Erhard Schüttpelz

# From Instruments to Containers, from Containers to Media. The Extensions of the Body

2021

https://doi.org/10.25969/mediarep/19312

Veröffentlichungsversion / published version
Working Paper

**Empfohlene Zitierung / Suggested Citation:**
Schüttpelz, Erhard: *From Instruments to Containers, from Containers to Media. The Extensions of the Body*. Siegen: Universität Siegen: SFB 1187 Medien der Kooperation 2021 (SFB 1187 Medien der Kooperation – Working Paper Series 21). DOI: https://doi.org/10.25969/mediarep/19312.

**Erstmalig hier erschienen / Initial publication here:**
https://doi.org/10.25819/ubsi/10026

# From Instruments to Containers, from Containers to Media: The Extensions of the Body

**(Translation: Anthony Enns) (May 2021)**

Erhard Schüttpelz
*University of Siegen*

"THE REVOLUTION OF THE TOOLS"

**WORKING PAPER SERIES | NO. 21 | MARCH 2022**
Collaborative Research Center 1187 Media of Cooperation
Sonderforschungsbereich 1187 Medien der Kooperation

**Working Paper Series**
**Collaborative Research Center 1187 Media of Cooperation**

Print-ISSN 2567–2509
Online-ISSN 2567–2517
DOI: https://doi.org/10.25819/ubsi/10026
Handle: https://dspace.ub.uni-siegen.de/handle/ubsi/2103
Weitere Identifier: urn:nbn:de:hbz:467-21037



This Working Paper Series is edited by the Collaborative Research Center Media of Cooperation and serves as a platform to circulate work in progress or preprints in order to encourage the exchange of ideas. Please contact the authors if you have any questions or comments. Copyright remains with the authors.

The Working Papers are accessible online at:
wp-series.mediacoop.uni-siegen.de

Print copies can be ordered by sending an email to:
workingpaperseries@sfb1187.uni-siegen.de

Publication of the series is funded by the German Research Foundation (DFG).

Cover image: Eva Lips: “The Revolution of the Tools”, in: Julius Lips, *The Origin of Things,* New York, 1948, 48.

Universität Siegen
SFB 1187 Medien der Kooperation
Herrengarten 3
57072 Siegen, Germany
www.sfb1187.uni-siegen.de
workingpaperseries@sfb1187.uni-siegen.de

# From Instruments to Containers, from Containers to Media:
The Extensions of the Body
(Translation: Anthony Enns) (May 2021)

**Erhard Schüttpelz**
***University of Siegen***

**Abstract** There is a long tradition of conceptualising the 'extensions of man' or the 'extensions of the body' as devices enabling the emergence of technical instruments and/or of media, a tradition renewed by recent discussions in German media studies (Siegert, Harrasser, Kassung). But most of the earlier protagonists of this tradition focussed exclusively on the extensions of human extremities and the brain (McLuhan, Leroi-Gourhan, Kapp). Only a minor tradition mentioned 'containers' as technical and figurative externalisations of the rump and of whole bodies (Mumford). Especially the British archeologist Clive Gamble has recently pointed to a long 'drift' from instruments to containers, and to the ambiguities of technical and figurative containers. Gamble's renewal of Mumford's intuition gives media theory a unique chance to develop a new prehistory of today's media and computer interfaces: acknowleding the long-term impact of gender divisions of labour; completing the incomplete matrix of Leroi-Gourhan's technical extensions by pondering the distributed cognition of traps and work-places; elucidating the spatial intelligence of useful, ritual and aesthetic skills; explicating the cooperative spatial action enabled by media such as maps and cosmograms, Amerindian bundles, Sub-Saharan masks and Siberian drums and many others yet to be explored in the long drift from instruments to containers to media.

**Keywords** Instruments, Tools, Container Technology, Media Theory, History, Ethnomethodology

'[A]s rational metaphysics teaches that man becomes all things by understanding them *(homo intelligendo fit omnia)*, this imaginative metaphysics shows that man becomes all things by not understanding them *(homo non intelligendo fit omnia)*, and perhaps the latter proposition is truer than the former, for when man understands he extends his mind and takes in the things, but when he does not understand he makes the things out of himself and becomes them by transforming himself into them.' – *Principi di Scienza Nuova* (1744), tr. T. G. Bergin and M. H. Fisch, §405

## *I.*

For Marshall McLuhan, the theory of the extensions of the human body was one if not the foundation of media theory. His main work even carried the title *Understanding Media: The Extensions of Man*.[1] From his perspective, media are extensions or prostheses of human organs, and vice versa. The concept of technology and that of the medium are thus blurred for McLuhan, as every technology can also be seen as a prosthesis.

1 Marshall McLuhan, *Understanding Media: The Extensions of Man*, New York, 1964.

This view has heuristic advantages, as it is possible to determine what a medium is through the technological extension of the body, which can in turn be determined through the invention of prostheses. The extension of the body becomes an extension of the concept, which can be historically concretised without having to be defined. For McLuhan, as well as other media theorists, this decision releases the theoretical imagination, which can argue that modern inventions in the area of prosthetic technology actually always overlapped with the history of the invention of new media. Does this overlap only apply to modernity, or does it also apply to the prehistory of media? And what meaning should be given to the distinction between tools and media, if one simultaneously wishes to proceed as undogmatically as McLuhan (and the German-language tradition of media theory)?

In the following, I will attempt to proceed as sceptically and prosaically as possible precisely because I want to reach far beyond McLuhan. Technological extensions of the body focus on what the human body *cannot* do and what it can do *better* or *only* with the help of tools and other people. In the history of the theory of technology this view has advocates who are just as strong as those for the theory of prostheses, such as Ibn Khaldun's claim that 'abilities' or 'crafts [...] procure for man the instruments that serve him instead of limbs, which other animals possess for their defense. Lances, for instance, take the place of horns for goring, swords the place of claws to inflict wounds, shields the place of thick skins, and so on'.[2] For Khaldun, however, animal models are insignificant for the human sphere of action due to his emphasis on the cooperative and collaborative organisation of technical processes.

In any case, to speak of an organ prosthesis or an 'exteriorisation of the organs' involves a threefold abstraction and reduction with respect to the concrete and commonplace: 1) a disregard of cooperative processes, 2) an abstraction of the techniques of body usage through a focus on one organ or a combination of organs, and 3) a reduction of body and interbody experience to their integration in an extrasomatic 'task' or 'function'. The relevant organ can only be conceived as a 'tool' through these abstractions and reductions. That should be noted in the following, which aims both to take part in and back away from these conceptual steps. Organs are not tools, and prostheses do not replace organs, even though the interconnected projection of these ideas undoubtedly has practical and theoretical consequences. Organs are not replaced by prostheses, but new technical assemblages do emerge, which at least partly succeed in meeting expectations by satisfying some of the demands placed on the missing organs.

André Leroi-Gourhan,[3] who has produced the most elegant theorisation of technical organ extensions to date, also derived his evidence not from the simple extension or elongation of body parts but rather from complementary or substitutional body techniques that can be practised with or without tools, such as scraping, scratching, boring, beating, and a few others. The recourse to corresponding body techniques remains familiar to us in every workshop: if we have forgotten a knife, we try to cut with our teeth; if we have forgotten a hammer, we check to see if we can stomp with our feet or if we can manage with our hands and a hard piece of wood; and if we have forgotten a screwdriver, we try to turn the screws with our fingernails. Leroi-Gourhan also assumes the primary status of body techniques, as his view of organ extensions implies the possibility that some common physical tasks can be modified in completely new ways with the help of auxiliary aids, such as boring with a finger, then with an ad hoc branch, a specially sharpened piece of wood, a pointed rod made to rotate with a string, and a mass-produced drill. The substantiality of Leroi-Gourhan's approach lies in the fact that he starts with a few elementary body techniques, which we all know how to perform with and without tools, and then postulates an evolutionary sequence during which the operational chains of body techniques are 'exteriorised.' His theorisation of technical evolution postulates five dimensions that collectively constitute—or would constitute if one accepts his argument—a 'totalised' exteriorisation. Namely, his history of exteriorisation describes 1) how organs successively exteriorise themselves through 'tools', 2) how the 'gesture of use' or the sequence of bodily operations migrates as a 'gesture in the tool itself', 3) how the motor function becomes independent in the tool, 4) how the 'memory' or 'storage' of gestures is transferred to machines, and 5) how the programming and thus the recombination and invention of a new technical process can be automated[4]. Leroi-Gourhan's consideration of these five dimensions with their many different technical inventions remains informative, even if it is difficult to understand them as 'steps' in human history before industrialisation. Apart from that, this approach is also oriented less towards a historical sequence of operational chains than the contemplation of a series of selected artifacts, between whose appearances there are deep gaps in the historical record: manual tools, machines (like mills), automata, looms, calculating machines, etc. In addition, for each of the operational chains transmitted by these artifacts it can be shown that this apparently

2 Ibh Khaldun, *The Muqaddimah: An Introduction to History,* tr. Franz Rosenthal, 3 vols., New York, 1958, 1: 90.

3 André Leroi-Gourhan, *Gesture and Speech,* tr. Anna Bostock Berger, Cambridge, 1980, esp. ch. 8 and 9.
4 Ibid., 237ff.

one-sided 'exteriorisation' gives rise to a *reciprocal* exteriorisation and thus a constantly new entanglement between artifacts and technicians or utensils and 'skills', through which the relevant technicians are forced to train and collaboratively organise themselves and their routine processes as 'tool of the tool', carrier of the operative gesture (the 'gesture of the gesture'), 'motor of motors', 'memory of memories', and 'programming of programmers'. The 'exteriorisations' postulated by Ernst Kapp and Leroi-Gourhan never occurred, even though they undoubtedly corresponded all too well to the rhetoric of technological promise of the 19th and 20th centuries or the wishful thinking of early 'artificial intelligence'—at the time of the emergence of Leroi-Gourhan's monographic outline and before the basic principles of early AI were quietly renounced in the 21st century in order to capitalise very pragmatically on the adaptability of algorithms and the breaking down of human actions into individual steps that could be more easily automated.

This double failure—of historiography and of the original design of artificial intelligence—demands a revision of the concept of 'exteriorisation'. On the one hand, it raises the question of which body is actually supposed to be exteriorised. Despite the variety of activities listed by Leroi-Gourhan and others, the 'extension of the body' is only directed towards three body parts: the extremities (hands, arms, legs, and feet), the teeth (used for cutting and tearing, as explained above), and the brain. Is that an entire body? Can an entire body be exteriorised from it? Obviously not. On the other hand, there is the question of what is derived from the externalisation of these organs. If their activities are externalised, then it should be expected that their workload is lightened at least with respect to the externalised functions. However, that does not appear to be consistently the case; in fact, the opposite tends to be true. The blank concept of an 'exteriorisation of motor functions' proves to be naïve (to say the least) if one knows the history of slavery after the introduction of the treadmill. In any case, the simplest step to this day is to transfer the motor function of transportation to other people, and the many daily carriers and couriers, movers and packers, are also by no means obsolete. Other forms of energy for motors have undoubtedly come along, besides wind and water, but the human motor has not disappeared.

