
WAYS OF ENCHANTING

Chaînes Opératoires and Yam Cultivation in Nyamikum
Village, Maprik, Papua New Guinea

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Abstract

Yam cultivation and display are central and very contemporary concerns amongst the Abelam of Papua New Guinea. Long yams, especially, have been interpreted as phallic symbols, images of ancestors and valuables. Describing the processes from which these 'artefacts' emerge, gives some importance to local interpretations, i.e. the *reasons* rather than the causes driving local technical processes. This analysis of the notion of operational sequences, or *chaînes opératoires*, proves very useful in unravelling the interlacing of practices and discourses that leads to the 'coming-into-being' of yams. Using a selection of operational sequences, the author discusses the methodology and investigates some aspects that have come out of his own use of the *chaîne opératoire*. Through its potential for describing the relations actively created between long yam cultivation and other domains of experience, the *chaîne opératoire* contributes to repositioning the study of techniques and technology in contemporary anthropological discussions of material culture.

Key Words ◆ Abelam ◆ *chaînes opératoires* ◆ horticulture ◆ technology
◆ yams

INTRODUCTION

Addressing 'technology' or 'techniques' from an anthropological point of view in relation to material culture can be a tricky issue, as the terms

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are often accompanied by preconceptions. In fact, the anthropological attitude regarding technical activities is ambiguous, very similar – because intimately related – to the historical relationships of the discipline with material culture (see Lemonnier, 1986, 1992; Faure-Rouesnel, 2001). In many respects, such attitudes also echo those found in anthropological forays into other problematic phenomena, such as art (for instance, Morphy, 2002[1994]). But, in contrast to the notion of ‘art’, the problem might not be so much about the potentially ethnocentric nature of the term ‘techniques’. Indeed, while one can examine whether ‘art’ is a cross-cultural category (Weiner, 1994), no such questioning can be applied to the notion of ‘technique’, as every human being can be seen doing and making things (with or without an aesthetic purpose).

The same cannot be said about ‘technology’. As discussed by many authors (among others, Lemonnier, 1986, 1992, 1993; Pfaffenberger, 1988, 1992; Sigaut, 2002[1994]; Schlanger, 2006), the English-speaking attitude towards ‘technology’ is fraught with theoretical reluctances and precautions. In fact, ‘technological’ phenomena appear to have been pretty much ensconced within what Staudenmaier (1990) qualified as the ‘major narrative’ of Western technical progress, the scale against which the material conditions of life and production of ‘Others’ were to be evaluated. In other words, because ‘technology’ has often been seen as primarily concerned with modes of production, subsistence and/or the control of energies, of nature or environment, its study can always be suspected of being too materialistic and ultimately always privileging new elements that justify, even involuntarily, the ‘major narrative’. As a result, one could suggest that the problem is partially located in whether we attribute the term ‘technology’ to a more or less restricted definition or field of application. This has been addressed by Sigaut (1985, 1987: 600, 2002[1994]: 422–3), who noted how, particularly in English, the term ‘technology’ has undoubtedly acquired an ethnocentric charge – referring, in media and political parlance, to modern, industrialized devices such as personal computers or mobile phones.

Without re-entering the debate about definition, it is worth noting that we can broadly agree on two main understandings of ‘technology’. The first one, rather dominant, can be found in both Lemonnier (1992: 1) and Dobrès (2000: 53) and refers to the social, embodied and meaningful dimensions associated with technical activities. The second one, less used, stemming from Haudricourt (1987[1968]) and endorsed by Sigaut (2002[1994]: 422), sees ‘technology’ as the *science humaine*, a humanistic discipline studying technical activities.

These two definitions also seem to have undergone various academic developments. The first definition, which sees ‘technology’ as the sum of practices, materials, tools, knowledge, etc. can easily be transformed into a broader one. This has been especially the case in the Anglophone

anthropological tradition,¹ even to the point where 'technology' can actually be applied in Foucault's (1988) sense. There, it appears as a complex social apparatus – consisting of practices, discourses, materials and devices – that can model, transform, create or recreate whatever it is applied to, whether it is the body, the self, sociality, beliefs or values. In this way, 'technology' is extended to all forms of practice of modification and (re)creation. However, one could ask whether this extension could also lead to the obviation of the very phenomenon one wants to study, that is, in the most basic sense, physical engagements with and transformations of the material world. One could say that the current phenomenological trend in anthropology tackles these engagements but, in fact, the actual technical part of these activities is often eschewed in favour of precisely a more Foucauldian or Bourdieusian approach of habitus and sociality. This type of dissolution could be seen as justifying Lemonnier's focus (following Leroi-Gourhan) on 'action on materials'. Thus, choosing to restrict the term 'technology' to physically making and doing things ceased to be based on any underlying materialist determinism but, rather, advocates a methodological circumscription of the very subject of study.

The same will to circumscribe the field can be felt in the second definition. 'Technology' as 'the science that studies technical activities', may, at first glance, seem more limited, as if trying to define its boundaries in what seems to be a more rigid sense. This might be so if one implies that the term 'techniques' can only be applied to actions on materials proper, following known physical and/or chemical laws of nature. But, most anthropologists studying indigenous techniques have referred to Mauss's (1950[1935]) original definition: as a traditional and efficacious act. The focus on 'making' and 'doing' at the University College London (UCL) material culture workshop, while tying the discussion to the physical and material nature of human lives, avoided precisely such limiting forms of determinism, by highlighting the contexts and modes of action.

For the members of the French School of Techniques and Culture, the domain concerned with the study of techniques is the study of phenomena relating to the actions of humans on materials (Cresswell, 1973: 823–8; Lemonnier, 1976: 103; see Lemonnier, 1993, for an overview). The apparent simplicity of this definition conceals the difficulty of defining more precisely what is encompassed by the terms used, such as 'humans' or 'material'. We might question why we should restrain our analysis to 'humans', thus risking getting caught in the cross-fire of debates on *homo faber* vs animal techniques (see Joulian, 1994, 2000). We might also question the inherent determinism that could result from restraining our interests to the ways in which materials can be or are transformed according to the types of techniques used. Equally, we might also ask why, by focusing on action, rituals and magic should be excluded on the

grounds that they have no direct (i.e. objective, observable) effect on either side of the definition ('humans' or 'materials'). And I would agree that even 'action' itself could be unclear.²

While terminological precision is desirable, one might get lost trying to accommodate all recommendations against limited definitions, methodological straitjackets and other forms of boundary policing. In addition, it might seem unnecessary to construct yet another definition of what has already been over defined. I would therefore start with a consideration of 'technology' as a slight variation of Lemonnier's definition: the study of interactions between people and the physical world, whether it is one's own body or that of others, leading to a real or supposed transformation. In doing so, I hope to allow the content of phenomena included in 'techniques' to be deployed in a more sophisticated, less unilinear, and infinitely more useful way than it might appear, while retaining a form of specificity vis-à-vis other types of phenomena studied by ethnographers.

This article will be about methodology and will investigate some aspects that have come out of my own use of the conceptual tools used in 'technology' (as 'the study of techniques', hereafter), notably the *chaîne opératoire*, or operational sequence, for my study of a particular type of artefact, the Abelam long yam. This will take the form of a personal narrative because I believe that bringing some personal aspects to the foreground of research can be particularly useful from a methodological point of view. It can also be valuable, especially when dealing with something that has been consistently de-humanized in the 'major narrative'. Techniques and their study can be rather inhuman – filled with steam, gears, wheels, wrenches, operators, or agents – so it may be particularly worthwhile to think about these practices from a more human point of view, both from the angle of the observant and the observed.

I hope to illustrate how the methodology of the *chaîne opératoire* has been useful in two senses. Firstly, in a positive way, as it enables the precise description of practices that can be used for analysis and comparisons. Secondly, because the limitations I have encountered also prove to be informative in themselves. Not only do these limitations highlight some dimensions of the artefact studied, but they also confirm the fact that it is in the methodological margins that interesting properties and phenomena become more visible.

