Humanized Topography: Storytelling as a Wayfinding Strategy

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Abstract: Many foraging tasks involve wayfinding, for which topographical knowledge is critical. Strikingly, hunter-gatherer folklore frequently contains stories about the origins of topographical features. The features highlighted in these stories are often explained as transformed human agents or as the handiwork of human agents, raising the question, Why encode non-social information as social information? The evolution of language created the opportunity for humans to share topographical information, yet it is unlikely that humans are designed to input this information verbally: all ambulatory animals must process spatial information, and since humans are the only animals that have evolved language, language cannot be requisite to navigation. In contrast, the mind does appear to be designed to input social information—in part—verbally. We argue that harnessing topographical information to social information provides a means by which the former can be input, stored, and recalled verbally. *[cultural transmission, hunter-gatherers, oral tradition, spatial cognition, wayfinding]*

Introduction

A Nez Percé Coyote tale tells of seven giant brothers that lived in the Blue Mountains of Oregon and Washington. The people were terrified of these monsters because they ate children. No one in the tribe was strong enough to fight the giants, so the headman asked Coyote for help. Coyote dug seven deep holes and filled them with reddish-yellow, boiling liquid. The giants fell into the holes and, as they struggled to get out, splashed the red liquid around them "as far as a man can travel in a day" (Erdoes & Ortiz 1998:24). Coyote then punished the giants by turning them into mountains. At the base of these peaks, he made a deep gash in the earth, to form a barrier between the land of the giants and the land of the Nez Percé. "Today the mountains are called the Seven Devils. The deep gorge at their feet is known as Hell's Canyon at the Snake River. And the copper scattered by the splashings of the seven giants is still being mined" (Erdoes & Ortiz 1998:24).

This story illustrates a recurrent trend in the folklore of foraging peoples: salient features of the landscape are often associated with a story—specifically, with the actions of a human agent or an agent with a human psychology. The Kets, for example, believe that their mythological heroes (e.g., Great Al'ba, Ul'git) have "turned into a mountain range, river rapids, islands, and other forms" (Alekseenko 2000:457). This phenomenon results in a vivid link between topographical features on the one hand and human events on the other.

The first author discovered this pattern in the course of doing other research on the oral traditions of foraging societies. Her non-systematic reading of the literature suggested that this was a widespread phenomenon; for this paper, we sought to determine

whether it was a statistical universal, and if so, why the mind would encode topographical information as social information.

To this end, we analyzed a cross-cultural sample of folklore collections to see how many contained stories that encoded topographical information as social information (see Appendix 1). We used the collection as the unit of analysis because not all stories are expected to contain detailed topographic information, and not all such information is expected to be encoded as social information. To assemble the sample, we conducted a literature search of the University of Oregon Knight Library forager and forager-horticulturalist folklore holdings. To be included, a collection had to (1) consist of stories told by indigenous informants, and (2) constitute a bona fide attempt by the editor to collect a representative sample of tales from a given culture. The only exception to these criteria is Erdoes and Ortiz (1998), in which numerous tribes are represented and for which the editors selected stories dealing with a single subject (i.e., tricksters). However, because there is no reason to expect trickster tales to be biased with respect to our hypothesis, this volume was included in the study.

Obviously, there are limitations to the convenience sample approach. The sample is not random with respect to the universe of folklore tales that have been recorded, and leaves out many forager and forager-horticulturalist groups. However, the Knight Library folklore holdings were accumulated for reasons unrelated to the inclusion and form of topographical material in the narratives, and are therefore unlikely to be biased with respect to our argument. Moreover, our goal was not to analyze the relative frequency with which topographical information is included in a sampling of narratives *per se*, or the proportion of topographical references that are encoded as social

information (although the latter would have some usefulness). Rather, our goal was to determine whether or not topographical information is widely encoded as social information across foraging societies and, if so, why.

The search yielded 28 collections comprising 2,839 stories and spanning five continents: Africa, Asia, Australia, North America, and South America. None of the 28 collections was focused on stories about wayfinding; nevertheless, 24 (86%) of the collections contained examples of social encoding of topographic information. Evidence of this phenomenon was found in cultures from all five continents covered by the study, although the evidence for Africa comes not from a collection but from Guenther's (1986) discussion of Nharo folklore (see below). Social encoding of topographic information does therefore appear to be widespread across cultures and continents, and can thus be considered a "statistical universal" (Greenberg 1975:78)—that is, "a trait or complex more widespread than chance alone can account for" (Brown 1991:44).