The idea of an increasing 'exteriorisation of memory' through storage media proves to be even more contradictory as soon as one grasps the history of the socialisation of writing. It is more than ironic that literate cultures attribute a special emphasis on memorisation abilities to oral cultures, whether as a gift, a constraint, or both, when every form of literacy training still requires the memorisation of details and processes, and no one is released with a degree until they have internalised this retentiveness and demonstrated it through exams. In short:

Every exteriorisation occurred in a recursive form through the training of the 'memory of forms of memory', the 'gesture of the gesture', and so forth. In other words, every exteriorisation had reciprocal effects on the human body and produced new forms of interconnection and specialisation. Even the domestication of animals and plants had reciprocal effects on humans, as it forced the domesticators to supplement the characteristics that tamed animals and cultivated plants lost in the process of their domestication—that is, they had to reorganise parts of the 'exteriorised' behaviour of previously wild animals and plants and place them under the care of human responsibility. Farmers and shepherds thus became guardians of the animals entrusted to them, and they acquired the characteristics of a 'master of animals' as well as those of a domesticated animal that must take care of all the other animals. It is equally true for both domestications and technical or media inventions that every exteriorisation has repercussions for the exteriorisers and produces a broadly distributed series of new responsibilities. Exteriorisations occur recursively or not at all, and their consequences cannot be documented in any history of worldwide evolutionary 'stages'—even using the evidence of accumulating inventive steps.

***2.***

Leroi-Gourhan's equation of an all-encompassing technical accumulation with an increasing 'exteriorisation' is thus misleading as a whole and in all of its concrete historical applications to verifiable sociotechnical organisations. At the same time, there is something irresistible about the idea that extremities are 'exteriorised' or at least extended through the use of tools. And, as already described above, we use our bare hands or teeth when the appropriate tools are missing. As François Sigaut noted, the extension of the human body through tools also allows the organs involved to be seen as 'tools' that contribute more or less efficiently to a task.[5] It is this learning process that is actually experienced as a physical extension, although it is also a reciprocal extension of the body into the environment, such as when blind people use canes as a tactile, acoustic, and (for others) visual extension of their sensory perceptions. But also vice versa:

As biologists inform us, during the routine use of tools the body experiences an epigenetic change as soon as a person feels up to a technical task and is confidently

**5** François Sigaut, 'Technology', in *Companion Encyclopedia of Anthropology: Humanity, Culture and Social Life*, ed. Tim Ingold, New York, 2002, 420–459.

engaged in a technical process, as the tool is welcomed as part of the body. Leroi-Gourhan did not know how to contribute much to the feedback effects of every technology on the individual body other than the insight of tool classification. But his exteriorisations were only directed towards the extremities and the brain, which shows that a large part of the body was still missing. The question thus needs to be asked again: what would have been a real exteriorisation of the human body? Or has it occurred somewhere else?

Leroi-Gourhan also knew that the exteriorisation of the extremities and the brain did not include a large part of the technologies he discussed. The third part of his major work focused on forms of settlement and their symbolic construction, although he also addressed textiles, pottery, and cosmograms of all kinds. These technologies lacked any unifying concept, although he saw them as a basis for the creation of aesthetic forms and the ethnicisation of the groups that sustain them. Leroi-Gourhan also postulated that there was a tendency for this twofold development to be increasingly externalised so that technology, language, and aesthetics—at least in his own lifetime—principally flowed into the same 'sink' of human-historical stagnation:

> [S]ince technics and language are but two aspects of the same phenomenon, aesthetics could well be a third. We should then have something to guide us, for if tools and words developed into machines and writing by similar stages and more or less simultaneously, the same phenomenon ought to be observable in the case of aesthetics […]. Stages in aesthetic evolution comparable to the transition from the mythogram to writing and from the hand tool to the automatic machine would have to be found in historic times—an 'artisanal' or 'preindustrial' period in aesthetics in which the arts and social and technical esthetics had reached their peak at the individual level, followed by a specialization stage in which the disproportion between the producers of aesthetic material and the increasingly large mass of consumers of prefabricated or 'prethought' art became accentuated.[6]

What remains particularly striking is that Leroi-Gourhan refers to most of the technologies he discusses no longer as 'technologies' but rather only as symbols, decorations, and aesthetics, including all of the technical achievements involved in urban construction, housing construction, pottery, and hundreds more. For Leroi-Gourhan, the concept of 'technology' is supposed to coincide with that of exteriorised tools. He apparently lacked a brilliant idea to complete his schema. Other theorists have pleaded for a holistic integration of the exteriorisation schema using the central nervous system by comparing external communication channels and networks with bodily communication links.[7] Tools also extend the nervous system through their sensors and effectors, and the same applies to all technologies. Does this mean that all technologies are exteriorisations of the central nervous system? The concept then loses its specific parameters, and it merely means that the nerves are involved in everything that comes out of and goes back into them. The 'exteriorisation of the central nervous system' is useless as a scientific concept.

It can be said that the preparation of food through cooking, roasting, steaming, and smoking makes it more easily digestible, and cooking devices contribute in this way to the extension of entirely concrete physical processes—namely, the alleviation of digestion and thus pre-digestion. Cooking can thus be conceived as a contribution to the exteriorisation of the body, and it is possible to specify what cooking, steaming, curing, smoking, fermenting, and pickling mean for the alleviation, modification, and externalisation of digestive processes, such as how they supplement and replace bodily forms of energy management and what kind of protection from germs they do or do not offer. The concept of the 'exteriorisation of the central nervous system' is lacking such a corresponding physical concretion.

Leroi-Gourhan lacked an idea that could connect his genetic history of art with the history of the origin of technology. In retrospect, it is possible to postulate that such an idea was available in a form he would have presumably rejected as amateurish. It only obtained a professional archaeological application fifty years later through the distinction between 'tools' and 'containers' developed by Lewis Mumford. As Mumford wrote:

> Paleolithic tools and weapons mainly were addressed to movements and muscular efforts: instruments of chipping, hacking, digging, burrowing, cleaving, dissecting, exerting force swiftly at a distance; in short, every manner of aggressive activity. […]
>
> Under woman's dominance, the neolithic period is pre-eminently one of containers: it is an age of stone and pottery utensils, of vases, jars, vats, cisterns, bins, barns, granaries, houses, not least great collective containers, like irrigation ditches and villages. The uniqueness and significance of

**6** Leroi-Gourhan, *Gesture and Speech*, 275.

**7** See Ernst Kapp, *Grundlinien einer Philosophie der Technik* (1877), Berlin, 2019 and Marshall McLuhan, *Understanding Media*, among others.

> this contribution has too often been overlooked by modern scholars who gauge all technical advances in terms of the machine.[8]

According to Mumford, 'container' technologies later remain a feminine domain:

> In general, the mobile, dynamic processes are of male origin: they overcome the resistance of matter, push, pull, tear, penetrate, chip, macerate, move, transport, destroy; while the static processes are female and reflect the predominant anabolism of woman's physiology: for they work from within, as in any chemical transformation, and they remain largely in place, undergoing qualitative changes [...].
>
> Cooking, milking, dyeing, tanning, brewing, gardening are, historically, female occupations: all derive from handling the vital processes of fertilization, growth, and decay, or the life-arresting processes of sterilization and preservation. All these functions necessarily enlarge the role of containers: indeed are inconceivable without baskets, pots, bins, vats, barns [...].[9]

Sixty years later it can be said that Mumford hit the mark with this major thesis on the human step 'from tools to containers', for today the formula for perhaps the most important technical development is precisely what he proposed in his day: 'from tools to containers'. And today it also refers to a shift of the typical innovations from the palaeolithic to the neolithic and beyond. His statement on the feminine history of invention and the function of women as technical inventors through their roles as 'home-maker, house-keeper, fire-tender, pot-molder, garden-cultivator'[10] has also proven correct in terms of history as a whole. There is a 'male bias' in the history of technical inventions, and Mumford rightly made an energetic effort to correct it. However, his thesis is only right if one accepts three qualifications:

- it does not involve an actual 'step', or, if it does, then only in retrospect;
- the dating must be corrected;
- and, while recognizing feminine inventiveness, the gender correlation cannot be generalised.

To begin with the gender question: Mumford went too far when he attributed his image of the female body to women's occupations. A vast number of everyday female activities 'overcome the resistance of matter, push, pull, tear, penetrate, chip, macerate, move, transport, destroy'. And what Mumford calls 'static processes' are just as dynamic and to some extent also sudden as allegedly masculine processes. The responsibilities associated with 'stabilizing processes', such as the tasks of 'protection, storage, enclosure, accumulation, continuity', which he attributes to women, are also realised by both genders.

In different cultural settings, all of the individual technologies specified by Mumford are used with different sexual divisions of labour—sometimes by men and at other times by women (including a third gender of gender reversal). The sexual division of labour was undoubtedly one of the central features of human societies since the upper palaeolithic period. For that reason alone, it can be postulated that more than half of the technical inventions were the work of women. And the history of the invention of textiles, household devices, cooking, cultivation, and medicine remains particularly inconceivable without this work. However, it is not possible to attribute these individual technologies sweepingly to one gender or another on these grounds, as there are not only too many exceptions but also too many cultures. In short, there are too many demonstrably different forms of the sexual division of labour.

Something similar applies to Mumford's dating and thus to the question of an evolutionary step. In the archaeology of the last fifty years there have been numerous debates in which a 'revolution' was postulated whose duration and location was objectively proposed and then undermined for so long through other excavation sites and predatings that any talk of a 'revolution' no longer appeared valid. One of the last developments of this kind concerned the transition of prehistoric humans from a reliance on the successful hunting of large animals (including mammoths) to a more diversified range of food that also included many small and medium-sized animals as well as practically every available food source. This transition involved a reversal from the already conquered peak of the food chain to the much more pragmatic and almost opportunistic task of developing food sources. The term 'broad-spectrum revolution'[11] seemed appropriate enough since this change was equally as momentous as the much later 'neolithic revolution', as it allowed humans to conquer the entire world and to adapt everywhere to new flora and fauna, and in the process they learned how to deal with food sources more effectively. More importantly, the 'neolithic revolution'

**8** Lewis Mumford, *The City in History: Its Origins, Its Transformations, and Its Prospects*, New York, 1961, 15–16.
**9** Lewis Mumford, *The Myth of the Machine: Technics and Human Development*, New York, 1967, 140.
**10** Ibid., 141.
**11** Kent Flannery, 'Origins and Ecological Effects of Early Domestication in Iran and the Near East', in *The Domestication and Exploitation of Plants and Animals*, ed. Peter J. Ucko and G.W. Dimbleby, Chicago, 1969, 73–100.

also appeared to be an effect of the 'broad-spectrum revolution' or even its later radicalisation.