CASE STUDY: THE LONG YAMS OF THE ABELAM – SETTING

The communities known as the Abelam enjoy a certain fame within anthropology. Located in the southern foothills of the Prince Alexander range, in the Maprik District (East Sepik Province, Papua New Guinea), they have been the object of several ethnographies since the 1940s, dealing with social organization, art, architecture, kinship, gender, conflict

and history (Kaberry, 1941, 1941–2; Forge, 1966, 1967, 1970, 1990; Scaglione, 1976, 1999; Gerrits, c. 1978; Losche, 1982, 1995, 1996; Huber-Greub, 1988; Hauser-Schäublin, 1989a, 1989b, 1995, 1996). They also had visually spectacular initiation ceremonies, which have attracted the attention of ethnographers and played a fundamental role in the development of the anthropology of art (Forge, 1966, 1967, 1970). The Abelam have equally become relatively famous in anthropological literature for their agricultural system, centred around (but not restricted to) the cultivation of two main species of yams: the 'lesser' or 'short yam', *Dioscorea esculenta*, called *ka* in Abulës language,³ and the 'greater' or 'long yam', *D. alata*, called *waapi* (Lea, 1964, 1969; Scaglione, 1999; Coupaye, 2005). Gardeners possess several cultivars of both species, but the *waapi Maabutap* occupies a central place, notably during annual ceremonies when the longest, most beautiful and regular tubers are decorated and displayed before being exchanged and consumed.

The idea of studying long yams amongst the Abelam of the Maprik area attracted me because they appeared to be objects of particular interest, being situated at the 'margin' of different domains, prompting questions and allowing particular properties to emerge. They are botanical entities, grown in gardens, but they are also artefacts, decorated, displayed and assessed before being consumed and/or exchanged as valuables. This position at the intersection of different domains was reflected, I found, in a divide in the literature between, on the one hand, studies from geographers, botanists, agro-scientists (such as Burkill, 1960; Lea, 1964; Coursey, 1967; Quin, 1985) and, on the other hand, anthropologists (e.g. Forge, 1966; Tuzin, 1972, 1995; Roscoe, 1989). In both approaches, yams appear as food. But, with little risk of caricature, in the former, long yams (as botanical entities) are mostly evaluated in terms of cultivars, shapes, forms and productivity. In the latter, they appear mainly as phallic symbols, ancestors, spirits, initiates and valuables.

This particular position motivated an analysis that would take the artefact itself as the empirical point of entry. Coming from my early training as an archaeologist, I felt that this precaution was essential to avoid the object slipping out of my focus and becoming, as in classical anthropological approaches to material culture, an illustration of a 'higher' order of phenomena and subjects, such as culture, identity, gender relationships, kinship, religious beliefs, diet, or modernity. Doing so, I believed, would have failed to question the implicit division between nature and culture and, perhaps, even potentially produced new divisions. This fundamentally empirical foundation of my approach also had an experimental aim, as I felt the attempt to apply the anthropology of techniques to a living object (which at the same time was also a kind of 'art object') was quite exciting. The idea, therefore, was to go into the field and record the 'technical system', that is: to investigate how these things

were made and what they were made of, in order to understand why such objects were powerful, and how they acquired their agency (Gell, 1998).⁴ This also allowed me to combine elements from the anthropology of art, the anthropology of material culture and Melanesian ethnography. My methodological aim was to investigate whether the anthropology of techniques could enlighten some of the aspects mentioned in the literature, such as the famous agency of art, the notion of hybrids, the relationality of Melanesian personhood, and so on.

CHAÎNES OPÉRATOIRES AND THE INVISIBILITY OF TECHNIQUES

In his analysis of technology, Sigaut (2002[1994]) claims that one cannot see techniques, but only people doing things (p. 424). This challenging statement is based on the fact that actually observing someone digging a hole, or carving a sculpture, is fundamentally different from analysing the digging-stick, the hole, its width and depth, or from studying the carving, its materials, its volume, the composition of the different masses, or the tools and the colours used. In the latter case, one studies an actual material object but, in the former, it is a series of transformations and actions, the materialization of which is only made graspable through the traces left on material, as archaeologists know well.

The first step was thus to *materialize* what was observed, what Sigaut called 'technography'. It implied capturing the complex series of actions, intentions and transformations in a way that allowed an analysis of the whole. Rendering these processes visible and available for analysis could prove a difficult task because of their complex multidimensionality. Processes can only be made visible when transcribed in a medium (written or pictured, such as in a film, or a series of photographs), where the sequence of events, each one with a specific duration, is described. I also had to take account of the fact that these processes had a spatial dimension, as they always happen in relation to a specific place (or a series of places). Finally, because processes happened in the real physical world, they also had a physical and material dimension.

These methodological considerations placed my own research in a particular framework, as I was dealing with agricultural process. Similar to the custom in other Abelam-related villages, Nyamikum people cultivate at least two types of gardens. One for the *waapi*, and two to four for the *ka* (each year a new garden is opened, while the previous one becomes an 'old garden', before being used only as a storage for secondary crops,⁵ such as the different cultivars of bananas). In addition, most gardeners also tend a cash crop garden (coffee, cocoa and vanilla, which during the time of my stay was also increasingly cultivated). *Ka* gardens are open, tended by both men and women. *Waapi* gardens are located in more secluded areas, fenced in and cultivated only by men.

Ka are mostly used in everyday food, whereas *waapi*, as well as being food crops, are also valuable to be exchanged as compensations or ceremonial gifts (Forge, 1966; Lea, 1969). This ethnographic setting meant that I was facing different scales of phenomena, having to observe and record the temporal, spatial and material elements that intervened, potentially reaching from the scope of the entire agricultural year right down to the minute actions on materials – and these in different places. In order to understand the overall picture, I had to present all of this in a way that would show how and when these elements were integrated into the overall process.

THE BASIC OPERATIONAL SEQUENCE

The French school of *technologie culturelle* has developed a particular methodological tool for analysing technical processes. Based on theoretical recommendations set by Mauss (1950[1935]) and developed by Leroi-Gourhan (1971[1943], 1973[1945]),⁶ it is primarily a descriptive tool that ethnographers of techniques now share with archaeologists. I am referring here to the *chaîne opératoire*, a concept that is often used untranslated, although Lemonnier (1992) aptly suggested using 'operational sequence'. However, specific difficulties arose in the course of my research.

Recording operational sequences requires the breaking down of a given process into step-by-step actions, in 'a series of operations which brings a raw material from a natural state to a manufactured state' (Cresswell, 1976: 6), a definition that Lemonnier (1992) rephrased as the 'series of operations involved in any transformation of matter (including our own body) by human beings' (p. 26).

This simple definition implies investigating how the actor establishes a physical relationship with the material he or she wishes to transform (either directly or mediated by a tool), each gesture following a more or less embodied routine (depending on the quality of his or her training), aiming at the modification (often intentional) of the material, from a state *x* to a state *y*. The process is usually done with a general purpose in mind, and often with a series of intermediate goals. The process implies and creates a relationship between the mind, the eye, the hand, the tool (if one is used), and the actual physical qualities and properties of the material being worked upon. As a general rule, while performing the technical process, the actor can be seated, bent over, or be turning around his or her work, as he or she is progressing, evaluating, judging, making decisions (some taking only micro-seconds, others involving long minutes of stepping back and judging the situation; perhaps the process even involves leaving the place of work for some hours to check on a blueprint, have a cup of tea, have discussions with a colleague – or chew a betelnut).

Operational sequences, once recorded, thus take the form of a diagram that lists the actions taken by the agents in chronological order, along with circumstantial information on the time, date, place(s), tool(s), as well as on the 'agents' themselves (name, age, clan, ritual associations, etc.), and the materials transformed (Lemonnier, 1992: 28–32; Cresswell, 1996: 45–8; Sigaut, 2002[1994]: 424–9).

In contrast to fellow archaeologists, my aim was not to build a large corpus of operational sequences in order to track down variations at the individual, local or regional level⁷ but, more humbly, to try to understand the series of components, factors and elements that are brought together in order to produce a long yam.