The remainder of this paper attempts to account for this pattern. In the first section, we briefly situate this paper in larger anthropological and psychological context so that the reader is clear about what we are and are not arguing. Then, we explain the cognitive puzzle that social encoding of topographic information presents. In the next section, we describe and illustrate the humanized landscape phenomenon using examples from forager folklore. In the final section, we discuss the mnemonic advantages of storing topographic information as social information.

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Evolution, Function, and Culture in Brief

Anthropology arose with the seemingly simple scientific questions: what accounts for the similarities and differences amongst people? Because evolutionary, functional,

and cognitive approaches to culture have a long history, our argument might be confounded by assumptions regarding what we are and are not arguing. This is particularly the case since a lot of babies have been thrown out with the anthropological bathwater over the last century, to such a degree that many graduate students' view of their predecessors as little more than moralistic caricatures. Here then, is our brief. Early theories of cultural evolution (e.g., Lewis Henry Morgan 1877; Tyler) were rightly discarded: evolution does not proceed inexorably along particular lines (whether uni- or multi-linear, selection does not operate on the level of cultures, and, in any case, we didn't have enough information to generalize about these, even if they did exist. Nevertheless, people everywhere do face basic problems of harnessing energy, acquiring food, finding mates, caring for children and so on. Orthogenic evolutionism—the teleological progression toward definite ends-- is wrong, but Darwinian evolution, as Boas (1887, 1907), Lowie (190x) and others pointed out, is critical for understanding human life and culture: " evolution

How one does so is at least to some extent related to the options and resources available (i.e., Steward Boasian particularism alone

> "Ethnological phenomena are the result of the physical and psychical character of men, and of its development under the influence of the surroundings...'Surroundings' are the physical conditions of the country, and the sociological phenomena, i.e., the relation of man to man. Furthermore, the study of the present surroundings is insufficient: the history of the people, the influence of the regions through which it has passed on its migrations, and the people with whom it came into contact, must be considered." Boas 1887, *The Principles of Ethnological Classification.*

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Our basic argument is that we can better understand cultural phenomenon if we examine the problems our cognitive adaptations evolved to solve,

On this view, culture is the manufactured product of evolved psychological mechanisms situated in individuals living in groups. Culture and human social behavior is complexly variable, but not because the human mind is a social product, a blank slate, or an externally programmed general-purpose computer, lacking a richly defined evolved structure. Instead, human culture and social behavior is richly variable because it is generated by an incredibly intricate, contingent set of functional programs that use and process information from the world, including information that is provided both intentionally and unintentionally by other human beings.

Why Input Topographical Information as Social Information?

Evidence suggests that, among foraging peoples, narrative serves as a vehicle for storing and transmitting information critical to survival and reproduction (Biesele 1993; First Author 2001, 2006, 2008). Thus, it is easy to see why forager folklore might

contain information about local terrain: topographical knowledge is integral to navigation, and foragers traverse large spaces on a regular basis. Both hunting and gathering involve forays during which base camp is well out of sight, so both men and women must learn multiple routes to and from camp (New et al. 2006). At longer intervals, foragers move camp, sometimes traveling for several days. Camp may be moved several times a year, and camps revisited one or more times a year, which entails learning their relative positions. This information must be integrated with locations of and routes to seasonal resource patches. Foragers must also know the boundaries and relative positions of territories occupied by other groups in order to, among other things, meet up with other tribe members for rituals, raid (or avoid being raided by) enemies, and/or find a mate. Binford (1983:39), for example, notes that Nunamiut boys travel (usually with an older male relative) to become familiar with the land which will provide their sustenance as adults, but also to visit camps that contain unmarried girls (see also Gould 1982; MacDonald & Hewlett 1999).