There was one hitch in this scientific development: it was easy to detect the symptoms of the 'broad-spectrum revolution', but the archaeological evidence of this transition pointed to an enormously long span of time. If it is necessary to think in terms of millennia in order to recognise a significant difference, then it is difficult to speak of 'events'. Today the 'broad-spectrum revolution' is considered 'the revolution that wasn't', to cite the title of a classic essay on its demystification.[12] The transition to a more opportunistic use of food sources has neither a beginning nor an ending, and it does not take the form of a revolution. The transition from the invention of 'tools' to the invention of 'containers' also has no origin. It cannot be recorded through revolutionary events but rather only through a very long-term observation of a time when fewer inventions can be detected in the domain of tools (the extensions of the extremities) and more and more 'container' technologies are invented and accumulate in archaeological sites. This shift is therefore only a 'gradient' or a 'drift', but as a whole it is just as influential as a short-term technological revolution, such as the transition from analogue to digital storage media. Clive Gamble is credited with combining both of these insights: the historical principle of a transition without caesuras (i.e. without revolutions and origins) and the nevertheless possible diagnosis of a gradual change in technical inventions from tools to containers and thus, as I believe I can prove, to media.[13]

Historians and prehistorians can remain sceptical with respect to this long shift: if there is no event or process that can be detected as a radical change for a specific generation, then what does this long but sustained transition mean? But the list of inventions of new 'containers' is impressive, and it proves Mumford and Gamble right: the most important technological change following the invention of aggressive types of tools remained for millennia the invention of 'containers'—technologies that do not need to have anything in common other than the ability to enclose something but that simultaneously develop the potential to adopt stylistic and technical-constructive characteristics from one another or even to coordinate ever more finely with one another.[14]

Gamble's list:

'Examples of the material proxies of the body':

Instruments: knives, sticks, pestles, spears, ploughs, arrows, drills, chisels, axes, shuttles, looms, needles, chop-sticks, jewellery, brushes, pens, wheels, long-bones

Containers: bowls, pits, houses, barns, caves, pots, baskets, bags, quivers, mortars, blowpipes, rifles, clothes, moulds, jewellery, graves, tombs, masks, skulls.

*3.*

This list is not and cannot be complete. It should also include body techniques and modifications, like make-up, masks, tattoos, and brands, as well as the territorial 'container' structures extensively discussed by Leroi-Gourhan: the design of villages and cities, tents and camps, the allocation of compass directions along with apex and nadir, zenith and centre, navel or 'omphalos', the representation of cosmograms and their navigational aids—these can all be discussed as part of the 'drift from tools to containers'. And it remains undeniable that Gamble's new invention of the history of invention 'from tools to containers' also assumed aspects of Mumford's gender question, as seen in his contrastive comparison between hunting spears and hats or clothes:

The hunting spear is an 'extension of the hand and arm', and its parameters are 'strength, leverage, power and speed', which modify the hunter by 'changing the shape of the arm'. Conversely, textiles are directed towards the 'enveloped and wrapped body', and the desired qualities are 'warmth, softness, protection, comfort, well-being', which have the effect of 'altering the surface of the body'.[15] This contrast is certainly not true of all tools and containers; nevertheless, it can be said that Mumford and Gamble together solved the question that Leroi-Gourhan could not solve—namely, how can the history of the exteriorisation of the body be completed? The answer involves three steps:

First, the exteriorisation of the body extends not only to the extremities, teeth, and brain but also to the torso and face and thus the entire body 'neck and crop'.

Second, this 'step' has neither a beginning nor an ending, and it is still ongoing. In a sense this applies to all previous 'revolutions' in human history, which makes them so difficult to date, and their dating becomes a question of how we can and want to perceive them. There is a similar theory in socio-biology: the more zoologists trust animals while observing them in the

**12** Sally McBrearty and Alison S. Brooks, 'The Revolution that Wasn't: A New Interpretation of the Origin of Modern Human Behavior', *Journal of Human Evolution* 39, 2000, 453-563.
**13** Clive Gamble, *Origins and Revolutions*, Cambridge, 2007.
**14** Ibid., 108.
**15** All citations from Clive Gamble, *Settling the Earth: The Archaeology of Deep Human History*, Cambridge, 2013, 180.

field, the more they can actually observe and especially also document.[16] This plasticity of attribution and empathy is not infinite, yet it is very flexible when observing and writing. Similar criteria apply to archaeology: the more precisely one looks back at the stone age, the more similarities with the present can be recognised. This question of the retroactive effect of cognitive interest on the constitution of the object cannot be settled, as it is part of history of archaeology.[17]

Third, the exteriorisation of the entire body is different from that of the extremities from both a technical as well as a sensory-physiological point of view. A spear can pierce an animal, which a hand cannot, but the end result is that the animal is caught, and in this sense it is an extension of what the hand does with small animals, as it grabs and kills them. There is a 'literal' extension and thus a continuity between what the hand does on its own and what it does with the help of tools. There also seems to be a literal continuity in the case of clothes, which appear as a 'second skin' and thus as an extension of this largest organ of the human body. But the phrase 'second skin' remains metaphorical not only because of everything the skin can do that clothing cannot, such as the ability to feel, to be wounded, and to heal, but also because the functions of this tool are not as fixed and limited as those of the spear, which as a sharpened projectile is aimed at specific activities. Clothes are a protective 'second skin', but they are also for comfort, as Gamble writes, as well as social marking, concealment (under certain circumstances), covering (as part of a person that is public or intimate and only accessible to certain people), and many other uses. The idea of 'clothes as an extension of the skin' is in any case already a bundle of physical and symbolic relationships. On the basis of this bundling clothes appear not as 'tools' but rather as extensions of the person or of the body in its entirety, and this extension can refer to the entire body, its volume (the torso), or its personality (the face).

With respect to this shift, Gamble resorts to classifying containers as 'extensions of the body' only in a metaphorical sense. They are metaphorical not only because, as in the case of skin, it is possible to recognise functions or qualities that 'literally' assume what clothes and skin have in common, such as protection and feeling comfortable (in one's skin). And it should not be ignored that tools also have a metaphorical relationship to their agents—see, for example, Mumford's attributions of masculinity and femininity in their culturally specific uses. But the basic characterization of containers as metaphorical extensions of the body is correct and corresponds only too well to Leroi-Gourhan's descriptions of the artistic and cosmological orientation of houses, containers, granaries, ornaments, and forms of settlement.

The extension of the extremities leads first to the use of instruments and the coordination of organs and tools. Skilful use changes the personality and improves the instrument, and the combination of use and skill is thus directed toward the site of a 'coupling'. Conversely, containers latently refer to the entire body and its transformation, which is difficult to limit or focus precisely because this reference can remain quite vague. The extension of a face or a body through a mask or an outfit, even if it only conceals the face and the body, allows another person to emerge. And the extension of the body through an artificial body or torso, a volume with a surface and an inner life, results in the emergence of another body and with it the question of its personality. As already mentioned, containers pose a metaphorical question about personal affiliation.[18]

For media history, the long 'drift' of technical inventions from tools to containers involves not just any threshold but rather the decisive threshold or 'drift' in which we always still act. The question should thus be at least briefly discussed: if there was once a time when container technologies were not recognisably pervasive, or even a time when only tools and no containers were detected, then where did they come from? In response to this question, I can only contribute three pieces of evidence that do not produce a clear picture, as the question of the origin of language is as unclear as ever:

First, tools have undoubtedly formed a whole out of different parts, and they must have also always been transported using different forms of storage. In this sense, containers have presumably 'always already' existed, and the claim often found in the research literature that this was precisely the decisive step in human history, such as the agglutination of heterogeneous materials into a workpiece, the complementarity of bow and arrow, or the development of blowpipes or other slingshot devices that could be broken down into complementary units, thus appears futile. It is simply unlikely that there was any major cogni-

**16** This theory is exquisitely summarised in the following book and title: Frans de Waal, *Are We Smart Enough to Know How Smart Animals Are?*, New York, 2016.

**17** Gamble particularly emphasised this point once again in an email exchange with the author of these lines (especially in an email from 22 September 2019): the dates for 'container' technologies remain arbitrary. However, there is an important zoological qualification: Bill McGrew pointed out many years ago that apes do not build containers or use tools as containers.

**18** This may seem far removed from our modern everyday experience, but it is only necessary to look at how many labels on the objects in a normal household refer to strange people and organisations, starting with brand names, and how these things are affiliated with particular people in the household, which are all condensations of people through and with containers.

tive leap induced by technology, not even by container technologies, and it will probably never be possible to reconstruct the most important early containers due to their transience, apart from some exceptions. And we know from the ethnographic literature how containers like Melanesian 'string bags' were always already symbolically charged.

Second, the gradual inclusion of more animals and plants in the food spectrum during the 'broad-spectrum revolution' also produced all sorts of new specialised technical devices, including containers. If the 'drift' of this change is correlated with the drift 'from tools to containers', and if this process were regionalised (as there could not be an archaeological argument without regional evidence of such a correlation), then it would be possible to propose that there were special cases that inspired new containers, such as specialised traps for each type of animal.[19] Regardless of their form, traps are specific containers that must be attuned not only to the body but also to the 'personality' of the target animals. They require an intimate knowledge of the biography of each animal, their adaptation to the season and the terrain, their habits and hazards. In order to come up with a good trap, it is necessary to know at least one thing: how and why the animal would go into the trap. For example, a classic wolf trap consists of a corridor with a door, behind which a passage leads in a circle back to the door. The passage is so narrow that the wolf shuts the door after his first lap, as he cannot turn the corner. He continues to run, and the door opens again, but he cannot run backwards. He keeps going in circles, and each time the door opens and shuts again.[20] This is not the only case in which the construction of a trap is also the construction of a specialised container, as the demonstrated effect of 'holding and enclosing' is part of its construction.

Third, it is possible to refine the conjecture that the expansion of the food spectrum through the invention of specialised traps also implied an expansion of container technologies. It can be argued that special traps for specific animals consist of two principal components: a container that is supposed to catch animals or render them harmless and a surface that is designed to attract animals or exploit their ignorance. That is an abstract categorisation, but often enough it also holds true very concretely, such as a carefully concealed pit that uses one part of the landscape as camouflage and another part as a container. Traps thus feature not only the first automata and machines, such as the first self-firing devices, but also the typical structure of later containers: volume vs. surface, and the surface as a site of symbolisation and sometimes also of enticement or camouflage. In other words, the more one thinks about traps, the more one understands that they were not merely mechanical instruments or mechanisms of deception; rather, they were installations conceived by humans for animals, and their processes served to simulate a part of animal reality and mask a part of human reality by physically as well as operatively distinguishing between an attractive or unsuspicious 'surface' and a concealed and partly even automatic 'container'. With this distinction, in any case, the cognitive activity involved in the construction of traps found ample food in the truest sense of the word.[21]

**4.**

The containers and all their variants—bowls, pits, houses, barns, caves, pots, baskets, bags, quivers, mortars, blowpipes, rifles, clothes, moulds, jewellery, graves, tombs, masks, skulls—bring us inevitably to the concept of 'container space', which has been repeatedly maligned in the research literature.[22] This involves the outside and inside of the container, its content, and its spatial inclusion. Where does the topologically as well as topographically definable organisation of technologies begin and end? How is a space made of containers, which can be seen as the 'container of all containers', a good basis for the development of technical abilities? Is every technical intelligence also a spatial intelligence and a simplification of technical processes through spatial thought and action?

