From anthropology of things to anthropology of technology:

Is there a place for co-production of techniques?

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Abstract

We address the version of an ontological turn as a methodological imprint of the coproduction of knowledge. Although this perspective carries on a methodological effort to shed new light on object study through recursiveness, it neglects the importance of technical action. The present article aims to deepen the methodological venues offered by the ontological turn to address the notion of co-production related to techniques. Departing from the analyses of ethnographic contexts, we discuss whether experimentation as axes of co-production resonates with other methodological devices provided by the anthropology of technology. We argue that philistinism, inflection, and possibilism of material affordances colligate with experimentation reflected in different practices, overcoming representational bias and posthumanist excesses.

Keywords: experimentation, inflection, methods, resonance, philistinism, possibilism.

Da antropologia das coisas à antropologia da tecnologia: há lugar para a coprodução de técnicas?

Resumo

Abordamos a versão da virada ontológica como um cunho metodológico de coprodução de conhecimento. Embora essa perspectiva realize um esforço metodológico para lançar uma nova luz sobre o estudo do objeto por meio da recursividade, ela negligencia a importância da ação técnica. O presente artigo visa aprofundar os caminhos metodológicos oferecidos pela virada ontológica para abordar a noção de coprodução relacionada às técnicas. A partir das análises de contextos etnográficos, discutimos se a experimentação como eixos de coprodução ressoa com outros dispositivos metodológicos proporcionados pela antropologia da tecnologia. Defendemos que o filistinismo, a inflexão e o possibilismo das affordances materiais coligam com a experimentação refletida em diferentes práticas, superando o viés representacional e os excessos pós-humanistas.

Palavras-chave: experimentação, inflexão, métodos, ressonância, filistinismo, possibilismo.

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In the twilight of the action-structure paradigm in the social sciences and especially in anthropology, agency-based accounts have proliferated. These are at least partially concerned with analyzing a myriad of existing entities, including objects (Appadurai, 1991; Gell, 1998; Miller, 2005). These efforts have expanded the critical stances of the postmodernist and relativist approaches in anthropology, which attempted to overcome excessive formalism (Barnard, 2004). Nevertheless, approaches such as the ontological turn have gone beyond taking culture as text within a hermeneutic or interpretative framework: they have renewed the critique of representing alterity as beyond cultural analysis (Descola, 1996; Viveiros de Castro, 1996). Hence, the ontological turn has tried to explain a diversity of worlds and not just worldviews (Salmond, 2014).

Likewise, the ontological turn has also reacted against the Marxist perspective, wherein objects encompass the physical correlates of culture, encoded in symbols (Henare *et al.*, 2007). Material culture was assessed only through its surrogate role, which privileged the cultural sphere as a cognitive domain. Since ontological approaches have studied Indigenous peoples in regions such as Amazonia or Melanesia, they have been associated exclusively with exotic societies, appealing to an ontological relativism in terms of cartographies of differences (Bessire and Bond, 2014).

However, this ontological approach in anthropology is more concerned with a methodological program based on recursive ethnography and knowledge co-production within fieldwork (Holbraad and Pedersen, 2017; Salmond, 2014). This methodological stance aims to give nuance to the effects of the encounter between researchers and human cultural worlds, seeking to create productive tensions and interactions. At ground level, it is about creating the conditions to access the ethnographic data, not only through a clinical gaze or abductive reasoning *about* people, but via a learning process that includes people.

This creating with people evokes a recursive loop between ethnographic materials and analytical resources or co-production (Henare et al., 2007). Expanding upon this idea, Martin Holbraad and Morton Pedersen (2017) offer up a methodological account of co-production through three axes: reflexivity, conceptualization, and experimentation, understood as an intensification of earlier ways of thinking in anthropology.

However, even when these methodological efforts attempt to cope with artifacts in terms of thinking through things, ethnographic settings involving thing dissolve corporeal engagement with artifacts, neglecting the importance of technical action. Pierre Lemonnier (2012) stresses the gap between two academic labels: cultural technology and material culture studies. The former pays attention to the ways things are made and physically used while the latter concentrates on the cultural biography of things in terms of circulation and consumption.

