Perspectives in Anthropology, Feminism, and Gender for the Histories of Techniques and Technology: Interview with Francesca Bray

Interview conducted by Nicole Cristi via Skype on December 7, 2020

How to Cite this Interview: Bray, F., & Cristi, N. (2021). Perspectives in Anthropology, Feminism, and Gender for the Histories of Techniques and Technology: Interview with Francesca Bray. *Diseña*, (18), Interview.1. https://doi.org/10.7764//disena.18.Interview.1

DISEÑA | 18 |
JANUARY 2021
ISSN 0718-8447 (print)
2452-4298 (electronic)

Interview

Spanish translation here

Former President of the International Society for the History of Technology, Francesca Bray is a historian and anthropologist of science, technology, and medicine. She is Professor Emerita of Social Anthropology in the School of Social and Political Science at The University of Edinburgh. As a researcher interested in how politics are expressed and enacted through everyday technologies, she is involved in collaborative projects with anthropologists, historians, development studies specialists, and STS scholars. She is the author of *Technology, Gender and History in Imperial China: Great Transformations Reconsidered* (Routledge, 2013) and has recently co-edited *Science and Confucian Statecraft in East Asia* (Brill, 2019) and *Rice: Global Networks and New Histories* (Cambridge U. Press, 2015). Francesca Bray was awarded the Leonardo da Vinci Medal, the highest recognition from the Society for the History of Technology.

In this interview, Bray discusses the possibilities offered by a situated approach to the history (or histories) of techniques and technology in order to challenge hegemonic Eurocentric teleologies that surround it. From her research on Imperial China, Bray explains how an interwoven approach mixing gender studies, feminism, and an anthropological point of view could contribute analytically and methodologically to the History of Technology, in order to expand its margins beyond its recurring modern and binary tales.

I would like to start by asking you about the analytical perspectives present in your work. How are anthropology, history of technology, and gender and feminist studies interrelated in your research?

I will begin with a little autobiography, just to explain how I came into the intellectual mindsets that match my research. I came to the history of technology through working with Joseph Needham's project Science and Civilisation in China. I was in charge of the volume on agriculture. Unlike some of the other volumes where science and technology came together from the top-down, in the case of agriculture and agrarian systems, it was very clear that it was a dialectic between top and bottom, and this was recognized by the Chinese themselves, who were writing about it and were providing my sources. And so, immediately the importance of every day, bottom-up approaches to technical knowledge, technical skills, and technical systems became apparent. And because this was the 1970s, this was not very common in the English language history of technology or history of science.

I went to school in France, I had good connections with French colleagues, I was reading *Annales* and I got to know a lot of people from *Techniques et culture*, therefore from the very beginning people like André-Georges Haudricourt, François Sigaut, and Pierre Lemonnier were important influences for me. And that meant that, as I had also gained from my schooling in France, I did not make this distinction between what historians, anthropologists, or geographers do: I saw them much more as an *ensemble*. The history of techniques was perfect for me and I really loved doing it, and what I valued was that it brought in anthropological perspectives, therefore instead of saying "let's do a history of locomotives as separate from a history of carts," we said, "let's have historians look at why people wanted to get from A to B and how they thought they would do it." That became part of the match, a more general investigation of human types of activities, of human aspirations.

What I also appreciated about *histoire des techniques* is that it was inherently a critique of modern categories. And in Leroi-Gourhan's tradition, I was interested in techniques as self-fashioning and techniques as communication, and then of course with Bourdieu also in mind, everyday material practices became not only ways of communicating identity but also ways of expressing tacitly everyday values, everyday relationships, and so on. So, I thought this ideological infrastructure aspect of techniques was very important and helpful, and that is something I have been interested in since I began.

