

Playing to Survive: Children and Innovation During the Little Ice Age in Greenland

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Greenland is the world's largest island, but only a narrow strip of land between the Inland Ice and the sea is inhabitable. Yet, the Norse chose to settle here around AD 986. During the eleventh century AD, precontact Inuit people moved into Greenland from northern Alaska via Canada. Although the two cultures faced the same climatic changes during the Little Ice Age, the Inuit thrived, while the Norse did not, for multiple causes. The authors focus on one of these causes, the hitherto overlooked contribution of young children's learning strategies to societal adaptation. The detailed analysis of a large corpus of play objects reveals striking differences between the children's material culture in the two cultures: rich and diverse in the precontact Inuit material and more limited and normative in the Norse. Drawing on insights from developmental psychology, the authors discuss possible effects of play objects on children's future adaptability in variable climatic conditions.

Keywords: children, climate adaptation, play, toys, Greenland

INTRODUCTION

The prehistory of Greenland has witnessed several periods of human expansion and contraction. Climatic changes periodically affected Greenlandic flora and fauna such that the food sources available to human communities varied greatly (Gulløv, 2004). Human presence in Greenland began c. 2500 BC (Friesen, 2016). Around AD 985, Norse settlers from Iceland arrived in southwest Greenland, importing their pasture-based socio-ecological farming system. Concurrent with the beginning of the Little Ice Age in the fourteenth century AD, Norse settlements were abandoned (Arneborg, 2012), whereas the Inuit had spread almost all around Greenland at this time.

Much has been written about cultural responses to climatic change, both in the past and the present. Many studies have focused either on how climate change caused societal collapse (Douglas et al., 2016; Richards et al., 2021), how past communities survived climatic change (e.g. Degroot et al., 2022), or what we may learn from such scenarios (Jackson et al., 2018b, 2022; Izdebski et al., 2022). The role children played in climate change adaptation has received limited attention, despite them being central to our understanding of the human condition. By better grasping how children learn and contribute to salient innovation and adaptation in the past, we might be able to better understand the societal dynamics of

past adaptations and use these insights in the future. Children are a primary vector through which innovations—or, at the very least, variation—are generated (Lancy, 2017; Sterelny, 2021 with references). Therefore, looking at the diversity reflected in their play objects across time and societies can help detect whether a greater diversity of toys provides a richer background for innovation later in life.

Ethnographic and ethnohistoric observations suggest that Inuit society encouraged playful behaviour, including object play, while preparing children for surviving in the Arctic (Briggs, 1991). Norse toys relate mostly to agricultural pursuits and to strongly normative behaviour, as is also reflected in the material and textual sources in the wider Viking world (Raffield, 2019). Was it this normativity that made the Norse less adaptable? And did differences in cultural niches that promoted varying social learning practices play a role in the survival of the Inuit and the demise of the Norse (cf. Jackson et al., 2018a)? Here, we catalogue, contrast, and contextualize their playthings diachronically to reveal how play changed in these cultures vis-à-vis changing climate. We discuss the role of play and play objects in the socialization of children in high-latitude environments, with a focus on the downstream effects of this behaviour for societal adaptation. An extensive dataset of material related to the children of the Inuit and the Norse settlers in Greenland in the second millennium AD underwrites our analysis (see Supplementary Material). We couple these data to emerging insights from developmental psychology and the anthropology of childhood to show how similarities and differences between the Inuit and Norse foreshadow the contrasting fates of these cultures. In conclusion, we suggest that a greater focus on children in prehistory not only allows us to capture a more inclusive picture of past societies but

also illuminates the mechanisms by which these societies adapted to climate change.

PREVIOUS INVESTIGATIONS IN GREENLAND

Spurred by national fervour (Ries, 2006) and stimulated by initial excavations of Greenland's Eastern and Western Settlement (Bruun, 1895, 1917), interest in the fate of the Greenlandic Norse farms rose in the early 1900s (Arneborg, 2004). These investigations marked the beginning of systematic archaeological investigations of the Norse Greenlanders (Buckland et al., 1983), including their economy and their relationship with the Inuit (Arneborg & Seaver, 2000). Nørlund's (1924) excavations in the Eastern Settlement unearthed well-preserved medieval clothing and human remains in the churchyard of Herjolfsnes, evocatively illuminating Norse life in Greenland. Nørlund also excavated at Gardar (Nørlund, 1930), Sandnes Farm (Roussel, 1936), and Brattahlid (Nørlund & Stenberger, 1934). Roussel (1941) continued after Nørlund with excavations around Hvalsey Church and the Austmanna Valley. Since 1945, the National Museum of Denmark has carried out several campaigns, among others at Vatnahverfi (Vebæk, 1952, 1992) and Narsaq (Vebæk, 1993). Recent excavations of the 'Farm Beneath the Sand', an unusually well-preserved Norse inland farm site, have provided additional details (Berglund, 2020).

Early in the 1900s, interest in the pre-contact Inuit also gained momentum, especially in the context of the Thule Expeditions between 1912 and 1933. The Fifth Thule Expedition yielded extensive ethnographic and archaeological observations from Greenland to Alaska (Appelt et al., 2018) and allowed Therkel Mathiassen (1927) to describe Inuit

culture, including its prehistory for the first time (Mathiassen, 1930, 1931, 1933, 1934, 1936). This work was continued by Holtved (1944a, 1944b, 1954). Larsen's (1934) analysis of the artefacts from Dødemandsbugten on Clavering Island charted diachronic changes in Inuit material culture in this region, while others gained further insights into southern and north-eastern Greenland (Bandi & Meldgaard, 1952; Tuborg Sandell & Sandell, 1991; Sørensen & Gulløv, 2012). Recently, investigations of Inuit occupation, especially in south-western Greenland, have been undertaken (e.g. Panagiotakopulu et al., 2020; Madsen & Lennert, 2022).

