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RESEARCH ARTICLE

The Bow and Arrow and Early Human Sociality: an Enactive Perspective on Communities and Technical Practice in the Middle Stone Age

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Abstract In this paper, I draw on postphenomenology and material engagement theory to consider the material and emergent character of sociality in *Homo faber*. I approach this through the context of the bow and arrow, which is a technology that has received recent attention in cognitive archeology as a proxy for assessing criteria that made early human cognition distinct from that of other hominins. Through an ethnographic case study, I scrutinize the forms of knowledge that are required to use the technology in the dynamic field of environmental practices that constitute the hunt. I demonstrate that the learning of the skill is a transformational process where beginners develop self and intentionality by attuning subjective capacities for sensory awareness and creative responsiveness. Through mutual participation, the bow and arrow aligns disposition and rapport among those whose life processes are shaped by the skill. As a mechanism of shared experience, the bow and arrow generates a community can together perceive and act creatively in an impermanent world. Through these observations, I argue that early human sociality was built not on a pre-evolved capacity for symbolic representation but on technical experience, and I consider important questions this raises about the nature of evolutionary processes at work in the development of communities through time.

Keywords Sociality · Bow and arrow · Material engagement theory · Postphenomenology · Early human cognition · Metaplasticity

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1 Inherited Versus Emergent Sociality

The enactive relationship between mind and technology is a shared tenet of postphenomenology and material engagement theory (MET) and one that has profound implications for the nature of processes at work in human evolution. If our evolutionary path was blazed in the making and use of technology, then the developmental-materiality of human life processes must be assessed. One field where such attention should be directed is the origins of human sociality—our unique capacities to form cultural identities, to share understandings, and to think and act together as communities. In many manifestations of social theory, there is an assumption that the complexity of human social life is dependent on a pre-evolved cognitive capacity for representational thought and communication. This can be identified in contexts where "community" is understood to be a collection of individuals who subscribe to a stock of external knowledge. In such perspectives, individuals are socialized through the internalization of a cultural library of rules, symbols, and mental templates, which regulate their action in the world and define the character of togetherness that comprises a community. The representational model of cognition that supports this *inherited* sociality, however, is challenged by the enactive perspectives of postphenomenology and MET, which understand the mind as something that is radically embodied, sensitive to lived experience, and stabilized in technical practice. The special ability of humans to evolve by means of material engagement, what Malafouris (2010, 2015) describes as metaplasticity, is consequential for understanding development of mind, but also the becoming of communities. In Creative Evolution, Bergson (1998) argued that we are *Homo faber*, but if we are shaped by technology, how did the unique complexity of human social life develop?

In this paper, I theorize the development of human sociality as an *emergent* property of technical practice. I approach this by examining the social efficacy of the bow and arrow, which is a technology that has been a focus of recent debate on the distinctive features of early human cognition in the Middle Stone Age (MSA). Using a method I refer to as developmental analysis, I explore the position of the bow and arrow in the fall caribou hunt, which is a key event through which Inuit communities in the Central Canadian Arctic traditionally created a subsistence. This ethnographic analog well illustrates the reflexive relationship between the bow and arrow, personhood, and the alignment of shared subjectivity in the community (Walls and Malafouris 2016). I use the case of the fall caribou hunt to consider what the use of the bow and arrow by early modern humans demonstrates about deep history of mind and community, and I specifically challenge recent perspectives that ultimately frame the technology as evidence for the genesis of the Cartesian mind. Expanding on the material emphasis that postphenomenology and MET add to Merleau-Ponty's (1964, 1968) concept of intercorporeality, I demonstrate how the technology scaffolds the regeneration of a community that perceives and responds creatively in an impermanent environment.

2 Why the Bow and Arrow?

The bow and arrow is an excellent example of how technologies act as developmental pathways through which humans grow and become. Each of the bow and arrow's

varied cultural contexts, whether used in conflict, hunting, or sport, require honed musculature, attentive posture, and special forms of sensory engagement with the world. In cases such as *Kyūdō*—"the way of the bow"—the technology has even been adapted into a martial art, used as a practice within Zen Buddhism to overcome illusions of representation and separation through the materially mediated experience of flow (Soeiro 2011). The skilled archer releasing an arrow towards a target is a powerful context in which the radically embodied nature of cognition is easily illustrated. As such, the reflexivity of the technology is a case that has often been used to explore the ecology of mind and specifically the material and corporeal infolding of consciousness (e.g., Krein and Ilundáin-Agurruza 2017). Don Ihde (2009, 2012) uses the bow and arrow as a prime example of his concept of a multi-stability, drawing on cross-cultural variations of archery to demonstrate its dynamic potential for shaping life worlds. However, the most important layer of significance the bow and arrow may hold for postphenomenology and MET is its antiquity and entanglement with human evolution.

