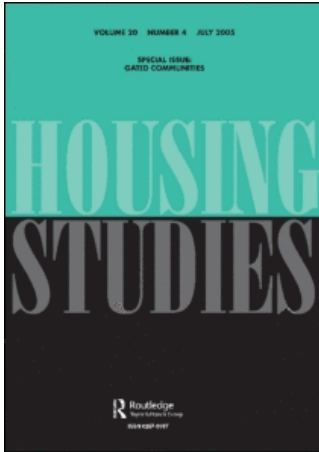


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Unfriendly Architecture: Using Observations of Inuit Spatial Behavior to Design Culturally Sustaining Houses in Arctic Canada

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Unfriendly Architecture: Using Observations of Inuit Spatial Behavior to Design Culturally Sustaining Houses in Arctic Canada

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ABSTRACT *In the decades following the Second World War, Inuit of the Canadian Arctic were introduced to Euro-Canadian architecture in communities that were scattered throughout the North. These houses, and the settlements in which they were situated, were spatially designed around Euro-Canadian concepts of family, community, economics and administrative control. Direct observations of space use by Inuit families were carried out in a remote Canadian Arctic community, and interpreted using space syntax analysis and agency theory. The results of this study indicate that the programmatic categories typically used to structure Euro-Canadian houses, such as bedrooms, kitchens, living rooms and porches, are rarely adhered to by Inuit families. While this apparent mismatch between intended versus actual uses of space may appear arbitrary, it is, in fact, systematically matched to the spatial structure of the houses they inhabit. These interpretations have important implications for the development of aboriginal housing policy in northern Canada.*

KEY WORDS: Human agency, northern housing, Inuit, space syntax, acculturation, architecture

Introduction

Government modernization programs, in which indigenous peoples are resettled into the communities of dominant cultures, provide a unique context for examining the social effects of housing. While this paper deals with such a situation in the Canadian Arctic, it is one that has occurred in the recent and distant past at many times, and in many places. The process of resettlement introduces indigenous peoples to new forms of spatial organization that define the routines and practices of other cultural groups. Agency theory provides a theoretical framework for understanding how people respond under such circumstances. Agency theory maintains that the actions of individuals (agents) are both constrained and enabled by the institutional structures they produce through the enactment

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of daily life. Houses are an embodiment of this process because they are spatially configured to facilitate these enactments. But what happens when people are forced to inhabit houses designed around the concepts of family life of another culture? Do they mimic the domestic practices of those seeking cultural domination? Or do they retain traditional ways of doing things as an expression of resistance, or as a denial of the changes that they face?

This paper explores these questions by examining the effects of post-war housing programs on Inuit families in the Canadian Arctic. Euro-Canadian houses are commonly organized into contemporary programmatic categories such as bedrooms, kitchens, living rooms and porches. However, the uses of these spaces by Inuit families often do not match the functions associated with them. Using a technique of analysis based on space syntax, and drawing on agency theory, this paper shows that the mismatch between *intended* and *actual* allocation of activities within houses is not arbitrary, but systematically matched to the spatial structure of the house. Studying these spatial behaviors illustrates how existing house designs can be improved so that they better suit the needs of Inuit families. Therefore, the results of this study have implications for the development of more effective aboriginal housing policy in northern Canada.

The Settlement Era in the Canadian Arctic

In the years between the wars, the Canadian government practiced a policy of benign neglect in its dealings with Inuit people, which was achieved through a strategy of population dispersal. By discouraging the centralization of Inuit in settlements, and supporting the continued use of out-camps on the land, the Canadian government hoped that Inuit would remain economically self-sufficient and avoid dependency (Damas, 2002; Duffy, 1988; Nixon, 1984; Tester & Kulchyski, 1994). The emerging strategic military importance of the Canadian Arctic during the Cold War Era, coupled with the disastrous and much-publicized starvations in the Kivalliq region during the winter of 1957–58, threw this policy into question (Damas, 2002; Tester & Kulchyski, 1994).

The construction of Distant Early Warning (DEW) line stations at locations such as Cambridge Bay, Coral Harbor and Churchill, brought wage labor jobs, and an almost limitless supply of building materials, such as scrap lumber, to the Inuit. Out of necessity, many families began to build 'shanty-style' dwellings around the perimeters of DEW line stations and military bases (Department of Northern Affairs & Natural Resources, 1960, pp. 74–80; Duffy, 1988, p. 24; Nixon, 1984, p. 128). Similar types of self-made houses emerged on the edges of settlements where Inuit children were now attending *qallunaat* (white) schools. Observations made by Tester (2006) and other researchers during the 1960s and 1970s suggest that some of these dwellings were remarkably well built and comfortable. Nevertheless, most southern visitors were shocked by the living conditions of the Inuit they encountered, and many considered these self-built houses to be substandard (Damas, 2002, p. 120; Nixon, 1984, p. 128; Tester, 2006, p. 236). This was partially due to the fact that methods of house construction varied dramatically between communities. In some areas, for example, Inuit families lived in snow houses lined with boards, plywood, canvas and paper (Graburn, 1969, pp. 164–165). The fact that imported cotton clothes and rubber boots were now used as substitutes for warmer traditional clothing only compounded the problem (Department of Northern Affairs & Natural Resources, 1960, pp. 74–80; Duffy, 1988, p. 24; Nixon, 1984, p. 128).