Work at both Norse and Inuit settlements has been extensive, but the children's material culture has rarely been addressed. Toys have been found in many Inuit excavations, albeit seldom described in detail. For the Norse excavations, toys have rarely been documented (Berglund, 2020); no systematic compilations of play objects across Norse and Inuit societies exist. Here, we present a compilation of several thousand play objects from Inuit and Norse contexts in Greenland. Given recent breakthroughs in our understanding of children's material culture in the past and their role as motors of innovation (Milks et al., 2021; Lew-Levy et al., 2022; Riede et al., 2021, 2023), we add our observations to existing explanations for the demise of the Norse and the success of the Inuit, based on the material culture of children and in relation to child developmental theory.

INUIT AND NORSE CULTURES

The Norse Greenlanders and the Inuit had very different approaches to the environment and its affordances, and it is precisely these differences in their social

structures and ecological relations, as reflected in their material culture, that make comparison valuable. Crucially, these differences were culturally constituted (Appelt & Gulløv, 2009); play objects are an important part of the socialization process among foragers and agriculturalists alike (Janik & Cooney Williams, 2018; Raffield, 2019). Earlier analyses on Norse toys remain scarce (Morgan, 2016; McGuire, 2019). As for Inuit play objects, Whitridge (2021: 242) has recently used the small wooden dolls for querying socialization among Inuit girls, showing that dolls reflect a 'semantically rich core of Inuit cultural life'. Nonetheless, studies like this are rare for Inuit material culture, too (Park, 1998; Hardenberg, 2010).

Precontact Inuit culture encompasses a variety of chronologically and geographically differentiated 'branches' (Figure 1). The Thule District in north-western Greenland represents the Classic Thule (from AD 1000) and the entry point from Canada. A subsequent phase, the Ruin Island Phase, evolved in the region from AD 1200 to 1400 (Holtved, 1954; Gulløv, 2004). From north-western Greenland, the culture branched out in two directions: to western and south-western Greenland, where it developed into the Inugsuk culture (AD 1200–1900; Mathiassen, 1936), and to north-eastern Greenland, where a distinctive variant also emerged (AD 1400–1900). From north-eastern Greenland, migrations into south-eastern Greenland eventually led to the emergence of the recent Angmagssalik branch during the sixteenth to eighteenth centuries (Sørensen & Gulløv, 2012).

Norse settlers

Archaeological and written sources suggest that the Norse reached Greenland from Iceland around AD 985 (Gulløv, 2004), in

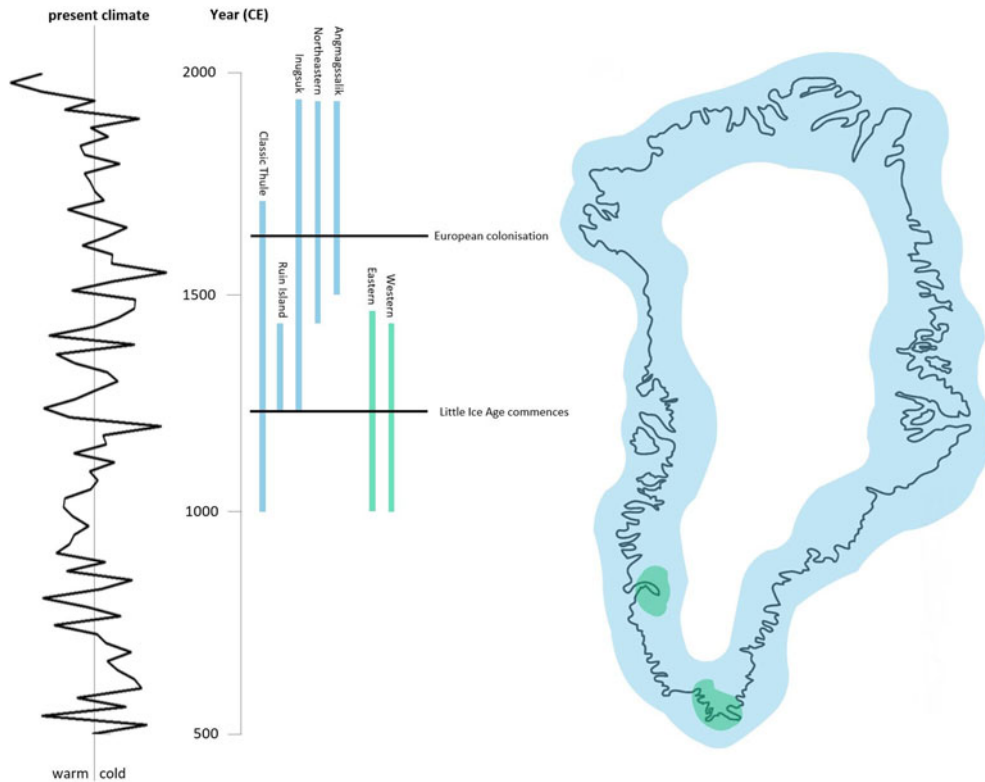


Figure 1. Left: mean annual temperature for Greenland through time (data from Vinther et al., 2010). Centre: timeline for the Inuit (blue bars) and the Norse in Greenland (green bars). Right: distribution map of the Inuit and the Norse (modified after Madsen et al., 2020: 4763).

the waning Medieval Warm Period. This warmth translated into a relatively rich vegetation. Fjords and inland regions yielded game and driftwood from Siberia and North America allowing them to successfully establish settlements in Greenland (Arneborg, 2004): the Eastern Settlement in southern Greenland, and the Western Settlement in the west. The settlers took their ancestral farming systems with them to the North Atlantic islands, primarily relying on livestock (Madsen et al., 2020; Zhao et al., 2022). Documentary and archaeological sources further demonstrate that the Norse attempted to cultivate cereals in Greenland (Henriksen, 2014).

The settlement pattern, farm layout, architecture, and economy of the farms

reflect a stratified society—a true copy of the social system that prevailed across the Viking world. To complement the pastoral economy, hunting trips northwards were organized in spring and autumn. The distribution of animal bones recovered from the farmsteads shows that all farms are likely to have contributed to these hunting expeditions, albeit unequally so (Arneborg, 2012; Buckland, 2012).