It is becoming increasingly clear in archeology that the bow and arrow originated deep in the MSA of Southern Africa. While complete bow and arrow sets rarely preserve in archeological contexts, a number of recent papers have argued that particular forms of microliths[1] demonstrate that the technology was probably in use about 60–70,000 years ago (Brown et al. 2012; Lombard 2011). This is significant because our closest cognitive relatives, *Homo heidelbergensis* and *Homo neanderthalensis*, are understood to have also constructed composite tools which involve multiple stages of making and assembly, such as hafted spears (e.g., Hardy et al. 2013). However, while the new dates push the origin of the bow and arrow well into the MSA, the technology seems, at present, to have only been used by early *Homo sapiens*. This has led to optimism among many cognitive archeologists that the complexity of the bow and arrow may be a good proxy for assessing features of human cognition that distinguished our species from other hominins.

To this end, there have been a number of recent papers that consider the cognitive work involved in making and using the bow and arrow. These deploy a variety of methodologies, but an underlying commonality is that they mimic experimental psychology by framing the technology as a problem-solving exercise (e.g., Williams et al. 2014). In one of the most prominent examples, Lombard and Haidle (2012) examine the operational sequences of bow and arrow production and compare this to technologies used by earlier hominins. They construe the overarching purpose in producing any particular technology as acquiring food and map the actions involved in making according to their positive contributions to achieving that goal. From their analysis, Lombard and Haidle propose that the significance of the bow and arrow is that the technology is complimentary—the maker must produce both a bow and an arrow separately. They argue that the leap in cognition this represents is that it requires a greater capacity for working memory because in each action, the maker must set aside both the understanding of how the bow and arrow function together, along with the larger task of acquiring food. Coolidge et al. (2016) expand on this and argue that making a bow and arrow requires episodic memory and autonoetic consciousness in

[1] Microliths are small bladelets made of knapped stone. In this context, these artifacts would have been set into the tip of an arrow shaft.

order to represent and simulate self in past and future possibilities. They imply these representational capabilities must be pre-evolved and point to assumed genetic mutations that altered the structure of the precuneus and enhanced the capacity to store what they term "technical modules."

There are several implicit assumptions about the nature of mind and sociality that can be recognized in these perspectives. The knowledge involved in making the bow and arrow is being construed as an abstract schema, deployed to solve a definable problem. Although there is ambiguity in how it is shared between individuals, this modular knowledge can be described as super-organic in that it exists in separate and prior to the experience of any particular person—it is abstract, declarative, and decontextualized from the environment. Whether intended or not, this understanding of knowledge has an embedded model of human sociality. Here, the togetherness of people in a community is a matter of subscription; the similarity of action between individuals is controlled by internalized representations of the world (Enfield 2013; Froese and Di Paolo 2011); pre-extant rules, or recipes for action, are the fabric of a community as they control its organization and boundaries. Speaking on the evolutionary significance of projectile technologies in general, Brown et al. (2012) aptly sum the wider objective by suggesting the technology is evidence of communication and capacity to transmit knowledge between individuals with high fidelity. Such approaches to understanding human cognition through the bow and arrow remain firmly rooted in cognitivism. They contribute to the paradigm by arguing that our social complexities are built on the foundation of the Cartesian mind. We are, in this view, *Homo symbolicus.*

The problematic dimensions of that underlying model, however, are increasingly exposed as the magnitude of human neuroflexibility gains greater recognition in the broader cognitive sciences. There is a growing appreciation for the sensitivity of the mind to environmental conditions and developmental experience, which has been a long argued position in pragmatism, phenomenology, and ecological approaches (e.g., Bateson 1972; Bergson 1998; Gibson 1979; Merleau-Ponty 1968; Vygotsky 1980). Among the gamut of contemporary situated and embodied perspectives, postphenomenology and MET expand on these philosophical roots and offer a radical anti-representational framework of mind with a strong emphasis on its material dimensions (Hutto and Myin 2013; Malafouris 2016; Rosenberger and Verbeek 2015). In the developmental arc of postphenomenology, Ihde's anthology repeatedly confronts the varied ways that technology stabilizes perception, demonstrating that even the cultural urge to think of ourselves as information-processing machines is a phenomena of the instruments of science (e.g., Ihde 1979, 1990, 2011, 2012). The value of such a framework in reassessing the role of creativity in evolution is particularly evident in Malafouris' sense of metaplasticity, where humans constantly recast the bounds and character of our life worlds through material engagement (Malafouris 2013, 2015, 2016). For cognitive archeology, a ramification of metaplasticity is that the artifacts we study are not just the output of acculturated minds, because much of what cognivitism assumed to be innate can be demonstrated to be epigenetic, developmental, and contingent on technological dimensions of experience (Garofoli 2016; Gosden and Malafouris 2015). In this perspective, the significance of the bow and arrow is that it may be part of the framework around which human minds and communities developed.

