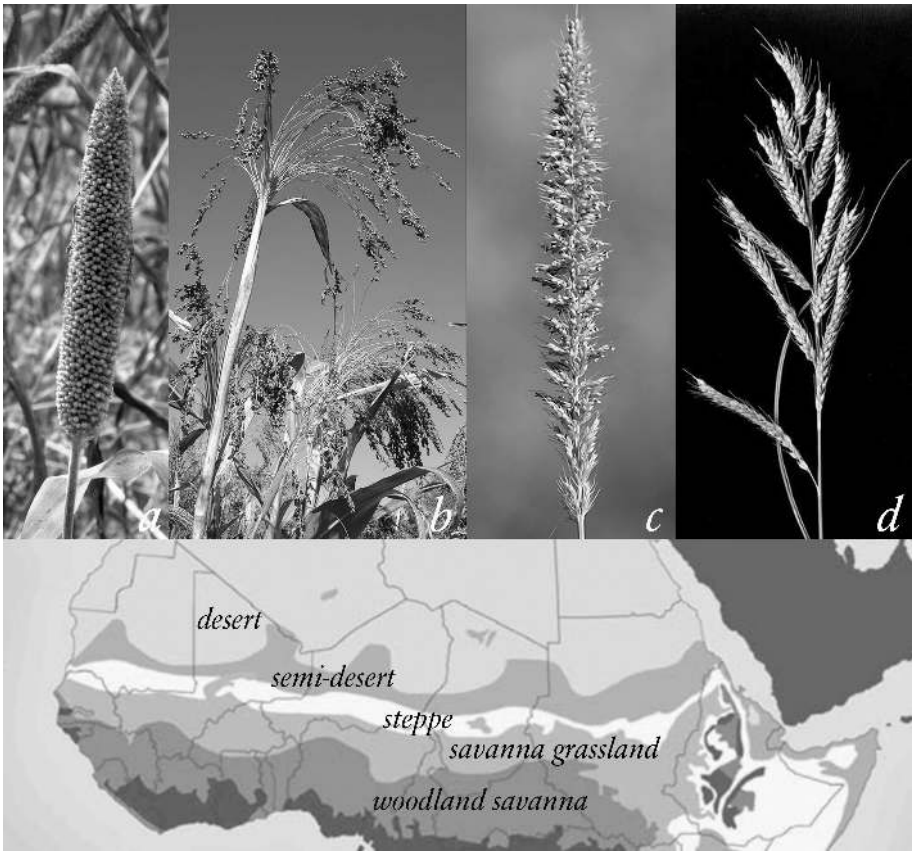

Fig. 2 African millets and the current savanna belt, (a) pearl millet (*Pennisetum glaucum*), (b) wild sorghum (*Sorghum arundinaceum*), (c) bur-bristl grass (*Setaria verticillata*), (d) burgu (*Echinochloa stagnina*).

specialized early Holocene foraging communities in the eastern Sahara. Archaeologically, their material culture was accredited varyingly to either Epipaleolithic, Mesolithic, or Neolithic tool kits as well as with both the absence or presence of pottery,[34] as if none of these object classes could have changed during the process. The major line of distinction was drawn between a 'pre-pastoral' and a 'pastoral' subsistence (as will be discussed below). This reverses the southwest Asian scheme of a gradually emerging sedentism into a north African sequence of sedentary fisher-hunter communities living along lakes and rivers, turning gradually into mobile cattle pastoralists.[35]

34 Wendorf and Schild 2001; Kuper and Kröpelin 2006.

35 Garcea 2006, 200, 204; cf. Gehlen et al. 2002. This domestication process is thought to even predate the first archaeological evidence for the Neolithic in the Nile valley (c. 5100 cal BCE) by more than 2000

The causes for this transition were presented from a modern rationalist viewpoint as an ecological requirement and as a benefit for an economic surplus: (1) the ongoing desertification of the Sahara had enforced highly adapted subsistence strategies such as cattle pastoralism[36], and (2) concluding from present-day sub-Saharan Africa, domesticated cattle would have immediately meant the provision of milk as well as the existence of property and wealth,[37] despite objections that both might be the outcomes of long-term processes. Most unsatisfying, the theory that Saharan foragers started to 'domesticate' wild cattle locally essentially lacks an explanation as to why the hunters' perception of animals – both had lived in a mutual relationship facing a series of climatic crises long before – should have changed in a lasting way at this particular juncture and why they should have developed an additional demand for domesticated southwest Asian goats and sheep that have no wild African progenitors.

It comes as no surprise that the assumed autochthonous primary cattle domestication has come under massive criticism. Although during the Early Holocene aurochs held a prominent position among the archaeologically accessible species in the Egyptian Nile valley,[38] there seems to be no contemporary evidence for human engagement with aurochs other than in hunting and mythological practices.[39] When depicted in late Pleistocene rock art (Fig. 3), aurochsen appear as uncontrolled and are found in contexts with other wild species.[40] In more recent rock drawings and reliefs, domestic cattle are drawn more statically, enumerated and often accompanied by humans (Fig. 7, 8).

Uncontroversial evidence for domestic cattle as well as for sheep, goat and pig – based on bone size comparisons – is dated to around 5100 cal BCE, or respectively, after the supposed initial contacts with migrating Levantine groups.[41] Although it is very likely that these contacts are the causal events for the introduction of domesticates and would prove to be a critical juncture for further developments, they do not yet explain the varying degree of their acceptance or rejection in northeastern Africa.

Indeed, there are genetic patterns in African cattle that might have emerged only after significant genetic introgression of local aurochs.[42] In the past, cross-breeding is

years, while reliable dates are conspicuously missing (cf. Dittrich 2013a, 52–54).

36 Cf. Wendorf and Schild 2001; Gautier 2001; Hassan 2002; Lernia 2006. A typical reductionist definition of pastoralism in this context is the "exploitation of domestic animal herds for food production" while moving the herds "for grazing according to seasonal availability of pasture" (Garcea 2004, 111). In a similar way, African pastoralism has been viewed as broad adaptation to a basic grassland environment (Smith 1992, 10).

37 Wendorf and Schild 2001; Garcea 2006, 200.

38 Linseele and Van Neer 2010.

39 Although the latter might include practices such as capturing, taming and sacrificing that could be termed practices of domestication (cf. Russell 2012a).

40 Huyge and Ikram 2010.

41 Grigson 2000; Dittrich 2013a, 49, 52–54.

42 Gifford-Gonzales and Hanotte 2011. Humped or zebu breeds are thought to have been introduced to northeastern Africa during a more recent period, most likely from Asia via the Horn of Africa (Gifford-Gonzales and Hanotte 2011, 8).

Fig. 3 An aurochsen herd, two small gazelles and a goose as probably encountered during a spring season, rock carving, Qurta (Egypt), late Pleistocene.

likely to occur during free-range herding, and its promotion or tolerance would have involved pre-existing knowledge about aurochs (cf. Fig. 3). Therefore, it might be interesting to pay more attention to the encounters of wild and domestic cattle populations in the Saharan corridor during the mid-Holocene. Later on, cattle herding must have had a severe impact on wild populations such as the African buffalo in the Sudanese Nile valley as well as hartebeest and aurochs in Egypt.[43]

In this respect, animals, either being on the domestic or wild ends of the broad spectrum of human-animal relations,[44] should not be viewed as static elements of prehistoric landscapes. From the paleo-environmental record it can be concluded that northeast African interest in domesticates occurred during a climatically favorable period with significant rains (cf. Fig. 1). The question of domesticates as a choice and necessity to respond to climatic deterioration – strongly influenced by present conditions and their economic effects – could have risen only much later and would then have enforced specific innovations, e.g. irrigation. Furthermore, since biological changes in animals became visible as long-term outcomes only, the scientific restriction to them as the actual novelties may obscure much of the underlying social practices. Thus, the respective practices should be discussed in greater detail.

43 Linseele and Van Neer 2010. While African buffalo seems to disappear almost completely and rapidly from Neolithic assemblages in the Sudanese Nile valley (Dittrich 2011, 232–234), there is still evidence for wild aurochs in the Egyptian Neolithic and late Neolithic sites (cf. Linseele and Van Neer 2010, tab. 3).

44 Russell 2002.

4 Animal domestication as social practice

The exploitation of animals for obtaining meat has long been thought of as the primary motivation ('primary product') for their domestication.[45] However, this view has recently been challenged by zooarchaeologists in stating that domestication as social practice is actually a clear shift to the living animal.[46] It may be necessary here to examine the passive role assigned to animals even more critically. Based on the modern binary oppositions such as humans vs. animals, society vs. nature, or reason vs. instinct, animals have been consistently stipulated as 'the Other' or 'Opposed' to human beings.[47] Criticized early during the 20th century and taken up recently by a broader sociological perspective of human-animal studies,[48] this dichotomy emerges as the outcome of anthropocentrism and speciesism excluding 'non-human' animals as constituents of contemporary Western society.[49] Rightly, human-animal studies claim that although 'non-human' animals are present in almost all social spheres, in most modern historical and sociological reflections animal agency remains invisible. In archaeology animals are seen mainly as material resources while being reduced to 'economic imperatives' and to 'symbolic schemata'.[50] It is often ignored that access to the material properties of animals commonly involves killing them and – as part of the modern 'production process'[51] – since the 19th century has stimulated innovations around the maximization and industrialization of the killing process. In contrast, the ethnographic and mythological record of pre-modern conceptions is full of living and acting animals to which various grades of subjectivity are often ascribed. Consequently, with regard to neolithization, a "fundamentally social approach to domestic animals"[52] is claimed to also affect the still prevailing biological notion of domestication.[53]

In pre-modern societies, animals as well as other entities appear largely as subjects, and are approached by humans as persons or even as divine manifestations.[54] Therefore, dead animals' materials should be kept conceptually distinct from the agency of living animals. The notion of animal 'products' is restricted here to living animals' products such as milk, dung, urine, body heat, or blood.[55] In animistic cosmologies, even artefacts made from organic materials may not just be 'dead' things emerging *ex nihilio*

45 Sherratt 1981.
46 Russell 2012b, 219. Furthermore, the obvious 'unbalanced distribution' of animal body parts in the archaeological record including burials of animal individuals does not mesh with such a general explanation (Marciniak 2011, 127).
47 Cf. Ingold 2000, 61–63.
48 Cf. Mütherich 2008, 5107.
49 Chimaira 2011.
50 Orton 2010, 189.
51 Cf. Dittrich 2013b.
52 Orton 2010, 189.
53 Russell 2002; Russell 2007.
54 Descola 2011, 197–218.
55 The bleeding of living African cattle to obtain blood for food was probably overestimated by 19th and early 20th century ethnographers (El-Mahi 1988, 91). Bleeding may have ritual or medical backgrounds (Evans-Pritchard 1940, 28). In general see Dittrich 2013b.

to underline the subject position of their human creators/inventors but may be transformed subjects who still keep some of their original ontological predicates.[56] These may transcend life and death and may continue to have effects on the bearer.

4.1 Kinship

As novelties related to domestication primarily regard the 'social incorporation' of domestic animals into the society,[57] it was thought that "this locates the key change in animal domestication not in the animals' bodies, nor even in human-animal relations, but in the social definition of animals as a resource".[58] In a more recent paper, Nerissa Russell considered domestication a social practice that could be equated to kinship extended to other species or 'distant relatives'.[59] Most importantly, kinship as a classificatory system is partly established through non-biological relations such as marriage, adoption or godparenthood. When animals are integrated into families, herd structures, mating partners, movements and locations of herds or individuals are ordered according to other social and cosmological patterns. By analogy, this would relate the food taboo to the incest taboo for close 'relatives' (pets), or the concept of castration of oxen to the notion of their edibility.[60] Russell would also relate the emergence of bridewealth constituted of herd animals who follow into the new household to an extension of the kinship system.

4.2 Mother-child relations

As it is not sufficient to simply transpose human social schemes onto human-animal relations, animal behavior can also become a model for human behavior. Because young mammals rely on milk-giving, they are all familiar with receiving food through another human or animal individual. Milking enables a set of trans-species interactions as known from various myths that narrate relations between an animal mother and a human child. As an example, the ideal of kingship during the Old Kingdom in Egypt was still based on animal-animal relations providing a role model that might be as old as the idea of domestication in the Nile valley. The king was likened to a "strong bull", while the kings' mother was "the cow that hath borne a bull".[61] Accordingly, the sun (king) appeared as

56 Descola 2011, 568.
57 Ingold 2000, 64.
58 Russell 2002, 291. As this view reduces novelties in human-animal relations to changes in human-human relations, it has been criticized as reductionist (Orton 2010, 190).
59 Russell 2007, 33–34.
60 Russell 2007, 35.
61 Frankfort 1948, 162. While Henri Frankfort has offered useful insights into the religious basis of human-environmental relations, his ideas of cattle herding connected to 'hamitic' or 'semi-hamitic' diffusion should be regarded with great caution, cf. the criticism of Sanders (Sanders 1969). It has been further warned that, due to a historically handed-down holiness of cattle, "forms and images relat-

"the bull of heaven", born and suckled by the heavenly cow.[62] The word for "joyful, being friendly/caringly" was written with a hieroglyph showing a cow turning backwards to her calf.[63] Among the Tanzanian Iraqw, milk itself "as a metonym for the mother-child relationship […] may be used metaphorically only in relationships that share some of the same intimate qualities" and it may therefore be considered shameful to sell milk at markets.[64]

While keeping in mind that a joyful and caring cow-calf relation could mark the ideal of descent, it is remarkable that female human and cattle figurines made of clay, ivory, or stone appear with the onset of the Neolithic throughout the Nile valley (Fig. 4, see also fig. 10).[65] It has been suggested that female and cow figurines generally signified motherhood and stood for a basic trust that also characterized the ideal of other social dependencies.[66] At the same time we observe a different categorization and more prominent position of children in Neolithic burial rituals.[67]

Although the life cycles of domestic animals are shorter than those of humans, children and young animals can grow up together, in a way that intertwines their life histories.[68] For example, among the South Sudanese Nuer, milking is practiced by women and youths, promoting their identification with cows (Fig. 5). The identification of men, however, is expressed by the care, feeding and adornment of their favorite oxen that are handed over during initiation and destined for later sacrifice.[69]

4.3 Sacrifice and death

Sacrifice acts as an institutional frame when killing becomes part of this mutual relationship.[70] It involves both the domination and violence that were suggested to be

ing to cattle have often remained subject to cliché and generalization in archaeological interpretation" (Wengrow 2001, 91). Therefore, the notion of a general Neolithic 'cattle complex', employing a term of Herskovits (Herskovits 1926) or of a Neolithic 'cattle cult' in Northern Africa (Lernia 2006) simply based on the presence of a species remains superficial as even basic herders' quite different concepts of categories such as calf, cow, bull, or oxen are not considered.

62 It is interesting to note that the goddess Hathor's (or Nekhbet's) "embodiment was not the domesticated cow but the wild animal, living in the marshes" (Frankfort 1948, 171). The ancient Egyptian notion of wild cows, however, does not necessarily conform to our biological notion of wild cattle (aurochs). For instance, it may have concerned free-ranging domestic cows that are not otherwise fed.

63 Frankfort 1948, 162.

64 Rekdal 1996, 376.

65 While cattle and particularly cow figurines in combination with human imagery were found in the Neolithic settlement of Merimde Benisalâme in the Nile delta (Eiwanger 1992, fig. 18), Neolithic figurines are mostly known from grave goods in burials of adults as well as children.

66 G. Haaland and R. Haaland 1995.

67 Cf. Dittrich 2011, tab. 8.4.

68 Ingold 2000, 86.

69 Evans-Pritchard 1953. Prior to initiation, male Nuer children are mainly concerned with small livestock such as goats, sheep and calves (Evans-Pritchard 1953, 186). Unfortunately, Evans-Pritchard failed to study female categories and activities in similar detail.

70 Russell 2007.

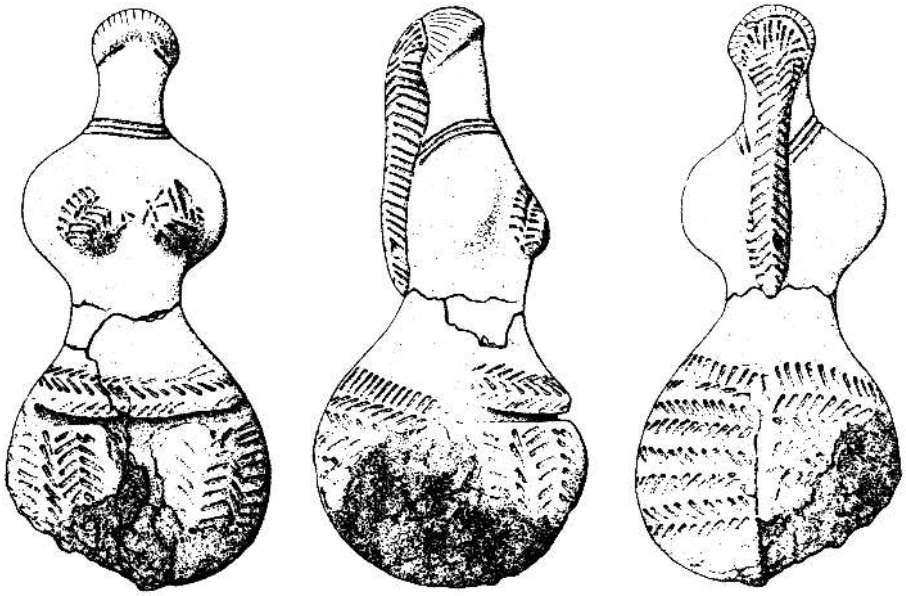

Fig. 4 Female clay figurine from a Neolithic burial, Kadada, Sudan, late 5th millennium BCE.

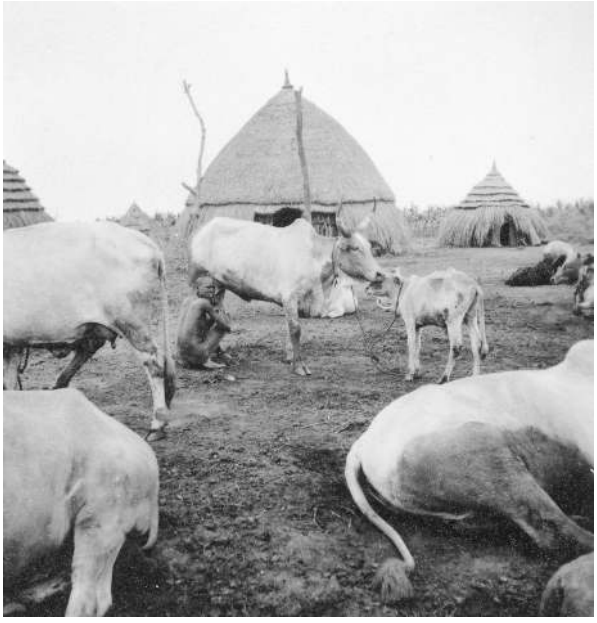

Fig. 5 Nuer girl milking with cow and calf tethered and a hut for cattle (byre) behind, photograph taken by E. Evans-Pritchard in 1935.

viewed according to classical moral concepts of domination and care connected to the ideal of the well-being of the household. Consequently, Timothy Ingold linked human domination over animals with human domination over other humans, namely slaves or captives.[71] Human dominance over dependants might seem difficult to detect for the prehistoric past, however, there are certain features in burial rites that are indeed interpreted in this way.[72] Only recently, a Neolithic burial of an adult man surrounded by three supposedly sacrificed humans and two dogs has been reported from Kadada in the Sudanese Nile valley.[73] The sacrifice of humans is commonly deduced from their peripheral and subordinated position (Fig. 6).

Beside the inhumation of dogs, burials of domestic animals such as cattle, sheep and goat frequently appear at Neolithic and Predynastic cemeteries throughout the Upper Egyptian and Sudanese Nile valleys. The animals' presence ranges from parts such as legs, hides or horns and bucrania (Fig. 6) to complete and carefully arranged burials of individual animals. A tomb complex excavated at Hierakonpolis and dated to 3650 cal BCE not only contained numerous satellite graves of "what may be interpreted as family and courtiers",[74] but was also surrounded by a whole animal cosmos of 46 burials of 'wild' and 'domestic' species such as aurochs, elephant, cow and calf, goats, bull, hartebeest, dogs, cats, baboon, and hippopotamus. Similar to humans, animals could be placed on or covered by matting and textiles.[75] Also cowhides served as mats for human corpses[76] which – next to the presence of cattle horns (cf. Fig. 6) – could point to their assistance during the transition to afterlife/rebirth.[77]

This broad range of burial practices calls for a precise definition of sacrifice, which is thought to specifically occur together with domesticated animals.[78] Edward Evans-Pritchard provided a detailed account of Nuer traditions according to which cattle should not be slaughtered except in sacrifice, meaning that this should take place only on rare occasions while observing specific rules of participation and meat sharing.[79] To

71 Ingold 2000, 61–76.

72 Reinold 1987.

73 "Archaeologists dig up 'oldest' African human sacrifice", AFP news, 15 Feb 2008. Available: http://www.sudantribune.com/spip.php?article25984 (visited on 17/01/2017).

74 Friedman, Van Neer, and Linseele 2011, 157.

75 Friedman, Van Neer, and Linseele 2011, 175.

76 Reinold 1987; Wetterstrom 1993, 217.

77 Structural parallels to practices among the Bayankole were suggested to exist during the 19th century according to which the dead king after having been washed with milk was wrapped in the hide of a sacrificed cow (Frankfort 1948, 164). Other cows were made to participate in the mourning through being separated from their calves to further mark the unbearable event. In Jie conceptions, the cow skin is linked to procreation instead, as it is an indispensable prerequisite for the wedding night (Mirzeler 2009, 408).

78 Russell 2012a.

79 Evans-Pritchard 1953, 192–194. As the eating of such meat has sometimes been refused by the former cattle owner because of his emotional attachment to a particular animal, sacrifice reveals itself as a communal practice that may cause emotional plight among individuals.

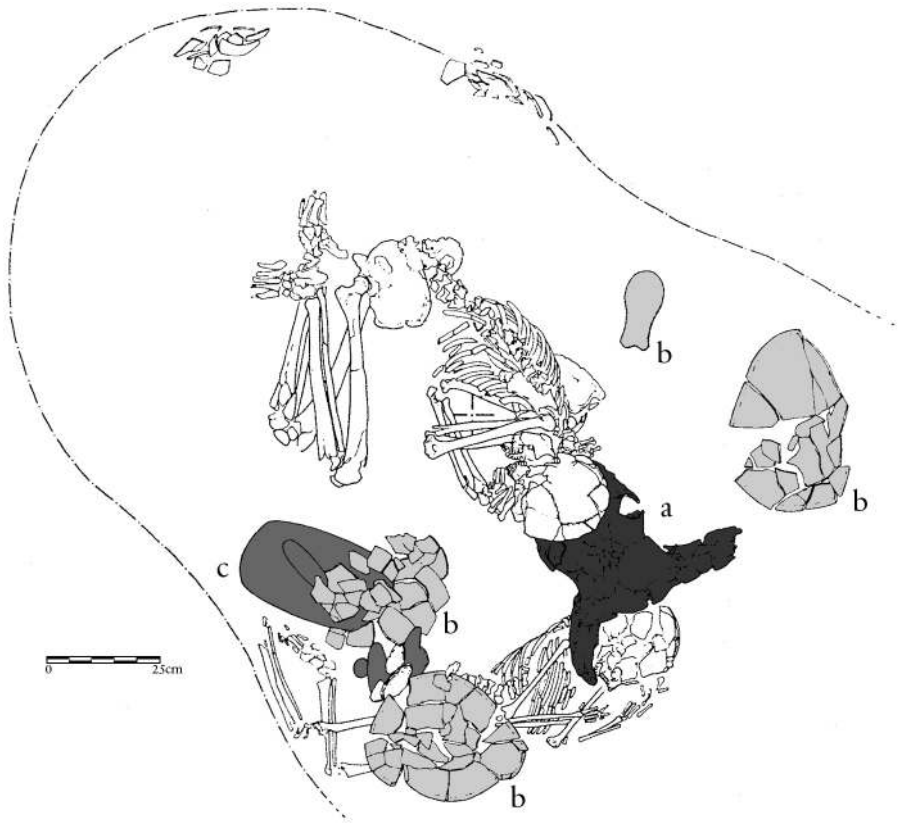

Fig. 6 Neolithic burial of an adult with head resting on a cattle bucranium (a) and of a 10-year-old child placed beneath grave goods including pottery (b), a stone palette and a grinder (c). Kadada (Sudan), late 5th millennium BCE.

subject carefully chosen animals to 'ritualized killings' could be seen as a practice of domestication, as through ritual[80] this act is marked as different from the otherwise sanctioned violation of animals. While for animal materials among the grave goods, such as bone tools, ivory objects and used animal hides, the sacrificial transformation may date back in time, the burial of intact animal individuals equates them to the human deceased – as (living) companions for the afterlife. Thus, the Neolithic burial rites proved

80 Ritual is to be understood as a "system of ritualized actions, which were practiced by active and passive agents […] repeatedly in prescribed, strict or fluid order, time and form, in created areas or instances of liminality and the results of which have intentionally altered the physical world with the motivation to express sacred beliefs […] so that order, in the way they understand it, can be maintained and […] their society can prosper" (Koutrafouri 2009, 96–97).

both dominance exercised over dependants through sacrificing and slaughtering – the latter remained restricted to animals – as well as careful concern with contemporary humans and non-humans.

5 Studying prehistoric innovations or 'difference and repetition'

The view of domestication as a set of social practices seems to call for an equally formulated concept for studying prehistoric innovations. Generally, the use of modern economic terms superficially transposes to the past inscribed mechanisms, power relations or ideal goals such as reducing human labor input or increasing yields. These become most inapplicable to the discussion of animals and human-animal relations predating the present industrialized exploitation of animal life. In archaeology, domestic animals and plants are still *per definitionem* encountered as 'objects' or 'products,' hindering a social approach that goes beyond human-object relations to them.[81]

Our present notion of innovation is not only rooted in modern economic relations but also embedded in certain practices such as writing and publishing, copyright laws, patents, brands, first editions, or scientific reports. Thus, a more general concept of innovation will be used here as a novelty being imposed on pre-existing structures in a way that will lead to the alteration of known things and relations.[82] While being mediated through certain non-written practices such as rituals, contradictions that would arise in this process are responded to by relating new schemes to existing categories.[83] Similarly, Claude Lévi-Strauss attributed changes in the totemic classification to the constant concern of society with differentiating features but not to the interest in change itself. According to him, variations are due to "several means of re-establishing a system, which may not be identical with the earlier one but is at least formally of the same type".[84] As a consequence, however, the categories themselves are transformed in the long-term.[85]

Since innovation is not an inevitable event or process, the intentions for its promotion or rejection might be rooted in unequal power relations.[86] Viewing innovation as progress passing through various consecutive stages, remains a retrospective view confined to a linear notion of history.[87] When Schiffer classified consecutive stages of (1) invention, (2) development, (3) replication, and (4) adoption for studying innovation in archaeology,[88] he relied heavily on Everett Rogers' five sequential stages of knowl-

81 Cf. Dittrich 2013b.

82 Thus, the supposed 'novelty' is closely related to the concept of the 'event' which – when perceived as a "happening of significance" (Sahlins 1985, 153) – is both a historical and a mytho-practical instrument of relating to cultural change.

83 Sahlins 1981, 67–72.

84 Lévi-Strauss 1966, 68.

85 Sahlins 1981, 67–72.

86 Bernbeck and Burmeister, this volume.

87 In economic history this is also known as path-dependence (cf. Martin and Sunley 2010).

88 Schiffer 2010.

edge, persuasion, decision, implementation, and confirmation as defined for the purpose of studying principles of modern economy.[89] Both Michael Schiffer and Everett Rogers considered a problematic intermediate stage of resilience or aversion that has to be overcome to demonstrate the historical success of an innovation. However, it would be false to reduce innovations to necessities, the implementation of which has to be completed while facing various complex challenges. When van der Veen recalled that 'Western technology' introduced to "poor, developing countries" often failed to find acceptance,[90] her example unintendedly illustrated much of the colonial and optimistic connotation of the term innovation. In fact, this kind of transfer caused many social and environmental problems. In the words of Gabriel Tarde, "inventions are far from being, then, the simple effects of social necessities; they are their causes".[91]

Predominantly through the material access of archaeology, one of the above mentioned stages, namely that of replication/imitation, is studied. In this way, the linearity of historical processes could be replaced by a cyclical view that is more in accordance with the reproduction of knowledge in non-literate societies through repetitive commemorative ceremonies and bodily practices.[92] This is exactly the point where the early thoughts of Gabriel Tarde about invention and imitation become relevant for prehistoric archaeology: "since, then, all inventions and discoveries are composed of prior imitations […], and since these composites are themselves imitated and are destined to become, in turn, elements of still more complex combinations, it follows that there is a genealogical tree of such successful initiatives and that they appear in an *irreversible*, although otherwise indeterminate, sequence".[93] As a consequence, it is argued here that innovation cannot be analyzed as a category that becomes effective on its own or that is viewed without considering preceding and succeeding events.

Tarde's sequence of invention and imitation might be understood not only chronologically but also dialectically, not in the sense of an antithesis of the new and the old, but of an immediate dialectic of difference and repetition, as was pointed out by Deleuze.[94] Since imitation is an act of repetition involving conscious or unconscious differentiation, imitation itself always emerges as a source of variation.[95] Only recently, more attention has again been paid to change that "partly comes about through unintended, contingent, accidental interactions".[96] Fortunately for archaeology, most of those interactions are materialized in one way or another. This is the point where both the history of innovations and the material scope of archaeology could intersect.

89 Rogers 1962, fig. 5–1. Rogers himself was influenced by Gabriel Tarde's *Les lois de l'imitation* first published in 1890 (Tarde 1903).
90 Veen 2010, 3.
91 Tarde 1903, 93.
92 Lucas 2005, 77–82.
93 Tarde 1903, 45.
94 Deleuze 1994, 40, 157–158.
95 Tarde 1903, 6–7.
96 Hodder 2011, 182.

However, with prehistory there is no static knowledge fixed by certain practices such as writing that can be followed through and still identified after having passed subsequent stages of manipulation. In contrast, prehistoric or pre-modern inventions/innovations that occurred as historical facts became invisible in a palimpsest of practices, rooting them in mythology. The initial events were often re-enacted as a kind of mytho-praxis[97] and yet, may be still accessible in this form.[98] From this viewpoint, the notion of innovation also emerges as a qualification that may be exercised only afterwards through detaching it historically from preceding imitations, regardless of their human or non-human origin. The latter becomes most obvious with the current extension of modern patents to animal and plant breeds, while preferably employing wild, old, or indigenous varieties. The rhetoric of innovation may thus also emerge as an appropriation of rights that have never been claimed before. At the moment we ask when and where innovations occurred during prehistory we simultaneously create them as quasi-historical facts.[99]

To avoid this, I would like to stress the continuum between various past and present practices, the chronological separation of which – into 'prehistoric', 'historic' or 'modern' practices – remains often quite arbitrary or, with greater distance in the past, even pejorative. Consequently, I do not aim to historize such practices.[100]

6 Pastoralism, space and gendered activities

According to the notion of change brought about by the reproduction of a system – or by imitation that resulted in variation – I want to discuss how concepts related to spatial categories and gendered activities may have transformed with neolithization. It is of particular interest how novelties imposed by the seemingly new social obligations to domesticates could have been attached to already known schemes. Explicitly, the focus is on contexts that become archaeologically known to us.

Since Neolithic animal herding has never been imagined in terms different from that of (recent) pastoralism – loosely defined by mobility for the welfare of animals[101] –,

97 Sahlins 1981; Sahlins 1985.

98 Mytho-praxis is defined as relating historical events and persons to the stereotypic reproduction of existing myths and mythic descent, thus creating "historical metaphors of mythical realities" (Sahlins 1981, 11). A good example would be the Ark of Noah event. It memorializes a threat to the existing order where a sufficient number of humans and animals are transferred to an unknown place to re-establish 'domestic' and 'wild' spheres there as known before.

99 Lucas discussed very similar arguments that are employed to detach prehistory as 'lost' or 'other' time that archaeology seeks to bring back "through historicizing narratives that employ devices such as chronology or origin stories" (Lucas 2005, 126).

100 Although such practices do widely exist in non-economic contexts of contemporary modern societies, they are still best documented in ethnographic records in non-industrialized environments to which this article occasionally refers.

101 Smith 1992; Garcea 2004.

this notion has hindered a view of Neolithic subsistence in its own historical context. It seems paradoxical that while highly mobile groups may have promoted the fast spread of domesticates, and thus mobility seems to be an important concept in this respect, it is the establishment of multiple domestic spheres that predominantly characterize Neolithic landscapes.

In this context it is worth looking at spatial conceptions as they were expressed through decorations of funerary chapels during the Old Kingdom in Egypt that may have originated in human-environmental relationships predating this period. Space in ancient Egypt, either worldly or transcendent areas, could be displayed as an 'inner' and an 'outer' cultural landscape within a fundamental world of "eating and being eaten".[102]

6.1 The inner sphere

The inner sphere is imagined as a place of preparation and transformation of ritual food with different tasks done by women and men.[103] The transformation of cereals through brewing beer and baking bread[104] provided the prerequisites for furnishing sacrifices, feasts or paying debt. Such social properties of domesticated cereals must have been occupied long before by sorghum and other wild grasses. A major difference between north and south lies in the shifted seasons, resulting in different periods of cultivation and therefore in the shifted reoccurrence of feasts that are related to periods of harvest and abundance.[105] While southwest Asian crops in Egypt were harvested in early spring,[106] in the sub-Sahara sorghum is presently harvested twice during the wet season, in autumn and winter.[107]

During feasting as well as in daily life, it is often the gift of specific food and drinks that enables reciprocity or solidarity, as the example of the still important role of sorghum beer in Tanzania vividly illustrates.[108] After the introduction of barley and emmer wheat, differences between north and south were also manifested in the varying importance of baking and cooking. As Randi Haaland put it, while Egypt became firmly placed in the "bread eating world", Nubia formed the corridor to "the porridge eating world" in the south.[109] The different practices seemed to favor the "invention of different

102 Fitzenreiter 2010, 314, fig. 12.

103 Fitzenreiter 2010.

104 Fermentation is an important means for these transformations, thus also a form of domestication (Fitzenreiter 2010, 333).

105 It has been stated that since potentially difficult relations could be settled through special events of giving and sharing, feasting became prominent among growing sedentary groups during the Neolithic (Benz 2006). Furthermore, as agricultural rites are related to myths about death and birth as major transitions in life (cf. Frankfort 1948), the subsequent feasting marked the transition as successfully accomplished.

106 Wetterstrom 1993, 209–210; Murray 2000, 520.

107 Evans-Pritchard 1940, 97.

108 Rekdal 1996, 369.

109 R. Haaland 2007, 178.

items for food preparation – ovens and pots respectively – in the two regions".[110] This combination is thought to explain the fact that pottery had already appeared around 2000 years earlier than domesticated cereals in Africa.

Among Jie pastoralists in Uganda it is related that it was women who took up the novelty of sorghum sowing and cultivating.[111] Through the circulation of sorghum grain – grains and lands are handed down by the mother – "women's social power is constituted".[112] Furthermore, Jie occasionally express human descent through the metaphors of 'granaries' as mothers and 'seeds' as fathers.[113] As excavations of oval huts and pits show, the storage of sorghum and other wild grass grains was already practiced around 7100 cal BCE in the Egyptian Western desert.[114] At that time wild grasses constituted the staple food throughout Northern Africa,[115] and such finds suggest that in ecologically favorable areas sedentism as a temporal establishment of an inner sphere had already emerged. During the Neolithic, granary pits were still dug into the higher ground of settlements and lined with coiled basketry as documented in the Egyptian Fayum[116] and in the Nile delta.[117] As the ethnographic record further suggests, granaries are not just mere containers, but myths of birth and origin might also have been attached to them that were manifested in rituals during their seasonal filling and emptying.

The inner sphere constitutes the stage for animal domestication requiring the daily repetition of practices such as individually approaching, taming, feeding and milking, which are often within the scope of women.[118] Cows are fastened with ropes close to the villages while the calves are around. The Old Kingdom pictorial record observes further practices exercised by men in domestic environments. Captured wild animals were sometimes symbolically domesticated through feeding such as the force-feeding of hyena or the cramming of fowl, most likely shortly before sacrifice.[119] This practice would remain invisible in the archaeological record and may well predate the Neolithic.

110 R. Haaland 2007, 179.

111 In ancient Egypt, Osiris as the personified principle of pending rebirth and resurrection has been claimed as the one "who made the barley and the emmer to nourish the gods, and even so the living creatures after the gods" (Frankfort 1948, 185). Osiris is thought to manifest physically in sprouting cereals. It is interesting that a similar idea of an ancestor (god) manifesting in grains is known among the Ugandan Jie; however, Orwakol is meant to be present in the grains of sorghum. Likewise, the harvest of sorghum is accompanied by a set of rituals (Mirzeler 2009, 395).

112 Mirzeler 2009, 393. As was rightly stated, "the metaphor of cattle has long been the main topic of the academic conceptualization of pastoralist communities in East Africa […] but sorghum is yet to be incorporated into these formulations" (Mirzeler 2009, 389).

113 Mirzeler 2009, 408–409.

114 Królik and Schild 2001.

115 Boulos and Gamal el-Din Fahmy 2007, 507.

116 Caton-Thompson and Gardner 1934, pl. 25–27.

117 Wetterstrom 1993, 212–213. Since some of these excavated granaries still yielded mice nests (Caton-Thompson and Gardner 1934, 53), it seems tempting to associate the subsequent appearance of the domesticated cat in Egypt and its paramount tasks.

118 Fijn 2011, 129.

119 Fitzenreiter 2010, 331, fig. 14.

Most significantly, with the institution of sacrifice itself, the actual place of 'domesticated' killings is relocated from the outer to the inner sphere.

Thus the village becomes structured by places for humans, animals and diverse human-animal interactions. The South Sudanese Nuer build huts for cattle out of wood (byres) that resemble the shape of human dwellings (Fig. 5) and that virtually confirm domestication as incorporation into the domestic sphere.[120] In present-day Africa, kraals are built out of wooden fences or thorn bushes to further fend off predators[121] as well as thieves.[122] While living fences remain so far unknown in the archaeological record, there is evidence for postholes of wooden enclosures and pathways at the Neolithic settlement of Kerma in Nubia.[123] Also some of the symbolic rock art depictions from Nubia could be interpreted as different types of spatial enclosures.[124] However, these might also include traps for game drives used during hunting[125] that would point to a pre-existing knowledge of herding practices. It can be assumed that a range of further practices were in use to expel predators and other forces endangering the integrity of the inner sphere.

6.2 The outer sphere

The 'outer' zone in Old Kingdom conceptions is represented exclusively by men's activities in the marsh lands of the 'north' or in the deserts of the 'south'.[126] In the marsh lands, the depictions comprise fishing, processing of marsh plants, hunting birds using throwing sticks (cf. Fig. 11.30, 31) and nets, as well as guiding cattle herds to remote pastures. Perhaps the pharaoh's expedition to the marshes for fishing and fowling[127] may be related to a symbolical renewal to secure abundance of these animals.

It has been stressed by many authors that given the North African ecology such as the deserts or the vast swamps of the Sudd, "cattle would not survive the harsh conditions" without human assistance.[128] Herders have to guide domestic animals to pastures and to water. During these activities, they tend to avoid bush lands where the tsetse fly is nesting or tick contact could occur.[129] Another method of minimizing contact with

120 Building houses out of reed for cattle is known from Uruk cylinder seals dated to c. 3000 cal BCE (Marciniak 2011, fig. 2). Such buildings have to be assumed for Neolithic Lower Egypt as well, but were depicted only much later on a Roman mosaic showing scenes of the Nile delta (Tristant 2005, fig. 17).

121 Wild predators such as lions account for a mortality rate of up to 10 % among domestic sheep and goat and up to 8 % among cattle in Africa today (Prins 2000, tab. 3). Crocodile and hippopotamus might be added as predators in the past, the latter being also known for severe attacks on humans and the damage of fields.

122 Honegger 2006, fig. 12.

123 Honegger 2006, fig. 7, 10, 11.

124 Dittrich 2011, 269, fig. 8.18.

125 Edwards 2007.

126 Fitzenreiter 2010, 328.

127 Cf. Altenmüller 2008.

128 Evans-Pritchard 1940, 36; Gautier 2002.

129 Gifford-Gonzales and Hanotte 2011. – During the mid-Holocene, the tree and bush savanna must have stretched far to the north of the present distribution (Neumann 1989).

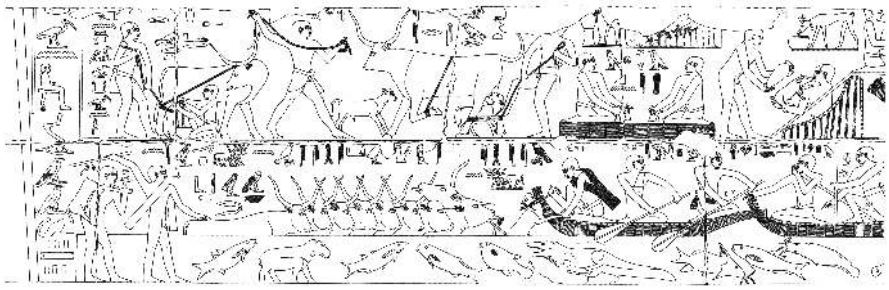

Fig. 7 Dangerous river passage (lower row): A calf acts as decoy to persuade the herd to follow, a man is pointing at a crocodile probably while casting a spell on it, relief at the tomb of Kagemni, Saqqara (Egypt), Old Kingdom.

insects is the burning of bush lands, through which African landscapes have become largely structured by humans in the past.[130] Burning grasslands may furthermore result in the fast growth of fresh green shoots or of fodder plants that would not grow due to competition with other grasses.[131]

In Egyptian reliefs, the activities in the outer zones are often imagined as being surrounded by potentially dangerous animals. In one scene a cattle herd is driven through the Nile dangerously close to a crocodile[132] eying the animals (Fig. 7), while in desert scenes 'wild' animals and free-ranging cows are hunted or captured by roping.[133] As some of these activities are related to foraging and hunting in potentially dangerous environments, they not only involved certain tools, skills and risks but they also must have already had a long tradition.

In the outer sphere and in contrast to the villages, herds are often combined beyond the species level and can reach very large numbers, similar to the behavior of wild savanna ruminants. Through this conduct, humans and animals become companions, and even more, humans start to defend the interests of herd animals. In Neolithic Saharan rock art, animal herders are frequently shown equipped with weapons, including bows and arrows, for protecting themselves and free-ranging herds. Lion attack scenes resemble an archetypal scheme of a dangerous and eventful human-animal encounter (Fig. 8) and were still depicted in Old Kingdom reliefs. In one of the latter, a lion attack on a cow is observed by a dog handler and two attentive dogs being directed either to intervene or to watch and learn.[134]

130 Prins 2000.

131 Smith 1992, 117. As charcoal is a frequent component of early to mid-Holocene sediments it can be concluded that the practice of burning bush and grasslands or gallery forests already originated within hunter-gatherer strategies of manipulating landscapes (cf. Dittrich 2011, 53–56).

132 As accompanying texts indicate the crocodile has to be fended off by the herders, a purpose for which the casting of magic spells might also be suitable (Erman 1919, 29–31).

133 Davies 1900, pl. 3, 22.

134 Davies 1900, pl. 22.

Fig. 8 Archers defending a backward turning cow from an attacking lion, rock painting, Jebel Ouenat (Egypt).

Domestic dogs are thought to have been followers of the introduction of herd animals from the Levant although the taming of captured animals was widely known among hunter-gatherers before. In northeastern Africa dogs are presently identified among the faunal remains of the Neolithic period but not earlier.[135] The mutual relationship between dogs and humans during prehistory remains far from being studied thoroughly. Apart from their social contributions to past societies, dogs may have played an active role in herding and hunting. In predynastic and pharaonic art, trained dogs are frequently depicted as companions of hunts where they are thought to metaphorically refer to the maintenance of "order over chaos",[136] with the chaos placed demonstratively within the contemporary notion of the 'wild'.[137]

The whole range of supra-regional movements of human-animal groups becomes archaeologically partly visible through the wide spread of exotic materials including Red

135 Gautier 2002.

136 Hendrickx 2007, 743.

137 The increase of smaller game such as hare or small gazelles among the hunted species as observed in the Neolithic faunal record in Sudan (cf. Dittrich 2011, fig. 7.15) could be seen as an outcome of the introduction of the hunting dog. Besides their controlled participation in hunting, dogs do account for the decimation of wildlife due to interference and the transmission of diseases (Prins, 2000).

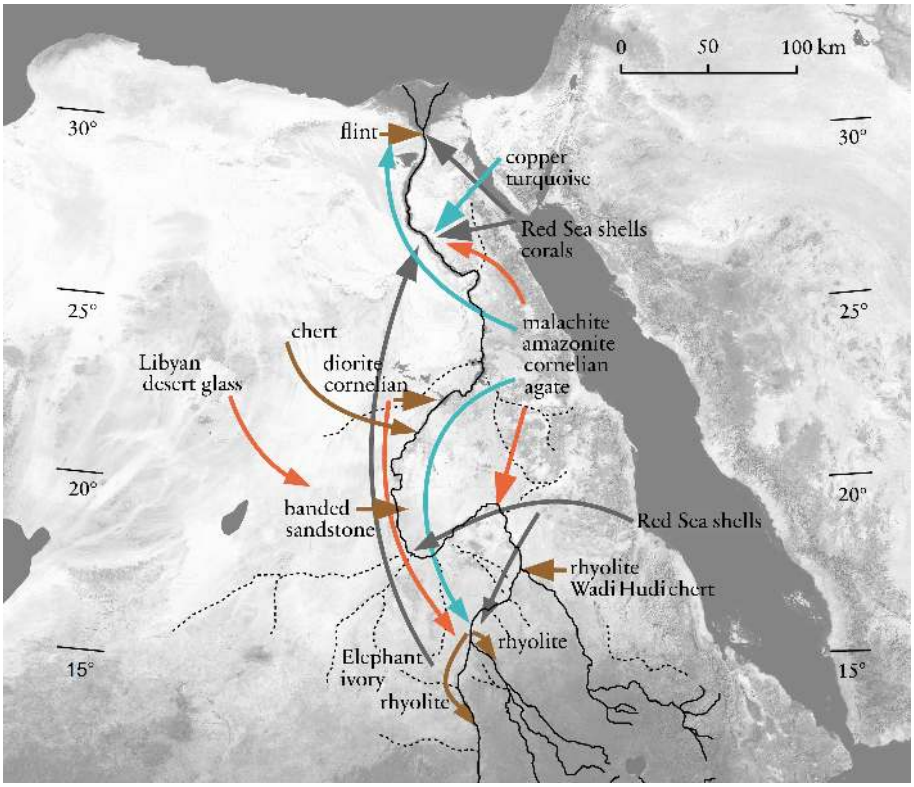

Fig. 9 Flow of exotic raw materials in the Nile valley and beyond during the 5th and 4th millennia BCE.

Sea shells, malachite, amazonite or cornelian (Fig. 9). The underlying network spanning from the Red Sea over northeast Africa is marked only by the location of recipients, as these materials are frequently found among Neolithic grave goods along the Nile valley and adjacent desert routes (cf. Fig. 10). They should not only be viewed as the sign of an emerging elite being involved in long distance exchange, but as a channel that had formerly enabled the migration of humans and domesticates.[138]

6.3 Complementary strategies

In short, the 'inner' sphere stands for transformed (domesticated) food while the 'outer' sphere imposed risks and unpredictability on the successful procurement of food while enabling different interactions with animals. The guidance of cattle herds is clearly assigned to the outer sphere, situated conceptually not far from the hunting of desert ani-

138 Krzyżaniak 1991.

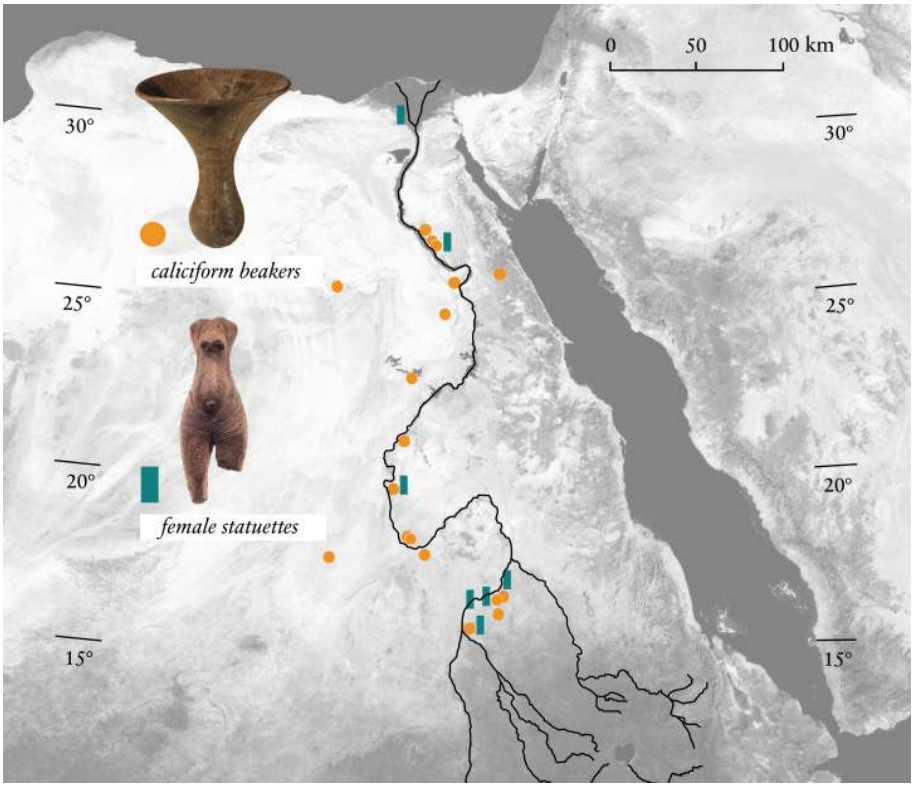

Fig. 10 Finds of caliciform beakers and female figurines, mainly from burials dated to the second half of the 5th millennium BCE.

mals. Skills required for both could have made cattle guiding attractive to certain groups of people, among them men and subadults. However, a general analogy between pastoral herding and hunting[139] may emphasize the prestige as maintained by only very few protagonists. To the exclusion of other gender-related activities, this view neglects not only the actual contribution to food procurement, which may be minor with respect to the processing of plants in villages, but also ignores the changed perceptions of landscapes and human-animal relations among pastoralists when compared to hunters. When used for the description of the prehistoric past, the term pastoralism might therefore not be appropriate to represent past societies on equal terms.