In short, wayfinding is integral to foraging life, and we may thus expect humans to have evolved means of acquiring and storing information instrumental to this task, such as the relative locations of various landmarks, their distinguishing features, and any benefits or hazards associated with them (e.g., Silverman & Eals 1992; New et al. 2006). Given the costs of acquiring such knowledge firsthand, we would expect individuals to capitalize on opportunities to acquire it more efficiently. Verbal transmission provides one such opportunity, and as we will argue, s~~S~~torytelling may be a particularly useful way to convey such information~~provides just such an opportunity~~: indeed, narrative

enables individuals to efficiently acquire many different kinds of useful information (First Author 2001, 2003, 2006, 2008).

With respect to wayfinding, storytelling offers another advantage: not all parts of a forager's range are visited with equal frequency. The Beaver, for example, frequently let an area lie "fallow" for several years to give animal populations time to replenish (Brody 2002). Visiting other groups—common practice among hunter-gatherers (e.g., Lee 1984; Rasmussen 1931; Tonkinson 1978)--similarly entails foraging in infrequently-visited territory. A mnemonic device would facilitate navigation in such instances. Pfeiffer (1982) and Mithen (1990) argue that Upper Paleolithic cave art provided just such a mnemonic device—in this case, for retrieving subsistence information. Mithen (1990) argues that some of these images represent cues hunters use to locate and track prey. Noting that the animals most commonly depicted in these paintings are among the least represented in the faunal remains, he posits that these animals were hunted infrequently, and that the paintings functioned to reacquaint hunters with animal sign and behavior seen only at infrequent intervals. Similarly, the far corners of a forager's range are encountered relatively infrequently; landmarks and routes through these areas may fade from memory over time. Re-telling (or re-hearing) stories that reference these landscapes enables an individual to "return" to them periodically, mentally rehearsing the landmarks contained therein, their spatial relationships to one another, and/or the resources and dangers associated with them.

What is puzzling, then, is not that hunter-gatherer folklore contains topographic information, but that this information is often encoded as social information. The key to solving this puzzle is language. The emergence of language created an unprecedented

opportunity: through verbal exchange with conspecifics, humans could potentially acquire information about places they had never visited. The problem is, spatial cognition evolved prior to language, so the mind is not designed to input navigational information verbally. Humans use three basic means to find their way--dead reckoning, cognitive mapping, and piloting (Allen 1999; Hauser 2000; New et al. 2006; Silverman & Eals 1992)—none of which is dependent upon verbal information input or particularly well-suited to direct verbal transmission. Dead reckoning (also called *path integration*) involves continuously calculating the angle of change from one's starting point, as well as rate of speed and distance traveled; cognitive mapping involves referencing a mental picture of the relative positions of a set of points in space; piloting involves following a series of landmarks.

Some researchers argue that our navigational sophistication derives from having language: children's navigational abilities have a developmental trajectory similar to that of the acquisition of competence with words for spatial concepts ~~posit a relationship between the ability to represent space using words~~ (e.g., *above/below*, *inside/outside*, *left/right*)~~ and the ability to navigate~~ (Hermer & Spelke 1994, 1996). However, correlation is not causation, and it seems implausible, at the least, to imagine that children could acquire spatial word use competency prior to gaining competence with their underlying conceptual referent. Indeed, Kamil and Jones' (1997) work with Clark's nutcrackers indicates that these birds retrieve cached seeds by referencing a mental representation of a position between landmarks—something akin to "the middle"—all without the benefit of language. Although the literature on the various and complex navigational abilities of non-human animals is too vast to review here, a~~A~~s Hauser (2000)

observes, all animals must process spatial information and, consequently, all animals must have specialized mental tools that enable them to navigate. Since humans are the only animals that have evolved language, language is clearly not requisite to navigation, and prior to the evolution of language humans therefore must have had specialized mental tools enabling them to navigate.