The same author also suggests, however, that there has recently been a renewed focus upon the relationship between techniques and culture, dealing with the productive tensions between these academic labels, enlightening reciprocal effects of technical and material actions as crucial elements of different practices (Lemonnier, 2014). It is thus crucial to stress that while the ontological turn questioned several versions of representation-based accounts, mediation between humans and artifacts through techniques has not yet received sufficient attention.

Since technology concerns action and involves cognitive issues, anthropology's technological analysis consequently demands a cognitive proposal. Cognitive features could be associated with the idea of methods and mediation, insofar as it encompasses corporeal procedures anthropologists take on within their fieldwork (Hutchins, 1995; Menary, 2010; Varela et al., 1991). At the same time, corporeal procedures become techniques of the body (*sensu* Mauss, 1973), reflecting a loop between the material engagement of people with artifacts (production, use, and performance) and anthropological methods themselves.

The present article aims to locate methodological resonances between experimentation as co-production and different methodological insights. It also seeks to bring into focus methodological inputs made by the anthropology of technology within the British tradition and anthropology of technique of the French tradition in order to revamp our approaches to technological phenomena by taking into consideration recursiveness or coproduction.

In order to establish this connection, we first present efforts that emancipate objects from their alleged subsidiary role, trying to shed light on how bringing humans and artifacts together always already entails a mediation process. Later, we will expose methodological imprints within the anthropology of technology and technique, establishing different consequences or resonators with recursive ethnography.

Finally, we will address how the ontological turn promotes knowledge co-production looking at how technologies embodied in practices reflect shared cognitive processes between technical expertise and social constraints within the anthropological practice. We conclude by arguing that an intertwined recursive ethnography focusing on corporeal procedures enlightens new ways for anthropologists to grapple with coproduction techniques.

The anthropology of things from the ontological turn

The social life of things has been one of the most important approaches for focusing on objects beyond their place in museographical collections or curiosity cabinets. To a substantial extent, the social life of things is a precursor of agency-based accounts, which implies an ethnographic methodology that regards objects like people, generating cultural biographies of commodities through the analysis of value regimes (Appadurai, 1991). This perspective has been fruitful because it allows us to follow the paths of artifacts -- oriental rug production in Iran, for example, or *qat* consumption in Yemen -- which illuminate the circulation of phenomena through different contexts and value regimes (Cassanelli, 1991; Spooner, 1991).

Nonetheless, some advocates of radical accounts -- those promoting the idea that objects stand out by themselves -- argue that cultural biographies are still connected to a humanist notion of artifacts, constituting simple associations or assemblages with humans. This bias was qualified as anthropocentric by those scholars with more more exacerbated fetishistic inclinations, which resulted in more relational approaches toward human and non-human networks. According to this critique, the movement underlying an object's circulation after its production is external to the thing itself in the constitutive interest of human value regimes (Holbraad and Pedersen, 2017).

Other agency-based accounts concern Bruno Latour's Actor-Network Theory (ANT) and Tim Ingold's ecological perspective on materials, which embrace more relational approaches to objects (Ingold, 2000, 2011; Latour, 2015). According to ANT, however, non-humans -- either materials or artifacts -- must look towards transformation from a semiotic view, conforming to new entities or assemblages of humans and non-humans. Even in the case of a gunman, there is no arithmetical relationship or summing up of attributes that conform to this assemblages. Rather, there is a technical mediation between the human hand, the equilibrium of supporting the gun, and good shooting.

Regarding the ecology of materials, Ingold mobilizes a theory of enskillment. Some ontologists linked to recursive ethnography stress, however, the normative character of Ingold's theory, arguing that it tries to replace scientific ontology (Chua and Salmond, 2012; Ingold, 1997, 2000). According to this perspective, the ethnographic method in ANT and the ecology of materials weakens and is divorced from real informants' life experiences. Recursive ethnography rejects any theoretical bias about what an object is as a point of departure. Instead, this perspective advocates overlapping thinking with lived experience; that is, thinking through things and, at the same time, challenging dichotomous perspectives regarding persons and objects, matter and meaning, representation and reality (Henare *et al.*, 2007).