In the ancient Egyptian conception, both the 'inner' and the 'outer' activities appear as complementary. By contrast, the Neolithic communities in northeastern Africa

139 Gautier 2001; Wendorf and Schild 2001.

did not solely rely on food procured from and by domesticates. Instead, several subsistence strategies have been followed such as fishing, collecting mollusks, hunting, capturing, herding, fowling, farming of cereals, or gathering of wild plants and fruits.[140] Wilma Wetterstrom concluded that the reliance on a broad subsistence spectrum reminds us more of the diversified strategies of 'delayed-return' foragers than of restricted agropastoralists who are highly dependent on a few species.[141] This overlap of gathering, herding, hunting and cultivating forms a continuum and transcends our present pre-Neolithic vs. Neolithic or pre-pastoral vs. pastoral dichotomies. Most significantly, the cultivation and collection of wild millets continued or even intensified after the introduction of herd animals in large parts of northeastern Africa.

7 New combinations

Apart from previously existing knowledge that could have been advantageously amalgamated into new schemes, the incorporation of certain combinations may prove also unintended or unconscious consequences inherent in innovations. Such combinations were obviously not actively questioned but accepted as whole sets during the Neolithic and later.

7.1 Harvesting

As a general observation, both humans and cattle rely on grasses but when looking more closely at the level of plant species, a range of other plants has become involved. From the predynastic settlement of Hierakonpolis there is evidence that common field weeds of Eastern Mediterranean and Irano-Turanian origin must have reached Egypt along with emmer wheat and barley.[142] Harvesting must have occurred in a way that ensured their follow-up seeding.

Prior to the Neolithic period, no specific cutting tools such as sickles could be identified among the lithic material, because seeds of wild grasses (cf. Fig. 2) are thought to have been easily stripped off by hand or swept into a basket without cutting the whole plant.[143] No threshing was required, while dehusking may have been necessary.[144] Threshing of barley and emmer, however, would produce large quantities of remains

140 Wetterstrom 1993; El-Mahi 1988.

141 Wetterstrom 1993, 224–225. Over the annual cycle the seemingly wide range of subsistence strategies is reduced to successive seasonal patterns.

142 Boulos and Gamal el-Din Fahmy 2007, 508–509.

143 R. Haaland 1999. As such sustaining procedures would not impose pressure for selection, they might explain the delayed genetic modifications among African savanna grasses (R. Haaland 1999). Presently, such human-plant interactions seem to escape the domestication paradigm.

144 Fuller, Allaby, and Stevens 2010, 16.

that could be further used as fuel, fodder, or as temper in pottery or plaster.[145] Fuller, Allaby and Stevens[146] suggested that threshing appeared as an additional and probably unintended practice with domesticated plants and, consequently, they did not call it an 'innovation' but "a 'trap' of new work" that people fell into. It is thought to require the cutting of halms for which specific cutting instruments such as sickles were needed.[147]

Neolithic sickle blades hafted in wooden handles are clearly designed as cutting instruments for farmed crops since in the Fayum they were found in granary pits together with cereals.[148] During Pharaonic times flint sickle blades were still set into wooden handles, sometimes in the shape of cattle jawbones resembling the animals' teeth (Fig. 11.22).[149] This further indicates that real cattle jawbones may also have been used.

Although pottery making does not appear to be directly connected to cereals, modifications occurred with the Neolithic. One of the simple but significant characteristics is the availability of the dung of domesticated ungulates following their introduction into the Nile valley or of chaff from threshing remains. Both materials could be used as temper in the pottery making process, resulting in a reduction in weight of pottery vessels.[150] At the Neolithic settlement site of Merimde Benisalâme in the Nile delta, chaff-tempered pottery occurs at an early stage in the occupation,[151] indicating that when introduced to this region, pottery making had become dependent on the availability of chaff or dung.

Hence, the whole set of interrelated and already inseparable practices, i.e. the sowing of plant combinations, the seasons of harvest and feasting (as discussed above), cutting, threshing, and processing of threshing remains must have been introduced together with barley and emmer to Egypt. Furthermore, such combinations did not only involve tools (cf. Fig. 11) and human labor; threshing by trampling as well as sowing – namely the trampling in of the grains – were two ancient Egyptian practices assisted by hoofed domestic animals.[152]

7.2 Milking

Since milking – as attested through fat residues on pottery – dates back to 6500–5000 cal BCE in Anatolia,[153] it must have already been of interest when herd animals were introduced to northern Africa. As the mother-child relation formed an important ideal, cow milk was shared between humans and calves. The Nuer hold "that if the calf were

145 Murray 2000, 526.
146 Fuller, Allaby, and Stevens 2010, 6.
147 Other methods of harvesting include uprooting the whole plant, as known from flax, or reaping the cereal ears by hand (Murray 2000, 520–522).
148 Caton-Thompson and Gardner 1934, pl. 26.1, 30.1.
149 Cf. Murray 2000, fig. 21.8.
150 Dittrich 2011, 262–263.
151 Eiwanger 1992.
152 Murray 2000, 519, 524.
153 Evershed et al. 2008.

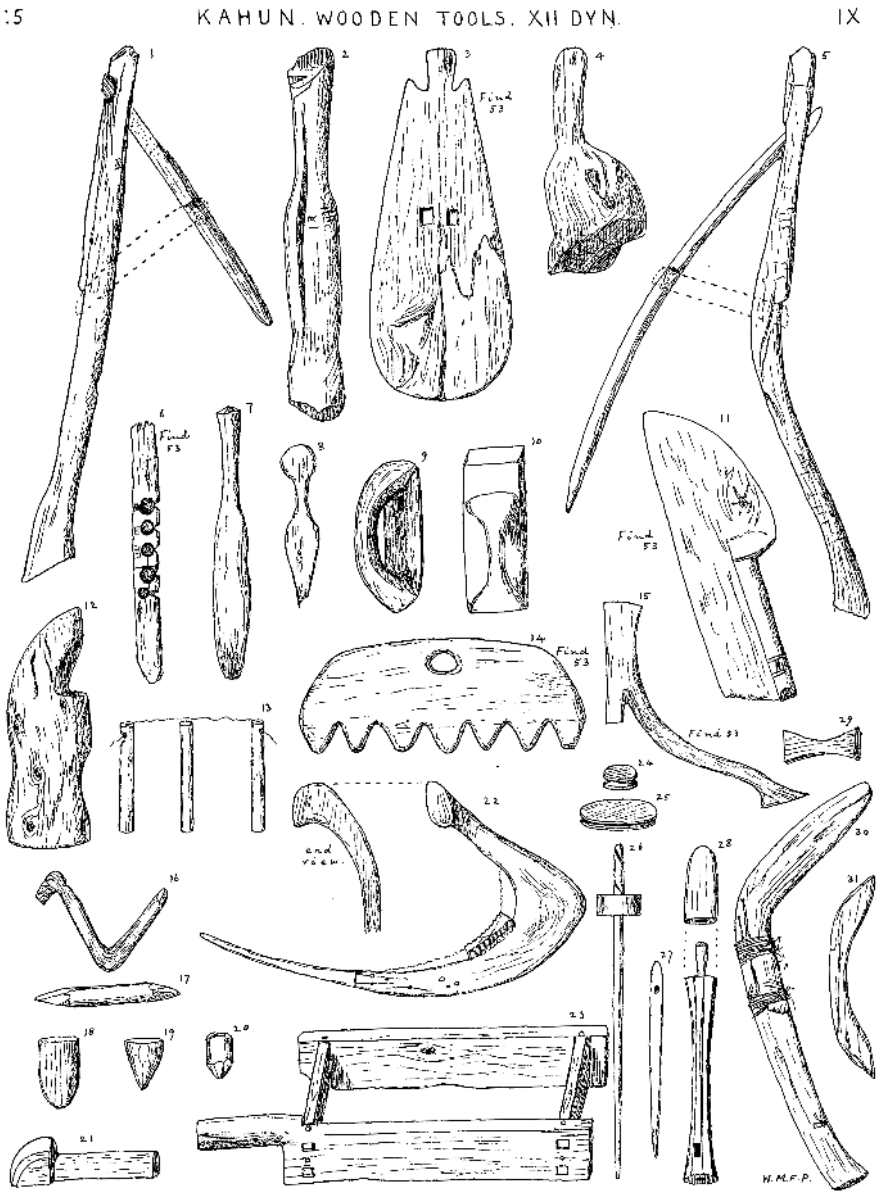

Fig. 11 Wooden tools that in 19th century imagination formed indices to ancient Egyptian agriculture including a sickle in the shape of a cattle jaw with flint insertions (22), Kahun (Egypt), early 2nd millennium BCE.

not first to suck the cow would hold up its milk".[154] After that, the calf might be fastened with a string to the foreleg of the cow to allow further interaction between them (cf. Fig. 5).

The transformation of milk into cheese or yoghurt demanded as indispensable requisites the use of vessels, either made of wood, gourds, animal skins, or ceramics.[155] Not much is known so far about the types of rennet used in this process during prehistory. The description of recent Nuer practices indicates that rennet was considered part of specific churning gourds that usually remained uncleaned and were probably exchanged in that state.[156]

The range of pottery types known from Neolithic grave goods[157] becomes more diversified with a tendency towards smaller bowls and beakers to meet the increasing demands for commensal dishes (cf. Fig. 6). In later Egyptian reliefs both types appear as milking vessels. The characteristic shape of high and slender caliciform beakers (*Tulpenbecher*) – a type occurring only at the turn of the 5th to 4th millennium BCE – points to an imitation of leather bottles. Their appearance in few but often richly furnished burials[158] (Fig. 10) suggests that they may have been on display on special occasions. Although an analysis the presence of milk or other fat residues does still not exist, such vessels were certainly used for liquids, either collecting or pouring them during a ceremony.

7.3 Body decoration

Body painting, tattooing and scarification are well-known from Saharan rock art and from female figurines found in the Sudanese Nile valley (as seen in Fig. 4). Furthermore, in Saharan rock art different patterns and colors of cattle as well as horn shapes were carefully depicted (cf. Fig. 8), thereby reminding us of the enormous number of terms that still exist for differently colored cattle, for instance among the Nuer.[159] As in animistic belief systems bodies are seen as mere cover for personal interiorities,[160] decorating and manipulating this cover would highlight classificatory features.

In this respect, the manipulation and artificial deformation of cattle horns – mainly the left one from oxen – also needs to be mentioned.[161] Among the Nuer, this painful

154 Evans-Pritchard 1940, 22.

155 Only recently, a study revealed fat residues from dairy products still present on Neolithic pottery finds from Libya (Dunne et al. 2012). While pre-Neolithic pottery did not contain such traces, the first pottery supposedly used for yoghurt and cheese dates back as far as the 5th millennium BCE.

156 Evans-Pritchard 1940, 24.

157 Although pottery may remain scarce or even absent among grave goods in areas such as Lower Egypt.

158 Cf. Math 2006; Dittrich 2011, 85.

159 Evans-Pritchard 1940, 41–48.

160 Descola 2011, 198.

161 Deformed horns are known since as early as the Fifth Dynasty from pharaonic depictions but were also identified among faunal remains of the contemporary Nubian Kerma Culture (Chaix 2006). Neo-

procedure of "cutting (ngat) of one of the horns of a favorite ox […] so that it will grow against the cut in a fancy angle, generally in a curve around the muzzle (ma gut)" is compared to the initiation of human youths during which scarification plays an important role.[162] Both acts would mark an important life transition. Furthermore, the wearing of bracelets on the upper left arm becoming tightly fixed over time might be connected to such practices. Nuer youths and men frequently used their arms to describe the specific shape of the horns of their favorite ox.[163] The analogous body language of human arms and cattle horns is evident in Egyptian mythological depictions where either cow horns or human arms lift up the solar disc.[164] Much earlier during the predynastic period (c. 3650 BCE) the uplifted arms of red-painted female figurines may resemble the pointed horns of a cow.[165] Bracelets made from elephant or hippopotamus ivory, horn or shell belong to a widespread class of ornaments and cosmetic objects that occur simultaneously at the beginning of the Neolithic.[166] Thus, specific forms of body decoration seem to appear in combination with domestic animals.

7.4 Powerful tools

In the Sahara and the Egyptian Nile valley, bifacial or surface retouch started to be applied to stone tools during the Neolithic.[167] While through this technology distinctive contour lines and artificial surfaces could be created, the first respective tool types comprised hunting or fighting gear (arrowheads) as well as butchering tools (knives). Both are on display not only during supposedly 'daily' activities but also during their ritual counterparts such as sacrifice.[168] Large flint knives were still in use during pharaonic times and can clearly be linked to the occasion of the butchering of domestic animals in sacrifice.[169] I would tend to also include surface retouched sickles here, especially when they are viewed in the light of ancient Egyptian mythology. The time of harvest was

lithic cattle horn remains have not yet been evaluated in this respect.

162 Evans-Pritchard 1953, 187.

163 Evans-Pritchard 1953, 187.

164 Hornung 1982, fig. 9. For the depiction of cattle horns as arms in a greeting gesture cf. Frankfort 1948, fig. 38–39.

165 Cf. Wengrow 2006, fig. 5.3.

166 It has even been concluded that the preoccupation with the adornment of human bodies, which surely included also those of domestic animals, would call for the term 'embodiment' focusing at the locus of the body instead of 'domestication' in the sense of focusing at the house (Wengrow 2006, 70–71).

167 Shirai 2007.

168 Judging from the often fragmentary archaeological record, however, none of these tools can be clearly associated with pre-Neolithic hunter-gatherer activities as has been stated by Riemer 2007 and Shirai 2007).

169 Erman reads the speech added to a butchering scene as *put something into the knife's mouth*, "[i.e. the] knife is hungry" (author's translation; Erman 1919, 10). During the predynastic period the ivory handles of such knives were often decorated with the 'order over chaos' theme through depicting a hunting dog behind rows of 'wild' animals (Hendrickx 2007: fig. 6–9). As knives are not commonly thought of as hunting gear, this again illustrates sacrifice as a transfer of the killing act to the inner sphere which required its encoding in ritual.

likened to a potentially dangerous period in the transition between the death and rebirth of Osiris who was manifest in the cereals.[170] Accordingly, his death was exercised through the cutting of the plants, while his rebirth can be expected from the moment the threshing of grains is finished. Thus, the surface retouched instruments were indeed charged with prestige as assumed by Noriyuki Shirai[171], namely with the power of killing.

It would seem that the concept of the Holocene surface retouch of knives, arrowheads and sickles, which undoubtedly has southwest Asian origins, appeared simultaneously with domesticates in Egypt. In this area, it might have mediated the introduction of specific rituals when compared with the less specifically shaped lithic tool types such as those found in Sudan and Sub-Saharan Africa.[172] In the latter areas, insertions for composite tools, either cutting instruments or projectiles, were still made by flaking and backing, more similar to the microliths of the preceding Mesolithic/Epipaleolithic period.[173] There must have been a different concept of marking powerful instruments or actions and thus, as with the different seasonal cycles of wild grasses, a different set of rituals formed around domesticates.

8 Living with herds: commodification or commitment?

There is still one point left that seems to provoke controversy even with the discussion of the social side of domestication. It is a concept thought to have profoundly altered human-animal relations, and it is commonly encompassed in the term 'property'.[174] Prevailing materialist notions still stress the object status of animals by relating Neolithic herd animals to 'commodities' to assign their passive role in property and production systems.[175] It has been argued that it was through becoming exchangeable commodities – resembling the Marxist notion of *Waren* and explicitly including animals – that new technologies and ideas were created and accepted.[176] Consequently, the term 'domestication' could be replaced with that of 'commodification' as an assumed key change with neolithization. The definition implies universality in both the things and their values. However, it is difficult to believe that one single 'thing' concept existed for establishing

170 Frankfort 1948, 186.

171 Shirai 2007.

172 However, tools made of a characteristic brown Egyptian chert – with the exception of sickles – can be identified as imports to southern regions as far away as the Nubian Nile valley. Many of them bear the characteristic 'brand' of their origin from the Egyptian plateaus since they contain a white cortex that had been deliberately left visible by the manufacturers.

173 Dittrich 2011, fig. 4.32.

174 Ingold 2000; Russell 2002.

175 Orton 2010 has remained so far the only one to acknowledge the status of animals as 'beings' and, consequently, suggested the term 'sentient property'.

176 Gebel 2011, 43.

relations between all the different entities given the 'beings' among them must have been charged with subjectivity and personality.[177]

We have every reason to acknowledge that the pre-modern interaction with non-human species did not comprise a naturalistic worldview, but included animistic and totemistic beliefs that consisted of subject-subject relations.[178] Therefore, it is the relations between subjects, both human and non-human, that condition the 'production' of means of subsistence. This contradicts the modern notion that the production of objects constitutes the relations between human subjects only.[179]

A whole set of subject relations can be applied to greater entities as known from hunter-gatherers who perceive the forest as 'father' and 'mother' nursing its dwellers in a 'giving environment'.[180] When the Egyptian pharaoh himself set off to the marshes to 'receive' fish and birds – commonly captured in large quantities – he aimed precisely at the renewal of these very old relations. As stated by Sahlins[181], to keep the worldly order he staged a 'mythic reality'. The perception of the marshes or the forest as an "ever-providing parent" is in contrast to the construction of nature as a "reciprocating ancestor" as seems to prevail among cultivator and cultivator-hunter groups.[182]

An 'ancestor nature' may provide its yields only reciprocally in return for "appropriate conduct".[183] The role of human cultivators is then to assist earth in bringing forth its crops.[184] However, we must be careful not to view this just within the narrow limits of the anthropomorphization of human-environmental relations. Particularly human interaction with herd animals or dogs has produced a specific body and noise language,[185] and there is an enormous corpus of knowledge on animal behavior and diseases. Before herd animals can act as a 'giving' entity, favors have to be done to them. They need to be raised, assisted to give birth, led to watering places and pastures, or protected from diseases. In religious texts, humans are advised to treat herd animals and crops as divine gifts and to ensure the blessing that lasts on them.[186] According to Timothy Ingold, this does not fit the modern category of 'production' since "bringing up children or raising livestock, just as much as the cultivation of crops, is a process in which plants, animals or people are not so much made as grown, and in which surrounding human beings play a greater or lesser part in establishing the conditions of nurture".[187] Thus, the term 'food production', as frequently used to describe Neolithic subsistence, is clearly rooted in our present-day animal exploitation after having widely broken up the dialectical linkage of social and beneficial approaches to herd animals.

177 Cf. Descola 2011.
178 Ingold 2000, 47.
179 Descola 2011, 472.
180 Bird-David 1990, 190.
181 Sahlins 1981.
182 Bird-David 1990, 190.
183 Bird-David 1990, 190.
184 Ingold 2000, 86.
185 Fijn 2011, 39, 123.
186 Dittrich 2013b.
187 Ingold 2000, 87.

The Neolithic notion would have probably been more in line with a 'commitment' according to Barbara Bender[188] that would root human-herd animal relations in a kind of mythically handed down contract consisting of mutual favors. With this, the concept of property of animals emerges less as a set of rights in resources than as a set of obligations to beings. In the same way as the Egyptian goddess Hathor bears certain physical and beneficial cow qualities, every living cow must also bear some divine qualities. It is in this way that among contemporary African herders cattle can still be found in connection to important social spheres and transitions such as with "marriage and divorce, with burial, inheritance and food customs".[189] While also acting as debt, loot, companionship, gifts, bridewealth, prey and most significantly as sacred beings or as belonging to divinities and thus being occasionally destined for sacrifice, cattle are frequently subjected to outside claims[190] that undermine much of the concept of herd animals as static property. Rather, similar to the kinship system, decisions about the translocation and exchange of herd animals largely appear to follow social patterns,[191] while the selling and buying of animals and animals' products may often be restricted by taboos.[192] As the commitment to domesticates emerges as a specific path taken in the long-term it is less likely that it has been mediated through a material – in the sense of an objectified or inanimate – value system subjected to changing variables, but rather through the integration into a vivid social community that was always made of more than just humans.

9 Conclusions

Although it undoubtedly involved the introduction of several domesticated species and combinations from the outside, the process of neolithization in northeastern Africa emerges partly as a continuation of former practices that should not be historicized in terms such as Neolithic or Mesolithic. Pottery making, sorghum cultivation, sedentism, or the burning of bushlands are only some of those practices that became archaeologically known to us. Furthermore, domesticates were encountered through the lens of specific pre-existing worldviews. While for Egypt it would appear as if Neolithic subsistence as known in southwest Asia had just been translocated through migration, the difference is in the detail. From various cereals only two, barley and emmer wheat, were selected, along with several dependent technological combinations such as field weeds, feasting seasons, harvesting and threshing techniques that existed at that specific moment. Although all these combinations existed as available options, in Sudan

188 Bender 1978.
189 Herskovits 1926, 272.
190 Evans-Pritchard 1940, 20, 91, 165.
191 Russell 2007.
192 Cf. Rekdal 1996.

and adjacent regions domesticates were integrated differently, based on shifted seasonal rhythms. Clearly in this case environmental conditions may have set the limits, but the social properties of southwest Asian cereals were still occupied by sorghum and wild millets. African millets in fact became confirmed in their importance, culminating in the later alteration of species with biological domestication.

Yet, in both regions domestication practices induced a general refiguring of concepts of kinship, ancestry, death and afterlife as well as of worldly and ritual landscapes. The 'inner' perspective would have been formed by the spatial re-definition of landscapes into fields, gardens, kraals, or pastures and the establishment of villages and burial sites along the Nile valley. It is here that close relationships between sedentary humans and domesticates emerged, mediated through daily procedures and rituals. It is here that strong bonds to ancestors and an intensified care for the dead materialized through specific rites. Finally, domestication practices may transcend the biological dichotomy of 'wild' and 'domestic', which becomes obvious with the inclusion of 'wild' animals into burial and sacrificial rites. In the 'outer' perspective, mobility seems to be an important issue because it enables further and different modes of human-animal companionship when compared to villages.

If the focus is on practices not on categories, the process of prehistoric innovation can be seen as cyclic imitation of previous actions *sensu* Gabriel Tarde.[193] As imitation produces variation, a constant dialectic of reproduction and differentiation emerges with neither of them happening apart from the other.[194] Thus, a more cyclic view of innovations would lift neolithization out of the unique historical development in which it is presently rooted. Consequently, the neolithization of northeastern Africa cannot be qualified as a process different to elsewhere, or as the secondary, partly or subordinated recycling of outside ideas. Since it emerges as a set of practices related to a reconception of human-environmental relationships, it could be termed neolithization 'in progress', yet with quite different outcomes than in the regions in which the term is commonly claimed.

One may ask if the notion of innovations materialized in tools and techniques would still apply. Certainly it does, but they cannot be thought of independently from encompassing practices and ideas. This becomes most significant when animals are taken into consideration. Animals considered wild, semi-wild or domestic are by no means innovations in terms of 'cultural artifacts' or 'products', because with this we end up in the one-way road of recent speciesism. Also for their alleged object status as commodities or property, it is difficult to believe that domestic animals were encountered with a 'thing' concept and a material value only. This does not explain in the least the

193 Tarde 1903.

194 Deleuze 1994, 319.

wide array and aspects of human-animal relations. However, when we look at the degree of practices aimed at marking them differently from the contemporary notion of the 'wild' – the unfed, uncontrolled, and uncared-for in an environment ruled by both, well-disposed and disastrous forces –, humans, animals, plants, houses, tools and other objects together became more closely involved in a worldview based on their growing cooperation for the maintenance of cosmological cycles in these environments. While giving way to a pre-modern notion of animals as living companions, it becomes obvious that interest in domesticates is a commitment to other species. Most importantly, this was confirmed by the extension of kinship to other species[195] as well as by the emergence of animal sacrifice as ritualized killing in domestic spheres to maintain reciprocity between both divinities as creators and enlarged human-animal communities as preservers. With the supposed shift from a 'parent' to an 'ancestor' notion for relating to the 'giving environment;'[196] the human sense of participation and responsibility intensified, and intimate social relations were projected to a wider circle as a novelty with neolithization.

195 Russell 2007.

196 Bird-David 1990.

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Florian Klimscha

What Makes the World Go Round? Silenced Consequences of the Introduction of Metallurgy

Summary

This paper discusses the underdetermined changes brought about by the introduction of extractive metallurgy in the southern Levant. It takes a long-term-perspective. The author sums up current perspectives with regard to a modified chronology based on calibrated radiocarbon dates before re-evaluating the interconnections between technical innovation and social change. Arguments in favor and against a Schivelbuschian view on extractive copper metallurgy are discussed as well as a variety of social fields in which changes can be detected.

Keywords: Metallurgy; technical innovation; Southern Levant; Chalcolithic; Early Bronze Age.

Dieser Beitrag beschreibt die Veränderungen, die die Einführung der extraktiven Metallurgie in der südlichen Levante bewirkten. Dabei wird eine Langzeitperspektive eingenommen. Der Autor fasst aktuelle Perspektiven im Hinblick auf eine geänderte Chronologie zusammen, die auf kalibrierten Radiokarbondaten basiert. Damit können die Verbindungen zwischen technischer Innovation und sozialen Veränderungen neu bewertet werden. In diesem Zusammenhang werden Argumente für und gegen einen an Schivelbusch angelehnten Blick auf extraktive Kupfermetallurgie sowie auf eine Vielzahl sozialer Bereiche diskutiert, in denen Veränderungen festgestellt werden können.

Keywords: Metallurgie; technische Innovation; Süd-Levante; Chalkolithikum; Frühbronzezeit.

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1 Introduction

This paper deals with technical innovations in the Chalcolithic and Early Bronze Age of the southern Levant. Even though the first usage of metal started in the Neolithic,[1] this issue will not be broached here. The focus will be on the period in which the smelting of ores and casting of objects started. Not only is a much more elaborate technology required for this procedure, but also significantly higher amounts of labor. The interconnections of this complex metallurgy with other innovations can only be understood in a long-term perspective.

Neither the radicality nor the underdeterminded nature of the changes caused by smelting and melting technology are well understood. Chronological errors as well as sociological and technological misconceptions have shrouded a clear view of the sequence of events and their interregional consequences. New data suggest that surprisingly complex metallurgy was not only established in the second half of the 5th millennium BCE, but also interwoven with innovations in social distinction and religious acts. A close analysis of these finds implies that a major advantage of metal objects did not lie in their functionality but in their use as prestigious objects. It is argued that probably without knowledge of possible future uses, the introduction of metallurgy was a lengthy process that took place via overlapping gift-giving networks.

Only after social and ideological innovations had set free significantly more labor in the Early Bronze Age can a new usage of metal items be seen. These can be summed up as a "package of efficiency" consisting of the use of animal traction, flint sickles and heavy copper tools. Metal is then produced in much higher quantities that clearly exceed household needs and starts to substitute for lithic tools. This is possible because of a social reorganization, the freeing of available labor by simplifying traditional crafts and other innovations, mainly in transport, which slowly change the technical sub-structure of societies that used metal objects. In the long run, not only tools, but also sign systems, exchange relations and power structures are significantly transformed, not in every case intentionally.

I start with providing a short chronological and regional overview of the area studied, including a summary of the conventional interpretation of metallurgy and its role in the cultural evolution of the ancient Near East. In a second step, many important finds are re-dated based on new radiocarbon results. This, in turn, has major consequences for the understanding of the chronological position of several technical innovations and will result in a narrative about how innovations transformed, some would possibly say malformed, life in the prehistoric Levant. The sequence of events will not only deal with changes in material culture, but also social changes into which the production of metal

1 Molist et al. 2009.

objects was embedded. This account shows that many changes are due to shifts in communication and production systems that begin to center less on personalized contacts and creativity, instead stressing impersonal exchange mechanisms.

2 Metallurgy and society: previous research strategies and biases

The introduction of metals into prehistoric Europe[2] has been discussed extensively, but the resulting models have not been tested for the Middle Eastern archaeological record. The vast difference in the state of research and published data between Europe and most regions in the Middle East make such a task rather challenging. Therefore, a focus on the southern Levant was chosen; the state of research there is at a similar level, and therefore differences can not so easily be explained away by a lack of study.

The perspective chosen sees metals and society closely interconnected and changes in technology as pushing specific social developments. This point of view makes extensive use of anthropological data and sees technology as something evolving to overcome practical problems. Major issues with previous attempts to understand the introduction of smelting metallurgy can be summed up as either viewing efficiency as deterministic or relying heavily on ethnographic data. While the inherent concepts have their strengths in explaining prehistoric technology, there are also certain problems involved. Even though modern studies of innovations show how their diffusion can be steered and controlled, and are often based on the perceived superiority of a technology, this can hardly be proposed for copper metallurgy. In fact, copper tools were inferior from a functional point of view in comparison to flint tools.[3] Economic models that stress usage and function are therefore not very convincing and also ignore the variety of social factors that could affect the success of an innovation – especially gift giving and marriage alliances, as has been demonstrated with a variety of ethnographic data.

On the other hand, analogies from recent or sub-recent societies also have several severe shortcomings. Most societies researched by social anthropologists have had contact with so-called 'complex' or 'industrialized' societies or with neighboring groups that had such contacts. The living space of such groups has been further and further reduced during the period of colonialism and as a consequence of heavy industrialization. Therefore, they represent in no way an original way of life. Even though ethnographic data can be very good for modelling human behavior on a broad, comparative level, one should be extremely careful about simply generalizing the living conditions and social

2 Strahm and Hauptmann 2009.

3 Jørgensen 1985.

relations of the few groups who have evaded Western influence to model a general and universal stage of human social evolution.[4]

Thus, in the following, technologies are analyzed as being part of a network of social relations in which they are actors among the various producers and users. This seems to be a promising way to avoid the previously mentioned misconceptions. Yet, the fact remains that in the archaeological record there are periods in which new technologies were adapted quickly and experimented with. The question that follows is if it is possible to identify the characteristics of these periods and if it is also possible to explain from a *longue durée* perspective why such experimental societies were successful at some times and why during other times the majority of societies adopted totally different strategies.

3 The state of research

The topography of the southern Levant (covering the modern states of Israel, Jordan, the Palestinian Autonomous Territories, as well as parts of Syria and Lebanon) dominates the possible routes along which any kind of information, including innovations, was able to spread: from Sinai in the south to the Lebanon in the north, there are nearly 300 kilometers of coastline that favor communication of any kind using ships. Contact between the coastal regions of Egypt, Cyprus and Anatolia via the Mediterranean was thus easily possible. When travelling east, on the other hand, there are several areas that, like the Golan, lie more than 1000 to 1200 meters above sea level. In the inland, the river Jordan is the central communication axis, connecting the Sea of Galilee with the Dead Sea. From there, only wadis allow travel in southern or southeastern directions. Further to the east and southwest, there are again mountain and desert areas; the Negev and the Arabah. Travel and transport within these regions is as difficult today as in prehistory. For example, access to drinking water is very limited in many places. With the exception of the river Jordan, the region lacks large waterways that can be travelled by boats, which even in Roman Europe was the quickest way to travel. This variety of climates and landscapes is reflected in a diversity of archaeological cultures, art styles and settlement strategies.[5]

The use of major amounts of smelted copper objects begins during the Chalcolithic or *Ghassulian* period. There is no broad consensus about the chronological frame of the Chalcolithic, and both its definition and the chronological and geographical limits are disputed.[6] Teleilat Ghassul was excavated from 1929 to 1938; it is situated on the

4 Cf. also Wolf 2010.

5 Lovell 2001, 51; cf. Levy 1998 for a different view.

6 Rowan and Golden 2009, 3–10; Gilead 2009. The concept of a Levantine "Chalcolithic" was first brought up by Albright, who in the early 1930s argued that some forms of Neolithic ceramic vessels could be explained as archetypes for later Early

northeastern shore of the Dead Sea.[7] It became eponymous for the *Ghassulian* lithic industry, and this name was later transferred to the complete set of Chalcolithic material culture.[8] In the following, the term Chalcolithic will be used synonymously to *Ghassulian*, although there are good reasons to have the Chalcolithic sequence begin earlier and differentiate an Early (*Wadi Rabah*), a Middle (*Tsafian, Besorian*) and a Late (*Ghassulian*) Chalcolithic phase.[9] However, we lack copper from these periods, contradicting the term 'Chalcolithic' – at least in the tradition of prehistoric archaeology.

Within the southern Levant, the density of research is highly diverse and therefore the knowledge of many regions is sparse, and the archaeological record is far from representative for the whole region.[10] The geomorphological variability determines that some areas are quicker and more intensively urbanized, and this as well as political factors blur the knowledge, publication and distribution of sites and finds. The *Ghassulian* ends between 4000 and 3900 BCE, leaving a gap of several hundred years before the commencement of the Early Bronze Age (in the following: EBA).[11] Only in recent years have a few sites been published that can be dated to that period.[12] Therefore the apparent gap is likely caused by lack of research, and it will be necessary to re-think our models about the Chalcolithic–EB development.

For a long time it was assumed that metallurgy started with simple flat axes in the *Ghassulian*, and then became more and more complex until the beginning of the Urban Revolution. This traditional logic saw metallurgy as one of the major factors for the beginnings of social complexity, apart from the sailboat and development of writing.[13]

Triggered by technical innovations that allowed the smelting of copper ores, the social systems of the region were thought to be drastically changing. The intensified use of copper would have necessitated a re-organization of available labor, because the labor process needs greater manpower and specialized knowledge. To use copper in the long run, it was thought that tight social control mechanisms were needed, as well as increased power of elite groups. This would theoretically have led to a network in

Bronze Age types, and therefore an intermediate stage should be introduced. Cf. Albright 1931; Albright 1932.

7 Mallon, Kœppel, and Neuville 1934; Koeppel et al. 1940.

8 Neuville and Mallon 1931; Neuville 1931.

9 E.g., Garfinkel 1999; Kerner 2001; cf. also Rowan and Golden 2009, 5–10.

10 Rowan and Golden 2009, 14–20; Gilead 1988.

11 Cf. Klimscha 2009b. Although the exact dating of that beginning is difficult to pinpoint, cf. Genz 1997; Joffe and Dessel 1995; Kerner 1997. Some authors claim that there is another Ghassulian phase, namely 'Terminal' Chalcolithic, bridging the time from 4000 to 3600, but a correlation of the available radiocarbon data used for this phase and archaeological strata is not convincing (Joffe and Dessel 1995, 514; contra: Rowan and Golden 2009, 12. Cf. also M. Burton and Levy 2001).

12 Klimscha 2009b; Klimscha 2012; Khalil and Schmidt 2009. Cf. also the chronological table in Levy 2007, 14. It was certainly not the only site settled in this period and new, yet unpublished data from Ashkelon seem to point in the same direction (information provided by Amir Golani, IAA, Jerusalem).

13 E.g. Childe 1947; Childe 1951; Levy 2007.

which only a selected range of settlements were involved in the *châine opératoire* of metal production. And this in turn would have amplified specialization and in the long run the Urban Revolution.

In such a model, copper ultimately does not only change the means of production but also the division and organization of labor in prehistoric social systems, i.e. the relations of production. The available evidence for specialization, central cult places and control mechanisms limiting the access to prestigious goods and social elites suggests a much stricter social differentiation than in the Pottery Neolithic.[14] This would, in fact, be a major factor in the evolution of social complexity.

Apart from the aforementioned new data concerning the Chalcolithic–EB transition, there is also considerable change in what was traditionally accepted as the beginning of metallurgy. One of the most important finds from this time is a hoard found in the so-called *Cave of the Treasure* in the Nahal (Wadi) Mishmar along the western shore of the Dead Sea. Apart from a large number of copper mace heads, it included 'scepters', 'standards', 'crowns' and vessels. The latter examples show very complicated shapes. Some have figurative elements protruding from the objects that could only have been produced in the lost wax casting technique.[15] The find was traditionally dated by radiocarbon dates from the cave to the time around 3600 BCE. Thus, the highly complex metal finds were thought to mark the beginning of the Early Bronze Age metal tradition that was considered to be a major factor in urbanization.[16] The hoard had been wrapped in a reed mat and hidden in a natural crevice of the cave. New radiocarbon samples from this mat now date the hoard to between 4350 and 4250 BCE, more than 500 years prior to what was previously assumed.[17] The old carbon-14 dates were derived from samples from the settlement layer post-dating the hoard and were never really appropriate for the copper items.

Originally, this early date was taken as proof that the mat was a "holy item" which had been in use during this long time span, but because of its special status was used carefully enough to survive several centuries.[18] However, recent excavation data and a re-evaluation of older absolute dates render a different scenario much more plausible: the hoard belonged indeed to the second half of the 5th millennium BCE. Apart from the new carbon-14 dates, this argument can be summed up as follows:

– all available comparisons for the 'complex' metal objects that were cast in lost wax technique, that is 'scepters', 'standards', 'crowns', etc., are from *Ghassulian* contexts

14 Kerner 2001; Klimscha 2014.

15 Cf. Bar-Adon 1980. For online pictures cf.: https://de.wikipedia.org/wiki/Nachal_Mischmar#/media/File:Hecht_090710_Sceptre.jpg (visited on 17/01/2017); http://www.metmuseum.org/toah/hd/nahl/hd_nahl.htm (visited on 17/01/2017).

16 Bar-Adon 1980.

17 Cf. Aardsma 2001; Klimscha 2013.

18 Aardsma 2001.

and can be radiocarbon-dated independently into the second half of the 5th millennium. The only exception seems to be Givat Haʿ Oranim in Israel, but the carbon-14 samples are from a completely different cave than the standards and thus cannot be used to date them[19];

– the flat copper axes show good analogies in *Ghassulian* contexts but are different from Early Bronze Age axes with flatter shapes and flanges;[20]

– the available carbon-14 dates for *Ghassulian* contexts end between 4000 and 3900 BCE.[21]

This new chronological frame has important consequences for our understanding of the role of metallurgy in the prehistoric Levant.[22] Instead of being the end of a tradition of craftsmanship, the technical peak is now placed at the very beginning.[23] This, in turn, means that almost all metallurgical innovations now have to be within ca. 300 years instead of a millennium: from 4500–4000/3900 BCE during the *Ghassulian* Chalcolithic, there is evidence for intentional copper-arsenic alloys, lost-wax casting, the use of precious metals, surface manipulation of metal objects, specialized metal weapons and the use of heavy metal tools such as axes. In the 4th millennium, only slight alterations follow: ingots of standardized shape are produced for trading in smelted copper, while tools and weapons become larger and more efficient; this leads to the disappearance of their stone counterparts around 3600 BCE. During the period discussed here, metallurgy appears in such a technical perfection that there must have been precursors.[24]

When considering the ways in which metallurgy can change society, there is the straightforward thought that metal objects can substitute for objects made from other materials such as flint, ground stone or bone (skeuomorphism). The level of production (Fig. 1a) is difficult to reconstruct, since there are only a few excavated and published metal workshops in the southern Levant. Possible consequences could have included damage to the environment due to inappropriate use of wood. Further, the poisonous gases that were released during smelting and melting may have had a negative effect on

19 Cf. Scheftelowitz and Oren 2004.

20 Klimscha 2010.

21 Gilead 1989; Klimscha 2009b.

22 For a more detailed discussion cf. Klimscha 2014; Klimscha, Notroff, and Siegel 2014.

23 In this paper the terms 'technique' and 'technology' are used synonymously. Technique, as German sociology understands it, implies the interaction of mechanical, habitual and symbolic media to be effective. – Cf. Rammert 2007, 16 Fig. 1; cf. also for the application to archaeology Eichmann and Klimscha 2012, 1 Abb. 1.

24 A discussion of the influence that metallurgy had on other parts of the material culture, needs to begin in the late Pre-Pottery Neolithic B. Cf. also: Molist et al. 2009. When studying the ceramic sequence from the Neolithic and Chalcolithic, Garfinkel already in 1993 proposed to call the later part of the Neolithic, the so-called Wadi Rabah culture, Early Chalcolithic, because even if metal is still missing from that time, many social changes are already visible that are usually attributed only to the Ghassulian (Garfinkel 1993).

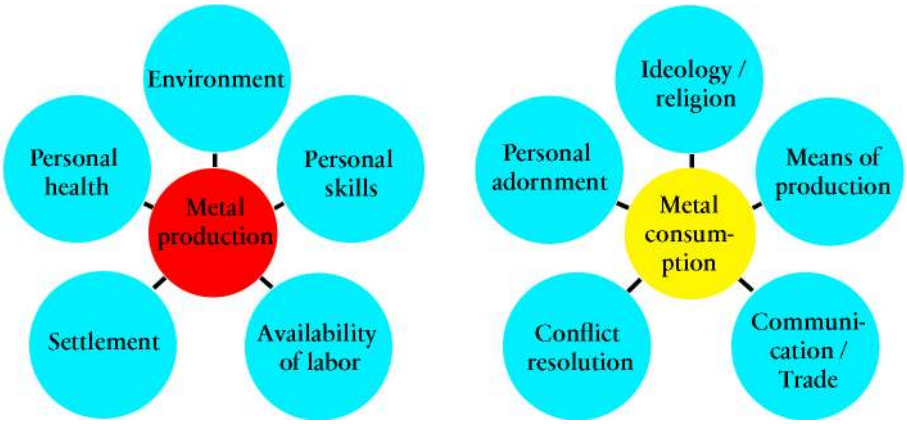

Fig. 1 Assumed secondary effects of the production (a) and consumption (b) of cast metal artifacts.

human health.[25] The increased demand for labor means that there will be a limiting factor: either less labor power for other tasks or less time for 'leisure'.[26]

This may in the long run even result in a 'de-skilling' in terms of traditional techniques because the time required for the production of copper artefacts could mean that the elaborate accomplishment of other tasks was no longer possible. The production sequence of copper also had consequences for settlement activities. Social groups had to establish a connection with the mines and casting places, either by founding new settlements or through the protection or even pacification of trade routes. The consumption of metal goods is well known and can be briefly summarized (Fig. 1b): metal artefacts can be used as tools, they can be traded in the form of ingots or semi-finished products, and they can be turned into weapons, used as jewelry or prestige goods and play an important part in religious ceremonies.

25 Such an effect was also noted by Erica Hanning during her experiments with Bronze Age smelting (E. Hanning, Bronzezeitliche Schmelzversuche auf der Henrichshütte. Lecture given at the Heinrichshütte, Hattingen, Germany, on 25th of November 2011).

26 I use the terms 'labor' and 'leisure' here to designate the time not used for task-oriented work but rather for sleep and other activities, even though I am aware of the modern implications of the term and the underlying concept of *Lohnarbeit*, 'wage labor'. I am aware that Chalcolithic labor very probably could not be turned into an exchange value.

4 Nahal Mishmar and beyond: shiny heavy metal in Neolithic exchange networks

The first metal items appear in Anatolia and Syria in layers dating to the Pre-Pottery Neolithic.[27] All objects are tempered and/or cold hammered. A major technical breakthrough happens with the smelting of ores and the casting of metal artefacts: not only does it allow the production of much larger items, but also the recycling of broken or unwanted artefacts and the fabrication of shapes that were impossible to construct with other materials. The technique allows an axe to be transformed, for instance, into a sickle, a sword, or an arm ring and vice versa. It also made possible the creation of completely new shapes such as diverse thin, long and sharp objects as well as elaborate pieces of personal adornment.

Smelting first took place around 5000 BCE in Anatolia and the Balkans.[28] A comparable early horizon is still unknown in the Levant, but this may very well be due to a lack of research. Especially for the late 6th and early 5th millennia, the archaeological data in the Levant are very sparse. At the time of this writing, the first evidence for smelting technology dates to the *Ghassulian*, from 4600/4500 BCE onwards. However, the complexity of the Nahal Mishmar finds, which can now be dated to the 44th or 43rd century suggests that there must have been a longer technological development that is so far unknown to us. Future research at Middle Chalcolithic (i.e. *Tsafian*) sites could offer some new data here.

Apart from awls and 'needles,' flat axes and adzes belong to this first horizon. They were cast in an open mold and then hammered into the desired shape. The axes are an imitation of Neolithic stone axes translated into copper. It is remarkable that the first objects larger than awls, wires or sheet of prehistoric communities in Europe,[29] Egypt,[30] Anatolia,[31] the Levant[32] and Mesopotamia are always flat copper axes. The universality of this rule is remarkable, because in the preceding periods these regions had quite distinct cultural systems. Scientific research is needed to further investigate the role of axes. The chronological primacy of axes over all other heavy metal tools must hold significance in terms of the special role axes played in these societies. The ideological charging of axes occurs not only inter-culturally, but also cuts across various ecologically distinct zones: from the Nile valley to the North Sea, prehistoric communities used copper to imitate the same *functional* tool, although not necessarily with the same morphology.[33]

27 Özdoğan and Parzinger 2000; Molist et al. 2009. From the Neolithic there are also the first larger items such as a copper mace head from Can Hassan (Yalçin 2000, 21 fig. 7).

28 Boric 2009; Yalçin 2000.

29 Vulpe 1970; Todorova 1981; Klassen 2000; Klassen 2004.

30 Rizkana and Seeher 1989, pl. 4.

31 Yalçin 2000.

32 Miron 1992.

33 E.g. Klimscha 2009a; Klimscha 2016; Barkai 2005; Jeunesse and Pétrequin 1995; Pétrequin et al. 2002; Whittle 1995.

The crafting of copper axes in the Levant does not lead to an immediate 'extinction' of stone axes, but within the lithic traditions several developments are visible. Simultaneous to the first heavy copper items, the chipped flint industry starts to exhibit creative traits. New perforated flint discs and new types of flint axes, this time with a triangular, lentil-shaped or trapezoidal section appear during the *Ghassulian* and demonstrate that the appearance of copper did not lead to the neglect of flint, but coincided with a last peak of chipped stone tool productivity.

Did *Ghassulian* metallurgy also have an influence on ceramic traditions? In the Nahal Mishmar hoard are a number of cast copper vessels that show only a slight connection with the contemporary *Ghassulian* ceramics. *Ghassulian* pottery occurs in a variety of shapes: apart from a multitude of bowls, jars and basins, there are churns, footed vessels, bottles, stands and pithoi.[34] The vessels are decorated with painting, incisions, thumb-impressed rims, fenestrated feet, applied knobs, rope decorations, fingernail impressions, multiple handles or elaborate plastic decorations like horns or animals. Multiple handles and spouts also suggest a variety of uses apart from cooking and storage. The shapes of some of the Nahal Mishmar vessels are clearly Ghassulian, resembling necked bottles and pithoi.[35] Yet, the decoration differs completely from the known repertoire and resembles the incised designs of the Wadi Rabah culture.[36] Additionally, there are burial containers, or ossuaries, which resemble anthropomorphic houses decorated in multifarious ways. The various usages of fired clay for ceramic containers are striking and enable an artistic creativity unseen elsewhere at that time.

With the end of the *Ghassulian*, this changes. Pottery from the transitional phase to the EB, at Hujayrat al-Ghuzlan for instance, is rarely decorated, and if it is not plain, it has finger impressions and small incisions (Fig. 2). With the later EB pottery tradition, this intermezzo is quickly superseded, but the variety of decorations and usages of the *Ghassulian* are not reached again. The influence of the slowly turning potter's wheel, the *tournette*, seems to have had no major consequences for the styles and shapes of pots. The only exception is the so-called V-shaped bowl. This vessel was not, as sometimes presumed, wheel-turned, but rather wheel coiled (or wheel-spun) using a slow-moving wheel that is rotated by hand.[37] Parts of slowly-turning potter's wheels are already known from *Ghassulian* contexts, but the same technology continues until the end of the Early Bronze Age, i.e. the end of the 3rd millennium, without becoming dominant in the archaeological record.

The only plausible explanation for this creative climax in the realm of flint tools and pots seems to be to assume a connection of their social meaning with that of the first copper tools. Marcel Mauss has shown that economic transactions in "archaic societies"

34 Garfinkel 1999, 200–299.
35 E.g. Bar-Adon 1980, 106 no 158; 110 no 162.
36 Garfinkel 1999, 104–152.
37 Roux 2003.

Fig. 2 Complete pots from the Chalcolithic–EB transition. Tall Hujayrat al-Ghuzlan.

are usually embedded in social bonds in the form of the exchange of gifts.[38] A gift implies three obligations: to give it to someone, to accept it and to reciprocate it. The latter must not necessarily happen immediately, but can be delayed. Of course repaying a gift starts another cycle of giving, accepting and reciprocating, and such an exchange can connect individuals or groups in the same way that a treaty does. Communication, identity and political power in such gift-giving societies are achieved by exchanging goods.

Gift exchange is a "total social phenomenon"[39] that regulates, for instance, the communication between elites, in marriages, communication with higher deities and many other phenomena. The exchange of gifts is based on culture-specific rules that define the 'right' gift for the 'right' occasion. Whoever does not own any gifts that are exchangeable according to cultural consensus will not be able to participate in such an exchange. This means that he or she will not be able to form alliances, marry or integrate him/herself in such circles. Not having exchangeable gifts, therefore, equals social impotence – the

38 Mauss 1990; cf. also Polanyi 1978; Godelier 1999; I use the term 'archaic' here to describe pre-industrial societies characterized by the importance of social relations (e.g. Lévi-Strauss), even though certain scholars have pointed out the western notions and prejudice that lead to the classification of these societies as "archaic" or "primitive" (Wolf 2010). Nevertheless, there is still a strong consensus in anthropology that there are a number of common traits that seem to be spread almost universally (Kohl 2000). Gifts are spiritually charged items, and their circulation does not follow the rules of a market (cf. Constance von Rüden's paper in this volume).

39 Mauss 1990, 22.

inability to be accepted as an actor in a social system. This is often signified in terms of gender: as an illustration of how the possession of artefacts can be used to define social roles, one could turn to Morocco, where Jews and foreigners are spoken of as females by Muslim males, because they do not wear daggers.[40]

But what happens when a new item intrudes into such gift exchange networks? There are the following extremes: either it is ignored, or it becomes very valuable to the participants of the network. The consequence of the latter is that we might find a change in traditionally exchanged goods to raise their attraction as a gift, or we see their disappearance when exchange networks stop communicating via these goods. Neolithic ceramics and axes are two types of objects that, we can assume, were charged with social meaning and exchanged in various overlapping systems of differing scales.[41] Copper must have been a shock in the reproduction of those arrangements not because it, in itself, was able to substitute for lithic artefacts, but as soon as it was comprehended as a prestigious item it started to infiltrate exchange relations. This meant that it went into competition with other prestige goods and, if it was accepted, made a shift in the directions of exchange necessary. Copper was only found in certain mining areas and was not as frequently available as other materials. Even in the case of equally rare goods, this meant a change, as the technology for the production of copper items was too complex to be easily copied. In the long run, this would also have made it necessary to shift the directions in which exchange networks that included copper were spread. Thus, it became necessary to develop new strategies to continue social relations.