Yam gardening is part of a general technique known as shifting cultivation, a process that takes place over several months. This brings in the question of scale of description but, before I address this specific problem, here is a diagram of the basic operational sequence (Figure 1, cf. Conklin, 1961: 29).

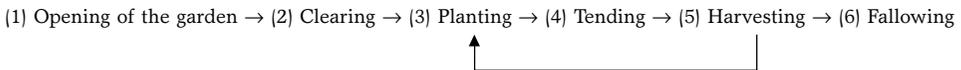


FIGURE 1 Diagram of the general operational sequence of shifting cultivation.

These six steps are organized according to what has been defined as an 'internal logic' (Balfet, 1991: 12; Cresswell, 1996: 31), a notion fundamentally different, I feel compelled to add, from a fixed determinism. Instead, it demonstrates the fact that certain steps can be organized in a specific order, often corresponding to a complex set of interrelated material, environmental, practical or other constraints. Technical actions never exist as isolated acts, but always as part of a wider series (Balfet, 1975: 52; Cresswell, 1996: 43). Hence, the making of a new garden necessarily implies clearing out a portion of bush (step 1) before cleaning out the remains (step 2), and then starting to plant crops (step 3). Once these are planted, the area must be kept clean and the crops must be tended (step 4), so they can fully develop in a satisfactory manner (step 5). In Nyamikum, the Abelam village where I did my fieldwork, steps 3 to 5 were repeated in up to three consecutive cycles before returning to fallow as, after a first harvest, the same area could be replanted.⁸ It is easy to see that steps 1–2–3 must be in that specific order since burning after planting would result in the destruction of the crops. This internal logic, which directly leads to the notion of 'strategic operations', covers sets of operations that cannot be avoided or delayed, as defined by Lemonnier (1992: 21–4), and that are made visible through the analysis of operational sequences.

Nyamikum people open one new *ka* garden every year. The one opened the previous year then becomes an 'old garden'. But, for the men who decide to grow *waapi*, long yam gardens are opened between one to three months before opening their short yam ones. This implies that if one takes one garden as the unit of observation, each year there are two parallel sequences, separated by a time gap, and the beginning of the *waapi* sequence marks the beginning of the agricultural cycle, a fact that will be seen as important in a later section.

MAKING PROCESSES VISIBLE: OPERATIONAL SEQUENCE AS DESCRIPTIVE DEVICE

Technical activities happen in the course of everyday life. As a result, they are enmeshed in a continuum of activities (Balfet, 1991: 13), a flux (Cresswell, 1996: 62) that must be written down in order to be useful for analysis. I discuss elsewhere the automatic suspicion raised in the humanities by graphical formalizations of human activities, and how the reasons for these suspicions can be related to an abstract conception of time (Coupaye, forthcoming). For this article, I wish to briefly discuss how these suspicions have contaminated the perception of what the writing down of *chaînes opératoires* in ethnography implies, and how this type of 'formalization' is fundamentally different from abstract, deterministic and prescriptive models.

When it comes to technical actions, the writing of an operational sequence remains fundamentally a description and cannot appear as a formalized prescriptive model. It is the only way to make visible, first, the necessarily sequential nature of technical process (Schlanger, 1991); second, the different steps of transformation of a material from an initial state to an intended (or aimed at) result; and, third, the logic and the order of (bodily) actions and choices made by the 'agent'. Therefore, the transcription of a sequence of actions and its codification is but a methodological tool that helps to materialize these *processes* that are otherwise difficult to perceive and to think through. It is, in itself, an artefact, made by the ethnographer, as useful and subjective as a photograph can be. The inescapable reduction of a complex, multilinear multidimensional phenomenon into a simplified linear description must not be mistaken for an attempt to build a more 'scientific' approach of the fertile mess of human activities. It must be regarded as the writing down of genealogies, a methodological tool that presents some analytical advantages, provided that some theoretical precautions are taken. As with ethnographic descriptions – even if the level of detail very much depends on the ethnographer's capacity of observation – when analysing the description, one must keep in mind that it presents only one possibility among many others. It helps to avoid the trap of confusing one occurrence with the general rule,

while making visible the actual important choices made by the 'agent' (the strategic tasks) (Lemonnier, 1993).

The methodological nature of the operational sequence is confirmed by the limits that researchers have faced when comparing their writings. Each must find his or her own form of representation, adapted to the type of activity and to the type of question he or she wishes to study. Hence, there are few official formalizations of operational sequences, as illustrated by comparing the examples given by Balfet (1991), Cresswell (1996: 43–67) and Lemonnier (1992: 29–35), where we find tree-diagrams, boxes and, in my own case, lists with numbers. This absence of a formal rule of transcription confirms, if necessary, that 'it could prove counter-productive to force technological phenomena into predetermined categories' (Lemonnier, 1992: 29), while at the same time it also maintains the adaptability of the method.

ON DESCRIBING TECHNIQUES: TEMPORALITY, SCALES AND COMPONENTS OF OPERATIONAL SEQUENCES

The operational sequence deploys the timeline of the process on paper. This temporal perspective includes the specific amount of time dedicated by the actor(s) to the process, but also makes visible the local logic of actions (that does not always appear in verbal accounts) by showing the specific order in which things have been done. This reveals what the 'agent(s)' consider(s) as proper, and how his or her ideas of efficacy are articulated within social, mechanical and material requirements.

This outlining of the temporal dimension of an operational sequence also inscribes the technical activity within larger time-frames, from a couple of minutes, to several weeks, months or even years. For instance, the life-cycle of a single garden plot can extend up to four years. A sequence is generally included within a longer process, which is in turn organized and articulated with other activities. Like Chinese boxes, simple technical activities lasting for a couple of minutes can be included within a wider level of operations, calling for several dimensions of people's lives. For instance, the cutting of a tree can be included either within the wider process of opening a new garden, which also includes, as is the case in Nyamikum, the building of a fence or the construction of a garden shelter. When it comes to the growing of long yams, the basic cycle has a year-based timeline that forms an integral agricultural cycle, which is locally broken down into months ('moons', *baapmu*), during which people go to work in their different gardens, have jobs in town, repair tools and implements, go abroad, visit friends, build new houses, or prepare ceremonies.

Because of this series of inclusions of activities, deciding which level of description to apply is one of the essential questions that the ethnographer needs to face:

It is very difficult to define or delimit a particular technique. For instance, gardening in a given society of New Guinea is a technique. Building a fence to protect a New Guinea garden from semi-domestic pigs is also a technique, part of the first one. To sink a post in the ground, or to compress the ground at the bottom of the post with one's foot, heel, or toes, are also technological actions that might be called 'techniques', and each can be isolated as a single technique. Selecting the appropriate *level of description* remains a problem and one that the researcher himself or herself must address on a case by case basis by deciding on a delimitation that fits his or her specific research problems. (Lemonnier, 1992: 7, emphasis added)

Choosing the level of description remains a crucial matter for the ethnographer, knowing that the recording of every single operation involved (in this case: in yam cultivation) would be an unrealistic task and likely to be of little use. Thus, the selection must be done according to the type of characteristics that one wants to investigate, the time devoted to the research, what people themselves indicate as relevant and the overall contingencies of ethnographic fieldwork – what Lemonnier (1992) poetically called 'the glorious uncertainty of ethnography' (p. 28).

The problem posed by the scale of description also relates to the fundamental relatedness of techniques, or their systemic nature (Mauss, 2002[1947]: 50; Lemonnier 1976, 1983; Gille, 1978: 2–21), as technical acts are never isolated, but always part of an overall project (Cresswell, 1996: 43; Balfet, 1975: 52). Once written, operational sequences can make apparent connections that exist between domains of activity, such as string-bag making, which relates to rope making, dyeing, or the tending of trees (Mackenzie, 1991). In contrast, it can also be used to illustrate how an apparently isolated operation can be part of a larger project. Equally, a similar technique can be used for different purposes: thus, pursuing the previous example, the cutting of a tree can be part of the opening of a new garden for a newly wed son, but also of the building of the frame for a new house, or even the carving of a *tëkët*, the frieze decorating the front of a ceremonial house *kurabu*.

