A Newly Documented Whole-Sky Circumpolar Constellation in Alaskan Gwich'in

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Abstract. Traditional approaches to the documentation of indigenous astronomical knowledge often assume a one-to-one or near one-to-one correspondence between indigenous and classical constellation terms. Only a single constellation, equated with the Big Dipper, is robustly attested across the Northern Dene languages. Here we provide evidence from Gwich'in (Dene) that shows that the equation of this single Gwich'in constellation with the classical constellation is only partial. The Gwich'in constellation *yahdii* is actually a whole-sky constellation that maps nearly the entire sky. The Big Dipper is the tail of *yahdii*, and the remaining stars in the constellation are identified by other Gwich'in body-part terms, forming a unified functional conceptualization of the sky. Our work demonstrates how observational and cultural biases can prejudice the description of cultural astronomy. Dene astronomy is much richer than has been previously claimed and provides the first well-documented indigenous example of a whole-sky constellation.

Introduction

The Arctic is often claimed to be lacking in a rich cultural astronomy. In his classic ethnography of Gwich'in, McKennan (1965:73) reports that "my informants said their people had never been much interested in the heavenly bodies, and this is borne out by the paucity of starlore among the Chandalar Kutchin." Birket-Smith (1930:78) makes a similar observation regarding Dene-Sųłine (Chipewyan), claiming that "the astronomical knowledge of the tribe . . . seems to be only very small." Some authors have justified this claim in terms of environmental (Pearce 1993) or geographic (Kursh and Kreps 1974) factors, while others assert an indigenous disinterest in the sky (McKennan 1959; Spencer 1959). This latter assertion seems particularly implausible in the arctic context; prior to the emergence of clocks and artificial light, the night sky was the dominant environmental feature for indigenous cultures in the north for at least half of the year. In addition, objects in the sky would have been the most consistent and reliable features of the environment for use in the development of indigenous time-reckoning systems.

Whatever the proposed justification is, cultural astronomy has been largely ignored by ethnographers of Alaska. In part this oversight may be circumstantial. McKennan (1965) acknowledges that his field work was carried out

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during the late spring, during which time he did not have the opportunity to observe the night sky. However, many of the most ethnographically rich dictionaries of Alaskan languages are vague as to the identity of the constellation names found among their entries.[1] The paucity of documented indigenous astronomical knowledge is particularly striking among the Northern Dene (Athabascan) languages, where only a handful of named constellations have been previously recorded (McKennan 1959).[2] Although the classical constellations of the zodiac spread widely across both the Old and New Worlds over a period of some five millennia (Baity 1973), these constructs are largely absent in Alaskan cultures. Instead, just one constellation term is robustly attested across the Northern Dene languages: Gwich'in *yahdii* and cognates thereof are found in at least 17 of the Dene languages (see Table 2).[3]

The Gwich'in constellation *yahdii* and its cognates in related languages are usually identified with the constellation Big Dipper (within Ursa Major), but there is some evidence in the literature that this term actually references a much larger group of stars. This is stated obliquely in nineteenth and twentieth century ethnographic reports. Jetté (ca. 1905) refers to "legs . . . formed by the minor stars in front of the pointers" of Koyukon *naagheltaale* (Big Dipper). And a more recent recording of Gwich'in speaker Frank Ginnis clearly states that "*yahdii* covers all the skies" and includes distinct asterisms named using body-part terms (Mishler and Ginnis 1986). Additional evidence for the broader denotational value of *yahdii* can be found in the use of body part terminology to refer to individual stars or star groups (asterisms) within constellations. In Dene languages, for which such body part asterisms have been documented, the handle of the Dipper is denoted by the body part term for "tail." While this could reflect a conceptualization in which the Big Dipper itself is an animal constellation, it also suggests that the Big Dipper may represent only one part of a larger constellation that includes other stars and star groups identified by other body-part terms. In the arctic winter sky the Big Dipper is located far overhead, surrounded by stars leading off toward the horizon in every direction. That the Big Dipper would be named while the entire surrounding sky remained largely unnamed is at least remarkable, if not improbable.[4]