When I was working on the history of agriculture in China, initially I was just working on how class and power hierarchies related, but then feminist studies started to become important in the history of science. For me, that was as radical a transformation as the Marxist influence, because it is not just about what are women doing, or what are men doing to women, it is about how all our structures of inequality and power are produced and what forms of identity are rendered in that process. Hence, perspectives on gender were obviously an interesting way to look at the history of technology, particularly since at that point, history of technology had been mostly the history of white men. When I was thinking about these things and I was working on late imperial China, I saw gender analysis as a way to address a double disadvantage from the perspective of the history of technology. First of all, it was presumed that China had no history of technology important enough for western historians to consider. The assumption was that after about 1400, technology in China simply stagnated. That was one form of disadvantage. And the other challenge was to bring in women. What did women have to do with technology? Everyone knows that technology is something that men do! [laughs]. I thought that by looking at the making of gender through technology and techniques in late imperial China, I was bringing a radically new perspective to this double disadvantage. I am not sure if these days it qualifies as intersectionality, but being ancient Chinese and being an ancient Chinese woman was, in the terms of intersectionality, a layering of disadvantage from the perspective of historians of technology at the time.

In epistemological and methodological terms, what tensions or difficulties emerge from the intersection of anthropology, history of technology, and gender and feminist studies?

One of the big tensions for me and my work has always been the one that exists between historical specificity and the search for patterns. The culture of the historian, particularly the way history is viewed in English speaking circles, which is very legitimately a history that looks at historical materials in order to reconstruct *that* moment of the past in its own terms (or our terms). And the point of the reconstruction is precisely its historical specificity, so you cannot generalize from it. Whereas sociologists and very often anthropologists produce theories, or patterns, consequently they like to generalize from specific cases. Of course, there is the danger that you flatten the cases in order to make an argument, or cherry-pick your cases in order to fit your argument. And quite apart from what it is that the historical sources allow you to do, because they are what you have to work with, even if you try to read them against the grain, which

is what feminists should be clearly doing, you have to read between the lines and generalizing is always risky. In my work, I wanted to say general things about gender and the materiality of gender, and the relationship between the materiality of gender and the Chinese State. China is a country you cannot study without studying the state. And in order to say general things about that, of course, I had to flatten. And at the same time as I was working, I had colleagues who were working in a much more post-colonialist vein, for instance, Prasenjit Duara, to try and rescue the history of the nation, which is I think a very important endeavor. But at the same time while you can try to rescue premodern Chinese history from the State, in doing so, you risk losing sight of the State and how pervasively important it was. These things are quite risky, maybe not so much at the level of epistemology and methodology but readership and engagement. But it is very much a dialectic. In terms of methodology, we need both kinds of history. The kind of history I tend to do is not impeccable because it does run these risks of generalization. But at the same time it raises general issues, which sometimes get obscured in the other kinds of history. And this applies not just to the history of China but to every form of scholarship.

How are these intersecting fields related to the history of design? In your experience, how can the history of design, and more specifically, the notion of 'user' – that is central in design studies – analytically contribute to these fields?

From the perspective of these two fields, the history of technology and STS, and the way they have been developing in the past few years, there has been great attention to 'technologies in use,' specially in the work of David Edgerton, David Arnold, and many other people criticizing the idea that just looking at how things are industrially produced is going to tell us everything. And then there is the 'users matter' approach, which is not identical because it is focused on a sort of dialogue between producers or designers and consumers, here termed 'users,' in a rather different way. And for people like me who work on preindustrial societies, the user category – and how it is deployed – is a product of our contemporary industrial-consumer society, where production and consumption are conceived of as being two ends of the spectrum. Therefore, it tends to build this kind of polarity that separates production from consumption. It looks at design as something almost always

"It is not just about what are women doing, or what are men doing to women, it is about how all our structures of inequality and power are produced and what forms of identity are rendered in that process"

professional, and certainly intentional and deliberate, and it produces all kinds of interesting ideas, for example about user scripts, which have been very useful and important. But on the other hand, there is a temptation to say, "well, we too should be looking in terms of producers and users," and that does not necessarily work very well. Producers or designers are users too, certainly, but that is not the point. The point is that the two make up a series of entangled operating sequences. You need to be careful about remembering that producers and designers are also users, and there is no point in which something stops becoming production and becomes use, or consumption.

That said, many of the artifacts that people like me work with, do not exactly fall under the category of designed objects, because nobody has said, "How is this to be designed, how I get to make this." Perhaps it has to do with ancestral knowledge: you make it this way because the master of your workshop made it that way, and his father made it that way before him, and his father before him. Until you no longer have that type of wood and must find a different way to do it.