Children started working on the farms at an early age (Arneborg, 2004). Finds of miniatures (Figure 2) that reflect adult Norse society reveal that play was part of the life of Norse children, and that the simulation of grown-up life was—as in most societies past and present—an important part of children’s play. A clear

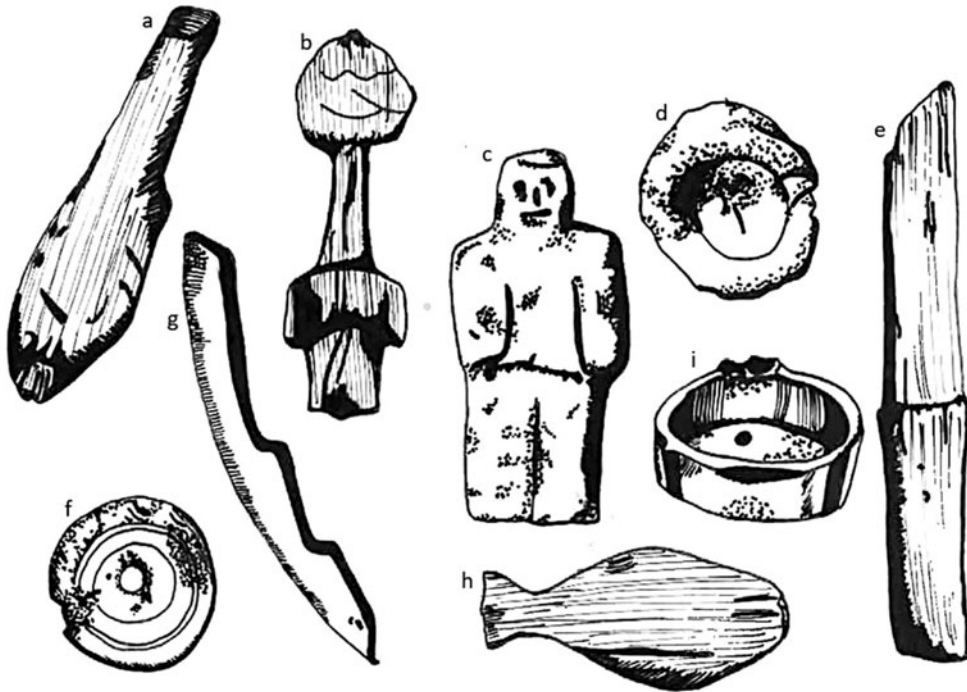


Figure 2. Norse toys. *a*: bird figure (wood; redrawn after Berglund, 2020: 112); *b*: toy sword (wood; redrawn after Vebæk, 1993: 36); *c*: doll (steatite; redrawn after Rousell, 1941: 265); *d*: cooking pot (soapstone; redrawn after Berglund, 2020: 112); *e*: knife (wood; redrawn after Berglund 2020: 113); *f*: disc for spinning top (whale bone, redrawn after photograph on the Archive of the National Museum of Denmark in Copenhagen); *g*: ship stem post (wood; redrawn after Rousell, 1936: 100); *h*: fish figure (wood; redrawn after Berglund, 2020: 113); *i*: bowl (soapstone; redrawn after Nørlund, 1930: 156). Not to scale.

gender division for the toys has been proposed, reflecting the strongly normative organization of adult life on the farms (Berglund, 2020): women took care of the house, food, and textile production, while men took care of work outdoors and tool production (Berglund, 2001).

Precontact Inuit

Precontact Inuit are a part of the Neo-Eskimo culture originating from northern Alaska and expanding across Canada into Greenland (Friesen, 2016). The Inuit migration is the later of two dispersal episodes that spanned the entire breadth of

the North American continent. Most probably, this migration was initiated by extended families from various locations along the northern and western Alaskan coasts who sought a better life (Friesen, 2016). Often described as remarkably rapid, with no evidence for lengthy pauses through the areas of the eastern Arctic, this migration may have started as early as AD 1000 (Park, 2023). When the Inuit arrived in Greenland, they quickly spread along both the southern and north-eastern coasts and had completely circumnavigated the landmass by the early sixteenth century AD (Madsen et al., 2020).

Inuit culture is characterized by considerable diversity in material culture, refined