Concerns that modernization projects would increase Inuit dependency on the welfare state placed many northern administrators in a catch-22 situation (Tester, 2006, p. 233). Although officials had identified housing as an area of concern, the implementation of housing programs in the Canadian Arctic had been delayed because of concerns over the creation of dependency. These circumstances quickly changed in 1959, with the publishing of a report entitled *Eskimo Mortality and Housing*, which argued that substandard housing conditions in the Canadian Arctic were exacting a huge toll on Inuit health (Department of Northern Affairs & Natural Resources, 1960). General illness within the Inuit population, and high instances of infant mortality, were attributed to the continued use of self-built houses. The report concluded that Inuit children faced two stark choices: “either gastro-enteritis in the shack, or pneumonia in the tent” (Damas, 2002, p. 120; Department of Northern Affairs & Natural Resources, 1960). In response, the Department of Northern Affairs and Natural Resources embarked upon a series of ‘crash’ housing programs throughout the Canadian Arctic (Buchanan, 1979, p. 25; Redgrave, 1986, p. 50; Thomas & Thompson, 1972, p. 1). The perception that housing was urgently needed precluded any in-depth consultation with Inuit about their requirements. Indigenous knowledge was excluded from the design process, meaning that southerners, unfamiliar with both the Inuit and the Arctic environment, were left to make critical decisions regarding design, furnishings, and construction materials.¹

Attempts were made early on to design structures that were culturally familiar to Inuit. These included a type of *iglu* manufactured from 6 inches translucent Styrofoam blocks held together by an adhesive seal, and circular double-walled canvas tents insulated with moss (Department of Northern Affairs & Natural Resources, 1960, p. 67). However, the high cost of building houses in the north meant that it was cheaper to use existing designs that were easily transportable, and inexpensive to build. Experimentation was also hindered by national building codes and standards, which, to a certain extent, determined what Inuit houses had to look like. As a consequence, many culturally sensitive approaches to house design had been abandoned by the end of the 1950s in favor of building ubiquitous houses that were basically facsimiles of those used in southern Canada (Damas, 2002, p. 120).

Establishing Criteria for Architectural Design

At first glance, the introduction of Euro-Canadian architecture in the Canadian Arctic could be viewed as an example of high modernism gone awry. Many Canadian government administrators, including northern service officers, were committed to the basic tenets of modernity, in part due to their experiences living through two world wars and a great depression. Consequently, the modernist schemes they implemented were not so much about acculturation, as they were about alleviating poverty, and the dangers many Euro-Canadians associated with traditional Inuit life (Tester, 2006, p. 236).

In a broader context, the application of modernist ideals to architectural design illustrates a desire among post-war building professionals to ‘universalize’ the design process, reducing it to a series of basic principles that could be employed dependably and with regularity (Ward, 1996, p. 38). The idea that ‘basic’ human needs existed beyond the influence of culture, gender and age represented another axiom upon which architects attempted to establish ubiquitous design principles (Ward, 1996, p. 38). However, it was soon realized that in relation to human need, there were no absolutes, and social context

came to be recognized as a far more important criterion (Ward, 1996, p. 38). In an effort to explore this concept further, and out of disappointment with other solutions in solving architectural design problems, Western architects began to search for design principles among pre-industrial societies in the archaeological and ethnographic records (Lawrence & Low, 1990, p. 458). Foremost among these was Christopher Alexander, who, in a 1964 article entitled *Notes on the Synthesis of Form*, postulated that over time traditional societies had shaped their built environments to provide a perfect 'fit' for their own social needs. According to Alexander, the ability of Western societies to achieve such a 'fit' had been lost because of increases in social complexity and tempo of environmental change (Ward, 1996, p. 39).

The contrasts between 'systematized' versus 'culturally sensitive' approaches to architecture capture the central issue in northern aboriginal housing. As mentioned previously, urgent need for housing, coupled with the high cost of labor and shipping materials to remote northern settings, often required planners to use 'universal' rather than 'culturally specific' design criteria. By way of illustration, a housing administrator in the Nunavut government once remarked to me that, given budget limitations, it was far more cost effective to use current 'off the shelf' house designs, than to innovate and develop new designs tailored to the needs of Inuit families.