When Leroi-Gourhan published his history of exteriorisation, the question of the exteriorisation of the brain or its cognitive abilities seemed to be the question of an external 'storage' device that could externalise human memory and also eventually program itself. As with the hand and the extremities, he also focused on the exteriorisation of the organ, as certain activities performed by the cognitive abilities of the brain, including memory, were 'transferred outward' through the tools and machines he specified, which entered into another interaction with the body. Leroi-Gourhan's question thus gives way to the somewhat different question of a spatial extension of cognitive processes by extrasomatic means: is it possible to 'think', memorise, plan, or solve problems better or also only differently using spatial tools? This is

**19** See Andrew Shryock and Daniel Lord Smail (eds.), *Deep History: The Archaeology of Past and Present*, Berkeley, 2011.
**20** Julius Lips, *The Origin of Things*, New York, 1948, 68ff.
**21** For more on traps, see Alfred Gell, 'Vogel's Net: Traps as Artworks and Artworks as Traps', in *The Art of Anthropology: Essays and Diagrams*, ed. Eric Hirsch, London, 1999, 187–214.
**22** After reviewing the relevant literature, I decided to leave these polemics alone, as the container technologies discussed here are not concerned with a unified metaphysics of space that would have to be disassembled, and they are concerned with countless aspects of spatial enclosure that the literature addresses only peripherally or not at all.

the formulation no longer of an exteriorisation of the brain but rather of 'distributed cognition', as 'thought' and 'action' are here not opposites; rather, cognitive processes also take place outside the physical boundaries of the body, as our environment is constantly arranged in ways that make it easier for us to manage. We think not only spatially in imaginary spaces but also physically in concrete spaces by moving and manipulating things. And presumably we are able to explore and memorise imaginary spaces so well because we have practised in concrete spaces.[23] The spatial units constructed for our activities are perhaps not 'media' (that also needs to be discussed), but their forms migrate into all (later) media.

That sounds very abstract, and it is therefore time for a few examples of everyday processes of spatial arrangement and technical planning and implementation. If we want to perform a technical task, like cooking, then we often arrange the components of the task in a series of piles, such as chopped vegetables for the sequence of a cooking process. If the spatial sequence conforms to the planned temporal sequence, then it becomes a 'waiting queue'. The task is temporally divided, but it is also spatially divided so that it is no longer necessary to think about the sequence in which the different piles are supposed to be dealt with. In this way, planning becomes part of the space, and the plan can be spatially 'memorised', 'improved', or 'thought', such as by considering whether to proceed one way or another by testing different spatial arrangements.

These are extensions of our cognitive abilities that function very practically, and they are thus also 'extensions of the brain', as we would act differently—and actually less effectively and intelligently—if we could only solve pending tasks with our brains. The act of putting together a jigsaw puzzle involves the typical spatial activity of making piles with analogous colours in order to prepare a part of the image or a possible addition of the same colour. At a much later stage, these piles are worked through to fill specific gaps or more subtle colour matching is carried out in order to decipher how a monochromatic section was translated into puzzle pieces. According to psychologist David Kirsh, three technical simplifications occur through such processes: simplifications of selection or the decision pathway, simplifications of perception, and simplifications of mathematically relevant estimates.[24] A non-psychological classification would presumably look different, as it would not have to start with cognitive processes (evaluation, perception, calculation), and it could focus instead on the practical unity of action and thought. All of the examples mentioned by Kirsh also involve technical processes and tricks.

These examples are particularly relevant for media theory, and they recall something that usually remains unthematised—namely, how many spatial techniques of external thinking, ordering, planning, and improvising we have learned and mastered:

- we construct spatial sequences in order to prepare sequences of tasks and to remind us of the next step in the spatial arrangement;
- we understand the corresponding 'stations' partly through the use of other memory aids or possible 'ingredients', which are already in the right place;
- we block decision pathways by discarding certain objects so they are not visually available or are excluded as 'waste';
- conversely, we save any remainders that are technically still valuable, as we can occasionally improvise with them and then receive 'something in exchange for nothing';
- we form not only long lines of objects to be processed or spatial to-do lists but also flat and three-dimensional processing spaces, like a matrix that can be arranged in rows and columns;
- we use spatial arrangements as models for other similar arrangements, and we sometimes even use an object or one of its models to measure its repetition through symmetry, inversions, and rotations (such as using 'tracings' of clothes to determine the size of the next part to be produced, which involves the use of one form as the model of another).

Kirsh's examples demonstrate individually and as a whole that there is still an entirely different and actually more fundamental reason why every—every!—technology is an 'extension of the body': '[I]n having a body, we are spatially located creatures: we must always be facing a direction, have only certain objects in view, be within reach of certain others. How we *manage* the spatial arrangement of items around us, is not an afterthought; it is an integral part of the way we think, plan and behave.'[25] The workspaces of our technical devices are designed to cope with technical tasks, and every technology is thus also from this point of view an 'extension of the body'. Technology appears on-site in workspaces as the planning, implementation, and improvisation of operational chains, and spatial organisation and arrangement

**23** The research literature on 'distributed cognition' and the spatial navigation and arrangement of distributed tasks is extensive and goes back to a large extent to Edwin Hutchins, *Cognition in the Wild*, Cambridge, MA, 1995. My explanation of this interpretation is based on David Kirsh, 'The Intelligent Use of Space', *Artificial Intelligence* 73, 1995, 31–68. This essay discusses the basic approach of 'distributed cognition' using a clear and consistent representation of practical everyday technologies.

**24** Kirsh, 'The Intelligent Use of Space', 35.

**25** Ibid., 31.

serve as a means of implementation in every such chain, from cooking to index cards.

However, there is also here a turning point for mastering a particular métier. According not only to Kirsh, an expert is someone who does not 'plan much' but who has proven highly effective in a given situation.[26] Experts thus rely on work environments that they have arranged using marks and memory traces, 'keywords' or 'keyword objects', and other aids that must be brought into view for a partial step and then disappear again: 'Agents "seed" the environment with attention-getting objects or structures. These can be harnessed to not only reduce perceived choice but to bias the *order* in which actions are undertaken.'[27] Our working and living spaces are full of long-term, medium-term, or short-term arrangements of marks that enable certain actions and block others. It can look terribly disordered from the outside, which it is for those who are less experienced.

The basic idea remains the same for beginners and experts: every technical step turns the space into an instrument for performing technical tasks, but it also becomes the technical space of an operational chain that runs through it. Every container can, in turn, be used as a 'technical space' where the steps of an operational chain can be processed. After some practise, imaginary spaces can also serve as media for these steps and their linear or alinear processing. Containers are thus not only tools but also process media—that is, they are media of processes and are themselves also processed in order to serve as graphic representations of possible processes, including not least the processing of additional tools, containers, and media.

**5.**

Leroi-Gourhan reserved the concept of technology for the world of tools, and Lewis Mumford and Clive Gamble corrected the inconsistency in this concept, which terminated the history of the technological extension of the body at this decisive point. They all agree, therefore, that containers are technologies and artistic processes that give rise to metaphorical relationships between containers, bodies, and the world or cosmos, such as the idea of a container as a metaphor for the body or the world in which the body is situated, or the idea of the body itself as a metaphor for its world.

These relationships have remained common since the upper palaeolithic period: the masked, painted, or tattooed body as a container or as part of an artificial container; the body painted and clothed in a house, tent, or another container, or buried in a container with its own objects or in an entire house for eternity; the house, the body, or a drum as metaphors for one another, such as the house as a body, the body as a house, the body in the house in the cosmos, the cosmos in the structure of the house and in its representation through the body. All of these technical possibilities give rise to metaphorical and other figurative relationships, which have presumably experienced no increase in complexity since their inception, so we are stunned again and again by their concentrations or abstract dispersions, regardless of the time and place from which they originated.

If the aesthetic complexity of all art since the upper palaeolithic period is acknowledged, then it is difficult to accept a unified concept of technology that would include, for example, the artistic sophistication and material competence of extreme miniaturisations, which can be found in all parts of the world, and the most mundane hoeing in the ground. It may be tempting to consider Leroi-Gourhan's solution more plausible—against all evidence—and to divide 'tool' and 'art' from one another. Our ancient and modern predecessors did not have this problem, as is well known, because they had the concept of *techné*, which referred to a systematically teachable and learnable skill. Since the 18th century, however, this concept can only be invoked through the new concept of 'technical ability' or 'technical skill'. The question remains: if tools and containers follow an entirely different logic, then what will become of the unified concept of technology?

I will answer this question in two parts in order to reconcile as much as possible the modern opposition between useful crafts and anti-utilitarian art and the dichotomy of grinding routine and cognitive refinement, with which it is often associated. As is well known, there was no opposition between crafts and art in nearly all cultures and societies, and, as Mumford never tired of emphasising, the dichotomy of routine and refinement only seemed to pertain to certain 'advanced civilisations', whose technicians were forced to produce repetitive piecework and whose refinement was reflected in the organisation of labour rather than the quality of the modular pieces. Like Mumford, however, we are also repeatedly faced in these civilisations with new refinements, which reveal that craftspeople enjoyed their autonomous activity and that no amount of supervision could deprive them of this enjoyment. It thus seems that what we understand as art in old containers was based on technical training, which developed if not inevitably and 'spontaneously' then at least with considerable regularity. Can the enjoyment of aesthetic refinement also be theoretically reconstructed in a way that clarifies that it is impossible to 'ignore' the opposition

26 Ibid., 36.
27 Ibid.

between craft activity and aesthetic pleasure in the design tasks of many cultures?

The historian of mathematics Jens Høyrup[28] divided practical knowledge and ability into four levels, and this categorisation is valuable not only for mathematical knowledge but also for every form of technical ability or practical skill:

First, practical activities are learned from other people. For example, mathematical abilities like counting and calculating can be learned very practically, such as by counting animals or estimating quantities of substances, and this traditionally occurs in 'communities of practise', which means through what Jean Lave[29] calls 'legitimate peripheral participation'. First, novices observe what others are doing and acquire an impression of the desired state of mastery. Then they are entrusted with unimportant auxiliary work and later with supervised preparatory work. They gradually assume more responsibility, including organisationally, and are eventually allowed to help out completely and on occasion even to take the place of an expert professional. This career advancement does not require formal exams, as their talent and engagement are constantly being tested under the aegis of an informality that is not required to sanction a departure. Novices must also decide for themselves how far they have come, as there is no set curriculum. Training in crafts (including training in the crafts related to the production of container technologies, such as pottery, weaving, millinery, etc.) was normally of this kind, and the corresponding training centres had a high dropout rate.