If the human mind is not designed to input topographic information verbally, we would predict that use of verbal instead of visual-spatial cues would lead to comparatively poor navigational performance. Tellingly, research finds no correlation between verbal and wayfinding ability. Thorndyke and Stasz (1980), for example, found that use of a visuo-spatial strategy to retain environmental information resulted in more effective wayfinding than reliance upon verbal rehearsal or verbal mnemonics. Fenner et al. (2000) examined the relationship between wayfinding competency, visuo-spatial (V-SA), and verbal ability (VA) among two groups of children, ages 5-6 and 9-10. The groups were sub-divided into high VA/low VA and high V-SA/low V-SA groups. In both age groups, verbal ability had no effect on wayfinding performance. In contrast, younger children who scored high on V-SA tests also performed better on wayfinding tasks, although for older children results were not significant. Fenner and colleagues conclude that topographical knowledge "may be represented in both an analogue, visuo-spatial format and in an abstract prepositional code" (Fenner et al. 2000:168; see also Cohen 1996), not in a verbal format.

A spontaneous field experiment (alas, with no controls) testifies to the robusticity of the visuo-spatial format for cognitive mapping: Rasmussen (1931) reprints several maps that he asked his Netsilingmiut informants to sketch for him, commenting that,

"Though they had no previous knowledge of paper and pencil, they were remarkably quick in outlining the shape of their great country, and, having done so, could put in all the details with remarkable certainty. . . . all islands, peninsulas, bays and lakes are reproduced so accurately, that finding one's way from place to place is an easy matter" (1931:91).

Piloting, too, is highly dependent on visual input (e.g., seeing landmarks from different angles/distances and in different light/seasons). For example, when Yiwara males are initiated, they are sometimes taken to a sacred place and taught the songs associated with it; the associated ritual involves looking around carefully to register every detail of the topography and vegetation, as well as "backsighting"—periodically looking back over the shoulder when leaving so that initiates will recognize the site if they return (Gould 1969).

Path integration is similarly divorced from verbal input mechanisms. With this method, the angle of change from one's starting point and the distance traveled are calculated by using velocity and acceleration information. Velocity information is acquired through internal and external cues. Internal cues include impulses sent from the nerves to the musculature and impulses sent from the musculature to the nerves; external cues include optic and accoustic flow. Acceleration information is acquired through the sensing of linear and rotary accelerations via vestibular and somato-sensory cues, such as pressure against the skin. This information is then used to calculate displacement relative to starting position (Loomis et al. 1999). Famously, path integration coupled with knowledge and sensitivity to the feel of currents, rebound of waves breaking on distant shores, and astronomical patterns are critical for long-range inter-island navigation

among Caroline Islanders of Puluwat (Goodwin 1970). The fact that navigators must stay awake for the journey, sometimes for days, suggests that verbal transmission of this continuously changing spatial information is not readily transmitted verbally.

Because navigation mechanisms are designed for non-verbal inputs, verbal wayfinding inputs may be difficult to encode, and resistant to long-term memory storage and/or recall. This is a problem: if you can't efficiently store/retrieve wayfinding information acquired from others, it can't be available to you for future use. One way around this problem is to store the information visually, in the form of a map (made, e.g., on rock, dirt, bark, or hide). However, we are unaware of any ethnographic evidence that foragers use portable (e.g., hide, bark) maps. As for non-portable (e.g., rock, dirt) maps, these must be memorized, and whereas Rasmussen's experiment suggests that the mind readily stores and retrieves information about *known* places in map format, we know of no evolutionarily relevant study that tests how well maps of places a person has never seen are retained in memory, although we expect it is easier than recalling verbal directions per se.

A verbal solution to the wayfinding information sharing problem is to link verbal descriptions of topographic features to highly memorable information that language is well-suited to transmitting. Social information fills this bill nicely: evidence suggests that the human mind is designed to input social information—in part--verbally. Gossip is a human universal (Barkow 1992; Boyer 2001; Brown 1991), used to acquire and transmit social information and to manage reputation (Emler 1990, 1992). Indeed, Dunbar (1996) argues that language evolved for the express purpose of gossiping, driven by increased group size and the concomitant pressure to maintain a greater number of

alliances. Thus, harnessing topographical information to social information provides a route by means of which the former can be input, stored, and transmitted verbally.