Designing culturally sustaining architecture is challenging, and a vast literature in anthropology, urban planning, environmental psychology and architecture exists which documents attempts to reconcile the relationship between space and culture in the built environment. Much of this work can be summarized into six approaches that represent complementary, rather than competing, methods for understanding human spatial behavior. Ergonomics and proxemics share a paradigmatic view of space in which some cross-cultural constant (mechanical properties of activities, biological impulses such as territoriality/privacy) determines how humans organize space. Likewise, agency theory (e.g. Bourdieu, 1977; Giddens, 1984), space syntax (e.g. Hillier & Hanson, 1984), dramaturgical approaches (e.g. Goffman, 1959, 1974), and methods examining the relationship between space and power (e.g. Foucault, 1984; Markus, 1993; Sibley, 1996) all argue that local 'rules' frame human activities and interactions which, in turn, reproduce the social structure. Furthermore, they see this process as both facilitated by, and reflected in, the spatial organization of the built environment. For the purposes of this paper, agency theory and space syntax analysis have been chosen because agency theory is seen as having explicitly spatial dimensions that are well suited to the methodology of space syntax analysis.

Defining the Spatial Dimensions of Human Agency

The roots of agency theory lie in the ideas of Durkheim (1984, 1995); Marx (1964, 1992, 1998); Parsons (1937); Weber (1992); and most recently, Bourdieu (1977, 1990) and Giddens (1984). Agency theory maintains that the routines of everyday life allow human agents to reproduce the social structures they inhabit (Barrett, 2000; Bourdieu, 1977; Giddens, 1984). These structures consist of characteristic patterns of relationships, which are formally organized into various economic, social, political and ideological institutions. Such relationships are maintained and modified through the purposeful work of agents (Giddens, 1984, p. 113). Because the work that agents engage in is often constrained by limitations in time, space, materials, and technology, a tension exists between agent and structure (Dobres & Robb, 2000, p. 4; Dornan, 2002, p. 307; Giddens, 1984, pp. 111–112).

This has resulted in the much-used phrase that structures are both enabling and constraining to agents (Giddens, 1984, p. 25).

Spatial expressions of human agency occur on a daily basis, yet often go unnoticed. For example, at the university where I work, landscape architects have recently designed a system of paths around a green space near one of the newer buildings on campus. Soon after the concrete sidewalks were constructed, an alternate system of 'trails' mysteriously emerged (Figure 1). The routing of the concrete sidewalks reflects the architects' belief that students should have an opportunity to appreciate the aesthetics of the campus while walking to and from class. On the other hand, the students recognize that the spatial design places constraints on their time, which is almost always in short supply. Consequently, to save time, they circumvent the architects' design by cutting trails directly through the green space. These patterns of cement sidewalks and trails are spatial representations of the tensions existing between agent and structure. They are also analogous to Inuit usage of domestic space in Canadian Arctic communities. Visiting with an Inuit family can reveal individuals sewing caribou hides in living rooms, or sitting on the floor of the kitchen eating muktuk (whale blubber) or dried caribou meat. Like the trail systems described earlier, these practices appear out of place because the spatial layouts of Euro-Canadian houses map out the routines and practices of a different culture. In both instances, architects have failed to take the needs of users into account, and agents have responded by using space according to their own needs.



Figure 1. Cement sidewalks and trails illustrate the difference between planned versus actual uses of space at the University of Calgary

Methodology

Different cultures have different concepts of ‘public’ and ‘private’, and this can influence how spatial behavior is expressed. Activities that require privacy, for example, are usually conducted in locations where the presence of others is low. Conversely, activities that are public tend to occur in locations where the presence of others is more likely. The probability of encountering others while moving through a building is determined by how the spaces within them are connected together (Hanson, 1998; Hillier, 1996, 1999; Hillier & Hanson, 1984). Spaces that are centrally positioned and well connected, for example, are easily accessible from other locations within the structure. These highly integrated areas tend to attract movement, and often function as public spaces (Asami *et al.*, 2001; Bafna, 2003; Hillier, 1996, 2004; Hillier *et al.*, 1993). The opposite is true of locations that are peripheral and poorly connected. Such areas are commonly used as private spaces because they are less accessible.

Space Syntax analysis was developed in the 1970s as a way of formalizing the relationship between spatial form and space use by means of topological graphs (Hillier & Hanson, 1984). A positional measure called Real Relative Asymmetry (RRA) quantifies the geometric properties of these topological graphs, which describe the layouts of buildings and settlements. This value is computed by calculating the average depth of each space (node) from all other nodes in the topological graph (Bafna, 2003, p. 25). Here, ‘depth’ refers to the number of turns along a path between one space and another (Bafna, 2003, p. 24). ‘Relative asymmetry’ (RA) is ‘mean depth’ expressed as a fraction of the maximum possible range of depth values for any node in the graph with the same number of nodes as the system (Bafna, 2003, p. 25). RRA is a ratio of the RA values of the nodes of a given system, and the RA values of the central node of an idealized diamond-shaped graph with the same number of nodes as the system (see Bafna, 2003, p. 25 for a more complete discussion of RRA). This ratio has been found to be a more realistic standard for comparing spatial systems of different sizes, such as houses with different numbers of rooms. Most current space syntax research utilizes ‘integration’ values, which are an inverse of the RRA values ($1/\text{RRA}$) (Bafna, 2003, p. 25).