Second, there is the concept of *techné*. If formal teachability and learnability are added, which can be structured as a curriculum, then it is possible to speak of a 'technique' or a *techné* in the ancient sense, as there is not only an estimation but also a verification of ability (*natura*), exercises (*excercitia*), and attention to rules or precepts (*praecepta*). The exercises mostly follow models and involve working through examples. A community of teachers and learners emerges from these 'communities of practise', and as a result the learning content is modularised and partly also assumes the form of questions and answers. The sequencing of learning repeatedly emphasises the learning of repeatable sequences or what Leroi-Gourhan (in connection with Marcel Mauss) called 'operational chains'.[30]

Third, the more prestigious a *techné* becomes, the more it produces conflict and competition as well as a recognition of virtuosity—in terms of both its practise and training. The most prestigious models or masters are repurposed as 'textbook examples' for 'showroom exercises'. Most of these examples arise not from practise but rather from training through competition over rules, exercises, and talent. They do not elude practical application, and the more prestigious a technique and its virtuosity becomes, the more the practise of comparative virtuosity is used. This practise is not based on everyday applications, but it is a major source of the increase in consistency and formalisation. New mathematical procedures and figures also arise on this basis—that is, they arise from textbook examples and the agon of comparison, which requires technicians (mathematicians, grammarians, etc.) to prove their superiority. However, it is possible to see in every technology and art that the training and proving of specialised talent reveals formal properties that can be understood only by other virtuosos and not by amateurs. From a practical point of view, these formal properties are primarily understood as 'methods': how, in what way, and by what means can the practical goal be reached? Under certain circumstances, however, the competition for prestige turns them into one object of study: what are its constituent elements, and to which and how many transformations is it subject?

Fourth, the highest level of practical and technical knowledge is reached when the formal properties of the formal objects constructed by virtuosos become the basis of practical instruction for everyone. This occurred in the history of mathematics, but only in the modern period (and with well-known difficulties). It also occurred in the grammar of Indian Sanskrit on the basis of oral formalisations. Mixed states of formalised and less formalised branches were and remain widespread. For example, there were two kinds of mathematics in ancient Greece: geometry, which was admired philosophically for its 'useless' nature (despite its usefulness) and its function in the *theoria* or contemplation of formal properties (especially dimensions), and a mathematics of accounting, which

**28** Jens Høyrup, 'What is Mathematics: Perspectives Inspired by Anthropology', in *The Nature and Development of Mathematics: Cross-Disciplinary Perspectives on Cognition, Learning and Culture*, ed. John W. Adams, Patrick Barmby, and Alex Mesoudi, London and New York, 2017, 179–196. I am extending Høyrup's approach by applying his explanations to other non-mathematical techniques. If this account proves correct, then Høyrup deserves the credit; if not, then any mistakes are due to my approach.

**29** Jean Lave, 'Situating Learning in Communities of Practice', in *Perspectives on Socially Shared Cognition*, ed. Lauren B. Resnick, John M. Levine, and Stephanie Teasley, Washington, 1991, 63–82.

**30** The literature on the genealogy of the concept of the 'operational chain' is now very extensive. For a discussion of Marcel Mauss's explanation of the 'operational chain', see Marcia-Anne Dobres, 'Technology's Links and *Chaînes*: The Processual Unfolding of Technique and Technician', in *The Social Dynamics of Technology: Practice, Politics, and World Views*, ed. Marcia-Anne Dobres and Christopher Hoffman, Washington, 1999, 124–146.

was designed for practical use and was never philosophically appreciated or recognised as *techné*.[31] But the emergence of formal properties from the competition between 'showroom exercises' was also due to the Babylonian mathematisation of astronomy and astrology and Indian mathematics.

If the teaching of formal properties is performed in a formal way and organised as a curriculum, especially if the curriculum is designed to study and terminologically specify formal properties for their own sake, then it can just as well be considered a 'science'—even for non-European practises. Unfortunately, there is currently no curriculum on the history of science that could satisfy this criterion, and accounts of non-Hellenistic sciences have also been a patchwork that have so far only been improvised in reference books.[32]

The fact that there were two kinds of mathematics in ancient Greece shows that even in the case of mathematics the evaluation and composition of their activities remain arbitrary. We thus trace the history of mathematics as a history of numbers that arose from the physical process of ordinal and cardinal numbering, which also remains clearly recognisable in our decimal system and is still counted on fingers. The picture is clear: earlier, elsewhere, and everywhere, people could only count and calculate crudely, and this was followed by an entire series of numerical inventions from the Indians, Babylonians, and Greeks, which we do not share with anyone (besides the Mayas).[33]

The history of container technologies indicates that in many cultures there was little need for the techniques of counting and calculating, but there was tremendous need for geometrical and topological practises that developed formal objects and properties in appropriately practical ways. A large part of the mathematical intelligence of past times seems to have been based on container guidelines and their topological relations, and it is therefore still unwritten to this day. For example, the practise of textiles, ornaments, string games, weaving, and sewing led to the development of a practical mathematical intelligence on all continents, which remains largely unknown to us because we never practised it. Only a few of us have the topological process of string games in mind, with which we impress spectators and initiates and at the same time enjoy formal properties that could bear comparison to Euclidean theorems—do we know it?

It is easier to recognise a mathematical refinement in the geometry and topology of ornaments, which affect us aesthetically and which we appreciate for their aesthetic characteristics. In his discussion of Inuit embroidery, for example, Franz Boas attempted a comparison that suitably highlights the technical, social, and formal side of the subject at the same time:

> If these facts have a wider application, it would seem that on the whole the pleasure given by much of the decorative work of primitive people must not be looked for in the beauty of the finished product, but rather in the enjoyment which the maker feels at his own cleverness in playing with the technical elements that he is using. In other words, one of the most important sources in the development of primitive decorative art is analogous to the pleasure that is given by the achievements of the virtuoso.[34]

This statement points out that in the long duration of humanity the virtuosity of the technical arts did not distinguish between arts and crafts motives and that it repeatedly went through all four of Høyrup's 'stages' of technical learning and partly also skipped over them due to 'the enjoyment which the maker feels at his own cleverness in playing with the technical elements that he is using'. The virtuosity of technical ability takes centre stage, and it simultaneously produces formal properties that are later appreciated partly as aesthetic characteristics and partly as mathematical objects and processes. The history of container technology was designed to succeed in many different registers and often in multiple registers at the same time, such as in Melanesia and on the northwest coast of North America: in mathematics, especially topological relations; in material competence and knowledge; in the aesthetic virtuosity of the stylised representation of symmetries, overlaps, and part-whole relations; and in social classification through acts of coordination, delegation, addressing, and identification.

**31** See Markus Asper, 'The Two Cultures of Mathematics in Ancient Greece', in *The Oxford Handbook of the History of Mathematics*, ed. Eleanor Robson and Jacqueline Stedall, Oxford, 2009, 107–132. Jens Høyrup described the pre-modern diversity of practical mathematics in a drastic way using the example of geometry: 'On the whole, the pre-Modern geometrical cultures of scribal administrators, surveyors and master builders were as isolated from each other as, say, dentists, air traffic controllers and public relation experts nowadays.' Jens Høyrup, 'The Rare Traces of Constructional Procedures in "Practical Geometries"', *Filosofi og Videnskabsteori pa Roskilde Universitetscenter Preprints og Reprints* 2, 2006, http://akira.ruc.dk/~jensh/Publications/2006%7Be%7D_The%20rare%20traces%20of%20constructional%20procedures.PDF, 8.

**32** David Pingree, 'Hellenophilia versus the History of Science', *Isis* 83, 1992, 554–563.

**33** Georges Ifrah, *From One to Zero: A Universal History of Numbers*, tr. Lowell Bair, New York, 1985.

**34** Franz Boas, *Race, Language, and Culture*, New York, 1940, 592.

*6.*

The main title of the book by Marshall McLuhan that is subtitled 'The Extensions of Man' is 'Understanding Media'. This title was apparently a little contingent. 'Understanding Media' was intended for a book market that already featured titles like 'Understanding Literature' and 'Understanding Physics', and it thus denoted little more than 'An Introduction to Media' or 'Media for Beginners'. We nevertheless accepted the credo that media theory was a theory of the extensions of the body and that 'understanding media' means understanding the extensions of the body. Based on the range of phenomena presented here so far, is the theory of the extensions of the body really a 'media theory'?

There is some evidence that the prehistoric history of media took a decisive media-historical step with the shift from tools to containers. However, there is no decisive container to which this question can be attached. The container technologies identified by Gamble are diverse: bowls, pits, houses, barns, caves, pots, baskets, bags, quivers, mortars, blowpipes, rifles, clothes, moulds, jewellery, graves, tombs, masks, skulls.[35] And a survey of the archaeological record and its globally related subjects soon leads to the arts and media: ornate bowls, symbolically divided houses and temples, cave painting and graffiti, pots with patterns, baskets, bags, mortar and songs for its operation, clothes, jewellery, graves, masks, and overmodelled skulls are all immediately recognisable as material objects with images, ornaments, symbols, and ritual uses. In other words, they are apparently media, even in cases where we do not understand their language. How can this fact be integrated?

Let us begin with a disappointment in order to see what it means. In German media studies a triad was popular for several years that privileged three operations of signal transmission as a characterisation of all media: transmission, storage, and processing.[36] An entire series of container technologies were actually created to perform these operations in an entirely material way: containers and storehouses can be used to store; bags, barrows, and baskets can be used to carry (and store); and cooking pots can be used to process (as well as store and transport food). Materials and individual items are stored, carried, and transmitted, and they are also processed through their transportation and storage. The ethnographic literature also describes symbolic cases of storage, transmission, and processing through containers from all around the world. However, signal transmission is governed by the paradigm of a messenger or letter model, in which the message is converted into signals, transmitted in signal form, and then later converted back into a message, or it is placed in an envelope and then taken out of the envelope again.[37] But the messenger model ignores the entire problem of the message and the messenger, as not all messages are entrusted to all messengers. The idea that it is the content of a transmission that is 'communicated' does not stand up to closer scrutiny. Indeed, the message is not what is transmitted but rather what can be explained, commented on, and corrected.[38] And in the case of containers, it is precisely the surfaces themselves that are medially charged, as it is impossible to separate containers and contents or signals and messages.

An examination of containers based on the triad of 'transmission, storage, and processing' has a similarly disappointing conclusion. Containers were not media in the sense of signal transmission, and they were not 'messages' or 'envelopes with contents' in the sense of a messenger theory of media. It would be easier to argue that the evidence for the signal transmission theory and the messenger theory of media—that is, the two container theories of communication—is as compelling as it is limited, as container technologies have been media from time immemorial.

The media theory of the drift 'from tools to containers' must therefore proceed differently. Containers were already media for thousands of years before a few selected media were subject to a 'container theory' that only addressed three selected operations, and the theory fails due to this limitation. Even the crudest survey of this material record since the upper palaeolithic period shows that what all of the possible forms of historical containers have in common is that they always involve 'ornate' objects, which means that the surfaces of these objects engage viewers, allow them to explore patterns, force them to reflect, but also potentially mislead them. They have such a power over their viewers that their viewers must change their lives and sometimes even dedicate themselves to the

**35** Clive Gamble, *Origins and Revolutions*, Cambridge, 2007.
**36** See Friedrich Kittler, *Grammophon Film Typewriter*, Berlin, 1986. The origin of this triad was rarely discussed, but it appears to come from a textbook on informatics in which other triads and quartets can also be found: transmission, storage, representation; recording, processing, storage, retrieval; or, at the beginning of cybernetics, transmission, storage, monitoring (as discussed by Karl W. Deutsch). I only refer to the most common triad in the following, although the argument also applies to all of the other variants. For more on the German-language discussion of basic concepts, see Hartmut Winkler, *Prozessieren: Die dritte, vernachlässigte Medienfunktion*, Paderborn, 2015.