Cross-Cultural Overview of Humanized Landscapes in Forager Folklore

Humanized landscapes might initially appear to be instances of metaphor, but they are more than that. Naming a rock formation "penis rock" involves the use of metaphor, but naming a rock "owl his penis it sits" (Goodwin 1939:179) and tacking on an explanation of why it sits there goes beyond analogical reasoning. In the story alluded to here, Big Owl's penis is so large that he has to wrap it around himself and carry it everywhere he goes. This is inconvenient and tiresome, so he decides to trim it to a more manageable length. He climbs to the top of a big rock, hangs his penis over the edge, and cuts it with a smaller rock. Afterward, he coils the remnant around the base of the big rock, and covers it with pebbles and dirt so no one will see it. The story ends, as many stories with humanized topography do, with an assertion that the landmark can still be seen: "The rock where Big Owl cut his penis off is still there. . . . You can still see the rock on top of the big one, with which Big Owl cut himself. Around the base of the big rock his penis is still coiled and piled on top of it are the small rocks and dirt he put there" (Goodwin 1939:179). This seemingly gratuitous grafting of social information onto descriptions of topographical features is what interests us here.

The Dreamtime is perhaps the most elaborate example of the linkage of topographic features with human agency. According to Tonkinson, the Mardudjara are familiar with hundreds of these myths, many of which recount the wanderings of ancestral, creator beings, "their encounters with others, their hunting and gathering, and

their naming and creation of the many sites they visited" (Tonkinson 1978:89). The exploits of the Two Men (cross-cousin companions who traveled as lizard-people) are but one example:

> Two Men traveled on and made camp at Dibil waterhole. Next morning, they got up and went hunting. They spotted some dingoes lying down in the shade. They crept close, then speared and killed them. They gutted them, threw away the guts, picked up the livers then threw them down and they turned to stone . . . you can still see the livers at that place. . . . They named that spot Bunggulamangu then headed off in the direction of their home country. En route they camped at Birli rockhole, then went on to Djiluguru, their main camp. There they . . . went hunting in the afternoon. They climbed a high sandhill to sit down and rest; as they sat they untied their beards . . . which unrolled along the ground. . . . Their beards turned to stone; you can see those two rocks there now. They returned to camp and lay down, but a large rock was blocking the sun so they split it open, and called it Mulyayidi. (Tonkinson 1978:90)

The journeys described in these tales canvass territory that is unfamiliar to many members of the audience. In so doing, they "broaden the cosmological and geographical outlook of the Aborigines and give them a feeling that they know those areas" (Tonkinson 1978:89).

The creation of landmarks by a human agent or agents in the course of a journey is a common motif in forager oral traditions. For example, Guenther reports that the

"most common theme of Nharo myths and tales is the theme of creation," including "meteorological and topographical features" (1986:225). Many of these features—e.g., waterholes, pans, and riverbeds--are the result of pranks performed by the trickster //Gãũwa on his travels throughout the Kalahari. At the end of the Yanomamö cycle of the brothers Omamë and Yoasi, Omamë is frightened by an antbird and flees with his family, never to be seen again. In the process, he creates the mountains that demarcate the present-day Yanomamö world:

> While Omamë was fleeing . . . he threw behind him *hokosikë* palm leaves, planting them in the ground: *kosssssi*! These leaves immediately turned into mountains. Those are the mountains that can be seen rising in the forest. . . . He planted all those mountains in his flight. First he planted Wërɨbusimakë—*koshshshshsho*!—then Hakomakë—*thikë*—then Arimamakë—*thikë*--then Waimamakë—*thikë*!—then Oroikɨkë—*hou*! *thikë*!—Takaimakë—*hou*! *thikë*!—Rëbraikɨkë—*hou*! *thikë*!—then Ruëkɨkë—*hou*! *thikë*!—then Waroroikɨkë—*hou*! *thikë*! . . . What other mountains did he create? Oh, yes! Arebëthamakë—*thikë*—and Tireikɨkë—*thikë*! That was how, in primeval times, Omamë planted the mountains and fled in the direction they still mark. That is what the old people told me. It was in that direction, over there. He fled downriver and crossed the river Barimi u and the river Aru u where they are large. . . . He fled toward the river Aru u, where the forest ends, where there are no more trees, where the earth becomes sand. (Wilbert & Simoneau 1990:417-18)