Another way of understanding integration is as a normalized version of what social network theory calls ‘centrality closeness’—the degree to which an individual is near all other individuals in a network, either directly or indirectly. This concept is illustrated in Figure 2. In the spatial configuration (a), each room can be accessed from two adjoining spaces, so they all share the same level of closeness, or integration. However, in spatial configuration (b), the arrangement is changed. While rooms 2 and 3 can be accessed from two adjacent spaces, rooms 1 and 4 can only be entered from a single neighboring space. Spaces 1 and 4 are more segregated than 2 and 3 because the combined distance from either 1 or 4 to the three other spaces in the system (which is $1 + 2 + 3 = 6$) is more than that for either 2 or 3 (which is $1 + 1 + 2 = 4$).

Observational studies of human spatial behavior demonstrate that differences in integration determine how people are likely to distribute themselves in space. For example, a 1995 study of visitor behavior in London’s Tate Gallery showed excellent correlations between observed patterns of pedestrian movement and the integration values of various areas within the building (Conroy Dalton, 2001, p. 50). Within 10 minutes of entering the galleries, movement traces showed a marked tendency towards the more integrated left side of the building plan (Hillier *et al.*, 1993, p. 9).

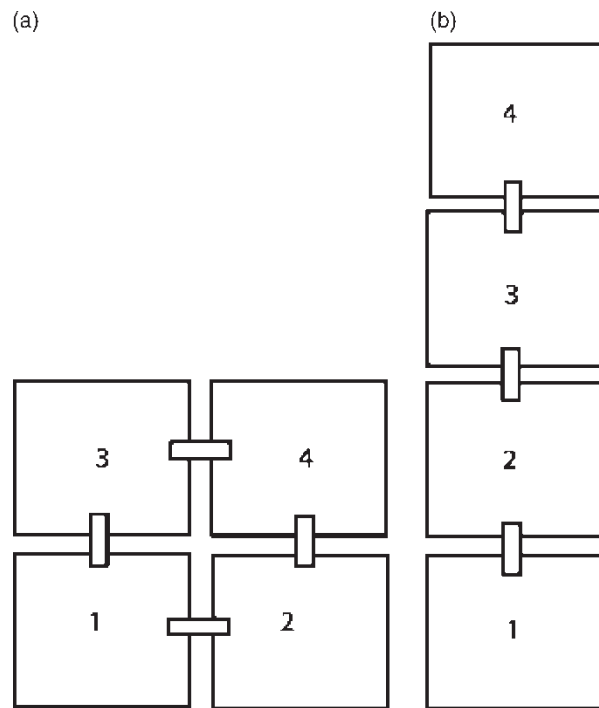


Figure 2. Two different configurations of space that alter the accessibility of rooms 1 & 4

For the purposes of this study, integration (centrality closeness) was used to forecast how people and their activities are supposed to distribute themselves within Euro-Canadian houses. These forecasts were then compared with how Inuit *actually* use space. This involved the following four steps:

- (1) Determining the integration values of rooms using Space Syntax software.
- (2) Observing the daily activities of a sample of Inuit households.
- (3) Mapping these activities onto the plans of their houses.
- (4) Comparing observation data with room integration values to determine the 'degree of fit'.

Several space syntax computer software packages are currently available for calculating the numerical integration values of rooms (nodes) from architectural plans. A program called Pesh was used in this study to measure integration values for various northern house models using blueprints obtained through archival research at the Nunavut Housing Corporation in Arviat, and the Canadian Mortgage and Housing Corporation in Ottawa. Care was taken to ensure that the houses used by Inuit families in the study had not been modified from these original plans. Figures 3a and 3b provide examples of the resulting integration maps for two of these northern house designs: an 'Access' 3-bedroom house (left) and a 3-bedroom 'Coldstream' house (right).² Pesh 'tones' each area within the house according to its integration value, and along a sliding scale from black (most integrated) to white (least integrated). The graphs used in this study reveal two attributes common among Euro-Canadian houses: they are highly compartmentalized, and they