**37** For more on the messenger model, see Klaus Krippendorff, 'Der verschwundene Bote. Metaphern und Modelle der Kommunikation', in *Die Wirklichkeit der Medien*, ed. Klaus Merten, S. J. Schmidt, and Siegfried Weischenberg, Wiesbaden, 1994, 79–113.
**38** Also and precisely in the case of the theory of signal transmission: Claude Shannon and Warren Weaver, *The Mathematical Theory of Communication*, Urbana, IL, 1949.

objects. The surfaces of these objects are also image surfaces that allow their material carriers to become images, and they thus allow human people to become other artistically or artificially enhanced people.

Images are carried by the body, and they extend from the containers to scales that can focus on the entire inhabited world or manifest in individual bodies by 'embodying' them in different ways. Everything possible can be transmitted using containers—everything possible!—or it can be 'included' and thus transformed into 'content'. Following McLuhan's dictum that 'the "content" of any medium is always another medium', it is possible to say that 'the content of any container is always inclusion', or 'containers are the media whose content is an inclusion'. This inclusion can be broken down in three ways:

First, some of these media are objects that can be given and taken, denied or distributed, returned or destroyed, such as bowls, pits, pots, baskets, bags, quivers, mortars, blowpipes, rifles, clothes, jewellery, and masks.

If these objects are handled with others, then instantaneous actions occur that are material as well as symbolic: some of these objects can be shared with others, some can be hidden from others, some can be kept open or closed, some can be transferred or denied to others, some can be or become personal and/or collective possessions. Material handling inevitably creates personal relationships and raises questions about their rights and responsibilities or their spontaneous emergence as a result of sympathy and antipathy. Gamble cites game theorist Ronald Grimes on masks,[39] which can be worn or only transported, encountered unexpectedly or as part of a planned ritual, shown or concealed, presented or removed, revised and restored or destroyed and sacrificed, given or taken, etc. The same applies to all of the containers listed above. Masks can also appear as a torso, a face, or an 'entire body', and they can be complemented by other masks. The objects and the people who use them are both defined by what the people do with them.

Second, these possibilities allow container technologies to connect things and people, material and personal relations, the individual and the collective. This also applies to non-transmissible (i.e. inscriptive) containers, non-portable (i.e. unique), and static (i.e. fixed) containers, such as architectural constructions (bowls, pits, houses, barns, caves, moulds, graves, tombs, etc.) and the arts of body modification (tattooing, piercing, scarification, branding, etc.).

Marcel Mauss' essay on the exchange of gifts presented a detailed justification for this mixture of people and things, which remained an object of intense discussion for several years.[40] In this context it is sufficient to point out that in their respective cultures (including our own) many of the abovementioned containers either circulated as gifts or gave rise to gift-giving events that could occur on any occasion of rites of passage, also in order to deal with questions of collective property. And if containers were exchanged (including container technologies, such as those of the individual claimants), then they became units of value and sometimes even forms of currency through their possibilities of quantification.

Third, if the material handling of container-objects merges into personal relationships, and objectivity merges into personality, then it does not make sense to reduce these media to signal processing or to signs, people, or things, as they are all three at the same time. Container technologies demonstrate—again and for the first time—that media are situated in a middle from which they operate or are operated. And it is not only a vague and variable middle between people, things, and signs but also an entirely concrete middle between the interior and exterior of the container or between people and automatic apparatuses, such as the skin (in the case of tattooing) or the 'skin' of a 'user interface' (in the case of electronic devices).

If container technologies function for our present like the 'urmedium' of all media, as we likely cannot go back any deeper into the human history from which our tools and media emerged, then from the very beginning they constituted (for us) an 'impure medium' with overlaps between signs and objects, people and things, and signs and people. However, this was not because the handling of this medium was 'undifferentiatable' but rather because the abovementioned differentiations were set as well as undermined by the actions and operations performed with container technologies. In addition, none of the abovementioned technologies have died out, and they remain updatable in all of their aspects.

## 7.

If the drift from tools to containers can be interpreted such that the extremities were extended first, followed by the face and the torso at the same time, then what about the extension and exteriorisation of the brain? According to the theory of 'distributed cognition', the activities of brains are spatially extended because they always take place in space, which for all of us is a nor-

**39** Gamble, *Origins and Revolutions*, 99ff; Ronald Grimes, 'The Life History of a Mask', *The Drama Review* 36, 1992, 61–77.

**40** Marcel Mauss, 'Essai sur le don', in *Sociologie et anthropologie*, Paris, 1951, 145–283.

mal case of instrumental action in space, as explained above. However, there is one simple fact that contradicts the idea that technologies can extend the brain itself as a physical organ—namely, the fact that the brain has not grown during the entire history of human technology. In fact, it is impossible to detect any documentable change or improvement in stone tools in the millennia before the brain grew to its present size.[41] The conclusion could not be clearer: the size of the brain and changes in material technologies have developed completely independently of one another, or at least there is no evidence for any other proposition. That makes it somewhat difficult to believe in an 'exteriorisation of the brain' or to find this hypothesis scientifically plausible, as any grounds for such a correlation will be found neither in technologies nor in the brain. If one wants to speak of an 'exteriorisation of the brain' in a way that is not merely vague and metaphorical, then this should have been reflected in some correlation. This hypothesis can thus be disregarded—except in the sense already described above that people can cooperatively and individually think, act, memorise, plan, and improvise through spatialisations until something 'technically succeeds' or goes wrong.

Cooperative abilities are here undoubtedly the decisive factor of human history, and the second factor is that everything that can influence cognitive abilities and facilitate actions in and with space can also be done to and with containers.[42] In concrete terms:
- we can form spatial sequences using 'containers' in order to prepare sequences of tasks and to remind us of the next step in a spatial arrangement, such as in a workshop or on a timetable;
- we understand the corresponding 'stations' partly with the help of other memory aids or possible 'ingredients', which are thus already in the right place;
- we block decision pathways by making containers in such a way that certain parts are visibly unavailable or are available differently for different groups;
- we use containers to form not only long lines of objects to be processed or to-do lists but also flat and three-dimensional workspaces, such as a matrix that can be arranged in rows and columns;
- we use a spatial arrangement of containers as a model for other and similar containers, and we make a container the measure of its repetition through symmetry, inversions, rotations, matrix-patrix relations, etc.

All of these techniques and possibilities can be easily proven for container media and their cultures. If Kirsh says that the cognitive operations he cites facilitate perception, decision pathways, and mathematical correlations, then this applies to all 'container media' and their possible use in the spatial arrangement of tasks or as a 'spatial score' for other activities.

And, to return to the question of aesthetics posed by Leroi-Gourhan, one of the most striking features of many container media worldwide remains their stylised representation of the spatial world, especially in 'cosmograms' that combine elementary map functions with equally elementary spatial arrangements and that simultaneously classify spaces, their inhabitants, associated animals and plants or distinctive landscapes, and cosmological forces. If these cosmograms appear on portable surfaces, then they can also be understood and used as elementary aids to navigation or orientation. Even the arrangement of public spaces still retains something—or even more—from this cosmological matrix, which is easy to determine when the phrases in this paragraph are checked for the meaning of compass directions in the political sphere: 'the global south', 'the west', 'the near east', 'the far east', and the 'high north'.

These media of spatial navigation, orientation, and intelligence appear to be limited in their contexts and operations, but media usage has always been bundled in media (digital or analogue). In Native American societies they are quite literally 'bundles' or bundled objects that are unpacked for ceremonies and other gatherings, and they grant their legitimate owners the authority as well as the available assistance to perform certain world-renewing ceremonies or to summon the aid of certain protective spirits.[43] This perhaps most important Native American medium has been discussed again in recent years because it reveals three major differences between the old and new worlds:

- The peculiar mixture of a hierarchical ritual system and an awareness of freedom: Everyone is in principle entitled to the privileges of their respective bundle-powers, so there is no one who does not need to take into account the virtual superiority of an interlocutor. The other is not inherently 'equal' but rather potentially superior, and the cosmological constitution of

**41** For more on these results, see Daniel S. Milo, *Good Enough: The Tolerance for Mediocrity in Nature and Society*, London, 2019, 105.

**42** What follows is a somewhat differently accentuated summary of Kirsh's essay 'The Intelligent Use of Space'. See the more detailed explanation above, which is only partially oriented towards Kirsh's own research interests.

**43** For more on Native American societies as bundle-cultures and bundle-societies, see Karl Anton Nowotny, 'Rituale in Mexiko und im nordamerikanischen Südwesten', *Jahrbuch für Geschichte, Staat und Wirtschaft und Gesellschaft Südamerikas* 8, 1971, 4–38; Timothy R. Pauketat, *An Archaeology of the Cosmos: Rethinking Agency and Religion in Ancient America*, London and New York, 2012; Wesley Bernardini, 'Hopi Clan Traditions and the Pedigree of Ceremonial Objects', in *Enduring Motives: The Archaeology of Tradition and Religion in Native America*, ed. Warren R. DeBoer and Linea Sundstrom, Tuscaloosa, AL, 2012, 172–184.

the other is not supposed to be questioned (which obviously repeatedly happened in real life).
- The bundle-powers as the focus of ritual and political organisation: According to some accounts, the fundamental power within Native American societies lies in the responsibility for a particular ritual and its territorial basis. As David Wengrow explains, Native American societies are 'image-based', whether in the form of the collective or individualised 'vision quest' (a category he refers to as 'image-seeking' societies) or in the form of the territorial responsibility for masks, people, and reproduction (a category he refers to as 'image-wielding' societies, as in the case of the northwest coast).[44]
- If this was the nucleus of Native American societies, then it can be assumed that European sociological concepts were inappropriate for the new world and that recognition of the 'bundle' relationship allowed the indigenous inhabitants of the Americas to be recognised as what they wanted to be: not 'individuals' in an 'corporate' collective but rather singular bundle-holders with the authority to exercise and defend heterogeneously bundled ritual powers 'without which the world cannot exist'.[45]

Native American bundle-media perhaps appear chaotic and obsolete compared to our current technical environment, but they are not. First, we constantly bundle our bodies in clothing, which involves choosing between bundled statements, memories, and under certain circumstances helping spirits. Second, we should not forget the bundles we carry in our pockets or bags, which include identity cards, memorabilia, money, and documents of all kinds. Third, it is also possible to ask whether our mobile phones are nothing more than media bundles that we only open to others for special purposes and otherwise keep to ourselves as our best-kept secret. In other words, they are not simply telephones but rather bundles of media technologies that provide a singularised node of access to the 'private spheres' of their owners, including their social and electronically saved privileges as well as their constant spatial navigation and coordination with others ('where are you now?').

Our current media are thus in principle comparable to those of earlier and other cultures in terms of their 'extensions of the body'. Media history is alinear in this respect, as there is neither a fundamental rupture nor the continuity of a common denominator. The mobile phones of today have more in common with Native American bundles than with the fixed phones of yesterday. The surprising continuities and ruptures of comparison should be accepted as they appear, including in particular the metaphors that feed on container relations and technologies, as Gamble rightly diagnosed. I offer here two additional examples of extensions of the face and body.