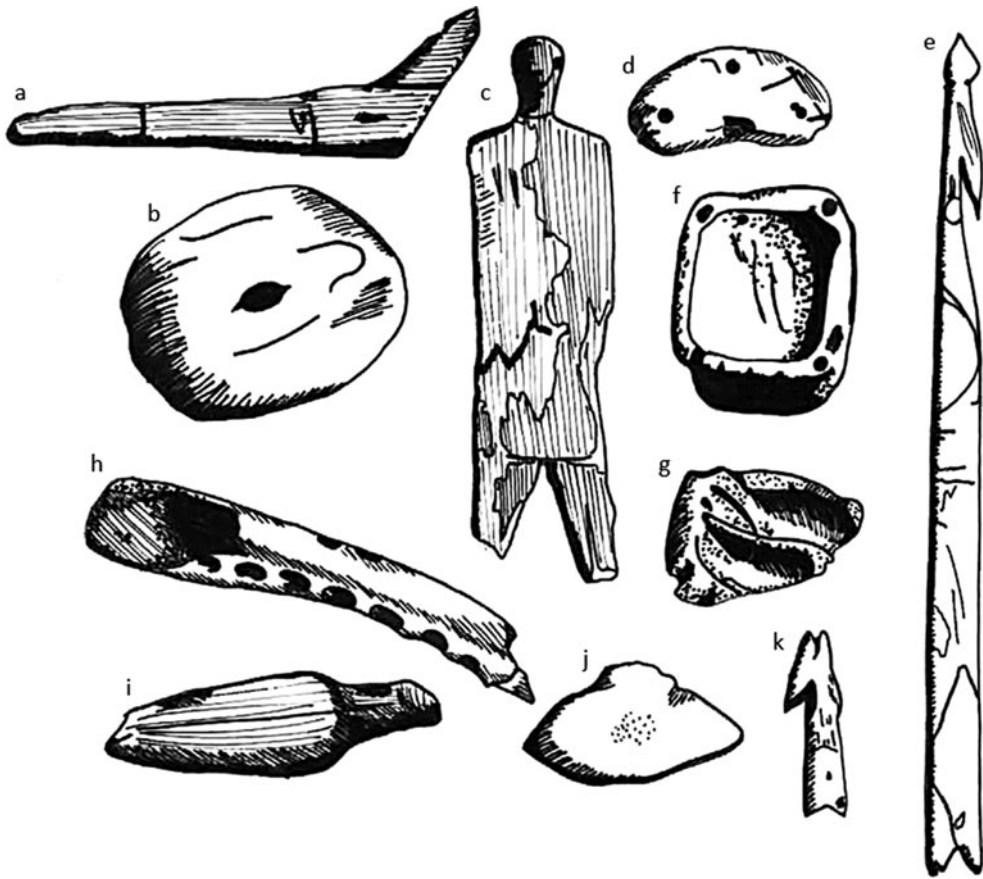


Figure 3. Inuit toys from the collection of the National Museum of Greenland in Nuuk. *a*: sledge runner and upstander (wood), *b*: disc for spinning top (wood), *c*: doll (wood), *d*: sealing stool (for sitting on when hunting seals on the ice (bone), *e*: harpoon (baleen), *f*: cooking pot (soapstone), *g*: lamp with ledge (soapstone), *h*: ajagaq (bone), *i*: snow knife (wood), *j*: ulo blade (women's knife; slate), *k*: harpoon head (bone). Not to scale.

weaponry, and transport technologies (Pfeifer, 2022). Especially the *umiaq* (skin boat) and the dog sled, two advanced transport technologies introduced to Greenland by the Inuit, allowed them to move on land/ice and on water at greatly reduced risks and costs (Friesen, 2016; Vitale et al., 2023). Over time, technologies were refined to include specialized weapons, instruments, and facilities (see Oswalt, 1987).

Inuit children can readily be identified in the archaeological record (Figure 3).

Within Inuit society, children were lavishly equipped with miniature tools and weapons, dolls, and figurines. These represent objects of play and learning. The miniature weapons and tools mirror adult material culture and are thus linked to learning specific skills (Riede et al., 2021; Pfeifer, 2022). Inuit youngsters had to learn how to use a wide range of implements, as well as how to manufacture them (Whitridge, 2021). This knowledge was expected to be acquired almost entirely through observation and experimentation

with functional miniatures of incrementally increasing size (Park, 2016).

MATERIALS AND METHODS

To interrogate the material culture across the two cultures in question in a comparative study, we catalogued and analysed a large number of play objects. Most of the material has been collated from the published literature, while the unpublished material was accessed directly at the National Museum in Nuuk. Of the latter, we found 497 items from seventeen sites classified as Inuit toys; a few ($n = 6$) Norse items were also recorded, all from site Ø34. Fifteen items categorized as toys from Greenland were found in the photographic archives of the National Museum in Copenhagen.

Excavation reports provide an overview of the material culture related to children found at both Norse and Inuit locations. In most of the reports from Inuit sites, detailed lists of the material including toys and games made recording straightforward, even if the information provided on each object was usually limited. The Norse material was less readily accessible. It is also not extensive, with a total count of items (not counting clothing related to children) recorded from the literature and directly at the National Museum in Nuuk amounting to seventy-two. Of the more than sixty sites in the Western Settlement and 200+ sites in the Eastern Settlement, only twelve locations contain material thought to be toys. Dice and gaming pieces are related to the adult sphere and thus not included. In comparison, the Inuit material is extensive, with 3014 items related to children from seventy-one different sites. Ranging from AD 900 to 1900, the material also includes a few earlier and more recent finds. For the present analysis, all items related to these,

and finds that could not reasonably be dated within a 200-year margin were excluded, bringing the Inuit material to 2397 items, including unpublished items.

Each object was described, and meta-data noted alongside relevant miscellaneous observations. Their dating is based on typology and, where available, archaeometric dating. Each object was assigned to a 200-year timespan, although this was not possible in all cases. The objects were sorted into five categories for comparison: skill play, social play, transport, tools, and weapons (Table 1). These analytical categories are aligned with those used in the excavation reports to describe adult material culture. Skill play and social play have been assigned to play objects that do not fit into any of the other ‘utilitarian’ categories. The difference between the two categories is that the items in the social play category relate to play of a more social character, where there is some degree of coordination of activities between individuals (e.g. play tents), while the objects in the skill play category require skill and physical exercise (e.g. spinning tops).

RESULTS

Toys are only rarely found on Norse farms, whereas on the Inuit sites it is unusual not to find miniatures or other play objects. The difference in the number of toys noted for each culture alone is compelling, especially given the larger number of Norse sites. Across the 200-year phases—starting at AD 1000 and ending with items dated to 1800 or later—changes in the relative frequencies of different play object classes can be seen in both the Norse and the Inuit material (Figure 4), although the percentage values for the Norse material must be treated with due caution given the small sample size. We do not believe that taphonomic

Table 1. The five categories of items found in the Norse and Inuit material, with the item types in each category and the total number of items listed. The astragali (*), used mainly as dice in adult games, have been included as they are interpreted as having been used as animal representation in the context of domestic pretence play.