Recursive ethnography is thus more concerned with ethnographic reflexivity rather than the incommensurability of world experiences. The recursive focus seeks to trace the paths of ethnographic objects, which are more than mere subjects, defining themselves in their own terms. The notion of different worlds is not an ontological claim but a methodological strategy to invoke realities constrained by the presence or absence of entities, concepts, or movements generated within cosmopolitical relations (Hanks and Severi, 2014; Salmond, 2014).

Expanding this proposal, Martin Holbraad and Morton Pedersen (2017) offer a renewed synthesis of the ontological turn, arguing in favor of three methodological axes: reflexivity, conceptualization, and experimentation. Departing from an alleged convergence between three anthropological traditions embodied in Roy Wagner, Viveiros de Castro, and Marilyn Strathern, the authors embrace common themes such as internal relations and horizontal abstractions to intensify old concerns regarding creative imprints. These authors addressed the ontological stance in terms of to what extent a posthumanist approach to things allows these to have the same kind of reflexive effects on conceptualization as people. In other words, how do things dictate forms of engagement through their material properties?

Here, we focus on experimentation as a third venue to intensify ways of operating within anthropological coproduction. Experimentation recognizes that anthropological knowledge results from a particular fieldwork encounter and its contingencies. According to Holbraad and Pedersen (2017), anthropologists do not just use themselves as research tools but also use the transformation of themselves and their interlocutors as a primary source of knowledge. This kind of methodological imprint advocates for maximal variance and the production of coproduced results.

These methodological stances draw on posthumanism's approach to things, which is not concerned with how these intertwine with the lives of humans but on how they stand by themselves. Holbraad and Pedersen's (2017) argument asserts that if, in any given ethnographic context, things are non-things (i.e., an artifact that contains spirits or an angry river), then the notion of a thing can have a heuristic role. These heuristics means we must de-theorize things, rendering them in a purely ethnographic form subjected to the thing's own exigencies and contingencies.

We have seen that the anthropology of things, viewed from the ontological turn, elucidates a procedural refinement by intensifying methodological concerns. Although this movement allows things an ontological self-determination, the role of corporeal mediation remains as a gap between things themselves and the intellectual exercise of thinking through things. Likewise, we see that the technical and cognitive implications of this way of perceiving the world are either absent or unexplored because recursive ethnography seeks to explain things through a generalized notion of thinking.

How can we explain thinking through things? If thinking is not exclusively a mental action, it entails corporeal procedures featuring cognition in terms of mediation. Nevertheless, how far does mediation encompass experimentation in the co-production of techniques?

The anthropology of technology: cognition, techniques, and sociotechnical systems

We set out, above, how the technology concerning culture and cognition opens a critical stance, stretching from anthropological perspectives to a critique of the hylomorphic theory of matter and, more recently, to the concept of material culture itself (Hicks, 2010). The hylomorphic theory of matter supported museological or stylistic approaches to artifacts mainly through trait analysis, which led some authors to critically consider technology as something other than the result of a mental blueprint, by incorporating cognitive scaffoldings, for example (Hicks, 2010; Ingold 2007a).

Likewise, the anthropology of technique within the French tradition has offered outstanding contributions to cognition and culture. Ethnology linked to prehistory offered the most significant insights since Leroi-Gourhan's (1971) account of operatory chain and expansive memory concepts. While his contributions are still a reference today in addressing the relationship between technology and cognition (de Beaune 2004), his effort to naturalize technogenesis in early hominins favors a biased reading of the individual as a species, individually attributing the creation of techniques. Nevertheless, as we will see below, the notion of the *milieu tecnhique* allows us to glimpse how skills emerge from a socially enriched environment (Leroi-Gourhan, 1989).

By situating analyses at a social level, the ethnographic research of Pierre Lemonnier (1992) offers up a comparative method applied to both tribal societies like the Anga of New Guinea and to aeronautical industries, establishing a symmetrical thesis in ethnographic fieldwork. According to Lemonnier, Mauss defines technics as effective and traditional, not different from the magical, religious, or symbolic action. Action concerns body posture, while traditional refers to the fact that execution has been inherited and learned through generations. Effective action points to body posture that seeks a physical outcome, involving several elements of technological systems: matter (body), energy (things, tools), gestures (operational sequences), and specific knowledge (know-how, choices, and social representation) (Lemonnier, 1992).

