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ARTICLE

Approaching the Past through Practice: Reconstruction of a Historical Greenlandic Dog Sled

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Abstract

Since the emergence of the Thule culture (AD 1200), dog sledding has been perceived as a central means of transportation in traditional Inuit life in the Arctic. However, there is an absence of research concerning Inuit dog-sled technology and the tradition of the craft. This study investigates the Inuit dog-sled technocomplex using enskilment methodologiesby employing experimental and ethno-archaeological observations to explore the relationship between knowledge and technical practice. It involves the reconstruction of a historical West Greenlandic dog sled, shedding light on carpentry techniques and construction processes. This method emphasizes the interaction between humans, technology, and time, providing essential practical data for future archaeological and historical research, particularly for comprehending fragmented archaeological remains. By focusing on process rather than end product, this research provides insight into understanding Inuit dog sled technology and the complexity of the practice. The connection between artifacts and materially situated practice is demonstrated through the reconstruction of a dog sled, which illustrates the value of physicality in enskilment. It highlights how experimental archaeology can improve our insights into the historical and prehistoric Arctic societies' technologies, economies, and practices.

Resumen

Depuis l'émergence de la culture Thuléenne (1200 apr. J.-C.), le traîneau à chiens a été perçu comme un moyen de transport central dans le mode de vie traditionnel des Inuits dans l'Arctique. Cependant, il y a un manque de recherches sur la technologie des traîneaux à chiens inuits et la tradition de cet artisanat. Cette étude examine le techno-complexe des traîneaux à chiens inuits en utilisant des méthodologies d'apprentissage pratique (« enskilment ») et emploie des observations expérimentales et ethnoarchéologiques pour explorer la relation entre le savoir et la pratique technique. Cela implique la reconstruction d'un traîneau à chiens historique du Groenland occidental, mettant en lumière les techniques de menuiserie et les processus de construction. Cette méthode met en relief l'interaction entre les êtres humains, la technologie et le temps, fournissant des données pratiques essentielles pour des recherches archéologiques et historiques futures, en particulier pour la compréhension des vestiges archéologiques fragmentés. En se concentrant sur le processus plutôt que sur le produit final, cette recherche offre un aperçu de la technologie des traîneaux à chiens inuits et la complexité de cette pratique. La connexion entre les artefacts et les pratiques contextualisées matériellement est démontrée à travers la reconstruction d'un traîneau à chiens, illustrant la valeur de la physicalité dans l'apprentissage pratique (« enskilment »). L'étude souligne comment l'archéologie expérimentale peut améliorer notre compréhension des technologies, économies et pratiques des sociétés arctiques historiques et préhistoriques.

Keywords: Arctic; experimental archaeology; technology; dog sledding; ethnoarchaeology; material culture; situated learning; enskilment

Mots-clés: Arctique; archéologie expérimentale; technologie; traîneau à chiens; ethnoarchéologie; culture matérielle; apprentissage contextualisé; enskilment

The use of dog sleds is one of the distinguishable traits of Inuit culture, and it was one of the key transportation methods in prehistoric Greenland. Dog sleds were essential for human mobility, and they played a major role in the dispersal of the Inuit culture across the North American Arctic around AD 1200 (Friesen and Mason 2016; Morey 2010). Although artifacts associated with dog sledding are often encountered in archaeological findings and ethnographic collections, there is an absence of archaeological and historical research concerning the Greenlandic dog-sledding culture, and the study of the material culture remains largely superficial, with only a few descriptions in popular literature (e.g., Gilberg 1992; Rosing 1976; Siegstad 2008). This article presents the reconstruction of a historical West Greenlandic dog sled, originally built in the 1930s, because these types of experiments can provide new insights to archaeological research on a scientific level (Renfrew and Bahn 1991). Given that very few intact Greenlandic dog sleds constructed before the nineteenth century remain in the museum collections, the examination and reconstruction of ethnographic and historic dog sleds can provide a great amount of valuable data behind the sled construction, which can assist in the interpretation of the archaeological findings. In the process of reconstructing an object, both qualitative and quantitative information can be collected—for example, regarding the technique and the effort required to perform the given task (Rasmussen and Grønnow 1999).

The importance of technology is often underestimated in relation to the understanding of an object and the mindset behind its construction (Madsen 1991). In this article, I consider the advantage of using an experimental method to examine the relation between humans, technology, and time.

The task of reconstructing a sled is process oriented. Consequently, rather than aiming for an immediate outcome, the focus is on the process itself—not on the end result. Instead of a quantifiable outcome, the intention behind the construction is the refinement of understanding the dog-sled technology. In contrast to the value system that often neglects the complex dimensions within arts and humanities research, this alternate approach makes the process itself become the aim of the experiment (Arima 1967; Petersson et al. 2020). Ethnoarchaeological observations of the dog-sled technology in Greenland are presented for an overview of the current knowledge of the practice. An explanation of dog-sled construction is followed by a discussion of the insights gained through the case study and how using traditions of the past can provide a better understanding of the dog-sled traditions and technological choices made in the present. This study should be regarded as being the first step in an investigation of a formerly almost untouched research area, and it demonstrates a unique opportunity to investigate how the process and cooperation with the dog as a working animal has operated in Greenland since the Thule complex (Morey and Aaris-Sørensen 2002).