NORSE		
Play object category	Items	N
Skill play	Astragali*, carvings, tops, top discs, toy pieces	12
Social play	Dolls, figures	19
Transport	Boats, keels, ships, stem posts	6
Tool	Bowls, cooking pots, knives, lamps, shoe trees, trenchers, troughs, vessels	30
Weapon	Arrowheads, axes, swords	5
SUM		72
INUIT		
Play object category	Items	N
Skill play	<i>Ajagaqs</i> , <i>ajagaq</i> sticks, balls, bark rolls, bodkin, bull rovers, buzzes, comb, drums, drum frames, drum handles, mussel shells, <i>nuglutangs</i> , pivots, platform mat, propellers, stones, string, tops, top discs, wind wheels	378
Social play	Dolls, figures (animal and human), play structures and playhouses	499
Transport	Boats, kayaks, kayak mountings, oar blades, paddles, ships, sledges, sledge cross bars, sledge cross slats, sledge runners, sledge upstanders, sledges with dogs, swivels, towing gear, trace buckles, <i>umiags</i> , whip handles	314
Tool	Blubber pounder, bowls, cooking pots, dishes, gull hooks, knives, knife handles, lamps, lamp stands, leisters, leister prongs, mattocks, mattock handles, mountings, quiver handles, saws, scoops, scraping boards, sealing stools, sinew twisters, sling handles, snow beaters, snow knives, snow shovels, spoons, throwing boards, trays, tubs, <i>ulos</i> , <i>ulo</i> blades, <i>ulo</i> handles, whetstones	570
Weapon	Arrows, arrow blades, arrow shafts, arrowheads, bird dart heads, bird dart shafts, bird dart side prongs, bladder darts, bladder dart heads, blades, bows, crossbows, darts, guns, harpoons, harpoon bladders, harpoon end blocks, harpoon foreshafts, harpoon heads, harpoon shafts, harpoon mountings, harpoon wings, lances, lance foreshafts, lance heads, leister harpoon heads, leister prongs, points, swords	636
SUM		2397

factors have skewed our results as the taphonomic conditions affecting Norse and Inuit playthings are largely identical. The visibility and density of the Norse settlements are greater than those of the Inuit; the Norse were also sedentary, and the site count is higher compared to Inuit locales. Together, this lends credence to the notion that the Norse had fewer and less varied play objects than their Inuit contemporaries.

Focusing on the period of overlap between the Norse and the Inuit (AD 1000–1200 and 1200–1400), weapons make up a much larger percentage of the Inuit material than among the Norse and no change in this category can be detected over time. Tools constitute a large proportion of the Norse material, while it is more modest in the Inuit material. There does not seem to be a marked change over time in this category either.

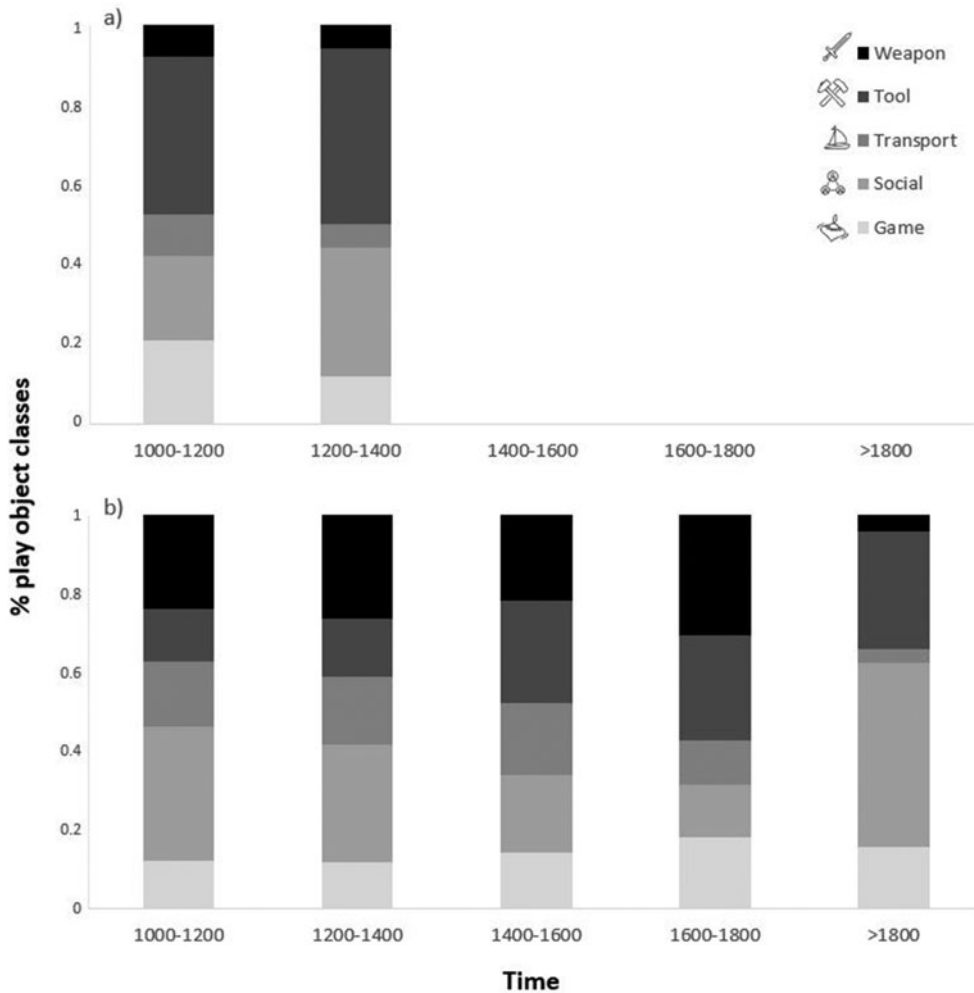


Figure 4. Percentages of play object categories in each timeslot for a) Norse, and b) Inuit.

Looking at the absolute numbers of play objects in each category over time, a substantial increase is visible in all categories for the Inuit material, while the Norse material remains modest (Figure 5). The increase in the Inuit material coincides with the climatic changes that occurred during the Little Ice Age.