The modern rubric of design, with these assumptions about materials, engineering, advertising, questions of preference and taste, and so on, involves multiple processes of translation and you have to think what material, social or cultural factors are influencing each specific stage of translation. But whatever you are operating, the notion of technological choices is one way into it. That is a helpful way to look into it.

'Technological choices' from Lemonnier, right?

Yes, any of us can play the game of the smash-hit BBC radio series "A history of the world in a hundred objects." The infinite seduction of taking a brick and saying, "Why is this brick-like this?" We can all do that from our materials, ranging from Paleolithic axes to modern spaceships. So, by taking a historical artifact and working out from it to ask why is it in this form and what are the consequences of these choices, can be very fruitful. One of the cases I used in China was the ancestral altars around which domestic space was organized, and how these helped to anchor society as it changed over time. Another very interesting example is provided by my colleague Dorothy Ko, who has worked on the social life of inkstones, very highly valued objects in their own society but which unlike silks or porcelains, did not travel outside China very much. But it is possible to look at these inkstones as entangled artifacts and build out from them, and part of that is thinking about what you might call 'design,' but it also brings in the various factors that constrained design.

One other thing I like about this history of one hundred objects approach is that, if you do it for other societies, it can be very informative for today's society. If you take this *anthropologie des techniques* approach, you can translate the questions, so you can say, "in Late Imperial China, the ancestral altar was the combination of the refrigerator door and the mobile phone, as a way to communicate with your ancestors, and communicating with the rest of the household and holding everybody together."

How did that translate into what people did in California at the end of the 1990s? How did they do it here? So then, instead of saying, "Well, refrigerators are part of the long history of keeping things as cold as possible" and looking at them this way, you get a different perspective. You can say, "In American households, the fridge door is how people talk to each other. Let us look at that!" I thought that was helpful because history is not just a question of human endeavors, but it is also about the politics behind them, the moral and value system. And for me, that is the study of the history of techniques.

Interweaving the fields of anthropology, feminism, and history of technology, it seems fundamental to redefine and question the term 'technology,' going from Eurocentric teleologies and white man's visions to situated perspectives. In your work, you talk about rethinking 'technology' as 'historical heuristic.' Could you delve into this concept?

There is the world of scholarship and there is the world. And they cover each other, they overlap. Technology in public understanding around the whole world today is about progress, and it is an idea about inventions typically by great men, like Tesla, or whoever it might be. This is obviously very much a modernist project, future-orientated: the future must be better than the present. The interesting thing is how this kind of approach uses history to reinforce hierarchies of place, race, gender or class.

When people ask what the role of technology in human history is (technology of course is a modern concept, so we cannot blame them for using modernist interpretations), they say "its role is to produce change, to make the world better." And who does this? People of a particular kind, geniuses who transform the world by inventing electric cars or whatnot. Today, most historians of technology repudiate this position, but it is very difficult to get beyond it in public thinking. If you look at the financing and resources for teaching and research, what people want you to make Ted Talks about, etc., it is constantly pushing back against

any attempt to transcend this point of view. It is a lovely simple point of view. I have a colleague in Singapore who is a historian of technology. When he was talking to the parents of his students they would say, "What do you mean by history of technology, technology does not have a history, it is about the future!" Students would say, "Trains? Trains are not technology, smartphones are technology!" It is quite difficult to change public opinion about all this when so much is against it. And there is an enormous appeal to this sort of Promethean view of progress, of new driving out old, and the Western exceptionalism associated with it. David Landes' *The Unbound Prometheus* is still one of the most cited works, even though he is not a historian of technology but a historian of economics, his work enormously appeals and sets the terms of the debate. If we look for example at the major part of the history of technology in the People's Republic of China, even today, and despite a lot of people doing really interesting original work, a whole part of it is about what China did first. And that – to them – means China really belongs in history. That is a big burden that we have. So, a situated perspective obviously takes a very different point of view, and instead of saying "Well, let us trace the lineages of the steam engine and see what China contributed," we say, "What matters in this society? What material forms does it take and what do we learn from that? What do they tell us? What do they not tell us?" Again, it is a very anthropological approach to technology, to society, and history. If you look at it that way, it is obviously inevitable that you will have to consider both meaning and power, even if it is only to assess why the information you have, or you do not have, is there.