The relatedness of techniques also exists at the level of the elements intervening in the process. To identify them, Lemonnier (1992) recommends the identification of five basic 'components' of technical systems: action, objects, energy, matters and knowledge, which 'interact together to form a technology' (pp. 5–6, 8). Complemented with dates, places, durations, peoples, materials transformed and local terms of phases and steps, the process is thus contextualized.

I have no room here to discuss the difficulties I encountered when identifying these components in the field, but at the present stage I would suggest that this idea of 'components' forced me to keep the material and physical level of people's experiences in focus. The definition of components also provided me with an essential methodological device: as similar tools, energies or matters appeared in different domains

of interactions and experiences, they also showed bridges between techniques, which seemed to allow people to establish material and/or metaphorical correlations. The description of precise articulations between gestures, tools and materials, leading to the transformation of a material from an initial state to another one, offered an insight into the fundamental role of contingencies, arbitrariness and cultural choices. It is often precisely these which are invisible in the finished product made by the maker in his or her process (Lemonnier, 1993; Mahias, 1993; Van der Leeuw, 1994).

In my case, the choice of what to include in these descriptions rapidly became of crucial importance if I wanted to draw a satisfactory picture of what people were doing in their gardens. While focusing on the artefact itself, the long yam, I had to avoid being confined to the purely physical, mechanical, or material features if I wanted to understand the series of values embedded within the process. Thus, it became clear that all the actions and events intervening in the work session could potentially be considered parts of the entire sequence. They could all be related to the purpose of the actor, and be integrated in the complex network of causes and reasons that surrounded the project. Accidents and incidents were to be dealt with, be they the breaking of a tool, an interruption by someone else, other actions such as washing hands before and/or after the session, the need to relieve oneself, or silent prayer.

I will illustrate the complexity of the operational sequence by getting closer into the general sequence described in Figure 1.

GETTING CLOSER

Each of the steps described in Figure 1 could be described in more detail, down to the level of actual actions on the materials. For reasons of space, I will restrict myself to a glimpse into one example:

(1) *Opening of the garden*: According to Alex Jalëmba, a gardener in his mid 30s, this step is called *naknë*. It includes:

(1.1) Cutting lower vegetation – (1.2) Felling the trees

This sequence illustrates a form of logic as, by cutting down the bush first, the felling of bigger trees becomes easier. But the main reason given by my friends is that, once the ground is cleared, they can evaluate which tree they could leave for later use – especially to help support the future stakes or trellises for the yam vines, an element that tied step 1 (*opening*), with step 4 (*tending*), in which I included the staking of yam vines.

In step 1.1, the tools used were mainly a bush knife, but also one's hands (to remove the remains of the cutting). The vegetation to be cut, depending on the fallow stage, consists mostly of young trees, canes,

bamboos and bushes (Allen, 1982, 1986). For a short yam garden, Jacob Mayëla, in August 2003, broke this step down into two main parts (defined by Jacob himself, although there were no specific names in Abulës):

(1.1.1) The garden area was cleaned first. This took Mawulëp (the actual land owner), and Jacob (invited to share the plot) and their three sons, three days to do (perhaps 18 hours). It involved, first, cutting the lower vegetation, notably cane, lianas and vines, as well as young trees and bushes, and then bigger plants such as bamboos.

(1.1.2) Then, a band of roughly two metres was cut around the future garden in order to delimit the garden and to form a firebreak. The cut remains were thrown into the garden. In doing this, the gardener makes sure that he is not overstepping the boundaries of the land he can use (either as an owner, or just a land user). This took a day's work.

For step 1.2, the *felling of the trees*, axes were used (previously these used to be stone axes; some axes used in 2003 were said to have been given by German missionaries in the 1950s). Following what I could see and Jacob's comments, I could break this step down into 1.2.1, *climbing on the trees to cut off the branches* (with a bush knife), and then 1.2.2, *felling the tree proper*. The direction of the lay (where the tree will fall) was evaluated in relation to the slope of the future garden and the natural leaning of the tree. Working on the biggest trees, men took turns of 10 to 15 minutes while the others made comments on the work or sat smoking or chewing betelnut. Once felled, branches had to be cut off the trunk and carried away, some of them to be used for construction, poles for staking, others to be placed on the ground after the burning to form little terraces to reduce erosion of the bare ground.

Step 2, *clearing the garden*, called *nasaknä* in Abulës, took place two weeks after the opening in order to let the remains dry, and consisted of their burning and, once completed and cooled down, the removal of the burnt remains.

MATERIAL AND NON-MATERIAL(?) ASPECTS

My description fits both short and long yam garden work. However, while it appears sufficient to completely understand the material logic and the strategic choices made by gardeners – notably the decision to leave some trees standing in order to facilitate staking or the building of a future trellis – at this stage, I have left aside something fundamental. All these operations also included interactions and procedures that the 'major narrative' often considered as peripheral, and not essential to the (material/physical) success of the operation. People are not machines that start working as soon as the anthropologist thinks/says/writes down that the work session is starting.

Once they arrived in a garden, people always started by lighting a small fire (in the garden shelter, *baarè*, if there was one) which was maintained as long as someone was in the garden. This is done, according to Robin Kitnyora, my host brother, to indicate that there is someone working in the garden. Near the fire is where one hangs one's string-bag, and goes and sits to rest or takes a nap. The fire is used for drying tobacco leaves for smoking and for cooking food (mostly short yam tubers brought for the occasion). My Nyamikum friends indicated that one must always arrive quietly in the garden, especially if the plot is to become a *waapi* garden. It is essential to avoid scaring off the groups of visible and invisible entities that participate in the growth of food (see next section). Thus, people first sat, smoked, chewed betelnut and chatted with their co-worker(s), exchanging jokes and discussing recent news and events before starting the cutting. Several breaks were taken during the work sessions (roughly every 30 to 45 minutes per person), in a way that always left one or two people working. The duration of these breaks was implicit, based on an intimate knowledge of proper conduct, enough to feel refreshed, but not so long as to be considered lazy. Breaks were important, my friends said, because they were the moments when the people who shared the garden could plan ahead and discuss, for instance, the type of cultivars to be planted, where, and how, which was also considered a way of avoiding possible misunderstandings and future disputes. The jocular component of these exchanges was also seen as essential: one must have some fun, commented Robin, because it makes the work easier, and one's skin (*sëpë*) feels lighter, and faster. To the anthropologist, sociality thus becomes an essential component to be included in the process.

Similarly, other elements that are 'invisible' in the process had to be included because the people insisted on their importance. In particular, the *Jëwaai*, the invisible substance that is part of the scent, the blood, the semen (Coupaye, 2009b: 100–1) of every human being (although of different quality depending on the individual) is crucial. First, it forms a sort of signature recognized by the underground entities that are said to watch over the land and ensure that only the rightful landowner (and the people he officially accepted to do so) will plant and grow food in his garden (these are in particular the clan spirits, called *waalë*, but also the earthworms, *baëkwaam*; see next section). Second, it is a type of procreative power (comparable to the English 'green thumb', and to the famous *mana*), which helps the growth of all food and which also intervenes in most types of personal endeavour (such as magic, war or public speeches). This substance and its role imply a transfer of substance between the person and what he or she is doing, and its nature as a body substance is mixed with the crops and the ground during the planting process (Coupaye, 2009b).

This substance can be 'sharpened' (*de taa*) by another process, also to be included in the overall cultivation sequence. The *Yakët*, a series of prescriptions and proscriptions, was said to be the required condition for the success of growing *waapi*. It appeared as a process of body modification through the avoidance of specific substances considered humid, heavy, too sweet, or too salty, as well as avoidance of specific actions and emotions, such as sex, anger or excitement. The *Yakët* also includes the making and drinking of liquid from secret vines and, in Nyamikum, the anthropologically famous penis bloodletting (Forge, 1966). The latter was particularly aimed at getting rid of the female *Jëwaaï*, which accumulates in the body through sexual intercourse and which can have a negative impact on the growing of long yam.