This process was certainly not a short-term affair, but rather a lengthy process. When considering the new carbon-14 record, it is even possible to imagine it to have happened over several generations. Again, this could even mean that people did not realize how copper became a more and more important means of communication via exchange. People did not need to choose copper and actively change the rules of gift giving, but as soon as copper was adopted by a group with a critical size, this went on more or less semi-automatically. The size of the group must have been large enough to keep marriage circles going without being dependent on groups without copper. Thus, a stable system in which copper was used for a variety of tasks could have been established. Other groups wanting to ally with those exchanging copper were then forced to adapt to this code, and therefore the need to acquire knowledge about this technology slowly spread. Once, however, the high prestige of smelted copper items was sought after by a social group, it caused traditional exchange networks to change radically or collapse.

Such changes also necessitated transformations in the modes of production and exchange. Either copper technology was quickly acquired or other goods that could be

40 Geertz 1987, 60.

41 Cf. Reingruber 2011 for an example from the Aegean Neolithic.

used to exchange for copper must have been produced in large numbers. A consensus, to ban copper from the exchange could be another option, as well as producing substitutes for copper items or rival prestige objects, i.e. new objects of traditional materials that could compete with the new items and their meanings as prestige goods. The geomorphology of the southern Levant enabled several systems to exist simultaneously, and so according to our current knowledge, the Mediterranean coast, the Negev, the Golan, the Jordan Valley and the Wadi Arabah seem to adopt the new technology at different times.[42] Thus, a conflict over the social significance of prestige goods can be assumed, in which prestige objects of different materials played a central role, and therefore craft traditions in general flourished.

At the point when copper items were available in large enough numbers to supply many exchange participants, the networks could slowly transform into copper-based ones. In the long run, other media lost their significance, and slowly but steadily, this resulted in pots and stone tools having a *new lack of social meaning*. If this assumption holds, it should be possible to trace 'more' social meaning in copper items that, for instance, in flint artefacts. Yet, how can an archaeological analysis do this?

The problem needs to be approached from a functional point: experiments have demonstrated that flint axes are the sharpest and most efficient axes for woodworking.[43] How can it be that copper axes which are not only more difficult to produce but also not as sharp, substitute for flint axes? To understand this, we need to investigate the role of axes in prehistoric societies. Axes are a social marker in nearly all documented preindustrial societies: in New Guinea and southern Australia, for instance, male identity is based on the possession of the 'right' and the 'best' axes according to cultural consensus.[44]

Copper axes are not at all necessary for prehistoric communities. All practical functions can be carried out with flint and groundstone axes. To choose an axe of copper, therefore, is much more than a simple substitution of a tool. In some regions of Europe, it can be shown that the appearance of copper axes caused stylistic (not functional) changes in the lithic tool kit.[45] Even though a similar demonstration is still not possible in the southern Levant, the distribution of copper items clearly shows that they are not found all over the region, but concentrated in the Negev and the Jordan Valley. Since from an economic point of view no drastic differences can be noted, the question remains as to why some communities chose copper axes.

It was already stressed that copper might have played an important role in regulating status. This can be easily explained for the scepters and other objects from the Nahal

42 Cf. the radiocarbon record and Pfeiffer 2009 for a discussion of smelting places.

43 Jørgensen 1985.

44 Cf. e.g. Godelier 1987, 34; Højlund 1978; Steensberg 1980; Vial 1940; Chappell 1966, 102; J. Burton 1984; Vicedom and Tischner 1943–1948, 423–451.

45 E.g. Klimscha 2011 for the eastern Balkans.

Mishmar hoard made from arsenical copper, but can this also be true for the copper axes?

A closer look at the hoard reveals that not only the standards, crowns and vessels as well as the hippopotamus ivory objects are without practical use, but also that at least some of the maceheads were cast around a core or very badly cast and thus also dysfunctional. The copper axes should be thought of in the same way as the maceheads. They had a practical function but were inferior to their lithic counterparts. A small group of people in the southern Levant seem to have valued their axes enough to cast them into metal and thus willingly accept a functional disadvantage. Certainly this group of people also should have had access to normal axes for daily use, but the option to use a copper axe for gift giving and offerings to the gods was one possibility to distinguish oneself in *Ghassulian* society.

This personal taste was not universally accepted. We do not know of many copper axes from the *Ghassulian*, so either most of them were re-melted, or it was just one way among others to show off one's status. The typological variety of copper axes in the Levant is from the beginning fairly large and includes squat, thick types with convex cutting edges as well as very long and thin axes. Copper axes in the *Ghassulian* are not at all standardized but can be shown to follow very local traditions. The only find in which several of these traditions were found together is, again, the Nahal Mishmar hoard.

Copper axes have one major advantage over flint ones: their size. While the length of flint axes is dependent on the size of the nodules from which they are made, this limitation does not pertain to copper axes. Copper axes can therefore be produced in longer and heavier forms that signify status much better than flint axes – or, for that matter, axes from any stone. A look at some metric data clarifies exactly how copper axes differ from their flint rivals (Fig. 3): Copper axes are significantly longer and much heavier but thinner. Apart from the precious material, a greater, dysfunctional size of metal axes is a major criterion to signify the prestige of the axes.[46] In this respect, copper axes could outbid stone axes easily. Copper axes can therefore easily be shown to be superior even to the best stone axes, but not because they were better adapted to chopping wood or butchering animals, but because they were better at showing off one's status. Thus, there was no functional surplus, but a social one. The functional deficits of copper axes suggest that their main usage must have been in gift exchange. Therefore, it can be assumed that the possession of a copper axe must have also carried with it certain implications. The possession of an axe (or other copper items) does *not* justify any status, but *enables one to gain* status by manipulating exchange. On the other hand, this can also mean that status results in the possession of many copper items.

46 Klimscha 2011; Klimscha 2009a.

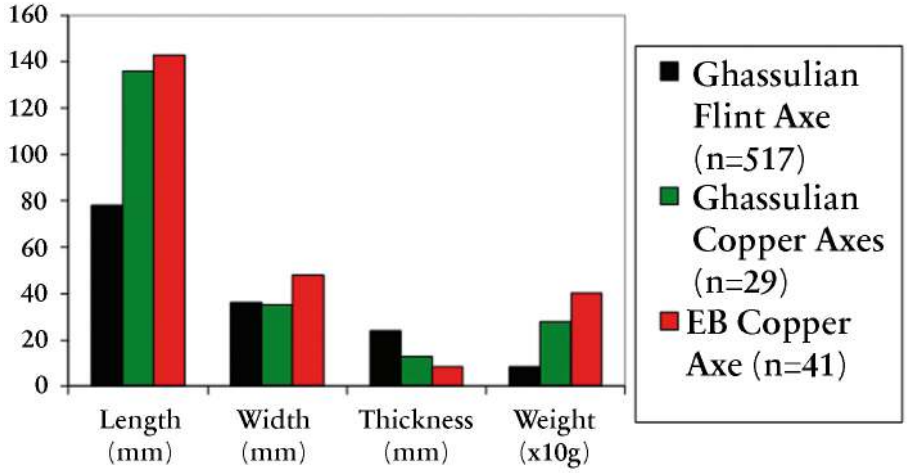

Fig. 3 Comparison of metric data of flint and copper axes from the second half of the 5th and the 4th millennium.

The possession of copper axes (or 'crowns', 'standards', 'scepters', etc.) implies that there is a connection between the person and the ability to influence social relations via exchange. Axes thus both classify and signify social status in the sense of Pierre Bourdieu.[47] They help to show off one's own status, but also their possession is a means to be classified as powerful by others.[48]

Because they are an important part of nearly all gift exchange networks, the most influential persons end up with the best and the most axes. Even though one has to acknowledge that it is also the story behind the artefact that matters, the economic aspects of gift giving must not be neglected. In the Kula, one aim is to acquire axes made from special stones, another is to barter and to get access to foreign goods that cannot be produced on one's own island.[49] Axes thus give not only the formal assurance of certain qualities; they suggest that the person possessing them is able to shift alliances, help with finding a marriage partner, has contacts with other elites, etc. Wherever anthropologists could talk to the owners of stone axes, they argued in the same way: the best man possessed the best axe, and consequently the person having the best axes should be seen as the best one in the first place.[50] The social inferiority of stone axes was also transferred to inferiority in other respects. Copper axes were for that reason indeed the best choice. Examples from ethnography might illustrate this (although they do – in no way – present a similar 'Stone Age culture'): in New Guinea, only the possession of steel

47 Bourdieu 1987 [1979], 36; 41.
48 Cf. Bourdieu 1987 [1979], 36; 41.
49 Cf. Malinowski 2001, esp. 59, 109, 136.
50 Højlund 1978.

axes allowed one to continue to "be a man", after these had been introduced by European missionaries,[51] and a similar connection between social identity and prestigious items can be assumed for prehistory. For the Chalcolithic of southeastern Europe, for example, a clear connection between elite households and male elite graves with flint axes and battle-axes can be identified.[52] Those who could not get one of the new axes had to either establish a sub-group in which the use of flint was still *en vogue*, which, in the long run, meant splitting away from existing socio-economic networks or changing to copper. Therefore, once metal axes had been accepted as being better than stone ones (just because they were *bigger*, *shiny* and *exotic*), a race started to acquire as many of these as possible and use them to gain power.

In this way, the possession of high quality axes also implies *real* power, namely the possibility to subtly manoeuvre within exchange networks and shift them in one's own favor. Similar semantic relations between artefacts and assumed abilities still exist today, for instance, when automobiles are often highly sexualized in advertisements. The relation can best be described as index linked. Via the possession of the artefact, its wearer is either seen as different, or all those who do not possess and wear such items are seen as different.

5 The role of copper artefacts in transforming networks and society

EB copper axes are longer, heavier but thinner than *Ghassulian* ones. Flint axes were not used anymore; neither the artefacts nor their production waste is found. If a similar social constellation as in the Ghassulian is assumed, all persons competing for the best exchange partner should now possess copper axes. By then, copper was used for a variety of functional tools, and several kinds of flint objects ceased to exist within the first half of the 4th millennium. However, one specific lithic tool began to be produced in huge numbers: with the advent of the Early Bronze Age, flint sickles of the standardized Canaanite type are found in significantly larger numbers.[53]

Sickles are different from all other tool types in that they actually increase from the Pottery Neolithic to the Iron Age. This increase is bound to specialized workshops and the use of either Canaanean or Egyptian blade techniques from around 3500 BCE onwards.[54] Canaanean blade production makes use of large cores that are efficiently worked, so that very long trapezoidal blades are produced. These blades are then mainly used for sickle production.

51 Cf. e.g. Godelier 1987, 34; Højlund 1978.
52 Klimscha 2016.
53 Rosen 1997, 153.
54 Rosen 1997, 59 fig. 3.19.

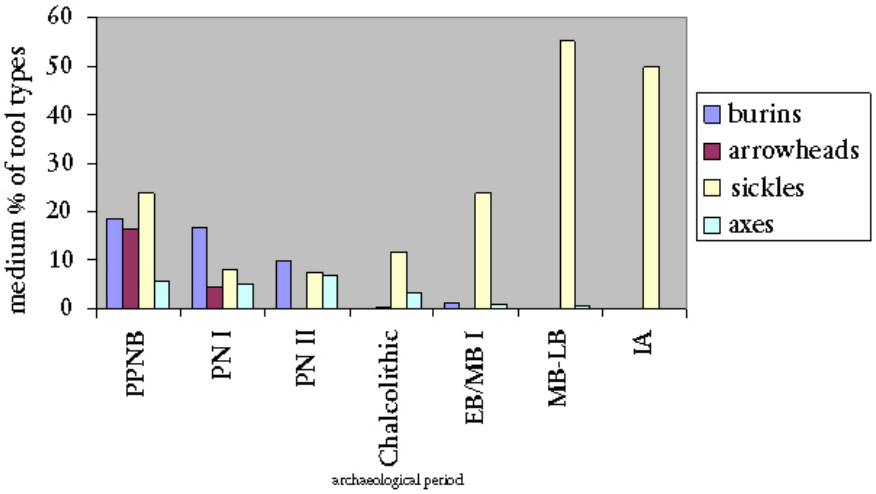

Fig. 4 Frequency of selected lithic tool types from the PPNB to the Iron Age in Western Asia (according to data taken from Rosen 1997).

While a slow but steady replacement of heavy tools by copper substitutes is apparent within the EB I, innovative and very efficient chipping techniques are used to produce small flint tools *en masse* (Fig. 4).[55] This latter change is not connected to the functionality of copper at all, but to a new organization of craft production. The Canaanite blade workshops are highly standardized and do not allow much room for individualization. The reduction sequence aims at chipping as many blades as possible from a single core. This was probably done by specialists, and it required skill and precision. The downside of this intensification and focusing of chipped stone industries was that flint was not used for the multitude of tasks that it was used for during the Chalcolithic. There can be a variety of reasons for the decline of a tool type, and the wider availability of copper in EB I seems to be only very indirectly connected with this. Copper equivalents of the flint tools known from the *Ghassulian* are unknown in the EB. They disappear for various reasons.[56] The new efficiency behind the production makes less typological/morphological variety necessary and results in strictly standardized techniques that do not allow for much variation. Thus blade production is *cleansed of creativity* and at the same time *increased in efficiency*.

55 From the beginning of the *Ghassulian* onwards, flat axes and awls were made from copper, and other flint tool types were produced less numerously until they ceased to be made in the EB I. Cf.: Rosen 1997, 112–115.

56 Cf. Rosen 1997 for a detailed discussion.

The tendency to make copper axes as long and heavy as possible but also significantly thinner can be the result of a variety of factors. When taking into account the new efficiency in tool production, one could best imagine them to be the result of innovations in casting techniques. This saved material and completed the functional requirements for long, very flat but heavy tools for sharp concussions; such a combination was only possible with metal casting technology.

Even though the production of copper axes required significantly more labor than the chipping of flint axes, this may not have been relevant in a society which had fully adapted to copper smelting and melting: the *châine opératoire* can be easily made more efficient. While the smelting and melting of one or a small number of axes may require more time and may be more complicated than the chipping of flint axes, this ratio can be altered in favor of copper axes when larger amounts of copper are used to cast several axes at once, not to speak of the material saved by recycling old axes.

Some artefacts from the Chalcolithic of the southern Levant are traditionally interpreted as representing social differentiation, and I go along with this tradition: in a cave in the Nahal Qanah, eight rings made from gold and electrum were found. These were cast in an open mold and then hammered into shape.[57] Radiocarbon dates as well as finds in the vicinity suggest a *Ghassulian* date. The absolute age has to be sometime in the second half of the 5th millennium BCE.[58] The pieces are very small with an outer diameter of 4.4 to 5.0 centimeters, and weigh between 88 and 165 grams. No standardization is ascertainable, which makes an interpretation as ingots improbable. Nevertheless, the rings do not resemble jewelry, and no obvious function is implied by their shape. This suggests that they can be understood as representing just their material: gold. This argument is also strengthened by chemical analyses that show that most of them were indeed not made from gold even though they look like it.

Most rings were made from electrum but had – by a yet unknown method – their surfaces enriched with gold. Their makers were pretending to have prepared pure gold rings. This suggests that gold had a high value, and the material 'gold' was accepted as a symbol. Otherwise, from an aesthetic point of view, the color of electrum would surely have sufficed. The rings were concentrated in two groups; five pieces were hidden between two stones and separated from another three by ca. 1 meter. They were associated with human bones and fragments of an ossuary and therefore are thought to be the remains of a destroyed grave. Individuals who had the right to be buried with ca. 1 kilogram of gold/electrum can easily be identified as an elite based on the possession of wealth. Sadly, many other graves from that time have been destroyed or robbed, so that information about such groups is still is very limited. However, if neighboring regions are taken into consideration, similar phenomena can be seen: the best example for

57 Gopher and Tsuk 1996.

58 Klimscha 2014.

the establishment of different groups that distinguished each other by the possession of material goods is the Eneolithic cemetery of Byblos in Lebanon.[59] The deceased were buried in big ceramic vessels (pithoi), and these graves can be categorized into various groups. The classification is based on distinct numbers of grave goods and the presence or absence of silver items.

Even if *Ghassulian* cemeteries do not show social differentiation similar to that known from Byblos, this does not imply an egalitarian society. The high quality casting of the "standards" from Nahal Mishmar[60] is not found regularly in settlements. If this is taken at face-value, it could suggest a limited availability of prestigious items. However, one must not forget that hoarding is an intentional deposition, while settlement finds are mostly unintentional. Therefore, the rarity of 'scepters' and 'standards' could also simply be the result of archaeological filters, and they could have been part of everyday life. Nevertheless all scepters found until now are unique. Thus, even if they were in use more often, they seem to have been a unique artefact, one whose shape, elaboration and size would very well allow social distinction.[61]

Social inequality can furthermore be deduced from rare exotic items such as ivory. Ivory is well known in the Beersheva area where it is amongst other things used to produce figurines resembling those from the Egyptian Badari culture.[62] Special ivory objects from hippopotamus tusk was found in the Nahal Mishmar and Nahal Qanah caves,[63] and a perforated rod from the latter seems to be an imitation of ivory rods found at Ghassul and Mostagedda. The finds demonstrate close relations based on elite exchange between Egypt and the Levant already in the second half of the 5th millennium BCE. The connection via Sinai, the Mediterranean or the Red Sea between Egypt and the Levant will become even more important in the Early Bronze Age.[64]

5.1 Metal in the Ghassulian cult

Copper had the biggest impact on the various modes of gift exchange. Mauss already included the sacrifice into the realm of exchange, and it is not really astonishing that the first specialized cultic areas also appear in the Chalcolithic. They seem to be connected with the cultic use of copper objects. At En Gedi, such a 'temple' was excavated. The architecture is unique and includes a feature resembling a shrine. The building can only be entered through a single, narrow entrance. The temple walls are a vehicle to bar the majority of the population from religious acts. David Ussishkin proposed that there is a connection between the En Gedi Shrine and the Nahal Mishmar treasure because of

59 Artin 2009.
60 Bar-Adon 1980, 112.
61 Cf. also Kerner 2001, 151.
62 Dayagi-Mendels and Rozenberg 2010, 29 fig. 21.
63 Scham and Garfinkel 2000.
64 Cf. Teeter 2011.

the closeness of both finds and because no temple treasure was found at En Gedi. Even if there is not much evidence to substantiate the claim of a connection between the two sites, it can be assumed that copper played a role in cultic ceremonies.

The famous wall decorations from the contemporary site Teleilat Ghassul show a star and a person next to a part of a building that could represent a shrine of the En Gedi type. Even stronger is the link with another wall decoration, which shows a procession in which a copper object of a shape similar to some scepters in the Nahal Mishmar hoard is used.[65] While the interpretation of the picture with the star is ambiguous, the connection of copper and the procession is difficult to deny. There is no reason to identify the inventory as a treasure hidden for later recycling; rather, all the items in it point to a cultic or ceremonial use. The Nahal Mishmar hoard certainly is unique in more than one way, but even if the explanation as the inventory of a shrine is refuted, the hoard demonstrates the manifold uses of copper in *Ghassulian* cultic performances.

Since metal goods started to dominate the cultic sphere, they can be seen as one of the few forms of permitted sacrifices to elder things and transcendental entities such as deities. Sacrifices are a contract between mortals and higher beings[66]: the sacrifice aims not only at pleasing the gods but also influencing their treatment of oneself. *Do ut des*. I give, so that you may give to me. However, not every object may be sacrificed or given to the supernatural beings. A society has rules about the correct way to sacrifice.[67] Therefore, metal could be used to bar access to supernatural beings as long as the secret of its creation was controlled by a small group. That would suggest a monopolization of this form of communication, and since offerings are used in many socially relevant contexts, this monopoly could be translated into social power. Those who owned copper were the only ones who could speak with the gods. For everyone else the situation was similar to that after the destruction of the Tower of Babel. One could speak, but the gods would not listen anymore.

Of course, the scenario just presented is in parts speculative. Yet, there are a multitude of explanations in every society for why a sacrifice is not successful. At the point where people can explain an unsuccessful sacrifice with offering the wrong gifts, the offering group or person becomes vulnerable. Various kinds of disasters that strike a community could suddenly be linked to people offering the wrong gifts. This could also have accelerated the shift to the production of copper items important in the cult. This is a well represented line of thinking in the discourse on Copper Age and Early Bronze Age hoarding in Central Europe and the Black Sea region[68] but has not yet been discussed in depth for the Levant. From this perspective, people who requested supernatural help were forced to turn to those with access to copper. Thus, if somehow the access

65 Seaton 2008, 285.
66 Mauss 1990, 44.
67 Hansen 2003.
68 Hansen 2013.

to copper could be limited to a minority, this would turn that minority into an elite, because it could have caused an exclusivity of communication with the supernatural. Such a monopolization of the communication with the supernatural could be mirrored in the enclosed architecture of En Gedi. Walls blocked the public from the cult, and a narrow door allowed the control (or denial) of those who wanted to offer. Metal might thus be connected with the establishment of religious elites, although it need not be the factor causing the exclusivity of the cult.

5.2 Long distance communication and metallurgy

The similarity of developmental trajectories in ceramic style and flint technology is often used to construct prehistoric communication routes and zones.[69] Before the middle of the 5th millennium BCE, several traditions can be defined within the southern Levant. With the advent of metallurgy, most were integrated into the *Ghassulian*. A number of traits in ceramic, lithic and copper technology were shared over a larger area than before. A specified set of craft traditions was shared by a larger number of people. And the influence of these workshop traditions was wider than the area for which we can identify *Ghassulian* culture. For instance, in the Eneolithic cemetery in Byblos, Lebanon, we can easily identify within a large number of local pottery designs *Ghassulian* shapes such as churns.[70]

Within this context, one has to return to a discussion of the scepters made from arsenical copper. Apart from the Nahal Mishmar treasure, similar scepters have been found at Neve Noy/Bir es-Safadi,[71] Givat Ha-Oranim,[72] Nahal Qanah,[73] Shiqmim,[74] or are depicted on Ghassulian ossuaries, for example at Azor[75]. The distribution shows that, apart from the Nahal Beersheva, the coastal plain, the Dead Sea and the Jordan valley were included in a distribution system.[76] These networks could bridge considerable distances.[77] Apart from local items such as ceramics and lithics, the cave of Nahal Mishmar included various goods that must have been produced more than 100 km away – most clearly in the case of the gold since there are no gold deposits whatsoever in the Levant. During the *Ghassulian*, metallurgical remains are centered on the Wadi Beersheva. Many finds are still skeuomorphs, imitations of objects that were traditionally produced in other materials. This is made clear by a copper shaft-hole axe from Nahal Mishmar which has part of the hafting of a stone axe modelled on it.[78]

69 Gilead 1989.
70 Cf. Klimscha 2014 for a more detailed review of the Eneolithic in Byblos.
71 Eldar and Baumgarten 1985.
72 Scheftelowitz and Oren 2004, cover image and 71 fig. 5.1–16.18, 73 fig. 5.2.
73 Gopher and Tsuk 1996, 116 fig. 4.19, 1–2.
74 Levy 1987; Shalev and Northover 1987.
75 Perrot 1961, 39 fig. 1.
76 Gošić 2008 with further references.
77 Gopher and Tsuk 1996, 234 fig. 12.6.
78 Bar-Adon 1980, 112, no. 163.

During the Early Bronze Age I, however, production changed. There were also more sites that produced copper items, and these are spread from the Sea of Galilee to the Red Sea.[79] Consequently, a much *higher exchange rate of copper* items can be supposed. Rectangular and oval ceramic molds from Tall Hujayrat al-Ghuzlan reflect this larger market for smelted copper. Ingots which would fit into these molds were found in Egypt at the site of Maadi (Fig. 5).[80] The copper used in Maadi can be archaeometallurgically traced to Wadi Feinan,[81] but the typology of the Maadi items is clearly local. Within the 4th millennium BCE, copper is transported as an intermediate good along the Sinai or the Red Sea, where it was again cast into local forms. The lithic industry of the Buto-Maadi culture does not use flint axes anymore, as they had been replaced with copper ones.[82]

After the decline of the flint workshops, there would have been difficulties in building houses, butchering animals or making new prestigious items in Lower Egypt once the copper from the Levant stopped flowing. The technology changed Lower Egyptian society in a way that made it *dependent on long range trade*. This also opened the way for a higher quantity and a different quality of trade between Egypt and the Levant: in the second half of the 5th millennium BCE, only prestige goods are transported, whereas now it is possible to identify a broader range of traded items, traded commodities and a higher quantity of trade goods. One example that highlights this connection is the distribution of so-called *Libyan* vases or wide-brimmed jars that connect both Upper and Lower Egypt with the Mediterranean coast of Africa and the Red Sea coast of Jordan (Fig. 6).[83] These goods cannot be identified as being prestigious or functional *per se*, and one plausible explanation would be that it was not the stone vessels but their content that was traded.

How does this scenario mesh with the new chronology? With the beginning of the 4th millennium BCE, there are no more finds of arsenical copper items produced in the lost wax technique. What lies behind this apparent 'breakdown' of the metal industry and its technology? To answer this question, one needs to consider that nearly all items making use of this 'advanced' technology were standards, vessels and crowns, that is, items commonly interpreted as prestige goods or ceremonial items: they neither made daily life easier nor brought a new quality to one's daily activities but instead were used to show off social differences. Thus bronze technology, which had the possibility to be shaped and further incorporated into daily life, was only used for its color and ability to signify social differences.

79 Cf. Genz 2000.
80 Pfeiffer 2009.
81 Pernicka and Hauptmann 1989; cf. also Hauptmann, Khalil, and Schmitt-Strecker 2009.
82 Rizkana and Seeher 1989, pl. 4.
83 Cf. Rizkana and Seeher 1988, 62.

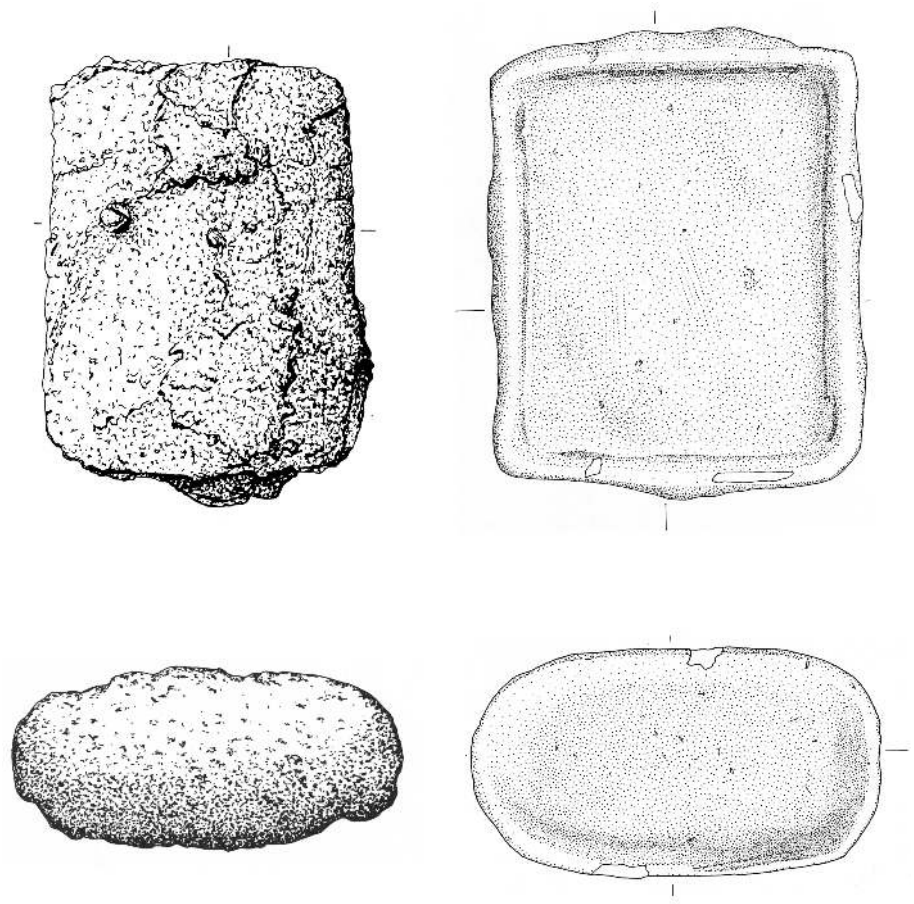

Fig. 5 Ingots from Maadi and moulds from Tall Hujayrat al-Ghuzlan, Aqaba.

Despite Moorey's claim[84], the maceheads from the Nahal Mishmar hoard show little evidence of use as weapons. They are badly cast, hollow or cast over a lithic core and thus are metal representations of stone maceheads and not copper weapons. They are *images of maceheads* made in copper (of course, many highly polished stone maceheads made from marble or other semi-precious stones could also be seen as prestigious items). This view is further strengthened by the many stone maceheads of similar shapes that show traces of usage. The weapons that were actually used were still manufactured from stone. Even so, the Nahal Mishmar maceheads *could* be seen as a new idea about the importance of conflict or power.

84 Moorey 1988.

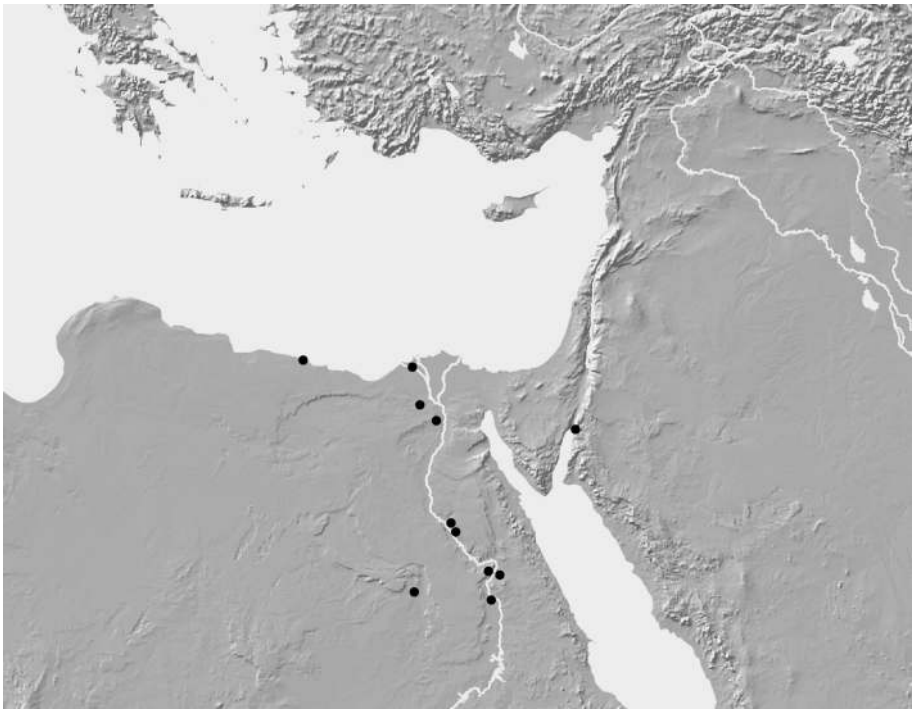

Fig. 6 Distribution of wide-brimmed jars during the 4th millenium BCE.

These principles change with the beginning of the Early Bronze Age. The donkey figurines, for example, are often taken as a continuation from the Ghassulian. However, in contrast to the zoomorphic *Ghassulian* vessels,[85] the donkeys are figurines and not vessels – although sometimes they also carry miniature vessels.[86] A depiction from the second half of the 4th millennium from Tell el-Farah (North) continues this tradition by depicting two oxen under a yoke as a decorative element in a plate.[87] It therefore seems as if EB miniatures are expressions of a new ideology that is heavily influenced by new technologies: crucibles and molds representing metallurgy and domestic donkeys for the new means of transport.

It is true that we do not know of a single item cast in lost-wax technique from the 4th millennium, but when keeping in mind the limited distribution of the standards and the opening of communication routes with the early 4th millennium BCE, one should also consider alternative explanations, such as lack of research, bad preservation or simply the end of hoarding. The regular contact with new cultures may also have

85 Amiran 1986; Joffe, Dessel, and Hallote 2001.
86 Cf. Milevski 2011, 177–192; 185 fig. 10.3.
87 Dayagi-Mendels and Rozenberg 2010, 39 fig. 4.

resulted in the adoption of social rules considered as superior: Thorstein Veblen's ideas of the spreading of innovations by imitation of people seen as superior come to mind. In that respect, it is striking that prestige goods of unequivocally Egyptian origin begin to appear in the Early Bronze Age.[88] In Egypt, large, ripple-flaked knives were in fashion, and these are also found in Levantine burials, for instance at Azor.[89]

6 Conclusion: what do these changes in material culture imply?

Interpreting the available data one can see drastic changes between the 5th millennium BCE Ghassulian complex on the one hand and the Chalcolithic/Early Bronze Age transition and Early Bronze Age I on the other hand. Fifth millennium copper production is located in the Wadi Beersheva relatively near to the copper mines of Feinan – although still on the other side of the Dead Sea and spread over various smaller sites. During the 4th millennium, larger sites are spread across all of the southern Levant.[90] The archaeological record shows that this is parallel to a raised production volume, which could reflect higher demand. However, the process is interwoven with a number of other changes and innovations. The domestication of donkeys, which happened in the first half of the 4th millennium BCE, made this much easier.[91] It allowed not only greater transport volumes but also faster transport, and therefore may be one of the factors that both enabled and caused the boom of metal in the 4th millennium.

These examples may be completed with reference to the many depictions of sailboats on Naqada ceramics.[92] Only around 3700 BCE is a greater boost of trade relations visible in the increasing numbers of imported prestige goods in the Levant, Levantine exports to adjacent regions as well as new means of transport, such as the mentioned donkey and greater use of sailboats. However, other prestige goods such as gold could already travel similar distances in the 5th millennium BCE, while the communication routes for copper items were still fairly limited.

The new amounts of copper available also result in changes in craft production that are not connected to it at first glance: while the means of production in the 5th millennium BCE are still mainly manufactured from stone, there is a shift to the usage of copper tools. Of the lithic tools, only sickles remain in use during the Early Bronze Age. Also, the beautifully decorated handmade pottery changes to more standardized, less decorated shapes. Lithic tools are socially and functionally replaced by copper objects but also erased from the chipping workshops with the new rule of efficiency that comes with the Canaanean blade. The influence on ceramics must have been different.

88 Veblen 1994 [1899].
89 Ben-Tor 1975, 46 fig. 13, 15.
90 Cf. Genz 2000; Genz and Hauptmann 2002.
91 Benecke 2009; Milevski 2011.
92 Teeter 2011, 178–179; 185.

Fig. 7 Cortex tools from Tall Hujayrat al-Ghuzlan, Aqaba.

It suggests that the *Ghassulian* pottery constituted a sign system that was also socially relevant. With the substitution for stone by copper, there must have been a rearrangement of social bonds, which in the long run also impinged on those connections that were responsible for the *Ghassulian* style. Technique ultimately destroyed social relations.[93]

The usage of copper for prestige goods and their use context in 'architecturally closed' spaces such as En Gedi implies a domination of a specific group in the communication with the gods. The access to copper enabled new restrictions in religious activity. In this way, social differentiation was enforced by the emergence of metal technologies.[94] In the 4th millennium BCE, this is not visible anymore. While rich graves and ritual specialists are apparent in the archaeological material of the 5th millennium, these are more difficult to grasp in the EBA. The ripple-flaked knife from Azor, however, shows that similar distinctions still existed, but the codification of status had changed. Ethnographic reports demonstrate that the introduction of new prestige goods that could not be obtained by everyone certainly caused drastic changes.[95]

While one could argue that all these changes resulted in enhanced trade that could be enjoyed by all those who consumed traded goods, there is also a downside:The smelting of copper required high amounts of fuel for which dung could only partially be used. There are also changes concerning the quality of living: settlement specialization caused not only noise, in a quality until then unknown, but also negative consequences such as pollution. Standardized tools such as Canaanean blades used as sickles or the cortex tools used for the shearing of sheep (Fig. 7) attest to the existence of far-reaching communication networks that were not only based on prestige goods but similar economic strategies.[96]

93 Ellul 1964 [1954], 126.
94 Levy 2007.
95 Sharp 1952; Sharp 1967; Klimscha 2011.
96 Schmidt 1984.

During the transition from the Chalcolithic to the Early Bronze Age in the southern Levant, there was a shift from personal exchange within elite groups to a more open trade with semi-finished products that were then melted into local forms. There was also a shift from the production of elaborate prestige goods made from copper, flint and ivory to a larger-scale production of copper tools. Creativity was eliminated from the sphere of handicraft and caused more efficient techniques with flint sickles and less decorated ceramics. While ideology is no longer dominated by prestige goods and warfare (standards, crowns and maceheads), both still exist in the 4th millennium BCE but are not stressed as much in cultic activities (hoards and graves) as during the *Ghassulian*.

Copper metallurgy did not change society by itself. However, understanding the complexity of the *châine opératoire* of metallurgy and its embedding into a dynamic social system allows us to see the multitude of connections metallurgy had to various social spheres. The change visible in the archaeological record is also reflected in the metal finds. Conversely, most metal finds derive from either graves or hoards. These are intentional depositions *sensu* Eggers.[97] The disappearance of a depositional act does not mean that the objects preserved through this ritual also ended. Within the transition from the Chalcolithic to the Early Bronze age, a successive transformation of the exchange relations between Egypt and the southern Levant causes a higher amount of exchange. Metallurgy is implanted in this transformation as well as lithic and ceramic finds, and a shift in settlement strategy, the use of new means of transport and an increasing efficiency within traditional crafts.

It is striking that no specific determinism is visible in the spreading of metal items in the southern Levant. There was neither a functional nor a social need. Consequently, it is probably too easy to just cite a former book title, "Metals make the *world* go round"[98]; but I would rather refer to Stanley's question, "What makes the world go round?"[99]. Various sociologists have stressed the importance of personal meetings and marriages for the coming together of human groups. Within such networks regulating marriage, feasting, elite relationships, etc., gift giving must have been an important factor. All preserved early metal items fall into categories of either very small tools, such as awls or needles, larger artefacts that are functionally inferior to flint tools, or such objects without a practical use. It could be argued that the latter two were ideally suited to substitute for traditional prestigious items in existing gift-giving networks. They were shiny and could be made heavier, larger and formed into yet unknown shapes. Groups exchanging this new shiny, heavy metal were special partners, because they could monopolize the production of these goods. Therefore, if another group shared the evaluation of metal, it

97 Eggers 1959.
98 Pare 2000.
99 Stanley 1980.

was either dependent on the gifts from metal producers or must have somehow tried to emulate or copy the technology.

This was not a quick process, but rather it may have taken several generations in which subtle changes in exchange circles happened. In the long run, however, once metal items became an important factor in gift giving, it was essential to acquire the technology of their production. Otherwise, alliances, trade relations, marriages, etc., were more difficult to forge and a group not able to produce copper goods could even become isolated. This seems to be a plausible model for the slow and regionally diverse spreading knowledge of 'advanced' metal technology (see above) developed in the western part of the southern Levant and its diffusion into neighboring zones. A higher production volume is reached in the 4th millennium BCE, even in regions where metal played only a small role in the depiction of elites.[100]

In the succeeding millennium, metal is for the first time used in large amounts for heavier tools and ingots, but this new efficiency does not need to be the result of metal itself (although it *is* still possible). Instead, a new *Zeitgeist* of efficiency can be traced in many areas. New transport technology and harvesting techniques result in better transportation and possibly also surplus. While alloying and lost-wax casting are invisible in the archaeological record from that time on, a continuous improvement in the casting process has to be assumed. Metal was, however, involved in a change of long-range contacts. The exchange, so to speak, was liberated from elite bonds and now also included goods for everyday use.

In the dialectics of ancient innovation, metal changed society but also was changed by society. Technical development caused unintended changes that destroyed social bonds and thus enabled the setting free of labor, new settlement strategies and caused a new simplicity in material culture. Progress means stepping forward but not necessarily a better life.

100 In Egypt, for instance, ingots arriving from the Aqaba region: Khalil and Schmidt 2009, 30 fig. 14.

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1 Florian Klimscha. **2** Irmard Wagner, Deutsches Archäologisches Institut Berlin Orient Department. **3** Florian Klimscha; data from Barkai 2005; Miron 1992. **4** Florian Klimscha; data from Rosen 1997. **5** Khalil and Schmidt 2009, 323 fig. 17. **6** Florian Klimscha; data from Klimscha, Notroff, and Siegel 2014, 168–169; Rizkana and Seeher 1988, 62. **7** Nico Becker, Deutsches Archäologisches Institut Berlin.

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Iron and Consequences of the Introduction of its Technologies in Northern Central Europe

Summary

This paper deals with the introduction of iron technology in Northern Central Europe and discusses two major aspects. On the one hand, it asks to what extent we are able to trace the process of the introduction of iron and how it might have taken place. On the other hand, intended and unintended consequences of the introduction of this new technology are investigated. Can we spot 'collateral processes' that accompany the introduction of iron? To what extent do these processes enable such innovation, are an integral part of it, or are triggered by it?

Keywords: Iron production; innovation; Iron Age; technology; archaeology.

Der Beitrag behandelt die Einführung der Eisentechnologie im nördlichen Mitteleuropa und diskutiert zwei wesentliche Aspekte. Zum einen wird der Frage nachgegangen, in wie weit es heute schon möglich ist, den Verlauf des Einführungsprozesses zu rekonstruieren, und wie dieser ausgesehen haben könnte. Zum anderen wird der Einführungsprozess auf intendierte und nicht intendierte Folgen hin untersucht. Welche ‚Kollateral-Prozesse' begleiten die Einführung, inwieweit ermöglichen sie die Innovation, gehen Hand in Hand mit ihr oder werden durch die Innovation angestoßen und hervorgerufen?

Keywords: Eisenverhüttung; Innovation; Eisenzeit; Technologie; Archäologie.

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1 Introduction

The wonderful book *The History of the Railway Journey* by Wolfgang Schivelbusch uses the example of the introduction of the railway to show which conscious and subconscious accompanying effects and after-effects an innovation can have. The question of intentionality will be addressed below by looking at a very central innovation: the beginnings of iron smelting. The specific region in focus is the northern part of Central Europe. This is not about the territory of the invention of iron smelting, but rather concerns a region in which iron was not introduced until more than half a millennium later.

Stefan Burmeister has pointed out in his introduction that archaeologically identifiable innovations are normally obtained from an accumulation of individual observations. Depending on the available data, these processes can be reconstructed in a high or – as is the case here – in a low temporal resolution. The very heterogeneous evidence in Northern Central Europe makes it necessary to employ the concept of innovation for a long time period of several centuries.

Two questions should be addressed. The first concerns the extent to which it is already possible today to reconstruct the innovation process and how this process could have proceeded. The second concerns the 'Schivelbusch aspect'. Which 'collateral processes' accompanied the beginnings of iron technologies? To what extent do they enable the innovation, go hand and hand with it, or are triggered and caused by iron technologies? To answer these questions, the instrument of 'technology assessment' is available and is used to predict side effects, to identify opportunities and risks, and ways to seize opportunities of the new technology and make it manageable. The focus is not only on technical, but also societal and social aspects that are not restricted to the development of – not always unproblematic – acceptance strategies, but make, for example, changes in the perception of people a subject of discussion.[1] In reversing the chronology, the second question attempts a form of retrospective technology assessment. It is in the nature of the archaeological evidence that this section is in many areas speculative.

Production of iron is not very complicated, but it requires some specific knowledge (Fig. 1). This has to do with space-related knowledge – where raw iron occurs and how one can procure it – as well as knowledge of technical processes in order to perform a successful smelting. In the case of Northern Central Europe, it is usually bog iron ore that occurs near to the surface in low-lying land and can be dug easily. The ore is subjected to a first cleaning, generally by roasting and then crushing it, before the furnaces are loaded with it. The other raw material that is needed in the furnace is fuel. Most likely – even if the use of wood was possible – this would have been charcoal. What

1 Grunwald 2010; see here especially p. 212–215.

Fig. 1 Chaîne opératoire of the smelting of bog iron ore in the shaft furnace with slag pit. 1 – quarrying the bog iron ore; 2 and 3 – roasting and crushing the bog iron ore; 4 – charcoal production; 5 – construction of the shaft furnace above the previously dug out slag pit; 6 – pre-firing of the furnace shaft; 7 – filling the furnace initially with temporary filling material for the slag pit, then with charcoal and crushed iron bog ore; 8 – breaking the shaft furnace; 9 – removal of iron bloom; 10 – reforge the still hot iron bloom.

the various types of early furnaces had in common was that they were built of clay and had an air supply. Often it was a shaft furnace with a slag pit below the shaft in which the slag was collected. In a successful furnace campaign, the slag is then formed into an iron bloom[2]. The still glowing bloom is compressed at the end of the smelting process by hammering.

2 Furnace campaign refers to the course of the smelting process in the smelting furnace; the iron bloom is the outcome of this process in the form of concentrated iron.

It is important to know that in the Late Bronze Age and Early Iron Age, other fire-based innovations in Northern Central Europe were in use. Although the production of charcoal is presumed since the beginning of copper smelting, this can currently be determined archaeologically only for the Pre-Roman Iron Age in Northern Central Europe.[3] This is likely due to the fact that simple kilns set on the surface are hardly preserved, so that potentially older evidence is untraceable today. In any case, the amount of charcoal burning grew significantly through iron smelting. Also, the burning of lime can at times be traced archaeologically since the Late Bronze Age[4] and becomes an important technology in the Iron Age. Among the challenges that arise in overseeing the process, this procedure is quite comparable to smelting. Salt boiling experienced an upswing in the Iron Age. Although, here we already have secure evidence from the Neolithic, for example from Central Germany, salt production experienced a boom in the Late Bronze Age and the Iron Age.[5] Iron production is not isolated as a new process, but forms part of a number of other fire-based production processes, which are also new or now gaining enormous importance.

2 The innovation of iron smelting in Northern Central Europe

The reconstruction of the beginnings of iron technology has to draw an important dividing line. Iron smelting and forging of iron have – as far as we know today – different innovation patterns. It all starts with the transfer of regional forms, traditionally crafted from bronze, to a new material – iron. The iron scythe from Gánovce in Slovakia, according to Furmánek the oldest iron object in Central Europe, references regional models made of bronze and was supposedly made at the beginning of the Middle Bronze Age, long before any indication of smelting activities.[6] In Northern Central Europe around 600 BC, traditional bronze objects like razors and gooseneck needles are made from iron (Fig. 2). Obviously, artisans resorted to imported iron before autochthonous iron production started. The archaeological evidence for iron smelting is excellent as iron slag hardly weathers and is easy to find even after 2500 years.

However, as it turns out, slag can be dated only with the aid of C14 samples from adhering charcoal, a complicated process that has so far only rarely been carried out. It depends on the specific context in which slag was found and on relative dating of the finds from these contexts. This requires the implementation of archaeological excava-

3 Brumlich (unpublished); for the evidence of late pit kilns in late Bronze Age cp. Eibner 1991, 215–216.
4 Uschmann 2006.
5 Nebelsick 2007; Saile 2000.
6 Furmánek 2000.

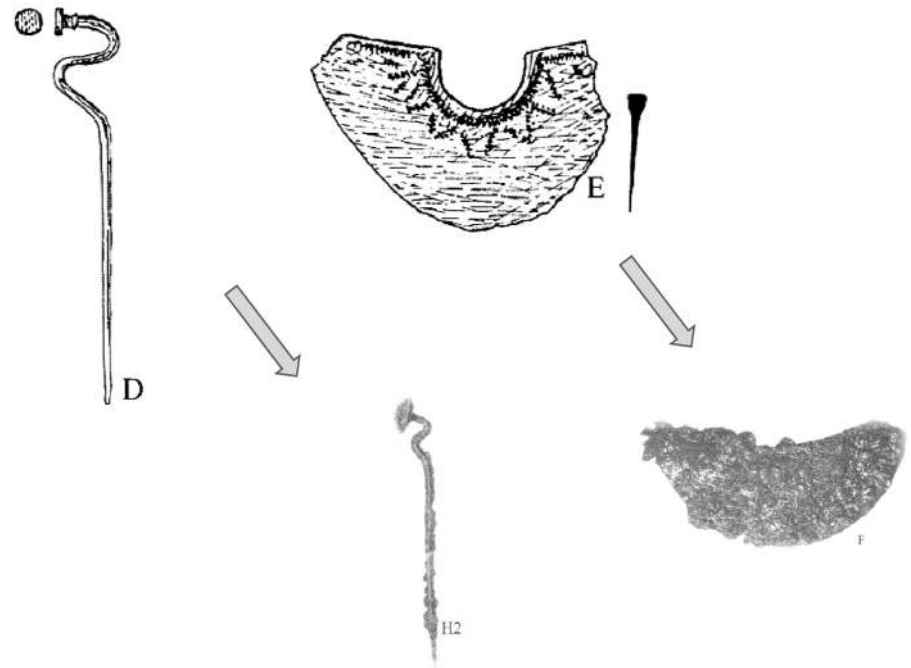

Fig. 2 From Bronze to Iron: gooseneck needles and razors in bronze and the new material iron. Above: Astofte, Ribe Amt, Denmark; bottom left: Heitbrack, Kr. Uelzen, mound 4, grave 2;. bottom right: Heitbrack, Kr. Uelzen, mound 4, grave 3.

tions. In the still poor state of research on Iron Age settlements, especially in the area of Jastorf Culture, currently all statements are based on a very small dataset.[7]

There are three key suggestions for the course of the emergence of iron smelting (Fig. 3). Based on the systematic review of sites with slag finds in Denmark, L. Nørbach[8] developed a three-stage model with an "introduction phase" (ca. 500 to 300 BC) and a "consolidation phase" (ca. 300 BC to 200 AD), followed by a "centralization phase" (ca. 200 to 700/800 AD). The phase sequence is characterized by an increase in the number of sites and the total weight of slag from each site. However, it is uncertain whether the slag from the introductory period derives from the smelting process; bloom furnaces[9] do not exist in this period.