The approach to analyzing the bow and arrow, or other past technologies, as problem-solving tasks is also problematic. A general critique that situated cognition has leveled against cognitivism is that the commitment to an evolved modularity of cognition rests on a blindness to developmental history (Bateson 1972; Hutto and Myin 2013). For example, much of experimental psychology's observations of human cognition involve individuals with similar life histories (university students and patients with specific pathologies) who perform problem-solving tasks in experiments which are carefully designed to shut out the heterogeneity of the world. From a situated perspective, the atmosphere of isolation in controlled experiments is an illusion because subjects carry their developmental history into the laboratory. If cognition is developmental and ecological in character, then it is something that must be studied out in the lived world (Hutchins 1995; Walls 2016). While ancient hominins cannot, of course, be placed in actual cognitive-testing experiments, this critique is relevant to cognitive archeology because there is a tendency to make the same assumptions. The evolutionary moment that is being addressed is unclear when the making and use of the bow and arrow is framed as a matter of problem-solving. Is it cognition in an idealized moment where the technology was first invented? Is it cognition in a scenario were a hominin is isolated from their community and must come up with alterative means to survive? In this sort of reasoning, ancient hominins are placed in imagined laboratories, and ensuing assertions about the genesis of representational thought in early modern humans suffer the same blindness to the ecology of mind.

3 Inuit Subsistence and the Fall Caribou Hunt

The bow and arrow was an important feature of subsistence for many recent hunter-gatherer communities, and there are a number of ethnographic examples that offer avenues for observation of the relationship between the technology and sociality in the lived world. In his investigation of the bow and arrow, Ihde (2009, 2012) adapted Husserl's variational analysis to demonstrate the multiple stabilities in experience the technology cultivates by comparing cross-cultural contexts of archery. Here, I favor a developmental analysis in the sense of Bateson and Vygotsky's modes of investigation, one which focuses on the deep entanglement of the bow and arrow with mind and community in a specific context. In the following discussion, I draw on the ethnography of Inuit communities in the Central Canadian Arctic who traditionally used the bow and arrow before it was replaced by firearms during the colonial period. The materials I employ include classical ethnographies, Inuit oral history, historical accounts, museum collections, photographs, and filmed episodes of practice. These allow for detailed observations of technical practice and learning in a particular environmentally situated context.

For most Inuit groups in the Central Canadian Arctic, traditional livelihood followed a seasonal pattern of hunting on the sea ice during the winter, switching to the tundra during the warmer and transitional seasons. The tundra in this part of the arctic is extremely flat; broken up by swamps, rivers and lakes; and offers little opportunity for hunting for most of the year. The exception is the late summer/early fall, when caribou (*Rangifer tarandus*), which number in the 100,000s, amass and migrate southwards to the wintering grounds below the treeline. At this time, the caribou have ample stores of

fat and new coats of winter fur. As they migrate, the herd is channeled by the landscape to key sites such as river crossings, which allowed Inuit communities to intercept them with a degree of annual predictability. At these locations, Inuit deployed a range of hunting methods which involved ambushing the caribou with kayaks in the water, or with the bow and arrow on land (Bennett and Rowley 2004; Balikci 1970; Rasmussen 1931).

In the fall caribou hunt, Inuit families worked together to create a subsistence. The community needed to dry and cache enough meat to last a difficult seasonal transition before it was possible to hunt sea mammals from camps on the sea ice. Caribou traditionally accounted for much of the material culture of the Inuit, from skins for clothes and tents, to sinew for cordage and antler for tools—even the bows the Inuit crafted in this region were constructed out of caribou antler with sinew backing, and the arrow tips of carved antler. This is important to understand, because the task in hunting with the bow and arrow is complex, and the moment-for-moment success of a hunter's actions is dynamic and relative to a spectrum of situational considerations. Another consideration is that in the community, there were many varied forms of participation in the hunt and traditional separations in labor where use of the bow and arrow was predominately by men (Bennett and Rowley 2004). However, while not all practiced the use of the bow and arrow, its materiality shaped environmental experience on the part of the community as a whole. Using examples of skilled practice, I develop three important observations critical to understanding agency of the bow and arrow in shaping the community. These include (1) the knowledge involved in the skill is constituted through environmentally situated experience, (2) the building of that knowledge shapes personal intentionality and capacity to perceive and act in the world, and (3) the materiality of the bow and arrow is essential in the formation and maintenance of a community bound by mutual participation.