The Tailed Man, *Yahdii*

The task of documenting cultural astronomy in Alaska is complicated by recent rapid language shift, and this may partly explain previous claims regarding the paucity of astronomical knowledge in the Arctic. It is likely that much indigenous knowledge of the sky has been lost in the past few decades, as modern technology has replaced every aspect in which astronomy was formerly utilized. However, it is nonetheless still possible to reconstruct knowledge of the arctic sky by combining archival research, ethnographic interviews, and a thorough knowledge of scientific astronomy. In the case of Gwich'in, we were fortunate to be able to consult speakers who learned about the sky at a very young age. One speaker with whom we consulted recalled being taken out every clear night by his great grandmother to talk about the stars. By discussing archival documentation with several speakers in the primary Alaska Gwich'in settlement of Fort Yukon (located just north of the Arctic Circle at latitude 66.3345 N), we were able to tease out the nature of *yahdii*, the Tailed Man.

Over the course of several nights our consultants took us outdoors and identified each of the asterisms in the constellation by direct observation.[5] In some instances specific stars or star groups were identified and named, such as *tł'ǫhts'ąįį vidzee* (his left ear), comprised of Castor and Pollux in the classical constellation Gemini. In other cases only general areas of the sky were identified as belonging to a body part, such as his left and right legs and body. We have identified 13 individual asterisms within *yahdii*, each named using a Gwich'in body-part term (Table 1), although in four cases we have not yet precisely identified each individual star within these asterisms.[6] A 14th asterism is identified as "yahdii's knife," and the Milky Way is referred to as "yahdii's trail." In all cases the names and locations of the asterisms were confirmed independently with several Gwich'in speakers.

The constellation *yahdii* is comprised of stars that span more than 133 degrees across the sky, all of which are circumpolar or nearly so at the latitude of Gwich'in country (Fig. 1). In the Gwich'in knowledge system, *yahdii* is envisioned as a tailed man crouching face down above the earth with head turned toward his right and holding a crooked knife in his left hand. Stargazers therefore observe the ventral side of *yahdii*. The two back feet and two front hands appear as low-altitude asterisms, each located in separate quadrants of the sky, while the tail and body are located directly overhead in the Big Dipper. Left and right hands, feet, ears, and legs are distinguished using Gwich'in terms *tł'ǫhts'ąįį* (left) and *shreets'ąįį* (right), applied from the point of view of *yahdii*. In addition, the asterisms that delineate the hands, feet, and ears are each easily recognized as bright pairs of stars. To an observer in Gwich'in country, *yahdii* appears to rotate sunwise or from east to west with his head facing his direction of travel. In the Gwich'in language, this is described as *yahdii ahaa*, literally "yahdii is walking."

Table 1. Identification of asterisms within the Gwich'in constellation y*ahdii.*

Asterism	Translation	Stars
vitsi'	his tail	Big Dipper (within Ursa Major) [A]
tł'ǫhts'ąįį vanli'	his left hand	o Leo (Subra), α Leo (Regulus) [B]
shreets'ąįį vanli'	his right hand	γ And (Almaak), β Tri [C]
tł'ǫhts'ąįį vatth'an'	his left leg	specific stars not yet identified [D]
shreets'ąįį vatth'an'	his right leg	specific stars not yet identified [E]
tł'ǫhts'ąįį vidzee	his left ear	α Gem (Castor), β Gem (Pollux) [F]
shreets'ąįį vidzee	his right ear	α Aur (Capella), β Aur (Menkalinan) [G]
vanhtral	his snout	Messier object 45 (Pleiades) [H]
vindee	his eyes	specific stars not yet identified [I]
viki'	his head	all stars in the ears, eyes, and snout
vatthąį	his body	specific stars not yet identified [J]
tł'ǫhts'ąįį vakwai'	his left foot	α Boo (Arcturus), η Boo (Muphrid)[K]
shreets'ąįį vakwai'	his right foot	α Cyg (Deneb), γ Cyg (Sadr) [L]
(vigwiitsii)[7]	crooked knife	γ Leo (Algieba), ε Leo (Algenubi), ζ Leo (Adhafera), η Leo (Al Jabhah), μ Leo (Rasalas) [M]
vatąįį	his trail	Milky Way galaxy

Stars identified by Bayer designation abbreviation, followed by common name in parentheses. Uppercase letters in brackets following star names refer to locations in Figure 1.