In Scandinavia and Schleswig-Holstein, C. Zimmermann identifies four phases.[10] After a first phase of iron objects (ca. 1200 to 500 BC), the second phase is characterized by slag finds and the third phase by insignificant settlement-bound iron smelting with

7 Meyer 2010.

8 Nørbach 1998; see most recently Olesen 2010 with new discoveries from the early Iron Age.

9 Simple clay furnaces made for smelting iron.

10 Zimmermann 1998.

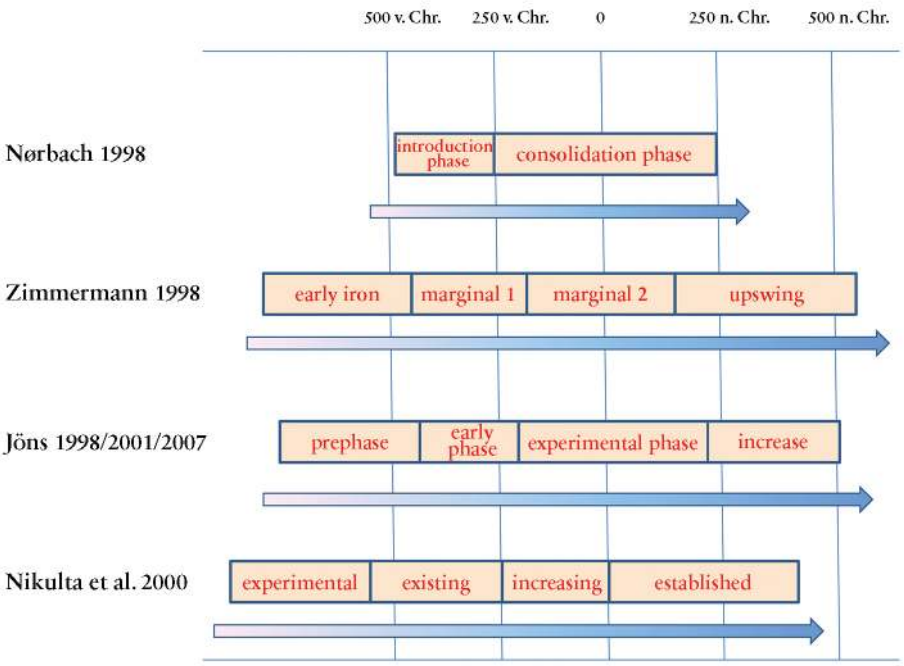

Fig. 3 Comparative presentation of important models for the introduction of iron smelting in Northern Central Europe.

first definite bloom furnaces, whereby the development shows regional patterns (500 BC to 200 AD). It is only with the fourth phase that we see a massive rise in production (ca. 200 to 750 AD). Other turning points are deliniated by F. Nikulka et al.;[11] they see an experimental phase (Late Bronze to Early Iron Age), a phase with evidence for the existence of iron smelting (Early and Middle Pre-Roman Iron Age), a third phase with increasing technological experience (Late Pre-Roman Iron Age), and a phase with a generally established knowledge of smelting procedures (Roman Iron Age).

After a critical review of older ideas from H. Hingst, H. Jöns was right to emphasize that secure evidence for independent iron smelting in Northern Central Europe exists only after the transition from Late Pre-Roman Iron Age to Roman Iron Age.[12] The iron supply was here based mainly on the import of iron blooms. He later presented a modified model that was already based on the data from Teltow.[13] Relying on the early datings

11 Nikulka, Bartels, and Augstein 2000.
12 Jöns 1998.
13 Jöns 2007, 58.

of E. Hjärthner-Holdars, he defines a preliminary phase (1500 to 500 BC) with iron objects accompanied by a very early onset of smelting in Scandinavia. This is followed by an early phase (550 to 300 BC) with iron slags as evidence of the start of iron production, although reliable traces are still rare. The first bloom furnaces are present during the experimental phase (ca. 300 BC to 200 AD), while in the expansion phase (200 to 500 AD) a significant increase in production takes place.[14]

Against the backdrop of such sparse evidence, it is currently almost impossible to develop more detailed models.[15] Only an insufficient amount of datable findings are available from the beginnings of iron smelting. The necessary generalization of the models due to the naturally rough phasing can, however, cause us to detect a linear development even if the above-cited authors have made clear through the use of words such as 'experimental phase' or 'introductory period' that the development does not proceed uniformly.

It should therefore be emphasized that linear concepts implicitly included in the above scenarios are rejected by modern innovation theories mainly developed in Economics and Sociology. Rather, reviews of different stages of innovations and their re-evaluation, as well as the results of the concurrent introduction into the market, lead to many changes in the course of innovation, which can be described only with non-linear models.[16] Although the archaeological evidence does not support these yet, it is still important not to look only for common trends, but to assess non-linear elements such as time delays, repairs, disruptions, and disjunctions.

This indicates two important aspects which are closely intertwined and promote or 'trigger' an innovation. First, it is the combination of innovation and optimization that makes an innovation attractive; second, social assessment is key, because it exerts a strong influence on the success or failure of an innovation. How were technical changes evaluated? Who profits from an innovation or suffers disadvantages? Are scenarios conceivable in which innovations were sanctioned as deviations from the norm of behavior?[17]

It is therefore exceptionally interesting to examine when developments began and end, and why people living in different regions behaved differently. In the well-studied region of Teltow, where evidence exists for intense iron smelting activities after the 4th century BC,[18] the question remains unanswered as to why settlements in the area of Glienicke Plate were abandoned at the latest in the 1st century BC and why for centuries after that iron smelting is no longer detectable, while the inhabitants of other settlement areas moved on to small scale iron production and to using a different type of furnace. In addition, we do not yet understand why a large number of smelting areas, especially in the younger Pre-Roman Iron Age, are present in Teltow while comparable findings are

14 Brumlich, Meyer, and Lychatz 2012.
15 E.g. Nørbach 1998, 56.
16 Details on this e.g. B. Braun-Thürmann 2005, 30–33.
17 Cf. Braun-Thürmann 2005, 14.
18 Brumlich, Meyer, and Lychatz 2012.

missing in the neighboring regions. Was the supply of iron through exchange systems simple and reliable enough in these regions? Or did the residents not see the benefits of iron to be important enough to learn and organize the new technology?

Comparable questions were raised for the start of iron smelting in Sweden. The Late Bronze Age iron production proposed by Hjärthner-Holdar cannot yet be connected with the Late Iron Age smelting.[19] Has a previously known technology been forgotten here?

Apparently, it took quite some time for the new iron objects to be seen as an improvement in Northern Central Europe. Only then was imported iron used as raw material for autochthonous production. The step towards production of iron does not happen simultaneously, varying from one region to another, and it is not necessarily maintained permanently. If it was possible to understand the reasons for this, we could obtain a deeper insight into the social dynamics of these times.

3 Iron and its consequences

By now it is possible to ask how this innovation – the mastery of iron production – affects the individual and the society of the Pre-Roman Iron Age.

3.1 Individuals and individual skills

In fire-based production, success or failure depends on assessing time intervals and temperatures, and also on the ability to determine the quality of the raw material in reliable ways. Basically, the mastery of pyrotechnics – a knowledge that includes the combined properties of fire and matter – was nothing new. Time, temperature, and quality were equally important parameters in preparation of food as in bronze processing, lime burning, and salt boiling. Iron smelting, however, was a long process of twelve hours or more, which was performed by supplying oxygen, charcoal, and iron ore, and which was dependent on viable bog iron ore with low silicate content. Additionally, the smelting furnace was closed during the smelting process so that the activities in the furnace could only be assessed from the outside.

Today we use measuring instruments such as thermometers and chronometers as well as analytical methods, like X-ray fluorescence, to determine the iron and silicate content of bog iron ore, which helps to make the knowledge of the process an explicit knowledge. The Iron Age metalworkers had to use their senses for these purposes. Whether bog iron ore was usable could be seen and felt in its grain and color. The temperature

19 Hjärthner-Holdar, Kresten, and Lindahl 1993; Hjärthner-Holdar and Risberg 2003.

was felt during the blooming process and changes during the process could be determined from the color of the smoke. The beat of the bellows was kept constant with a sense of rhythm, and with the sense of time the duration of the smelting process was assessed.

All of this was based on experience – the reproduction and application was done through a sharpening of the senses; the body was used as a measuring instrument. Together with other fire-based innovations, iron smelting lead to a new targeted use of certain body skills.[20] With the beginning of iron production and processing, people who have a seemingly unimaginable ability became visible: people who were able to turn stones into malleable objects. In Northern Central Europe, where no copper and tin deposits had been exploited, and bronze had arrived only in ingots or as finished products, this must have caused an overwhelming impression.

This impression can be seen indirectly in a number of tombs. Occasionally, forging tools are present in graves and so the buried person was supplied with the attributes of this craft.[21] The special position of the metallurgists and forgers is more clearly visible through a series of tombs, in which construction slag was used or where slag or ore pieces were added (Fig. 4).[22] Unfortunately, this slag is generally no longer preserved today, so whether they were byproducts of forging or smelting cannot be investigated.[23] Nevertheless, the waste products can be seen as a symbol of the transformation of the raw stone to the objects with which the deceased were connected. Since all of these tombs date to the Early Pre-Roman Iron Age, it can be ruled out that this was an accidental use of slag. The early dating shows instead that the mystic properties of this process were apparently lost when the technology became a commonplace.

Unfortunately, we know very little about the organization of smelting and blacksmithing processes. An exception is the Late Iron Age settlement of Hodde in Jutland. Here we have evidence of one homestead that, over the entire settlement period of about 150 years (Fig. 5), shows concentrations of forger's slag.[24] This finding is remarkable: not only is a specialization recognizable here, but also the passing on of this task over generations. In other words, the process of learning and the transfer of knowledge are

20 See e.g. Borić and Robb 2008. – This aspect, however, is not the focus of the current trend on the body as a subject of analysis.

21 Brumlich 2005. – They presumably worked during their lifetime as blacksmiths. It is also conceivable that – as discussed, for example, for bronze casters by Bartelheim 2007, 207 and Bertemes 2004, 148 – the objects of metal craft served as a status indicator, without the buried having actively performed this craft.

22 Brumlich 2005.

23 According to Bartelheim 2007, 207, in the Bronze Age the blacksmith would have been more likely than the miner or metallurgist to be honored in graves by the gift of professional utensils. "It is conceivable that in this way, similar to the modern relationships, it is expressed, that more prestige (and probably also profit) was associated with the processing of raw materials into high quality products and their distribution than with the extraction of the raw materials themselves."

24 Hvass 1985, 168–170, 215.

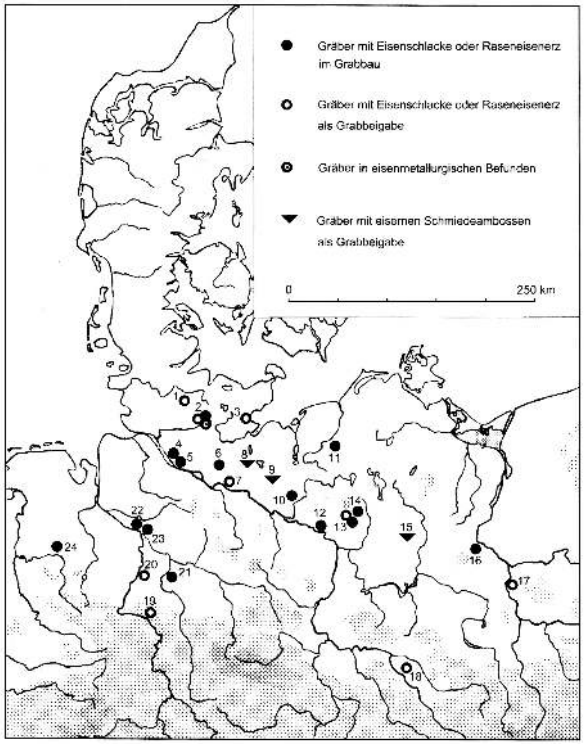

Fig. 4 Graves with iron slag, bog iron ore, anvils and burials dug into iron metallurgical findings.

recognizable here without written tradition. It is probably limited to one family, embedded in everyday life, and introduced in childhood. It does not otherwise differ from the other homesteads of the settlement that are fenced in by a stockade and from which only one farmstead stands out over the entire duration of the settlement. This place, to its unusual size and the fine ceramics that were found only here, is considered the place of the leading family of the village community.

An important insight about the people, who mastered iron smelting, is presented by the Iron Age settlements of Teltow located south of Berlin. Here, in more than 20 settlements, the smelting of iron can be detected in a very specific type of furnace, which was apparently used at all of the sites. As the experience and knowledge necessary for smelting can only be maintained by continuous practice – something that cannot be identified in any of the settlements here – Brumlich et al. recognize specialists at work that did not exercise their craft – potentially for generations – in a fixed location, but rather at a regional level.[25] If one accepts this model, another process of knowledge

25 Brumlich, Meyer, and Lychatz 2012.

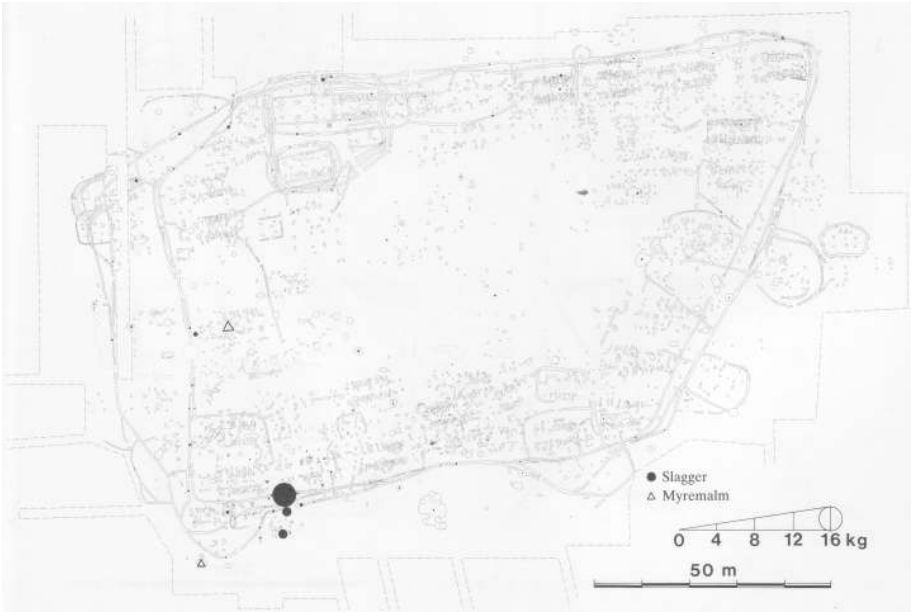

Fig. 5 The concentration of slag finds in the Late Iron Age settlement of Hodde indicates the location of the smithy.

sharing is also visible: The knowledge was dispersed into the individual settlements, where it could be taken up and further developed.

3.2 Perception of the landscape

While the specific technical skills, but also the awareness of the body as a measuring instrument, are initially bound to individuals so that their influence on society may have been indirect, the production of iron changed the collective perspective of the landscape.

The lowlands are now seen as potential or real deposits of bog iron ore; aside from the soil and its quality, the plants and the indigenous wildlife, the mythical significance of the landscape, its everyday use at first and later its special use, a new aspect is now added. A treasure lies in the lowlands that can be extracted and utilized. It can be used for the production of weapons and military strength, for improved tools, and for more lavish jewelry. This meta-level can now resonate if the environment of the settlement is recognized and valued.

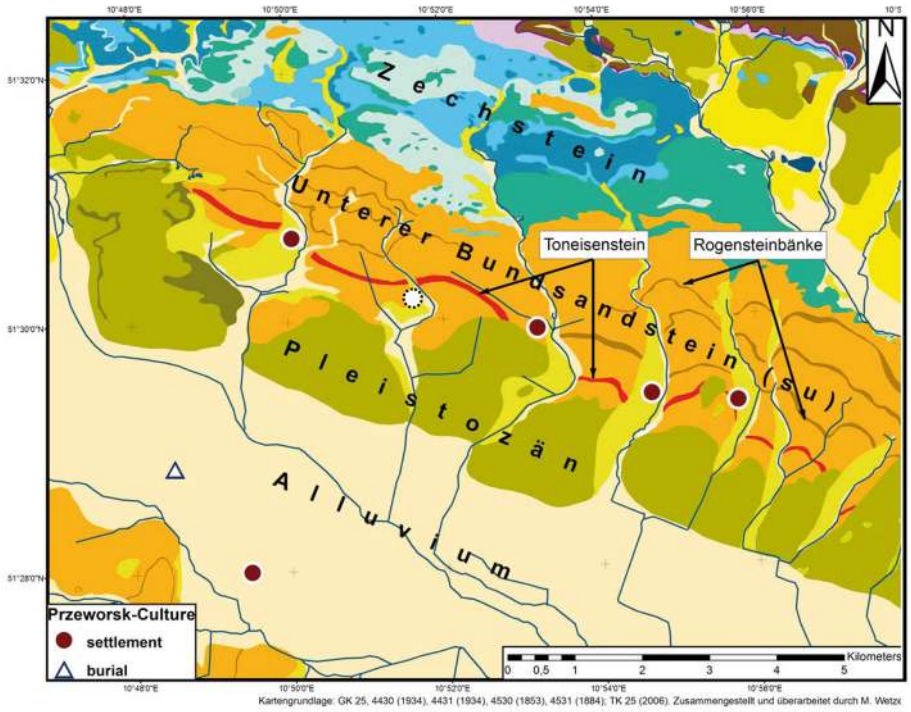

Fig. 6 Location of settlements of Przeworsk culture on the northern edge of the 'Golden Meadow' (Southern Harz foothills) and their relation to clay ironstone deposits.

3.3 Settlement and resources

The relation of Pre-Roman and Roman Iron Age settlements to the deposits of bog iron ore demonstrates that this new view can also be action-conducive. Seyer described this in 1982 for the Teltow,[26] and this is confirmed by current investigations.[27] This connection is also clear in Holstein, where settlement concentrations in the Roman Iron Age mainly occur within the vicinity of iron ore deposits.[28] A very particular example is the location of settlements of the Przeworsk Culture in the Southern Harz foothills.[29] Apparently, migrants from the area of the southern Polish Przeworsk Culture settled here. Four of these settlements were founded at the periphery of the "Golden Meadow," an ideal agriculturally zone, which is clearly linked to a rich horizon of clay ironstone that stretches out across a narrow strip (Fig. 6).

26 Seyer 1982, 35–37; cf. also Kossack 1997.
27 See Brumlich, Meyer, and Lychatz 2012.
28 Jöns 1997, Fig. 33; Hingst 1983, Fig. 1; Michel 2005, Map 25–29.
29 Meyer 2013.

3.4 Society

The Iron Age society of Northern Central Europe is not extremely stratified when it comes to burials and settlements. Only at the end of the Iron Age do graves appear in a significant number, which stand out due to a broad spectrum of grave goods found in the majority of the burials. While some speak of a segmentary lineage society,[30] other authors also see evidence of power structures that cover at most a local or regional area.[31] The idea that society was differentiated regionally may be inferred from significant clothing accessories and ceramic finds.

It is conceivable that this reflects the new possibilities of the procurement of metal. In the Late Bronze Age, bronze was used as the only metal the continuous use of which could be obtained solely based on extensive trade or through exchange networks. In contrast, in the Iron Age, the need for the new metal resource could be satisfied either on site or at least directly out of the region.[32] Although bronze was then still used and obtained from the outside, there did no longer exist a strong dependence on this commodity, so exchange networks did not play a decisive role here. One can see in this a prerequisite for a more regionally-based society.

3.5 Ritual and society

In Southern Scandinavia, we can witness a very interesting use of weapons in two periods, which corresponds to developments in iron production. In the Early Iron Age, a ship including the equipment of many warriors was sunk in a lake in Hjortspring on the island of Als in Southern Denmark (Fig. 7). Most of the weapons (swords, lances, spears) found are made of iron; only a number of lances, whose tips are made of bone, show that not enough iron was available at that time to make all of the weapons out of iron. The intensely debated dating of the finds can be narrowed down by two C14 dates to the 4th/3rd century BC.[33] This is exactly the time when, along with the findings of Glienick and the cluster of sites on the Teltow, intensive iron smelting is first detected in the Jastorf zone in the Pre-Roman Iron Age. If we apply this observation to Holstein and Southern Jutland, it appears logical that there would be a connection between the offerings of large amounts of iron and the availability of the new metal.

30 Brandt 2001.

31 Martens 2009.

32 For the Hallstatt period see also Bartelheim 2007, 220.

33 Martens 2001, 141. – Dating from the wood of the ship: K-5015 – Radiocarbon Age 2240 ± 50; 1 sigma ranges: [cal BC 385: cal BC 351] 0,283358; [cal BC 300: cal BC 227] 0,61182; [cal BC 224: cal BC 210] 0,104823; 2 sigma ranges: [cal BC 397: cal BC 196]. – Dating from a lance shaft: K-5016 – Radiocarbon Age 2290 ± 70; 1 sigma ranges: [cal BC 406: cal BC 349] 0,418941; [cal BC 311: cal BC 209] 0,581059; 2 sigma ranges: [cal BC 724: cal BC 694] 0,013482; [cal BC 540: cal BC 170] 0,986518; calibration with Calib Rev 6.1.0.

Fig. 7 Selection of finds from Hjortspring.

Offerings of weapons begin again in large numbers at the turn of the second and third century AD. This is the time when, according to Nørbach,[34] we experience a significant intensification of iron smelting – a phase in which iron was available in larger quantities than before. When mapping the weapons offerings together with the distribution of bog iron ore deposits, it is clear that – although they almost never lie directly within the vicinity of larger deposits of raw materials – they are almost never very far away from them (Fig. 8). Therefore, because iron was easy to obtain, the weapons of defeated enemies no longer had to be used or reused as source of raw material. Both examples show how the knowledge of iron smelting and its subsequent intensification had an impact on rituals.

34 Nørbach 1998.

Fig. 8 Weapons offerings and ore deposits. Roman Iron Age and Migration Period war booties from bogs in Denmark and Southern Sweden, and distribution of bog iron deposits.

4 Concluding comments

The comparison of different explanatory models for the introduction of iron smelting in Northern Central Europe shows that currently no clear, supra-regional picture can be sketched. This reflects the still insufficient state of research. However, it is also conceivable that differences and regionally divergent development rhythms will begin to emerge, as is to be expected in an innovation process. Therein lies great potential for research: The regional differences in innovation provide an opportunity for researchers to identify regional structures more clearly and to develop new approaches for their interpretation.

This paper distinguished different levels of innovation processes, which can be seen in the context of emerging iron production. For the successful implementation of the smelting process, a new use of the body as a 'measuring instrument' has been suggested,

and we can witness a change in the perception of the landscape. The relationships indicated here – between new possibilities of extraction of raw materials and changes in social organization, including the religious sectors – are certainly not to be read as clear causalities, but they open our eyes to the social aspect of technological innovations.

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Illustration credits

1 Jöns 1997, Fig. 60. **2** Schneider 2006, Taf. 20, D.E; Taf. 2, F.H2. **3** Michael Meyer. **4** Brumlich 2005, Map 1. **5** Hvass 1985, Pl. 112. **6** Meyer 2013, Fig. 15. **7** Kaul 1988, Fig. 17. **8** Ilkjær 2003; Zimmermann 1998, Fig. 1.

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Sabine Reinhold

Sedentism as a Process of Innovation. Technological and Social Perspectives on the Architectural Development of a Bronze Age Settlement System

Summary

In the second half of the second millennium BC, many areas of Western Eurasia witnessed the return to a settled lifestyle after a long epoch of mobile life. Between the Black Sea, the Caucasus, and neighbouring mountains, a new type of settlements arose. Particular in the Caucasian mountains an architectural tradition emerged that involved the permanent building material stone for the construction of very sophisticated multifunctional buildings. Stone architecture probably was not invented in the Caucasus, but the innovation once adopted fell on fruitful ground. Over nearly one thousand years of recurring leaps of innovations can be followed. This article discusses the dialectics of these innovative leaps as well as between the development of new technical solutions and new social demands in building as well as dwelling.

Keywords: Architecture; *Architektursoziologie*; Caucasus; Bronze Age; innovation; building; dwelling.

In der zweiten Hälfte des zweiten Jts. v. Chr. zeigen sich in vielen Gebieten Eurasiens nach einer langen Epoche mobiler Lebensweise wieder permanente Ansiedlungen. Zwischen dem Schwarzem Meer, dem Kaukasus und dessen Nachbargebirgen entstehen neue Siedlungstypen, die ganz oder teilweise aus Stein errichtet sind. Insbesondere im Kaukasus bildet sich eine neue Architekturtradition mit komplexen, multifunktionalen Häusern heraus. Die Steinarchitektur wurde möglicherweise nicht im Kaukasus entwickelt, doch lässt sich hier ein kreativer Umgang mit dem neuen Baustoff beobachten. Fast über ein Jahrtausend hinweg sind immer wieder Innovationsschübe fassbar, die einerseits technische Lösungen

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im Wohnbau abbilden und andererseits das Reagieren auf soziale Bedürfnisse, die mit den neuen Wohnformen entstanden.

Keywords: Architektur; Architektursoziologie; Kaukasus; Bronzezeit; Innovation; Bauen; Wohnen.

1 Sedentism – an innovation of the Bronze Age?

> Regardless of whether or not fixtures are present, a campsite is re-established anew with each annual occupation. Each occupation is a fresh event, to a large extend independent of previous events. By contrast, a permanently occupied village, or even one that is seasonally abandoned has a history.
>
> — Roger Cribb

In the second half of the second millennium BC, between the Black Sea and the northern periphery of the ancient Near East, after a lacuna of more than one and a half millennia of mobile lifestyle, we witness a reorganisation in permanently settled societies. Representative of this transformation was an elementary shift in settlement structure, including related architectural features. During this epoch, building techniques appear that use stone. They develop into a sophisticated tradition of stone architecture with further consecutive technological innovations. Quantity, quality, and functionality of buildings reveal innovative leaps that are directly connected to the social development of the settled communities of the time.

Architecture is one of the most powerful aspects of human living environments (Fig. 1). Permanent or not – architecture, unlike any other element of everyday life, shapes the spatiality of human beings. Architecture integrates aspects of creation – building – and social practice – dwelling. The beginning and differentiation of a specific architectural tradition is therefore an ideal case for studying the spectrum of technological and social processes involved in an innovation process.

At first, sedentism as the focus of a study of Bronze Age innovations may seem surprising. Settled life, i.e., a habitation located in one fixed place, is considered one of the key innovative elements of the 'Neolithic Revolution.'[1] Permanently inhabited

1 Childe 1956; for the current status: Boyd 2006; A. Goring-Morris, N. Goring-Morris, and Belfer-Cohen 2008.

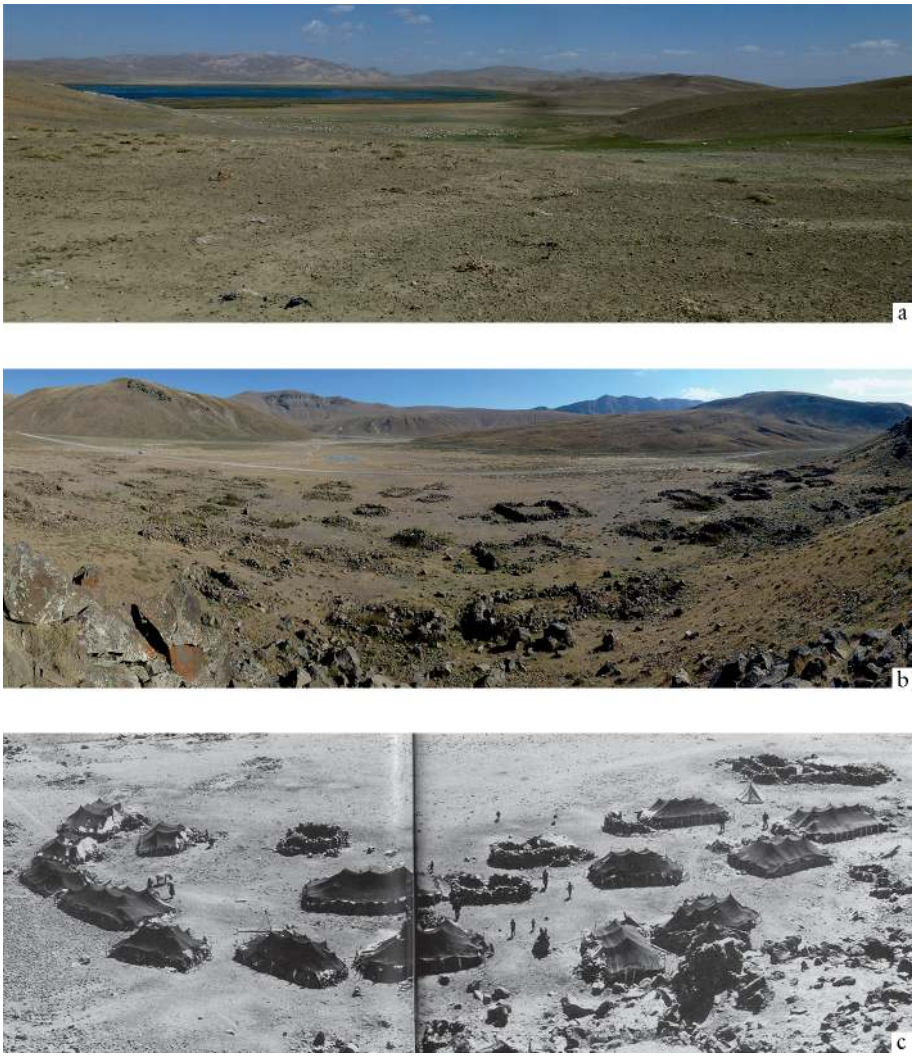

Fig. 1 Architecture creates places: (a) abandoned nomad camp at lake Tuna near Van, September 2012; (b) abandoned nomad camp with stone architecture at Nemrut Dağ, September 2013; (c) the same camp in 1981.

settlements are known at least since the 8th millennium BC. The shift away from a mobile, hunter-gatherer lifestyle, combined with a food producing economy, is regarded as one of the epochal social reorganizations of the Neolithic. However, by now it has become obvious that the criteria that once defined the 'Neolithic' as the cultural epoch of sedentary farming cultures, are misleading. Mobility, temporary or in longer cycles, was always an integral part of societies that we identify as Neolithic. According to Re-

nate Ebersbach, for example, mobility is constitutive of flexible lifeworlds where social relations within a large, widespread social collective are more important than the permanent anchoring of a smaller group with a specific subsistence economy in a given place.[2]

The shift of subsistence and quotidian practices from many to a few even to only one place, coincident with an increasing length of stay, is a conceptual answer to survival strategies that operate within the wide range of spatial movements. Certain economies, such as specialized livestock breeding with alternating pastures or the use of seasonal resources, promote mobile strategies of economy and life. Unstable environmental conditions or population fluctuations can influence mobility patterns and their characteristics. However, spatially variable survival strategies are always closely interwoven with the necessary technological solutions that a community chooses for its living arrangements, economic infrastructure, and means of subsistence. Processes of sedentarization and their counterparts can therefore still be observed today and are often solutions to problems of changing social and economic conditions.[3]

If we u conceive of innovation not as unilinear progress, but as scenarios of actions that open up new technological or social possibilities, the process of settling down can in fact be understood as a historically unique but also as a recurring process of innovation. Any group that voluntarily or forcibly trades its mobility for a fixed location finds itself in need of new architectural technologies. Such a group has to familiarize itself with new materials, or a new use of old materials, has to learn new patterns of movement, of orientation, and if necessary to develop whole new sets of material culture and new social practices to cope with this situation.

From a historical perspective, the question emerges in what social, geographic, and economic environment the process of sedentarization is anchored and whether the oscillation between 'sedentary' and 'mobile' is part of specific social groups and/or landscapes.[4] If so, cultural techniques that appear to be new would be familiar practices. They simply would not have been implemented as social practices at certain periods or in certain areas. The beginning of sedentism among Bronze Age groups in the North Caucasus leads me precisely to pose the question of whether this was an invention or a cultural and technological transfer; we know that permanent architecture developed earlier in neighboring regions to which groups in the Northern Caucasus maintained cultural links.

2 Ebersbach 2010; similar for the West Asian Neolithic: Bernbeck 2008.

3 Salzman 1980, 13–18; Hof 2001; Fratkin and Roth 2005.

4 Cribb 1991b, 23–34; Salzman 1980, 13–17.

2 Origin and evolution of Late Bronze Age technological transfer in the North Caucasus – an example of processes of technological and social innovation

During the third and early second millennia BC mobile subsistence strategies prevailed in large areas of western Eurasia and western Asia. The assumption of high mobility stems from a recognition of an economy that specialized in livestock breeding.[5] More importantly, the lack of documented settlements that are contemporary with a large number of grave mounds is at the base of the argument for mobile lifeways. Archaeozoological evidence is weak but recent stable isotope analysis of animal bones strongly call into question large-scale migration scenarios argued for in the past. Nevertheless, these studies reaffirm the existence of mobile groups with a chiefly pastoral economy for this period.[6] The general situation also applies to the high-mountain zone of Caucasia and Eastern Anatolia: there is substantial evidence for human presence in the form of burial mounds since the beginning of the third millennium BC. However, sporadic camp sites and even some settlements are known as well.[7] For the Bronze Age cultures of the Northern Pontic, a few settlements are also documented. The level of permanence of life in such places, however, is still largely unexplored.[8] The existence of individual settlements is thus no argument against a mobile lifestyle. Rather, it shows that temporarily, sedentary components may be an integral part in mobile societies just as mobility is part of basically sedentary modes of life.[9]

Shortly before the mid-second millennium BC a portion of the previously mobile groups began to settle down in a wide area between the Black Sea and eastern Anatolia/northwestern Iran. This is primarily detectable in changing forms of construction: archaeologically invisible, mobile, and organic architecture is transformed into permanent dwellings built of stone or into buildings dug into the ground.[10] This architectural development can be traced in the material record, but the reasons for this shift to a more permanent use of places are still unclear.

In modern times, external pressure often leads to rather involuntary (re)settlement processes,[11] but there are also counterexamples.[12] In our case study, external pressure, for instance by advancing military forces, violent takeovers or similar phenomena, cannot be observed. What could be the driving forces for a group to settle down? Are there internal motivations that render less mobile elements in an economy so attractive as to abandon a mobile lifestyle? Or are the permanent settlements unintended consequences

5 Shishlina 2008.
6 Shishlina 2008, 212–217.
7 Edens 1995.
8 Pieniążek 2012, 59 with further references.
9 Modern example by Salzman 1980, 13–17.
10 Caucasus: Reinhold 2010; Northern Pontic: Pieniążek 2012; Don-Volga area: Anthony et al. 2005; Van Hoof, Dally, and Schlöffel 2013.
11 Salzman 1980, 11–14; Hof 2001; Fratkin and Roth 2005.
12 Goldschmidt 1980.

of a process that was initially not directed towards the idea of permanent residence? It is difficult to read into the archaeological record demographic pressure before the resettlement started, but such pressure becomes an important issue later, possibly along with environmental parameters that triggered the invention of new herding practices as well as innovations in infrastructure.

2.1 Architectural development in the North Caucasus – the facts

The architectural development discussed here is part of a prehistoric cultural system at the northern flank of the Great Caucasus that can be traced over a period of almost a thousand years. It it dates to the Late Bronze and the beginning of the Early Iron Age, that is, to the 18/17th through the 7/6th centuries BC. At about 1000 BC, the entire settlement system, which had emerged fully developed on a high mountain plateau, was relocated to the valleys, a process that has been studied in detail in the area around the Kislovodsk spa.[13] This displacement defines the transition from the Late Bronze to the Early Iron Age.[14]

Current knowledge of the architectural sequence includes around 170 settlements, over 100 other archaeological sites in the high mountains (Fig. 2–3), and more than 90 Early Iron Age settlements in the Kislovodsk basin. The layout of these sites has been documented using GIS technology and the sites were dated relying on systematic field surveys, excavations, and more than 40 radiocarbon dates (Fig. 4). With the help of large-scale magnetometric prospection and innovative soil analysis, comprehensive insights into the use of the sites were obtained. The presence of animals inside the houses and in the settlements could be verified and regularities of their activity patterns identified.[15]

At the center of the development of architecture in the high mountains are small villages with buildings the bases of which are constructed of dry stone walls. The settlements were built on the flat plateaus near canyon edges with good water supply from nearby springs. The sites are distributed over an area of approximately 100 x 25 kilometers. In diachronic perspective, the settlements show changes in the layout and configuration of the houses (Fig. 4). Outside the settlements proper, enclosures and individual buildings were constructed with dry stone walls. Long stone walls were set up across the landscape and stone stelae were erected. Grave monuments with stone and earth constructions are part of the repertoire of Late Bronze Age architecture, too, and extensive terrace systems evolved during the Early Iron Age. In addition, in all epochs, wooden structures like barns, sheds, huts, fences, bridges, etc., likely existed as well.

13 Reinhold, Belinskij, and Korobov 2007; Belinskij, Korobov, and Reinhold 2009; Reinhold 2010.

14 Reinhold, Korobov, and Belinskij 2012.

15 Peters et al. 2014.

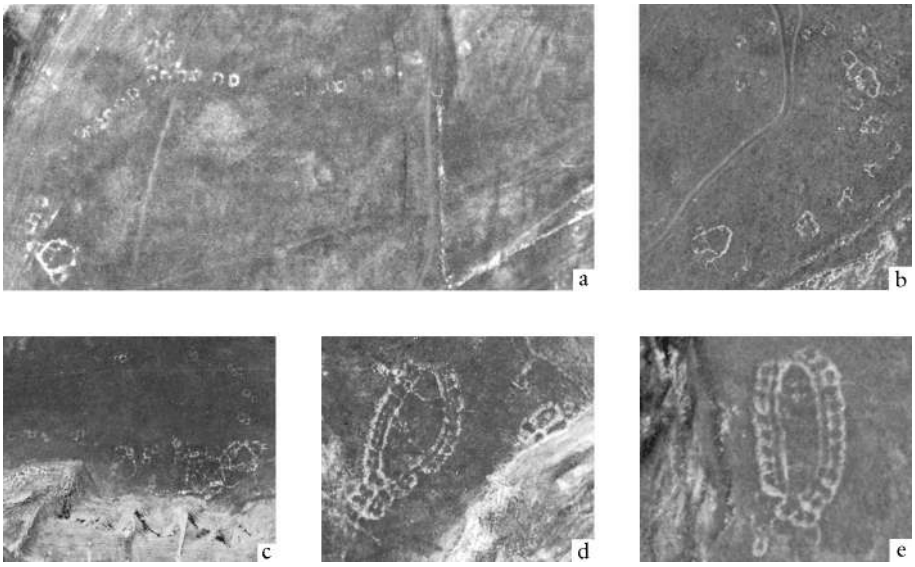

Fig. 2 Late Bronze Age settlements in the North Caucasus: (a) linear settlement concept; (b)–(c) oval-circular settlements; (d)–(e) closed settlement rings 'settlements with symmetrical layout.' – Aerial photographs, different scales.

The oldest houses dated so far have small, rectangular floor plans with a length of 8–11 meters (Fig. 5, a–c). They are one-roomed buildings with 60–120 square meters of floor space. The foundation walls were made of more or less carefully built double-faced masonry or vertical orthostates filled with cobblestones. The entrance was located at the center of one of the walls and often flanked by elongated stone blocks. Two characteristics distinguish these constructions from others: The corners of the outer line of the walls are rounded while the inner walls meet in right angels, and they are built in segments (see Fig. 8, a). Ethnographic analogies suggest that there might have been upper constructions from organic materials. After temporary use, they could have been dismantled and transported elsewhere[16] (see Fig. 1, b–c). However, during the excavations in Kabardinka 2 no indications of erosion were found inside house 23. Such layers would be expected in the snowy and rainy mountains if these walls had not been covered by a roof. Whether the buildings were permanently inhabited or not cannot be determined with certainty. However, it seems plausible that the building structures were covered with a roof year round.

It is worth noting that even these early buildings are quite standardized and are almost exclusively found in two settlement configurations: settlements with a linear lay-

16 Cribb 1991b.

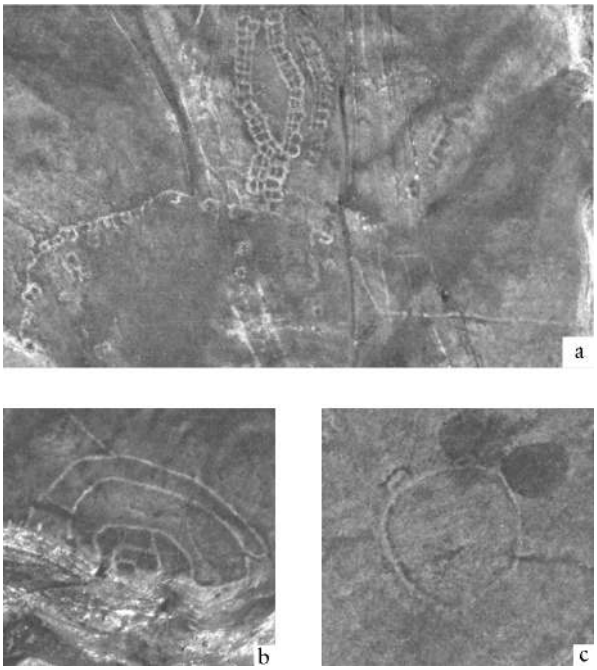

Fig. 3 Late Bronze Age settlements in the North Caucasus: (a) combination of an arc-shaped linear complex and a 'settlement with symmetric layout'; (b) the enclosure at Ransyrt 1; (c) circular complex with side buildings. – Aerial photographs, different scales.

out (Fig. 2, a; Fig. 3, a; Fig. 9, a–b; Fig. 10; Fig. 15) and settlements with an oval to circular plan (Fig. 2, b–c; Fig. 11, a–b). At these sites, the square buildings are either single buildings or part of agglutinating complexes.

So far, linear configurations are the oldest documented settlement layout in the 16th to 14th/13th centuries BC, although the oldest site with stone architecture – Ransyrt 1 (see Fig. 3, b) – is not a regular settlement but a multiple enclosure. It was built at the turn of the 18th to the 17th century BC. The particular arrangement of houses in linear settlements varies and some of them form wavy configurations where the buildings are occasionally linked by interconnecting walls. Sometimes integrated corrals are identifiable – round to oval buildings with stone walls that are clearly too large to be covered by a roof (Fig. 8; Fig. 10).

Chronologically, oval-shaped open settlement layouts follow the linear ones (Fig. 2, b–c; Fig. 11). According to the radiocarbon dates, they fall into the 15th/14th centuries BC. Since they are not represented in all micro-regions considered here, it is possible that this settlement type was not a chronological but rather a local development. In addition to square, one-room complexes, agglutinative structures are present, which comprise up to seven chambers of the same basic square room unit (Fig. 10, b; Fig. 17). They are related to large animal pens, and the number of rooms roughly correlates with the size of these enclosures. Magnetometry measurements at one of these structures –

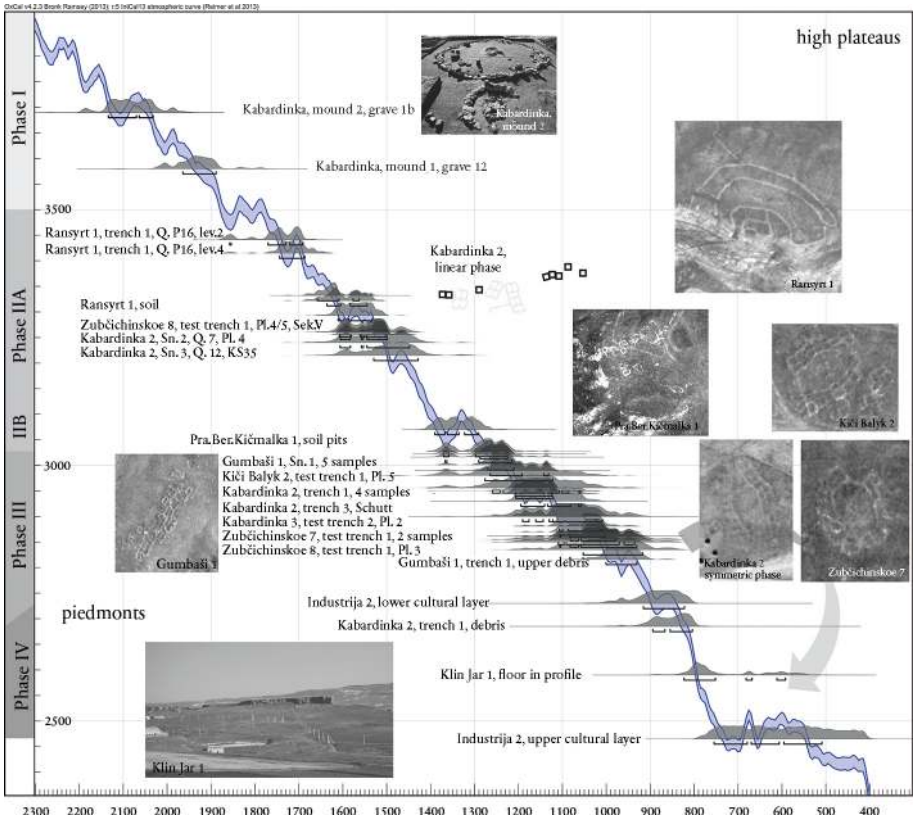

Fig. 4 Chronology of the settlement development in the region south of Kislovodsk.

Pravoberežnaja Kičmalka 1 – lead to the conclusion that some of the pens probably had stables attached on their outside.

Starting with the late 14th century BC, we see a radical change in architecture, design and construction of settlements. A two- to three-roomed house type developed (Fig. 5, d–e). According to archaeological finds and the microbiology of floors, these houses combined residential and economic spaces – i.e. areas for stables – under one roof. There are houses with an elongated layout, 15–20 meters long and 10–15 meters wide, divided by one or two transverse walls with doors. Interior positions of wooden posts indicate a gabled roof with a longitudinal ridge and roof-bearing posts along the walls. In most cases, the short sides of the houses that face the outside of the settlement have an apsidial shape. The entrance is found at the center of the apses, or slightly off–center, and flanked by long, massive limestone blocks (Fig. 6, a–c; Fig. 7, c). The walls of these buildings were constructed as double-faced masonry walls. They connected neigh-

Fig. 5 House forms: (a) single-room, square house at Kabardinka 2, house 23; (b) Pokunsyrt 37 view of one-room houses in a row; (c) Pravoberežnaja Kičmalka 1, agglutinating houses one-room houses; (d) Kabardinka 2, double-room house 14, (e) Gumbaši 1, double-room house E).

boring houses. The most elegant variant utilizes vertical limestone orthostates and carefully set dry-stone walls filled with cobblestones (Fig. 7). Similar to the older buildings, the walls were completed in segments (Fig. 8, b–c) and have curvo-linear exterior edges. However, the walls are now built up to 80 centimeters in height and their widths range from 1.5 up to 2.5 meters. The upper parts of these houses were most likely log constructions, yet it remains unclear whether they had one or two stories.

The architectural and structural details of this house type are known from two completely excavated buildings in Kabardinka 2 and Gumbaši 1 (Fig. 5, d–e). House 14 in Kabardinka 2 is a representative example. The house location was partially carved into the bedrock, but some of the rooms were additionally outfitted with stone slabs as floors. Several indications support the hypothesis that the actual living floors were set on a higher level than the bedrock.[17] This is a typical construction technique in mountain-

17 Reinhold, Belinskij, and Korobov 2007.

Fig. 6 Architecture details: façades and entrances. (a) Kabardinka 2, House 14; (b) Gryskina Balka 1; (c) Gumbasi 1, house E. – Different scales.

ous regions and can be still observed in the Alps, the Caucasus, or in the Himalayas today.

At both of the excavated houses a tendency to accentuate the outside façade is visible. Almost identical buildings to those from Kabardinka 2 at two other sites reveal that this is a general characteristic for this house type (Fig. 5, a–c). A variant of the type combines two apsidal outer rooms with a transverse interior room. At several sites, this variant is aligned, forming corridor-like configurations of interior rooms (Fig. 13, a; Fig. 14 a). In these cases, a common roof can be reconstructed that covered all rooms.

Similar to the one-room houses, the double- or triple-room houses correlate with certain architectural configurations, in this case with settlement layouts, where houses were arranged around a large oval or circular central plaza (Fig. 12–15). Along with the development of the two-room, multi-functional house type, this settlement design is the second fundamental architectural innovation of the last third of the second millennium BC. The foundation walls of the buildings are interlocked and form a closed oval ensemble. All interior rooms face the central square, while the apsidal rooms with the entrances are directed towards the area surrounding the settlement.

Further characteristics of this form of settlements are a symmetrical arrangement of the buildings, the carving of the central plaza into the bedrock, a subdivision of the central square by a transverse wall, and one or more separately located individual buildings. In addition, these complexes are almost always part of two or three groups of neighbor-

Fig. 7 Architecture details: double-framed walls. (a) Pravoberežnaja Kičmalka 1; (b) Ransyrt 6; (c) Kabardinka 2, House 14. – Different scales.

ing settlements (Fig. 13, b; Fig. 14, a). A total of 122 complexes were built in accordance with this arrangement. It includes 69 % of all archaeological sites classified as settlements. Compared to the 21 (12 %) linear-shaped and 13 (7 %) oval-circular complexes, this is a significant increase in sites (Fig. 15). Dated stratigraphic sequences also indicate that these sites were inhabited for long times. In Kabardinka 2, the dates suggest approximiately 300 radiocarbon years of constant habitation, and in Zubčichinskaja 7 at least 128 radiocarbon years. A similar timeframe of about 250 radiocarbon years was documented for Gumbaši 1.

Around the turn of the second to the first millennium BC, the entire settlement system shifted into the neighboring valleys. This went along with another radical change in the history of these communities: A shift from a livestock-focused subsistence economy to intensive farming. The areas on the high plateaus were abandoned and new villages emerged with new configurations of settlement and new house types. Surrounding the settlements are now large necropolises with graves that are not visible on the surface, while the entire potentially arable land is used for agriculture. From the 9th century BC on, this applies also to hill slopes which were to a large extent terraced.[18]

18 Korobov and Borisov 2013.

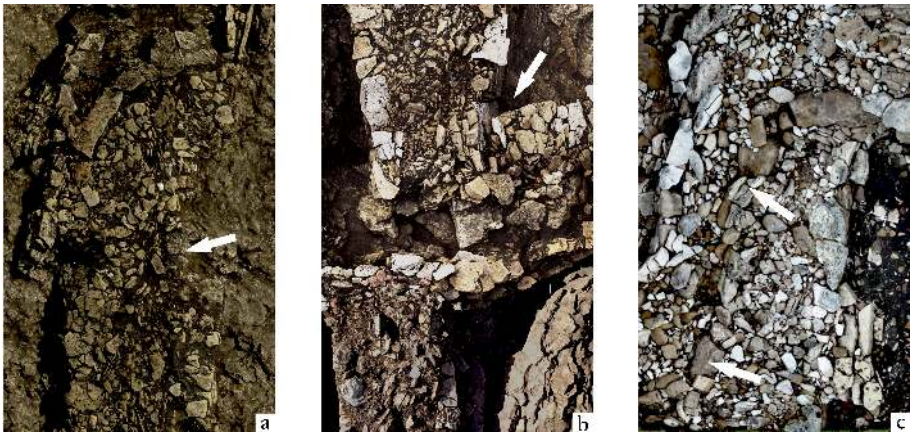

Fig. 8 Architecture details: segmented construction with wall facades inside the course of the neighboring walls. (a) Kabardinka 2, House 23; (b) Kabardinka 2, House 14; (c) Gumbaši 1, House E. – Different scales.