3.1 The Cognitive Work of Hunting Caribou with the Bow and Arrow

Observed within the flow of activity that comprises the fall caribou hunt, it is evident that the knowledge the hunter draws on when using the bow and arrow cannot be isolated from a wider field of environmental practice. Consider the moment depicted in Fig. 1, where the bow and arrow is in use. The image is from the Netsilik Eskimo film series, and the sequence it is part of allows for a frame-by-frame analysis of the hunter shooting an arrow at a practice target (Balikci and Brown 1967; Walls and Malafouris 2016). He begins the shot by placing one foot forward, aligning his body and posture with the target. With his eyes scanning the target, he then knocks the arrow so that its shaft rests between the bow stave and his left hand, which stretches outwards from the body. His right hand begins to draw bowstring back towards his right cheek. As the tension increases, he compensates his posture, keeping the arrow in a position favorable to the desired trajectory. To shoot, the hunter releases the bowstring in his right hand, and the shot as a process becomes irreversible. However, even as the arrow takes flight, the outcome is uncertain because in the brief moment it travels along the stave, its path remains contingent on the hunter's bodily attention. If the hunter's body shifts as a result of the sudden release of tension, the arrow's trajectory will be altered as it leaves the bow.

Fig. 1 A Netsilik hunter prepares to shoot an arrow at a practice target. Still image from the Netsilik Eskimo Film Series (Balikci and Brown 1967)

The context of this specific event is that it was performed for the benefit of the ethnographer's camera. Yet, even in this simulation, the notion that the cognitive work involved is just in the hunter's head, coordinated in reference to a pre-extant representation of the action, can already be challenged. Hitting the target with the arrow is the outcome of careful attentiveness to relationships between the hunter's body, the bow, and his target. The practice target does not move, but no two shots can be the same because the hunter must adjust each time to the circumstances of the moment, such as the strength of the bow, distance to the target, or other factors such as crosswind. To use the bow and arrow in an actual hunting scenario involves many more environmental contingencies, which make right practice far more complex than range and accuracy. To act skillfully in the fall caribou hunt, the hunter must anticipate how the herd will move through the landscape and coordinate action with others in the community to create a subsistence. A successful shot within the hunt is the outcome of many scales of preparations to alter relationships between the community and herd, and the knowledge involved in that cascade of practice is embedded in the hunter's actions as they use the bow and arrow.

The activity leading to a successful hunt would begin years in advance with social arrangements between families to converge and pool the labor involved in ambushing and processes enough animals (Bennett and Rowley 2004; Rasmussen 1931). Throughout the year, the community coordinated other subsistence activities and travel to ensure they were prepared and at the hunting grounds at the right time. The primary challenge is that the tundra offers little opportunity for cover, making it difficult to approach the caribou and take enough for the community's needs. The caribou have their own sensory awareness and move together as a herd. They have the ability to move much faster than humans and if alerted to danger can quickly move out of range. As a result, the consequences of unskilled practice were very high, and the hunt required working together to coordinate movement in a way that avoided being seen, heard, or smelled by the caribou at the wrong moment. The movement of the caribou is also sensitive to many situational contingencies beyond the community's control, such as an early frost or activity from predators, which can divert the herd to locations far from where they are anticipated to arrive. In each year, the outcome of the fall caribou hunt was something that was always uncertain, and success required perceiving and

responding creatively to unfolding relationships between the community and the herd (Balikci 1970).

In the ethnography and oral history of the hunt, it is clear that the circumstances of the hunt could change rapidly, variously requiring quick bursts of movement or waiting for hours in uncomfortable conditions. In Knud Rasmussen's (1931) vivid account, he describes situations where hunters had to run for hours to keep downwind of the caribou and others where they crawled for kilometers through swamps and streams to keep cover. Most strategies where the bow and arrow were used involved part of the community driving the herd towards locations where other hunters were waiting with better cover. The community would arrange drive lanes made of piled stones called *Inuksuit* which would help funnel the herd towards locations where hunters were waiting in ambush behind stone hunting blinds (Bennett and Rowley 2004; Brink 2005; Friesen 2013). However, even the best laid plans could go awry, requiring hunters to silently and intuitively coordinate ad hoc responses that contributed to taking not just one or two animals but enough for the community's livelihood. In some cases, hunters would have to break cover and enter the sensory range of the herd to approach them. In these circumstances, they would mimic the movements and actions of the caribou themselves—indeed, the half kneeling posture that Inuit archers adopted to shoot imitates the profile of a buck, and camoflaged their presence within the herd (Fig. 2)(Balikci 1970; Rasmussen 1931). Even once the caribou entered the range of the hunters' arrows, it was critical to have the skill to perceive if it was the correct moment to shoot, and how that action might affect the activity of others in the hunting team.