Enskilment and Technical Knowledge

Through experimental archaeology, archaeologists learn how to make an artifact. In this process of enskilment, the challenge is not following prescribed schemes, but in developing sensorimotor capabilities to perform the task (Ingold 2011; Schlanger 1994). Acquiring a skill is actively developed through concentrated and deliberate practice (Walls 2016). This corresponds with the complex life history of a dog sled, which continuously involves adjusting, rebuilding, or repairing. Therefore, it is never fully complete. The structure of a dog sled is interconnected with the process of enskilment for a sled builder. Furthermore, enskilment has been described by Lave and Wenger (1991) as "situated learning"—that is, learning through performing the skill—and knowledge is seen as co-constructed instead of transmitted from someone more experienced. Consultation and collaboration with local mushers in Sisimiut highlighted the value of knowledge in the situated practice of relationships and provided insight to the technology of the material culture. During the experiment, the learning was culturally specific and took place in a social context through apprenticeship between an experienced musher and me (the learner). There is a distinction between developmental knowledge and characteristic cognition models, given that the knowledge of development has material dimensions. Materials create movement through the act of making and using, which are fundamental for incorporeality and practice in evolving communities (Malafouris 2013). Within the aspects of material culture and archaeology, the perception is that objects can possess social agency and enter into relationships with humans. Gell (1992, 1998) discusses how these objects and their underlying technology can serve as social actors within theories of human relations to things. The dog sled can be regarded as a secondary social actor, if "actor" is defined here as something that influences its surroundings and can be used to gain a broader understanding of how humans, dogs, and dog-sledding material culture interact (Gell 1998). Understanding the material dimensions to get a deeper insight of the different aspects of society can also be accomplished by experimental observations (Rasmussen and Grønnow 1999). In apprenticeship and technical studies, the focus tends to be on the process of making the technology and not on the usage. Nevertheless, practice holds equal importance in the research of enskilment, and the primary focus of this study lies on the technology and enskilment process (Walls 2016). In this context, studying technical enskilment is a key factor for interpreting material culture within archaeology, because it can embody environmental knowledge and provide insights related to the changes of human material culture and cultural transmissions (Ingold 2000; Jordan 2014).

Ethnoarchaeological Perspectives on Dog Sledding

Since the emergence of the Thule cultural complex (AD 1200), dog sledding has been perceived as a central means of transportation in traditional Inuit life in the Eastern Arctic (Morey and Aaris-Sørensen 2002). In this article, I use experimental and ethnoarchaeological observations of dog-sled construction to explore and understand the relation between knowledge and technical practice. It was not possible to pursue dog sledding in all areas of Greenland; for example, the tradition has not been practiced in the southwestern region due to the warmer climate. Therefore, it is possible to distinguish three types of the Greenlandic dog sled based on the regions: West, North, and East Greenland (Gilberg 1992). The construction of dog sleds has been adapted to the specific landscapes and climate in each region.

The sled of North Greenland was originally built for driving on the sea ice, and it was therefore longer and narrower than the sleds of West and East Greenland (Figure 1; Gilberg 1992; Rosing 1976).

The sleds of East Greenland used to be smaller compared to the other regions, mainly because they were not used for long travels but also due to the greater amount of snow (Rosing 1976). In the older

Figure 1. Overview of the regional variability in Greenlandic dog sled technology: (a) dog sled from Innaanganeq (Kap York), Northern Greenland, which was retrieved during the Danish Literary Expedition to Greenland in 1902–1904, and in 1905, was brought to the National Museum of Denmark by Ludvig Mylius-Erichsen; (b) dog sled from the Upernavik district (West Greenland), originally built in the 1930s; (c) traditional dog sled from Tasiilaq (formerly known as Ammassalik), dated to the late 1800s (CC-BY-SA, National Museum of Denmark); (d) modern dog sled from Tasiilaq, constructed by Dines Mikaelsen at the Artic Nomads workshop in 2016. (Photo by Carsten Egevang.)

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type, the upstanders of the East Greenlandic sled were very wide (Figure 1c)—compared to those of West and North Greenland—and terminated in a circle-shaped handle (Birket-Smith 1928). The runners of the North Greenlandic type were straight (Figure 1a), whereas they were more curved in the west and suitable for sledding inland (Figure 1b). The Inughuit from the north used shorter sleds that were around 2–3 m during the winter. In the spring, they typically used sleds that were 3–4 m in length, because, historically, the sleds were used as bridges when there was a crack in the sea ice (Birket-Smith 1928; Gilberg 1992). The East Greenlandic sled design was significantly influenced by contact with European expeditions and their sleds, resulting in larger sleds with several modifications (Meyer 1992). Given the significant amount of meltwater on the ice, the modern sled runners in East Greenland are not made of a single board; instead, they have open legs (Figure 1d). This construction type allows water to run beneath the sled platform, keeping the top of the sled dry (Gilberg 1992). The sleds in West Greenland have several distinguished features. Some of these characteristics include the upstanders, which have a more curved angle, the marked curve of the runners' tips, and the lashings of the crosspieces. This sled has been adapted to be more suitable for traveling inland and across pressure ice. With more curved upstanders, it is easier to reduce the speed by tipping the sled backward so as to steer it around ice blocks (Hansen 2008).

Other factors affected the differences in sled construction, such as access to materials. In the past it was necessary to build sleds of several pieces of driftwood and bone or even of frozen skin and meat (Boas 1888; Rasmussen 1931). There was also a great variety in the size or length of the sleds. Smaller and shorter sleds were often used for minor hunting trips with less to transport, whereas the long sleds are preferred for longer journeys with space for a big load, such as caribou hunting expeditions. As the access to wood has become easier, sleds have undergone different alterations (Arima 1967; Bertram 1939). From around 1880 until the 1920s, there was an increase in the number of sleds, mainly due to the growing prosperity and the expansions of trading stations. In North Greenland, the number increased from 357 sleds in 1881 to 900 in 1923 (Birket-Smith 1928). In modern times, the dog sled has been threatened by climate and technological changes. Since the snow scooter emerged, many of the Inuit populations have adopted this vehicle even though the hunters believe that the sled is less fragile and less expensive (Robert-Lamblin 1986). Despite their regional differences, the known archaeological and ethnographic variations were based on three main structural components: runners, crosspieces, and upstanders (Figure 2). Other associated components include the sled shoeing and rope for assembling the sled. However, several features of the dog sled have been modernized and have adapted to change. In the 1930s, the runners had sled shoeing made of whalebone, whereas metal was primarily used in the 1960s (Hansen 2008).