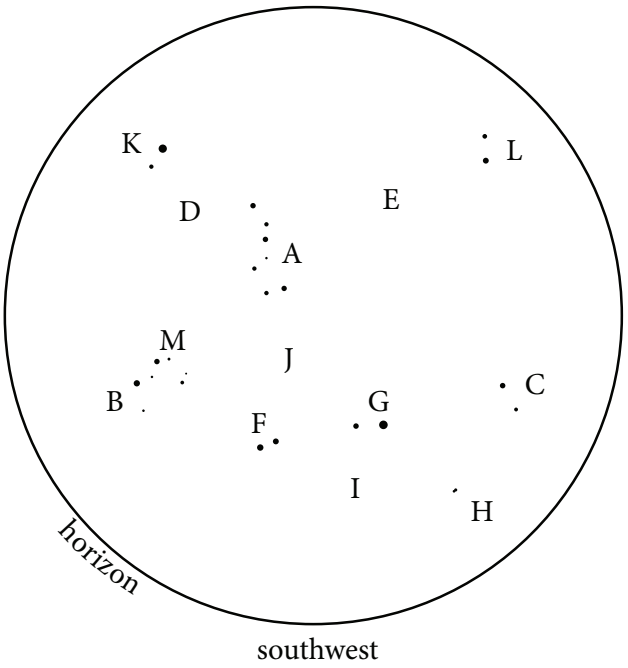

Figure 1. Whole-sky view of *yahdii,* the Tailed Man, as seen from Fort Yukon, Alaska on March 26, 2013 at 22:45 local time. Zenith lies in the center of the circle. Letters correspond to asterisms listed in Table 1.

The lowest-altitude asterism within *yahdii* is his left hand, consisting of the stars Subra and Regulus in the classical constellation Leo. These stars have declinations of 9.8317 and 11.9025 degrees respectively and thus are not quite circumpolar at the latitude of Fort Yukon.[8] Hence, the left hand does not rise above the horizon until late September, remaining visible until early May, after which time there is too much light to see stars at this latitude. However, the configuration of *yahdii* and the body-part metaphor allow the location of the left hand to be inferred even before its heliacal rising in the fall. The second lowest-altitude asterism within *yahdii* is his left foot, comprised of the stars Arcturus and Muphrid, with altitudes of 19.1822 and 18.3977 degrees, respectively. These stars are nearly circumpolar in Fort Yukon, dipping just below the horizon during part of the night in early winter but remaining visible for at least a portion of the night. Again, the position of the asterism can also be inferred from the location of other body parts within *yahdii*. The remaining asterisms within *yahdii* are circumpolar, remaining visible throughout the year and throughout each night (so long as it is dark enough for stars to be visible). The constellation *yahdii* is thus an enduring, dominant feature of the night sky in Gwich'in country.

Yahdii provides a single unifying system for mapping the night sky, and the reliance on body-part metaphors renders the system highly mnemonic. No external knowledge of mythological relationships among constellations is necessary

in order to relate the various asterisms within *yahdii* to one another. Once the stars corresponding to the individual body parts are known, their locations can be readily identified as *yahdii* rotates through the night sky. By recognizing one part of the constellation, an observer is immediately able to identify the remaining parts based on an existing mental map of the body. The circumpolar position of *yahdii* yields a highly functional system that facilitates both orientation and time reckoning in the Arctic. Yet, latitude alone cannot account for the existence of whole-sky constellations, as the Inuit languages spoken immediately to the north of Gwich'in contain at least 17 distinct constellations rather than a single whole-sky constellation (MacDonald 1998). However, there is evidence that suggests that a whole-sky constellation is a defining linguistic and cultural feature, not just in Gwich'in but in Northern Dene languages more broadly.

Beyond Gwich'in: A Northern Dene Megaconstellation

Forms cognate with Gwich'in *yahdii* and documented as referring to Big Dipper are found in at least 17 other Dene languages occupying a contiguous area stretching from the Alaska–Yukon border region east to Hudson Bay (Table 2). In addition, the term has been borrowed into Tlingit, a language more distantly related to the Dene language family.[9] No term for the Big Dipper was documented for the now-extinct Eyak language, so we cannot ascertain whether the concept of a whole-sky constellation extended beyond Dene to the Eyak–Athabascan family. Nevertheless, the form *yahdii* is archaic, preserving the rare Proto-Dene gerundive form **həsda·* (sitting), grammatical evidence of the deep antiquity of the term (Leer 2000:117). It is likely that not only the form but also the concept of *yahdii* as a whole-sky or megaconstellation can be reconstructed at the level of Proto-Dene, a language family with a time depth of at least 2000 years (Holman et al. 2011).