Being positioned to seize the opportunity for skilful shot is the outcome of a long chain of improvisations, in which the hunter attends to relationships between their body, the bow, the community, and a dynamic environment. Even as the hunter assumes the posture to aim, corporeal action must be responsive to the sensory awareness of the herd. This knowledge cannot exist decontextualized from the environment; the hunter can only know the moment to shoot by drawing back the bowstring and interacting with the sensory awareness of their prey. The hunter cannot depend on a pre-extant representational knowledge (i.e., rules or recipes for action), because that type of scripted intelligence does not have the flexibility or confidence to act intuitively in the contingent nature of the caribou hunt. The hunter's practice in the moment the bow and arrow is used is not defined by template for action, but rather an attuned capacity to perceive and respond with environmental impermanence. Cognitive work in the fall caribou hunt is an embodied capacity to sense and engage creatively with a world that changes even as the hunter releases the arrow.

Fig. 2 The posture an Inuit archer assumes mimics the profile of a caribou buck. Left, image from Rasmussen (1931:76). Right, a caribou buck at Maguse Lake, Nunavut. Photo by author

3.2 The Bow and Arrow and the Situated Production of Self and Intentionality

If the knowledge involved in hunting caribou with a bow and arrow is of an attuned form, how is it shared within the community through time? What consequences does the materiality of learning have for individuals and communities? Recall the argument that the complexity of the bow and arrow is evidence of an evolved capacity for the communication of representations about the world—that the technology is transmitted between individuals with fidelity. It is difficult to reconcile this assertion with the process of becoming a skilled participant in the fall caribou hunt. For Inuit, becoming a skilled hunter is a life process, closely entangled with personhood and increasing importance and connection within the community (Briggs 1970; Briggs 1991; Stern 1999). It is evident in the ethnography of the caribou hunt that behind each moment of skilled practice, there is a long developmental history in which the capacity to perceive and act is constructed through experience (Bennett and Rowley 2004). Becoming a skilled hunter, capable of "expecting the unexpected," required years of careful training and practice to develop physical fitness, emotional dexterity, technical ability, social ken, and environmental awareness.

Learning started in childhood with games designed to increase sensorimotor and technical control. In Fig. 3, for example, a young child is playing with a toy bow and arrow which he uses to shoot snow targets sculpted into the shapes of animals by his mother who watches and encourages him. As children progressed, they would move from games like this to shooting with real bows against practice targets, and eventually small prey around the camp (Balikci and Brown 1967). In time, and with experience, learners would begin to participate in the caribou hunt itself, first by maintaining the *Inuksuit* and helping to drive the herd towards the hunters. In such moments, learners developed direct experience of how the caribou move as a herd and their sensory interactions with humans. Beyond overt episodes of structured training such as these, learners also developed experience of the community's dependence of the herd through participating in the routines of daily life. As a part of the community, children were participants in the orchestration of annual movement to intercept the herd. After each hunt, they helped with the processing and storage of meat and the preparation of sinews and skins from the hunt. By wearing clothes of caribou fur and eating dried meat from the caches, they developed an embodied experience of the community's dependence, which was critical in evaluating and judging context and action during the hunt. It also is important to recognize that becoming a hunter is a process with no fixed endpoint because the knowledge involved in the hunt is of a form that requires maintenance. Throughout the year, hunters would build and repair their bows and practice their skill by participating in archery competitions at social aggregations (Bennett and Rowley 2004; Rasmussen 1931).

There is a significant gap between the knowledge of beginners and experts in the caribou hunt, which takes years to bridge. In the Vygotskian (1980) perspective on learning, this is referred to as the "Zone of Proximal Development" (ZPD)—the difference between what a learner can and cannot become without help from the skilled community. In skilled communities, closing the ZPD is a continuous process as new generations join experienced ones. It is not a passive process where knowledge is simply handed to learners who then internalize it. Instead, learning takes place through a process of co-construction, which requires agency on the part of beginners and

Fig. 3 A Netsilik child plays with a toy bow and arrow. Still image from the Netsilik Eskimo Film Series (Balikci and Brown 1967)

teachers. Consider again Fig. 3 as representative moment of a hunter's process of becoming. In such moments, teachers can point to aspects of the learner's form and direct their attention to errors in practice (Gibson 1979). Language is useful in this interaction; however, no amount of verbal communication can "install" the ability in the learner. Moreover, co-construction of the skill can only take place immersed in an environment that offers the learner feedback against which they can observe the effectiveness of their actions. Materially anchored simulation seems vital to learner's progress. In creating the parameters of didactic simulations, such as using a toy bow in target practice, the skilled community draws on their own experience in the hunt to map out the notion of right practice and to determine when a learner is ready to advance. As the learner progresses, the simulations are altered to become more challenging, gradually introducing more of the dynamic variables of the real hunt, until the learner has the capacity to participate without compromising the task at hand. At no point in this process of becoming is the hunter's knowledge representational or removed from the physicality of experience.