ON WORMS, BUTTERFLIES AND OTHER AGENTS

What anthropologists call sociality is thus seen as playing a *technical* role in terms of efficacy, intimately associating material operations with human interactions. But the same applies to non-human entities considered as participating in the process. These 'agents' include, among others, *waalë* (tutelary spirits), but also butterflies and earthworms, especially the *baëkwaam*. These are described as a large species of worms, coloured and known for the specific sounds they make at night. They play a role, particularly but not solely, in the growth of *waapi*. They are said to act as the facilitators of tuber development, both by softening the ground in which the tubers will grow (the actual agronomical role of earthworms), but also as observers of the gardener's behaviour. As with all potent beings, they are potentially dangerous. Both Alex and Robin explained that the reason one should never start work straight away when arriving in the garden, or make a lot of noise, was to avoid 'scaring' the *ka* in the ground. This, they confirmed, was a metaphorical reference to *baëkwaam*, who do not like noisy and brutal people.⁹ Thus, as the *baëkwaam* were said to watch over all subterranean crops, a calm and respectful behaviour was considered appropriate. This was related by Robin and Alex to the Abelam way of life and their rules of calm and control. By starting work too quickly, one does not have sufficient time to think about what needs to be done. In turn, they indicated that the same rule applied to important discussions between individuals (including our own discussions and recommendations regarding my own way of asking questions). One should never start directly and in an upfront way, but take time to think and preferably take another 'road' to come to one's point (i.e. begin with another topic before starting the proper discussion). Directness is impolite, whether it is in doing things or in verbal exchanges. It indicates eagerness, an improper behaviour for real *Nëmadu*, 'great men'.¹⁰

But the 'agency' of *baëkwaam* also has another technical implication, particularly in the case of long yam growing. The invisible worms were considered to be closely associated with stone altars, kept in secret in one of the storage houses of major hamlets and each the property of particular clans. These stones, watched over by a warden (called *Kajatudu* in Nyamikum), were said to be each dedicated to a particular type of food and the source of the growth potential of the species they are associated with (Huber-Greub, 1988: 147–50; Hauser-Schäublin, 1989a: 187–9; Coupaye, 2005: 129–34). *Baëkwaam* act as the 'agents' of the stone, and those specifically associated with the stone that controls *Maabutap* cultivars (the long yam cultivar that is considered to be the major tuber and the centre of the major long yam ceremony) are of utmost importance. Notably, they are able to detect whether the gardener has been properly following the *Yakët* required for the growing of *Maabutap*, especially during the opening of the garden, as sweat – a component/part of the *Jëwaai* – produced by the effort of hacking and cutting, drops on the ground where the *baëkwaam* can 'smell' it. This, from a sequential point of view, justified the start of the *Yakët* before the beginning of the new planting season and before the opening of the garden itself, in order to 'get clean'.

Combined with the elements mentioned earlier, the sequence is illustrated in Figure 2.

(1) Start of the *Yakët* → (2) Start of the *waapi* garden → (3) Start of the *ka* garden

FIGURE 2 Diagram of the sequence of long and short yam gardens opening.

Both steps 2 and 3 can be broken down into the elements described in Figure 1.

INCLUDING LOCAL REASONS

In my own use of the *chaîne opératoire*, the most tricky part was to find the right balance between the *etic* position of the 'technographer', and the *emic* perceptions of my Nyamikum friends. These *emic* elements tied my initial sequence to other types of operations that, in some instances, would be overlooked by a strictly 'technicist' approach, as not falling within Western notions of technical operations. They implicated dimensions of technical activities (with which anthropologists are quite familiar) such as social, ritualistic and/or symbolic activities (Mauss, 1968[1909]; Gell, 1988; Rowlands and Warnier, 1995). Not only were these dimensions, from an *emic* point of view, considered efficacious, indispensable and an integral part of the technical system, but they also provided information about what ultimately constituted the artefact produced –

information that would not have been apparent from just observing the material result, nor directly from observation of the usage and engagements with it once it was finished.

Emic explanations also necessarily extended the series of technical operations I had to take into account – some directly part of the processes (such as the one I have described) and others less directly directed. They forced me to shift my perception (and my documentation) both towards a more intuitive understanding of what was happening and towards my friends’ indications about what was relevant from their point of view. Thus, as I have discussed briefly elsewhere (Coupaye, 2009b), by following people’s justifications and explanations I was able to include in the operational sequences those elements usually (that is, in more objectivist or materially restricted accounts) considered superfluous in the (objective) cultivation process.

Following Wittgenstein’s critique of Frazer’s study of rites and magic (Glock, 1996), this implied a shift from a causal type of explanation towards a focus on the reasons given by the people, instead of the observer’s (my own) definitions of the causes. It implied a focus on intentionalities rather than causalities. At the highest level of description, it allowed me to highlight the relationships between yam cultivation (both long and short) and the annual yam ceremonies, called *Waapi Saaki* in Nyamikum. All accounts explained that long yam ceremonies were essential because they would give strength to the village and to the gardens: ‘If you don’t harvest long yams, you cannot have food coming out of your gardens’, explained Tepmanyëgi, one of the most respected *Nëmadu* of Nyamikum.

The entire operational sequence is illustrated in Figure 3.

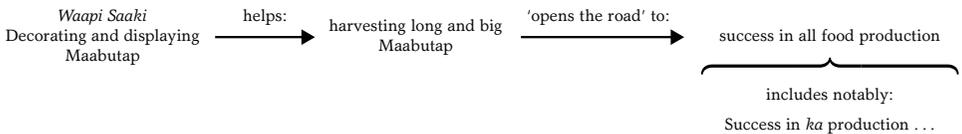


FIGURE 3 Diagram of the overall sequence of yam cultivation/ceremony.

I was thus able to perceive connections established between the different gardens: all are geared to a time cycle in which the long yam ceremony is a sort of time marker, indicating the change of the agricultural year. This explanation, as given by the people, tied both the short and long yam into an overall logic, putting together what a positivist approach would have separated, yet what is linked in people’s accounts, following Hocart’s (1952: 23) advice.

CONCLUSIONS

Any methodology is *etic* in its nature and purpose. I am aware how mine has 'materialized' the long yam in a series of diagrams that cannot entirely reveal the complexity and multidimensionality of the phenomenon. As such, this materialization has only the value and limitation of any representation: it is already in itself an artefact that we can look at, evaluate, exchange and engage with.

Interestingly, while the way in which operational sequences have allowed me to investigate was nothing particularly new, from an anthropological point of view, their application has highlighted the logical connections made by Nyamikum people between different domains of activity. More than any series of determinisms, I saw a series of dynamic relationships between the different elements that I was able to perceive and document at different levels, such as bodies, artefacts, gardens, or the region (to mention just a few).

At a closer level, body techniques and the evaluation of their efficacy were visible in garden operations, but appeared in other domains as well. These included activities such as house building, as mentioned earlier, but they also appeared in evaluations of people's attitudes. From these emerged an 'aesthetics of action' (Hardin, 1993), which established non-verbal 'redundancies' between techniques (gardening, among others) and other social behaviour – precisely because of the enmeshing of technical operations in a continuum of activities, the flux mentioned by Cresswell (1996) and Balfet (1991). This aesthetics formed an unspoken frame against which proper behaviours and ways of doing things were implicitly evaluated and which not only loosely governed the actual doing (and making), but also allowed for building cognitive bridges between contexts of performance and occurrence that can be analysed from a phenomenological perspective.¹¹ For example, at the level of the artefact created, the yams, the same body techniques allowed me to suggest a relationship between the long yam trellis, the yam storage houses and the ceremonial houses, through architectural and linguistic elements, relating yams with images and initiates (Coupaye, 2009a).