3 Architecture and innovation – anchoring, building, dwelling

Architecture is omnipresent in human lifeworlds. Whether mobile or fixed to a location, private or public – architecture creates artificial living environments and structures them. Built space deeply anchors social worlds.[19] Innovations in the built environment lead directly and quickly to significant changes in the physical and social practices of everyday life involving all inhabitants of a certain place. In this way, architecture differs significantly from innovations in other cultural techniques such as the introduction of new materials or a new technique in the realm of crafts.

Since the revolutionary construction programs of modern architecture in the early decades of the twentieth century, innovation is closely connected to the field of architecture.[20] To materialize innovations is still considered a central task of contemporary architecture,[21] even if the overall purpose of architecture has changed dramatically from early 20th century programs of communal architecture to the postmodern individualism of the 1990s and early 2000s. The current debate in cultural studies (*Kulturwissenschaften*) about space focuses on different aspects and levels of analysis, and considers architecture, among other elements, crucial in the structuring of space.[22]

19 Moravánszky and Gyöngy 2003; Delitz 2009; Bourdier and Minh-ha 2011.

20 Moravánszky and Gyöngy 2003, 1–7.

21 E.g. Ednie-Brown 2013.

22 Cf. Löw 2001; Schroer 2006; Fischer and Delitz 2009.

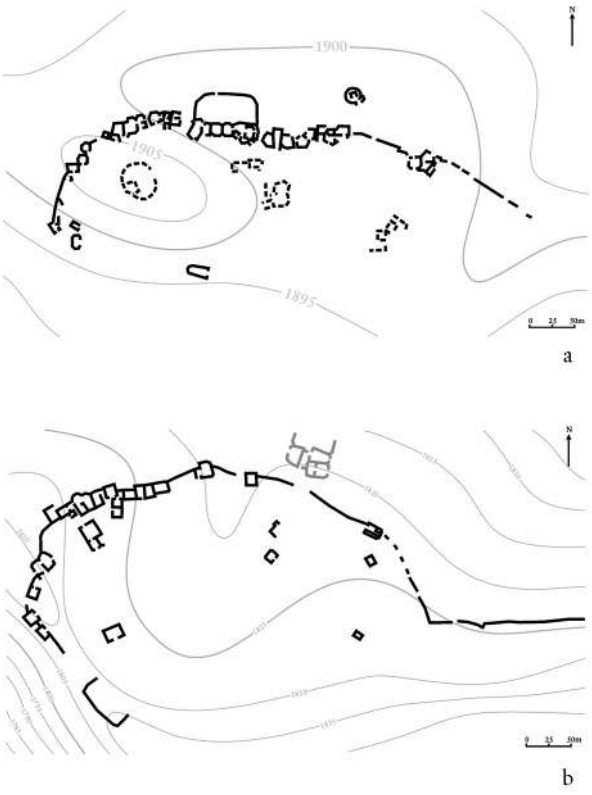

Fig. 9 Arc-shaped shaped settlement conceptions: (a) Pokunsyrt 8; (b) Pokunsyrt 10.

3.1 Localization

At the interface of a to sedentary a lifestyle, one aspect is particularly important – *architecture creates places*.[23] 'Architectural' places are artificially altered, specific, and fixed locations that differ from their surrounding space and at the same time constitute this space. Neither architecture nor the creation of places is necessarily linked to a permanent presence in a particular place (see Fig. 1). Mobile and temporary buildings count as architecture just as much as do fixed and permanent structures.[24] All of them create places. However, the places thus created are short-lived. They are less bound to their actual materialization than to the social configurations of their temporary residents or the collective memory of a group that creates an ephemeral site.[25] However, places with

23 Ingold 2000, 172–181; Löw 2001, 198–201, 272–273; Moravánszky and Gyöngy 2003, 488–502, with reference to Heidegger 2000 [1951].

24 Delitz 2010.

25 Places are certainly not solely constituted from artifacts such as buildings etc. A more open definition of the concept would be the 'anthropological place' described by French ethnographer Marc Augé (Augé 1994, 49–77). For a discussion of non-architecturally

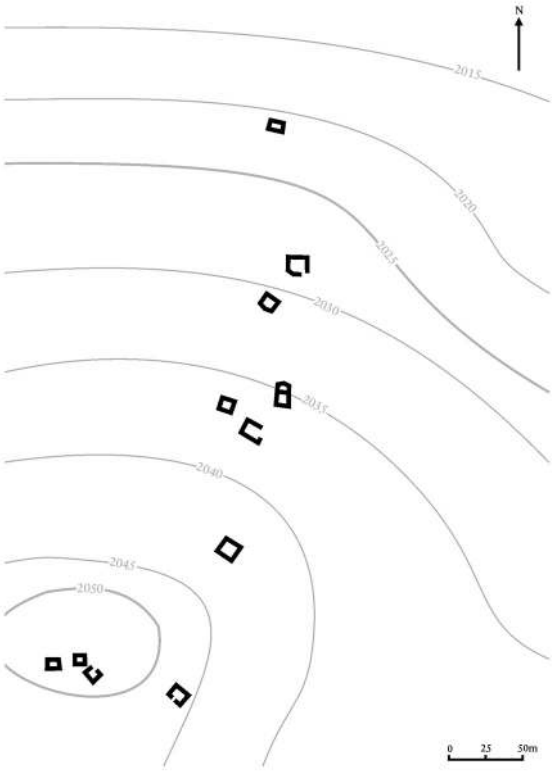

Fig. 10 Linear shaped settlement conceptions: Abasykylak 7.

architecture constructed of permanent or semi-permanent materials differ qualitatively from those made of organic materials. Both are physically present for an identifiable group of residents (Fig. 1, b–c), they often have an individual name and a historical depth, i.e., a location in time, social, and physical space.[26] As a result, the mentioned term 'sedentary' would perhaps best be replaced with the term 'localized', referring to the anchoring of a community in a fixed location. This would shift the focus from the actual presence of individual residents towards a conceptual presence of a group in one place.[27]

According to Martina Löw's on the sociology of space, a place is "the objective and [a] result of the placement of […] social goods and people or the positioning [of] primarily symbolic markings"[28]. Following this line of reasoning, the role of architecture would be that it 'furnishes' an environment with buildings – villages, castles, walls,

constituted places such as natural locations or invisible ritual places, see Bradley 2000, Reinhold 2005, 358–359, and Hansen 2008.

26 Cribb 1991b, 156.
27 See Ebersbach 2010.
28 Löw 2001, 158; 273.

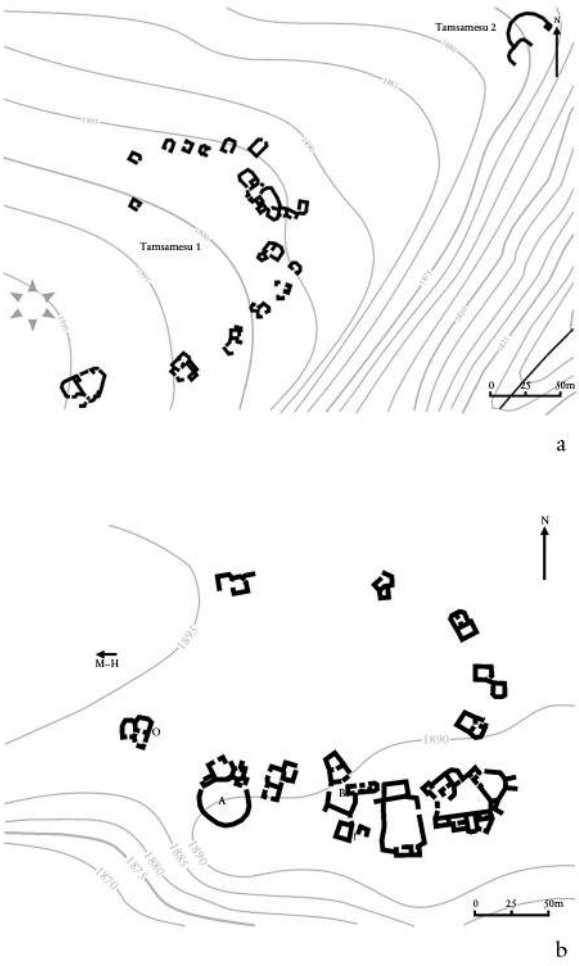

Fig. 11 Oval shaped settlement conceptions: (a) Tamsamesu 1; (b) Tamčibaši 2.

paths, enclosures, canals, field terraces, etc. It creates spaces for the assembly of people, of other living beings, or the placement of goods, forming specific topologies and nodes in webs of relationships.[29]

In this context, the question of innovations concerns the emergence of new structures, or the emergence of new forms of a built environment. They create new places or new qualities of places. It requires a dialectical discourse about the particularities of such new places and their necessary 'furnishings'.

29 Ingold 2000; Schögl (unpublished); Schroer 2006.

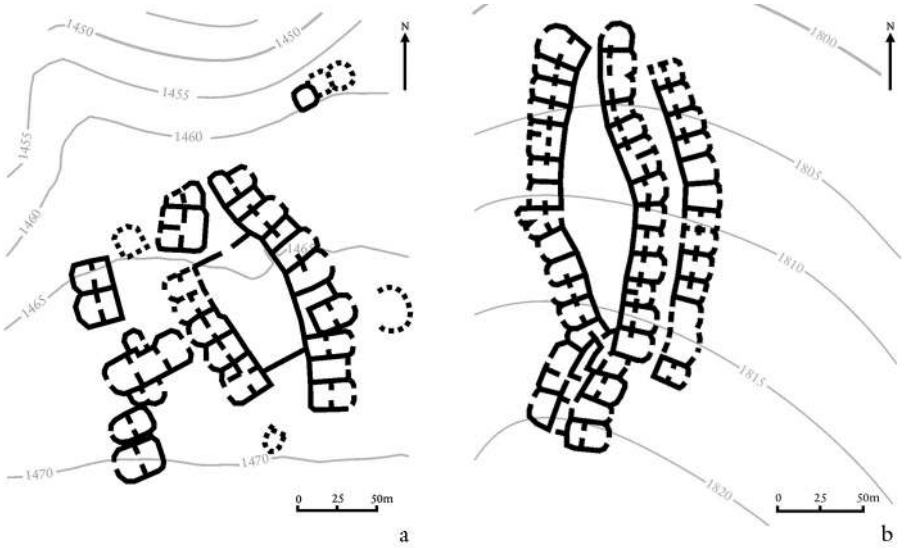

Fig. 12 Settlements with symmetrical layout: (a) Kabardinka 2; (b) Pokunsyrt 11.

3.2 Building

Building is that component of architecture where technological innovations become most easily observable and where one would expect them most clearly. New techniques of construction, new materials, new installations, new details in design, and new house forms or configurations are classic elements of a technological view of innovation in architecture.

In contemporary architecture, the technical operations related to the construction of houses are largely separated from other aspects of dwelling: architects design, specialists build, and inhabitants reside. In this sequence, innovations are supposed to derive predominantly from the claim of the designing architect to pursue his or her creative ideas, sometimes even apart from subsequent use.[30] Prehistoric architecture, however, originated quite differently. Prehistoric buildings are vernacular architecture, a way of building that is based on traditionally mediated construction. The embodied knowledge of dimensions and aesthetics, structural and material characteristics etc. is not limited to specialists, but is part of collective social practice. The builders themselves are commonly the later residents,[31] supported by other members of a local community. Only some particular knowledge is limited to specialists, e.g., on ritual aspects or specific constructive elements requiring experience or mathematical understanding. Vernacular

30 Moravánszky and Gyöngy 2003.

31 Oliver 1989.

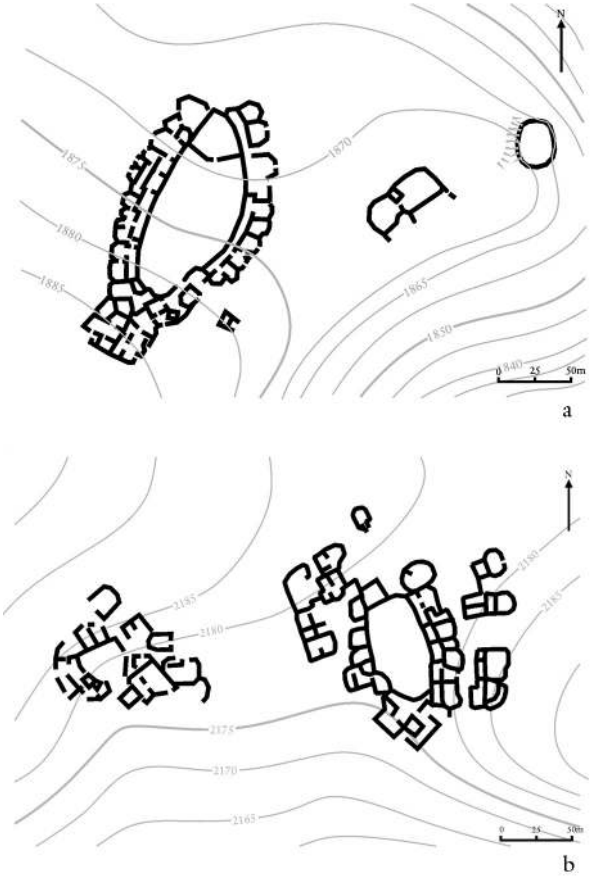

Fig. 13 Settlements with symmetrical layout: (a) Pokunsyrt 23; (b) Verchnjaja Kičmalka 2–3.

building is guided by economic prerequisites for an autonomous existence of a household's life. Nevertheless, social norms and sometimes the cosmology of the residents are taken into account in forms and structures of buildings.

> Knowing that all houses in the community share a single planning principle, that no house would disorient a visitor who belonged to the community, arouses and sustains ethnic solidarity.[32]

Even if one does not want to follow the idea that ethnicity is created through architecture, collective building is an aspect of social practice that creates common habitual structures, embodies them while building, and presents them to the outside world.[33]

32 Bourdier and Minh-ha 2011, 25.

33 Bourdieu 2000.

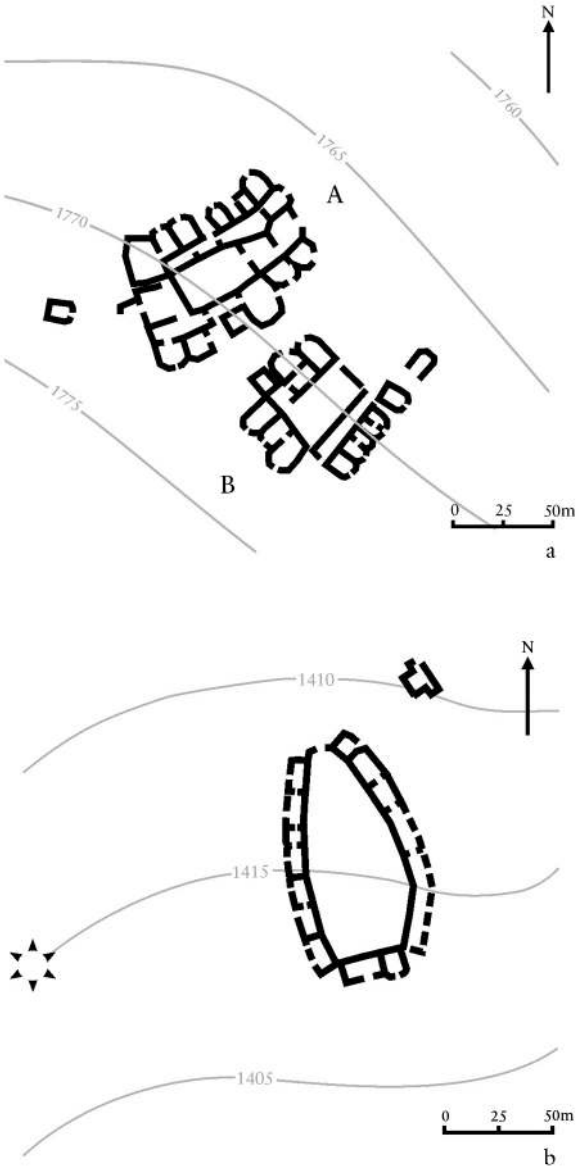

Fig. 14 Settlements with symmetrical layout: (a) Kici Balyk 4–5; (b) Pokunsyrt 33.

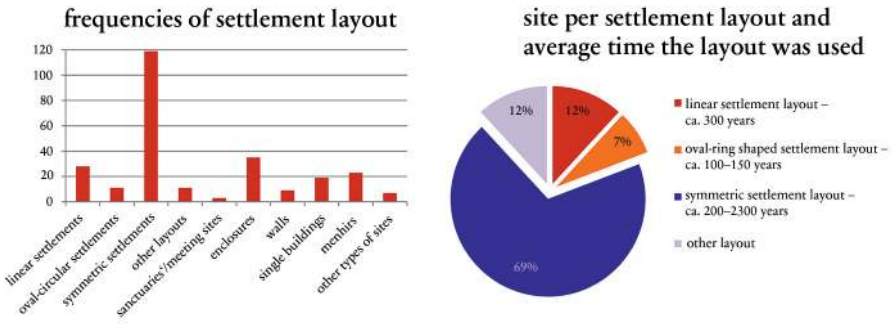

Fig. 15 Settlement concepts, their frequency and their probable period of use.

At the same time, collective construction creates social bonds similar to other collective activities. Traditional architectural design is therefore an effective way of representing social conformity. Social control in the transmission of techniques through learning-by-doing consciously or unconsciously leads to standardization.[34] This may cause a reduction of individual creativity where traditional schemata are repeated without much thinking. However, ethnographic case studies in vernacular architecture reveal that even seemingly standardized buildings are used in a broad variety of individual adaptations by their actual dwellers. Innovations that change the basic structures of buildings or settlement layouts represent all the more a deliberate and conscious divergence opposing traditions and thus are a perceptibly breaking away from the conventional.[35]

3.3 Dwelling

Architecture creates living space. In current discourse, the concept of dwelling centers around a phenomenological debate that largely goes back to the essay *Bauen, Wohnen, Denken* by Martin Heidegger.[36] "Building is already dwelling, and not the other way around"[37]; this view of vernacular architecture reflects Heidegger's existentialist understanding of living and dwelling, and it holds true even if one is not following the entire existentialist program.[38] A similar existential notion of dwelling can be found in the ethnographic perspective of Tim Ingold's work[39] or in the discourse of architect Achim Hahn[40] whose understanding of dwelling is taken very far and is more metaphorical than practical. Practical aspects are related to the creation of certain atmospheres, moods, and feelings rather than to actual activities. The limitations of archeology's sources must make us

34 Oliver 1989.
35 Oliver 1989, 56–59.
36 Heidegger 2000 [1951].
37 Bourdier and Minh-ha 2011, 22.
38 Moravánszky and Gyöngy 2003, 486.
39 Ingold 2000, 185–187.
40 Hahn 2010.

very cautious when trying to operate on the basis of such a philosophical discourse. However, if we recall the profound and often radical break that innovations can initiate in conceptual worlds, it seems justified to investigate the causes and consequences of architectural innovations in their relation to dwelling.

In contrast to activity areas, living space is generally constructed within the physical boundaries of architecture. It concerns everyday life and the social relations of all individuals who live in a building – humans, animals, and also possible imaginary residents.[41] In practice, the social, economic, and spiritual parameters direct the design of house floor plans, the presence or absence of closed rooms and open spaces, installations, light, acoustics, air supply, and the form and placement of furniture.[42] In a phenomenological perspective, these parameters affect the moods and atmospheres of spaces.[43] Strict rules for the use of space inside a house can be present, such as the dualistic division of space in the "Berber House" as described by Pierre Bourdieu[44] or gender-related spaces in ancient Greek houses.[45] However, everyday life often blurs such ideal-type spatial assignments.

The fragmentary archaeological evidence leaves little room to reconstruct such aspects of dwelling. However, with the help of modern survey methods and excavation techniques it is possible to detect evidence of the actual use of rooms or the activities performed in settlements.[46] The Caucasus case study moreover shows that it is possible to identify changes in the spatial practices of the inhabitants.

3.4 Cascading, continuous, and discontinuous innovations

How long does an innovation process take, when does it start, and when does it end? Much ink has been spilled over the question of what an innovation process is, which parameters and sequences of action belong to it, and what course it takes.[47] Most scholars agree to distinguish the creation of a new idea or technique – an invention –from the process of its appropriation – an innovation. Invention is a creative act during which individuals consciously or unconsciously transcend traditional thinking and create new things. Innovation is a social act of accepting a new way of looking at things, among a larger group of users. Innovation also includes the temporal and spatial transmission beyond an original group of users.[48]

41 One might think about ancestors, house ghosts, and other imaginary inhabitants whose presence can play a significant role in the welfare of a house as a whole (e.g., Bourdier and Minh-ha 2011, 39–40; 44).

42 E.g. Hof 2001 and Schroer 2006, 82–106 with reference to Pierre Bourdieu; Bourdier and Minh-ha 2011 for an ethnographic view.

43 Hahn 2010.

44 Bourdieu 2000.

45 Nevett 1995.

46 Kent 1990; Reinhold, Belinskij, and Korobov 2007, 149–153.

47 Rogers 2003; O'Brien and Shennan 2010.

48 Haggett 1991; Rogers 2003; Schiffer 2010, 237–239; Roux 2010, 217–218.

In modern, technologically oriented innovation theory, the appropriation of new features or techniques generally has a positive connotation. Adoption is a wavy but somewhat linear process with an adoption rate that comes close to 100 %.[49] More complex is Michael Schiffer's cascade model of innovation that draws attention to longer periods, feedback, and side effects, as well as possible discontinuities in the developmental flow of innovations.[50] Neither specific time frames nor a linearity of the development or its appropriation are fixed in Schiffer's model. Innovative spurs originate in the deficits of earlier innovations, requiring new solutions. This, however, leaves the question open when an innovation cascade ends.

French approaches to the sociology of technology rely on a similar model.[51] However, Valentine Roux distinguishes innovations qualitatively: 'Continuous innovations', such as those in Schiffer's cascade model, react to technological – but why not also social? – deficits and find an end when a practicable state is reached. Roux distinguishes these from 'discontinuous innovations' which raise a whole technological system to a fundamentally different level. Such processes can have existential consequences for social organization. Breaking traditions is more severe than in continuous innovations, the risks are higher, and benefits can often only be felt retroactively.

4 Innovations of Bronze Age building

4.1 Walls, floor plans, settlement configurations

For the case study reviewed here, it is worth noting that before the development of domestic architecture, i.e. 'localized' dwelling, an experimental phase of construction existed when stone walls were not used for the erection of residential houses but for buildings that clearly had a communal, non-domestic function.

The oldest stone walls of the North Caucasian plateau zone are the dividing and terracing walls of the huge enclosure at Ranysrt 1 (see Fig. 3, b) that was built on a plateau that is hard to access. Four rings of walls, some with passages, surround a central complex. Stone buildings were recently excavated in the center. Their small size, taphonomic data and the huge quantities of finds suggest that these were locations for communal activities, including extensive feasting, rather than residential buildings.

The perimeter walls are massive, double-faced, with a width of 1.5–3 meters (Fig. 16). Near one of these walls, excavations uncovered a fire place that was already visible on the local magnetometric plan as a small anomaly. The floor here was paved with stones, but

49 Haggett 1991, 386, fig. 13–3.
50 Schiffer 2005, 486.
51 Roux 2010.

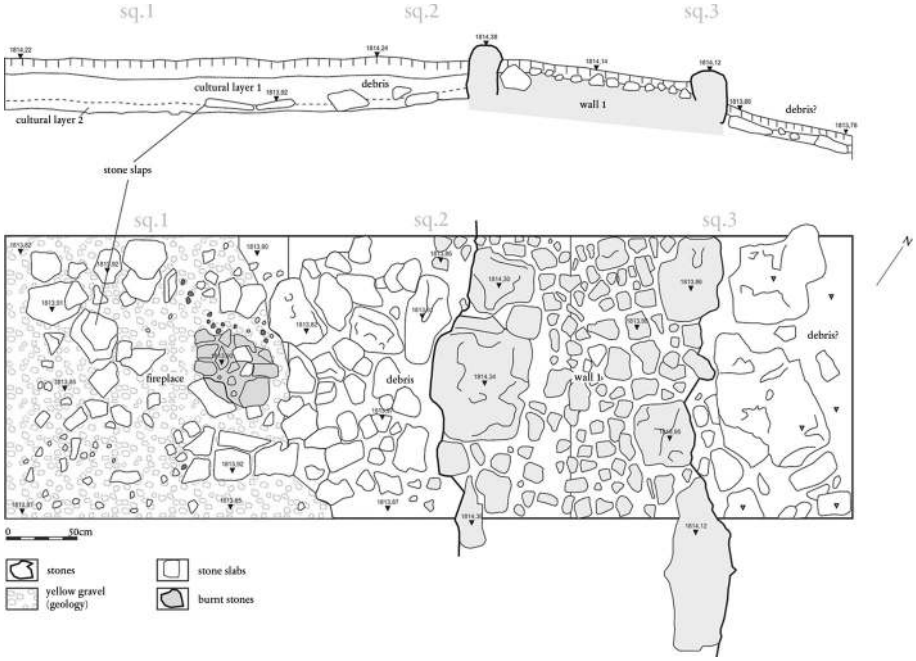

Fig. 16 One of the oldest stone walls of the study area. The double-layered fortification wall of the enclosure at Ransyrt 1.

no other architectural features were present. Cultural debris included pottery and animal bones alongside the hearth. Marginal remains of mobile architecture, made from organic materials, could barely be detected. The magnetometric image, however, shows several hundreds of such anomalies within the area of the site. They could all be similar hearths. These possible hearths are most likely the palimpsest of hundreds of visits by a mobile population that did not yet use the newly developed technique of building stone walls for their every-day life.

At the beginning of the architectural development in the North Caucasus, the first buildings of stone most likely had a communal function, including ritual and feasting activities, at a site that was most likely only used temporarily. Ransyrt 1 is an ideal place to round up herds in autumn, to divide and slaughter a selection of animals, and to preserve the meat by drying it in the mountain air. It may represent the focal point of a fragmented society of pastoralists who assembled periodically at a central location that shaped common values, rituals, and social coherence.[52] At such a site, labor forces for communal building activities can easily be recruited,[53] and today there is increasing

52 Cf. Mauss 1999, 192–195.

53 Reinhold, Korobov, and Belinskij 2012.

evidence that groups from various regions came together at the site to found a new common identity.

At this particular and 'new' place, a new spatial permanence was created. Since all stone architecture in this region known from previous epochs is connected to burial monuments and is technologically very different, Ransyrt 1 represents the 'invention horizon', referring to an entirely new form of construction that was experimented with. The massive walls clearly defined a territory separated from its surroundings, delimiting an interior from an exterior. The durable material gave this demarcation a permanent reality. The semicircular shape of the complex, whose central axis is almost perpendicular to the cliff face of a gorge, leads to a focal point at the center where a well-built small room and neighboring platforms with successive layers of deposited feasting remains were excavated 2015.

If innovation constitutes a break with what previously appeared to be secure and useful, the start of something new in an exceptional place is not inherently surprising. A place such as this, where it is possible for all users to break old rules and traditions, has a great potential for creating hybrid new forms of social practice and their material representations. Hybridity and creativity are important means of negotiating new social configurations. The new architecture at the communal site of Ransyrt 1 may well have served as an integrative medium.

Nevertheless, while the techniques of building in stone were developed as early as the late 18th century BC, domestic architecture remained in its organic, archaeologically invisible form for the next century at the least. Everyday living and building changes only with the development of domestic house architecture in the early 16th century BC. These stone constructions set physically noticeable signs into the landscape (see Fig. 1, b–c). In this particular region, this is an ideological novelty as well – all earlier visible monuments had always been reserved for the dead.

The initial citation of Cribb describes this step towards permanent stone architecture as a step towards a place-bound historicity. With the new locations, the inhabitants were permanently positioned in space and time, and new nodes in spatial communication networks had been created.[54] From this point on, one can assume that social groups began to identify their homes and the surrounding territories. Pastures, routes, locations of certain resources, or possible places with spiritual significance are frequented also by mobile groups, but in a dynamic way. Now, they turn increasingly into fixed territories.[55] Participation rights must be organized and negotiated consensually in order to prevent over-exploitation of territories and prevent conflicts.[56] Ownership claims emerge quickly, even if they are flexible and fragmented. The distance between Late

54 Cribb 1991b, 156; Schögl (unpublished).
55 Weichhart 1990.
56 Stadelbauer 1984 with examples from the Caucasus.

Bronze Age settlements at the time usually ranged from four to five kilometers. This suggests that territorial rights of neighboring settlements were observed or that new settlers could demand territorial respect by force.

Due to a lack of radiocarbon dates, the time span over which these developments proceeded cannot currently be determined with precision. However, the earliest domestic stone buildings can be dated to ca. 1600 BC. Likewise, it is still unclear which percentage of mountain dwellers started adopting this new form of settlement. It is quite likely that some communities continued life in mobile camps and the new form of dwelling was only one among many. Similarly, as communities continued to rely on a pastoral economy, a considerable part of the inhabitants must have retained a mobile or semi-mobile lifestyle despite the existence of fixed base camps.

As stated earlier, the oldest house type known so far is a square, single-room house, built using similar techniques as for the enclosure walls of Ransyrt 1. It could accommodate a nuclear family of five to seven persons. Despite the standardization of construction techniques, these houses were flexibly managed in their spatial arrangements. The linear arrangement of buildings permitted their expansion. The number of households to be built together was therefore not fixed, regardless of whether people lived permanently in the settlements or not. Of particular interest are the respective distances of the buildings to each other, and the use of built-up space.

Two basic layouts can be discerned: on the one hand, a close alignment of houses, sometimes in groups (see Fig. 9) or rows (see Fig. 10, a); on the other hand, houses set apart at distances of up to 50 meters. At some sites with buildings of the first subgroup, the houses are connected by an additional wall (Fig. 9), and settlement plans of this kind are almost always slightly curved. In addition, they all feature a large corral, where the herds of all inhabitants were apparently accommodated together. The second sub-group comprises straight lines of houses loosely built in the countryside (Fig. 10, a). They are never connected and there are very rarely enclosures. These complexes are smaller than the other ones. They display another social strategy to cope with the new style of living. The variability in the appropriation of stone buildings is a good indicator for the adoption process. The new material feature of life was experimented with, and a customized solution for the particular needs of each group was sought. The linear composition of the sites, however, still reflects the preferences of mobile pastoralists – flexibility, easy access for humans and animals, workspace and depositional areas around the houses, and a focus on small social units.[57]

Spatial distance between individuals and places to stay – and not just of humans – as well as their spatial arrangement play an important role in the regulation of social

57 Cribb 1991b, 123–132; 139–149, fig. 8.3–6, fig. 8.9; 162–184.

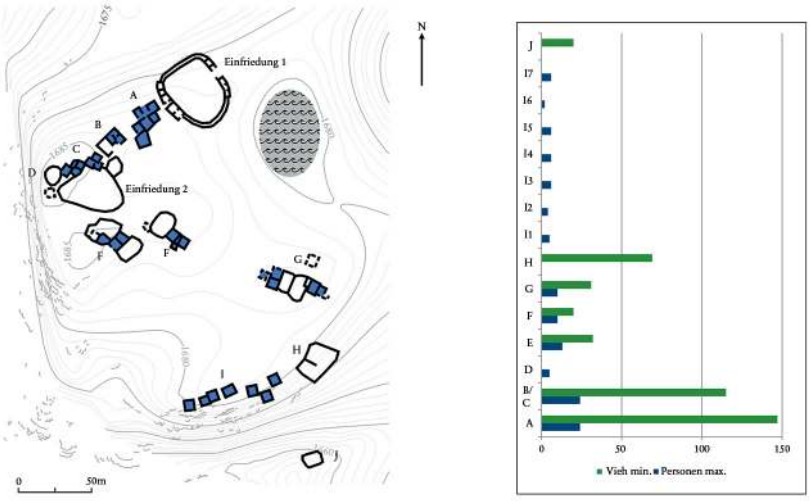

Fig. 17 Differentiation of the inhabitants (humans and animals): Prav. Kichmalka 1.

structures.[58] Space and the objects arranged therein are media of non-verbal communication.[59] Thus, the choice of close or loose arrangements, connected or separated, are indicators of more intensive cohesion or a greater autonomy of the individual households. The first sub-group also seems to have integrated a greater number of animals in their living environment; even the herds were not kept near or inside the houses, as the lack of the corrals suggests, identified via soil analysis in Kabardinka 2. This may have had practical reasons, however, as current studies of human-animal relations suggest a close interdependence on both sides at the household level.[60] Seasonal cycles and the species-specific needs of animals certainly influence the disposition of houses, stables, and corrals.

The curved shape of some sites (Fig. 9), moreover, is a first step towards a spatial configuration that is no longer as open and flexible as a linear settlement or camp site. The tendency towards demarcation using the spatial structure of the settlement layout intensified with the later oval or circular shaped complexes (Fig. 11). This building arrangement in a ring focusing on a center is something fundamentally new. These locations could no longer be expanded and were closed off from the outside world, even if it was still possible to access the center from the outside because intermediate spaces between the buildings were not closed. However, it was now much easier to control movement. Enhanced visual control and passive contact – the chance to meet more or less often due

58 Fraser 1968; Grøn 1991, 101–108; on the psychological foundations: Jüngst 2000.

59 Schögl (unpublished).

60 Armstrong Oma 2013.

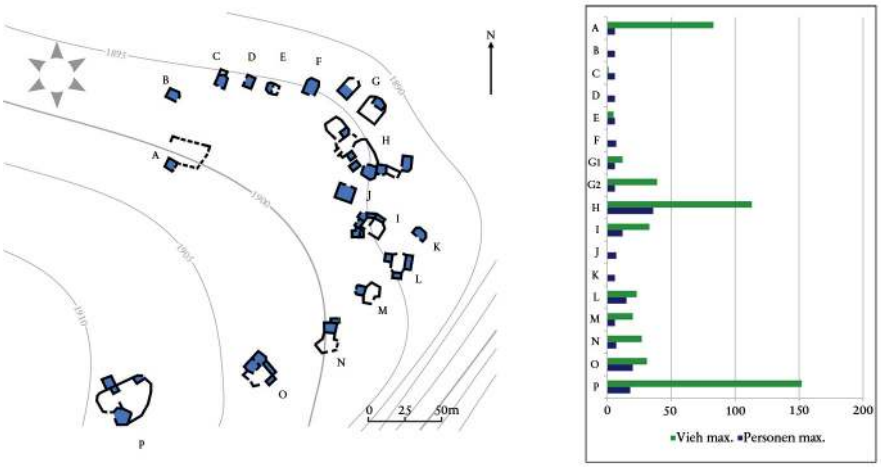

Fig. 18 Differentiation of the inhabitants (humans and animals): Tamsamesu 1.

to the regulation of movement patterns – are of far-reaching consequences for the social organization of communities (see Fig. 1).[61] Social control through observation did not only regulate the actual construction process of houses, but likewise their arrangement in terms of more or less straight lines-of-sight.[62] The same applies for movement patterns in space.[63]

At this stage, the change in lines of sight and movement is the actual innovative step. The house architecture seems to have remained unchanged. Only the combining of several one-room buildings to agglomerated complexes is a novelty. It indicates the beginning of a differentiation into larger and smaller households. Since the larger complexes always include individual animal enclosures, the architecture also indicates the start of an economic imbalance of the inhabitants (Fig. 17). Compared to the linear arrangements with communal corrals, space for animals becomes 'privatized'. The larger complexes with enclosures are often concentrated in specific areas of the rings, while separate houses without enclosures fill the gaps (Fig. 11; Fig. 17). Further excavations would be needed to explain this spatial differentiation more precisely as a reflection of the beginnings of social differentiation.

The most significant change in the development of the North Caucasian Bronze Age architecture was, however, the development of settlements with symmetric layout at the turn of the 14th to 13th century BC. This radically changed living arrangements

61 Grøn 1991, 107–109.
62 Bourdier and Minh-ha 2011, 25.
63 Hillier and Hanson 1984.

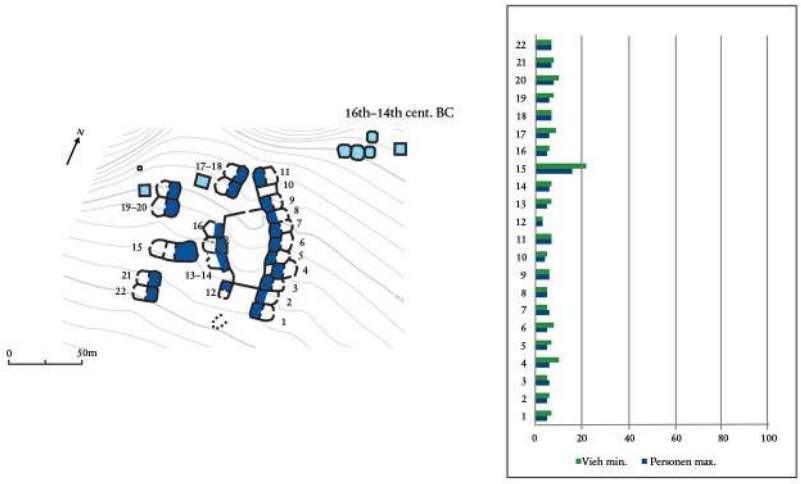

Fig. 19 Differentiation of the inhabitants (humans and animals): Kabardinka 2.

as well as activity and movement patterns of the residents. The development of the multifunctional byre-dwellings that united humans and animals under one roof, required not only the new double-roomed floor plan design (see Fig. 5, d–e), but also more massive walls (Fig. 7, c) and probably more massive superstructures. The segmented construction technique of the walls (Fig. 8, a) was developed further to construct durable foundation walls (Fig. 8, b–c). The walls of the houses were built exceptionally carefully and the stones were often dressed (Fig. 6, a–c). The massive walls and their construction certainly changed the optical, thermal, and acoustic characteristics of the houses. Stables, which were probably seasonally used as storage rooms or workspace, allowed the removal of activities from the interior or the courtyard into the economic section of the house. Storage space also must have drastically increased, e.g., in the attics below the roof.

Lines-of-sight and axes of movement in these settlements suggest surprising patterns of mobility.[64] The representative entrances of the houses that faced to the outward required people to walk around the settlement if they wanted to visit neighbors on the opposite side of the plaza. Access to the plaza from inside the houses cannot be verified based on the archaeological evidence. Even if wooden steps might have existed, the patterns of movement of the houses were directed away from the center. The central square was entirely sealed off by walls with only one narrow entrance that was protected by a massive gate. The central squares of these settlements obviously did not have the focusing

64 Reinhold 2010, 224–226.

function of internal plazas at other settlements.[65] Nevertheless, the whole arrangement served as a fortification ring, less for the inhabitants of the houses than for the animals kept in the central square. Soil analyses demonstrate their presence in the plazas.[66] Effective herd management, where the interbreeding of animals is artificially influenced, requires the ability to separate old and young animals, as well as males and females respectively.[67] The central square was a highly suitable building arrangement for this purpose. The development – invention? – of the byre-dwellings with the possibility of safely wintering large numbers of livestock, and the central places that allowed breeding control, combined different strategies of herd management. Both targeted high economic efficiency of livestock production. However, the architectural detail and the symmetrical arrangement of the buildings are specific to the studied area. Other architectural solutions for herd management could have served the same needs, such as sheltered enclosures or separate winter stables.[68]

Houses and squares were thought of as a unit. This becomes obvious in construction details. At the excavated sites of Kabardinka 2 and Gumbaši 1, neighboring houses have interconnected foundations. The wall frames of the double-faced wall of one house run sometimes inside the wall of the next building (Fig. 5, d; Fig. 8, c). Such construction technique makes only sense if the entire settlement is planned in advance, following a well-known template with standardized house forms. The whole complex must have been built at the same time. There is further evidence for all three points. One site was never completed, yet even the half-finished structure reveals the general layout and the intended number of houses. At nearly all sites, the central places were carved into the bedrock, showing that the number of possible buildings had already been set at the start of the construction. These settlements did not grow slowly but were planned and established systematically for a more or less fixed number of inhabitants.

Returning to the aspect of building, an important prerequisite for collective construction is a clear coordination of the construction processes and a large number of helpers.[69] The symmetrical settlements with their large, multi-functional houses are signs of a highly organized society that shows its social coherence and economic prosperity in its architecture. Compared to the earlier oval- or circular-shaped systems with their differentiation of households, the uniformity of building and settlement layout is remarkable. With the advent of symmetric settlements, individual traits in the architecture disappeared. The settlement plan and the clearly outlined ideal number of

65 For archaeological examples, see Zdanovich and Batanina 2002; for ethnographic ones, Bourdier and Minh-ha 2011, 153–171; Kumhera 2010.

66 Reinhold, Belinskij, and Korobov 2007, 157–158, Fig. 19–20; Peters et al. 2014.

67 Ebersbach 2002, 141–145.

68 See Giovanioli 2004 for Alpine economic architecture.

69 Oliver 1989; Bourdier and Minh-ha 2011, 153, fig. 159.

occupants appear just as stringent as the actual construction and architectural details. The power of social regulations within this collective must have been immense.

Despite the fact that a settlement organization as described here is hardly conceivable without regulatory mechanisms and individuals who make decisions, there are no architectural traces of any subgroups that could be designated as elites. The abovementioned beginnings of social differentiation during the period of open oval sites did not lead towards a more complex social organization, but rather toward the opposite. With their uniform architecture, the communities living in symmetric settlements tried actively to counteract the segregating tendencies displayed in the earlier oval complexes. Unlike suggested by Bourdier and Minh-ha[70], who understand uniformity in architecture as an indicator of ethnicity and a positive sense of community,[71] uniformity is as strong a social means of discipline as it can be the result of forceful repression. At the investigated sites, visually perceptible social differentiation was meant to be regulated if not suppressed entirely.

With the byre-house and the symmetrical-oval settlement plans the architectural development arrived at a stable solution for social and economic requirements. It persisted for more than 300 years, longer than any constructive scheme before or after. This architecture was perhaps perfectly adapted to the economic and social needs of its inhabitants, so that they saw no need for further improvements. However, it is also possible that the stone foundations of the buildings were so inflexible that later residents did not want to undertake the effort to change the entire system. It is also possible that the inflexible ways of life and the suppression of individuality were such strong means of disciplining people and their conceptual horizon that further changes, including new forms of architecture, became unimaginable. The innovation cascade, if we return to Michael Schiffer's terminology, had reached its end. The following architectural development of groups who migrated into the valleys after 1000 BC changed their economy, with the result of new architectural forms. They are, however, not the subject of this paper.

4.2 Social practice – innovations in dwelling

With the changing types of houses and settlement layouts, social practices that took place within them and in their direct surroundings had to change gradually. Dwelling itself is not bound to a specific architecture, and it includes many more aspects than physical residence in a particular area. With the step towards 'localization', living and dwelling were altered. The builders of the 'new' stone buildings probably became soon aware of the changes in their everyday life. Mobile architecture, which was probably

70 Bourdier and Minh-ha 2011, 25.

71 Bourdier and Minh-ha 2011, 25.

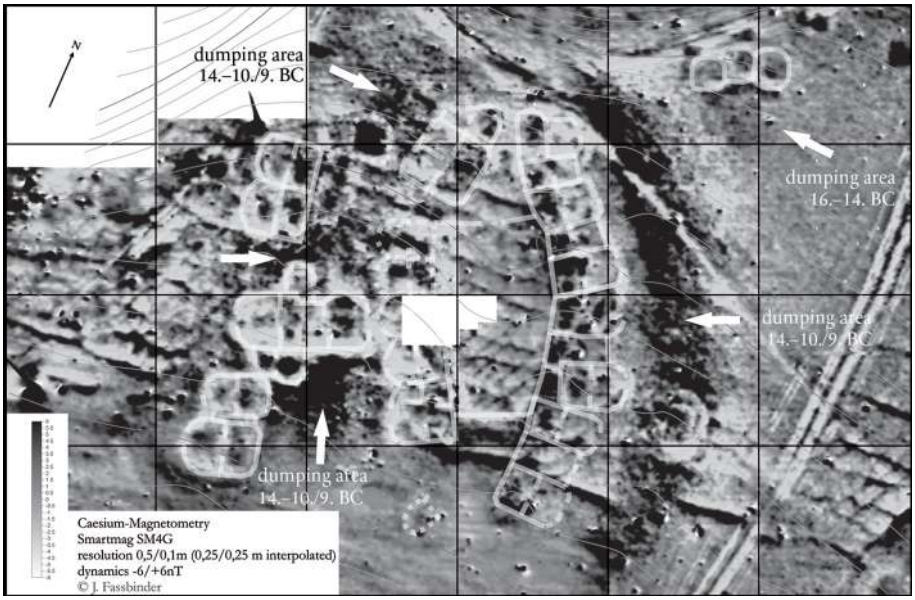

Fig. 20 Midden zones around the linear and symmetrical settlement Kabardinka 2.

mainly textile or organic architecture – tents, yurts, huts –differs substantially in terms of lighting, acoustics, smells, or temperature from stone or massive wooden or earthen constructions.[72]

Magnetometric measurements and the subsequent investigations make it possible to delineate activity areas, i.e., to separate economic from residential areas and compare intensities of activities. Although the ground plans of the different house types vary considerably, an undivided room of about 60–100 square meters was typically used as living room. This would accommodate nuclear families of five to seven or maximal ten people per house, regardless of the respective house forms of different epochs.[73] Only in the open oval settlements with their agglutinative structures could larger and smaller overall units emerge. At these particular sites, the number of co-residents became more flexible (Fig. 18). With the symmetric settlements, however, the communities returned again to the standard size of living rooms suitable for a core household. Magnetometry and soil analyses reveal similar ranges of activity intensities of rooms in the double-room houses (Fig. 20). This indicates that these buildings had largely identical use patterns.

The actual innovation in dwelling probably took shape only in response to the adaptation to the characteristics of the stone architecture, i.e., with the development of closed

72 Cf. Hof 2001.

73 Cf. various calculations at Mischka 2007.

symmetric sites. Initially, there were few differences in terms of everyday routines between linearly organized tent camps and linear architecture with stone houses. This concerns movement patterns of humans and animals or the use of open spaces around individual dwellings. Living in flexible camps and similarly arranged linear complexes preserved the residents' autonomy. Most likely, the new building materials initially affected above all the quality of living. One can assume that the increasingly massive architecture influenced first aspects such as lighting conditions, ways of sleeping, eating, resting, working, playing, or hygienic conditions.[74] Thick walls made of solid materials such as the later multi-functional byre-houses, resulted in warmer but also darker and acoustically enclosed spaces. Hard materials restrict movement, and the accumulation of garbage and filth is different in a house than in a tent or a yurt. Moisture can accumulate and adversely affect the hygienic conditions. Also, entry into closed spaces is difficult and contact to the outside takes place only when wanted. The ethnographer Annedore Hof describes the sedentarization process of Yürük families in Turkey. Communication structures changed for former camp residents who now could no longer informally visit their neighbors in their tents. Instead of personal visits, communication shifted toward indirect means such as the use of the telephone.[75] In this particular case, social behavior in villages permits public participation outside the house only for males so that the women became bound to the house. With permanent buildings, the accumulation of objects, including heavy furniture, began as well. Unfortunately, without more excavations that would allow a comparative analysis of different houses within the sequence of the North Caucasian architecture, such aspects still remain in the dark.

Both the multi-functional byre-houses and the co-developing symmetric layout of settlements must have changed village life in fundamental way. With each stage of architectural development, the spatial distance between neighbors as well as humans and animals waned. People in symmetric settlements lived separated from their neighbors only by a wall and were in close contact with animals in the stables, at least temporarily. The massiveness of architecture certainly created new barriers. Nevertheless, one inevitably met more people when entering or leaving houses. We can assume an increasing relatedness of all neighbors that could perhaps also have created new forms of distancing, including polite ignoring, looking away, and not listening. Such behavior would be an indirect but certainly imaginable side effect of an innovation cascade.

Another aspect of social life is garbage. Hygiene and waste disposal are important activities reflecting various mentalities toward mobility. While mobile groups tend to dispose of the little waste that accumulates during their stay close to their areas of residence, a well-directed garbage disposal is more of a concern for sedentary groups.[76]

74 Delitz 2010; with example Bourdier and Minh-ha 2011.

75 Hof 2001.

76 Cribb 1991b, 122–129, fig. 7.4.6–7; 10.3; Sommer 1991.

Geophysics, soil analysis, and archaeological evidence reveal that accumulation of waste took off at the sites with the advent of stone constructions. While this is still rather ephemeral in the linear and oval settlements, settlements with symmetrical layout have significant 'rings of waste'. Magnetometry shows in several localities dark anomalies that are due to high concentrations of ash and organic perishables in the soil (Fig. 20). On-site surveys and an excavation at the Kabardinka 2 site also exposed considerable layers of ash, bones, and pottery concentrations.

A last aspect of dwelling considered here is the presence of animals. At all stages of architectural development a close coexistence of humans and animals can be assumed. However, the spatial relations and above all the intensity of human-animal contact changed significantly over time. In a study on human-animal interaction, Kristin Armstrong Oma argues that the particular species-specific behavior, the seasonal rhythms, and the specific needs of animals have a clear influence on conditions and intensities of co-habitation.[77] It likewise influences the construction of houses, stables or corrals. The closer the spatial integration, the clearer are the changes in the perception of animals and their products. Animal excrements in cases of integrated residential-stable spaces, for instance, might not be perceived as 'dirt', but rather as 'pure', welcome heating material, or just as neutral. The close symbiosis between humans and animals allowed the boundaries between them to dissolve.[78]

The North Caucasian case study demonstrates an increasing proximity of humans and animals over the course of time. At the excavated house of the linear phase of Kabardinka 2, microbiological soil analyses show that no animals had been present inside or in the vicinity of houses. In the oval to circular shaped complexes, stables for animals were initially probably built alongside corrals. In the multifunctional byre-houses, animals were integrated directly into the immediate living environment of humans. Not only the distances between human inhabitants decreased with the transition from linear to symmetrical settlements, but also those between humans and animals. As both moved closer to each other, the latter won security while the former gained easy access to animal products. At the same time, degrees of autonomy, freedom of movement, and hygiene were lost, increasing the risk of parasites or transmission of diseases. With the integration of animals into residential areas, a change in their perception is almost certain. In Armstrong Oma's view, this can be regarded as a 'domestication process', only in this case, human behavior adapts to animal needs and not the other way around.[79]

77 Armstrong Oma 2010; Armstrong Oma 2013. For Kabardinka 2, the archaeo-zoologist Ekatarina Antipina draws attention to the enormous social stress that animals endure in an enclosed space, especially if the species-specific individual distances fall short, or different sexes are housed together.