Vygotsky's understanding of the relationship between teachers and learners and the continuous scaffolding of experience is well augmented by the technical and enactive emphasis of MET (Theiner and Drain 2016). The outcome of learning to act skillfully in the hunt is more than the acquisition of ability by the learner. By expanding their capacities for awareness and response, the learner is also constructing new bounds of consciousness—a process of engagement that Malafouris (2014, 2016) describes as creative thinging. Coordinating the subsets of ability and awareness one needs to hunt with a bow and arrow is a transformational process that is material and recursive in character. In training against practice targets, the learner shoots the arrow many times before they can act meaningfully in the real hunt. Each time the learner draws back the bowstring and lets the arrow fly, they become a new self as they incrementally increase their musculature and attention to subtle relationships between the body and the world. Perfect repetition in training and practice is impossible because each time the hunter shoots the arrow, they themselves change, altering all subsequent practice. Through this oscillation between action, observation, and adjustment, the skill becomes a foundation for their intentionality with consequences that extend beyond the activity of the hunt. In this sense, the reflexivity of the bow and arrow can be just as powerful an illustration as

the potter and the clay for MET to anchor the concepts of metaplasticity and creative thinging (Malafouris 2014, 2015; Malafouris and Koukouti 2017).

Through creative thinging, the hunter directly attunes to a dynamic environment rather than a cultural representation of the world. This developed experience and sensory awareness shapes pre-reflective disposition in new and unexpected scenarios. The skilled hunter intuitively knows the consequences if the wind shifts direction, if the herd dashes one way, or if the community is delayed in their annual travel to the hunting grounds. That capacity to perceive and act creatively as a participant in the community's subsistence is brought about through a developmental ecology—an interdependence between the body in movement, social relations, the environment, and the technology itself. The bow and arrow is part of the structure of that developed self, around which the learner builds fitness and awareness. Using the term "transmission" to describe the process of creative thinging is problematic as the fidelity that cognitivism expects between skilled hunters does not exist. This is because the knowledge cannot be decontextualized from the environment in abstract form. The knowledge is shared by learners going out into the environment and attuning themselves to the movements and behavior of the caribou herds. It must be rebuilt in the experiences and improvisations of each generation.

3.3 Mutual Practice and the Material Scaffolding of Community

The bow and arrow does not exist as a stock of representational knowledge shared among users through transmission. Nonetheless, the perpetual bridging of the ZPD is a potent cultural process through which the community is continuously generated. In the hunt, the community shares understandings of the unique character of the situation at hand and responds intuitively as a group. The bow and arrow is used in this flow of activity, but it is also part of the structure around which this ability to think and act together is produced. In the becoming of a hunter, the bow and arrow is clearly part an individual's developed subjectivity. The technology cultivates particular pathways for experience, characterizing the circumstances through which they encounter their world. While the personal experience this subjectivity rests upon cannot simply be handed between individuals, it can be shared through a process of mutual practice. Just as the technology is part of the developmental ecology of self and intentionality, the physicality of practice results in an aligned togetherness. Within the community, there is convergence of experience between those who participate in the skill and attune themselves to the same nuances of the environment. This shared subjectivity, tied to bodily action in the world, is what Merleau-Ponty (1964, 1968) referred to as intercorporeality. Intercorporeality is a sort of rapport between individuals with parallel developmental histories (Malafouris and Koukouti 2017). It is at work as the community improvises together in the fall caribou hunt, but it also influences how the community acts in new situations in their wider environmental practice.

The emergence of shared subjectivity as a consequence of mutual technical practice challenges models of sociality where communities are constituted through subscription. This demands an understanding of community that is not delineated by representational knowledge. Considering emergent organizational patterns, it is useful to draw on Lave and Wenger's (1991) concept of a "community of practice." A community of practice is a collection of individuals bound by the intercorporeality of particular skilled