On the one hand, Lemonnier stresses technical questions: not about artifacts themselves, but about the arbitrariness of the technological choices underlying artifact production. On the other hand, he emphasizes technological systems as constitutive elements that involve techniques, cultural phenomena, and social representations It is essential to note here that this approach is not entirely antagonistic to the epistemology of representation, but rather challenges the notion of information embedded in style, addressing matter beyond artifactual form and function. Operational sequences or actions of execution based on an operational chain constitute the primary data of this kind of anthropology of technological systems.

At the same time that Lemonnier was developing his ethnographic perspective, Bryan Pfaffenberger (1992) established another proposal, taking technological issues to a more sociological level and departing from what he called "sociotechnical systems". It is crucial to distinguish between techniques and sociotechnical systems. The former are constituted by material resources, tools, operational sequences, and coordination modes that allow artifact construction. The latter concern technological activities underlying techniques and social coordination work. The internal logic of a sociotechnical system responds to political and economic dynamics, promoting solidarity woven by social relations, some of which could be ritual in nature (Pfaffenberger, 1992).

Although Pfaffenberger's account emerged from the relationship between sociology and STS, it shares with Lemonnier's a critical stance regarding the informational bias that stresses style over performance. The author characterized the ritual dimension as a tension between sentences and subversive answers, which seeks to react against the domination imposed by social structures, addressing technological activities as a political matter: a technological conflict (Pfaffenberger, 1988).

Treating artefacts as texts opens up multiple interpretations in which a hegemonic discourse can be challenged or removed. Sociotechnical systems appear as an alternative resulting from a technological possibilism, the link between an artifact's causal and physical potential, and the innovation derived from human organization (Díaz Cruz, 1995; Ingold 1997; Pfaffenberger 1988, 1992).

The anthropology of technology and anthropology of technique from the ontological turn: is there a place for co-production of techniques?

From the above, it is clear that recursive ethnography has methodological differences as compared with the early anthropologies of technology and technique. Nonetheless, both perspectives converge significantly, especially with regards to their critical stance on representation-based accounts. However, since recursive ethnography seeks to shed light on artifactual analyses that copes with scaffoldings of thinking, it takes the artifact's existence for granted, neglecting action on matter and manufacturings processes' technical concerns.

In order to understand the neglect of technical action or mediation within recursive ethnography, it is essential to unravel how thinking through things evokes the ethnography of things. This kind of ethnography put forward the question of whether heuristically defined things might be able to contribute to their conceptual variation. Conceptual variation elicits data to make a (conceptual) difference concerning the transformation of materials into forms of analytical thought.

Instead of treating all the things as modes of representation, equating concepts and things, recursive ethnography seeks to overcome the analysis of artifacts in terms of their material properties (form and function). However, recursive ethnographic case studies do not involve things created through technical action, as occurred with Ifa dust on Cuba. This artefact's power in specific ritual contexts is carried through motricity and performance, and not necessarily techniques (Holbraad, 2007). Something similar occurs with the talismans of thought presented by Morton Pedersen (2007), which describe a detailed Mongolian shamanistic session related to two artifacts: costumes and vessels. Pedersen's approach was partially based on cognitive science's Extended Mind Theory, which sought to explore extended beliefs or extended selves through the employment of shamanistic paraphernalia (i.e. artifacts). Pedersen unfortunately does not go into details regarding costume and vessel production techniques.

As we said before, the engagement of the ontological turn is, in a broad sense, more methodological than theoretical, meaning that artifactual production involves reflexivity, conceptualization, and experimentation to achieve knowledge co-production (Holbraad and Pedersen, 2017). Likewise, the notion of thinking through things privileges reflexivity and conceptualization, leaving unexplored other methodological axes such as experimentation. We want to determine how this methodological axis could be applied to envisage the co-production of techniques, especially when they resonate with mediation through gesture, possibilism, and operational sequences. At the most basic level, we are interested in a provocative breakthrough in understanding to what extent the anthropologies of technology and technique might be merged in a fruitful dialogue.