78 Armstrong Oma 2013, 171–172.

79 Armstrong Oma 2013, 164.

These few insights into possible changes of lifeways reflected in the archaeological sources demonstrate that with innovations in Bronze Age architecture go hand in hand with fundamental innovations in social practice, often probably as unintended byproducts. The decision in favor of greater localization and the choice of permanent buildings initiated these fundamental changes in daily routines as well as the adaptations of architecture to new, unforeseeable tasks. This is clearly demonstrated by modern case studies as well.[80]

5 Stone architecture at the transition from Middle to Late Bronze Age in the Caucasus – invention or technological transfer?

With the last phrase in mind, it is necessary to ask whether the Bronze Age settlement development in the Northern Caucasus was indeed the (re)invention of a sedentary lifestyle and of solid architecture, or whether they were adopted via as cultural and technological transfers from the outside.

Architecture, and domestic stone architecture in particular, is a phenomenon that is nearly unknown in the Northern Caucasus during the Middle Bronze Age (MBA) in the third and early second millennia BC. While thousands of burial mounds were erected using stone construction for graves and mound embankments, no technological link can be drawn between this form of architecture and the later buildings discussed above. This is also true for the few excavated domestic MBA constructions in the Western Caucasus or Dagestan.

Technological aspects, however, and in particular the double-faced wall construction, link the Caucasian sites to places with domestic buildings and fortifications in the Lower Don region and on Crimea. During the epoch of the multicollared ("Mnogovalikovaya") ceramics, i.e., at the turn of the third to the second millennium BC, a settlement development similar to that of the Northern Caucasus begins. It is not as straightforward as in the latter area, but it reveals quite comparable traits.[81] The changes in the Lower Don and on Crimea predate the oldest complexes with stone walls in the Northern Caucasus by several centuries and display their own peculiarities. The double-faced construction technique in Planerskoe,[82] a Crimean site from the beginning of the second millennium BC, however, is a direct prototype for the walls in Ransyrt 1. Even more revealing are the structures excavated at the site of Livencovka near Rostov-on-Don. A twin-complex with massive stone walls was excavated in the 1980s.[83] It also dates to the epoch of multicollared ceramics. Livencovka is considered a fortification and refuge

80 Hof 2001; Cribb 1991a.
81 Pieniążek 2012, 59–62, fig. 11–12; 170–179.
82 Kislyj 1991.
83 Bratčenko 2006, 34–76.

for a larger, mobile population. Inside the enclosure, tombs have been found, but no domestic architecture. Contemporary domestic buildings, however, existed in the vicinity of the Livencovca fortress and inside the neighboring Karataevo enclosure.[84] Both adjacent complexes are semi-circular in shape, built at the edge of the steep bank of the river Don. These places were constructed as a series of stone platforms with gaps in between. It is unclear, to what extent these sites were really inhabited on a permanent basis and used as fortifications.

Is the process of sedentarization in the Northern Caucasus then a cultural transfer from the adjacent steppe zone in the northwest? Is the double-layered wall construction a technological transfer? In 2015, one of the excavators of Livencovca visited the Ransyrt 1 excavation in the mountains and confirmed considerable correspondences not only in both building techniques and site layout, but in parts of the material culture as well. From this perspective, it is quite possible that the first impulse to abandon the predominantly mobile lifestyle of the Middle Bronze Age arrived in the Northern Caucasus from the Lower Don or the Lower Kuban area. This may have included the development of new forms of construction, Nevertheless, the local development that started there is neither comparable in terms of the architecture nor in terms of settlement conceptions. And it ended just before the development in the Caucasian mountains took off. Magda Pieniążek noted for the North Pontic area, which has with its own ecological and economic regularities, that unlike in the Northern Caucasus the sedentary way of life was never really anchored deeply in the mentality of the population. Rather, it always oscillated between more or less mobile principles.[85]

6 Concluding comments

Why do humans construct architecture? The question of its 'utility' has occupied architectural theory since its inception. The need for 'shelter' was long considered the primary motivation for human construction of buildings, but the shaping of 'new cultural ideals' is already mentioned by Gottfried Semper in the 19th century.[86] The architect Joseph Rykwert concludes that the significance of architecture lies in its symbolic and creative potential, not in its protective function.[87] Rykwert mentions the need for a 'home' in one of his essays, not an entirely unproblematic term.[88]

The invention of buildings constructed in stone – a technological innovation involving a new material in domestic architecture – should therefore not be considered only

84 Bratčenko 1969.
85 Pieniążek 2012, 170–179.
86 Moravánszky and Gyöngy 2003, 35.
87 Ingold 2000, 181–182; Trebsche, Müller-Scheeßel, and Reinhold 2010, 16–19.
88 Rykwert 1991; Ingold 2000, 182.

as a technological phenomenon. The mobile groups of the early second millennium BC probably did not need fixed homes. They had their transportable buildings – tents – that gave them protection and shelter. The adherence to a site layout that resembles those with mobile architecture during the first phase of the innovation of 'sedentism' suggests that it was not necessarily the functional benefits of stone houses in a village configuration that led to their initial construction. More likely, these houses were symbols for the creation of new places for a newly formed population with a new self-conception. All subsequent developments are adaptations to the consequences of this decision, innovative spurts in an innovation cascade, to reference Michael Schiffer again.

It is undeniable that the image drawn up here neglects all social groups that remained rooted in mobile architecture and are thus not archaeologically documented. The seemingly linear development from mobile to sedentary could therefore certainly be disrupted by the existence of such alternatives. Yet, the overall trajectory would remain the same.

The Northern Caucasian case study, despite the early stages of research, opens up some interesting aspects in the debate on technological and social innovations. Radical shifts in everyday life have been mentioned above. Yet, it remains uncertain why settlers started to settle down in the high mountains at all, and why they did not move to the more convenient valleys when faced with population growth and probably harsher climate conditions after the mid-second millennium BC.[89]

The first question might be answered with reference to the pastoral economy of the first settler groups who had to cope with the problem of aridization of the steppe zone. This required them to find new treeless pastures for their herds in mountainous terrain. The second question is harder to answer. The invention of settlement forms adapted to semi-mobile seasonal pastoralism, i.e. an actual combined mountain economy (*Almwirtschaft*), permitted a considerable population increase in a precarious environment. The number of sites and households per site increased steadily at a time when climate conditions became harsher, i.e., when external pressure started to weigh on the environment.[90] The mountain dwellers, however, instead of shifting down to the valleys, reacted with the development of new architectural solutions for a new form of intensive herd management. This probably went hand in hand with an intensification in mountain agriculture operated by parts of the population that was now permanently located in villages.

Technological innovation as an answer to economic or social tasks is a characteristically modern thought. Yet, the Northern Caucasian Bronze Age mountain communities

89 Davis et al. 2003, fig. 3.

90 The overall European data on harsher climate conditions after the mid-second millennium BC is confirmed by the finding of several studies of paleopathology of the cattle from this period, which suffered from severe colds and hypothermia (Antipina 2013).

obviously preferred the investment in technological solutions involving considerable risk to the 'easier' solution of out-migration. Life in high mountain locations occupied by their ancestors only a few hundred years earlier was apparently deeply anchored in the collective memory of these communities, opposing utilitarian aspects of a more convenient life in the shelter of the valleys.

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SABINE REINHOLD

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Working Lives in an Age of Mechanical Reproduction: Uruk-Period Mesopotamia

Summary

The notion of mechanical reproduction was made famous by Walter Benjamin in a 1936 essay. Benjamin was concerned with modern developments; in this paper I argue that a shift toward pervasive repetitiveness in work and thus a form of mechanical reproduction was already introduced in the Uruk period (4th millennium BCE) in southern Mesopotamia. I consider the ways in which work was conceptualized and structured in Uruk times, and by extension how innovations in the realm of work affected other spheres of life. My examination includes the production and use of pottery, buildings and their constituent mudbricks, durable imagery involving anthropomorphic depictions, and textiles.

Keywords: Mechanical reproduction; work; repetitiveness; Uruk period; Mesopotamia; standardization; creativity.

Ein Aufsatz Walter Benjamins aus dem Jahr 1936 verschaffte dem Begriff der mechanischen Reproduktion zur Berühmtheit. Benjamin beschäftigte sich allerdings mit modernen Entwicklungen. Hier argumentiere ich, dass es schon in der Uruk-Zeit im 4. Jt. v.u.Z. in Südmesopotamien eine weit verbreitete Tendenz zu sich wiederholenden Arbeitsvorgängen und damit zu mechanischer Reproduktion festzustellen ist. Ich erörtere, wie Arbeit in der Uruk-Zeit verstanden wurde und strukturiert war, und wie Innovationen im Bereich der Arbeit selbst andere Lebenssphären beeinflusste. Meine Überlegungen schließen Herstellung und Verwendung von Keramik, Bauten und das Baumaterial Lehmziegel, aber auch anthropomorphe Bilder aus dauerhaftem Material und Textilien ein.

Keywords: Mechanische Reproduktion; Arbeit; Wiederholung; Uruk-Zeit; Mesopotamien; Standardisierung; Kreativität.

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In his famous essay *Work of Art in the Age of Mechanical Reproduction*, first published in 1936, Walter Benjamin engages in a meditation on art and aura in a time of fundamental transformation. For Benjamin, the possibility of mechanically reproducing imagery at a magnitude and with a rapidity that had never previously been possible was a transformation of major proportions. He traces the technology from classical Greece – the use of stamping and foundry to make coins, bronzes, and terracottas – through the medieval to modern development of woodcuts, printing, lithography, and finally photography and especially film. Benjamin bemoans the loss of the aura of the artwork that he considers to have accompanied these developments. He argues that mechanical reproductions are no longer the careful, individually crafted copies that were once made: "Replicas were made by pupils in practice of their craft, by masters for diffusing their work, and, finally, by third parties in the pursuit of gain".[1] Rather, modern works are churned out mechanically and repetitively by the use of techniques such as photography. In other words, mechanical refers to a form of (re)production that is unreflected and to at least some extent independent of social context, taking place by means of processes that allow large quantities of more or less identical copies to be made.

For Benjamin aura is a product of the situatedness of an artwork in a particular time and place, which confers on the work a specific history and locates it within a specific tradition. All of this was, according to Benjamin, lost when technological innovations allowed copies to be produced in more or less infinite numbers, to be viewed and interacted with in almost any context.

Despite a certain nostalgic sense of lost authenticity, Benjamin also saw some glimmers of hope in these developments – an unprecedented access on the part of the masses to art forms such as film. As a result of this democratization process, "for the first time in world history, mechanical reproduction emancipates the work of art from its parasitical dependence on ritual".[2] In an age of mechanical reproduction, art is something that is designed to be reproduced and exhibited, and it is based on politics rather than ritual. His analysis, Benjamin suggests, may be "useful for the formulation of revolutionary demands in the politics of art".[3]

Like so many philosophical reflections by European and North American scholars, Benjamin adopts a perspective on history in which little or no attention is given to non-

1 Benjamin 1968 [1936], 218.
2 Benjamin 1968 [1936], 224.
3 Benjamin 1968 [1936], 218.

European or pre-modern cultural contexts. Rather, he is concerned with specific historical developments in the early 20th century. I will argue in contrast that some of the most profound and transformative elements accompanying a shift toward mechanical reproduction – specifically the pervasive repetitiveness in work via mass (re)production – was introduced in much earlier historical times and other cultural contexts. The specific case on which I focus is the Uruk period (4th millennium BCE) in southern Mesopotamia.

1 Repetitiveness at work

The sociologist of work, Richard Sennett, has examined scholarly evaluations of the role of repetitive work in the context of emerging industrialization in the mid-18th century in western Europe.[4] He contrasts the judgments of two very different scholars regarding this subject. In his *Encyclopédie* the philosopher Denis Diderot discussed routine as a crucial element leading to the mastery of a craft. He argued that routine was essential to the organization of industrial production. It was not to be seen as merely the endless mechanical repetition of an activity; rather, learning to do something to the point that one can do it more or less automatically ultimately makes creative work possible, according to Diderot, by allowing the person who has mastered the process to introduce changes. The person who has internalized the routine of a work process also learns the appropriate rhythms of the work and can, at least to some extent, modify them according to need. In other words, routine, the result of repetitiveness, is associated with the mastery of a work process, which in turn makes it possible to vary elements, thereby fostering – at least in principle – creativity. Ingold makes a similar argument, citing an artist who says that he focuses on the process of making and "let[s] the piece [being created] take care of itself".[5]

Sennett juxtaposes Diderot's positive perspective on the development of industrial routine against the distinctly more negative view of Adam Smith in *The Wealth of Nations*. Smith saw routine work, in which each worker carries out boring, repetitive tasks, as something that dulls the mind. The problem, according to Smith, was that workers lose control over their own activity and cease to have reason to exercise judgment and understanding in their work. As a result, work becomes a routine without rhythm, accompanied by a minimum of spontaneity. In contrast to Diderot's view, Smith saw routine and repetitiveness as leading to dullness and stagnation.

Another element of repetitiveness and mass (re)production derives from their temporal implications. Highly repetitive work processes may be decoupled from 'normal'

4 Sennett 2006 [1998], 39–56.

5 Ingold 2007, 11.

rhythms, those characteristic of domestic life or of seasonality, becoming instead subject to administrative forms of timekeeping.[6] These in turn are more easily subject to manipulation of tempo, for example the push to speed up work.[7]

2 Repetitiveness in Uruk-period Mesopotamia

The 4th millennium BCE in the alluvial lowlands of southern Mesopotamia is widely acknowledged by archaeologists to have been a time of major transformations. Referred to as the Uruk period from the site of Uruk in present-day southern Iraq, the 4th millennium witnessed an array of fundamental changes in material practices as well as in demographic, economic, political, social, and ideological spheres of life. Together these have been subsumed under such rubrics as the origins and consolidation of the first states and the emergence of urban societies.[8] Among the most notable changes were a vast growth and agglomeration of settlement; alterations in river regimes resulting in a gradual drying out of what had previously been a predominantly deltaic landscape; a wide array of technological changes in craft production; elaboration of systems of recording and counting that culminated in the invention of writing; visual representations of violence among people; and a widespread distribution of characteristic styles of material culture over a large geographic area in the latter half of the Uruk period, the so-called Uruk expansion.[9]

In my examination of the introduction of mass production and pervasive repetitiveness in work in Uruk-period Mesopotamia I am not concerned primarily with innovations in terms of specific technical processes, although these do play a role in my discussion. Rather, I am interested in how work was conceptualized and structured, and by extension how innovations in the realm of work affected other spheres of life, for example, the mass mobilization of labor that was undertaken in order to produce and transport goods. In other words, how did the introduction of repetitiveness as a basic feature of work processes affect:

– what was produced, i.e. the products;

– how the products were used, i.e. how people dealt with mass produced things; and

6 Cf. Englund 1988.

7 See, for example, Paul Virilio's discussions of speed and the "revolution" in transportation that he situates in the 19th century (Morisch 2006).

8 Johnson 1973, Johnson 1980; H. T. Wright and Johnson 1975; Adams 1981; Nissen 1988; H. T. Wright 1998; Pollock 1992, Pollock 1999.

9 Algaze 1993, Algaze 2008; Rothman 2001; Pournelle 2007.

– the subjects who were produced through their interactions with these forms of work and with the objects thereby made?

Ultimately, I examine how pervasive repetitiveness produced monotonously similar things. At the same time – although not necessarily for the same persons – repetitiveness allowed and perhaps even encouraged diversity and creativity, what we often consider to be the heart of innovation. What may have begun primarily as a means to rationalize production of certain key products ultimately changed the people who made and used them, in ways that could not have been entirely intended or foreseen by those who initiated the changes.[10]

3 Technological change and mechanical reproduction

Archaeologists have frequently remarked upon innovations in the realm of technologies during the Uruk period.[11] I suggest that many of these innovations can be understood as part of an introduction of pervasive repetitiveness that came to characterize many spheres of life by Late Uruk times. Here I examine several realms in which the practice of pervasive repetitiveness can be observed.

3.1 Pottery production and use

The production of pottery underwent substantial changes in the Uruk period, with a proliferation of different vessel forms as well as changes in the technologies of vessel manufacture. Moulding was widely used to form vessels, specifically beveled rim bowls, the single most commonly occurring type of container made in Uruk times (Fig. 1). On the basis of their characteristic properties, the frequency with which they were discarded when still intact, along with analogues in the earliest written texts of the Late Uruk period, beveled rim bowls have been considered to be vessels used for the distribution of food or drink in the form of rations to dependent laborers.[12] The introduction of the fast wheel for throwing vessels, including the development of the technique of "throwing from the hump"[13], dates to the later Uruk period, and it, too, was confined primarily to the production of mass-produced containers used for the large-scale distribution of food and/or drink. These technologies for forming pottery made it possible to produce large quantities of very similar-looking vessels in processes that seem to have been designed to maximize output and minimize investment of time and were clearly in the interests

10 Cf. Schivelbusch 2000 [1977].

11 Nissen 1977, Nissen 1989; Algaze 2008.

12 Nissen 1970, 136–138; Johnson 1973, 129–139; Pollock 2003, 27–32.

13 Rye 1981, 75.

Fig. 1 Beveled rim bowls, the most common form of ceramic vessel produced and used in the Uruk period.

of those who commandeered labor that was compensated through the allocation of rations.

It is not only the production of vessels by moulding or throwing on a fast wheel that speaks to an emphasis on repetitive practices but also the ways in which these ceramics were used in consumption. The mass distribution of food and/or drink using these vessels was organized with an eye to effectiveness and efficiency, as is graphically illustrated by an in situ find at the site of Chogha Mish.[14] There, beveled rim bowls were lined up in rows, apparently ready to be filled and handed out to workers. The standardized sizes and shapes of the bowls point to an environment in which consumption of food was rationalized to an extreme, being divided into a series of easily repeatable segments. As is the case for almost all of the other pottery produced and used in Uruk times, the beveled rim bowls are devoid of decoration. The 'loss' of decoration was a gradual process that took place over centuries,[15] culminating in a nearly complete absence that coincided with the introduction of mass production.

Mass-produced vessels were used for the distribution of food and drink to feed a new class of workers, who were themselves engaged in repetitive forms of labor (see below,

14 Delougaz and Kantor 1996, Pl. 15.

15 Wengrow 2001.

Durable Imagery). Many of them probably had little opportunity to exert control over their conditions of labor or commensality. In this way, standardized products of mass production were in turn used to 'mass reproduce' laborers who were themselves engaged in work that was constituted of repetitive tasks.

Accompanying the production of standardized vessels made in moulds or thrown on the wheel is a marked proliferation of different vessel forms. The introduction of substantial numbers of new vessel forms can be understood as a location of innovation and creativity on the part of potters who were learning new methods for preparing clay that was suitable for throwing on a wheel and used the occasion to experiment with the production of novel forms of rims and necks as well as the use of handles and spouts that were seldom attested before. This diversity of vessel shape and attributes must be understood not solely as a matter of functional differentiation, but rather as a product of changing forms of labor that permitted and to some extent perhaps encouraged a certain degree of experimentation.

3.2 Mudbricks and building construction

A growing emphasis on repetition in production and use of objects is evident in the realm of construction as well. Mould-made, sun-dried mudbricks had long been employed in Mesopotamia for the construction of buildings, but in later Uruk times a new form of bricks with a square cross-section, known as *Riemchen*, was introduced.[16] Their usage extended well beyond that of a local custom – *Riemchen* were used in sites as distant as southern Iraq and northern Syria. Their uniformity of shape and size made them more flexible to use than earlier forms. The production of mudbricks is physically demanding work, and the growing size of some non-domestic buildings and associated structures, especially mudbrick platforms, would have required massive quantities of bricks. Furthermore, production was probably seasonally restricted, as water and tempering materials – often consisting principally of straw or chaff – would have had to be available and the weather suitable to allow the bricks to dry. The likely result is that bricks were generally made after the harvest in the late spring/early summer, possibly continuing up to early winter.

At the same time as massive quantities of interchangeable 'building blocks' were being produced, there was also an unprecedented experimentation with building form and elaboration, best known from the array of monumental, non-domestic buildings from the site of Uruk.[17] The repetitive production of components – in this case, bricks – allowed for creativity, with these building blocks ultimately used to construct edifices of

16 Sauvage 1998, 110–114.

17 Nissen 1988, 96–100; Butterlin 2003; Eichmann 2007.

a previously unmatched size and elaboration. The possibilities for creative use of these flexible components did not necessarily translate into occasions for experimentation on the part of the workers engaged in the actual building process, but was more likely reserved for those entrusted with designing the buildings.

3.3 Durable imagery

In comparison to earlier periods, durable imagery bearing anthropomorphic depictions exhibits a veritable explosion in quantity and form in the latter half of the Uruk period. We can speak of an innovation in terms of the display of people in relation to each other.

One of the most common media in which such imagery is present are cylinder seals. The use of seals and sealings has a long history in Western Asia, extending back several thousand years prior to the Uruk period. Earlier sealing practices were centered around the use of stamp seals, which were generally small and often button-shaped, with a flat surface into which a design was engraved in negative. By impressing the carved surface into moist clay, the design could be transferred to a sealing, which closed a container, package, or door.

Beginning in the Middle Uruk period, there was a dramatic change in sealing practices, as the long-used stamp seal gave way to cylinder seals. As the name implies, this new form of seal was cylindrical in shape, with the design carved around the circumference. The impression was produced by rolling the seal across a piece of clay rather than stamping it. As was also the case for stamp seals, most cylinder seals were made of stone of various kinds, but examples made of shell, clay, and metal over a bitumen core are also attested. The sheer quantity of seals and sealings increases markedly with the introduction of cylinder seals. The early cylinder seals display an array of sizes and shapes, from tall and narrow to short and squat,[18] only later becoming more standardized.

The technology of seal making and carving has been studied in some detail. Edith Porada suggested that cylinder seals may have been developed by lapidaries who made stone vessels.[19] Others have proposed that the preforms for cylinder seals may have been the waste product of making stone vessels. In a series of studies, the dentists Leonard Gorelick and John Gwinnett argued that nearly all of the necessary component technologies for making cylinder seals were available long before the first appearance of these seals. Cylindrical forms were derived from traditions of bead-making, engraving had been practiced on bone, shell, and ivory objects as well as on stone stamp seals, and imprinting was used on pottery, figurines, and the impressions of tokens on clay bullae or of stamp seals on sealings.[20] Gorelick and Gwinnett described the transition from ver-

18 Frankfort 1955, 13–14.
19 Porada 1993.
20 Gorelick and Gwinnett 1981.

tical bow-drill to horizontal bow-lathe as a primary technical innovation which allowed for mechanical engraving as well as the potential of using metal versions of tools that had previously been made of stone or wood. Their analysis nicely demonstrates how a new kind of object – the cylinder seal – could result from combining a series of existing technologies in novel ways.

A variety of other elements accompanied the introduction of cylinder seals or emerged as consequences of their production and use. Two important novel effects of their introduction were, first, the way in which the designs carved on their surfaces were conceptualized, and secondly, how these designs were transferred to sealings. The motifs on cylinder seals lack a clear beginning or end.[21] The carving of a cylinder seal also meant conceptualizing the work surface as continuous. The skills needed to create designs in the round were already practiced in other media, including in painting ceramic vessels, which had been common for millennia prior to the Uruk period, and carving designs on stone vessels, which (re-)appeared around the same time as cylinder seals.[22] For cylinder seals, however, the phenomenon of designing in the round extends beyond their production to their use as well: where to place the seal when starting to roll it is not obvious, and a seal can, in principle, be rolled as far as the extent of the sealed medium allows. Hans Nissen has proposed that the introduction of cylinder seals was a response, among other things, to the need to more effectively cover the surface of a sealing with an impression – for example, a sealed clay tablet – than was easily possible with a stamp seal.[23] Producing an impression with a cylinder seal also requires mastering the technique of rolling it and at the same time maintaining a constant pressure if the motif is to be transferred clearly – legibly – to the sealing.

The connection between cylinder seals and repetitive reproduction has yet another dimension to it. A striking feature of Uruk cylinder seal motifs is the diversity and type of designs carved on them. In fact, there are almost no two identical scenes, although similar structural principles were followed in composing seal designs. For the first and almost the only time in the history of Mesopotamian sealing practices, scenes of people working – whether in a ritual context or in one of daily work – form a substantial part of the repertoire. Many of these scenes also show people engaged in highly repetitive and often hierarchically organized scenes, often involving work.[24] In other words, not only do the properties of the seals themselves – the possibility to transfer the images on them by rolling – place an emphasis on endless repetition, but many of the motifs they transfer onto sealings are themselves characterized by repetitive actions, thereby linking form and content. The primary exceptions are those scenes in which a bearded figure

21 Moortgat 1982, 34.

22 Carved stone vessels were used in Neolithic times, for example at Körtik Tepe and Hallan Çemi in eastern Turkey (Rosenberg 1999; Özkaya and Coşkun 2009).

23 Nissen 1977.

24 See Pollock and Bernbeck 2000, Fig. 13.2.

Fig. 2 Alabaster cylinder seal and modern impression, showing two standing figures facing each other. The figure on the right holds the reed bundle that is the symbol of the goddess Inanna, the one on the left wears the characteristic skirt of the *Mann im Netzrock*.

wearing characteristic attire and widely identified as the depiction of a leader is shown engaged in activities that can be interpreted as politico-religious in character (Figs. 2 and 3) as well as some scenes involving what I have elsewhere referred to as "genderless figures".[25] In other words, once again the emphasis on repetitive action does not hold for those in the highest sociopolitical sphere.[26]

Fixed hierarchical relationships among people are also emphasized in the so-called Standard Professions List, a text containing approximately 100 different professions that are listed in apparent order of importance.[27] This list was copied over and over for several hundred years after its first attestation in the Late Uruk period, apparently serving both to train scribes and to fix – by sheer repetition – a particular understanding of social relations. Here the practical repetition of labor shown on the seals is converted into a structural repetition of similarly graded or ranked professions.

Carving on the convex surfaces of objects is also attested in Uruk times on stone vessels, which became quite common in later Uruk times, and of which the most famous

25 See, for example, Pollock and Bernbeck 2000, Fig. 13.3.

26 Pollock and Bernbeck 2000; Pittman 1994.

27 Nissen 1988, 80–81; Englund and Nissen 1993.

Fig. 3 Cylinder seal and modern impression depicting the *Mann im Netzrock* feeding animals in a ritualized scene.

and one of the most intriguing examples is the so-called Uruk Vase (Fig. 4). Carved on this one-meter-tall limestone vessel is a fascinating scene of idealized hierarchy extending from plants and animals to men of different social categories and up to the goddess Inanna.[28] In all but the uppermost register, motifs are repeated, from plants to animals to men bringing offerings, with differentiation primarily in the specific products carried by the men. Only in the top register, which depicts the leader, his attendants, and the goddess Inanna do we see a part of a scene in which repetition plays only a minor role.

The cylinder seals and the Uruk Vase were part and parcel of an enormous expansion in durable imagery in the Late Uruk period. More important than just the sheer quantity of images, however, are their content and form: many of them include a particular kind of novelty, in the form of images of people in relation to one another, something that was almost completely absent earlier in Mesopotamia. By virtue of being carved into vessels or seals, the relationships depicted among people and between people and animals became literally fixed in stone (or other durable materials). If that were not enough, the composition of the scenes and the way in which cylinder seals were used emphasize the incessant repetition and reproduction of those relationships as transferred to a new medium, the sealing. In this way, along with a massive increase in the diversity of images

28 Winter 2007, 125–131.

Fig. 4 The Uruk Vase, divided into registers showing, from bottom to top, stylized water, a row of plants followed by one of animals, a series of naked men bearing filled vessels, and at the top the *Mann im Netzrock* and his attendants bearing gifts to a figure who represents the goddess Inanna or her priestess. – Plaster cast; original in The Iraq Museum, Bagdad.

and in the form, size, and materials of the carriers of those images (primarily cylinder seals), the political and social messages they disseminated were carefully channeled and fixed by sheer force of repetition. And that repetition shows, in many cases, people at work who have little control over their conditions of labor.

3.4 The medium of cloth

I turn now to my final example, that of cloth. The massive growth in the textile industry that went hand-in-hand with the use of wool as the fiber of choice is often considered characteristic of the 3rd millennium Mesopotamian economy,[29] but it is an innovation that can be traced back at least to Late Uruk times. Although there is little question that the large-scale adoption of wool brought with it fundamental changes in labor as well as in the use of cloth, it should be stressed that as in the case of cylinder seal production, there are few indications of innovations in the technology of textile production that involve the invention or adoption of new tools or techniques. Rather, it is the novel combination of already existing technologies that is responsible for the innovative consequences of woolen textile production.

A variety of evidence, including the composition and age profiles of animals, imagery, and written texts, points to the late 4th millennium as the time in which the production of woolen textiles became a major element in the Mesopotamian economy.[30] Prior to the appearance of sheep bred specifically to produce wool, flax was the major source of fiber suitable for producing woven textiles. Joy McCorriston has argued that the transition from flax-based to woolen textiles brought with it a fundamental change in labor requirements: whereas growing flax necessitates access to prime agricultural land, raising sheep for wool can easily be done in areas of poorer soil; moreover, tending flocks requires fewer people than working fields.[31] The extraction of usable fibers from flax and readying them to be spun are also more labor-intensive activities than the comparable tasks for wool. An outcome of the switch in emphasis to woolen cloth is that by the late 3rd millennium, if not earlier, linen garments came to be reserved for kings and deities.

Not only do fiber sources undergo a major change sometime in the later 4th millennium, if not before, but the sheer quantity of textiles produced also seems to have grown substantially. Judging by depictions of spinning and weaving on cylinder seals, as well as mentions in early written texts, cloth production formed a major part of the political as well as the domestic economy, growing into what can quite reasonably be called an industry.

Elizabeth Barber has made the provocative proposal that in temperate regions clothing was used only to a minor extent prior to the 4th millennium BCE.[32] The basis for her assertion – that people are often depicted naked – is not without problems.[33] Indeed, the

29 Waetzoldt 1972; Zagarell 1986; R. Wright 1996; McCorriston 1997.

30 Pollock 1999, 93–110.

31 McCorriston 1997.

32 Barber 1999, 118.

33 It may have more to do with the contexts of representation than with actual everyday practice.

relatively widespread distribution of small quantities of spindle whorls and other textile-related tools in Ubaid (5th millennium BCE) times points to small-scale household-based production of cloth.[34] However, Barber's point remains worth contemplating, drawing attention to the fact that the production of cloth and wearing of clothing is not something that can be simply taken for granted as an everyday phenomenon for all people.

Both spinning and weaving require enormous investments of time, not to speak of the labor involved in the extraction and preparation of fibers in the first place. Judging by depictions on seals as well as mentions in texts, the wool-based textile industry of Late Uruk times employed large numbers of people and was organized in a highly structured, hierarchical fashion. The specialization of tasks heightened the repetitiveness of textile production, as seal images graphically highlight. In addition to repetitiveness, the spinning of thread and weaving of cloth share with other Uruk spheres of activity the potential for almost limitless continuity. Thread can be prepared – spun and dyed – and stored indefinitely for later use, allowing productive tasks to be cut up into small segments. This is of particular relevance in the case of quasi-industrial production, as it means that the manufacture of cloth could be disengaged from rhythms of labor that were centered around domestic tasks and seasonal patterns of resource availability.

Fibers can be spun into thread of any desired length, limited principally by the amount of fiber available. The length of a woven cloth is in turn dependent on the size of the loom and the length of the warp thread. Garment length seems to have carried special significance in Uruk times. On the Uruk Vase, the principal human figure, the so-called *Mann im Netzrock* who is usually identified as a politico-ritual leader, wears an ankle-length garment with a long tassled train. The *Netzrock*, more clearly seen on a variety of seal depictions (cf. Fig. 3), is itself a piece of clothing that is distinguished by its unusual woven structure. Although we lack the detailed descriptions of types of cloth that are known from late 3rd millennium Mesopotamian texts, the Uruk-period depictions point clearly to the social importance of garments that were elaborated in terms of length and woven patterns and thereby distinguished from the more ordinary forms of cloth. The typical garments worn by workers are less well known, although depictions in working scenes on seals indicate that they were simple, unelaborated forms.[35] Here, once again, is a context in which the emphasis on repetitive work – the spinning of fiber and weaving of cloth – also became the basis from which to produce elaborate forms of clothing that distinguished certain kinds of persons from others.

Another important element of textile production, but one that has received much less attention, is the incorporation of color into cloth. In cases in which archaeologists and art historians have examined the use of color in Mesopotamia, for example in the

34 Pollock 1999, 83–86; Sudo 2010.

35 For example, Boehmer 1999, 140, Abb. 120 e–h, k–l.

form of jewelry, there is good evidence that specific colors and color combinations, as well as particular properties of color such as luster, were highly valued.[36] Although the use and presence of colors of all sorts form an unquestioned backdrop to our contemporary lives, obtaining and maintaining color in the ancient world was often a difficult undertaking. Raw materials come in various colors, but transferring them to other objects is more of a challenge. Textiles are a case in point. Barber and others have observed that flax, which is an off-white color naturally, does not easily take permanent dyes.[37] Wool, however, does: in the first place, it comes naturally in a variety of colors, but more importantly it absorbs dyes relatively easily, and the acids present in the raw wool help to fix those dyes permanently. The process of weaving allows color to be applied to a finished cloth in a variety of ways. While it is possible to dye an entire piece or apply color or a design by stamping it onto a fabric, weaving different colored thread into cloth offers the possibility of controlled incorporation into the very fabric of the material being produced as well as elaboration of pattern. The use of dyed thread in order to weave a colored design results not only in greater control of the outcome but also a greater degree of repeatability of the product, as choice of color schemes can be made prior to beginning to weave. Perhaps what we see as a net-like pattern on the skirt of the *Mann im Netzrock* is an indicator of the use of multiple colors in a garment?

4 Conclusion

In each of the realms considered here – the production and use of pottery, the construction of buildings, the making and use of durable imagery, and textile production – the emphasis on pervasive repetition via increasingly mechanical forms of production, often subsumed under the archaeological rubric of 'craft specialization', is apparent. These repetitive actions were also accompanied by – and themselves often productive of – diversity (Tab. 1).

When Benjamin wrote about new art forms and their reception by the masses, he expressed the hope that they would lead to "a tremendous shattering of tradition"[38] that would further the revolutionary potentials of mechanically (re)produced artworks in the hands of the masses. As is so often the case, the Uruk example does not so clearly lead in this direction: rather, the examples explored here point to the ways in which an elite class increasingly appropriated for its own benefit the potentials of repetitive labor in order to promote a diversity of products that could be used as expressions as well as mechanisms of control and repression. In Uruk Mesopotamia mechanical reproduction

36 Barber 1999; Winter 2010, 293.
37 Barber 1999, 118.
38 Benjamin 1968 [1936], 221.

Sphere	Repetition	Diversity
Pottery	Forming techniques; use of beveled rim bowls for rations	Repertoire of vessel forms
Building construction	Uniformity of brick building blocks	Special 'public' buildings
Seals and sealing	Rolling as means to transfer design; actions within scenes depicted	Materials, sizes, elaboration of seals; content of scenes
Textiles	Production steps (spinning, weaving) at an 'industrial' scale	Elaboration of cloth: differences in weave, length, color

Tab. 1 Repetitive actions and diversity in spheres of production and use.

and repetitiveness in work routines seem to have meant drudgery, alienation, and discipline for the masses, a diversity of material forms and their elaboration for (consuming) elites, and probably some modicum of creative possibilities for the artisans who produced and/or conceptualized objects such as cylinder seals or major buildings.

The story does not, however, end there. Mesopotamian archaeology has, on the whole, shown a stunning disregard for investigating the ways in which ordinary people – those who did not belong to elite classes – positioned themselves within their changing worlds. Instead, narratives have devoted attention primarily to the spectacular and novel, the so-called works of art, and with that an implied – if not explicit – orientation to the perspective of the elite consumers who benefited from this new regime. The lot of the masses, whose possibilities for self-expression and realization were for the most part radically curtailed, is thereby minimized,[39] along with the central role of new forms of labor and laborers whose work contributed in no small measure to creating many of the material elements – and with them the immaterial ones – of the emerging 'civilization'. To an even lesser extent has the possibility been considered that the artisans and laborers made creative and potentially subversive use of the outcome of their age of mechanical reproduction.

39 But see Bernbeck 2009.

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Constance von Rüden

Producing Aegeanness – An Innovation and Its Impact in Middle and Late Bronze Age Syria/Northern Levant

Summary

In the second half of the 18th Century BCE Yarim-Lim of Alalakh gave instructions to decorate his palace with wall paintings. Instead of following the inner-Syrian or 'Mesopotamian' tradition of *al secco* painting on dark mud plaster, he decided in favor of a technical and iconographical innovation known from the Aegean, a bright, shiny lime plaster with a griffin as a depiction. Later, similar decorations appeared in palaces and houses in Syria and beyond. My paper analyzes why this technical and social innovation was successful within the local life world. Secondly, it takes a closer look at the impact of the murals by exploring the use and meaning of Aegean-related motifs in the following centuries and the production of a Levantine Aegeanness in different media of expression.

Keywords: Wall painting; Alalakh; Qatna; Aegeanness; fresco technique.

In der zweiten Hälfte des 18. Jahrhunderts BCE gab Yarim-Lim von Alalakh Anweisung, seinen Palast mit Wandmalereien zu schmücken. Statt innersyrischer oder ‚mesopotamischer' Tradition von al secco-Malerei auf dunklem Lehmputz zu folgen, entschied er sich für eine technische und ikonographische Innovation der Ägäis, einen hellen, glänzenden Kalkputz mit einer Greifendarstellung. In der Folge treten ähnliche Wandverzierungen in Palästen und Häusern in Syrien und darüber hinaus auf. Mein Beitrag analysiert, warum diese technische und soziale Innovationen in einer lokalen Lebenswelt erfolgreich war. Zweitens werfe ich einen genaueren Blick auf die Auswirkungen der Wandmalereien, indem ich auf die Verwendung und Bedeutung der ‚ägäisierenden' Motive in den folgenden Jahrhunderten eingehe und die Herstellung einer levantinischen ‚Aegeanness' in anderen Medien untersuche.

Keywords: Wandmalerei; Alalakh; Qatna; Aegeanness; Freskotechnik.

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The expression 'producing' in the sense of producing a certain image of a culture is borrowed from the book *Archaeology and European Modernity. Producing and Consuming the 'Minoans'* (Hamilakis and Momigliano 2006). Aegeanness as a term was used the first time by Marian Feldman to describe the appearance of wall paintings of Aegean type in the Levant as an element of the reinvention of the Northern Levantine kingdoms. The term is borrowed from her article, but is used here in a slightly different and extended way. I want to thank the editors of the volume, Stefan Burmeister and Reinhard Bernbeck, as well as Yannis Hamilakis, Johannes Becker and the reviewers for their helpful support, the numerous fruitful hints and inspiring ideas they were generous enough to share with me for the improvement of this paper.

1 Introduction

In the first half of the second millennium BCE Yarim-Lîm of Alalakh or one of his successors must have given instructions to his officials to decorate his recently built palace in the northern Levant with wall paintings. However, he did not follow what we consider to be the common inner-Syrian or 'Mesopotamian' tradition of *al secco* painting on often darker mud or quickly drying gypsum plaster[1]; he decided in favor of some Aegean-related technical and iconographical innovations and furnished at least parts of the upper floor with bright, shiny lime plaster upon which plants, a bucranion and a griffin were depicted (Fig. 1).[2] In the following centuries, similar decorations appeared in palaces and houses in Syria and the Levant. Examples include the approximately contemporaneous paintings of the palace of Tel Kabri in the Southern Levant;[3] the ones at Tell el Dabʿa in the Eastern Nile Delta, dated to around 1500 BCE – a centre which was strongly politically, economically and culturally interrelated with Western Asia;[4] the paintings at the royal palace of Qatna in western Syria,[5] whose find context is dated to the middle of the 14th century BCE, and at the same site eventually also the ones that

1 Next to *secco* paintings on mud plaster there are also examples of paintings on bright gypsum in Mari, see Parrot 1958.

2 Woolley 1955, 228–235; W.-D. Niemeier 1991; W.-D. Niemeier and B. Niemeier 1998b; W.-D. Niemeier and B. Niemeier 1998a; W.-D. Niemeier and B. Niemeier 2000.

3 W.-D. Niemeier 1991; W.-D. Niemeier and B. Niemeier 1998b; W.-D. Niemeier and B. Niemeier 1998a; W.-D. Niemeier and B. Niemeier 1999; W.-D. Niemeier and B. Niemeier 2000; W.-D. Niemeier and B. Niemeier 2002; for an even earlier dating of the Kabri paintings see Cline, Yasur-Landau, and Goshen 2011.

4 Bietak 1992; Bietak 1994a; Bietak 1994b; Bietak 1995; Bietak 2000b; Bietak 2000a; Bietak 2005; Bietak and Marinatos 1995; Bietak and Marinatos 2003; Bietak and Palyvou 2000; Bietak, Marinatos, and Palyvou 2000; Bietak, Marinatos, and Palyvou 2007.

5 Rüden 2011.

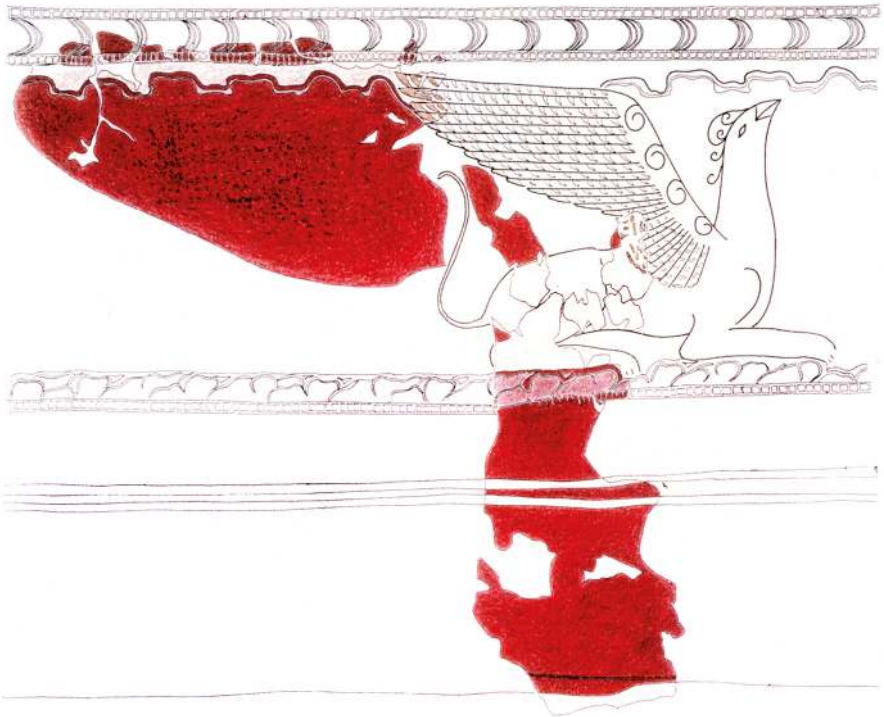

Fig. 1 Reconstruction of the Griffin of Alalakh VII by Niemeier and Niemeier.

decorated the Lower-Town-Palace;[6] the murals of a house from a later period in Alalakh (level IV) and possibly some fragments from temple 9 in Hattusha-Bogazköy (Fig. 2).[7]

The fresco-secco technique used to execute these paintings is a very sophisticated one, a complex interplay of various technical knowledges, which are not necessary for the *al secco* paintings. While *secco* paintings are produced using a binder on dry mud or gypsum plaster, these paintings need to be at least partially executed on moist lime plaster, resulting in a whole series of specific technical solutions and their involved human skills: a person executing this way of painting needs to know the right composition of lime plaster and ideal plasticity in the different stages of processing, the possibilities to apply the plaster to the wall, the different kinds of surface preparation with string lines, incisions, circles or any other kind of preparatory means, and he or she needs to be aware of the right moment to paint and burnish the plaster's surface.[8] Many aspects of such a work flow rely to a large extent on the embodied knowledge of the craftsperson. A

6 Luciani 2006, 17 fn. 13.

7 Neve 1993, 26 fig. 75.

8 Brysbaert 2002; Brysbaert 2003; Brysbaert 2007b; Brysbaert 2007a; Brysbaert 2008.

Fig. 2 Map of the Eastern Mediterranean.

spatial distribution of these techniques and the adaption of the technical innovation of fresco painting is hence only possible by direct contact between people of the Aegean and Western Asia, either through travelling craftspeople or through an intensive and longer lasting craft interaction – which allows a mimicking of the process in context of an apprenticeship.[9] Even though many aspects of these techniques seem to be better known from the material culture of the Aegean, it is certainly premature to argue for a simple one-way distribution of these techniques from the Aegean to the Levant. That this is hardly ascertainable is shown, for example, by some technical features of the recently found murals with 'Egyptianizing' and not 'Minoanizing' iconography from the early Middle Bronze Age building of Tall Burak in today's Lebanon whose technique has been considered by Jens Kamlah and Helen Sader as a preliminary stage to fresco painting due to the string impression visible at their surface.[10] The use of string impressions as a preparatory means to organize the moist plaster surface can be usually observed

9 Bietak 1992; Bietak 1994a; Bietak1994a; Bietak 1995; Bietak 2000b; Bietak2000a; Bietak2005; Bietak and Marinatos 1995; Bietak and Marinatos 2003; Bietak, Marinatos, and Palyvou 2000; Bietak, Marinatos, and Palyvou 2007; Bietak and Palyvou 2000; Brysbaert 2002; Brysbaert 2003; Brysbaert 2007b; Brysbaert 2007a; Brysbaert 2008; W.-D. Niemeier 1991; W.-D. Niemeier and B. Niemeier 1998b; W.-D. Niemeier and B. Niemeier 1998a; W.-D. Niemeier and B. Niemeier 1999; W.-D. Niemeier and B. Niemeier 2000; W.-D. Niemeier and B. Niemeier 2002; Rüden 2011, 111.

10 Kamlah 2010, 96–97; Kamlah and Sader 2010, 109.

in fresco technique and are at least not necessary in an execution *al secco*.[11] Another example of a similar early evidence of string impressions can be identified above and below the lines framing the well-known running spirals on a pedestal in Mari, which is now visible for the first time thanks to a very recently published colour photograph by Robert Koehl.[12] Observations like this make evident that the processes underlying such a technical interrelation are far more complex than we had thought before. Yet surely we can consider the painting's techniques and iconography as linked to the Aegean even though the exact nature still remains obscure.

However, the appearance of the fresco-related techniques in the Levant, the way they have been spatially transferred and locally adopted are just one side of the innovation 'fresco painting'. The other side is the murals' design as an at least partially new form of artistic expression. Of course both aspects are closely interrelated, and none of them should be considered as primary or secondary. Moreover, the paintings should be regarded as a materialization of these tightly interwoven social practices – and to reveal the innovations in these social practices will be the aim of the paper.

In the following part I will act from the assumption that the wall paintings were mainly desired because of their visual appearance and not primarily because of any technical advantages in a modern sense of a rational technological progress. Of course their sophisticated manufacture would have conferred additional value, but more in the sense of a maybe secret or magical procedure whose execution was restricted to a specific group of people. Apart from the executing craftsperson, most of the people were experiencing the wall paintings on a visual and perhaps haptic level. I will thus concentrate on the phenomenological aspects of such a novelty, by exploring two crucial questions.

I analyze why this innovation was successful; how could Yarim-Lîm's desire for such a change have emerged in the local lifeworld[13] of western Syrian society? Therefore, the focus will be on what is called in innovation theory the threshold for adapting innovations.[14] Secondly, I take a closer look at the possible impact of Aegean or Aegean style objects on local seeing habits and the ascription of their meanings. I do this by investigating the use of Aegean forms and motifs in the local material culture; in other words, what I shall describe later as the production of Aegeanness in various media of expression. The term "seeing habits" can here be best understood in the way Bourdieu de-

11 In Egypt colored imprints of strings are used to subdivide the surface with the help of a raster in a secco technique, but these are not impressing the gypsum plaster.

12 Koehl 2013, 173, fig. 4. I am very thankful to Robert Koehl who was so kind to discuss with me this aspect and to send me the photograph which indeed permits one to see even the typical imprint of the impressed string.

13 Lifeworld is meant here as the taken-for-granted, unquestionable and intersubjective background of daily life, first used as an analytical category in sociology by Alfred Schütz (Schütz 1974) and later developed in *Theorie des kommunikativen Handelns* by Jürgen Habermas (Habermas 1981, 192).

14 Granovetter 1978.

scribes the "cultivated ability of art perception", even though seeing habits are of course not restricted to images alone, but can be extended to all cultural objects.[15] For Bourdieu "any art perception involves a conscious or unconscious deciphering operation." For him it is

> an act of deciphering unrecognized as such, immediate and adequate 'comprehension', which is possible and effective only in the special case in which the cultural code which makes the act of deciphering possible is immediately and completely mastered by the observer (in the form of cultivated ability or inclination) and merges with the cultural code which has rendered the work perceived possible.[16]

As a conscious or unconscious 'cultivated ability' it has, similar to Bourdieu's habitus, a certain persistence, but nevertheless new experiences have an impact on it and can change the individual and communal seeing habits.