An Ethnographic Example: The Original Upernavik Dog Sled

The reconstructed sled is based on an ethnographic example from Upernavik (Figure 1b). The original dog sled was given to the National Museum of Denmark as a present in 1930 by colony manager C. E. Lemcke Otto. The sled is 2.40 m in length and 1.11 m in height, and the 14 crosspieces are around 66 cm in width (Figure 3). It has traditional "shoeing" of whalebone and is tied together with sealskin thongs. Dog-sled equipment was also donated along with the sled, and this consisted of a sled bag of sealskin with embroidery, a caribou skin, and tethers for fastening.

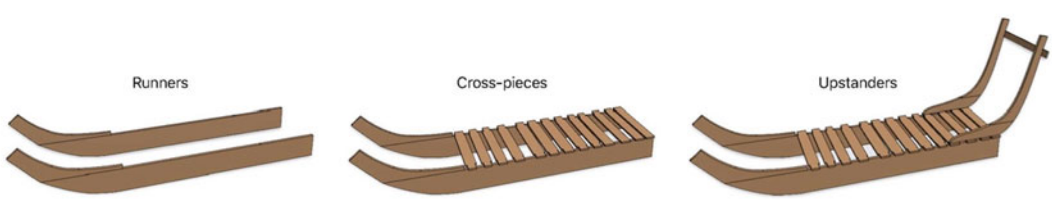

Figure 2. The general sequence of a West Greenlandic dog-sled construction. The illustration is based on the reconstructed West Greenlandic dog sled, exhibited at the National Museum of Greenland in Nuuk.

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Dog Sled Construction Sequence

This section is an account of the reconstruction process, including a presentation of the structural components that are common to all types of historical Greenlandic dog sleds. The construction plan was based on detailed hand drawings of the original sled from Upernavik. However, the descriptions draw on documents that refer to dog-sled construction types from all over Greenland (Birket-Smith 1928; Gilberg 1992; Hansen 2008). Given the regional variations in terrain, dog sleds are produced with different stylistic and functional features to meet the specific requirements of each landscape. Nevertheless, the following components represent the key stages of dog-sled manufacturing and are from fieldwork conducted during the winter of 2023 in Sisimiut, Greenland, where I apprenticed with local dog mushers. The research involved both participant observation and interviews. I did the physical construction myself, with consultation from local carpenters. As an attempt to understand the skill set and workload it had required to build the sled, I chose to use primarily hand tools for the reconstruction.

An essential aspect of carpentry is material selection. Wood was difficult to access in Greenland, and it only became more obtainable throughout the historic period due to European trade. Driftwood deriving from the Siberian rivers was therefore the primary material for building a dog sled. Given that carpentry tools and lumber stores are easily accessible today, the most visible difference in the development of Inuit dog sledding is the aspect of materials and tools. However, it still requires a specific knowledge and understanding of wood to select the right material and process it (Grønnow 1996; Walls 2010). For all parts of the frame, it is important that the wood be as straight-grained and knot-free as possible. The wood has to meet these criteria for the construction to become structurally sound (Walls 2012). Because the original ethnographic example from Upernavik was made of firwood, the same material was chosen for the reconstruction.

Adjustments were made given the available materials and tools. When the Upernavik sled was originally constructed, the selection of lumber-grade wood was limited, which affected the length of the

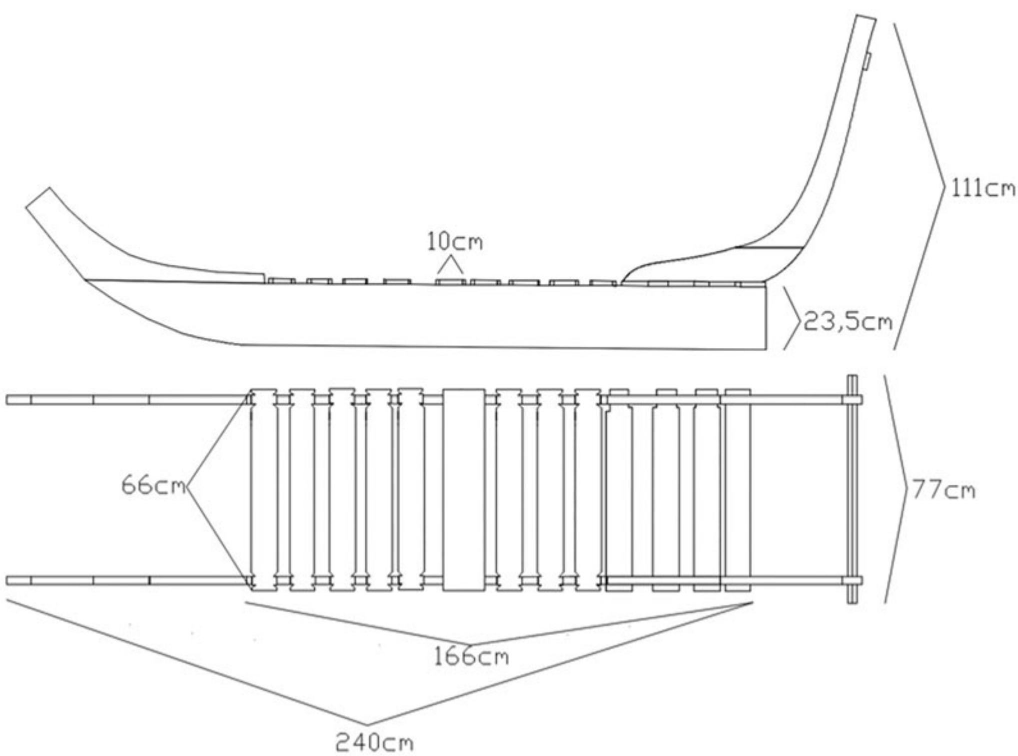

Figure 3. Blueprint of the original Upernavik dog sled with measurements.