> **"The user category – and how it is deployed – is a product of our contemporary industrial-consumer society, where production and consumption are conceived of as being two ends of the spectrum. Therefore, it tends to build this kind of polarity that separates production from consumption. (...) The point is that the two make up a series of entangled operating sequences. (...) there is no point in which something stops becoming production and becomes use, or consumption"**

This often means a lot of surprises about the places you are studying, but also surprises when you take those ideas and look at your own history in those terms. And that is where the real excitement comes from for historians of the West. If you look for example at the work of historians working on things which might be called 'technology' in the context of Africa, you will find Clapperton Chakanetsa Mavhunga, who has this collec-

tion of papers called 'What do Science, Technology, and Innovation Mean for Africa.' He and Kathryn de Luna have both talked about the assumptions that are made about fixity, being in place, being a condition for making technologies and making them work. Accordingly, if you start thinking about a society where mobility is more important than staying in place, that is when you have to rethink what a significant technology is, how it works, and so on.

That is a very inspiring set of approaches at the moment. And another one, which your colleague Ludovic Coupaye or the historian Pablo Gómez or quite a few people are pursuing, is looking at things that nobody has ever thought of as a technology, like yams or stones.[1] That incites us to examine very deeply our convictions about the disenchantment of technological practice in our modern industrial society and why we need to think that technology is disenchanted. What happens when we start recognizing that is very much not so? Perspectives like this can play a big role in working towards epistemological justice, giving people who have been made invisible and activities that have been erased, the importance that is their due. And it is very important to refresh the critique of technology in today's society, where we are still living with assumptions that technology is neutral, technology is apolitical, technology is not religion. All around us, we see this happening, but we do not have the political tools to do anything about it.

1 See Coupaye's 'What's the Matter with Technology? Long (and Short) Yams, Materialisation and Technology in Nyamikum Village, Maprik District, Papua New Guinea' (*Australian Journal of Anthropology*, Vol. 20, N° 2); and 'Caribbean Stones and the Creation of Early-Modern Worlds', by Gómez (*History and Technology*, Vol. 34, N° 1).

How does the technical experience in Imperial China challenge the linearity of the ideas of 'technological change' and 'progress' which are recurrent in European historiography of modern 'technology'? How are stability, cohesion, and continuity interwoven with technical narratives in Imperial China?

Even before the term was coined, technology becomes this great justification of western superiority in the mid-19th century at the height of colonial endeavors. As Michael Adas points out, it becomes a measure of man and it becomes a justification for imperialism and the civilizing mission. And, in order to make yourselves feel better about all this, you need to denigrate the others that you are taking over, so we get this caricature emerging, this caricature of Asian societies as being stagnant and incapable of dynamism or change (Marx is as guilty as anybody about that). And this goes with the idea that real technology, the technology that matters, is the technology that transforms society and brings a revolution of some kind or another. However, if you look at what people in power want, you see that they do not want a revolution, they want to stay in power. If

you look at families with mortgages, they do not want a revolution, they want to be able to go on paying the mortgage and educating their children, they are very intensely conservative. And most technological efforts have gone into keeping things the same, although they may of course think, as Lampedusa said, "We will have to change everything in order for things to stay the same." The point is that those at the top want to stay there. So, today many historians of western industrial society are starting to think about the fact that huge amounts of effort go into keeping things the same. That this is part of a very important social project in most societies.

This important issue became very obvious to me when I was studying late Imperial China, but also when I was studying 1990s California. I was there through the cell phone revolution. I saw the start of it, I saw it unfolding, I saw how it evolved and became an everyday indispensable fact of life for almost everybody, although some still could not afford it. And it was very interesting to see how it became this no longer questioned or even noticed central tool, along of course with all kinds of infrastructural and business changes that helped make this happen. So, I think looking at this is a very good way of linking micro and macro, looking at State regulation, the assignment of licenses, the formulation of family plans, the ways in which you entice people into buying cell phones, and so on. And then, the way that people were using cell phones. It was a lovely chain, just as you can do similar chains for weaving in imperial China.