Obviously we are not dealing with the development and distribution of a 'primary innovation' – several aspects of the iconography I am focusing on in this paper were widespread in the Aegean since around 2000 BCE before they reached Western Asia. It is therefore not possible to describe its appearance with Rogers' linear concept of the distribution of innovations.[17] He generally describes the emergence of innovations within broadly the same society as an organic development within a local process. Out of local social needs and preferences, by acceptance or refusal of different stages of the inventions, a local society or parts of it become involved in such a development – both society and innovation are usually entangled during this process. This involvement keeps the threshold for the later broad acceptance of an innovation lower than would be the case within societies which are not involved in these processes, for example if new ideas and inventions are introduced from outside. In the latter case the invention needs to hit randomly the social needs of the group. This is not an easy task, as can be shown by one of Roger's case illustrations about the attempt to introduce water boiling as health prevention in a Peruvian village.[18] There, most of the people refused to boil water not out of functional reasons, but because the village norms consider it as culturally inappropriate to boil water. Hot water is associated with illnesses, and therefore only ill people are allowed to drink boiled water. The practice of boiling water in everyday life, as it has been developed in other societies, is therefore not compatible with their values and beliefs and has been mostly rejected.[19]

15 Bourdieu 1993, 216.
16 Bourdieu 1993, 215. For these fruitful hint I am very grateful to Johannes Becker.
17 Rogers 2003.
18 Rogers 2003, 1–5, based on a study by Wellin 1955, 71–103.
19 Rogers 2003, 1–5.

Fig. 3 Bridge-spouted jar from Byblos, Camares ware.

We can assume similar difficulties in our present case of Aegean-influenced wall paintings in the Levant. Certain aspects of the way the walls have been decorated in *fresco-secco* with what we categorize to a certain extent as Aegean motifs was apparently transferred to the northern Levant. The local population was not involved in the original development of this means of visual expression. In the process of their integration, the wall paintings have been of course locally transformed. These modifications are not restricted to the more obvious technical, iconographical or spatial adoptions; rather, they extend to a modification in regard to their specific local meaning, surely different from an Aegean one. Due to the fact that the populations of both regions, even if they might have been in contact, were surely not sharing the same lifeworld, the process of adoption in Syria must have inevitably resulted in a different ascription of meaning. Such a process of adoption can be considered a local reinvention. This cross-cultural transfer of an innovation leads to a higher threshold for its wider acceptance and makes its spread a difficult task. Why should a Levantine ruler abandon local ways of decorating architectural space in favor of an 'Aegean style' fresco painting? The innovation must be linked to specific social circumstances and already existing needs which I investigate in the following section.

Fig. 4 Camares-cup from Sidon.

2 Producing Aegeanness

To understand Yarim-Lîm's choice of such a design we have to include written sources as well as other materials that might shed some light on the perception of Aegean-related objects and styles within the local lifeworlds of the Levant. Singular imports from the Aegean had already reached Syria and the Levant during this time. Some Middle Minoan cups and few bridge-spouted jars of Kamares type were found in various locations of the Levant (Figs. 3, 4).[20] Similarly, some metal vessels of possible 'Minoan' origin were deposited in the tombs of Byblos.[21] Their contexts and therefore their local meanings are often difficult to evaluate, but mostly they have been found in the surroundings

20 Ḫariği: Buchholz 1974, 398–399, 437; Warren and Hankey 1989, 134–135, pl. 12A; Ugarit: Schaeffer 1948, 22, pl. XII, 25; Schaeffer 1949, 256, fig. 109, pl. XXXVIII; Merrillees 2003, 128, fig. 1, pl. 1a, 130–131, pl. 1b; MM IIA cup: Merrillees 2003, 130, fig. 2–3; for some further fragments see summary in Sørensen 2009, 45, Ug 4–8; Qatna: Smith 1965, fig. 20c; Du Mesnil du Buisson 1926, 325, fig. 41; Byblos: Deep cup or bowl (MM I): Schaeffer 1948, 66, fig. 74, I; Dunand 1937–1959, pl. CLXIV nos. 4170, 1939a, 311 no. 4170; two Kamares cup without context: Merrillees 2003, 132, fig. 4, 5; two Kamares cups of niveau II: Schaeffer 1948, 71; for a summary of earlier possible findings from Crete see Sørensen 2009, 11–12; furthermore see two bridge-spouted jars (MM I–IIB, MM I–IIIA): Merrillees 2003, 131–132, 135 (tomb); Schaeffer 1948, 66–67, fig. 74, 2–4; Sidon: Doumet-Serhal 2003, 12–13; 2008, 21, 31, fig. 29, 33, figs. 32, 34, fig. 33; see furthermore a fragment of a possible bridge-spouted jar: MacGillivray 2011/2012; Southern Levante/Egyptian Nile delta: Grace 1940, 10–11; Kemp and Merrillees 1980; Merrillees 2003; Stewart 1963, 197–200, pl. 7.

21 Summarized in Sørensen 2009, 39–40, cat. nos. Bb 11–17.

Fig. 5 Find-context of the Camares-cup from Sidon.

of palaces, or in case of the metal vessels even in the royal tombs of Byblos.[22] Such find locations are usually related to the upper class.[23] Furthermore their shapes can be associated with feasting habits,[24] and an exceptional find from Sidon may even give us some ideas about their specific use context in the Levant (Figs. 4, 5). On a thick white plaster floor next to an earlier warrior burial, a 'Minoan' cup was found inverted on top of a heap of animal bones composed of the meat-bearing bones of an adolescent goat and two young sheep, most probably the remains of a funerary feast.[25] In addition, another four Kamares cups have been found in the context of Middle Bronze Age tombs in Ugarit where a similar use as funeral feasting vessels should be considered.[26]

The emergence of these vessels in western Asia brings up questions about the nature of contact to the Aegean during this period. In this regard, a text from the site of Mari on the Middle Euphrates gives us some hints. In connection with tin trade, the text mentions a man from Kaptor, usually considered to be the island of Crete, at Ugarit.

Transliteration:
1^{+} x/3 ma-na an-na a-na kap-ta-ra-i-im
1/3 ma-na an-na a-na lù ta-ar-ga-ma-an-nim ug-la [dam-gà]r k[a]p-ta$^{!}$-ra-i i-na ú-ga-ri-tim^{ki}
(Archives royales de Mari 23, 556: 28–31)

Translation:
Une mine x tiers d'étain pour l'Homme de Crète;
un tiers d' étain pour l'interprète, chef de marchands crétois
(Durand 1990, 40, no. 3)

22 Montet 1923, 336.

Guichard considers the appellation "l'Homme de Crète" as more than an "ethnic" term. He interprets it to mean a prince or ruler of the island.[27] Furthermore, the text mentions the Cretan chief trader in Ugarit as a translator, which might even hint at a possible Cretan *karum* – a trader consortium in Ugarit.[28] At any rate, we can say with relative certainty that Cretans were known in Syria and the aforementioned items could have been imported directly, not via middlemen or down-the-line trade.[29] However these contacts were surely not as frequent and intensive as with other, closer regions of the Eastern Mediterranean. If the perception of Kaptor in a later text from Ugarit can be assumed also for the Middle Bronze Age, Kaptor was considered to be far away (*[Kaptor] is indeed far, O Gods*).[30] The appearance of people from far beyond the coastal Mediterranean of the Levant must have inspired a certain imagination and possibly led to the ascription of exoticism or mystery to the Cretans in Syria. The handling of 'Minoan' objects seems to be restricted to the upper class, but except for the cup from Sidon, specific practices associated with them can rarely be identified in the archaeological record. They can be associated with feasting and drinking habits in a broader sense, but a more precise evaluation of their local perception or even the regions they came from is difficult. Following the writings of Mary Helms on the cultural anthropology of trade,[31] Bernhard Knapp assumes that imports were generally regarded as increasingly valuable, the more distant their places of origin were within the Eastern Mediterranean.[32] This is a possible consideration for these findings. However, I will demonstrate in the following that people in the Levant linked these items more specifically to Crete or what they considered to be Cretan, and not generally to any nonspecific exotic place.

Some further texts from the Mari archives mentioned above list objects associated with the name Kaptor: two of the earlier texts, probably from the time of Yahdun-Lîm[33], list three shoes and six gold bowls as "Kaptorian"/Cretan.[34] Another 31 texts from the time of the last king of Mari, Zimri-Lim mention shoes, leather belts, possibly textiles,

23 Despite its industrial and capitalistic connotation, class is used here as an analytical term in its Marxist definition. In my point of view it rightly emphasizes the importance of the economic base for the quite rigid hierarchies of the palatial societies and the role people have within the system of production, whereas the more fluid idea of an elite does not necessarily rely on an economic base.

24 Dietler 2001.

25 MacGillivray 2003; MacGillivray 2008b; MacGillivray 2008a, 188; Doumet-Serhal 2008, 21–22.

26 Necropolis between Baal and Dagan temple: Schaeffer 1948, 22, pl. XII, 25; dromos of tomb 86: Schaeffer 1949, 256, fig. 109, pl. XXXVIII; possibly from an ossuary below Tomb 36: Merrillees 2003, 130, fig. 2–3; Tomb 36, ossuary below clay floor: Schaeffer 1939, 22, 54–56, fig. 43–44; for further literature see Sørensen 2009, 44–45, cat.-nos. Ug 01–03, 05.

27 Guichard 2005, 162, fn. 8.

28 Cline 1995, 273; Guichard 2005, 162.

29 Renfrew 1975.

30 Keilalphabetische Texte aus Ugarit (KTU) 1.1 III: 18. For the completion see Dietrich, Loretz, and Sanmartín 1976, 7, note 1.1 III (5).

31 Helms 1988, 261–263.

32 Knapp 1998, 195.

33 Guichard considers it as at least before the reign of Zimri-Lim and most probable during the reign of Yahdun-Lîm.

34 Guichard 1993, 44.

gold and silver vessels as well as weapons.[35] Their designation as "Kaptorian" does not tell us whether they were actually produced on Crete or whether they were of Cretan style only. However, it is obvious that these objects were regarded as highly valuable. Not only because of their precious materials such as gold, silver or lapis lazuli, nor alone for the fact that some of them received special care, which is evident due to the description of a specific box that was used for the safekeeping of a "Kaptorian" weapon.[36] In trying to understand the social meaning of these objects, the gold and silver vases are of particular interest. Some of them had been exchanged as gifts between Mari, Carcemish, Babylon and Aleppo – the most prominent example is sent in the frame of a royal gift exchange to Hammurabi of Babylon.[37] The fact that these vessels had travelled long distances as royal gift items gave them additional meaning and prestige[38], a prestige which is therefore associated with Kaptor.

The desire for such objects is also evident in another text that deals with servants of the king of Mari who were especially sent to Yamhad (Aleppo) to buy three gold vessels. It might be of interest that the text describes their decoration as containing a bird and floral motifs[39] which could indeed reflect Minoan iconography.[40] It is very tempting to relate these descriptions and the labeling of items as "Kaptorian" to the 'Minoan' imports in the archaeological record or for example to some of the above-mentioned metal vessels from the royal tombs of Byblos. Yet we have to admit that some objects were also called Cretan even though they were clearly manufactured in Mari itself: another text mentions a Cretan boat that was produced on the Euphrates.[41] It is unclear whether this object is to be considered a real means of transport or a kind of votive, but surely it would have been a luxurious item because the text describes it as decorated with about 10 kilograms of lapis lazuli. Obviously, for the people of Mari it was not of great importance whether these objects really originated in Crete or were locally produced – this question seems to be more important to modern archaeologists –, but clearly these objects were associated specifically with "Kaptor", which is either the island of Crete or more generally the Aegean. The fact alone that these objects were included in an inventory list of the palace shows their relevance, but their prominent social value is clearly enhanced by the involvement of some of the vessels in one of the most important diplomatic rituals: the royal gift exchange.

If they were involved in the royal gift exchange they were probably displayed in a performance and exposed in an at least partly public ritual which implies an inten-

35 For a summary see Sørensen 2009, tab. 1–2.

36 Guichard 1999, 171; Archives royales de Mari 23, 104: 30.

37 Guichard 2005, 208.

38 For the Late Bronze Age, see Liverani 1990 or for an anthropological example and the accrual of stories associated with these items, see Mauss 1994.

39 Guichard 2005, 208–209, no. 184–4, no. 237–9.

40 Guichard 2005, 208–209.

41 "20 mines (10 kilo) de lapis-lazuli: j'ai reçu d'Iddiyatum, lorsqu'on fait la barque crétoise", seal of Mukannišum, translated by Guichard 2005, 162–163.

sive human-object interaction. For a smaller fraction of the participants, this interaction would have been even tactile, although most of the participants were mere spectators with a visual experience only. This must have happened during a highly official, royal diplomatic act and probably also later in case the objects were exhibited in the palace to display the far reaching social networks of the king of Mari. Within these performances people repeatedly experience the shape, surface appearance and motifs of the metal vessels associated with a meaning of high social value in the context of interregional contacts. Through these practices, such objects were incorporated into the local elite lifeworld; a process which will have a conscious or unconscious impact on the local seeing habits as described above.

In contrast it is more difficult to understand the role of Kamares pottery in their archaeological context. There is no evidence that these vessels seem to be of great importance in the royal gift exchange and the inventory lists of the palace. The 'Minoan Cup Assemblage' from Sidon mentioned above is evidence for their use and display in a feasting event in a burial context. Consequently the burial ritual is another public practice in which 'Minoan' vessels had been involved. In experiencing the ritual, the participants might have ascribed a specific, perhaps magical meaning to the vessel, and by doing so its visual perception again entered the local seeing habits of the involved group. Obviously, these objects must have left a deep impression on the perception of the local societies. Their incorporation into local public spheres even seem to have resulted in changes in the local material expression: for example, clay imitations of Cretan vessels have been detected in Ugarit.[42] Additionally, at the time when Yarim-Lîm decorated his palace with at least partially 'Aegean style' wall paintings, single motifs of these vessels also found their way into the local iconographic repertory. Some seals of palatial officials from Alalakh, Carcemish and Ugarit show clear influences of the Cretan material culture: as Dominique Collon already pointed out, the officials adopted the festoon motifs of the Cretan Kamares ware into their 'personal' iconography (Fig. 6).[43] One of the imports, a Middle 'Minoan' cup from Ugarit, even displays a similar festoon decoration (Fig. 7).[44] Possibly these vessels fulfilled a similar role to the metal vessel, but for a somewhat lower class of the society or wider public still within the palace surroundings. Additionally, the adaption of their decoration can be seen as a materialized memory, when Kaptor vessels were displayed in royal gift exchange and in elite feasting events and hence were incorporated in the local lifeworld and its material expression. Furthermore, other more or less contemporaneous Aegean conventions of representation, for example the flying gallop, were first used during this time in the seals of the

42 Schaeffer 1939, 60–63, fig. 50.

43 Collon 2000, 291, fig. 15, 293. For the example from Alalakh see Collon 1975, no. 164, for Carcemish see Collon 1987, no. 223 and for Ugarit see Amiet 1992, nos. 440–442.

44 Schaeffer 1939, 279–280; Walberg 1981, 14; Collon 2000, fig. 15.

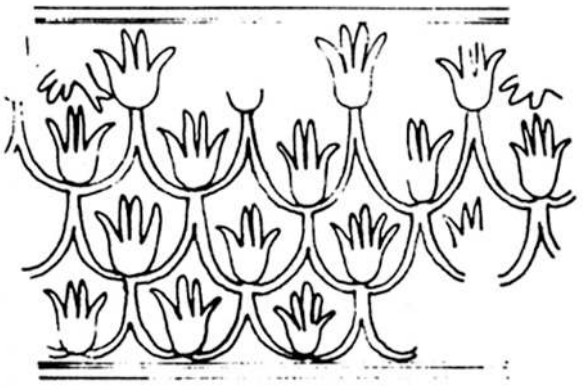

Fig. 6 Seal from Alalakh, layer VII.

Fig. 7 Fragment of a Camares-cup from Ugarit.

same workshop.[45] In general, the use of these 'Minoan' motifs on seals, an important medium to ideologically and bureaucratically represent the identity of the palatial elite, makes their reference to high social status very probable. Their choice of a motif such as the festoons of the Cretan Kamares ware might be a hint that the motif had already established a tradition of its own within the local material culture.

It seems to me that the interaction with objects labeled as 'Kaptorian'/Cretan in the palatial surroundings inspired a desire not just for the objects themselves, but also for their design. The social environment produced their own 'Levantine' Aegeanness as an expression of high status and affiliation with the upper class of society. Such a social constellation in Middle Bronze Age Syria certainly lowers the threshold for an acceptance of further aspects of Aegean/Cretan designs and techniques for the palatial decoration of Alalakh. The social acceptance of Cretan goods and manufacture and their

45 Collon 1975, nos. 111, 122; Collon 2000, fig. 1a–c, 2 and 3–5.

association with a high social status make Yarim-Lîm's choice for Aegean-style paintings comprehensible.

3 Levantine Aegeanness and its impact on the material culture of the upper class

Now we can go back to Yarim-Lim's palace in Alalakh. A person crossing the upper halls of the palace perceives either consciously or unconsciously the unusual design of the wall paintings: the nearly white shiny background of the lime, instead of the darker and duller mud or gypsum plaster; the highly burnished surface, which reflects the light of windows or the flickering fire of lamps, the irregular outline of the landscape instead of the regular half circles of the more 'Mesopotamian' "fish scale" convention, their spiky grass depiction with their parallels to the Kamares pottery[46], and the crouching griffin, well-known in Levantine seal iconography, but possibly with an original Aegean wings design (cf. Fig. 1). Furthermore s/he found her/himself in a royal palace, itself a symbol of power and a space where people from different regions of the kingdom gathered for various events and where foreign delegations were welcomed. No matter if the person was a palace official, a servant or a visitor, he or she would have connected the wall paintings with a certain atmosphere of importance, power and intercultural encounter and therefore a materialized ideology of power. Such an experience reinforced the idea of Aegeanness already produced by the interaction with the Kaptor objects of the Mari texts or the use of 'Minoan' motifs on the seals, the representational medium of the palatial elite. However this spatial experience cannot only be considered a simple perpetuation of the previously known meaning ascribed to an Aegean-related thing; it even exaggerates this idea. In the other cases one was confronted with mobile objects which can be looked at from the outside; they can be easily handled and controlled, fetched and disposed by persons. Now one has to deal with a large-scale, immobile visual means as part of a massive palatial architecture. It entirely encloses the visitor who is completely exposed to the design.

Inaugurated persons, for example some palatial officials, servants and even some visitors, might have been additionally aware of the sophisticated, Cretan-like production process of the paintings, which gave them an additional value. Not only would their appearance possibly have been labeled as Cretan, but so would the craftwork itself. A Late Bronze Age and therefore clearly later text from Ugarit could support my hypothesis. It is a passage of the Ba'al myth, the original version of which is dated to the middle of the

46 Winter 2000, 746; Walberg 1981, 29–32

second millennium BCE.[47] It describes how the goddess Anat received El's permission to build a palace for her brother Ba'al on Mount Saphon and that she should approach for her undertaking the god Kothar-wa-Hussus, who is known for his sophisticated craft skills.

Transliteration:
12. idk.al.ttn
13. pnm tk. Hqkpt
14. il.klh.kptr
15. ksu.tbth.hkpt
16. ars.nhlht
17. balp.šd.rbt
18. kmn.lp'n.kt
19. hbr.wql.tšth
20. wy.wkbd hwt
21. wrgm.lktr
22. wḫss.tny.lh
23. yn.dhrš.ydm

Translation:
12–23 „Go to the Lord of Hqktp God of it all (Kptr [Crete] is the throne on which he sits, Hkpt is the land of his inheritance) from a distance of a thousand sd (shin), ten thousand kmn to Kothar and prostrate, bow yourself down to homage to him, and say to Kothar wa Hussus, repeat to Hayin, the one with skillful hands […]"
(Translation after Strange 1980, 83–85, no. 29)

In this text the god of craftsmanship is clearly related to Kaptor/Crete (even though not exclusively) which is here described as his throne. The passage can be understood as a mythological mirror for the perception of Cretan craft skills by ancient Syrian societies. The craft skills with which Ba'al's palace has been erected in the myth were associated with Crete. This can be extended to the Aegean influences in the wall paintings of Alalakh. Although the same caution is as necessary as before with the description of Kaptor objects in the texts of Mari: even if the paintings of Alalakh were perceived as Kaptorian, it is no evidence for who produced the wall paintings, Kaptorians or locals – the frequent question of our modernist archaeological understanding.

Basically, we might here again be confronted with a similar idea as for the objects displayed as royal gift exchange items in earlier periods – an articulate reference to Kaptor in a prestigious royal environment. However, qualitatively there is a difference: the

47 Mythological text of the archives, found within the area of the temple of Ugarit. Text 'nt VI: 12–23.

Fig. 8 Ivory pyxis from Minet el Beidha.

wall paintings are a part of the local palatial architecture. They create the palatial space in interplay with other architectural features, and have therefore another quality of impact on people. Instead of seeing an object from the outside in the context of a social act such as gift exchange, people are now inside the object and surrounded by the wall paintings; while the objects could be seen as controlled by people, the space for human interaction is now dominated by the wall paintings and their architectural setting. To escape their all-embracing impact is difficult. One can at most close the eyes or leave the room. This new quality of material-human interaction can also be observed in other centers mentioned above, such as Tel Kabri, Tell el Dabʿa, Qaṭna, in the later house architecture of Alalakh and perhaps Hattusha. The visitors at these different sites could have had similar visual and bodily experiences. Their experiences entered their lifeworlds and influenced their expectations, seeing habits and potentially their own means of visual expression.

Unfortunately, wall paintings cannot provide us with a good statistical base for further consideration, but the different contexts with fresco paintings span at least 200 years, so that we cannot consider their production as a short-lived event. As a tradition, for us detectable at least as early as Alalakh VII, it carries on into the Late Bronze Age. This new quality of Aegeanness also had a far reaching impact on other aspects of local material culture. Before the establishment of a 'Levantine Aegeanness,' only very few Aegean motifs and shapes entered the material culture of western Syria. Yet we can ob-

serve a heyday in the Late Bronze Age during the 14th and 13th centuries BCE, when motifs, artistic conventions and stylistic elements find their way into the manufacture of luxurious goods such as ivories (Fig. 8), metal and faience vessels or seals, seemingly still confined to the upper class.[48]

This development in the Late Bronze Age should not be separated from the earlier phases, when a specific meaning was ascribed to Kaptor objects, and can also be supported by the appearance of Nuzi pottery. It is a thin-walled ware with bright paint on a dark background – a common shape is a beaker with a small button base. The vessels have been considered by Akkerman and Schwartz as "elite-markers"[49] and some of their motifs have been generally considered as being influenced by Aegean material culture.[50] Especially the so-called Tell Atchana ware of Alalakh's layer II (Fig. 9), a subgroup of the Nuzi pottery, shows several 'Aegean' references: the representation of papyrus with a row of dots as the depiction of blossoms, flowers which resemble lotus, motifs similar to double axes and maybe even the bright on dark painting might reflect an Aegean or 'Minoan' influence. However, possible parallels would date much earlier. This was already observed by Evans in 1936, but of course he had difficulties bridging the time span.[51] Woolley interpreted the high number of these fabulously decorated vessels in layer II as an archaizing revival, long after such a decoration was common on Crete.[52] Additionally he observed that the different vessels depict only slight variations of the same motif and concluded that they reproduced or even copied the same motif again and again during the Late Bronze Age. Although the question arises as to why the people of Alalakh would do this. This practice of copying might be considered not only an attempt to preserve the design but also a significant local meaning of the beaker's decoration. It brings to mind the use of Kamares motifs (discussed above) in the seals of Alalakh VII. These early references to the Aegean within the Levantine tradition of material culture seem to have been of such social importance that they might have been preserved as a symbol for an affiliation to a certain class of the society until the Late Bronze Age. Obviously the process of their early establishment has resulted in a hybridizing effect maybe best described as a specific Levantine Aegeanness.

48 See for example the case of the ivory lid in a rich tomb from Minet el Bheida (see Schaeffer 1939, 33) or a seal with quatrefoil-trefoil motif from Alalakh (Woolley 1955, pl. LXIV, 82).

49 Akkermans and Schwartz 2003, 332.

50 Cecchini considers the thin walls, the white painting on a dark background, the interplay of naturalistic and geometric elements as well as single motifs, existing in both pottery productions as Aegean influences (Cecchini 1965, 46–47).

51 A. Evans 1936, 133; see also Cecchini 1965, 40–41.

52 Woolley 1955, 319 and 350.

Fig. 9 Beaker, Tel Atchana Ware.

4 Concluding remarks

With this diachronic view on Aegean influences in the Northern Levant we might approach again Yarim-Lîm's inspiration to decorate his palace with such 'innovative' paintings. An idea of a Levantine Aegeanness had been established through the exchange of 'Kaptorian' objects in the royal gift exchange or the use of the Kamares cups in the contexts of funeral feasts. The participants of both rituals incorporated the objects in their local lifeworld and their seeing habits, ascribing to them a meaning appropriate to the high social importance of the respective event. Contemporary to the wall paintings of Alalakh VII, palatial officials of several Levantine and Syrian centres were possibly inspired by these practices. They chose 'Minoan' influenced motifs for their seal iconography, their most important medium of their social identity, as a symbol of their affiliation to the upper class.

Such incidents resulted in a low threshold for the appropriation of new influences and innovations from the Aegean, and therefore it was possible that certain aspects of the habitually Aegean way of producing wall paintings were adopted relatively easily as a part of the genuine palatial architecture. Through its specific characteristics as an architectural feature, the new medium had a different quality of impact on people than the earlier mobile objects. People were surrounded by the wall paintings, and their perception was therefore entirely shaped by the materiality of the medium, a quality which might have contributed to trigger the wider acceptance of Aegean motifs in the Levantine material culture in following centuries.

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1 W.-D. Niemeier and B. Niemeier 2000, 789, fig. 22. **2** Aruz, Benzel, and J. M. Evans 2008, XVIII, XIX. **3** Bridge spouted jar from Byblos, courtesy of the American University Beirut Museum, 55.121. **4** Doumet-Serhal 2008, 33, fig. 32. **5** Doumet-Serhal 2008, 31, fig. 29. **6** Collon 1975, no. 164. **7** Collon 2000, fig. 15. **8** Aruz, Benzel, and J. M. Evans 2008, 408, cat.-no. 261. **9** Nuzi-beaker of the Tall Atchana-Ware from Alalakh, courtesy of the British Museum, London, AN248157001.

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The Documentary Gaze as a Mesopotamian Innovation

Summary

This paper analyzes 'innovation' as a discursive, narrative and dramatized construction with a strong tendency towards reification. I review examples, arguing for an understanding of innovation that moves away from new physical or epistemic things, to advocate instead a discourse-critical, practice-centered and contextualized understanding of innovations. Two cases from ancient Mesopotamia illustrate my argument. The first is found in every treatise on world historical changes: the introduction of writing. The second is a previously underappreciated and unperceived innovation for which there is even no clear expression: the emergence of a 'documentary gaze'. I elucidate its original context with pictorial evidence and describe the political dimensions surrounding this innovation.

Keywords: Development of writing; mobility; history of documentation; gaze; scribal practice; Mesopotamia; narrative of innovation.

Mein Beitrag analysiert ‚Innovation' als diskursive, narrative und dramatisierte Konstruktion mit einer deutlichen Tendenz zur Verdinglichung. Fallstudien führen mich zum Vorschlag eines Diskurs-kritischen, Praxis-zentrierten und kontextualisierten Verständnisses von Innovationen. Zwei Fälle Altmesopotamiens dienen mir als Illustration. Der erste findet sich in jeder Abhandlung über welthistorisch bedeutsame Erfindungen: das Aufkommen von Schrift. Das zweite Beispiel ist eine unterschätzte und weitgehend unbemerkte Innovation, für die es bislang nicht einmal einen Begriff gibt: das Aufkommen eines ‚dokumentarischen Blicks'. Ich beleuchte den Ursprungskontext mit Bildwerken und beschreibe die politischen Dimensionen dieser Neuerung.

Keywords: Schriftentwicklung; Mobilität; Dokumentationsgeschichte; Blick; Schreiberpraktiken; Mesopotamien; Innovationsnarrativ.

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1 Introduction

1.1 Innovation as a discursive construct

'Epochal change', 'fundamental breakthrough', and 'groundbreaking innovation' are evaluative descriptions that occur in connection with the earliest forms of writing, the introduction of pottery, bronze, the earliest glass, the wheel, steam engines, the Pythagorean theorem, theories of relativity, computers, etc. I contend that such assessments of significant innovations and their consequences consist of little other than a historical dramatization. The actors in this play are not the political or military 'great men' of Rankean history, but usually *homines fabri*. Each innovation narrative starts out from a core event which is elaborated as much as possible in order to highlight the importance of the purportedly new discovery.

Innovation research is too often obsessed with showing the assumed or actual intended consequences of innovative events. For which uses was the wheel first invented, and into which techniques was it then integrated? What were the primary goals of early copper smelting? What was the purpose of the earliest forms of writing? Studies that originate from such questions often imply a functional essentialism which assumes that materials, object categories or an entire technology can be so deeply imbued with a basic function that it overshadows everything else. If one knows the origin of a thing or a technique, one knows the essence, which is why archeology looks for 'first occurrences' with such vigor. Friedrich Nietzsche criticized and rejected such ideas in his *Untimely Meditations*.[1] The search for 'firsts' has further effects on larger scale historical narratives as it tends to dramatize (hi)stories by minimizing foregoing events and processes.

Wolfgang Schivelbusch's *The Railway Journey* proceeds in a different way.[2] Instead of focusing on the intended consequences of innovations, he elaborates in great detail on the unintended effects. The structure of such innovation stories is distinct from the traditional descriptions of linear cause-effect chains, as it focuses on historical *divergence*.

1 Nietzsche 1887.

2 Schivelbusch 1987.

In the end, the dramatizing effect of such stories is even stronger than in more traditional narratives. According to Schivelbusch, railways and associated technologies and practices are at the beginning of a wide swath of incongruent phenomena such as the recognition of trauma as a serious disease, a developing understanding of fatigue of materials, the emergence of specific travel literatures and much more. We see an emerging network that is derived from one single cause.[3]

However, the dialectics of innovation consist of something else, namely, that each instance of innovation that we focus on turns into a discursive construct. From such a historical moment, many future paths diverge which we account for as further creations or a series of reactions. But every so-called innovation is also a short-term process where long-term preconditions *converge* into what is perceived and accounted for as novel. The relevance of an 'innovation' does not depend on its technical, even revolutionarily new character, but on a narrative whose underlying dialectics combines converging and diverging historical events in a specific way. The artifice of such event assemblages becomes particularly evident in their alleged long- as well as short-term cause-consequence configurations. Typically, academic treatises about innovations are shaped as discourses that (a) conceal convergent, antecedent processes of an innovation, (b) compress them sharply and/or (c) anchor large parts of the precedent processes as self-evident truths of an unquestioned and unquestionable lifeworld.[4] In contrast to events preceding inventions/innovations, the consequences are presented as problematizeable and explicitly present in the minds of those who experience innovations. However, consequences that are assumed to be intended, for example the cart as a consequence of the innovation of the 'wheel', should be set in the framework of unintended consequences. For example, Schivelbusch describes vividly how the travelers' gaze changed after the advent of railway travels and how this affected the arts at the time.

Narratives about innovations present such series of consequences in detail. Depending on textual structures, the relation of intended and unintended consequences – situated in the arena of divergent phenomena – is designed to tie the two narrative elements of precedent processes and ensuing consequences together in a series of interconnected events. In Koselleck's terminology[5], narratives about innovations use silencing mechanisms to minimize spaces of experience and maximize the horizon of expectation within a teleological framework. Such discourses have a deeply dramatizing nature. At the same time, they propagate a future without a past. These narrative strategies have two main effects. First, we do not do justice to innovations, however defined, if we downplay long-term, preceding convergences. Second, the practical logic inherent in such convergences

3 One could read Hodder's book *Entangled* (Hodder 2012) as a wide-ranging, pessimistic world history of divergence of human innovation.

4 I use this term in Habermas' sense (Habermas 1987, Chapter VI).

5 Kosseleck 1985, 255–276).

needs to be explored historically, rather than relegating the underlying processes to the realm of unquestionable traditions.

2 The invention of writing: a case study

A prime example of the use of such discursive constructs is the development of writing in ancient Mesopotamia. We can be fairly sure that writing first appeared in the context of a need to remember and plan economic processes. The interest in these processes is certainly part of the reason why the Late Uruk period (ca. 3500–3300 BCE)[6], the time when this 'event' occurred, is one of the most intensively studied periods of Mesopotamian history.

The above-mentioned dramatization can be easily tracked, especially in synthesizing histories. D.O. Edzard belittles the documentary skills that were developed prior to the emergence of writing as "ein primitiver Zähl- oder gar Buchführungsmechanismus",[7] to then characterize writing as a performance that "die Menschheit seit ihrer Erfindung am Ende des 4. Jahrtausends nie wieder aufgegeben hat"[8]. "Die Schrift ist die größte Errungenschaft der Menschheit,"[9] announces Astrid Nunn in order to explain that it was the "Erfindung eines Individuums oder einer kleinen Gruppe"[10]. Even more grandiose are the introductory remarks by Christopher Woods in a volume dedicated specifically to *The Invention of Writing*:

> The ability to represent language graphically, to make language visible, stands as one of humanity's greatest intellectual and cultural achievements […] It would be difficult to dismiss the contention that writing – the boundary between history and prehistory – transformed civilization more than any other invention.[11]

Smith calls such ideas about the emergence of writing sarcastically "intelligent design" models, since they claim a staunch will behind this innovation and an unfailing strategy for its implementation.[12] In his remarkable contribution, he argues that a complex process of visual sign-intensification is the start for the development of writing. He differentiates between "visual objects" and "visual words", the former being the real world we see and categorize by naming it; the latter are the words we see when reading aloud,

6 Cf. Van Ess 2013.
7 Edzard 2009, 26 ("a primitive counting or even accounting mechanism", translation R. B.).
8 Edzard 2009, 27 ("Humanity, since its invention at the end of the 4th millennium, never relinquished [writing] again", translation R. B.).
9 Nunn 2012, 132 ("Writing is the greatest achievement of humankind", translation R. B.).
10 Nunn 2012, 133 ("The invention of an individual or a small group", translation R. B.).
11 Woods 2010, 15.
12 A. D. Smith 2013, 75.

and these make for a "more streamlined, less easily disrupted path to phonology than the visual object"[13]. Seeing and acting appropriately on words and on quotidian objects are different yet related practices.

In the work of Bottéro et al., we find another aspect of early writing that is echoed in the quote from Edzard:

> The first and without doubt the most precious of the treasures invented by the ancient Mesopotamians – one that they passed on to us and that has profoundly revolutionized our lives, shaped and developed considerably our minds – is writing.[14]

According to such enunciations, the millennia-old innovation has a direct bearing on *our* lives. Because such convictions are constantly repeated in general discourse,[15] they enter the sphere of unquestioned, self-evident truths.[16]

Not all discussions of the appearance of writing follow dominant discourse in such an uncritical fashion. Among treatises on the invention of writing, there is one variation that can be characterized by its attempt at what might best be called 'linear differentiation'. A number of individual stages following the first manifestation of writing is defined in various ways. Writing in word signs changes to 'rebus' and syllabic writing; for others,[17] the main stages are purely administrative writing and its change to the documentation of temporal series which appear later than the 4th millennium and are interpreted as the main transition from prehistory to history. In a different way, three stages of "pictographic writing – phonetic writing – language notation" are more or less finely divided.[18] Often, alphabetic writing is added as a much later innovation. Truly long-term stories occasionally add book printing and digitalization.[19]

We may add a massive compendium of reflections to these narrations that discuss writing as a generative phenomenon. Above all, scholars discuss the changing relationship between orality and literacy. Shifts in the mode(s) of remembering that are caused by writing have been discussed in detail by Walter Ong, Jan Vansina, Jack Goody and Jan Assmann.[20] These and other scholars give the impression that writing as an innovation is ideally suited for a kind of narration that is typical of Schivelbusch's works: writing is a novel practice that could colonize ever greater areas of the lifeworld. If management and word lists were the initial focus in the late 4th millennium in Mesopotamia, we see

13 A. D. Smith 2013, 77.
14 Bottéro, Herrenschmidt, and Vernant 2000, 19.
15 E.g. Habermas 2014.
16 When Ian Hodder claims a relevance of the domestication of cattle for present times, with similar reasons, this seems only strange because we are not used to this specific long-term argument (Hodder 2012, 161).
17 E.g. Wilcke 1982.
18 Bottéro 1987, 98–112; Damerow 2012.
19 E.g. Elkins 1999, esp. 123–142.
20 Ong 2002; Vansina 1965; Goody 1986; Assmann 1992.

religious and political content being added in third millennium BCE texts;[21] letters and contracts follow, until scribes even record music in cuneiform script in the 14th century BCE.[22] However, it should be noted that scholars focus only on a specific range of these diverging tendencies that result from the first appearance of writing: they search for the spread of this innovation solely in the realm of cognitive practices, activities that are restricted to the themes of conceptualizing, thinking and reading.

A more recent trend consists of research into the complex materiality of writing and related practices. Heidelberg University devotes a whole Collaborative Research Center to "Material Text Cultures".[23] The Center focuses mainly on the practice of writing and the associated materials and less on the semantics and conceptual elements. Jonathan Taylor investigates in great detail issues of reuse and recycling of clay tablets, as well as the complex processes that precede their production.[24] The shift from writing on the plastic material of moist clay to hard media such as wood, stone or metal is discussed by Susan Pollock.[25] She suggests that two aspects of divergence emerge that have hitherto been neglected. Once ancient scribes wrote on clay, their shift to new and other media should not be taken for granted. In writing, complex and exact signs were initially only impressed on soft and plastic clay; carving into stone and other hard materials was a very different affair. These inscribed objects, at the beginning restricted to cylinder seals, are in several ways comparable to the tablets: they are functionally anchored in the sphere of administration and management. Therefore, users of the object categories tablet and seal were often identical, or at least they stood in a hierarchical relationship to each other in one and the same apparatus. In addition, many of the relations between both kinds of objects and the human body are similar. Seals and tablets are objects that can be easily held in one hand,[26] and both afford the concentration of a human gaze. They are things that appeal to the visual sense. Writing later spreads from tablets and seals like an infection to other objects such as vessels, weapons or stone stelae. For stelae and other objects much larger than tablets and seals, it was necessary to experiment in order to monumentalize cuneiform writing.

A second and much wider field concerns another consequence of writing: the acquisition of its practice. From cultural anthropology we know of two basic forms of learning, imitative and generative. Imitative learning dominates in many non-industrial societies[27] and is based on the fact that practical, embodied skills such as chopping wood, weeding or sawing can only be acquired through exercises that imitate the performances

21 The thesis of a divinatory origin of Mesopotamian writing is still considered a possibility by a few scholars such as Jean-Jacques Glassner (Glassner 2003, 199).

22 Duchesne-Guillemin 1980, 10, 15–16.

23 Website under: www.materiale-textkulturen.de/ (visited on 17/01/2017).

24 Taylor 2011, see also Taylor and Cartwright 2011.

25 Pollock 2016.

26 See also Marzahn 2013.

27 See Bureau and Saivre 1988.

of more skilled people, but not by learning abstract 'discursified' rules. However, imitative learning is unsuitable for the transmission of practices such as specialized and often secret performative knowledge in rituals, or for the transmission of writing skills.[28] No one can learn writing without an explicit explanation of the specific relations between signs and their meaning, between arbitrary symbols and phonemes, especially since most scribes must be able to generate new, never before encountered sentences. Therefore the cultural transmission of writing is only possible by means of discursively formulated, generative, and likely rule-based learning.

3 Before writing: de-dramatizing narratives

In a discourse-critical approach such as the one followed here, the specialized scholarly literature on the emergence of writing in ancient Mesopotamia displays the characteristics of a dispute between a dramatizing and a de-dramatizing camp. The proponents of dramatization insist on fundamental change, while others argue for the opposite by de-emphasizing the importance of the 'invention' of writing in the late 4th millennium.[29] According to this latter group of scholars, thousands of years of development of small accounting devices can be organized into a series of incremental, chronologically not yet entirely clear steps that led to the emergence of writing. The tokens, small clay objects of geometric form, are the earliest such devices, already known from the Pre-Pottery Neolithic in many places in Western Asia.[30] From the late 7th millennium BCE onward, people also began to use stamp seals, albeit as objects that could have also functioned as amulets and buttons. At the same time we see the first evidence for massive use of both tokens and seals for administrative operations at the northern Syrian site of Sabi Abyad.[31] People sealed various types of mobile containers and doors, and likely also containers that enclosed tokens. While stamp seals in the 6th mill. BCE still retain an ambivalent status between amulet and administrative object, they develop into more complex forms in the 5th mill. BCE Ubaid period and are eventually replaced by cylinder seals in the 4th mill. In the same general change from stamp to cylinder seals – so far imprecisely dated only to the early part of the Uruk period – Mesopotamians started to package variably shaped tokens in small spherical, hollow clay bullae. These items served as contract documents and bore seal imagery on their outside. Probably somewhat later, the tokens that were enclosed in these hollow clay balls were impressed on the outside, turning them into a conceptual precursor of the earliest clay tablets.[32] It

28 Glassner 2003, 179.
29 E.g. Nissen 1986, Nissen 2012; Schmandt-Besserat 1992; contributions to Ferioli et al. 1991.
30 Schmandt-Besserat 1974.
31 Akkermans and Duistermaat 1997.
32 Nissen 1986.

should be noted as well that the first tablets seem to have been purely numerical, while a qualifier of what was enumerated in the form of a sign was only added at a later stage. Present knowledge thus seems to suggest that numeracy preceded literacy.

The subject of a long-term genealogy of writing has been discussed in detail in a recent publication by Reichel.[33] He comes to the conclusion that Mesopotamian societies had "pre-scribal bureaucrats" in the 4th mill. BCE.[34] According to Reichel, the emergence of writing was not a planned invention, but rather a product of pre-existing circumstances: "Mesopotamia's writing system represented, therefore, a *technological* not a *conceptual*, innovation".[35] The discourse about the invention of writing is perhaps exceptional, as a relatively large group of scholars explicitly addresses medium- and long-term processes of convergence, and thus criticizes imaginations of creativity and originality for the process of the advent of writing.

We cannot end the comparison between two types of narrations here. The story which Nissen[36], Englund[37] and others favor, simply mirrors the traditional narrative of great inventions and their consequential spread. De-dramatizing narratives insert the traditional *creatio ex nihilo*-discourse into a multi-millennia development of precursors of script in the realm of management practices: "So gesehen markiert die Schrift den Endpunkt einer langen Reihe von Möglichkeiten zur Kontrolle wirtschaftlicher Vorgänge".[38] The earliest cuneiform writing, anchored in the field of administration, is similar to its predecessors in its function of recording quantifiable and quantified processes that enable planning for the future. It is, as the title *Archives before Writing*[39] concisely summarizes, a systematic attempt to outsource memory into the sphere of materiality. According to this type of narration, the emergence of writing changes the means by which this process is performed, but otherwise no fundamental innovation is involved. Furthermore, the material form of writing – clay mixed with water, brought into a plastic consistency to be turned into a rectangular shape, and then incised or impressed – is very similar to some of the large complex tokens themselves, which bear incisions.[40] In this connection, one may wonder whether the idea of incising flat token surfaces with straight lines for additional information could be an imitation of the method of manufacturing stamp seals with abstract designs, a kind of artifact still found in the Uruk period.[41] Change in the realm of bureaucratic technologies should not simply be regarded as a process of obsolescence of previously used means of mnemonic storage.

33 Reichel 2013.
34 Reichel 2013, 47.
35 Reichel 2013, 65; emphasis in the original.
36 Nissen 2012.
37 Englund 1998, 42–49.
38 Nissen 2013, 169 ("Seen this way, writing marks the endpoint of a long sequence of possibilities for the control of economic processes", translation R. B.).
39 Ferioli et al. 1991.
40 Marzahn 2013, 179.
41 See Butterlin 2013, 208, Abb. 34.3.

These older systems did not disappear, at least not immediately, but continued to be used parallel to writing.[42]

Academics usually consider such discursive constructs – dramatizing and de-dramatizing – as differing scientific opinions. Since these narratives are embedded in other nuanced arguments, the purely discursive labor of their construction with its far-reaching effects remains largely hidden: it is inextricably interwoven with factual arguments and contextual descriptions. The obfuscation of discursive work, as argued so forcefully by Foucault[43], is not based on 'better' arguments, but mostly on positions of power within discursive fields.

4 Convergence instead of precedence

Writing is not only bound to its purely administrative predecessors, such as seals, tokens, sealed clay balls and numeracy. A ball-shaped or other clay wrapping, and also the advent of clay tablets, would not have been possible without another precursor: the "container revolution" of the Neolithic, originally defined by Lewis Mumford and more recently elaborated by Chris Tilley[44]. Containers come in many different forms and functions, e.g., houses, storage rooms or pits, as vessels, graves and other entities.[45] Containers are a tangible metaphor for an empty space which is separated from a potentially chaotic exterior by a skin or shell. Davis describes this innovation as largely unnoticed by archaeologists and considers it to be a phenomenon of emergence: it enables the development of other "technologies of containment" without being spectacular itself.[46] Containment technologies are relevant to this topic insofar as their existence was a prerequisite for the planned storage of small items such as the tokens used for counting.

Archaeologically, we encounter the multiplication of 'containers' since neolithization, especially in the form of pottery production, but also in the first containers for people, houses, and, as already commented, in 'containers for the counted'. To take the example of herd animals, containers with tokens standing for the number of animals are nothing other than the symbolic expression for a stable. Unfortunately, the earliest containers for counters are rarely identified because most of them were likely made from perishable materials. However, even more essential than the container itself is the possibility of opening and closure that appeared with them. The phenomenon of the lid or door has been well documented, for example, in the lid-like "portholes" for rooms

42 See Nissen 2013, 172 for continued use of pre-writing bureaucratic means; Houston, Baines, and Cooper 2003 on obsolescence.

43 Foucault 1984.

44 Tilley 1999.

45 Gamble 2007, 87–110.

46 Davis 1993, 130; see also Knappett, Malafouris, and Tomkins 2010.

at Ganj Darreh.[47] A systematized derivation of the lid uses a logic of *différance*[48], a technology that consists of (a) a deferred transmission of information that is by necessity negotiated because of a contractual time lag between closing an opening of the container that (b) supposes a difference between inside and outside. The systematization of such *différance* and the appearance of lids and doors can be dated to the late Neolithic, according to present knowledge to the period called "Transitional Halaf", when clay and seals were used to prevent the unauthorized opening of doors and vessel lids.

Finally, I have already discussed generative learning without which the intergenerational transmission of writing is impossible. Some finds indicate that this type of learning already existed in 5th millennium BCE Mesopotamia, long before writing appeared on the scene. The first precursor of a pre-writing spread of generative learning may actually be found in the craft of house building. Small model bricks from Tepe Gawra seem to have served as a means to exercise the laying of bricks in a 'theoretical' way, perhaps underlined by general rules.[49] I assume that the complex and very regular laying of so-called *Riemchen* mud bricks for monumental buildings in the following Uruk period resulted from the establishment of rule-based learning in the field of architecture. The supporting evidence is weak, but it cannot be excluded that this type of learning was one of the unrecognized *preconditions* for the development of writing, rather than one of its consequences, as is often maintained.

5 Unrecognized innovations: the example of the documentary gaze

The 'container revolution' has long gone unperceived as an innovation because it is not a strictly localized technology with an objectified form. Similarly, other technological innovations remain hidden to scholarly research. One reason is that many innovations are primarily situated in the realm of a particular practice rather than in a category of objects with clear shape and/or material characteristics. However, stories of innovations become interesting when one starts with practices rather than things. Some such narratives turn into creative discourses, for instance Garfinkel's *Dance at the Dawn of Agriculture*.[50] But what about other practices, e.g. the advent of swimming, or of shackling as a technique immobilization? Such techniques of the body should be closely explored for their historical development, an admittedly difficult endeavor since it can only be pursued through imagery or research on human physical remains.

47 P. E. Smith 1990, 330–331.

48 I intentionally abuse Derrida's term, who coined it as a merging of "deferring" and "differing" with the express intent to analyze and criticize the functioning of language (Derrida 1982, 3–27).

49 Eichmann 1991, 96–97; Bernbeck 2003, 226.

50 Garfinkel 2003.

Here I am concerned with a complex writing technique which consists of linking several physical practices: the simultaneous use of visual and motor skills, also known as hand-eye coordination. If writing is usually defined as the 'objectification of language', and thus the materialization of auditory perception, there is a variant which I call the "documentary gaze": writing using a gaze that captures and categorizes a specific sector of the world meant to be recorded. In the terminology of Adam D. Smith, cited above, this complex activity includes the *observation of visual objects*, and the *production of visual words*.[51]

Archaeologists should be particularly sensitive towards the development of this documentary gaze as they employ it constantly during field work. The physical work of excavating in trenches is continued in a documentary practice that translates the visible entities into words, graphs and photos. Even nowadays, the skills necessary for this activity can only be acquired through imitative, not through generative learning.[52] Internships and 'field schools' are an admission that not everything can be learned via generative rules. Documenting as a practice cannot be carried out simultaneously with other activities. Depending on the excavation system, it may be deemed preferable to separate documentation from excavation by assigning specialized personnel for each of these tasks, or both are performed sequentially by the same people.

Documenting, in the sense of simultaneous visual evaluation and written notation, is a practice that cannot easily be reconstructed archaeologically or historically. It is a generalized practice that can occur in many social spheres. As previously mentioned, writing as a practice can be studied through detailed observations of clay tablets. However, the documentary gaze includes visually stringent assessments in addition to writing. Gazing as a discriminatory practice is hardly ever directly problematized in ancient written documents, and can only be derived from imagery with great difficulty.

One way to reconstruct the development of the documentary gaze is to assume that it emerged at the same time as writing itself. One strong argument in favor of such a thesis is that the first Mesopotamian writing was decidedly not the materialization of spoken language, but the symbolic reproduction of counted objects and living things. People did not start writing down what they heard. However, the information inscribed on tablets and particularly on the so-called "tags"[53] was not necessarily inspected at the same time as the writing of the tablets. The amount of information on these labels was so small that it could be kept in mind for some time. A simultaneity of the discriminatory gaze and writing was not (yet) a given. Rather, early writing functioned according

51 A. D. Smith 2013, 76–78.

52 The tendency to mechanize this task, to mobilize electronic means in order to outsource the documentary gaze into various machines connected to a camera eye, leads to more and more schematized results that suppress a fundamental element in our lifeworld: ambivalence.

53 See Nissen 2013, Abb. 26.7.

to the logic of *différance*, deferred visual information transformed into a different, new medium.