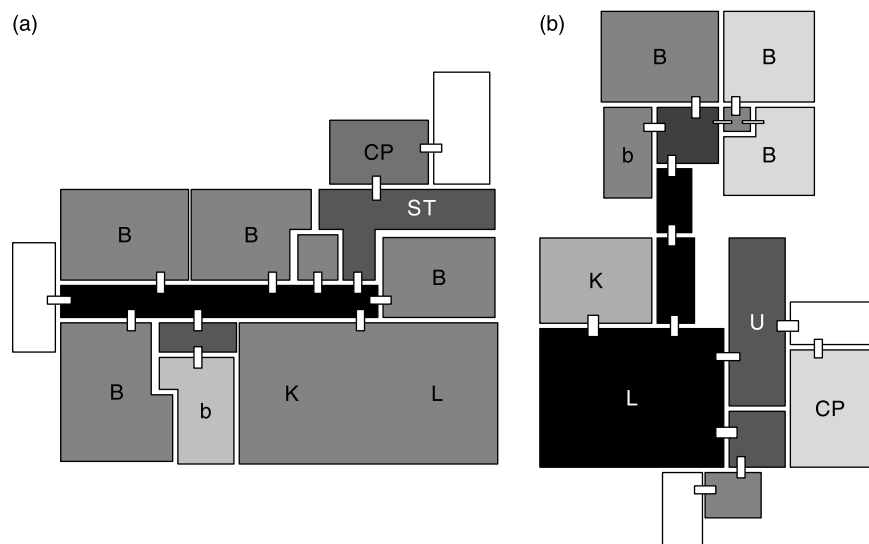


Figure 3. Floor plans shaded according to integration. Black indicates high integration, with values decreasing along a scale of grey to white, which indicate low integration. (L) Living room; (K) Kitchen; (B) Bedroom; (b) Bathroom; (ST) Storage room; (U) Utility room; (CP) Cold porch

express a greater tendency towards the spatial differentiation of activities, particularly in terms of function.

Next, the spatial behavior of 47 Inuit families was observed over an eight-week period in the community of Arviat, located in the *Kivalliq* Region of Nunavut (Dawson, 2004, 2003). Arviat is one of the most traditional Inuit communities in the Canadian Arctic. The number of *Inuktitut* speakers is extremely high, and many families continue to rely heavily on the land as a source of food and cultural identity. Conducting fieldwork in this community provided a fairly complete picture of the range of traditional and non-traditional activities practiced by Inuit households in this region. The observational methods used were developed specifically for use with space syntax software. Families were visited several times during the course of the day, so that the range of domestic activities they practiced could be captured. During each visit, the observer would walk from room to room recording all moving and stationary activities. These 'snapshots' were then recorded on a plan view of the house, and coded according to activity. Standard categories of activity include socializing, sewing, maintenance of hunting and fishing equipment, craft-making, cooking, eating, storing, and personal needs. These main categories comprise specific activities, which are summarized in Table 1.

The family activities recorded were next transposed onto the integration maps of their respective houses. Each category of activity was assigned the integration value of the room where it was most frequently observed. These activity values were then averaged and graphed in Figure 4. Activities are arrayed along the *x*-axis of the graph, and the averaged integration values are arrayed along the *y*-axis. Values below 1 tend towards increasing integration, while values above 1 tend towards increasing segregation (Hillier & Hanson, 1984, p. 113). The observed frequency of each activity category is listed as a percentage, and appears just below the trend line. Graphing the data in this way has a number of advantages; it quantifies and

Table 1. Actions and activities documented in the study

Activity	Action	Activity	Action	Activity	Action
Cooking	Char	Eating	Fresh Caribou meat	Other	Using computer
	Caribou		Dried Caribou meat		Operating small business
	Seal		Char	Personal Needs	Sleeping
	Beluga		Dried Char		Washing up
	Bear		Beluga		Brushing teeth
	Narwhal		Narwhal		Laundry
	Bannock		Bannock		Maintenance
	Cooking marrow		Country food	Snow machine	
	Northern store food		Tea/coffee	Boat	
	Miscellaneous country food		Store-bought food	Fishing nets	
	Hunting/Fishing		Butchering animals	Storing	Hides/hide clothing
Cleaning Char		Store-bought clothing	Playing with children		
Drying Char		Hunting equipment	Visiting with family and friends		
Preparing hides		Sewing equipment	Eating country food with family		
Making dry meat		Tools	Talking on CB radio		
Splitting bone for marrow		Toys	Listening to radio station		
		Char	Smoking/chewing tobacco		
Sewing	Hide	Bird eggs		Drum dancing	
	Cloth	Sea mammal			
Crafts	Carving	Northern store food			
	Jewelry	Large cooking pots			
	Wall hangings	Miscellaneous			
	Doll making				
	Miscellaneous				

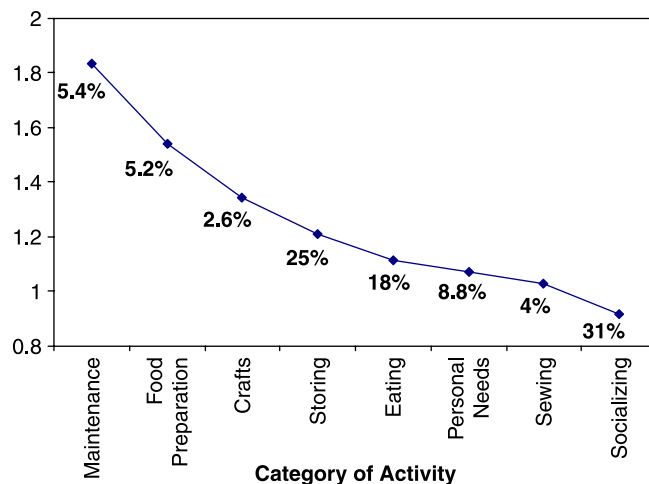


Figure 4. The spatial distribution of activity categories by integration

summarizes trends in Inuit spatial practices, and it provides a means of establishing the degree of fit between these spatial practices and the layouts of Euro-Canadian houses.