In the case of late Imperial China, historians like to see stagnation, and they insist on it over and over again. Yet you have a country which grows enormously, which is a leading economic power in the global system up until 1800, it is flooding the world with its manufactures. The industrial revolution is an attempt to stop buying from India and China. Something is going on there, it is not that things are not changing but at the same time, the basic nature of the State does not change. The state does not change, and its preoccupations do not change. That is an interesting place to look at, where attempts are made to maintain, preserve, and conserve by bringing in innovations.

If you want to study maintenance in the history of China, there is a huge amount there. I was sort of amused when US historians suddenly started saying, "Maintenance, yes, yes! We have not been thinking about it," and I thought, "This is fantastic, let us start looking at maintenance and all that it means." But then I got quite frustrated because two years ago, I found that the people who were carrying the banner for maintenance were still at the stage where they were looking at technological systems as self-contained systems. So, in that sense, they were looking

“Even before the term was coined, technology becomes this great justification of western superiority in the mid-19th century at the height of colonial endeavors. As Michael Adas points out, it becomes a measure of man and it becomes a justification for imperialism and the civilizing mission. And, in order to make yourselves feel better about all this, you need to denigrate the others that you are taking over, so we get this caricature emerging, this caricature of (…) societies as being stagnant and incapable of dynamism or change”

at how the telephone industry was kept going, and how new things are brought in to keep the same entities in existence. But they were not so interested in the social life of telephones, the modern meaning of telephones and their multiple roles in anchoring society. Cheap labor maybe, but not so much the more symbolic dimensions explaining why women are behind the standard and so on. This whole question of the social maintenance of technological systems and habits is interesting and deserves a lot more attention and gives a great opportunity for anthropologists and historians of technology because we are dealing with a public that is pleased to think of technology as being neutral.

From gender perspectives, in terms of masculinities and femininities, how is it possible to expand or dispute Eurocentric narratives of ‘technology’? What opportunities does this approach present for the history of technology and history of design (and their imbrications)?

This question inspires me. If you talk about gender, and masculinities, and femininities, there is a temptation to say ‘binary polarity.’ And I found in my work very early on that I had to be careful because there are multiple masculinities and multiple femininities at work in China. Basically, depending on age, rank, constitution and so on, people are somewhere along a gender spectrum in the terms of a cosmology whereby Yin becomes Yang and Yang becomes Yin. If you are a woman or a man, this can ostensibly be matched quite neatly onto western categories of masculinity and femininity. But, especially in China, things like class, generation, and race, were all often overriding factors, therefore, you have to be very careful about how you match them to something like technological practices, or how skills are attributed. But that does not mean you must not do it. You just have to be cautious. But that said, I knew there had been a strong move by some African and other postcolonial feminists to reject gender as a western imperialist concept that was imposed on their societies. Therefore, if we go in and we start looking at things in terms of gender, we are just playing the games of the colonial rulers. Fortunately, I work on China [laughs].

But one of the things I always thought was fascinating and that could be very productive was talking between settings, for instance, in Africa mother and father do not have the same meaning in different places, let alone with those categories as they have been reified in western society; in China too, mother encompasses very different biological and social roles. But one of the things I think is interesting for the history of technology and history of design, is to think in terms of what is the technological kit that particular social identities require. This was a game I used to play with my students in California. When they had to write their term papers, I said, "Choose a social identity, with which you are reasonably familiar, but it does not have to be your own, use the newspapers, or interviews, or advertisements, or TV, or films, or whatever, as well as your own experience, to see what technological kits they show they are needing, having, and wanting." This is all not only just about how people are represented, but how things are. So, taking the technological kit of the good mother in late imperial China is interesting because some of the things that you would expect there, are not mentioned. Cooking just does not feature. It just goes without saying, I suppose, and in an upper-class household the woman would not cook anyway, as in European upper-class households she does not interfere in the kitchen. Weaving, spinning, and sewing are everywhere, even for women who would never have had to do it. If they did not have to do it, then they were expected to sew slippers for their husbands, or something like that. And then in California, in the 1990s you could not be a good middle-class white mother if you did not have an SUV to keep your children safe, a huge refrigerator, a cell phone plan that had all the family members in it, a house with a mortgage, needless to say, etc., etc. You could put together this kit, and it would tell you a whole lot about the broader society. It was a nice way of connecting the micro and the macro.