At an intermediary level, it allowed for the investigation of the interlacing of different types of gardens. Again, these were visible in terms of the series of body techniques performed, but also in the 'artefacts', such as the transfer of crops like banana trees from older gardens, used as storage, to newer ones. What was cultivated and done in an old short yam garden influenced what was done in a new one, and further away in the long yam garden. In contrast, according to local explanations, the quality of the harvest in a long yam garden was seen as having a direct influence on the harvest of short yam gardens.

Finally, these associations also concerned a wider geographical and cosmological level. Through the relationship created between long yams,

Waapi Saaki ceremonies and short yam harvest, the village was actually linked to the rest of the Abelam-speaking area in a sequence that started in April/May in the western part, in Apangai (a village occupying a central position in local narratives about ancestral migration; McGuigan, 1992: 312–13), where the first ceremonies of the season were held, and ended around September/October in the eastern part, beyond Kalabu (Coupaye, 2005: 271–3).

What also emerged from this web of connections were elements directly related to current theoretical discussions on material culture and Melanesia.¹² Relationships between people and things appeared as created through processes of making and ways of doing, where I could perceive the merging of substances, of qualities and of values, instantiated and materialized over the course of the processes (see Bell and Geismar, 2009). These permeated the performing body, the matters manipulated and transformed and, as a logical consequence (both for me and my Nyamikum friends), the artefacts produced (the yams). This illustrated empirically how objects, bodies and persons were mutually defined by their interactions through the fluidity of local ontologies. Yams themselves appeared as good examples of distributed (soft) parts of something hidden (hard: the secret stone) and spread throughout the entire Abelam area in a trajectory evoked in ancestral narratives (Huber-Greub, 1988: 147–50; McGuigan, 1992: 310–11). Connections through series of metaphors (*Aaja Kundi*, the 'veiled speech') made by people (Huber-Greub, 1988: 224–66; Coupaye, 2007b) drew in discourses, perceptions and ways of dealing with modernity. These made yams particularly potent artefacts, explaining their multidimensionality as food, ancestral images, tropes and valuables (Coupaye, 2007a, 2009b). The materiality of yams derived from the process of their creation, their 'coming into being', or the very first moment of their biography (Kopytoff, 1986). Therefore, what made yams consumable in particular ways were the ways in which these processes interwove people, matters and substance (Coupaye, 2009b).

As for the agency, it became clearer how the power of decorated and displayed *Maabutap*, the epitome of all food, stemmed from their value as coalesced materialization of substances, agents, materials and sociality. These enchanted artefacts (Gell, 1992), indexes of relationships and intentionalities (Gell, 1998), could not but have cognitive and aesthetical effects on the audience, effects that went beyond (but without necessarily excluding) meanings and iconography, acting as material tropes, prompting people's emotions and evaluations.

Agency, distributiveness and materiality in my case bring into focus notions such as efficacy and intention, and the local way of relating action and results. These notions offer a way of tempering the forms of linear determinisms (material, social, environmental, historical) in which technical activities have often been couched, and which constitute one of the main reasons why technology has fallen out with anthropology. Without

going into deep philosophical discussions, I believe the problem is not so much about determinisms, but about the confusion between the 'universality' of the laws of physics and nature and the 'particular' aspect of their perceptions, explanations and interpretations by people who do things. As Mauss (1968[1909], 1950[1935]) suggested in his definitions of both techniques and rites, technical activities imply gestures that have an 'efficacy', in other words: the reasons why people do things in certain ways are due to the way in which intentions are properly carried out and the desired result can be achieved. This difference between reasons and causes in our anthropological interpretations of technical activities would benefit from further investigation but, as a heuristic tool, it invites us to include in our descriptions local or *emic* explanations, rather than focusing only on causal determinants.

'Technology', as the study of techniques, implies the combination of the objective study of how people do and make things, and the reasons they have and give for doing and making them in particular ways, while keeping in mind the place of materials (or materiality). We do things because we intend to transform, create, adapt, or destruct.¹³ Thus, people's actions can be understood not only in terms of the objective, real, material effect, but also in terms of their intentions and how both relate to one another. People's explanations force us to include in the picture dimensions that go beyond the supposedly 'mere' technical aspects, or rather, that invite us to extend our conception about what to include in technical activities. We could then start thinking about how technical processes can be seen to be related to our will to 'enchant' (or disenchant) the world.

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Notes

1. I am aware that this discussion leaves out all the research done by fellow archaeologists and ethno-archaeologists, who, in the Anglophone domain,

have explored many cultural aspects of the study of technology and developed the notion of *chaînes opératoires* (to quote only two, Lechtman and Merrill, 1977; Sillar and Tite, 2000).

2. Especially because, if investigated with reference to the philosophy of action, one may get carried away from anthropological and ethnographical domains and caught up in philosophical debates. While I agree that this could probably enlighten some of the terms we use, it is beyond the scope of this article to engage with these discussions.
3. In my transcription of the Abelam language, I use the spelling given in the dictionary compiled by the Summer Institute of Linguistics (Kudama and Wilson, 1987).
4. At the time of my PhD project, Gell's book had been recently published and, although I was excited, like many others, by the theoretical shift it proposed, I also felt frustrated by the fact that it was unclear exactly how an inanimate object was imbued with an agency that was more than a sociological metaphor (for a recent discussion, see Morphy, 2009). One of my original aims was thus to explore this process.
5. Both gardens are intercropped with other species, mostly taro, aibika and bananas. Although I call these 'secondary crops', they also play a fundamental role. Taro, notably, are considered as being the female companion of both species of yams, and their planting is mostly done by women (Lea, 1964).
6. Sophie Desrosiers (1991: 21) recalls the complex paternity of the term *chaîne opératoire*, indicating the rôle of the work of Marcel Maquet (1953) as one of the sources of the concept.
7. As an archaeologist colleague pointed out back then, I had an incomplete picture of the different variations in the entire sequence. To get the whole picture, I would have to record long yam cultivation sequences in several clans, villages and areas before being able to build up a proper interpretation. While this will certainly be the next step to investigate, my main concern at the time was to experiment with a methodology applied to a particular type of object.
8. See Lemonnier (1992: 61–3) for both an alternative operational sequence from the Highlands of Papua New Guinea and variations in the sequences themselves. For the Maprik area, see also Lea (1964).
9. This rule of quietness is valid at most times in garden work, apart from specific occasions, such as the planting in the new *ka* garden, when a noisy and joyful atmosphere is encouraged.
10. I use here the direct translation of the term *nëmadu*, which is used both for 'elder brother', and 'important men', the latter distinguished by my use of the capital letter. It is not meant as specific reference to discussions about the distinction between Great Men and Big Men (cf. Godelier and Strathern, 1991). The Nyamikum situation regarding these matters would seem to require further investigation, beyond the scope of my article.
11. In this, I concur with the praxeological approach of Warnier (2009), who astutely grounds a Foucauldian metaphorical use of technology within a more cognitive and material understanding of body techniques (Warnier, 2009).
12. One could argue, though, that they derived from my own perceptions, biased by my own (partially) embodied academic knowledge.
13. I am aware that unintentional results of events cannot be completely excluded from the discussion and will have to be investigated in order to reveal new elements of technical activities (about techniques that do not achieve their material goals, see also Lemonnier, 1993: 1–2). But discussions

on the agency of artefacts led me to focus, at this stage, on intentionality. In addition, to think about reasons for doing things does not especially entail that the results have to match the original intention.