Results

The Importance of Integrated Space

The dominant socio-economic unit in Arviat is the bi-lateral extended family (Birket-Smith, 1929; Burch, 1986). In cognatic or bi-lateral kinship structures, individuals can use any combination of male and female kin to define their extended family networks. These family structures serve as social networks of mutual assistance, and are sustained through constant patterns of visiting. Field observations revealed that individuals regularly spend over 70 per cent of their time circulating among the houses of friends and family members. Individuals will often enter a house, join in an activity such as watching television, preparing food or playing with children, and then leave, only to be replaced by another visitor (Figure 5a). Hence, most Inuit activities incorporate some sort of socializing component because they serve to focus person-to-person interaction within an ever-changing assembly of people. Social interactions like these are vital in Arviat as they provide opportunities to plan and coordinate subsistence tasks, share food, hunting equipment and labor, thereby reaffirming feelings of security and identity. For these reasons, socializing was the most frequently observed category of activity in Inuit households. Figure 4 also indicates that socializing activities are drawn to highly integrated areas within the house, probably because these locations attract movement and create opportunities for close contact with others.

The Emphasis on 'Public' over 'Private' Space

Inuit families emphasize individual privacy to a lesser degree than Euro-Canadian families. This is expressed in Figure 4, where personal needs activities such as sleeping



Figure 5. Examples of socializing (a) and sleeping arrangements (b) observed in Inuit houses

were observed in integrated locations such as living rooms. The practice of families sleeping together as a unit was quite common in Arviat, and it was not unusual to see one or two large mattresses on living room floors (Figure 5b). At the same time, bedrooms were either unused, or functioned as children's play areas, storage rooms or workshops. Inuit respondents gave a number of explanations for this convention. Some families simply expressed a preference for sleeping together. As one respondent explained to me, "Inuit families are stronger than southern ones", and because of this, her own family had slept together in a single room when her children were younger. Now that her daughters have grown up, they continue this practice with their own children. A second respondent explained that it was easier for parents to attend to their children if they slept together rather than apart. Living rooms are ideally suited to this purpose because they are typically the largest space in the house.

At first it was thought that overcrowding might explain the prevalence of communal sleeping arrangements, as this is a critical issue in many Inuit communities. However, the same forms of spatial behavior were observed in houses occupied by single families. Communal sleeping arrangements are also quite common in hunting cabins outside of Arviat, where family members and guests typically occupy a large sleeping platform at the rear of the cabin. These observations, combined with the sentiments expressed by many individuals about the importance of togetherness, suggest that this practice is a spatial expression of the closeness of Inuit families. The fact that bedrooms are frequently used for purposes other than sleeping (i.e. workshops, storage areas) is further evidence that the spatial conventions of Inuit families are not reflected in Euro-Canadian house designs.

Traditional Food as a Focus for Social Interaction

Traditional foods are an important source of cultural identity to Inuit, and often serve as a catalyst for integrating families through sharing and interpersonal interaction (Wenzel, 1995). Figure 4 indicates that the consumption of traditional foods such as caribou, beluga whale, and seal, comprised 18 per cent of all observed household activities. Because traditional foods are shared and eaten communally, cooking and eating areas should not isolate people from one another as they move through the interaction process.

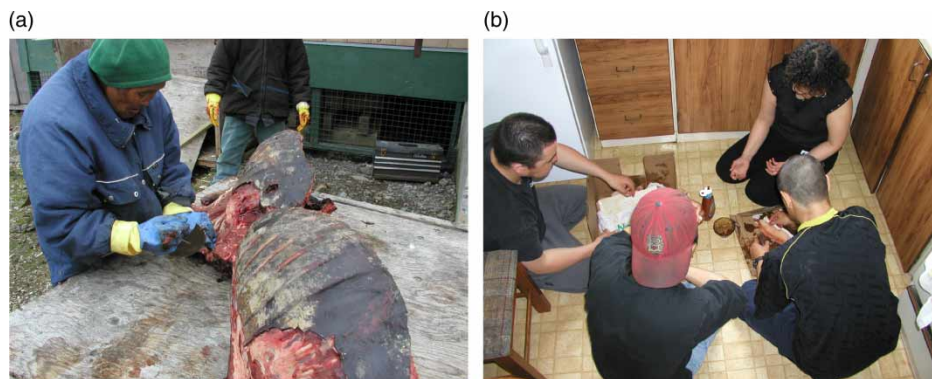


Figure 6. The preparation (a) and consumption (b) of traditional foods in an Inuit household

However, Figure 4 indicates that the preparation and consumption of traditional foods occur in different locations within the house. Why is this the case?