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sled. It is essential to emphasize that this account is based on dog-sled construction in the present, which is distinct from the techniques practiced by Inuit communities in the past. Differences lie in the absence of the intricate preparations of sealskin and whalebone for the lashings and sled shoeing, respectively. Due to the interdependence of gendered knowledge and skill, this is a limitation in understanding the community of practice, which is impacted by this aspect.

Sled Runner (qamuk) *and Shoeing* (alaavi)

In the first phase, the runners are preformed: pieces are shaped using a hand saw and then adjusted and smoothed by using a hand plane along the grain direction. Preferably, the runners are constructed of one solid piece of wood. However, the Upernavik example is made from two different parts, most likely due to the lack of longer and wider planks. In the Upernavik district, the horns of the runners end in a sharp squared shape (Figure 2), compared to the round finish of other West Greenlandic variants (Birket-Smith 1928; Hansen 2008). Before joining the two pieces with nails, they are trimmed and adjusted using a hand plane. These local stylistic traditions have most likely been passed down through generations. An important observation during the reconstruction process is that the runners need to be set with a "negative camber" (Figure 4). This camber is usually created with a bevel cut (angled cut) on the top surface (Figure 4a), which causes the runners go slightly outward when assembled with the crosspieces (Figure 4b). The bevel cut typically ranges between 9° and 13°, depending on the sled builder, and is cut to provide stability. In the reconstructed sled, the surface is beveled at 13° to assure that the angle is wide enough. As the bearing surface, the width between the runners must be sufficient

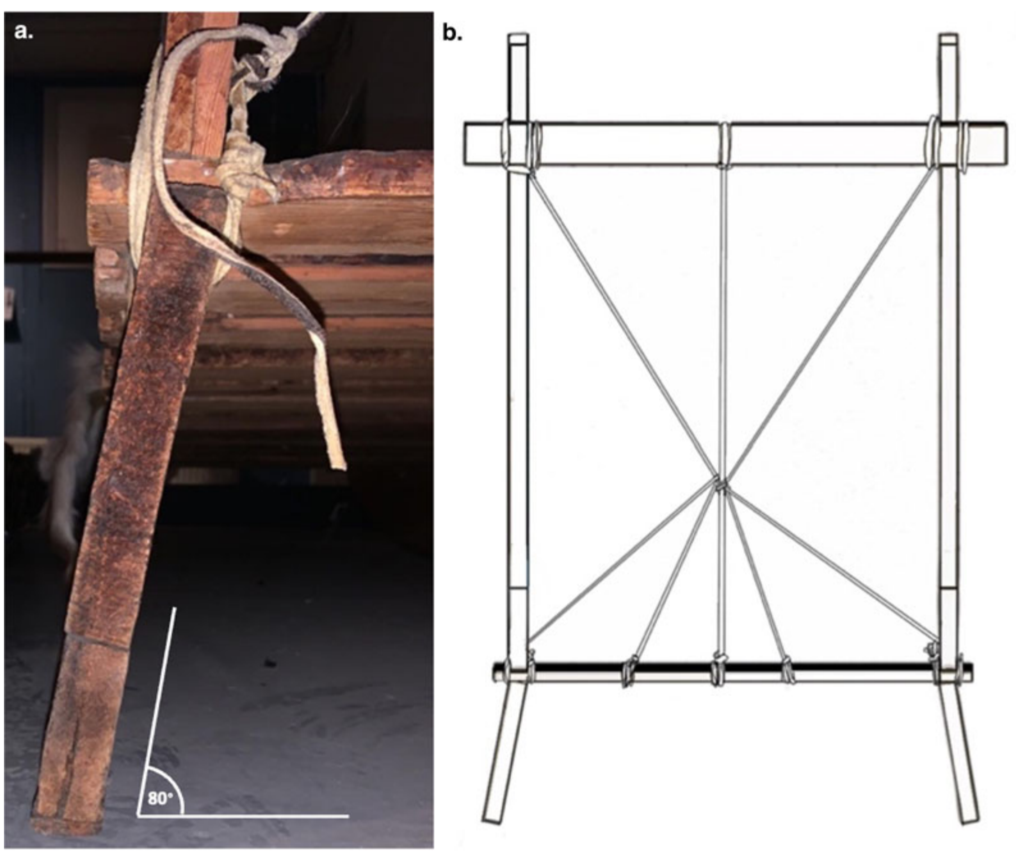

Figure 4. Angled cuts on the top surface of the runners cause them to tilt slightly outward when assembled with crosspieces: (a) the angle of the original runners; (b) illustration of the Upernavik sled from the back, with runners angled slight outward.

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to prevent the sled runners from collapsing inward, especially with a heavy load. To reinforce the runners and reduce the chance of cracking, dowels are placed horizontally every 30 cm in predrilled holes on the runners' top surface.