To further quantify and hence differentiate between Norse and Inuit play object use, we used the so-called Shannon Diversity Index and its associated values of evenness and richness to describe basic

dimensions of our corpus of objects (Table 2). The index, which is just one way to describe diversity in archaeology (see Dunnell, 1989) and a range of other disciplines, estimates diversity, here the number of object classes within the categories of play objects relative to the overall number of objects (Nolan & Callahan, 2006). Diversity is directly connected to innovation (Kuhn, 2020) and environmental risk (Fitzhugh, 2001): without diversity, there is no cultural evolution and hence no adaptation (cf. Eren

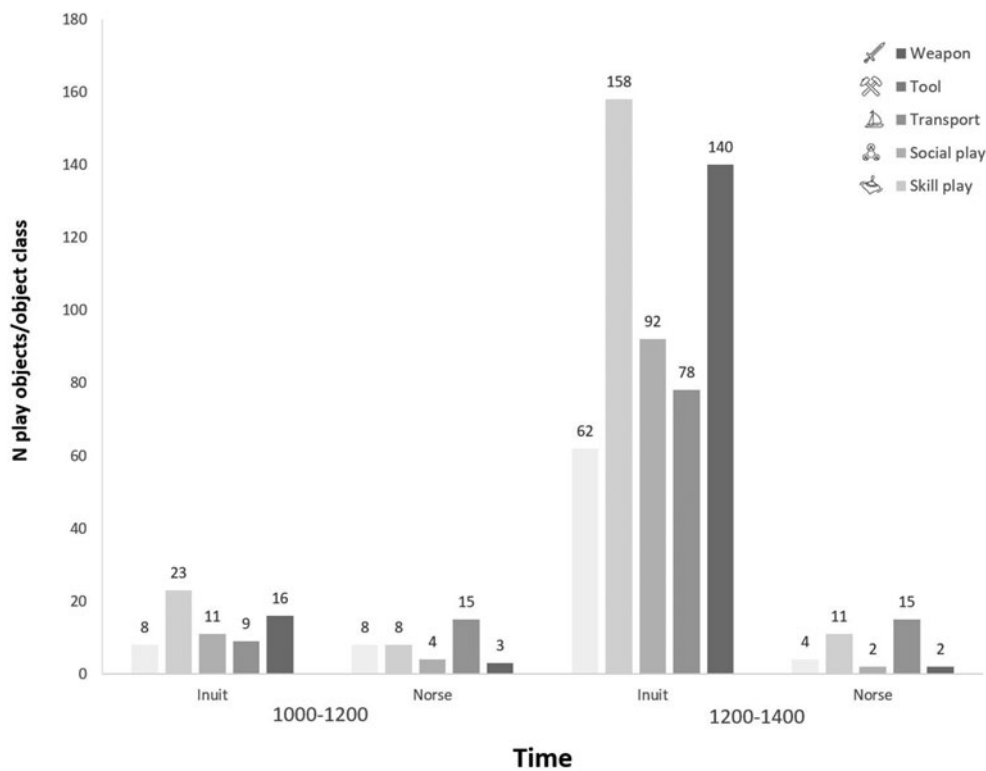


Figure 5. Absolute numbers of play objects per category for the Inuit and the Norse over time.

& Buchanan, 2022). We here use it to describe variation within our play object categories where low richness values reflect poor toy assemblages and low evenness values highly normative ones.

The number of classes within each category of play objects does not differ substantially over time for the Norse material, whereas it differs markedly among the Inuit, except for the ‘social’ category that remains stable for almost all timeslots (Figure 6). These changes in the number of classes coincide with the rise in the total number of play objects, which occurs in a period of increasing climatic stress. Another significant rise in both total numbers and number of classes appears between 1600 and 1800, a period in which the Inuit again encountered Europeans.

The qualitative differences and the diversity of the individual forms of objects

within the object classes corroborate the notion that Inuit play objects grew more diverse during the Little Ice Age. The Inuit material exhibits more variants in tools, transport, and weapons than the Norse. Table 2 illustrates a tendency towards a higher number of object classes within the five categories for the Inuit material. Within these classes, there is substantive variation in the details and materials used to produce the same play objects (Figure 7): For the *ajagaqs* (ring-and-pin toy), for instance, the material is always bone but the type of bone can vary from seal penis bones to whole mandibles. Their shape and size also vary depending on the properties of the bone. The number of holes in each *ajagaq* varies, too. As for the spinning tops, the material can be either wood or bone, and their shape ranges from perfectly round to oval and

Table 2. Shannon Diversity Index for each of the categories of toys per timeslot. *H*: diversity index; *E*: evenness; *R*: richness of the sample (i.e. how many different classes are contained in each category). When there is only a single class, then *H* = 0 and evenness cannot be calculated. The closer the evenness is to 1, the more diverse the sample is.

	SKILL PLAY			SOCIAL PLAY			TRANSPORT			TOOL			WEAPON			
	H	E	R	H	E	R	H	E	R	H	E	R	H	E	R	
NORSE	1000–1200	0.6	0.8	2	0.4	0.5	2	0	-	1	1.6	0.9	6	0.6	0.9	2
	1200–1400	1.0	0.9	3	0.3	0.4	2	0	-	1	1.7	0.9	6	0.7	1.0	2
INUIT	1000–1200	0.6	0.8	2	0.2	0.3	2	1.3	0.9	4	0.8	0.8	3	0.8	0.7	3
	1200–1400	1.5	0.7	9	0.3	0.4	2	1.5	0.7	8	2.0	0.7	16	1.5	0.7	8
	1400–1600	0.7	0.4	6	0.1	0.1	2	1.2	0.8	4	1.6	0.7	11	1.9	0.9	9
	1600–1800	1.1	0.5	12	0.9	0.8	3	1.4	0.6	10	1.9	0.8	12	1.6	0.6	12
	>1800	0.9	0.5	5	0.5	0.7	2	1.1	0.8	4	0.6	0.4	5	1.6	1.0	5

square. Some are very small and thin, others are larger and thicker.