Items such as dried caribou meat and *muktuk* are messy and bulky, requiring large amounts of space to cut up. The pots used to boil these foods are also extremely large, and rarely fit into the kitchen cabinets found in most Euro-Canadian houses. As a result, it is usually necessary to prepare traditional foods in segregated areas such as utility rooms, cold porches or in makeshift tents pitched outside of the house (Figure 6a). Large pots of caribou meat, for example, are occasionally cooked on Coleman stoves outdoors because the small electric stove elements of most kitchens are inadequate. Interaction between family members is also hindered by the size of Euro-Canadian kitchens, which are often too small to seat larger Inuit extended families. This is because they have been designed with smaller nuclear families in mind. To maximize the amount of usable space, Inuit families will remove kitchen tables and chairs to make room for others, and consume food while seated on the floor (Figure 6b). Kitchen countertops and tables are also easily damaged by traditional foods, which are cooked and served in portions that are often too heavy for them to support. Softening dried caribou meat using a hammer and anvil stone can further damage kitchen furnishings. This is another reason why Inuit families eat traditional foods while seated on the floor. All of these observations demonstrate that the typical Euro-Canadian house is not designed to accommodate the preparation of many traditional foods, or the communal meal arrangements of Inuit families.

The Spatial Accommodation of a Hunting and Gathering Lifestyle

Inuit families in Arviat are heavily dependent on a land-based economy because traditional subsistence activities are meaningful, and high rates of unemployment make Western foods prohibitively expensive. Consequently, many household activities relate in some way to the acquisition of traditional foods. These activities include sewing, carving and the regular maintenance of hunting and fishing equipment.

Sewing is a critically important activity because hunters require clothing that is durable, warm and dry. While outdoor clothing is available at the Northern Store and the Co-Op store, many respondents consider these garments inferior to the ones they sew for themselves. Sewing tailored clothing is also an activity that women in the community take

great pride in. However, Inuit respondents lamented that there were few locations within the house that were suited to this activity. Inuit respondents explained that making caribou and seal skin clothing requires that sewing locations be cool and spacious. This is supported by Figure 4, which indicates that sewing activities were performed in well-integrated spaces such as living rooms and kitchens. However, the heating systems in most houses produce conditions that are too hot and dry for sewing animal hides, and other family members heavily use these integrated spaces. As a solution, Inuit women are often forced to schedule sewing for times when other family members were absent from the house. When this was not possible, bedrooms would function as makeshift sewing rooms. Occasionally, the furnace would also be shut off to reduce the dryness of the air. The challenges of scheduling sewing activities in overcrowded homes likely explain why sewing comprised only 4 per cent of the activities observed during the study.

Like sewing, carving and the maintenance of mechanized hunting/fishing equipment are essential to life on the land. Carving has become an important source of income for many Inuit families who use the money they receive to purchase items such as rifles, ammunition, all terrain cycles, boats and outboards. The carving of soapstone, bone, and antler into objects that can be sold is a noisy activity that requires well-ventilated spaces because it generates airborne dust particles (Figure 7a). For these reasons, Figure 4 indicates that Inuit carvers seek out poorly integrated areas where they are less likely to encounter others. In Euro-Canadian houses, these locations are typically unheated cold porches. Sometimes, carvers also construct small, unheated shacks outside of their houses. Like carving, the repair of motors, rifles, char nets, and other items requires large amounts of well-ventilated space. Because Euro-Canadian houses are not designed to accommodate such activities, they are usually relegated to the outside of the house.

Specialized items such as hide clothing, rifles, ammunition, and carving equipment must also be stored when not in use. As Western families rarely use such items, the often-unique storage requirements associated with them are seldom met by Euro-Canadian house designs. Items such as hide clothing, for example, need to be kept cool in order to prevent deterioration, and are usually stored in freezers and cold porches, when possible. The lack of adequate storage space means that Inuit families are often forced to store items in locations that are less than ideal. This behavior is reflected in Figure 4, which indicates that household items are kept in a range of moderately integrated areas. In the absence of



Figure 7. Carving (a) and storage (b) in an Inuit home

adequate storage solutions for Inuit families, houses often take on a 'cluttered' appearance that makes it difficult for the household to function efficiently (Figure 7b).

Discussion

The previous discussion demonstrates that Inuit families use space in ways that often do not match the functional categories that structure Euro-Canadian houses, such as bedroom, kitchen and living room. Instead, Inuit families emphasize 'centrality closeness' by 'lumping' the majority of their activities into one or two highly integrated spaces. Many families also express a preference for sleeping together as a unit in integrated rooms (living rooms), leaving more segregated rooms (bedrooms) unoccupied, or used as storage or work areas. Why might this be so? The high degree of centrality closeness displayed by Inuit families allows individuals to regularly access information through other family members. Such information is vital for sustaining the social networks of mutual dependence that facilitate such things as the planning of harvesting activities, arranging childcare, pooling labor and equipment and communally preparing, sharing and



Cleaning the table before mealtime.

Figure 8. An instructional cartoon used in home economics classes to illustrate Euro-Canadian home-making skills to Inuit families, ca 1960

consuming food. On the other hand, Euro-Canadian families 'scatter' their activities over a wider range of integrated and segregated spaces. Activities are often assigned to specific rooms, and families sleep apart and in separate areas of the house. Euro-Canadian families do not typically function as networks of mutual dependence in the same way as Inuit families, and therefore do not emphasize centrality closeness to the same degree.