Zoe Strother[46] ethnographically observed the development of new African masks, and her account provides a genetic understanding of the relations between moving and static images. Sub-Saharan visual art assumes a hierarchy not only between bodily induced, bodily close, place-bound, and mobile images but also between images and danced music. The advantage of Strother's ethnography is that it starts with entirely profane and everyday activities and describes the media-technical process through which new faces are formed. This process begins with an informal gathering of people, such as unemployed youth, who try out a new rhythm and encounter a new character in the emerging atmosphere, which they emphasise through disabled movement. This character is evoked through dancing and the corresponding music, and after its stabilisation it is also clothed. The character's preferences, smells, foods, and taboos are identified so that he feels comfortable in our world while dancing, and his atmosphere spreads. The visualisation only occurs afterwards through the clothes, colours, and moving evocation of what had already been seen in the character, such as something comic, dazzlingly beautiful, ugly, or angry. And after the character is illuminated from all sides and understood in his moving spatiality and temporality, he becomes the portable image of a mask that can and must be danced. The mask is only a by-product of this long process of manifesting the spirit, and it seems so striking to outsiders because it emerged long ago from the non-visual, was set in motion, and then embodied in the well-thought-out appearance of a familiar person. In other words, it is not a coming-to-itself *(Zu-Sich-Selbst-Kommen)* but rather an ultimate palpability that draws attention to the contrast between the moving image that is produced by dancing and the rigid and emptied features of a momentary image that lights up like a flash of lightning.

Strother's description provides a kind of 'spectral analysis' of the emergence of a medium from bodily movements. The 'extension of the body' starts with dancing, which leads to an encounter with the figure of an unknown person who is clothed or 'fitted out' in all sensory dimensions, which is visually reinforced in the end by a portable mask. This sequence may seem strange to our culture—or at least to the way we see African masks, as our museums only rarely confront us with their rhythms and dancing (such as through short film clips on monitors). However, it may be recognisable to us from the dance trends of the 20th

**44** David Wengrow (London), e-mail correspondence with the author, September 2019.
**45** See Bernardini, 'Hopi Clan Traditions', 172-184.

**46** Zoe S. Strother, *Inventing Masks: Agency and History in the Art of the Central Pende*, Chicago, 1998.

century, which similarly involved the invention of new rhythms, their musical delivery, and their visual outfitting through clothes, haircuts, and synaesthetic 'styling'. They could even include visual 'masks', as in the stereotypical image of the cakewalk, which despite its maximal standardisation condensed a decisive balancing act between dance movements and the exchange of social perspectives into a veritable 'formula of pathos': coolness for one, wildness for the others, elegance, self-irony and mockery, racism and trickery.[47]

Media are distinguished by the fact that they open up multiple situations and descriptions of situations within a situation. It is possible to express this quality by saying, like McLuhan, that the content of any medium is another medium. It is also possible to say that a medium not only contains other media but also consists of different inclusions of each respective medium, which are bundled differently for different users. This quality applies to all media, but it is most clearly materialised by Native American bundles. It is also demonstrated instantaneously in free dancing through the perspectivism of the situation: we expect that 'the dance', and thus the dancing event, is different for everyone, that it looks and feels different from the perspectives of all of the people involved, and that it nevertheless takes place at the same location with all of the same participants and spectators. A medium consists not of communication but rather of the potential to generate multiple situations within a single situation, which can be interpreted in different ways by different people.

The example of a single medial object provides a rough insight into the constitution of the media that emerged from the long 'drift' from tools to containers and their media. Michael Oppitz has given an overview of the 'roles of drums' in the shamanism of the Himalayas, which cannot be further condensed. I will therefore cite it in excerpts and do no more than *italicise* a few of the container technologies and extensions of the body that play a role in his characterisation:

> The shamanic journey to the edge of the cosmos is expressed through the movement of dance, and the drum is actually the preferred accompanist of the healer who travels through worlds on behalf of his clients. This service can be fulfilled in different ways: as a pacesetter, a scout, a *navigational device*, a *map*, or a telescope; or it can transform into a *vehicle* for its owner. As a *means of transportation* for the healer, it is encountered at times as a horse, a reindeer, a bird, a boat or barque, a sleigh, a spaceship [...].
>
> Due to its sound the drum can be used to summon supernatural protective spirits [...]. Drums and drumsticks can also be used as tangible fighting instruments: the drumstick as a *dagger*, a *lance*, or a *stake* [...]; the drum as an aggressive club or a defensive shield [...]. Depending on his immediate needs, the healer can also convert his instrument into a *container*—a pot, a bucket, a chest, a basket, a catching device—; into a cover or a pillow; and into a mirror, in which spatial and temporal visions are concentrated: the *abode* of a lost soul, the *hiding place* of hostile forces [...]. The idea of the drum as a *screen* or illustrated cosmos in the form of applied paintings has been already mentioned.[48]

The shamanistic dance space thus comprises an immeasurable series of 'inclusions', and it reveals them at the same time through the drum and its healer. In the case of these three examples from three different continents (America, Africa, Eurasia), which each have a different focus (materialisation, situativity, the function or role of the medium), classical media theory is proven right: the medium is the message, and this message has social and cognitive-aesthetic consequences, as the technical history of the invention of media determines social relations and perceptions. However, it is equally apparent that in this case media theory must also be symmetrised, as a change in social relations (in potlatch between 1870 and 1930 on the northwest coast of North America, in the triumphal procession of the cakewalk, in the geographical and social conditions of shamanism) also changes the media (the arts and units of value on the northwest coast of North America; the constant interference of standard dances, dance schools, and dance trends in the 20th century; the drum and its form). The question of where it can be said that 'media' arose from containers or that container technologies encompassed the arts and media technologies presumably remains more than arbitrary, even in the future. However, it could hardly do a media theory any good to deny this status to Native American bundles, Himalayan drums, and sub-Saharan dance masks, and this could also obstruct the proper assessment of a fundamental development in the history of technology. There are still a few media to discover outside the cultures we know best.

**47** Ralph Ellison, 'Change the Joke and Slip the Yoke', *Partisan Review* 25, 1958, 212–222; Astrid Kusser, *Körper in Schieflage: Tanzen im Strudel des Black Atlantic um 1900*, Bielefeld, 2013, esp. 48f., 92ff., 118ff., 144–150, 204ff., 244–247, 286–293, 316–320.

**48** Michael Oppitz, *Trommeln der Schamanen*, Zürich, 2007, 105f.

***8.***

I am coming to a provisional conclusion, and due to the scope of the topic this conclusion must be oriented towards J. L. Austin's instruction: 'I dreamt a line that would make a motto for a sober philosophy: *Neither a be-all nor an end-all be.*'[49]

The shift in the invention of technology from tools to containers, as diagnosed by Mumford and Gamble, can be seen as the origin of the technical development of media and presumably as the easiest origin that can be archaeologically recognised. However, this origin has no origin or datable revolution to answer for but rather only a 'drift', which has not yet ended. It will presumably be dated and explained differently in the future, but there is hope that at least the following statements will remain worthy of preserving or discussing:

When humanity conquered the world, it was equipped with a whole series of container technologies. More specifically: these technologies were their equipment and their means of transportation. It is thus possible to infer or at least speculate that the human settlement of the world could not have succeeded without container technologies. This does not give primacy to technologies or media technologies but rather only provides a further insight into the ecological adaptability of homo sapiens. The 'niche construction' of global settlement was a 'cultural niche construction', and it included the development of a continually new assemblage of appropriate technologies from which processes of domestication occasionally evolved (or not).[50] The archaeological record indicates that the development of technical instruments that were adapted to each ecological niche succeeded rather than preceded settlement. Everything else would have been too complex for hunter-gatherer societies. Technical innovation, at least in the area of subsistence and its apparatuses (in the form of hunting weapons, traps for certain animals, and agricultural techniques), was thus a dependent rather than independent variable for most of human history. This sequence also indicates that humanity could be optimistic during its first settlement of the world, as its own resourcefulness ensured that a settlement would be better. This optimism is thus not a privilege of modern technologisation, and it is not self-evident. Long-established agrarian populations cannot share such technical optimism, as each technology introduced from outside could produce a precarious reliance on factors that are beyond local control.[51]

Humanity was perhaps never more modern than in the moment when the settlement of the world was progressing. Biologists and anthropologists have not found any reason to date 'modern behaviour' and 'modern intelligence' later than the palaeolithic period.[52] Humanity was in any case never more daring, as this settlement of all the ecological niches of the earth was the greatest adventure of its history, and all later explorations, space flights, inventions, and revolutions pale in comparison. And everything indicates that this settlement succeeded not only with daring but also with a compulsion to spread or, in other words, with enjoyment in the maximal expansion of demographic cohesion and with enjoyment in the maximal 'scaling' of the cohesion of very small groups, which ventured into the unknown as hunter-gatherers and nevertheless by all accounts managed to establish and maintain long and widely extended networks or to patch them together in always new ways. The scaling ability of the present—that is, of the computer we are working on and the global real-time network in which we find ourselves—is undoubtedly an astonishing technical achievement, whose long history of development can be analysed without amazement. However, the scaling ability of proliferating humanity is a riddle that is much less understood and that seems to be directly related to the different dimensions of the 'extensions of the body' that I have a briefly introduced:

- a shift in the history of technical inventions from tools to containers, including a shift in the metaphorisation of human and artificial bodies (and faces);
- a virtuosity in the emerging arts and crafts ('the enjoyment which the maker feels at his own cleverness in playing with the technical elements that he is using'), including an increase in topological ways of thinking and acting;
- an ability to think and act in space in order to simplify decision pathways, find cognitive shortcuts, and spatially map plans;
- the possibility to extend these cognitive simplifications and abilities to containers and the products of container technologies;
- an ability to project these possibilities as a scaling from the micro-level to the macro-level, and vice versa;
- an ability to represent the properties of containers as both objects and parts of people or personal relations and to mediate between signs, people, and material relations;
- in short, the materiality of media, the virtuosity of their technical production, an awareness of their circulation, and a thoughtful reception of differences in

**49** J. L. Austin, *Philosophical Papers*, 3rd Edition, Oxford, 1979, 271.
**50** Melinda A. Zeder, 'Domestication as a Model System for Niche Construction Theory', *Evolutionary Ecology* 30, 2016, 325–348.
**51** See Peregrine Horden and Nicolas Purcell, *The Corrupting Sea*, Oxford, 2000, 288–297 and 594–597.
**52** See Andrew Shryock and Daniel Lord Smail (eds.), *Deep History: The Archaeology of Past and Present*, Berkeley, 2011.

the possibilities of scaling, navigation, and the division of the world (through cosmograms).

Assuming that humanity was able to use all of these medial abilities or that it was 'behaviourally' and 'cognitively modern', to use the jargon of contemporary anthropology, what does this mean for the assessment of the world at that time and today? Caught between a small world of close proximity and an infinitely large world of spatial networks, humanity always lived with those who were absent, and it bridged the small and large worlds through scalings that were reflected in the form of even smaller containers and even larger inclusions: micro macro medium. The propensity for escalating scales is not an achievement or curse of modernity but rather by all accounts invariable.[53] The affective change in the scale of festivals and ceremonies was given a fixed terminology by Durkheim and Mauss, who used the word 'effervescence' to describe the swirling, bubbling, and fermenting substance and power of all festivals and other exuberant activities. 'Effervescence' is concentrated in seasonal festivals, intertribal gatherings, and later periodically held markets, fairs, pilgrimages, cities, and every kind of population density, and it produces forms of affective, technical, and social escalation.