The anthropology of technology tends to relational analysis beyond function and design. This has been possible through a theory of practice that is closer to formulations on cognitive phenomena using ecological and phenomenological insights (Bateson, 1972; Gibson, 1979; Ingold, 1997). Putting forward a practical stance initially significantly impacts the methodological axis of experimentation (*sensu* Holbraad and Pedersen, 2017). On the one hand, it allows for identifying how anthropologists use their bodies as an instrument and an object of investigation. On the other hand, a theory of practice involves learning processes that bring about contingencies in encounters with informants, which play an essential role as a source of knowledge.

Currently, at least three recent anthropologically informed proposals are coping with the technological phenomenon from a theory of practice: the skillful practice-based accounts of Tim Ingold (2018), the Material Engagement Theory of Lambros Malafouris and Colin Renfrew (2010), and Alfred Gell's (1998) abduction of agency. We discuss some insights of these proposals to account for a recombinant anthropology of technology in the light of methodological experimentation. We think this analysis revamps an approach to artifactual production by setting out in what senses we can talk of co-production of techniques within different anthropological traditions.

One of the most influential anthropologists is Tim Ingold, who conceives of thought as embodied and enacted, and of cognition as distributed across person, activity, and setting (Ingold 2007, 2000). Starting with Gibson's notion of affordances, Ingold develops how cognitive features rely on environmental opportunities through dwelling, the education of attention, and skillful habits (Ingold, 2018). Skillful practice appeals to anthropologists in an ongoing process of learning through time, however, lasting until they eventually reach the same degree of native expertise. This is seen, for example, in the correct use of a reindeerman's lasso in Lapland (Ingold, 1993). Thus, at first glance, the relational approach is only external, either related to grappling with different traditional techniques or shedding light on perceptions of the environment (Ingold, 2000).

The second proposal concerns Gell's account of technology, which constitutes an aesthetic critique of fine and primitive art conceived as a technical system. Gell focuses on how the distributive character of agency spans in an artifact is constitutive of a cognitive process called "the abduction of agency", displayed when specific effects or affects (i.e. beauty or magic) are perceived (Gell, 2006). While Gell's account acknowledges a second-order agency for artifacts, while privileging first order agency for humans, his interest lies more in the circulation and effects of artifacts embedded in social entanglements rather than in their production (Gell, 1998).

Finally, the last proposal within British anthropological tradition is the Material Engagement Theory of Lambros Malafouris and Colin Renfrew. This approach aims to shed light on the link between material culture and cognition, embracing questions such as what kind of relations and interactions describe vital connexions between brains, things, and bodies? This strategy seeks to enhance our understanding of the expression and diversity of human thought through material agency, relying on material engagement itself. Consequently, these authors stress how and when the in-between (i.e. interface) emerges in the relation of an artisan to his brute material (Malafouris, 2016; Malafouris and Renfrew, 2010).

These three proposals share fieldwork practices as their point of departure. Nevertheless, the authors maintain different degrees of awareness related to co-production. Each gives a margin to balance the experimentation axis and other methodological devices from the anthropology of technology that shed light on how to characterize a coproduction of techniques.

Although these approaches can be and are qualified as humanist accounts of things, they still promote a relational view that we are interested in connecting to other methodological devices of co-production techniques. Some authors like Ingold explicitly reject data (including interaction with informants) as original inspiration for anthropological knowledge. Instead, Ingold puts forward individual creativity and synthesis resulting from a combination of data and previous ethnographies (Ingold, 2018). However, he lets us carefully analyze skillment processes within ethnographic settings. How to throw a lasso, for example. This is a matter of recognizing inflection not as movement but as a way in which movement moves. At the same time, inflection evokes other methodological devices like operational sequences (*sensu* Leroi-Gouhran), which, more than framing a pattern, step by step, identifies rhythms and fluxes (Di Deus, 2019).

Unlike Ingold, Gell's account conceives of creativity as related to effects on people. Insofar as the authorship of art stretches into the artifact itself, however, what matters here is not the act of production but agency (Gell, 1998). Creativity is a central feature of Gell's methodology, especially in diagrams and visual representations. His approach, however, also understood artifacts as beyond individual technical expertise. The examples provided by Gell concern cars that refuse to start due to damaged engines or landmines in Cambodia, which embody and enact the intention to kill, leading Gell to assert that mines have agency.