DISCUSSION

Many theories for the demise of the Norse in Greenland have been proposed. Declining temperature has long been considered the best explanation, together with grazing-induced land degradation (e.g. Arneborg, 2004). Recent research suggests that persistent drying may have aggravated the impact of deteriorating temperatures (Zhao et al., 2022). Sea-ice accumulation, too, probably played a role in controlling access to marine foodstuffs and affected sailing conditions, which hindered trade and increased the risk of injury or death at sea (Kuijpers et al., 2014). In the 1400s, official passages from Norway ceased. This coincided with more frequent and violent storms and rising sea levels during the Little Ice Age (Arneborg, 2012; Kuijpers et al., 2014). In sum, drier summers with decreased pasturage and winter fodder production (Zhao et al., 2022), sea level changes and reductions in valuable grassland (Borreggine et al., 2023), loss of contact with the homelands (Arneborg, 2004, 2012), and increased storminess (Kuijpers et al., 2014) contributed to the Greenlandic Norse’s demise. These drivers are often foregrounded, yet climate change alone cannot explain the colonies’ disappearance. As Adger et al. (2013) point out, any society’s response to climate change is culturally mediated (see also Jackson et al., 2018a; Thomas et al., 2019; Burke et al., 2021). Isotope evidence has revealed changes in the Norse diet over time, towards an increasing use of marine resources (e.g. Arneborg et al., 2012; Nelson et al., 2012; Zhao et al., 2022); yet farming strategies remained essentially unchanged throughout.

In this context, we have here considered the role of children and innovation in

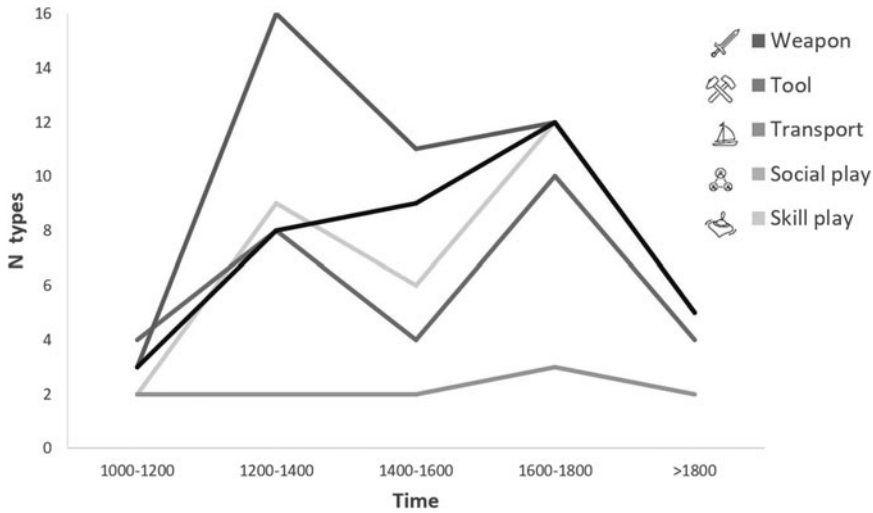


Figure 6. Change in the number of play object categories in the Inuit material over time.

adaptability. It has been suggested that the physical resources, including play objects, that shape child development as part of the so-called ontogenetic niche might have significant structuring effects on the youngsters becoming innovative adults (Riede et al., 2018). Neural plasticity—in interaction with material culture (Iriki & Taoka, 2012)—is fundamental to the acquisition and mastery of complex motor, cognitive,

and social activities. Object play serves to acquaint children with the technologies of adult life in the relatively safe environment of the home base or household (Riede et al., 2018). Miniature weapons, tools, boats, dolls, and figurines play an important role in the establishment of gender roles and identities, as well as in the guided transmission of specific ecological and technological knowledge (Riede et al., 2021).



Figure 7. Inuit play objects. Left: a collection of ajagaqs made from the bones of different animals. Right: spinning top discs made of wood and bone.

The diversity of objects related to children in the Inuit culture is significantly higher than among the Norse settlers in terms of the number of objects found, the number of objects across different categories of play, and the technological and morphological variation within each object category. Given that both Norse and Inuit assemblages have been preserved under essentially identical taphonomic conditions, the small number of Norse toys may reflect an actual dearth of toys in that society. Norse and Inuit population sizes were broadly comparable (Madsen & Arneborg, 2017; Park, 2023), but robust estimates are scarce and both populations likely fluctuated over time (Minc & Smith, 1989; Constandse-Westermann, 1993; Lynnerup, 2014). Despite demographic comparability, Inuit material culture is notably extensive and complex (Oswalt, 1987; Mason, 2009), suggesting a recursive relationship between play object diversity and overall technological complexity. While acknowledging that it is difficult to recognize all objects that have been played with (Crawford, 2009), we contend that the difference in the number and diversity of play objects manufactured solely for the purpose of being played with between these two cultures reflects a clear difference in their early-life learning environments as well as perceptions of childrearing. Sedentary societies tend to be more normative when teaching children, while foragers often allow for less formal learning (Lew-Levy et al., 2017). Our analysis of Inuit and Norse toys supports this observation and provides a deeper-time material culture correlate of pertinent ethnographic and literary accounts of the contrasting childrearing environs in recent Inuit (e.g. Briggs, 1971) and Viking (Raffield, 2019) societies, respectively. Moreover, most objects analysed here can be confidently identified as play objects made for children rather than merely casual

playthings; hence they do reflect the time, energy, and resources invested in the creative scaffolding of these youngsters.

Norse settlers did try to adapt to the changing environment over time by shifting their diet towards more marine-based resources (e.g. Nelson et al., 2012). This change is, however, not reflected in the play objects, since figures of seal or fish do not increase over time. Almost all the figures recorded are of horses or birds. The increase in toy weapons in the Inuit material can be argued to correspond to innovations in hunting implements. The most diagnostic Inuit artefacts are indeed harpoon heads, originally divided into five types by Mathiassen (1927; Gulløv, 2004). Among the play objects, there is a rise in the number of flat harpoon heads, especially in the timeslot 1600–1800. Winged harpoons first appear in the Inuit material around 1500 (Sørensen & Gulløv, 2012), which is also reflected in the play objects, where winged harpoons are only represented in the timeslots 1400–1600 and 1600–1800. Thus, the play objects of the Inuit can be said to reflect changes in hunting implements that occurred in response to the increasingly harsh environment. Playful experimentation with different weapon designs allowed them to become familiar with a wider range of uses and options. This, we argue, would enable them to better match technology to environment in later life. The opposite can be said about Norse children who were not presented with a ‘toy kit’ that supported exploration; at any rate it was available to a far lesser extent than among the Inuit (cf. Frankenhuis & Gopnik, 2023). It is through exploration that variation is generated; without explorative play during childhood, it is not easy to grow up and become an innovative adult able to adapt to differing climatic conditions.