In the structure of the ethnographic sled from Upernavik, the height of the runners increased from 18.5 cm where the front crosspiece is placed to 23.5 cm at the end. In Arima's (1967) ethnographic description of Itivimiut sled construction, used on the east side of the Hudson Bay, the builder (Davidialuk Alaasuaq) had tapered the runners from front to back in height, making the sled gradually lower. The intention with this design was to ensure that rocks or other obstacles caught between the runners would not break the front crosspieces, which the Canadian sled builder regarded as more important than the rear ones (Arima 1967). In Greenland, the rearmost crosspieces are likely considered more important because they provide stability for the upstanders, which are a typical component of Greenlandic dog sleds, that are attached at the back of the sled. The runners of the sled are protected by shoeing, which is attached underneath. In prehistory, sled shoeing was typically made from whalebone, walrus ivory, or caribou antler. The pieces were either lashed on with sealskin thongs or fastened with wooden or bone pegs. To make the sections fit, pieces are trimmed with a knife using the following procedure: ends are squared, the surface is leveled to fit under the runners, and the outer surfaces are rounded. To drill holes in the shoeing, a bow drill with an iron bit is used. In the 1950s and 1960s, iron became the primary material used, given that it was easier to work with. Since the 1970s, nylon shoeing has mainly been used due to the face that it slides more efficiently over the ice. However, bone was still preferred in some areas as late as the 1970s because snow sticks to the metal in very cold temperatures (Arima 1967; Carlisle 1975; Gilberg 1992; Hansen 2008). The ethnographic sled from Upernavik was also shod with sections of whalebone, with an extended piece to cover the front curve of the runner for reinforcement, given that it was often subject to greater impact during travel. In waterlogged snow, shoeing made of mud, water, flour, or seal blood was added. Before it froze to ice, the shoeing was smoothed out with a piece of hide (Birket-Smith 1928; Carlisle 1975; Hansen 2008). Unfortunately, it was not possible to obtain pieces of whalebone for the reconstruction, so it was shod with nylon as a replacement. In all other aspects, however, the sled was built with the same materials as the original. To ensure that the screws are leveled, it is necessary to countersink and drill out a small conical space at the top of the drilled holes.

Crosspieces (napui)

When constructing the crosspieces for a sled, there are several aspects that are necessary to consider. The number and measurements of crosspieces can vary regionally. The Upernavik sled has 14 crosspieces lashed across the runners—around 66 cm in length and 1.7 cm in height, varying in width from 8 to 12 cm. However, for the reconstructed model, only 13 pieces were needed, because I used store-bought wood, with standard measurements of 10 cm in width. The original sleds, however, most likely employed leftover wood from the construction process, resulting in varying dimensions. In the case of the Upernavik sled, a wider 20 cm board was placed in the middle to provide stability (Figure 6a). The local sled mushers in Sisimiut explained that in modern sled construction, one reinforces the inner side of the crosspieces with wooden strips to achieve the same effect. This middle crosspiece is the only one in which holes are bored for the lashings. Otherwise, the ends are shaped with a cut-out crossmember or notch to ensure fastening (Figure 5).

Together with other performance characteristics, the placements of the crosspieces determine stability and maneuverability (Figure 6a). If they are placed too close, the sled becomes less flexible; however, wide spacing can lead to instability during transport. Another important aspect for stability and robustness of the sled is placing the crosspieces with their crown side up—meaning that the growth rings create a "smile" at the end of the board, which minimizes splintering (Figure 6b).

Upstanders (napariai)

To support the load on the sled, two upstanders are placed at the back of the sled. They can also be used for steering the sled when the musher is running behind it. The upstanders usually have a slight incline inward and backward. In the past, driftwood was the preferred material for the upstanders,

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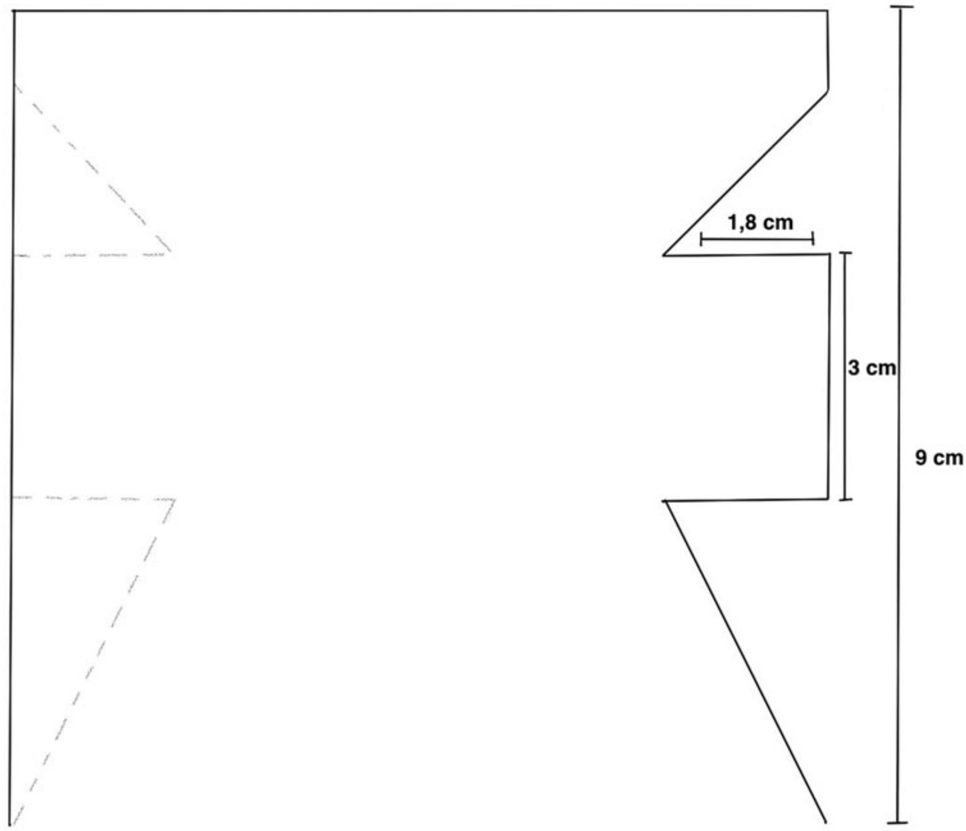

Figure 5. Sketch of the notch in the end of the crosspieces for fastening lashings.