experience. Used within a postphenomenology or MET framework, the community of practice must be understood to have a material basis. Because skilled knowledge is contextual to experience, there are as many forms of technological engagement as there are individuals in a community of practice. To account for these varied forms of participation and to avoid artificially packaging communities as solid social groupings with clear boundaries, Lave and Wenger (1991) used the term peripheral participation to describe each individual's unique pattern of development. When material dimensions of peripheral participation are accounted for, the concept bears similarity to the multi-stabilities and metaplastic*ities* of postphenomenology and MET (Garofoli 2016; Ihde 2012) All members of the community of practice are peripheral participants, from the highest levels of expertise to those who support the community but do not themselves practice the skill. In the fall caribou hunt, there are many identifiable forms of participation including elders, expert archers, teachers, and beginners and those in the wider community who contribute to the hunt without themselves using the bow and arrow. Yet, the materiality of the bow and arrow stabilizes and reconfigures the boundaries of experience in community as a whole. The bow and arrow characterized the situations in which all peripheral participants encountered the caribou, the scenarios through which they depended on each other, and materials they required. The bow and arrow controls the proximity the community needed to close between themselves and the herd and gave certain locations in the landscape and seasons their meaning. Beneath the varied forms of participation in the community of practice, there is a degree of intercorporeality that pervades all levels and grows stronger through joint practice. In this way, the physicality of the skill acts as a sort of attractor in aligning the social fabric of the community.

A culture can contain many communities of practice, and the bow and arrow is only one technology through which Inuit traditionally created a subsistence. However, the materiality of the technology plays an important role in how the culture as a whole perceives and acts together beyond the hunt. In Bourdieu's (1977) Practice Theory, knowledge acquired through environmentally situated experience is a core aspect of his concept of *habitus*. *Habitus* refers to the skills, tastes, and posture through which individuals comport themselves in the world. *Habitus* encompasses shared subjective understandings, and it provides regularity to how individuals in a community act in new situations. It is inculcated not through subscription but through practices and routines of daily life, which shape a community's disposition in new and dynamic situations. In expanding on the phenomenology of Merleau-Ponty, Bourdieu's sense of *habitus* was intended to be an anti-representational concept of community that could be contrasted with paradigms that cast culture as something that is subscribed to (see Bourdieu 2002; Throop and Murphy 2002). Beneath the noise of complex exchanges and contestations of meaning that many branches of social theory mistake for abstract symbolism, the fabric of a community is practice. *Habitus* is a concept worth revisiting from the vantage of postphenomenology and MET, particularly in considering the intercorporeal social patterning that is an emergent property of metaplasticity.

This form of community, emergent in technical practice, finds support in the contemporary Arctic, where modern Inuit communities are taking a renewed interest in traditional technologies as a means of exploring heritage. As with most traditional technologies, the bow and arrow was replaced during the colonial period. Although such technologies are no longer the primary means of subsistence, there are efforts in

many circumpolar Inuit communities to preserve practices such as skin-work, kayaking, archery, and other hunting practices (Takano 2005; Walls 2014). As part of *habitus*, contemporary Inuit communities find meaning in the persistence of traditional technologies because they act as a mechanism of intergenerational experience. These skills take years of practice to learn, and they foster forms of knowledge that can only exist through material engagement. The Arctic is sensitive to global climate trends, and Inuit faces many environmental and political challenges in the present. Through traditional technologies, contemporary Inuit carry forward unique capacities for sensory awareness and creative responsiveness that were developed through generations hunting life. These play an integral role in how the community perceives and acts together in an environment that is rapidly changing.

4 Discussion: The Emergent Character of Early Human Sociality

Ihde and Malafouris (this volume) ask "what is meant when it is said that technologies make us just as much as we make technologies?" Through the case of Inuit caribou hunting, I have outlined a framework of sociality where the community is continuously brought into being through technical practice. To borrow Latour's (1992) often used metaphor, the bow and arrow is one of the missing masses which patterns the bonds and shared understandings through which Inuit communities think and act together. The knowledge the community depends on in the hunt is not schematic but rather a capacity to think and act creatively in an environment that is always in flux. As demonstrated in the developmental analysis of Inuit hunting, the persistence of that knowledge between generations was a life process which involved recursive training, where the use of the bow and arrow, immersed in a dynamic environment, was critical to the formation of an attuned self and intentionality. Between those in the skilled community, there is convergence of material experience, regardless of how peripheral varied forms of participation appear. In this way, the bow and arrow is scaffolding around which the capacity to think, act, and create together emerges. The shared subjectivity generated in the skill is integral to how the community acts together in the hunt. And as a part of the routines of daily life, dispositions that are inculcated through technical practice transpose in the community's wider interaction in the world. The complex cultural understandings that Inuit communities share about their relationship to the world are not arbitrary but anchored in shared subjectivity that is built on material engagement. The case of the fall caribou hunt demonstrates how postphenomenology and MET can provide a bridge between orders of complexity, from the agency of technology in stabilizing perception and modes of development to the generation of a community.