Another potential form of documentation involved the dictation of information or text to a scribe, especially when the content was administrative in nature. A reason for this form of documentation becomes apparent when we imagine a concrete situation of writing. The finely levigated clay-water mix used for tablets must be brought into the right shape and consistency for writing and it does not maintain this plastic state for long, especially in a very dry climate such as Mesopotamia's. The specific Mesopotamian writing material is distinguished from other media such as parchment and ink in two ways: first, its preparation requires several steps which can be summarized in a *chaîne opératoire*, and secondly, the last steps of this process turn the material into a plastic, preformed state that can only be produced immediately prior to writing. The short time span during which clay holds its plasticity turns cuneiform writing into an expedient practice. A scenario that focuses on the practice of writing leads inevitably to the question of how one would have to imagine a situation of detailed documentation. Initially, Mesopotamian writing was very likely an attempt to outsource mnemonic labor. Because the information to be recorded was mnemonic rather than visual, no co-presence of recorder and recorded was required. In addition, independence from the visual presence of that which was written down turned into a precondition for the introduction of glottographic writing in the 3rd mill. BCE and the ensuing expansion to other narrative categories. Hints for the co-presence of recorder and recorded, or 'scribal eyewitnessing,' are difficult to extract from written texts themselves. Documenting 'on-site' can be achieved if the documented items themselves are mobile so that they can be inspected in a scribal office. This may be possible for very small objects, humans and animals. Indeed, state authorities use this mechanism quite often as a technique for the submission of human subjects. Otherwise, however, a precondition for the documentary gaze is a *mobile* technique of writing.

6 Images of scribal practice

My initial attempts at narrowing down the time-space parameters of the innovation of the scribal gaze gave me the impression that imagery is slightly more enlightening than textual documents, even though the elite activity of writing is only very rarely represented in ancient Mesopotamia. Neo-Assyrian sculptors and painters from the 8th and 7th centuries BCE produced a number of such images, almost always depicting two scribes who accompany the notorious war campaigns of the Assyrians. Recently, Julian

Reade published descriptions of these scenes along with an extensive catalogue.[54] For my purposes, Reade's article and older existing literature on the subject are doubly of interest. First, they are part of a scholarly narrative that revolves around this kind of writing in the form of a 'non-innovation' and counterexample to the 'emergence of writing' drama applied to the late 4th mill. BCE. I will try to insert this novel way of documenting in the context of a narrative of innovation. I should state at the outset that this is a purely formal exercise, consistent with my conviction that 'innovation' is largely a matter of narrative framing rather than historical reality. Secondly, Assyrian imagery is keen on showing the practice of writing, rather than its products: tablets and scrolls. The context of scribal practices reveals a complex multitasking that is the basis for these scenes.

In Reade's contribution, a total of 35 images of scribes is discussed.[55] The aim is an exact dating and the identification of material media of writing, which could be a clay tablet, a wooden, wax-filled diptych or a parchment-like material. Usually, two scribes are shown side by side, one with, the other without a beard. Diptych and tablet almost never occur as writing materials in the same image; rather, it is almost always parchment on the one hand, and a tablet or a diptych on the other (Fig. 1).

Contemporary texts mention scribes who write in the Aramaic and Assyrian languages. Since Aramaic is a cursive script, mostly written with ink on parchment, it is more or less obvious to assume a bilingual documentation of Neo-Assyrian war events.[56] Reade's article takes a "catalogistic" approach.[57] He lists all depictions of scribes in the Neo-Assyrian period. He then discusses the general context, i.e. the complete scene in which such scribes appear, as well as their equipment, clothing, and gender. Reade detects chronological change, but his focus is on the art-historical dimension, such as contexts of representations, antiquaria, the scribes' clothing, hair-style, gestures and techniques of writing. An essential part also evokes the question of what the scribes recorded, since Reade maintains that the one with parchment could have produced small-scale sketches for reliefs rather than Aramaic texts. Older scholarly papers that discuss these representations often view them as mere illustrative material for the practice of writing. At best, they mobilize these depictions in discussions of Aramaic writing, writing on diptychs or for a book cover of assyriological Festschriften. Overall, these narratives assume that the appearance of paired scribes on Neo-Assyrian reliefs and wall paintings amounts to nothing significantly new. Rather, writing, language, and documentation line up neatly in a context of long-term traditions. The pairing of scribes is interpreted

54 Reade 2012. Reade's article omits non-Assyrian depictions of scribes from the imperial periphery from Zincirli (Bar Rakib stela, dated to ca. 730 BCE) and Marash (a funerary stela of Tarhunpiyas, dated to ca. 875–800 BCE; see Bonatz 2000, Cat. No. C9, Tafel IX). They differ significantly from Assyrian ones by omitting the practice of writing.

55 Reade 2012.

56 Fales 2007.

57 For this notion, see Bernbeck 2010.

Fig. 1 Two scribes, with a soldier behind them, registering decapitated heads of enemies, looted objects and deportees (South Palace, Nineveh, Room XIX).

as a result of the tendency towards bureaucratic bilingualism.[58] This, too, appears in the above-mentioned scholarly narratives only as a remarkable process in the long term, a slow change that is outside of the more abrupt temporal mode of innovations.

7 Learning to see the documentary gaze

Nowhere does this discourse include the question of why a visualization of the scribes was deemed desirable or perhaps even necessary. However, the small number of representations from the second half of the 8th century BCE includes a remarkable development. The following interpretation rests on two assumptions. The first is that currently known illustrations of Neo-Assyrian scribes are representative of a larger whole. Second, depictions on the reliefs and a wall painting are to some extent reflections of past real practices. With these two provisos, scribal representations of the 8th century BCE differ significantly from those of the 7th century, with one exception to be discussed below.

58 E.g. Tadmor 1991.

Fig. 2 Vanquished city, lower level: deportee families; above: Assyrians driving herds away; inset: two scribes and a dictating eunuch (Tiglath Pileser III, 745–726 BCE; Central Palace, Nimrud).

Among the scribal depictions, Reade lists six as dating to the 8th century, from the time of Tiglath Pileser III (745–726 BCE) to Sargon II (721–705 BCE).[59] One of these does not depict a scribe, but a soldier who appears to be reading out an announcement.[60]

59 Reade's Catalogue No. 1, a depiction on one of the Balawat Gates from the time of Shalmaneser III, contains an image of a craftsperson who chisels an image into the rocks at the Tigris sources. The figure is not a scribe (for this, see Schachner 2009, 213–217).

60 Reade 2012, Cat. No. 7.

The oldest example of scribes, from the time of Tiglath Pileser III, shows women and children in the bottom row on bullock carts leaving a conquered city in the direction of an unknown world. The crenellated city is crowned by a date palm. Above this scene, Assyrians lead away large quantities of booty in the form of sheep and goats (Fig. 2). A contrasting scene is inserted into this standard war depiction: three figures, set apart from their environment. A eunuch standing on the left is holding in his right hand a stick like a musical conductor. He is armed with a sword. Turning his face to the right, he has the conquered city behind him, and has firmly in his view two beardless scribes, both without a sword or dagger. The scribe in front is obviously writing on a clay tablet, the rear one on parchment. This scene can be read as one in which the amount of spoils after taking a city is dictated to war scribes. Interestingly, the scribes are standing with the booty behind them: they document what is communicated to them orally, not what they observe.

A well known wall painting dates somewhat later. On stylistic grounds, it is often set in the time of Shalmaneser V (726–721 BCE). The two scribes in this scene are waiting in a row behind Assyrian soldiers who stand in front of the king or governor. Here, writing as a practice may play only a metaphorical role. Behind them are prisoners. Two reliefs from Khorsabad from the time of Sargon II show an interesting development of the scribal scene.[61] The first is the well-known looting of the Urartian temple at Muṣaṣir, an event that can be dated to the year 714 BCE. Similar to the scene from Tiglath Pileser's time, two scribes stand in front of a person who dictates information to them. However, the latter sits on a folding chair, his back turned to the temple as the Assyrian soldiers drag away captured shields over the roof of the temple. This time, it is the scribes who face the action of looting.

Reade's catalogue number 6 shows two scribes with a well-armed soldier and a military camp behind them.[62] A pile of at least six severed heads lies before them, and beyond the two scribes, prisoners in lace-ups are led by, followed by another Assyrian soldier and two enemies wearing identical footwear with chained ankles. An inscription in the military camp likely identifies it as "camp of Taklak-ana-Bel" (an Assyrian year eponym and a limu-official of the year 715 BCE). In all likelihood, this war scene can be identified with ancient Kišešlu and its transformation into the assyrianized settlement of Kar Nabu.[63] This is the oldest known scene in which the scribes clearly document the spoils of war without any intermediary; they write what they see (killed enemies and prisoners of war[64]). The custom of representing two scribes employing different writing techniques has, at this point, a tradition that harks back at least 30 years. It is important

61 Reade 2012, Cat. No. 4 and 6.
62 Reade 2012; see also Albenda 1986, Pl. 137.
63 Albenda 1986, 92.
64 Albenda 1986, Pl. 137.

to keep in mind that the two scenes from Muṣaṣir and Kišešlu depict events from consecutive years of warfare, 715 and 714 BCE. The creation of the reliefs must therefore fall between 714 and 706 BCE, the date of the inauguration of the entire Khorsabad palace complex.[65]

The 28 later Assyrian reliefs with scribes repeat the pairwise depiction of scribes. However, in none of these cases from the time of kings Sennacherib and Assurbanipal,[66] covering most of the 7th century BCE, is a dictating figure included. This change to direct documentation of what the scribes see can be explained in two ways. First, it may simply be a shift in pictorial conventions, where the act of speaking (dictation) is suppressed. The second possibility is in my view the more likely one. It is related to the question of why two scribes are depicted writing on two different media – clay or wax/wooden tablet on the one hand, parchment on the other. Again, the scholarly answer is the increasing Aramaization of the empire, where Aramaic was written on parchment and Assyrian on tablets.[67] That may well be, but the double-language documentation probably had the goal of preventing corruption in the scribal ranks. This thesis is supported by Fales' and Bunnens' contention that Aramaic writing did not originate in the regions where we might suspect the densest Aramaic population (today's Syria), but rather in the Assyrian imperial core since the style of the language is in several instances a kind of "pidgin Aramaic".[68] In addition, in two of the older scenes from the 8th century, an overseer dictates the lists of booty. Scribes wrote what they heard, but not what they saw. In both cases, the imagery seems to insist on accuracy when it comes to the economic basis of war – booty, including deportees and their potential labor. Exact, or at least pseudo-exact, documentation is not only confirmed in reliefs, but also in the case of Sargon's 8th campaign, in an extremely detailed and, on appearance, accurate report of this campaign.[69]

From Sargon II's time onwards, more precisely after 715 BCE, war scribes became independent and wrote down the figures of looting and deportation without the control of a superior. They were allowed to or had to record what they observed themselves. From these changes, one can infer increased confidence in scribal personnel on the part of the court as well as loyalty of these first 'war correspondents'. Furthermore, they had to have acquired specific multitasking skills of writing and simultaneously discriminating visually. Writing as a materialization of the auditory and reading as a retranslation of the

65 Tadmor 1958, 97.

66 According to Reade (2012), the dates of some fall into the years of the second-to-last Assyrian king, Sin-šar-iškun.

67 As mentioned, Reade maintains that the scribe with parchment could also have drawn sketches for the reliefs (Reade 2012, 708–712). However, the appearance of scribes only in connection with the spoils of war, rather than actual fighting, renders this interpretation unlikely.

68 Fales 1999; Bunnens 2009, 81.

69 Zimansky 1990. For a recent translation of Sargon's *Gottesbrief* see Mayer 2013.

visible into the audible were abridged here to a materialization of the visible without the intermediate stage of the audible.

This innovation falls under the radar of scientific visibility for three reasons. First, today's documentation processes are similar to those of the Assyrian scribes. A division of labor between dictation and writing still exists but has been almost eliminated from practical life. Second, I am suspicious of the implicit assumption behind much scholarship on scribal practices that the normal process of documenting, as attested since the earliest days, consisted of writing down what one saw, without any oral intermediary. For this kind of documentation practice there is, to my knowledge, just as little evidence as for the interposition of an oral intermediary. Third, and probably most importantly, the innovation described here is a reconfiguration of a complex web of relations of practices, including writing, the classifying and discriminating gaze, administrative mobility and collective violence.

This new documentation technology remains in use in later times. Thus, Alexander of Macedonia employed Anaximenes of Lampsacus and Callisthenes of Olynthus as official war correspondents;[70] the Roman general Pompey's war writer was Theophanes of Mytilene.[71] In the early modern period, war reporting became an even more widespread phenomenon with the introduction of printing technology and the advent of newspapers. The latest turn in the idea of battlefield records became the infamous 'embedded journalism' of the 21st century in the Iraq War,[72] whose earliest precursor can be said to be the Assyrian scribes. However, this technique of documentation had a number of other effects that may have been more important in the long term than war reporting alone. I limit myself to (a) the 'stately gaze' which the Assyrian soldiers and scribes had to incorporate, and (b) a multi-layered mistrust, which is likely to have evolved from the recording itself.

The scribal scenes always depict moments *after* battles when enemies were beaten, tortured, and killed or when captured towns and castles were burned and razed. In these moments of apparently random destruction, an underlying discipline was built in, since booty had to be channeled towards the Assyrian king so that he received what he deserved according to imperial ideology. Military economics involves discipline after victory. Unfortunately, this never implies the gentle treatment of victims, but the discriminatory skill[73] to recognize and sort out two kinds of booty. People, especially women and children, as well as animals and certain types of objects (weapons, valuable furniture), had to be brought before the scribal registrars (Fig. 3). We can assume that there was also individually appropriated booty that was of little interest to officials. Assyrian soldiers must have internalized a 'stately gaze' in order to carry out correctly the sorting

70 Demandt 2009, 2–3.
71 Gold 1985.
72 Cooke 2007.
73 On this notion see Baxandall 1972, 33–34.

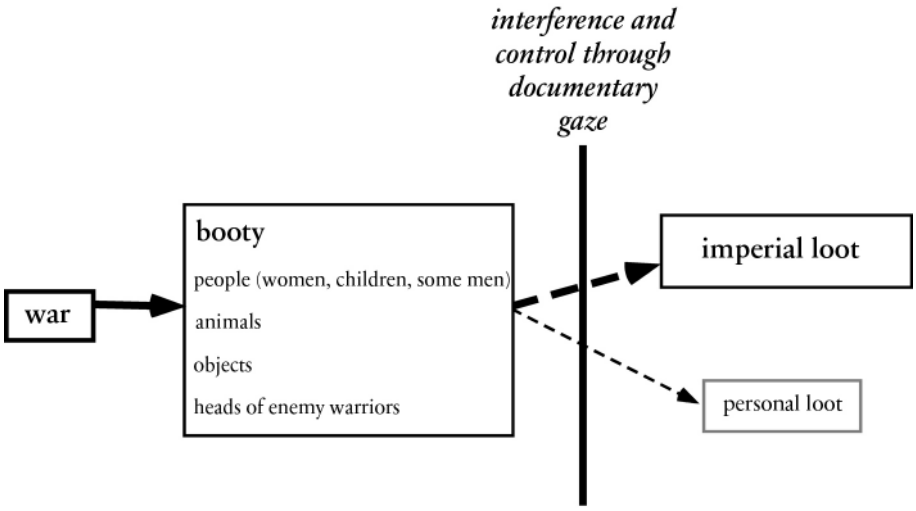

Fig. 3 Discriminatory skills that were mobilized in Assyrian post-battle situations.

of royal booty. Scribes, initially under the supervision of dictating eunuchs, were the organs of control of this discriminatory process.

A second element that emerges with this documentary gaze is a systemic mistrust (Fig. 4). There were certainly post-battle records of booty before their depiction in the middle of the 8th century BCE. The systematization of such record-keeping likely originated in the desire to control looting, and thus the economic profit of permanent wars, more effectively. The first attempts to set up such a system with a two-tiered documentation team, the superior responsible for the stately gaze and classification, the inferior for the materialization of the records on clay and parchment, dates to the time of Tiglath Pileser III. However, it soon proved too cumbersome and complex to maintain.

Bilingualism was apparently enough of a control agent to ensure scribal reliability. This is shown by the Kišešlu relief from Sargon's time and the 7th century renderings of scribal war documentation. An additional element may be the context of documentation. In the scenes with unsupervised scribes, we see in almost all cases soldiers that seem to be controlling not just the deportees, looted objects and head counts, but also the scribes themselves. The depiction of intra-Assyrian control mechanisms on the palace reliefs remains understudied because of the focus on war and relations between enemies. Finally, the oft-repeated depiction of the scribal scene is an indication of the institutionalization of disciplinary practices. The palace reliefs of the 7th century show 'booty control' as an integral part of war.

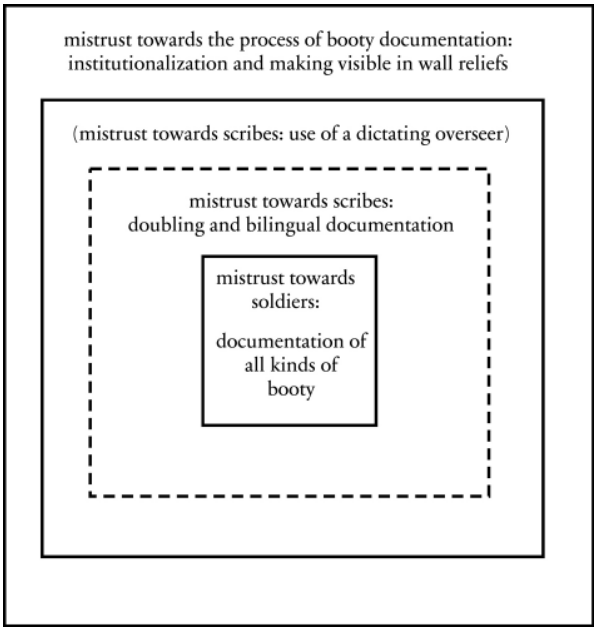

Fig. 4 Multi-layered mistrust in the Assyrian looting economy.

8 De-dramatization

Such cases of innovation are easy to de-dramatize since the phenomenon of historical convergence does not consist of pointing out precursors to a material item such as weaving equipment, sailboats, copper objects or other materially definable entities. Since the documentary gaze is a combination of practices, it suffices to show how they were gradually joined together. The four individual elements of this practice (writing, the discriminatory gaze, administrative mobility, and collective acts of violence) have been known for millennia, and some of them are known to have been linked long before Neo-Assyrian times. For instance, the diptychs of the Uluburun ship-wreck from the Late Bronze Age[74] can surely be interpreted as one of the earliest indications for the skill of writing on wax tablets, mobile documentation in general and likely a commercially oriented discriminatory gaze. The need for documentary precision to visually assess quantities, qualities, scales, colors or even the weight of things immediately and accurately developed in the traders' own interest. I also argued above that a link between writing and mobility should not be assumed as a simple matter of course.[75] Writing on

74 Payton 1991; Symington 1991.

75 The shipping of finished texts, for example letters or the collection of materials for libraries is known from early times on (Frahm 2012; Cancik-Kirschbaum 2013).

clay was ill-suited for this kind of multitasking. The combination of these practices depended on the development of wooden, wax-filled diptychs that could be folded and closed. The oldest evidence for the existence of this writing technique stems from the late 3rd mill. BCE.[76] But its widespread appropriation arose only with the Hittite empire, where we find two different terms for a "scribe [who writes on] clay" and a "scribe [who writes on] wood".[77] Whether such innovations are of minor or major importance is a matter of our own framing. It is my impression that in the case of the documentary gaze, current dominant discourse systematically de-emphasizes its innovative nature by inserting it into a long-term historical stream of small practical steps without fundamental consequences.

9 Instead of a conclusion

In this paper, I have tried to show that innovation is a discursively constructed phenomenon that depends to a large extent on the variable inclusion of relations between preceding conditions and consequences in narratives about innovations. Before we draw far-reaching conclusions from the factuality of an innovation, it is necessary to investigate closely scientific narrations that form the background for such changes. Innovation narratives are often delicately constructed discourses whose goal is the emphasis or outright suppression of the new. As such, they serve the fragmentation of a uniform chronology into individual, easily grasped sections such as 'aceramic – ceramic,' 'pre-industrial – industrial – post-industrial,' etc. A close analysis of individual historical cases in large part dissolves innovations into a dialectical relationship of assumed past expectations on the one hand and a more or less dominant role of traditions and experiences on the other. The second argument of my paper is concerned with novelty itself. Innovation discourses tend to glorify tangible objects and neglect practices that may be at the origin of their very existence. If my paper has an element of a 'symmetrical archaeology,' it consists of a call to balance these discourses and their fetishizing of materiality by paying more attention to the side of human practice. In this sense, I follow Schivelbusch's approach, whose history is one of traveling in trains, but not of the railroad as a material object.

76 E.g. Wiseman 1955.

77 Hoffner 2009, 8–10.

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Innovations That Failed to Materialize: Why Was There No Copper Metallurgy in the Central European Early and Middle Neolithic?

Summary

In this paper we propose a sociological concept of innovation capable of transcending the limitations faced by the approaches of common theories of action. The concept was formulated by Ulrich Oevermann and is based upon Max Weber's theory of charismatic authority. We apply this concept to archaeological data, using the example of Neolithic copper metallurgy in central Europe, and discuss the importance of analyzing innovations that failed to materialize even though they might have been "in the air" at the time. The concept sketched here enables the scientific study of such a phenomenon.

Keywords: Innovation; charisma; neolithic; copper; metallurgy; theory of action; Max Weber.

In diesem Beitrag wird zum einen ein soziologisches Modell von Innovation vorgestellt, das die handlungstheoretischen Beschränkungen der gängigen Innovationstheorien zu überwinden vermag. Dieses von Ulrich Oevermann entwickelte und auf dem Charisma-Konzept Max Webers basierende Modell applizieren wir exemplarisch auf archäologisches Material zur neolithischen Kupfermetallurgie Mitteleuropas. Dabei wird zum anderen der Blick auf ‚ausgebliebene' Innovationen gerichtet, das heißt auf solche, die gewissermaßen ‚in der Luft' lagen, aber nicht verwirklicht wurden. Auch diese Phänomene lassen sich mit dem hier vorzustellenden Modell differenziert betrachten und einordnen.

Keywords: Innovation; Charisma; Neolithikum; Kupfer; Metallurgie; Handlungstheorie; Max Weber.

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1 Charisma and the Emergence of the New: A Sociological Innovation Model

We apply the term 'innovation' in the following in a broad sense, encompassing the three phases traditionally distinguished in technology research. One is *invention*, in other words, the development of a new concept (further differentiable according to the psychology of creativity), another the *innovation* in the narrow sense, meaning the realization of such a new concept, and finally its *diffusion*, which overlaps with the establishment and spread of an innovation.[1] Patent law narrowed down these ideas further and produced the impression that an invention is a necessary precondition for any innovation. However, this is not necessarily the case, and Joseph Schumpeter already pointed out that an innovation is "any 'doing things differently' in the realm of economic life".[2] This can include an invention, but can also consist of a simple recombination of known factors.[3] In our paper we want to present and test through application to an example a sociological model that differs from others in one particular respect. It places emphasis on the objective course of innovation processes rather than on acting subjects.

The investigation of the formation and development of 'the New' in the social sciences is burdened by a legacy of practice theoretical approaches.[4] Practice theories evolved out of the notion of a rational, linguistic, and actionoriented subject. This outer layer of rational intentional action is in fact thin and superficial, and all other elements of action appear as irrational. Such supposedly irrational social phenomena turn into residual "unanticipated consequences of purposive social action", also called "latent functions".[5] Robert K. Merton, who coined these terms, demonstrated the magnitude of their significance and tried to conceptualize them in the framework of a theory. The development of this theory from a subjective-intentional to an objective-structural-analytical perspective can be traced back to both of his central works on *Unanticipated Consequences* from 1936 and the *Manifest and Latent Functions* from 1949.[6] While the later text analyzed the objective functions of the unintentional and objective rationality in social practice, the viewpoint of the practicing agents that dominated the earlier text

1 For the three phases cf. Ropohl 2009, 258–261; Max Eyth summarizes "the conception of the idea, its incarnation and finally its dissemination and use" (Eyth 1919, 245. – Translation by authors) under the heading "invention".

2 Schumpeter 1939, 84; for a political economical reduction of the innovation concept to economic usability cf. Röpke 1970, 75.

3 Schumpeter 1939, 87–88; for differentiation of invention and discovery, cf. Machlup 1961, 280–281.

4 Another legacy is that of social constructivism as represented in the field of sociological innovation research in the concept of SCOT ("Social Construction of Technology") by Trevor J. Pinch and Wiebe E. Bijker (cf. Pinch and Bijker 1987; Bijker 1995).

5 Well illustrated in the listing of 150 consequences of the introduction of the radio in the USA Ogburn and Nimkoff 1964, 571–587), or a compilation of the social consequences of the transition to irrigated farming by migrant farmers in Madagascar (Rogers and Shoemaker 1971, 334 Abb. 11.2). Only for a fraction of these consequences can we assume an intentional background.

6 Merton 1936; Merton 1968.

describes "unanticipated consequences" as simple mistakes. While the intended is comparatively easily identified in empirical research, it is much more difficult to categorically classify the realm of objective results. This is why theories that try to accomplish this often resort to metaphors such as "the invisible hand" (Smith), the "cunning of reason" (Hegel) or "*Das Sein bestimmt das Bewußtsein* – being determines consciousness" (Marx).[7] In order to appropriately shed light on the field of innovation, it must be subject to a change in perspective: the "latent functions", as they are described in Oevermann's model of innovations, must be moved from the periphery of a practice-theoretical approach to the center of a structural analysis. Even if the content of 'the New' cannot be anticipated, its processes of formation and distribution include a regularity that serves as a background to a reconstruction of the substantially unforeseeable as indirectly motivated. The New cannot be grasped in such practice-theoretical terms as 'rational' and 'irrational' because it appears in light of previously prevailing routines and scales of rationality as irrational but will prove itself via the chances of future practical trial as rational. This also applies to industrially planned innovations, for which developmental failure in the market is minimized with great effort but cannot be completely excluded.[8] What then constitutes the specific quality of the New between rationality and irrationality, where the quality that caused a new phenomenon that is not in accordance with prevailing rationality is still given the chance to practically prove itself? And to prove itself without an anticipation or warranty of its potential later rationality? Resorting to a central concept of Max Weber,[9] Oevermann identified this quality as *charismatic*. The concept of charisma can be dislodged from Weber's comparatively limiting use in a sociology of power and religion and inserted in a universal intrinsically logical model of innovation. In this connection, it is irrelevant whether the charismatic quality is a substantial element of the New or merely a successful staging of it.[10]

Five phases of this process can be analytically identified:[11]

1. The difference of the New from the existing routine must be distinguished; it is either obvious, or it must be made acceptable through a process of recognition.

7 In the field of innovation research, Jochen Röpke drew attention to the importance of an investigation of the unintended consequences of actions: Röpke 1970, 67–74.

8 For the 'failed innovations' neglected by innovation research cf. Braun 1992; Bauer 2006; insightful case studies can be found in Schneider 1989 (screen text); Lindgren 1990 (the difference engine and precursor); Knie 1994 (rotary engine); for 'camouflaged' innovations cf. Jung 2015.

9 Weber 1968, 1111–1157.

10 "Charisma may be either of two types. Where this appellation is fully merited, charisma is a gift that inheres in an object or person simply by virtue of natural endowment. Such primary charisma cannot be acquired by any means. But charisma of the other type may be produced artificially in an object or person through some extraordinary means" (Weber 1968, 400).

11 For the systematic background and detailed description of this model cf. Oevermann 1991; Oevermann 1995.

2. The rationality of existing routines must become questionable and appear as problematic in the light of the New.

3. The New must be seen as a potential solution to the emerging problem, a solution that is credible enough to be given the chance to prove itself.

4. This credibility must go hand in hand with the formation of a kind of followership that testifies to its credibility.

5. In the case of standing a practical test, the New in turn becomes routine and establishes new standards of rationality.

The generalization of this process, as abstract as it may seem at first, allows the overcoming of the undialectical dualism "of irrational, accidental and mutation-like change on the one hand and a completely rationally developed invention on the other hand".[12] Basic concepts of Oevermann's model are charisma, crisis and standing a test. They open the possibility for a genuine sociological approach to a complex of innovations. To avoid any misunderstandings: the concept that is discussed here is neither a derivative nor a variant of the instructive, empirically-based model of innovation diffusion of Everett M. Rogers and F. Floyd Shoemaker.[13] Three aspects of this model seem to us problematic that are also central differences to Oevermann's model. First, Rogers and Shoemaker reduce an examination of innovations to the processes of their communication, and, what is more, to a limited and one-sided transfer of information.[14] As a consequence, their disregard for the real qualities of the New or that which is touted as the New, leads them to a model in which the decision of whether something is an innovation or not is left entirely in the hands of acting individuals.[15] Second, this reductionist perspective implies that phenomena of appropriation[16] and redesigning of the New, in their own

12 Oevermann 1995, 50. – Translation by authors.

13 Rogers 2003; Rogers and Shoemaker 1971.

14 It is only logical that the title of the second edition of Rogers' basic work on *Diffusion of Innovations*, the one written with Shoemaker, is *Communication of Innovations*. This book states concisely: "Communication is the process by which messages are transmitted from a source to a receiver" (Rogers and Shoemaker 1971, 23).

15 "An innovation is an idea, practice, or object perceived as new by an individual or other unit of adoption. […] If an idea seems new to the individual, it is an innovation" (Rogers 2003, 12).

16 On different theories of appropriation, see Hahn 2011. Röpke has already pointed out the importance of appropriation as an "act of property seizure" in exploring innovation-induced cultural change: "The diffusion of radical innovations is slow. This process of adoption of innovations by mixing, fusion, 'métissage', the recombination of previously unconnected elements, can be called syncretism. Since syncretism amounts to the 'essence' the basic process of an adoption of innovations in a situation of acculturation, we can interpret it as an acculturation accelerator. Syncretism is the 'ideal process' of acculturation" (Röpke 1970, 88. – Translation by authors). However, Röpke understands such a formation of syncretistic compromise merely as a stage in a process that ends in extensive acculturation.

right often a source of innovations, cannot be adequately covered.[17] Third and finally, Rogers and Shoemaker evaluate practices of individuals who are confronted with innovations by ultimately applying standards of abstract rationality.[18]How can models of innovation such as the one by Rogers and Shoemaker be transferred to archaeology? Any such attempt leads immediately to a central problem of the archaeological disciplines. However, this is a problem that is constitutive of archaeology and must not be seen as a deficit: the genesis of innovation can be reconstructed when a preceeding constellation, the boundary conditions, are known; in contrast, archaeology has to start with an already materialized innovation in order to then investigate the preceding conditions that led to its realization. Normally that is impossible, as one cannot infer from a knowledge of a factual innovation any corresponding needs for a specific object or a necessity that has been invented. As explained above, such a need could have been produced *post hoc* by the already existing innovation, in light of which existing practices could have become suddenly questionable. But this would not have been perceived as such prior to that innovation.[19] Therefore, what can be researched through this model's application to archaeological evidence is primarily the process of dissemination and routinization of the New.

With Oevermann's innovation model and its rejection of a rationalistic practice theory, the direction of the question is reversed. Not only successful innovations require an explanation, but also the withdrawal of an innovation. An example for the latter process is Noel Perrin's[20] account of the 'extinction' of firearms in Japan in favor of the traditional sword. Equally in need of explanation are innovations that did not take place, in particular those that stopped only a small step before their realization, or those for which only a simple link between already existing phenomena would have been necessary. Below, we discuss such a 'non-happening' innovation,[21] the non-advent of metallurgy in early and middle Neolithic central Europe. The needed technological and

17 The use of this model might be self-evident for the explanation of the distribution of objects that have their own communicative properties. Ursula Eisenhauer's study on Middle Neolithic pottery styles of the Wetterau is such a case. It is based on the assumption "that ceramic styles (ornamentation) are a medium of communication that transmits information about the identity (group membership) of its users" (Eisenhauer 2002, 127. – Translation by authors). The model of Rogers has also recently been used for the reconstruction of the development of copper metallurgy in the Sinai (Pfeiffer 2013).

18 Rogers 2003, 232.

19 Expressed in the terminology of systems theory: "Preadaptive advances are achievements that can be developed and stabilized in the context of an older order type, but which occur only after further structural changes to the system in their final function. Preadaptive advances are as it were solutions to problems that do not yet exist" (Luhmann 1978, 433. – Translation by authors).

20 Perrin 1979.

21 Cf. also Marie Louise Stig Sørensen's remarks on the "ignored" innovation of iron in late Bronze Age Scandinavia (Sørensen 1989). Based on a study by Edward Wellin, Rogers also presents at the beginning of his investigation the case study of a 'missed' innovation, the failure of a health care campaign during which the inhabitants of a Peruvian village were to be convinced to drink only boiled water (Rogers 2003, 1–5; based on Wellin 1955).

logistical grounds for the development of metallurgy were present but clearly did not suffice to initiate such a process.[22]

2 Case study: The non-development of copper metallurgy in Early and Middle Neolithic Central Europe

Dating back to the 5th millennium BCE, 'non-metallic' artifacts such as figurines, Spondylus jewelry or pottery show a striking uniformity on aesthetic and technical levels across Europe. Direct contact with copper-processing Neolithic groups developed even before the Late Neolithic. Therefore, the comparatively late and sparse appearance of the first copper artifacts in the late 5th millennium in central Europe is surprising. Seen from a current archaeological perspective, all the cultural, technological and logistical requirements for the acquisition of copper as a new material were present at the latest by the beginning of the second half of the 5thmillennium. However, at least according to the current state of research, this did not lead to the import or use of copper artifacts, metallic copper, copper ores or carbonates (for example, colored minerals such as malachite and azurite). The relevant cultural and technological conditions, which can be interpreted as a ready background for the development or acquisition of metallurgy, will be outlined below.

2.1 Pre-existing cultural and technological conditions

The term 'cultural preconditions' does not refer to a specific culture concept but should merely be considered a framework for the technological requirements to be discussed below. Cultural preconditions include the following:

- An extensive communication network existed across central Europe and adjacent areas, which is reflected, for example, in the distribution of goods such as flint or Spondylus. The existing trade routes could have been used in part for the distribution of metal ores or artifacts.
- There were contacts from the Linear Pottery complex to the Vinča culture where copper was known. These relations are reflected in the material and spiritual worlds of the first farmers and stock breeders of central Europe.[23] Figurines and Spondylus jewelry of Linear Pottery culture are not everyday, mundane objects, and their

22 This is not the place for a discussion of Christian Strahm's phase model of metallurgical development (Strahm 1994; most recently Strahm and Hauptmann 2009; see de Zilva 2007, 68–95).

23 See Lazarovici 1983.

occurrence in two neighboring cultures cannot be explained as a phenomenon of functional convergence or by recourse to concurrent aesthetic preferences. Rather, these commonalities point toward similar background meanings and a comparable value system. In the archaeological inventories of the western Black Sea coast, Spondylus is regularly associated with copper or malachite beads since 5000/4900 BCE[24]. Therefore, the acquisition of two clearly interconnected symbol or value carriers into the Linear Pottery complex could have been expected.

– At the transition from the Middle to Later Neolithic in much of todays central Europe, we see an archaeological change which is characterized by an intensification and differentiation of previously existing 'cultural concepts'. Adapted in the wake of former Danubian Linear Pottery Neolithization, they include a further development of autochthonous strategies of artifact production, agriculture, house construction, mining of raw materials and of an exchange and communication network. This willingness to test new conceptual approaches manifests itself already at the end of the Linear Pottery Culture and is particularly evident in the course of the second half of the 5th millennium and the beginning of the later Neolithic in the vast number of contemporaneous, chronologically and regionally overlapping archaeological cultures.[25]

– In addition, an interest in color can be presumed. This is evident from the processing and use of colored minerals such as hematite, ocher or serpentinite and the use of the reddish to purple-skinned maritime spiked oyster *Spondylus gaederopus*.[26] Apparently, people also felt a need to adorn the body, as is evident in tombs with rich jewelry throughout the distribution area of the Linear Pottery Culture.

Existing technological requirements for a development of metallurgy are the following:

– The principles and procedures for mining raw materials were known. In this connection, Early Neolithic well digging and mining for flint should be mentioned.

– There was significant practical pyrotechnic knowledge, resulting from the use of furnaces, differentiated procedures for swidden agriculture and birch tar production.[27]

24 Todorova 1999, 237.

25 For the transformation processes during the transitional phase to the Later Neolithic see Schier 1993.

26 For this 'interest in color', cf. the contributions in Cochrane and Meirion Jones 2012 and Saunders 1999. For the importance of color qualities of metals, cf. Hosler 1995.

27 With respect to the pre-ceramic Neolithic in the Near East, W. David Kingery, Pamela B. Vandiver and Martha Prickett consider the production of mortar with quicklime as a binder as an important step for the mastery of pyrotechnology: "Plaster innovations supplied the requirements for metal smelting and provided all the technology necessary for, and set the stage for, the subsequent adoption of pottery as a major industry in the ceramic Neo-

As the examination of traditional non-ferrous and precious metal blacksmithing shows, the smelting of copper, gold or silver in small amounts of about ten grams does not require a structurally fixed smelter or crucible. For such small amounts, a small depression in a charcoal layer is sufficient, combined with a targeted effect of heat by directing an open flame using blowpipes.

– For the production of beads from malachite, there was no need to acquire new, material-specific knowledge and skills. Instead, already existing stone processing techniques – grinding, cutting, drilling and polishing – would have been entirely sufficient for a cold processing of copper minerals or of native copper, since the steps in the production of malachite beads correspond to those necessary for the manufacture of beads from other minerals.

There is thus no compelling, archaeologically tangible reason for the rejection of the new material copper in the central European Early and Middle Neolithic cultures. Since the initially sparse use of copper in the later Neolithic, during the transition from 5th to the 4th millennium, was without question in technological terms conventionally Neolithic, economically insignificant and in practical, user-specific respects initially not beneficial, this stage could have already been reached in Early or Middle Neolithic times.

2.2 Social and ritual restrictions

Although it is methodologically quite reasonable to first explore whether the functionality of an innovation has been exploited, without assuming *a priori* extra-functional motivations,[28] a merely technological-procedural perspective is inappropriate for an understanding of pre-modern societies.[29] Especially 'fire crafts' were traditionally a source of anxiety and ambivalence that had to be ritually banned or at least channeled. According to many ethnographies, it is the norm rather than an exception in need explanation that the exploitation of 'Mother Earth', the procurement and processing of specific raw materials, are connected to taboos and complex norms.[30] However, practices connected to such beliefs remain archaeologically invisible.[31] Modern scientific studies of 'prehistoric innovations' all too often lose sight of the fact that the acceptance of a new raw material and the modes of its processing in premodern societies were influenced by

lithic" (Kingery, Vandiver, and Prickett 1988, 241); see also Pfeiffer 2013, 56 n. 28.

28 On this, cf. Jung 2010.

29 Nayanjot Lahiri has shown by way of an example of the processing of copper and copper alloys in India how misleading a purely procedural interpretation can be. This investigation refutes the implicit evolutionist premise of "what is considered to be technologically superior must therefore be culturally preferred" (Lahiri 1995, 18).

30 Cf. Godoy 1985, 208–210; Knapp and Pigott 1997; Taussig 1980.

31 Cf. e.g. Böttcher 1981.

ideas that a technological perspective or a research-oriented mind would classify as irrational. Ethnographic studies of traditional blacksmiths or potters give the impression of a ubiquitous ritual contextualization without which prehistoric fire technologies are inconceivable.[32] At the same time, the mythical interpretive systems of such groups can be studied based on the ritual framing of metallurgy.[33] A vivid description of this dimension is provided by Georges Celis in an example of iron-working and blacksmithing in Africa:

> With regard to the characterization of the typical smelting process, we may not think that we need to concede any meaning to the rites and beliefs of the smelters and forgers. And indeed, these matters are influenced by people who do not have the slightest idea about the work of smelting and forging, i.e. diviners and healers. When one asks them, they will explain failures that may happen to the smelters and blacksmiths as the result of a non-observance of religious norms or as a result of black magic from disapproving neighbors – not, however, as a result of a lack of technological effectivity in need of improvement. Even those who are smelters and diviners in one person will respond in this way from the very start. They are convinced that the primary cause for a failure is to be found in a violation of traditional norms.[34]

Analogous to the exaggerated personalization of the emergence of the New in practice theories, traditional notions personalize reasons for the above-mentioned failures of smelting and forging processes by making deliberate or unintentional transgressions of individuals responsible for these failures. If we apply this finding to the question of why the development of copper metallurgy in the Early and Middle Neolithic failed to materialize, we would look for the reason in the religious or spiritual arena. But at what stage of the innovation model did the first approaches to a use and manufacture of copper objects come to a halt? The difference of the new material to the previously known and used ones is phenomenologically evident. But this does not mean that a second exploratory phase of experimental exposure will occur, with the aim to identify inherent possibilities of the new material and the exploitation of its technological potential. Insofar, the new material cannot prove its possible advantages over prior traditions, it cannot provoke a questioning of prevailing practical routines. Against the backdrop of a principal knowledge of copper through contact with other cultures that knew this material,

32 Cf. Budd and Taylor 1995; Childs and Killick 1993, 325–329; Herbert 1993; Reid and MacLean 1995.

33 In this respect, Eugenia W. Herbert's findings can be generalized for the working of iron in Africa: "Ironworking offers a precious window into African cosmologies and a model for other technologies with similar cosmological grounding. It corresponds to what refers to as a 'synedochic' representation of culture where one activity can be seen as a microcosm of more general beliefs and practices" (Herbert 1993, 3; see Clifford 1983).

34 Celis 1991, 116. – Translation by authors.

its lack cannot be qualified as merely due to disinterest or an inability to recognize the possibilities of the new material, but rather as a defense against the New. The reasons for this can only be speculated about.[35] It is conceivable that people feared 'magical' properties ascribed to copper and the modes of its processing, properties that escaped control; potential consequences of the acquisition of the new material for the social fabric could also have been a source of fear.[36] Most impressive is Lauriston Sharp's portrayal of the consequences that resulted from the introduction of steel axes to the Australian Yir Yoront. These objects replaced the traditional stone axes that were exchanged over long distances.[37] Even though the steel axes represented only a small and gradual improvement and acceleration for the work performed, their introduction amounted to the destruction of existing structures of this community. Traditionally, the stone axes were owned by the old men. Even though they could be borrowed by younger men and women, they were the most meaningful expression of "superiority and rightful dominance of the male".[38] When mission stations began distributing steel axes, the old men lost their privilege. The result was "a revolutionary confusion of sex, age, and kinship roles", as well as the collapse of the whole social organization.[39] Denial and rejection of a new material can be reasonable and appropriate for social reasons, even if its adaptation would imply an optimization of workflows.[40] It would be wrong to reproach the old men of the Yir Yoront in the fashion of a critique of ideology "to represent a particular interest as general or the 'general interest' as ruling"[41], because the decline of the dominant system has led to a lasting anomie.[42]

35 Culturally foreign objects perceived as threatening valences and on the other hand their potentially dominant legitimatory importance for those who are familiar with them, have been explained by Mary Helms (Helms 1988).

36 Even for inventions of the 19th century, Eyth stated: "It is not the hardship that brings out all these inventions, but inventions have a great need to overcome resistance from all sides by a well-ordered, generally self-satisfied world" (Eyth 1919, 236. – Translation by authors).

37 Rogers also refers to Sharp's study (Rogers 2003, 449–450).

38 Sharp 1952, 59.

39 Sharp 1952, 84. – To recapture their lost sovereignty over other community members, the old men tried to mobilize other objects which originated – like the steel axes – from the Europeans: "During a wet season stay at the mission, the anthropologist discovered that his supply of tooth paste was being depleted at an alarming rate. Investigations showed that it was being taken by old men for use in a new tooth paste cult. Old materials of magic having failed, new materials were being tried out in a malevolent magic directed toward the mission staff and some of the younger aboriginal men. Old males, largely ignored by the missionaries, were seeking to regain some of their lost power and prestige" (Sharp 1952, 89).

40 See the resistance of loggers in the 19th century against the replacement of axes by saws (Radkau and Schäfer 1987, 11–15).

41 Marx and Engels 1976, 61.

42 Innovations can be rejected not only for the sake of the preservation of specific status positions of the members of certain groups. Another reason can be the prevention of accumulating political power that may threaten a largely egalitarian state of a community. See Pierre Clastres for an example of the South American Indian mechanisms to safeguard equality (Clastres 1976).

2.3 New wine in old bottles: 'trinket metallurgy'

If we take into consideration the need for any metallurgy to incorporate 'fire crafts' into cultural ascriptions of meaning, the earliest Late Neolithic copper horizon of central Europe in the 5th millennium appears as an expression of social and cultural openness to new ideas, an attitude that did not exist previously. The subsequent stage in the development of the earliest northern Alpine copper metallurgy can be characterized with Barbara Ottaway's catchphrase of a "trinket metallurgy",[43] since the earliest copper artifacts followed familiar forms, such as awls and hooks:

> It is possible that this was a reflection of the inventor 'playing safe' and not wishing to 'violate community norms' (Arnold 1985:220). This meant staying within the framework of known forms with the new material until such a time when the invention had been accepted by the community. Only then would it be culturally possible to experiment with new forms.[44]

Such a development can be observed in various cultures around the world that adopted metalworking. In these cases, the initial appropriation process is mainly dominated by restrictions stemming from a degree of caution in combination with a pre-existing technological tradition. We do not witness a maximalist exploration of the possibilities of a new raw material. Consequently, the first castings or crucibles are usually found only after a certain time, in fact when new forms require a new technological standard, or, respectively, when a new technological standard allowed the development of new forms. The 'new forms' – in this case, the first copper axes – require smelting and especially casting by way of crucibles. These copper axes were 'new' only with regard to the new material. Morphologically, they resembled contemporaneous stone axes, although knowledge about their production was already quite complex.[45] We are confronted here with a pattern, in which the New is disguised in the forms of old.

If we relate our knowledge of the later Neolithic copper metallurgy to Oevermann's innovation model, the following contours emerge:

1. The difference of the New to known traditions is obvious. This led to misgivings, so that an appropriation was not necessarily possible or desirable.

43 Ottaway 2001, 103.

44 Ottaway 2001, 103, quoting Arnold 1985. The 'community norms' are essentially those of a stabilization of the social order, whether marked by equality or inequality.

45 Tobias Kienlin notes in the context of metallographic studies of copper flat axes of type 'Altheim': "It turns out that quite early, a complex sequence of manufacturing steps was followed. Castings were not just further processed by mere rounding, but by a more or less intensive, in the majority of cases multistage reforging" (Kienlin 2008, 108. – Translation by authors).

2. Despite continuities with the preceding Neolithic periods, routines become questionable in the Late Neolithic, also in other sectors such as construction or the economy.[46] Such a process would have been unthinkable in the formerly culturally uniform and rigid system of the Linear Pottery Culture. We can assume an increasing openness to innovation, albeit to a limited extent.

3. The New – in our case a new material – has the opportunity to prove itself in the traditional, i.e. in known forms ("trinket metallurgy"). In this way, dealing with an innovation appears largely to be familiar and therefore without risk. The New is – and we take that for an extremely instructive finding – not dramatized as new, but remains subdued.[47] If we follow Günter Ropohl's differentiation[48] of functional and structural inventions (taken over from Max Eyth[49]) and generalize it to all processes of innovation, we could say that a potentially functional innovation first occurs in the guise of a purely structural one.[50] Marie Louise Stig Sørensen has summarized a similar use of the raw material iron in late Bronze Age Scandinavia: "Iron in the Bronze Age and iron in the Iron Age were in cultural terms two different things. Only with the exploitation of the functional properties of iron in the late Pre-Roman Iron Age did iron in fact become iron, or in other words did iron become a material in its own right, used for a particular set of products."[51]

4. Embedded in this 'dangerless' state, the New may prove its usefulness. 'Allegiance' emerges in individual and collective examination of the new raw material and the immaterial sphere related to it, for example, a divinity or cosmic force associated with metal. New processing capabilities can be experimented with on the basis of an acceptance of responsibility for the handling and mastery of a new material.

5. Finally, such an innovation becomes routinized through practical trial. The new raw material copper with its new processing options sets new standards in the form of technical forging, metal smelting and casting processes. We must, however, distinguish between a routinization of the production of copper artifacts and their use.

46 Cf. Schier 2009.

47 This shows the importance of what could be described following Nietzsche, as "a little unconventional action" (Nietzsche 1911, 161): A deviation from the ingrained practical routines and the norms that sanction them may appear to be insignificant. Its perpetuation through trial can lead to a questioning of existing routines.

48 "Structural invention" refers to a structural improvement of an existing device which thereby becomes more efficient, whereas a "functional invention" opens a new idea of utilization for the first time (see Ropohl 2009, 261–277). "A functional invention renders (a) the hitherto unfeasible feasible or (b) the hitherto already feasible not only better, but fundamentally differently feasible" (Linde 1982, 10. – Translation by authors).

49 Eyth 1919, 231–233.

50 This is another example of the appropriative transformation of the New that cannot be illustrated in Rogers' model because the criterion of "observability" of the New is not met (cf. Rogers 2003, 258–259).

51 Sørensen 1989, 195.

The proposed interpretation of the phases of Oevermann's model in terms of copper metallurgy of the Later Neolithic seems to stand in opposition to the processes of a 'charismatic innovation,' as the New exactly does not experience an increasing charismatization that would radically question existing traditions. Rather, an innovation remains subdued and withdrawn, so that one could perhaps speak of a 'camouflaged' innovation, and its practical test takes place within the framework of known practical routines. Looking closer, however, Late Neolithic copper metallurgy turns out not to be a counter-example but a variation of the model. To put it in terms of Weberian sociology of domination: central to it is the difference between charismatic leadership as an ideal type and those charismatic elements that must be included in all forms of domination, including decidedly non-charismatic forms of domination.[52] Within traditional forms of power (and traditional lifeworlds in general) factual innovations have to be legitimized as always already materially established and as being in accordance with tradition. In the shadow of this legitimacy, the charisma of the New can unfold on a small scale and in the guise of tradition. It can be routinized through practical trials. Innovations do not command special attention. They do not challenge the traditional in offensive ways and do not appear as material improvements. Initially, they appear solely as functional alternatives. Within these protected settings, the New is given its chance to prove itself. Its charismatic qualities may unfold and potentially lead to the formation of an allegiance, consolidation and finally displacement of the old.

52 Dirk Krauße's interpretation of the dead from the Late Hallstatt 'princely grave' of Hochdorf as charismatic ruler is based on an inadequate differentiation of these spheres of the charismatic (Krauße 1996, 338–345; see also Jung 2006, 171–179). However, Krauße is in good company, since even Pierre Bourdieu does not distinguish adequately between the ideal type of the charismatic and historically concrete phenomena with charismatic dimensions: he accuses Weber of having "been trapped in the logic of realist typologies. This leads him to see charisma as a particular form of power rather than as a dimension of all power" (Bourdieu 1990, 141).

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