By linking discrete landmarks, these tales in effect chart the region in which they take place, forming story maps. As Basso observes in her work on the Kalapalo, “The land is well used and well known, marked by . . . ancient stories that describe how lakes, rivers, and rapids came in to being” (1995:33). Similarly, Washo mythology references the geographical features that make up the Washo world, which was traditionally centered around Lake Tahoe:

> Each creek flowing into the lake [Tahoe], each stand of trees or outcropping of rocks or lake in the high valleys is associated not only with the secular history of their people but with the sacred myths of the creation of the Washo world. At Emerald Bay, the mischievous companions, the long-tailed weasel and the short-tailed weasel, performed some miracle or committed some misdemeanor. The mysterious and malevolent Water Baby spirit lives in the Carson River, and a monster inhabits a sacred spring near there. In the heights beyond the lake, the dangerous wild men, half man and half demon, still roam. And in a cave above Double Springs the terrible one-legged giant Hanawuiwui lives. (Downs 1966:2)

The Salishan cycle of the Transformers Qwa’qtqwEtl and Kokwē’la makes explicit the relationship between wayfinding and subsistence, linking specific landmarks with important resources. The Transformers camp on the west side of the Fraser River, near Lytton: “Their camping-place may still be seen in the shape of a large flat rock” (Teit 1917:16). At this same place, a spring is created: “Since he had no water, Kokwē’la drove his staff into the ground; and when he withdrew it, water came out, and runs to this

day" (Teit 1917:16). After this, the Transformers part ways, and Qwa'qtqwEtl and his brothers travel up the south side of the Thompson River. Qwa'qtqwEtl throws a cannibal's wife into the hills above Botani Valley, declaring that "'Henceforth you shall be a short-tailed mouse, and your food shall be roots. At the place where I put you these will be in great abundance'" (Teit 1917:17).

This pattern continues with the brothers' next stop, the mouth of the Nicola River, where Qwa'qtqwEtl catches a big trout. After they have eaten it, Qwa'qtqwEtl throws the bones in the river, declaring that trout shall henceforth be abundant here: "This is the reason why the river near Spences Bridge is now a famous *tsô' .la* [trout] ground" (Teit 1917:18). The brothers then travel up the Nicola Valley, where they transform a hunting party "going up a hillside, one behind the other. They may now be seen as a long row of bowlders [sic] on the side-hill" (Teit 1917:17). A war-party transformed "[a]bove this place, on the south side of the river, near Nai'Ek" may be seen today as "pinnacles of clay in a bluff at this place" (Teit 1917:18). In this same location, the brothers transform Coyote's bed into stone, and Coyote transforms their tracks into stone, "which may all be seen there at the present day" (Teit 1917:18). The brothers then fill the Nicola Valley with beavers, and the Upper Nicola Valley with elk. The story of the brothers' journey forms a mental trail, identifying landmarks (e.g., river mouth, boulders, clay pinnacles, tracks in stone) that are near important resources (trout, beaver, elk), as well as their relative positions.

When visibility is low (e.g., due to dense foliage, high cliffs, fog, falling snow), auditory and/or olfactory cues may be used to navigate (Loomis et al. 1999). Interestingly, some tales identify landmarks by sound. For example, the Karok story

"Rolling Head" identifies a spot on the Salmon River, in part, by the noise that it makes. The people catch the head in a basket trap and sink it in a river: "Arareiyunkuri (where they poke a person in) is (the) place they put the head in. This is on Salmon River just above Oak Bottom on (the) left bank as one goes upstream. The water can be heard roaring always at this place" (Kroeber & Gifford 1980:139).

In addition to locating resources, topographic information is useful for avoiding threats, such as hazardous terrain and inclement weather. A Selknam tale, for example, relates the perils of traveling over the mountains of Tierra del Fuego. In the course of abducting North's beautiful daughter, South is pursued by the irate father and his men. As they are crossing the southern mountains, South lets loose a violent storm, and North responds in kind: "The ground became extremely slippery; they were constantly sliding downward. . . . When they sought to climb the mountain, exerting enormous effort, they more often than not fell down again. They hurt themselves badly and were too weak to stand on their feet" (Wilbert 1975:53). Commenting on the story, Wilbert notes that the "constant battle of the winds, the sharp contrast in weather between north and south has here been beautifully appraised" (1975:55). Similarly, a Caribou tale contains critical information regarding a river that bisects a trade route. In the story, a man being chased by a bear draws a line on the ground with his middle finger, causing a river to spring forth. The storyteller notes that, "It is a river that seems to spring straight up out of the earth, and not from any lake. And so deep is it, and so powerful the current, that it is impassable when the snow begins to melt in spring" (Rasmussen 1930:81).