The spatial behaviors documented in this study can also be understood as expressions of human agency, analogous to the 'trails' discussed earlier. Spatially, Euro-Canadian house designs define and facilitate the domestic practices of Euro-Canadian families. These practices, in turn, serve to reproduce the various economic, social, political, and ideological institutions of mainstream Euro-Canadian society. Paramount among these is the institution of the nuclear family, which emerged as a dominant socio-economic form in southern Canada, following the end of the Second World War (Miron, 1988). However, in Inuit society extended families are more the norm, and these family units engage in domestic practices that reproduce fundamentally different social structures. Historically, these practices have been discouraged through home economics classes, tenancy rules in public housing and house designs that are ill-suited to their requirements (Figure 8). Rather than let themselves be transformed by these obstacles into facsimiles of Euro-Canadian families, this study demonstrates that Inuit continue to use their houses as if they were traditional dwellings. These expressions of spatial agency have allowed many families to retain their cultural identities, as well as remain economically and socially viable within a semi-traditional lifestyle.

Observing how Inuit families operate spatially is highly instructive because it illustrates how houses *should* be designed to better accommodate the lifestyles and cultural values of Inuit families. For example, Figure 5 clearly shows that the Inuit lifestyle systematically distributes activities in the house according to the relative centrality (integration) of various rooms. This suggests that while Inuit families ignore the functional labelling of rooms, even when the labelling is supported by physical service infrastructure such as kitchens, they *are* sensitive to the syntactic characteristics of those spaces, both in terms of integration and visual exposure. This is a significant finding, since it makes the case that, even in those societies where a greater number of domestic activities are public, some syntactical structure is required in the house. For example, it would clearly be inappropriate, to design houses as large single rooms, even though this would seem to support the need for very public, multi-functional spaces that allow large gatherings of people. Instead, a more appropriate design strategy would be to increase the connections between rooms, creating more circulation 'rings', which reduce the privacy of individual rooms (since most can now be used as through passages), and allow for multi-functional uses of rooms.

Finally, observations of Inuit households in operation indicate that the ergonomic dimensions of traditional Inuit activities remain largely unsupported by current Euro-Canadian house designs. Floor plans and furnishings, for example, need to be modified in ways that are more suited to traditional cooking practices and communal meal arrangements, and storage solutions should be developed that acknowledge the traditional economic practices of Inuit families.

Directions for Future Research

Evidence-based design is slowly becoming an essential component of contemporary architectural practice and urban planning (e.g. Esber, 1986). Observing how human agents use space is the best way to anticipate and address their housing needs. Studying spatial

expressions of human agency, for example, allows housing researchers to identify instances where imported house designs are incompatible with the needs of indigenous families. Existing house plans can then be modified in ways that increase the life expectancies of housing stock by making them more culturally sustaining. The costs of not doing so are likely to be high. The performance of traditional activities in Euro-Canadian houses often leaves houses irreparably damaged. The boiling of caribou meat in large pots unleashes huge amounts of condensation into the air. Because building systems are not designed to cope with such practices, mold and mildew inevitably form on drywall and insulation. This severely reduces the life expectancy of northern houses, and exacerbates the housing shortages that plague many Inuit and First Nations communities in Canada. Therefore, designing houses to meet the cultural needs of their occupants is essential for another important reason—it ultimately lowers maintenance costs, which can then be redirected to construct more dwellings.

Attempts to design culturally sustaining houses have been successfully undertaken elsewhere. Examples include Esber's (1986) study of Tonto Apache (*dilje*) housing, and Waldram's (1987) research into the effects of settlement relocation in the Canadian Subarctic. In the case of this study, the Nunavut Housing Corporation and the Canada Mortgage and Housing Corporation are currently using the results to develop culturally sustaining house designs and housing programs for Inuit families in the Canadian Arctic. In a wider context, the exportation of Western housing to First Nations and Inuit communities in Canada, as well as to developing nations in other parts of the world, has been an ongoing component of humanitarian aid for many decades. An understanding of the social and cultural effects of house design on culture is therefore essential, and can be achieved using evidence-based approaches that combine spatial analysis with human agency.

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Notes

- ¹ Inuit also had to adapt to the bureaucratic and administrative structures that accompanied their new government houses. In 1965, the Canadian Government entered into a landlord-tenant relationship with Inuit through the Eskimo Rental Housing Program (Buchanan, 1981, p. 14; Duffy, 1988, p. 36; Nixon, 1984, p. 146). The program scaled rents to match the income of each family, and great pains were taken to explain the concept of rent and servicing costs to Inuit tenants. While an in-depth discussion of the repercussion of this lies beyond the scope of this paper, 'rent' and 'mortgage' remain poorly understood concepts among Inuit families even today (Redgrave, 1986, p. 126).
- ² The terms 'Access' and 'Coldstream' refer to two northern house models commonly found in Canadian Arctic communities.

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