Inuit and their subsistence on the tundra cannot simply act as stand-ins for the interpretation of MSA communities that also used the bow and arrow. However, as a relational analogy, the case of the fall caribou hunt provides observations that can be deployed to scrutinize base assumptions about mind and community found in recent literature on the significance of the bow and arrow in human evolution. Framing the cognitive work of making and using the technology as a matter of problem solving is simplistic and precipitates the assumption that human sociality was caused by the modular evolution of the brain. We cannot know the extent of the dynamic hunting practices in which MSA hunters used the bow and arrow, at least not at a resolution comparable to

ethnographic observation. However, it should not be assumed that the knowledge the hunter deploys in crafting a bow and arrow set, or shooting the arrow, is separate from a wider field of environmental practices (see also Garofoli 2015). The bow and arrow must have characterized the situations through which MSA hunters encountered animals and the relationships through which they depended on each other for support and training. The technology would have been deeply entangled with personhood, requiring developed physical fitness, sensory awareness, and personal experience. This alignment of shared subjectivity, built around the technology, would have been fundamental to how MSA hunters perceived and acted as a community.

MSA communities using the bow and arrow may well have used spoken language in their daily lives and social interactions. However, the assertion that the complexity of the technology itself is evidence for symbolic communication cannot be supported through ethnographic observation of the skill. As seen in the life processes of how Inuit becomes skilled hunters, the technology *cannot* be construed as an answer to a problem transmitted or handed between individuals passively. As we have seen, verbal exchange can be helpful in directing a beginner's attention, but learning can only take place immersed in an environment that offers feedback. Because the technology and skill are rebuilt in environmentally situated experience, there is no fidelity between skilled practitioners, only parallel pathways of metaplasticity. The artifacts that alert archeological observation to the use of the technology about 60–70,000 years ago are not just the output of evolved minds that acquire a particular technique. MSA communities were bound by intercorporeality generated through mutual practice.

In terms of the deep history of hominin evolution, it is therefore truly significant if early modern humans were using technologies such as the bow and arrow. However, the progression from Oldowan tools to the varied composite technologies in use by the MSA and Upper Paleolithic is a process that must be understood beyond punctuated changes in representational intelligence. These technologies demonstrate a pattern of increasing commitments of hominin life processes to building requisite physical fitness, sensory responsiveness, social ability, and environmental awareness (Garofoli 2015; Malafouris 2013). This weaving of hominin life processes and technology tightened through time forming a fabric upon which new possibilities for mind and community could coalesce. The developmental pathways that technologies opened for building unique capacities for sensory awareness and experience were critical in the formation of intentionality and subjectivity. And as the making of hominin minds became increasingly contingent on the scaffolding of technology, a new order of complexity, the community of practice, arose through intercorporeality. In cognitivism, it appears necessary to place the evolution of language as a precursor to the complexity of human social life. Building on the framework developed in this paper, I am sympathetic to the reverse possibility, where the prerequisite for language was mutual processes of embodiment (see also Deacon 2016; Zlatev 2016). It was between individuals whose intercorporeality was patterned in technical practice that new possibilities for signification flourished.

5 Conclusion

The ethnography of the fall caribou hunt offers a glimpse into the years of careful training and practice involved in becoming capable of using a technology like the bow

and arrow in a field of activity as dynamic as hunting. In this paper, I have argued that metaplasticity is important in rethinking the evolutionary significance of the bow and arrow's origins in the MSA. Through the case of the caribou hunt, I have outlined a theory of how hominin sociality was opened through technologies that demanded increasing investments of personhood in their making and use. The bow and arrow shapes the mind and cultivates forms of sensory awareness and creative responsiveness that are contingent on the practice. In mutual practice, there is the generation of shared subjectivity between those whose experience of the world around them is shaped by the technology. These forms of shared subjectivity which are co-constructed rather than inherited form the basis of a form of community that is constituted through practice rather than subscription.

Communities of practice have a number of properties that make them quite different than cognitivism's communities of subscription. Critically, a community of practice is sustained only by the continuous rebuilding of experience between generations. In contrast to a genetic population, the commonalities and togetherness of a community of practice are not perpetuated by inheritance. Unlike the concept of cultural adaptation, the capacity to think, act, and create together is always up-to-date with the environment because a community of practice only exists through material engagement. This un-inheritability and environmentally situated character of community increases doubt about the utility of Neo-Darwinian frameworks of explanation for understanding the change and development of hominin sociality. This raises many new questions for the types of processes involved in biological and cultural evolution of *Homo faber* (Gosden and Malafouris 2015). Whereas cognitive archeology has long looked to artifacts as the markers selective pressures on cognition, it is technologies themselves that shaped the evolution mind and community.

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