References

- Allen, B.J. (1982) 'Yam Gardens and Fallows in the Torricelli Foothills, Dreikikir District, East Sepik', in R. Michael Bourke and V. Kesavan (eds) *Proceedings of the Second Papua New Guinea Food Crops Conference*, pp. 236–56. Port Moresby: Department of Primary Industry.
- Allen, B.J. (1986) 'Some Environmental Considerations in Sepik Culture History', unpublished paper prepared for the International Symposium of the Wenner-Gren Foundation for Anthropological Research, 'Sepik Culture History: Variation and Synthesis', February 15–24, Mijas, Spain.
- Balfet, H. (1975) 'Technologie', in Robert Cresswell (ed.) *Eléments d'ethnologie 2*, pp. 44–79. Paris: Armand Colin.
- Balfet, H. (1991) 'Des chaînes opératoires, pour quoi faire?', in Hélène Balfet (ed.) *Observer l'action technique. Des chaînes opératoires, pour quoi faire?*, pp. 11–9. Paris: Editions du CNRS.
- Bell, J.A. and Geismar, H. (2009) 'Materialising Oceania: New Ethnographies of Things in Melanesia and Polynesia', *Australian Journal of Anthropology* 20: 3–27.
- Burkill, I.H. (1960) 'The Organography and the Evolution of Dioscoreaceae, the Family of Yams', *Journal of the Linnean Society of London [Botany]* 56(367): 319–412.
- Conklin, H.C. (1961) 'The Study of Shifting Cultivation', *Current Anthropology* 2(1): 27–61.
- Coupaye, L. (2005) 'Growing Artefacts, Displaying Relationships: Outlining the Technical System of Long Yam Cultivation and Display among the Abelam of Nyamikum Village (East Sepik Province, Papua New Guinea)', PhD dissertation, Vol. 2. Norwich: University of East Anglia.
- Coupaye, L. (2007a) 'Some Abelam Portraits', *Arts & Cultures* 2007: 258–75.
- Coupaye, L. (2007b) 'Beyond Mediation: The Long Yams of Papua New Guinea', in Celina Jeffrey and Gregory Minissale (eds) *Global and Local Art Histories*, pp. 205–20. Cambridge: Cambridge Scholar Press.
- Coupaye, L. (2009a) 'Experiencing Space: The *tëkët* Frieze of the Abelam, Maprik Area, Papua New Guinea', *Arts & Culture*: 210–25.
- Coupaye, L. (2009b) 'What's the Matter with Technology? Long (and Short) Yams Materialisation and Technology in Nyamikum Village, Maprik District, East Sepik Province, Papua New Guinea', *Australian Journal of Anthropology* 20: 93–111.
- Coupaye, L. (forthcoming) 'Growing Artworks, Displaying Relationship : Yam cultivation amongst the Nyamikum Abelam of Papua New Guinea'.
- Coursey, D.G. (1967) *Yams*. London: Longman.
- Cresswell, R. (1973) 'Technologie Culturelle', in *Encyclopaedia Universalis* 15: 823–28.
- Cresswell, R. (1976) 'Techniques et Cultures. Les bases d'un programme de travail', *Techniques et Cultures* 1: 1–16.
- Cresswell, R. (1996) *Prométhée ou Pandore? Propos de technologie culturelle*. Paris: Éditions Kimé.
- Desrosiers, S. (1991) 'Sur le concept de chaîne opératoire', in Hélène Balfet (ed.) *Observer l'action technique. Des chaînes opératoires, pour quoi faire?*, pp. 21–5. Paris: Editions du CNRS.

- Dobrès, M.-A. (2000) *Technology and Social Agency*. Oxford: Blackwell.
- Faure-Rouesnel, L. (2001) 'French Anthropology and Material Culture', *Journal of Material Culture* 6(2): 237-47.
- Forge, A. (1966) 'Art and Environment in the Sepik', *Proceedings of the Royal Anthropological Institute for 1965*: 23-31.
- Forge, A. (1967) 'The Abelam Artist', in Maurice Freedman (ed.) *Social Organization: Essays Presented to Raymond Firth*, pp. 65-84. London: Frank Cass.
- Forge, A. (1970) 'Learning to See in New Guinea', in Philip Mayer (ed.) *Socialization: The Approach from Social Anthropology*, pp. 269-91. London: Tavistock.
- Forge, A. (1990) 'The Power of Culture and the Culture of Power', in Nancy Lutkehaus et al. (eds) *Sepik Heritage*, pp. 160-70. Durham, NC: Carolina Academic Press.
- Foucault, M. (1988) 'Technologies of the Self', in Luther H. Martin et al. (eds) *Technologies of the Self*, pp. 16-49. Amherst: University of Massachusetts Press.
- Gell, A. (1988) 'Technology and Magic', *Anthropology Today* 4(2): 6-9.
- Gell, A. (1992) 'The Technology of Enchantment and the Enchantment of Technology', in Jeremy Coote and Anthony Shelton (eds) *Anthropology, Art and Aesthetics*, pp. 40-63. Oxford: Clarendon Press.
- Gell, A. (1998) *Art and Agency*. Oxford Clarendon Press.
- Gerrits, G.J.M. (c. 1978) 'The House Tambaran of Bongiora', unpublished manuscript, Basel.
- Gille, B. (ed.) (1978) *Histoire des Techniques: Techniques et Civilisation; Technique et Sciences*. Paris: Gallimard.
- Glock, H.-J. (1996) *A Wittgenstein Dictionary*. Oxford: Blackwell.
- Godelier, M. and Strathern, M. (1991) *Big Men and Great Men: Personifications of Power in Melanesia*. Cambridge/Paris: Cambridge University Press/Editions de la Maison des Sciences de l'Homme.
- Hardin, K.L. (1993) *The Aesthetics of Action: Continuity and Change in a West African Town*. Washington, DC: Smithsonian Institution Press.
- Haudricourt, A.-G. (1987[1968]) *La Technologie, science humaine: Recherche d'histoire et d'ethnologie des techniques*. Paris: Editions de la Maison des sciences de l'homme.
- Hauser-Schäublin, B. (1989a) *Kulthäuser in Nordneuguinea. Vol. 1: Architektur, Funktion und Symbolik des Kulthauses bei den Abelam; Vol. 2: Vergleichende Studien zu Kulthäusern im Sepik-Gebiet und an der Nordküste*. Abhandlungen und Berichte des Staatlichen Museums für Völkerkunde Dresden. Berlin: Akademie-Verlag.
- Hauser-Schäublin, B. (1989b) *Leben in Linie, Muster und Farbe: Einführung in die Betrachtung aussereuropäischer Kunst am Beispiel der Abelam, Papua-Neuguinea*. Basel: Birkhäuser Verlag.
- Hauser-Schäublin, B. (1995) 'Puberty Rites, Women's Naven and Initiation: Women's Rituals of Transition in Abelam and Iatmul Cultures', in Nancy Lutkehaus and Paul B. Roscoe (eds) *Gender Rituals: Female Initiations in Melanesia*, pp. 33-53. New York: Routledge.
- Hauser-Schäublin, B. (1996) 'The Thrill of the Line, the String, and the Frond, or Why the Abelam is a Non-Cloth Culture', *Oceania* 67(2): 81-106.
- Hocart, A.M. (1952) *The Life-Giving Myth and Other Essays by A.M. Hocart*. London: Methuen.
- Huber-Greub, B. (1988) *Kokospalmenmenschen: Boden und Alltag und ihre Bedeutung im Selbstverständnis der Abelam von Kimbangwa (East Sepik Province, Papua New Guinea)*. Basler Beiträge zur Ethnologie, Vol. 27. Basel: Weipf & Co. AG Verlag.
- Joulian, F. (1994) 'Culture and Material Culture in Chimpanzees and Early