The present looks spellbound at escalating curve progressions, such as the exponential growth of populations, production, consumption, and extinction (of languages, species, and other things). These curve progressions take the form of a 'hockey stick' or 'J curve', which creates the impression that the present is the time of escalation as compared to all earlier, less escalating, or even static and only unconsciously dynamic times. But that is misleading, as small group membership has not disappeared, and the scales and scale changes of the past were not flat, even in comparison with those of the present. Mary Stiner and others have answered the question 'what is on the long flat section of the curve, which seems to begin so slowly and only goes up shortly before the present?' And their answer is that 'it is J curves all the way to the bottom'.[54]

The J curve is made of J curves; it is self-similar and has no opposite. And the jump from multiples of ten to multiples of a thousand was from a historical perspective more radical than the population increases of the last hundred years: 'Indeed, the smaller shift probably required more complicated and durable alterations in human interactive styles.'[55] And if this jump is performed periodically, such as through seasonal festivals, then our ancestors lived more radically than we ever could with our instantaneously available audiences of millions. The most radical scaling in human history was and remains the scaling from ten to a thousand along with the scaling from the metaphor of the body contained in containers to the constantly tested leap into the unknown of the metaphorised body multiplied a hundredfold: *homo non intelligendo fit omnia.* These scale changes still give rise to new dance styles, musical styles, avant-gardes, philosophies, and technologies, even when they reach the millions or billions.

These are important historiographical claims, but they should be drawn not only from historians and archaeologists, who either accept or reject the dichotomies between modernity and non-modernity, but also directly from the inhabitants of the past and present worlds. The virtuosity and enjoyment of scaling through boundary dissolutions is the best-distributed thing in the world. Indeed, it is 'the world'. And it was then as now a function of the media world or of the production of alternative worlds using ecological niche constructions and their medial forms.

The question McLuhan formulated concerning the 'extensions of man' and the body has proven to be a good question. The shift from tools to containers remains a key phenomenon of media theory that classical media theory could unfortunately not recognise and that has not yet been conclusively researched. Pandora's box still contains much more than I could outline here, and the production of black boxes is never-ending, as is well known. A consideration of extended bodies and their containers also offers media theory another beginning, as its prior consideration of tools and containers did not begin at the beginning but rather in medias res. Before there were techniques with instruments there were body techniques without instruments, and the most important extensions of the human body are and were, ontogenetically and phylogenetically, other human bodies. It is only through them that we learn what physical boundaries are, how to deal with extensions of the body, and what the inclusion of a container includes. If the content of a medium is another medium, as McLuhan famously concluded, then the content of all media-containers and of all container technologies is the body itself—that is, not the individual and isolated body but rather the hypersensitive and hypersocial interbodily 'flesh'.[56] The constant extension of the body through container

**53** Mary C. Stiner et al., 'Scale', in *Deep History: The Archaeology of Past and Present*, ed. Andrew Shryock and Daniel Lord Smail, Berkeley, 2011, 241–272.
**54** Ibid., 253.
**55** Ibid., 247.
**56** Christian Meyer, Jürgen Streeck, and J. Scott Jordan (eds.), *Intercorporeality: Emerging Socialities in Interaction*, Oxford, 2017.

technologies assumes the experiences and abilities of intercorporeality that allow us constantly to adjust to the other bodies that inhabit our corporeal world with us. The development of container technologies and the media that emerged from them is possible because we inhabit the corporeal world of others, and they share our corporeal experiences with us and others. The miraculous scaling ability of humans cannot be deduced from the history of container technologies; rather, we must once again ask the question differently:[57] does the relationship between bodies represent an invariant mean of all containers and their scalings or even one scale for all media?

**57** Erhard Schüttpelz, 'Skill, Deixis, Medien', in *Mediale Anthropologie*, ed. Christiane Voss and Lorenz Engell, Paderborn, 2010, 153–181.

### *References*


Asper, Markus, 'The Two Cultures of Mathematics in Ancient Greece', in *The Oxford Handbook of the History of Mathematics*, ed. Eleanor Robson and Jacqueline Stedall, Oxford, 2009, 107–132.

Austin, J. L., *Philosophical Papers*, 3rd Edition, Oxford, 1979.

Bernardini, Wesley, 'Hopi Clan Traditions and the Pedigree of Ceremonial Objects', in *Enduring Motives: The Archeology of Tradition and Religion in Native America*, ed. Warren R. DeBoer and Linea Sundstrom, Tuscaloosa, AL, 2012, 172–184.

Boas, Franz, *Race, Language, and Culture*, New York, 1940.

de Waal, Frans, *Are We Smart Enough to Know How Smart Animals Are?*, New York, 2016.

Dobres, Marcia-Anne, 'Technology's Links and Chaînes: The Processual Unfolding of Technique and Technician', in *The Social Dynamics of Technology: Practice, Politics, and World Views,* ed. Marcia-Anne Dobres and Christopher Hoffman, Washington, 1999, 124–146.

Ellison, Ralph, 'Change the Joke and Slip the Yoke', *Partisan Review* 25, 1958, 212–222.

Flannery, Kent, 'Origins and Ecological Effects of Early Domestication in Iran and the Near East', in *The Domestication and Exploitation of Plants and Animals*, ed. Peter J. Ucko and G. W. Dimbleby, Chicago, 1969, 73–100.

Gamble, Clive, *Origins and Revolutions*, Cambridge, 2007.

– *Settling the Earth: The Archaeology of Deep Human History*, Cambridge, 2013.

Gell, Alfred, 'Vogel's Net: Traps as Artworks and Artworks as Traps', in *The Art of Anthropology: Essays and Diagrams*, ed. Eric Hirsch, London, 1999, 187–214.

Grimes, Ronald, 'The Life History of a Mask', *The Drama Review* 36, 1992, 61–77.

Horden, Peregrine, and Nicolas Purcell, *The Corrupting Sea*, Oxford, 2000.

Høyrup, Jens, '"The Rare Traces of Constructional Procedures in "Practical Geometries"', *Filosofi og Videnskabsteori pa Roskilde Universitetscenter Preprints og Reprints* 2, 2006, http://akira.ruc.dk/~jensh/Publications/2006%7Be%7D_The%20rare%20traces%20of%20constructional%20procedures.pdf, Accessed 1 May 2020.

– 'What is Mathematics: Perspectives Inspired by Anthropology', in *The Nature and Development of Mathematics: Cross-Disciplinary Perspectives on Cognition, Learning and Culture*, ed. John W. Adams, Patrick Barmby, and Alex Mesoudi, London and New York, 2017, 179–196.

Hutchins, Edwin, *Cognition in the Wild*, Cambridge, MA, 1995.

Ifrah, Georges, *From One to Zero: A Universal History of Numbers*, tr. Lowell Bair, New York, 1985.

Kapp, Ernst, *Grundlinien einer Philosophie der Technik* (1877), Berlin, 2019.

Khaldun, Ibh, *The Muqaddimah: An Introduction to History*, tr. Franz Rosenthal, 3 vols., New York, 1958.

Kirsh, David, 'The Intelligent Use of Space', *Artificial Intelligence* 73, 1995, 31–68.

Kittler, Friedrich, *Grammophon Film Typewriter*, Berlin, 1986.

Krippendorff, Klaus, 'Der verschwundene Bote. Metaphern und Modelle der Kommunikation', in *Die Wirklichkeit der Medien*, ed. Klaus Merten, S. J. Schmidt, and Siegfried Weischenberg, Wiesbaden, 1994, 79–113.

Kusser, Astrid, *Körper in Schieflage: Tanzen im Strudel des Black Atlantic* um 1900, Bielefeld, 2013.

Lave, Jean, 'Situating Learning in Communities of Practice', in *Perspectives on Socially Shared Cognition*, ed. Lauren B. Resnick, John M. Levine, and Stephanie Teasley, Washington, 1991, 63–82.

Leroi-Gourhan, André, *Gesture and Speech*, tr. Anna Bostock Berger, Cambridge, 1980.

Lips, Julius, *The Origin of Things*, New York, 1948.

Mauss, Marcel, 'Essai sur le don', in *Sociologie et anthropologie*, Paris, 1951, 145–283.

McBrearty, Sally, and Alison S. Brooks, 'The Revolution that Wasn't: A New Interpretation of the Origin of Modern Human Behavior', *Journal of Human Evolution* 39, 2000, 453–563.

McLuhan, Marshall, *Understanding Media: The Extensions of Man*, New York, 1964.

Meyer, Christian, Jürgen Streeck, and J. Scott Jordan (eds.), *Intercorporeality: Emerging Socialities in Interaction*, Oxford, 2017.

Milo, Daniel S., *Good Enough: The Tolerance for Mediocrity in Nature and Society*, London, 2019.

Mumford, Lewis, *The City in History: Its Origins, Its Transformations, and Its Prospects*, New York, 1961.

– *The Myth of the Machine: Technics and Human Development*, New York, 1967.

Nowotny, Karl Anton, 'Rituale in Mexiko und im nordamerikanischen Südwesten', *Jahrbuch für Geschichte, Staat und Wirtschaft und Gesellschaft Südamerikas* 8, 1971, 4–38.

Oppitz, Michael, *Trommeln der Schamanen*, Zürich, 2007.

Paßmann, Johannes, *Die soziale Logik des Likes: Eine Twitter-Ethnografie*, Frankfurt am Main, 2018.

Pauketat, Timothy R., *An Archaeology of the Cosmos: Rethinking Agency and Religion in Ancient America*, London and New York, 2012.

Pingree, David, 'Hellenophilia versus the History of Science', *Isis* 83, 1992, 554–563.

Schüttpelz, Erhard, 'Skill, Deixis, Medien', in *Mediale Anthropologie*, ed. Christiane Voss and Lorenz Engell, Paderborn, 2010, 153–181.

Shannon, Claude, and Warren Weaver, *The Mathematical Theory of Communication*, Urbana, IL, 1949.

Shryock, Andrew, and Daniel Lord Smail (eds.), *Deep History: The Archaeology of Past and Present*, Berkeley, 2011.

Sigaut, François, 'Technology', in *Companion Encyclopedia of Anthropology: Humanity, Culture and Social Life*, ed. Tim Ingold, New York, 2002, 420–459.

Star, Susan Leigh, *Grenzobjekte und Medienforschung, ed. Nadine Taha and Sebastian Gießmann*, Bielefeld, 2017.

Strother, Z. S., *Inventing Masks: Agency and History in the Art of the Central Pende*, Chicago, 1998.

Winkler, Hartmut, *Prozessieren: Die dritte, vernachlässigte Medienfunktion*, Paderborn, 2015.

Zeder, Melinda A., 'Domestication as a Model System for Niche Construction Theory', *Evolutionary Ecology* 30, 2016, 325–348.