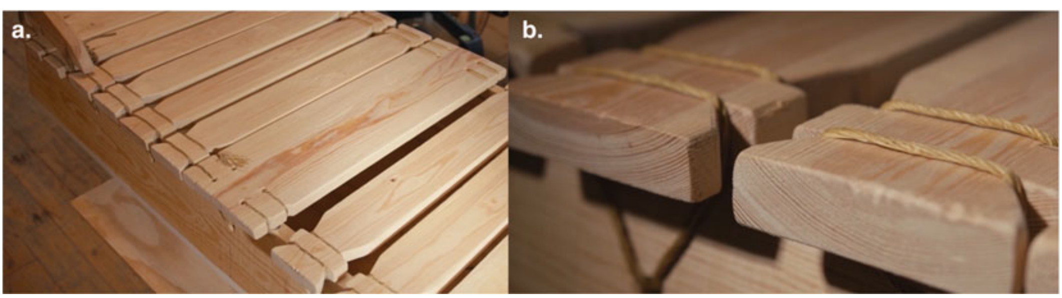

Figure 6. Feautures for improved stability and durability in sled construction: (a) a wider crosspiece was placed in the middle to provide stability; (b) the growth rings have to create a "smile" when placed at the end of the crosspieces, which makes them more robust.

because it would often curve naturally. The upstanders consist of the vertical pillars and "feet" on either side (Figure 7). They are connected by a crossbar at the top, which is lashed together in a cross shape between the two pieces. The ends of the sealskin thongs are fastened tight, because the crossed thong serves as a stabilizer for the upstanders and as rear support for the transported load. The upstanders of the ethnographic sled are 87 cm in height, measured from bottom of the feet to the tip of the pillar, and the crossbar is 77 cm long. In modern sled construction, upstanders are carved from one piece of wood. However, before wood became accessible commercially, it was rare to find pieces that were both long and wide enough. Therefore, upstanders are constructed from different

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Figure 7. Construction details of the upstanders, which consist of two horizontal pillars.

pieces, and their joints are scarf-jointed together . Next, the underside of the feet are leveled before being placed on top of the crosspieces at the back end of the sled. In the West Greenlandic sled, sealskin thongs are crossed in between the two upstanders. The upstanders are primarily featured on Greenlandic dog sleds, setting them apart from sleds in other Arctic regions, including Siberia and Alaska (Birket-Smith 1928). However, upstanders assembled by caribou antlers have been described in the ethnographic accounts of Canada (Boas 1888; Mathiassen 1928).

Lashing Techniques

The strength of the sled was greatly influenced by the lashings, given that the sled needs to be as flexible as possible when moving across the terrain. If the sleds were assembled with nails or screws, the wood would split too often when colliding with ice blocks. Originally, a sealskin thong was used for lashing the sled components together. Before being used for lashing, the sealskin thongs were soaked in water, causing them to tighten as they dried. However, nylon rope has become the primary material used today due to its convenience. Unlike sealskin thongs, nylon does not freeze or harden the way ice does (Gilberg 1992; Rosing 1976). The lashings of the sled were one of the most challenging components to manage, and they required technical knowledge and experience. For the continuous lashing of the crosspieces, staggered holes were drilled on the side of the runners—one for each crosspiece. It was difficult to get enough of the sealskin thong in Sisimiut to lash the crosspieces, so three lines of artificial sinew were twisted to form a rope. A local musher assisted with the lashings. We started at the back end of the sled, making a double loop through the hole of the runner and then tying the end of the lashing in a knot. Continuing to the next crosspieces, we slipped loops around the ends of the

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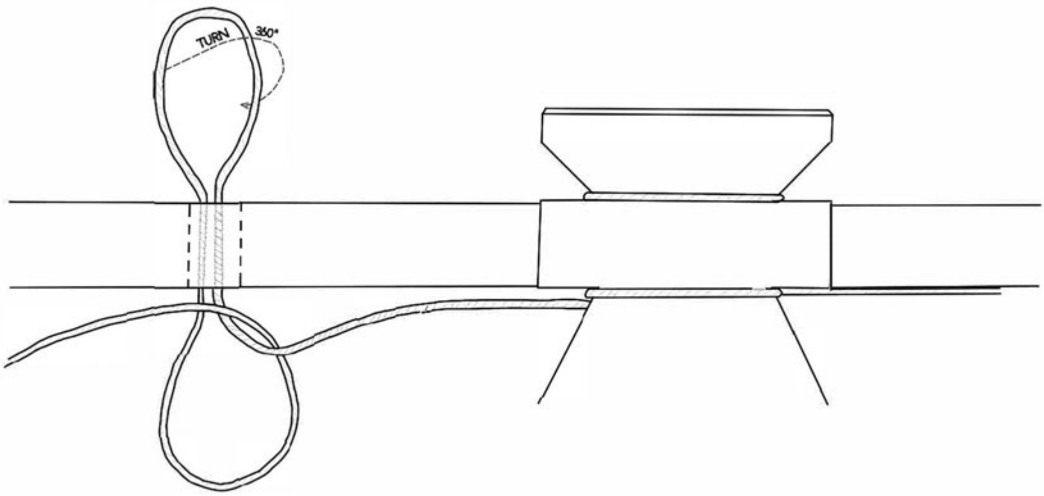

Figure 8. After the loop is inserted from the inner side of the runner, it is turned 360°. Then, a loop is made on the inside, before both loops are lifted up and the crosspieces are inserted. Finally, the rope is tightened.

crosspieces and tightened them firmly with the help of a screwdriver (Awa and Breithaupt 2014). This method for fastening the crosspieces is explained in detail in Figure 8.