Even when the ethnographic data does not support the attribution of agency, it is worth pointing out that Gell provides an methodological insight to figure out a path towards experimentation. Insofar as methodological philistinism concerns an attitude of a resolute indifference towards the aesthetic values underlying art

(Gell, 2006; Morphy, 2010), this suspension of judgment could be essential to the silent and non-verbal knowledge implicit in operational sequences.

Finally, Material Engagement Theory is inspired by fieldwork undertaken on the island of Zakynthos, Greece, comparing different ceramic workshops to enlighten how different potters think creatively with materials and techniques. Malafouris also concedes, however, that the final responsibility relapses to humans, as in the artisan is the source of normativity related to correct or incorrect form and function (Knappett *et al.*, 2010). Although this approach could be considered a humanist stance with regards to objects, some valuable methodological inputs can be had with regards to the notion of the container.

In his study of ceramic containers as a privileged issue of archaeology, Carl Knappet and Lambros Malafouris (2010) examine the idea of the body as a container that plays an essential (i.e. cognitive) role in shaping human intelligence. According to these authors, containers are not just vessels, but possibilities for action that bring forth forms of mediated action in terms of use and manufacture that stretch beyond functionality. Consequently, there are no boundaries in human engagement with the material world or fixed roles between agents and patients, or between artisans, technical action, and materials. What exists is the entanglement of affordances. It is worth pointing out that these affordances are the material scaffoldings that play a role in shaping artifacts.

Taking into account these methodological insights, a further step would be recovering methodological experimentation as a research tool and a source of knowledge to establish how we can revamp our gaze regarding co-production techniques. Ingold's notion of inflection, taken from Edward Manning, points out that movements take different paths and are not just a matter of changing rhythms. The mastery of anthropologists stems from their capacity to identify or co-envisage these paths through their bodies, allowing them to cast innovations as improvisation. Inflections supervene the fluxes of energy in the transformation of materials, either in the correct use of a reindeerman's lasso or in the manifold's ways of walking. Nothing ever happens in the same way.

Regarding the philistine attitude advocated by Alfred Gell, it becomes essential to grasp not only the suspension of aesthetic judgment, but also to stress non-verbal knowledge as gestures and body postures. In order to understand abduction as a cognitive process in order to track agency from different sources, anthropologists must synthesize technical expertise, going beyond humans as a source of technical normativity. In this case, philistinism is a potential research tool extending into the non-human domain, especially when it plays a role in shaping certain artifacts such as the canoe prow-board of the Trobriand Islands. Likewise, philistinism serves to gently manipulate underlying experimentation, which must be adequate to anthropologists' ethical commitments. Finally, Malafouris's account (2016) on action possibilities and corporeal affordances prompts cast material objects as a possibilism entangled in social processes, serving as mediators of relationships between people and domains of existence, such as the earthly and the spiritual (Morphy, 2010).

These three proposals show strong resonances regarding methodological insights from the French tradition of the anthropology of technique, such as operational sequence, gestures and rhythms (Leroi-Gourhan, 1989). We argue that if we consider inflection, philistinism, and material affordances as valuable methodological insights, it is possible to characterize a co-production of techniques within broad ethnographic settings. This movement has some important implications. For British anthropology of technology, it overcomes the illusory boundary between action and the external character of artifacts, as well as situates the descriptive character of technical processes (Coupayé, 2015). For the French tradition of anthropology of technique, it allows us to address the co-production of techniques beyond technogenesis (Parente, 2007).

This synthesis could be influential in renewing of understanding of ethnographic setting forward techniques as key to understanding cultural practices. For example, within Mesoamerican ethnographies, techniques often have been associated with strategies related to the economy as hunting and horticulture

practices, either related to the social organization or coordination of work (Galinier, 2009). However, other approaches focus on ritual practices emphasize people's singing, dancing, and other performative techniques, confronting the researcher's role (Neurath, 2014; Pitrou, 2011).

According to Johannes Neurath (2014) in his research about a Mexican Indigenous group called *Wirrarika*, the role of the researcher becomes problematic when they cannot gain access into the realm of specific ritual practices involving prohibited or potentially dangerous objects. In different combinations of ritual gifts such as bows and arrows, these offerings evoke ancestral and natural persons in different settings. While bowls concern reciprocal relations, arrows embrace violent actions and free gifts. Both artifacts are intertwined in the coexistence of ritual intentions that are often contradictory.