In mountains and canyons, falling rock can cause injury or death, a hazard that appears in a variety of indigenous North American cultures as the rolling rock tale (e.g.,

Beckwith 1938; Opler 1938). A Salishan variant tells of a place in Upper Utā'mqt territory where a boulder kills people by rolling on them. Coyote sticks his double-headed arrow-flaker in the ground, causing the boulder to fracture when it hits the point. Today in "this place there is a patch of sharp fragments of white rock" (Teit 1917:10). Stories may also map places of refuge. A Mandan-Hidatsa informant offers an example: "As you come down the Little Missouri there is a high butte on the edge of the river called Snake-people butte because when the Gros Ventre chased a group of Shoshone (called Snake people) they took refuge there" (Beckwith 1938:304).

Interestingly, one of the four collections that lacked stories in which topographical information was encoded as social information was a volume of Mataco folklore (Wilbert & Simoneau 1982). The Mataco live on the Gran Chaco flood plain, where annual floods regularly alter river courses and even wash away villages. Under such conditions, permanent landmarks are likely to be scarce; accordingly, one would expect stories about permanent landmarks to be scarce as well.

Mnemonic Advantages of Humanizing the Landscape

Thus far we have discussed the challenges inherent in acquiring topographical information from conspecifics; in this section, we address the problem of retrieving that information from memory stores once it has been acquired. Linking topographical information to social information makes the former available to what are in effect two powerful mnemonic devices. Boyer's (2001) discussion of religious concepts points to the first of these. He argues that attributing human characteristics to natural objects (or vice versa) violates expectations generated by intuitive ontological categories; thus,

concepts that do this are very attention-getting and memorable. For example, the Aymara believe that a certain mountain eats the sacrifices of meat that they offer it. The mountain is like other mountains except for this one special feature (i.e., digestion) that does not normally apply to its ontological category (i.e., natural object). Linking social information with topographical information involves a similar violation of intuitive expectations. Giants that turn into mountains and penises that turn into stone violate the expectation that people and animals (or their constituent parts) are made of tissue. Causing a river to spring forth by thrusting a stick into the ground violates the expectation that natural phenomena are caused by natural forces. Turning a cannibal's wife into a mouse violates the expectation that species membership is constant.

The second mnemonic device at play in humanized topography is social cognition: representing topographical features as the product of human action evokes problems associated with social relations, thereby activating psychological mechanisms dedicated to tracking the thoughts, feelings, and behavior of conspecifics. Depending on the behavior(s) represented in a given story, this may include mechanisms dedicated to theory of mind (Baron-Cohen 1995, 2005; Leslie 1987, 1991, 1994), kin selection (Hamilton 1964), cooperation (Axelrod & Hamilton 1981; Cosmides & Tooby 1992, 2005), tactical deception (Byrne & Whiten 1988; Whiten & Byrne 1997), mate selection (Buss 1989; Symons 1979), sexual jealousy (Daly et al. 1982), mating and parenting strategies (Buss 1994; Buss & Schmitt 1993; Geary & Flinn 2001; Hrdy 2001; Lancaster & Lancaster 1983; Thornhill & Palmer 2000), incest avoidance (Lieberman et al. 2003, 2007; Shepher 1971; Wolf 1970; Wolf & Huang 1980), and homicide (Daly & Wilson 1988), among others.

A few examples will serve to illustrate the arresting social issues linked with topographical features. The Mardudjara myth of the Minyiburu women links an otherwise innocuous site with rape, bestiality, and murder. This tale recounts the pursuit of the Minyiburu women by Nyiru, a man with a huge penis and a voracious sexual appetite. The women are camped at Giinyu when they see Nyiru coming; they flee in panic, accidentally leaving two of their party behind. Nyiru rapes these two unfortunate women to death, as well as a dingo named Giinyu. The dog later gives birth to hundreds of pups, who dig themselves nests all over the site, which consists of pitted sedimentary rock (Tonkinson 1978:51).