- Hominids', in J.J. Roeder et al. (eds) *Current Primatology*, Vol. II: *Social Development, Learning and Behaviour. Selected Proceedings of the XIVth Congress of the International Primatological Society*, pp. 397–404. Strasbourg: Université Louis-Pasteur.
- Joulian, F. (2000) 'Techniques du corps et traditions chimpanzières. Les animaux pensent-ils?', *Terrain* 34, March. URL (consulted 26 Aug. 2009): <http://terrain.revues.org/index951.html>
- Kaberry, P. (1941) 'The Abelam Tribe, Sepik District, New Guinea: A Preliminary Report', *Oceania* 11(3): 233–58; 11(4): 345–67.
- Kaberry, P. (1941–2) 'Law and Political Organisation in the Abelam Tribe, New Guinea', *Oceania* 12(1): 79–95; 12(3): 209–25; 12(4): 331–63.
- Kopytoff, I. (1986) 'The Cultural Biography of Things: Commoditization as Process', in Arjun Appadurai (ed.) *The Social Life of Things: Commodities in Cultural Perspective*, pp. 65–91. Cambridge: Cambridge University Press.
- Kudama, J. and Wilson, P. (1987) *Kudi Kupuk: Kudi Kupuk, Ambulas, Tok Pisin, English. Dictionaries of Papua New Guinea*, Vol. 10. Ukarumpa, Papua New Guinea: Summer Institute of Linguistics.
- Lea, D.A.M. (1964) 'Abelam Land and Sustenance Horticulture in an Area of High Population Density, Maprik, New Guinea', unpublished thesis, Australian National University, Canberra.
- Lea, D.A.M. (1969) 'Some Non-Nutritive Functions of Food in New Guinea', in Fay Gale and Graham H. Lawton (eds) *Settlement and Encounter. Geographical Studies Presented to Sir Grenfell Price*, pp. 173–4. Melbourne: Oxford University Press.
- Lechtman, H.H. and Merrill, R. (eds) (1977) *Material Culture: Styles, Organization, and Dynamics of Technology*. St Paul: Xest.
- Lemonnier, P. (1976) 'La description des chaînes opératoires: contribution à l'analyse des systèmes techniques', *Techniques & Culture* 1: 100–51.
- Lemonnier, P. (1983) 'L'étude des systèmes techniques, une urgence en technologie culturelle', *Techniques & Culture* 1: 11–26.
- Lemonnier, P. (1986) 'The Study of Material Culture Today: Toward an Anthropology of Technical Systems', *Journal of Anthropological Archaeology* 5(2): 147–86.
- Lemonnier, P. (1992) *Elements for an Anthropology of Technology*. Ann Arbor: University of Michigan Press.
- Lemonnier, P. (ed.) (1993) *Technological Choices: Transformation in Material Culture since the Neolithic*. London: Routledge.
- Leroi-Gourhan, A. (1971[1943]) *Evolution et techniques I: L'Homme et la Matière*. Paris: Albin Michel.
- Leroi-Gourhan, A. (1973[1945]) *Evolution et techniques II: Milieu et Techniques*. Paris: Albin Michel.
- Losche, D. (1982) 'Male and Female in Abelam Society', unpublished thesis, University of Michigan, Ann Arbor.
- Losche, D. (1995) 'The Sepik Gaze: Iconographic Interpretation of Abelam Form', in James Weiner (ed.) *Too Many Meanings: A Critique of the Anthropology of Aesthetics. Social Analysis* 38, pp. 47–60. Adelaide: Department of Anthropology, University of Adelaide.
- Losche, D. (1996) 'The Impossible Aesthetic: The Abelam, the Moa Bird and Me', *Oceania* 66(4): 305–10.
- Mackenzie, M.A. (1991) *Androgynous Objects: String Bags and Gender in Central New Guinea*. Chur, Switzerland: Harwood Academic.
- Maget, M. (1953) *Guide d'étude directe des comportements culturels*. Paris: Civilisations du Sud.

- Mahias, M.-C. (1993) 'Pottery Techniques in India: Technical Variant and Social Choice', in Pierre Lemonnier (ed.) *Technological Choices: Transformation in Material Culture since the Neolithic*, pp. 157–80. London: Routledge.
- Mauss, M. (1950[1935]) 'Les techniques du corps', in Marcel Mauss (ed.) *Sociologie et Anthropologie*, pp. 365–86. Paris: PUF.
- Mauss, M. (1968[1909]) *Les fonctions sociales du sacré*, Oeuvres I. Paris: Les Editions de Minuit. URL (consulted 26 Aug. 2009): <http://www.ccic-cerisy.asso.fr/mauss09.html>
- Mauss, M. (2002[1947]) *Manuel d'Ethnographie*. Paris: Payot.
- McGuigan, N.D. (1992) 'The Social Context of Abelam Art: A Comparison of Art, Religion and Leadership in Two Abelam Communities', unpublished thesis, University of Ulster.
- Morphy, H. (2002[1994]) 'The Anthropology of Art', in Tim Ingold (ed.) *Companion Encyclopedia of Anthropology*, pp. 648–85. London: Routledge.
- Morphy, H. (2009) 'Art as a Mode of Action: Some Problems with Gell's Art and Agency', *Journal of Material Culture* 14(1): 5–27.
- Pfaffenberger, B. (1988) 'Fetishized Objects and Humanized Nature: Towards an Anthropology of Technology', *Man* 23: 236–52.
- Pfaffenberger, B. (1992) 'Social Anthropology of Technology', *Annual Review of Anthropology* 21: 491–516.
- Quin, F.M. (1985) 'East Sepik Rural Development Project: Agricultural Research Sub-Project: Report on Yam Research (*Dioscorea* spp.) 1981–84', unpublished paper/report.
- Roscoe, P.B. (1989) 'The Pig and the Long Yam: The Expansion of a Sepik Cultural Complex', *Ethnology* 28(3): 219–31.
- Rowlands, M. and Warnier, J.-P. (1995) 'The Magical Production of Iron in the Cameroon Grassfield', in Thurstan Shaw et al. (eds) *The Archaeology of Africa: Food, Metals and Towns*, pp. 512–50. London: Routledge.
- Scaglion, R. (1976) 'Seasonal Patterns in Western Abelam Conflicts Managements Practices: The Ethnography of Law in the Maprik Sub-District Province, East-Sepik Province, Papua New Guinea', unpublished thesis, University of Pittsburgh.
- Scaglion, R. (1999) 'Yam Cycles and Timeless Time in Melanesia', *Ethnology* 38(3): 211–25.
- Schlanger, N. (1991) 'Le fait technique total: la raison pratique et la raison de la pratique dans l'oeuvre de Marcel Mauss', *Terrain* 16: 114–30.
- Schlanger, N. (ed.) (2006) *Marcel Mauss: Techniques, Technology and Civilisation*. New York/Oxford: Durkheim Press/Berghahn Books.
- Sigaut, F. (1985) 'More (and Enough) on Technology!', *History and Technology* 2: 115–32.
- Sigaut, F. (1987) 'Un couteau ne sert pas à découper, mais en découpant. Structure, fonctionnement et fonction dans l'analyse des objets', in APDCA (eds) *25 Ans d'études technologiques en préhistoire*, pp. 21–34. Juan-les-Pins: APDCA.
- Sigaut, F. (2002[1994]) 'Technology', in Tim Ingold (ed.) *Companion Encyclopedia of Anthropology*, pp. 420–59. London: Routledge.
- Sillar, B. and Tite, M.S. (2000) 'The Challenge of "Technological Choice" for Materials Science Approaches in Archaeology', *Archaeometry* 42(1): 2–20.
- Staudenmaier, J.M. (1990) 'Recent Trends in the History of Technology', *American Historical Review* 95: 715–25.
- Tuzin, D. (1972) 'Yam Symbolism in the Sepik: An Interpretation Account', *South-western Journal of Anthropology* XXVIII: 230–54.
- Tuzin, D. (1995) 'Art and Procreative Illusion in the Sepik: Comparing the Abelam and the Arapesh', *Oceania* 65(4): 289–303.

- Van der Leeuw, S. (1994) 'Innovation et tradition chez les potiers mexicains', in Bruno Latour and Pierre Lemonnier (eds) *De la préhistoire aux missiles balistiques. L'intelligence sociale des techniques*, pp. 310–28. Paris: La Découverte.
- Warnier, J.-P. (2009) *Régner au Cameroun: Le Roi-Pot*. Paris: Karhala.
- Weiner, J.F. (ed.) (1994) *Aesthetics Is a Cross-Cultural Category*. Manchester: Group for Debates in Anthropological Theory, Department of Social Anthropology, University of Manchester.

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