In your analysis, you consider micro and macro dimensions in which 'technology' and its representations operate. From the macro dimensions, beyond technical infrastructures, how are the cosmic order, and moral and ethical dimensions related to the technical development in Imperial China? How are micro and macro dimensions related in themselves contributing to 'technology' as a specific category?

To illustrate, I will use a concrete case, silk reeling, which is one of the foremost forms of what you might call 'womanly work' in China. It is a work performed by women, proved to be done by women, and conceived of as making good women. And when you look at this work of silk reeling you understand a lot more about how, what we can call micro

and macro, or individual and society, are connected in eastern educated elite ways of thinking. That is, a well-ordered household is the basis of a well-ordered State. Hence, the divisions of space and work between man and woman are fundamental to maintaining the moral order and the production of fundamental material goods a family and the State needs. Thus, households feed and clothe themselves, and households feed and clothe the empire (in taxes, in-kind). In consequence, men are supposed to be in the fields and even elite men are, in theory, not ashamed of taking the plow, though they prefer not to, and women of all classes are supposed to be engaging in textile production. Accordingly, women who are the heads of well to do families will probably be directing and organizing the work of junior women and servants. And the people who sit at the loom or feed the silkworms are more likely to be lower in the hierarchy. This is very hard work, extremely difficult, I doubt that most women felt enormous moral and cosmological satisfaction after doing it, but they were told that what they were doing was keeping the cosmos on its proper axis. If women do not do that work, then the cosmos will fall into disarray, the dynasty will crumble, war and pestilence will come. Not only that but, of course, your family will not have any clothes. It is a very important work. At a much more comprehensible level, there you are, reeling silk, making cloth, or raising silkworms. And all of this allows you to provide a dowry for your daughter or help her to make it for herself. It enables you to give gifts to the family, to relate to your neighbors, and to make an income. All these things are very closely entwined. Over and above that, from the perspective of today's history of technology, you are responsible, if it is silk, for inter-species management, because you have to work with 250,000 little silk-worms and you look after them as if they were your children.

There are multiple dimensions at which looking back on it, you can see how micro and macro, nature and non-nature connect. But also, if you look at the records from the perspective of the period, it was very clear to imperial Chinese moralists (and there was a moralist in every household). A woman spinning her silk properly was not only contributing to her family's well-being, but she was helping to maintain the order of the cosmos.

There is a marvelous book by Marie-Claude Mahias, *Le barattage du monde: Essais d'anthropologie des techniques en Inde*, who talks about the symbolism of churning milk and making butter in peasant households in India. It is not just me working on China. Almost every domestic technique has some of these dimensions on it. And it is a very good way to keep women in the kitchen, isn't it? [laughs].

What analytical relevance do you give to technical objects in your work? How do you work with, and consider, their agency in both subjectivation processes and macro technical representations in Imperial China?

I discussed quite a lot of this in my reply to one of your previous questions and talking about the history of the world in one hundred objects. There are so many different ways in which you can take an object, and it will not always be possible to look at all of them from all the perspectives you would wish. For example, my colleagues have been studying the reels and looms of China in enormous detail, but we still know rather little about the people who made them. We know quite a lot about what the machines consist of, and we know that carpenters made them, but we do not know how these carpenters got that knowledge or how they adjusted it, or where they got the materials from. So, sometimes you cannot trace all the things that you would think would be central to a history of technology. And in the case of China, we do know quite a lot about the structures, the uses, you can even reconstruct the productivity, and so forth. Those are sort of conventionally technical questions about them, but you can also think about things like, what is present when doing these things, what are the rhythms of life that are involved. And those are very well documented too, and that is an important part of everyday life, but also the life of the Imperial economy. So, these can again be tied into macro processes. Also, on the one hand, you are spinning virtue and on the other, you are spinning an extremely valuable commodity, but whose prices go up and down. It is a sort of total social fact. This silk-reel or loom is a thing that you could build out from, even to the confines of the global world, because these Chinese silks were one of the most valuable commodities on world markets until the mid-19th century, when China had quite a few international problems (the Opium Wars and semi-coloni-