Because the foremost crosspiece is exposed to greater shocks during travel, such as encounters with ice or rocks, it requires additional reinforcement (Carlisle 1975). Therefore, it needs to be fastened with an individual piece of rope lashed in double loops; the thickness of the thong holds it in place. Furthermore, the dogs are usually attached to the front crosspiece to facilitate steering, given that the sled turns more easily and quickly when pulled at this angle (Arima 1967). Two holes are drilled at each end of the foremost crosspiece, and then a nylon rope is passed through to attach the draft line for the dogs. Instead of sealskin thongs, nylon is used to attach the dogs. This is not only due to the difficulty of obtaining sufficient quantities in Sisimiut but to the fact that the dogs are known to be attracted to the sealskin lashings and sometimes attempt to eat them (Gilberg 1992; Rosing 1976).

Discussion

The construction of the Upernavik dog sled is somewhat different from the typical archaeologically based reconstructions. First, the work was based on an intact historical example from the 1930s rather than on excavated objects (Figure 9). Second, although the physical construction of the dog sled was one aim of the project, it was not the primary goal. This experiment was an attempt to learn about dog-sledding technology through the experience of sled building. In the construction process, issues that are important for understanding the dog-sledding culture were highlighted. The technical knowledge gained from the experiment provides a necessary baseline and fundamental understanding of the object, which is essential for ongoing research into dog-sled technology, as it is impossible to theorize everything in advance. I experienced this in the course of the reconstruction, in which details that had been considered peculiarities turned out to be styles of a certain district. Furthermore, in the process of the experiment, it became clear that some parts—such as the upstanders of the sled—were formed solely due to insufficient materials. The upstanders were constructed from two pieces of wood because it was not possible to craft them from a single piece. This method of assembly, although resourceful, resulted in a more fragile structure compared to the modern practice of building upstanders from a single piece of wood. This insight reflects the direct impacts of resource availability on construction techniques. By simultaneously investigating the modern types of dog sleds, the adaptations and evolution of the technology became even more evident. The knowledge gained through the process of building and driving a sled and of observing local mushers has provided the essential framework for studying the Greenlandic dog-sled culture.

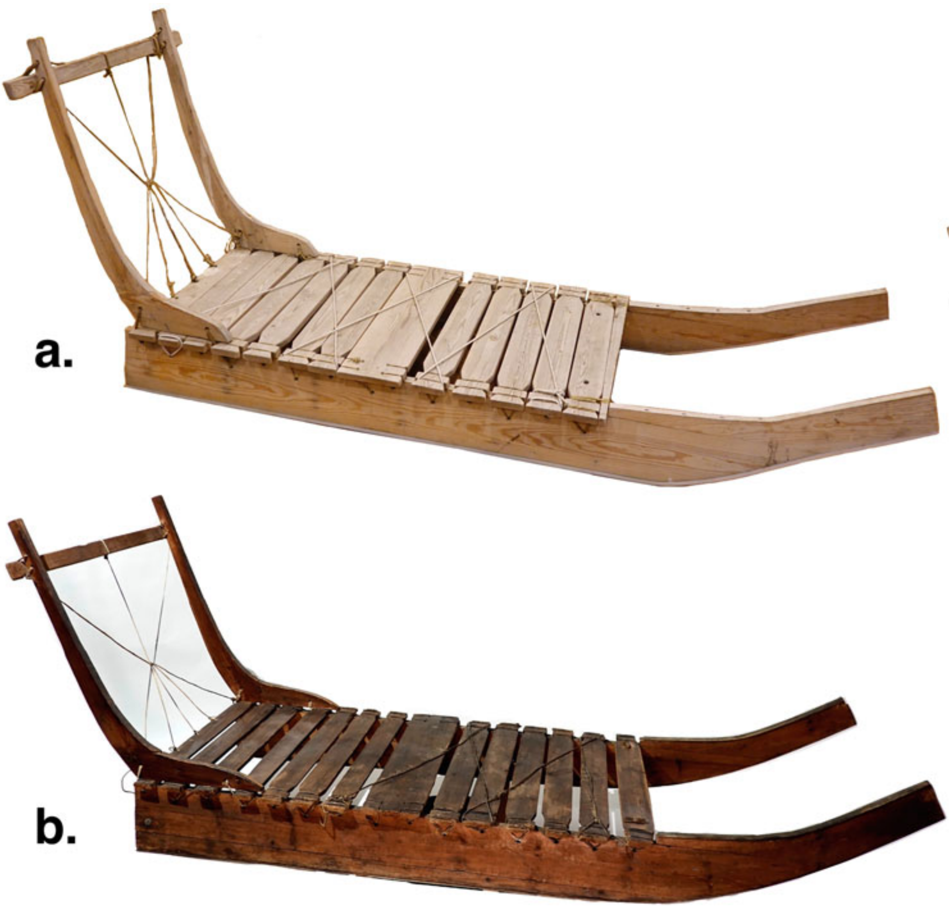

Figure 9. Comparison of the reconstructed Upernavik sled and the original sled that the reconstruction was based on: (a) the final reconstruction of the Upernavik sled; (b) the original historical Upernavik dog sled.