An Iglulik tale links a solitary stone with warfare, abandonment, and destitution. In this tale, a man from Amitsoq is killed, and when his fellows go to Aivilik to avenge him, they are taken by surprise and killed. The men of Aivilik divide all the Amitsoq women among themselves except for an older woman named Inukpaujaq. Since no one wants her, she wanders off to Haviland Bay. There she sees a man in a kayak and asks him if she can be his wife, but he tells her he doesn't want a wife who is getting old. Upon hearing this, she sits down and begins to stiffen with grief, eventually turning into stone (Rasmussen 1929:302-303).

Finally, the Juruna story of Uaiçá packs an emotional wallop worthy of prime-time television, combining infidelity, sexual jealousy, vengeance, and attempted murder. Uaiçá is a young man who acquires many powers and uses them to help his people. Unfortunately, his wife sleeps with another man, whereupon Uaiçá transforms her and her lover into animals. This angers his father- and brother-in-law, who decide to kill him. The brother-in-law sneaks up behind Uaiçá in order to strike him with a cudgel. Uaiçá

dodges the blow, which hits a rock instead and splits it open. Uaiçá dives into the crack and leaves his people forever: "Uaiçá still lives there at the Pedra Seca [dry rock], the rocky island in the middle of the Xingu River. All his belongings are still there. They have all turned to stone" (Boas & Boas 1970:146).

Discussion

Perhaps because it is rooted in social information (First Author 1996, 2005, 2008), narrative, too, is a powerful mnemonic device (Sperber 1994). One of Beckwith's (1938) informants recounted all the places he knew as a result of his experience as a war-party scout, recalling landmarks in terms of stories associated with them. For example, he tells her that, "North-east of this Willow butte there is a small butte where you can see the site of the dwelling of Old-woman-that-never-dies. They call this Grandmother's-lodge-butte. This was her original home. Below that is the Short river; on the south side is Red butte where the snakes were killed *in the story*" (1938:306; our emphasis). Beyond White-earth-creek is a range of hills linked to another story: "at an elbow in the range is a big spring. *The story is* that once an enemy was killed close to the spring. When they went through a second time they killed a beaver and on one of its claws was a ring, so they think the enemy turned into a beaver. Hence they call this country Turns-himself-into-a-beaver" (Beckwith 1938:307; our emphasis).

The memorableness of narrative has profound implications for the study of the human foraging adaptation. Information exchange is integral to success in the hunting-and-gathering niche (Boyer 2001; Kurland & Beckerman 1985; Tooby & Cosmides 1990; Tooby & DeVore 1987). As Biesele notes, "Basic to the adaptation which solved

the problem of living successfully under these [foraging] conditions are first, detailed knowledge and second, devices for remembering and transmitting it" (1993:41). Narrative offers a portable, readily accessible, energy-efficient means of acquiring, storing and transmitting information. Conceptualizing storytelling as an information technology that developed in the context of hunter-gatherer life leads to predictions regarding the kinds of information the mind is designed to process, store, and transmit to others. For example, Sobel and Bettles (2000) show that Modoc and Klamath myth provides a profile of subsistence risks and the coping strategies used in response to them, and the first author (1996, 2001, 2005, 2006, 2008) shows that, cross-culturally, foraging peoples use storytelling to transmit information relevant to subsistence, predator avoidance, and social relations. Given evidence that foragers acquire most of their skills and knowledge from others (Hewlett & Cavalli-Sforza 1986; Ohmagari & Berkes 1997), understanding the ways in which storytelling subserves subsistence and social relations can shed light on broader issues such as human evolutionary life history (e.g., encephalization, prolonged juvenility, longer life span) and cultural transmission (e.g., social learning). Although modern foraging cultures are not an exact facsimile of ancestral human life, studying their oral traditions may be as vital to understanding the evolution of the hunter-gatherer niche as studying their settlement patterns, subsistence strategies, and social organization.

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Appendix 1: Folklore Collections Used in Study

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N = 2,839
* Indicates collections that contained no tales with humanized landscapes.