It is worth pointing out that the manufacture of arrows plays an essential role in ritual and pleas in the form of singing. While both procedures involve techniques, Neurath describes arrows in terms of design and the color red or blue. Meanwhile, the importance of pleas is captured only indirectly through exegesis, myths, and stamen tables, since it is forbidden to record these performances. Here is where methodological experimentation resonates with inflection, philistinism, and material affordances, especially when we realize different operational sequences preceding the individuation of arrows disposed of for ritual offerings or the different rhythms and fluxes in underlying pleas beyond linguistic translation. This movement requires us to expand our understanding towards non-linear operational sequences.

Considering these methodological insights enables the researcher to overcome interpretative exercises due to the impossibility of recording some images, dances, or pleas. Therefore, notions such as inflection, philistinism, and material affordances acquire great importance. For example, inflections identify essential changes in operational sequences. Regarding the manufacture of arrows, Olivia Kindl (2001) describes a complex configuration of arrows composed of several items, such as a *tiskiri* or a hexagonal figure representing the sacred geography, a *nama* or an ancestral bed, pieces of cardboard, and cords akin to those employed in deer hunting. Nevertheless, there are innumerable inflections that are unregistered in these ethnographic settings.

If we take into account a broader notion of operational sequences (i.e. a *chaîne opératoire*) recovering non-linear segments of technical processes, these missing aspects could be tracked along multiple paths. However, it is necessary to stress that many of these elements remain, at first glance, invisible to ethnographical gaze, in part because they belong to other social domains, but at the same time constitute technical processes. The components of these segments remains hidden if the ethnographer persists in exclusively recording direct actions upon matter. According to Ludovic Coupayé (2015), the link between actions on matter and other components from political and cultural domains depends on the systemic character of the *chaîne opératoire* conceived as a transect within the entanglement of social life.

As a transect, the *chaîne opératoire* thus constitutes a valuable methodological device rendering visible those human and more-than human components embedded in an artifact. It is important to note that the transect delineates more than a physical space, including technogenesis, isolated elements and the artifacts themselves, It could thus be said that transect evoke an ecology of practices. Moreover, since this characterization of the transect involves contingencies (and contingencies are essential to experimentation), the *chaîne opératoire* prompts novel ways of co-production of techniques.

Hence, the complexity of arrow manufacture is not confined to representations, nor does magic emanate from an object once people manufacture it. These objects are also manifest in inflections from levels of individuation to subjectification. Even in the ontogenetic process of individuation (*i.e.* pre-individuation processes), one can find social components insofar as the pre-being of an artifact is necessarily more than one thing, lacking unity and identity (Simondon, 2007). To address pre-individuation processes through a transect allow us to expand technogenesis underlying *chaîne opératoire* as coproduced by heterogeneous elements.

Outbreaking methodological resonances within the coproduction of techniques pushes anthropologists to sink into the ritual without depriving it of its hidden power. Likewise, co-production embraces a double task of recording and conceptualizing relations between and among techniques based on fieldwork, resulting in a corporeal turn encouraging an entanglement of sources of agency.

We suggest focusing on participant observation beyond the mere recording of human activity on matter, attending to the whole process of engaging with materials and their acquisition, origin, historicity, and the learning processes involved. Even at the level of action on matter, imitation is a starting point to figure out the difficulties people confront, considering the possible obsolescence of certain materials, or to envisage to what extent modern technologies allow people to innovate or forget traditional techniques.

Although the notion of coproduction stems from recursiveness (or the feedback loop between ethnographic materials and analytical resources), it also encompasses the notion of co-production in STS literature about how scientific ideas often associated with technological artifacts evolve together with the discourses and institutions that give practical effect to objects (Jasanoff, 2004). This last reflection leads us to think that the relationality underlying the co-production of techniques also resonates beyond anthropology to a sociological domain.