Knowing whether the upstanders are lashed tightly enough or understanding the reasons for placing wider crosspieces in the center are forms of knowledge that can be challenging to transfer. A community can emphasize the practice to capture the learner's attention, but it is through repeated practice that the beginner can incorporate knowledge. This is a physical learning process in which the novice participates in using the sled amid the environmental changes. The knowledge involved in the process is difficult to characterize because there is no set of written rules or specifications. The surrounding environment and the materials are fundamental aspects of the learning process, functioning as components within the processual framework of co-construction. For beginners, it is essential to encounter challenges with the structure and the tightness of the upstanders' lashing to develop personal knowledge of its construction. When one gathers experience as a dog-sled musher and builder, one gains a sense of the dog sled's movement through the snow, not only as a separate practice but as a structural network of dependencies. This process evolves within a developmental ecology in which materials, social relations, movement, and the environment are interconnected (Walls 2016). By understanding the choices related to the technology, the materials used in the construction provides a deeper insight to a society's economy and subsistence—for example, the upstanders had to be assembled in several pieces due to a shortage of wood. Another aspect of the material dimension can be seen in the use of lashings. During the reconstruction, the crosspieces were tied on each side of the runners with one long piece of rope, imitating the original sled's construction. When only one long piece was used, the valuable material was saved. Today, each crosspiece is typically lashed individually to prevent

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the entire sled from collapsing if the rope breaks in one place. These sequences provide valuable insights into the process by which knowledge involved in dog-sled building is transmitted locally and between generations.

In archaeology, the process of technology production is often separated from its operation. For instance, we rarely associate flint knappers with carpenters or hunters, even though the knowledge related to these practices contributes to their activities. In the case of traditional dog-sled construction, the processes of making a dog sled and becoming a skilled musher are connected, and the knowledge of the environment and sled construction are intrinsically linked. The knowledge required for the practice of dog sledding is connected to a network of relations that exists within the overall enskilment of an individual. Given that skill development is an ongoing process without a definitive endpoint, the idea of correct practice is constantly evolving, and it can be challenging to envision the abstract knowledge behind the actions in a guided form (Walls 2016). In approaches based on *chaîne opératoire*, there is a tendency to rely on flowcharts or illustrations of technological sequences as concrete representations (Dobres 2000; Knappett 2011). However, it is essential to distinguish between these depictions and the sensorimotor skills involved in constructing a dog sled. Walls (2016), for example, refers to the frustration of the Inuit kayaking community regarding such conventions, because they uphold a fundamentally different technical approach. These representations consider cognition an internalized process that separates knowledge from the physical act of creation, even though both these components are part of the enskilment process. Within the practice of enskilment, knowledge is established through experience and movement, and it is related to the scenario of use (Walls 2016).

Comprehending the different dimensions of materials within dog-sledding enskilment makes it possible to associate artifacts with the community, which is composed of generations with experience obtained through environmentally embedded practices. A great example is the dog sled of bones, which was procured by John Ross in 1818 from the Inughuit people in northwest Greenland, during a British expedition. This dog sled is made entirely of bones—several of whose components consist of re- and upcycled sections from walrus and whale bones—that are lashed together. The bone sled can be regarded as a reflection of the Inughuit society, and it shows their limited access to raw materials the early nineteenth century. Furthermore, various elements of the Inughuit sled technology, such as the lashing techniques and manufacturing characteristics, were used in North Greenland in the early 1900s (Vitale and Grønnow 2024). In combination with other archaeological indications of dog sledding—such as dog-sled toys or models, hunting equipment, and mobility patterns—it is possible to establish that Inuit have been practicing dog sledding in Greenland with similar techniques for more than 800 years. This includes the fragment of a sled runner that was recovered in an archaeological context in the Eastern Shore of Peary Land, most likely dating to the Thule period. This fragmented piece displays material traces which can be associated with construction, repairs, and use, with several marks from the lashings (Grønnow and Fog Jensen 2003). Thus, for a better understanding of Inuit resilience and innovation over time, it is important to interpret artifacts as components of a developmental ecology (Walls 2016).

Conclusion

In combination with archaeological and historical knowledge, this experimental study has provided additional insight to the technological aspects of the Greenlandic dog-sled culture. The aim of the reconstruction was to build a traditional sled to (1) give archaeologists a better basis on which to interpret the evidence of the dog-sledding culture from prehistoric sites in Greenland and (2) improve our insights into the historical and prehistoric Arctic societies' technologies and practices. Given that the impact of an artifact's role in past societies is one of main endeavors within archaeological research, the concept of materiality is of great importance for uncovering social patterns and practices (Walls 2016). This article demonstrates the connection between artifacts and materially situated practice through the reconstruction of a dog sled, which illustrates the value of physicality in enskilment. There are no guides or blueprints with specifications and measurements for traditional Greenlandic dog-sled construction. Instead, learning takes place through environment, in the process of preparing different parts of the sled and joining the pieces together. Consideration of adjustments and shapes for the scenarios in which the dog sled is used requires understanding and guidance from experienced sled builders. It is a didactic process, and there is no internalized schema with which to learn and develop important skills needed to be a successful dog-sled builder and musher. The knowledge, which primarily relies on sensory and physical abilities, is acquired through the process of environmentally situated practice and often exists between generations. In the handling of each component of the sled in a construction process, a large amount of information about the individual parts is revealed (Porsild 1914). This knowledge is essential for investigating dog-sled technology, as it is necessary to begin with a clear definition of what the sled consists of. Porsild (1914) claims that until we have experienced and used the object, we are not aware of all the features that at first sight are unnoticed or regarded as unimportant. We should be able to use—and, preferably, make—the object ourselves. This experiment should be regarded as a stepping stone to enrich our understanding of the dog-sled technocomplex—a previously almost untouched field of research—and it offers a foundation for further investigations of the history and origin of the Greenlandic dog-sledding practice.

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