Although children have been identified in various societies (e.g. Milks et al., 2021;

Lew-Levy et al., 2022), they have seldom been discussed as part of the adaptation process during periods of climate change. Differences in the 'cultural niches' influence how children are brought up, ranging from strongly normative to more explorative. The developmental psychologists Flynn and colleagues (2013) refer to this as the 'ontogenetic niche' and a very normative upbringing can hinder an individual from being flexible enough when facing changing environments. The Norse learned the landscape of Greenland in a manner tied to their agriculturalist way of life (Rockman, 2012); as climate changed, their ecological and technological knowledge became increasingly ill matched to the prevailing conditions, and new generations of youngsters were poorly equipped to innovate adequately.

CONCLUSION

The ontogenetic niche is vital for human adaptation, physically, cognitively, socially, and materially. For children, this involves different resources, including play objects and especially functional miniatures, provided by older peers and adults. These resources have a significant influence on children becoming innovative as adults, as they allow children to acquaint themselves with the technologies of their society (Riede et al., 2018). The rich variants of play objects nurtured Inuit children towards explorative play, enabling them to become more innovative, and thus more adaptable, as adults.

Play is an important part of early-age innovation, which in turn is important for a society's ability to adapt to changing climatic and environmental conditions. Greenland during the Little Ice Age presents an effective completed natural experiment of history, where two different cultures faced identical climatic pressures.

We have argued that the Inuit way of learning, of giving children autonomy and a diverse 'toy kit', was part of a pedagogical approach that enabled their children to be experimental, innovative, and independent (cf. Briggs, 1991). In contrast, the seemingly more normative upbringing of Norse children resulted in a similarly normative adult culture that, in the face of deteriorating conditions, was unable to accommodate novel forms of technology and behaviour. Children and their material culture are not the only component of how Inuit and Norse societies adapted to climatic change, but our study has, for the first time, examined their contribution to the production and reproduction of social norms and technologies through play and materially guided cultural transmission.

We have used play objects as a direct proxy for children's learning contexts, specifically in relation to technological categories such as weaponry and transport. Our analysis highlights substantive differences in the number and diversity of play objects among the Norse and the Inuit. The Norse material does not show changes in diversity or number over time despite the changing climatic conditions of the Little Ice Age. In contrast, the Inuit's expanding and diverse 'toy kit' reflects the innovations and changes in adult material culture that occurred in response to an increasingly harsh environment. Our data support the notion that the objects that filled the cultural niches of these societies had a vital effect on their ability to adapt and survive adverse environmental conditions across multiple generations and centennial timescales. Whether the diversity and abundance of the Inuit toy assemblage compared to the Norse stems from a greater focus on implement diversity in Inuit culture requires further study. Future analysis should address the relationship between

the diversity of the play objects and adult objects in each society. Furthermore, the chronology of the play objects that we have been able to study is poorly resolved, limiting what can be said about dynamic processes and associated causality. Going forward, increasing the chronological resolution and including additional material will expand the comparative scope to wider regions and societies.

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SUPPLEMENTARY MATERIAL

To view the Supplementary Material (dataset) for this article please visit <https://zenodo.org/records/10806222>.

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BIOGRAPHICAL NOTES

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Jouer pour survivre : enfants et innovation pendant le petit âge glaciaire au Groenland

Le Groenland est la plus grande île du globe mais seule une étroite bande de terre le long de la côte est habitable. Pourtant les Norrois ont choisi de s'y établir en 986 apr. J.-C. L'arrivée des Inuits en provenance de l'Alaska du nord via le Canada date du XI^e siècle. Bien que les deux cultures dussent affronter les mêmes changements climatiques pendant le petit âge glaciaire, les Inuits prospérèrent alors que les Norrois échouèrent, pour diverses causes. Les auteurs de cet article examinent une de ces causes, encore négligée par la recherche, à savoir la contribution des modes d'apprentissage des jeunes enfants aux stratégies d'adaptation d'une société. L'analyse détaillée d'un vaste corpus de jouets révèle des différences frappantes dans la culture matérielle des enfants dans ces deux cultures : riche et variée parmi les Inuits, plus limitée et normative parmi les Norrois. Inspirés par la psychologie du développement, les auteurs considèrent l'influence que les jouets auraient pu avoir sur la capacité de s'adapter à des conditions climatiques changeantes. Translation by Madeleine Hummler

Mots-clés: enfants, adaptation au climat, jouer, jouets, Groenland

Spielen, um zu überleben: Kinder und Innovation während der kleinen Eiszeit in Grönland

Grönland ist die größte Insel der Welt, aber nur ein schmaler Streifen entlang der Küste ist bewohnbar. Trotzdem wurde sie um 986 n. Chr. von altnordischen Gemeinschaften besiedelt. Im 11. Jahrhundert zogen die Inuit aus Nord-Alaska via Kanada nach Grönland. Obschon die beiden Kulturen während der kleinen Eiszeit die gleichen Klimaveränderungen konfrontierten, blühten die Inuit, wohingegen die altnordischen Gemeinschaften scheiterten, und dies aus mehreren Gründen. Einer dieser (von der Forschung vernachlässigte) Aspekte ist der Beitrag der Lernformen jüngerer Kinder zu den Anpassungsstrategien einer Gesellschaft. Die detaillierte Untersuchung einer großen Sammlung von Spielzeugen zeigt markante Unterschiede zwischen der materiellen Kultur der Kinder in den jeweiligen Kulturen auf: reich und vielseitig bei den Inuit und beschränkter und normativer im altnordischen Bereich. Die Verfasser, von der Entwicklungspsychologie inspiriert, besprechen die möglichen Einflüsse von Spielzeugen auf die Anpassungsfähigkeit in wechselnden klimatischen Bedingungen. Translation by Madeleine Hummler

Stichworte: Kinder, Klimawandelanpassung, spielen, Spielzeuge, Grönland