> ***“Looking at something like a technological artifact, the emphasis is on one aspect: meanings and interpretations, and that is very important, and it had been neglected previously. But, when you start talking about materialities from that perspective, these materialities are nothing else than human projections onto an object. This has risk, a negative effect: it makes it seem that these things are infinitely malleable”***

zation by the Western powers) and the Japanese silk industry started rising and replacing Chinese silk markets. But until then, this reeling production in China set the rhythm for the rest of the world and prompted experiments in the United States, France, Spain, and pretty much everywhere, also in Latin America, to grow mulberries of your own, so that you would not have to import Chinese silks.

In your work, you identify the category of 'technology' as socially, symbolically, and technically situated, and at the same time, you argue it is still a productive analytical category. Could you delve into this dimension? Why do you still consider it is a productive analytical category? What risks do you identify in negating the analytical category, which as you mention, some material culture studies researchers did?

Of course, material culture studies is a huge field. But I do remember being surprised when I saw Danny Miller, saying, "Oh, technology is a useless, completely distracting category." And one of the things about the cultural turn is that in looking at something like a technological artifact, the emphasis is on one aspect: meanings and interpretations, and that is very important, and it had been neglected previously. But, when you start talking about materialities from that perspective, these materialities are nothing else than human projections onto an object. This has risk, a negative effect: it makes it seem that these things are infinitely malleable. You can make them anything you want, just by giving them meanings. Any interpretation, any design and use, any sequence of practices, any associations seem to be possible in principle, there are no material obstacles. But in fact, materials are very obstinate things, and it is not because you tell a piece of wood that you would like it to become transparent that it will do so. Humans are not in control all the time, and we can project our desires, but we cannot necessarily fulfill them. Therefore, we do *things* studies today, again, and things are 'thick,' but they are also excessive, and what 'excessive' means is that they will not always do what you want (we had other ways for saying it twenty years ago, but 'excessive' is just a single word, and that is nice).

That is one reason why I prefer thinking in terms of technology, because taking something like the Maussian concept of technology, where there are techniques that involve material practices, and they are exercised to produce a result which is acknowledged as being a particular way of doing things, artifacts which we recognize, or a transformation of a substance which we acknowledge is useful. So, this definition means that you cannot separate what I would call 'the material' from 'the social' or 'the symbolic.' They are all part of the same package, and I do not wish to get rid

of the meaning, but I think you also need the obduracy in there. The material struggles. Because otherwise, you simply cannot understand what is going on, and you lose the thickness of the object if you lose that dimension of the materiality.

This concept of the *chaîne opératoire*, the operating sequence, is extremely helpful here because you can put as much of this into the sequence as you like. And then you have to make choices, and you say, "Well I'm going to emphasize these particular elements in the chain, and I'm going to cut the context here rather than there." So, you become conscious of what you are doing, and you also have to acknowledge the material affordances and constraints. You cannot make clay without using water, as you cannot mold the pot after you baked the pot. They seem trivial observations, but you get into more complex artifacts and it is not so obvious, so we need to keep that in mind. This is why Lemonnier's book on technological choices was so wonderful, because it is a broad and capacious definition. And yet you have stone tools, and you have Aramis, the French transportation project of the 1970s; you have people training; you have people designing transport systems. You can bring them all together in a conversation. And a critical fruitful conversation, not just, "Oh my people do this." It makes us think afresh about what technology is, why human beings have technology, and what they do with it. As a historian I think that is really important, because in history of technology there is still a tendency to assume we know what was important in the past, and that we can tell the past, what happened, they did not know, but we can tell them. We must have the opposite approach: we allow history to speak to the present and to tell it differently both for the past and the world we live in.