Conclusions

We have established a contrast between contemporary approaches to objects from the perspective of the ontological turn and early accounts of the technological phenomenon from the anthropology of technology and anthropology of technique. Considering the methodological axis of the ontological turn, we saw that this perspective promoted an intensification of earlier anthropological concerns through three stances: reflexivity, conceptualization, and experimentation.

Moreover, we retrieved this methodological version of the ontological turn in terms of a posthumanist approach to objects. On the one hand, this opposes the alleged humanist approach to objects; on the other hand, we suggested framing experimentation within a mediation approach to delineate a path towards the co-production of techniques.

We first retrieved proposals conceived as alternatives to cultural representation-based accounts in treating objects and material things. Besides criticizing the conception of objects as residual to culture and the modernist bias of the distinction between mind and matter, these proposals appear as precursors of the ontological turn. Later, we exposed independent intellectual genealogies in French anthropology of technique and British anthropology of technology, the former taking as a point of departure the pioneering work of Leroi Gouhran.

We suggested a partial convergence between Lemonnier's account and Pfaffenberger's approaches to symbols, ritual, and power (i.e. technological choices and sociotechnical systems). In the case of Lemonnier, the account was valuable since he stressesed technical stances such as operational sequences, rhythms, and fluxes. Unlike Lemonnier, Pfaffenberger's account characterized the technological phenomenon as a text, and his focus on dramas inspired by Victor Turner touched upon most power relations in terms of discourses. His approach had the virtue of situating silence as a non-verbal resource within the ethnographic description.

Further on, we discussed three recent proposals from the British anthropological tradition that grappled with the technological phenomenon. This was related to methodological aspects of mediation: Alfred Gell's abduction of agency, Tim Ingold's ecology of materials, and Lambros Malafouris' Material Engagement Theory. Even though these approaches do not provide a homogeneous framework related to techniques and technology, we stressed the methodological they bring up (such as philistinism, inflection, and material affordances) as items that resonate with experimentation as research tools and sources of knowledge.

We established that these three proposals showed strong resonances regarding methodological insights in the French tradition of anthropology of technique, such as operational sequence, gestures, and rythms. We argued that if inflection, philistinism, and material affordances result in valuable methodological insights, it is possible to characterize a co-production of techniques within broad ethnographic settings. We oriented these methodological stances toward the notion of a *chaîne opératoire* that moves beyond linear sequences of action on matter. We retrieved the characterization of Ludovic Coupayé of the *chaîne opératoire* as a transect constituted by heterogeneous elements within the entanglement of social life.

We addressed these proposals to account for a recombinant anthropology of technology in the light of the ontological turn's concerns. We showed how it could be possible to revamp an artifactual production approach that takes methodological concerns seriously, such as the co-production of techniques within anthropological research. We concluded by discussing the resonances of these concepts in the light of recent Mesoamerican ethnography, especially that accomplished by Johannes Neurath with indigenous people in West Mexico.

Looking at ritual practices that involve arrows and bowls, we stressed to what extent philistinism, inflection, and material affordances can illuminate how an ethnographer could register the complexity of ritual arrows beyond their designs and colors. Specifically, inflection points out operational sequences beyond the manufacture of arrows, distinguishing levels of pre-individuation (*sensu* Simondon, 2007) and proper subjectification; this is when images and objects gain power and volition: agency. At a more basic level, we stressed some important implications resulting from taking into account these methodological resonances. We showed how these could impact upon a British anthropology of technology by overcoming the illusory boundary between action and the external character of artifacts, as well as situating the descriptive character of the technical. We also showed how, for the French tradition of anthropology of technique, these implications allow one to address the co-production of techniques moving beyond technogenesis.

We think that the co-production of techniques is valuable for two reasons. The first concerns overcoming difficulties such as those reported by Johannes Neurath and others related to the ban on recording specific ceremonies or rituals involving techniques such as singing. To sing involves not only a grammatical discourse as revealed by linguistics, but also relations, tempos and fluxes recorded by ethnographers expanding their research tools. Secondly, this paper tried to reconcile different intellectual genealogies and anthropological traditions instead of opposing them or reformulating a new research agenda as Perig Pitrou does (2016). Also, insofar as the co-production of techniques retrieves earlier efforts to focus upon objects in relational terms, they attenuate extreme versions of posthumanism in anthropology.

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