Preliminary investigations of Big Dipper terms in Alaskan Dene languages provide support for the hypothesis that these terms denote not just Big Dipper but rather a whole-sky constellation that includes the Big Dipper. Within Alaska, cognates of *yahdii* are found only in the Alaska–Yukon border languages of Gwich'in, Upper Tanana, and Han. However, the Alaskan languages Ahtna, Koyukon and Dena'ina each have circumpolar constellations comprised of the Big Dipper with asterisms named after body parts (Jetté 1900; Kari 2007:148; de Laguna and McClellan 1960). Moreover, the concept of a tailed man in the sky is found in folklore for both Dene languages with terms cognate to *yahdii* (e.g., Upper Tanana [Tyone

Table 2. Cognates of y*ahdii* in Northern Dene languages.

Name	Language (ISO 639-3)†	Source
yahdii	Gwich'in (gwi)	Peter 1979
yihjah	Han (gaa)	Ritter and Paul 1980
yihdaa	Upper Tanana (tau)	Kari 1989
yíhda	North Slave (scs)	Rice 1978
yìhda	Sekani (sek)	Hargus 2000
yìhda	Dogrib (dgr)	Dogrib Divisional Board of Education 1996
yïhda	Wiitsuwit'en (bcr)	Hargus 1999
yihta	Carrier (crx)	Morice 1932
yéhtai	Chilcotin (clc)	Morice 1890
yìhdā	Kaska (kkz)	Kaska Tribal Council 1997
yehda'	Tahltan (tht)	Palgrave ca. 1902
yehda	Chipewyan (chp)	Laurent 1916
yèshta	Beaver (bea)	Petitot 1876
yèda	Southern Tutchone (tce)	Tlen 1993
zhída	South Slave (xsl)	South Slave Divisional Education Council 2009
zhéhde	Northern Tutchone (ttm)	Ritter, et al. 1977
yax't'e	Tagish (tgx)	McClellan 1975
(yaxhté)‡	Tlingit (tli)	Edwards 2009

†ISO 639-3 language codes provided for clarification in cases where language names may vary in the literature and in modern usage.
‡The Tlingit term is not cognate but borrowed from neighboring Dene languages. Forms are cited in practical orthography.

1994]), as well as in languages which have noncognate terms (e.g., Ahtna [Kari 1986]). Upper Tanana *yihdaa* is clearly cognate to Gwich'in *yahdii* (see Table 2), while Ahtna *nek'eltaeni* is not cognate but is also described as a tailed man.[10] Recent field work by the authors confirms that both Upper Tanana *yihdaa* and Ahtna *nek'eltaeni* are in fact circumpolar whole-sky constellations similar to Gwich'in *yahdii*, comprised of individual asterisms named by body-part terms that are cognate to those used within Gwich'in *yahdii*.[11] The existence of other Dene languages with folklore describing a tailed man in the sky suggests that other large or whole-sky constellations may be present in those languages as well.

Furthermore, the use of body-part terminology to delineate asterisms within a larger constellation may have great antiquity within the broader Dene family beyond the northern group. Navajo, a Southern Dene or Apachean culture, divides most constellations into asterisms named after body parts (Griffin-Pierce 1992:168; Haile 1977). While Navajo does not delineate a single whole-sky constellation, at least five of the eight primary Navajo constellations depict human forms that are subdivided into body-part asterisms (Griffin-Pierce 1992:168). Many of the body-parts terms used to denote asterisms within Navajo constellations are the same as those found in Northern Dene, suggesting that the strategy of using body-part asterisms may have some antiquity within the Dene family.

Finally, it should be acknowledged that there is more to Dene stellar astronomy than the single megaconstellation. Indeed, most Dene languages show evidence for a handful of other named constellations and astronomical phenomena, such as Gwich'in *vats'a' gach'agahaajil* (morning stars) (Cannon 2014). However, these smaller constellations are few in number and exhibit much more variation across the language family. They are thus much more likely to represent recent innovations. In contrast, the concept, of a single megaconstellation—if not the terminology—may extend across the entire span of Northern Dene languages and have great antiquity.

A Unique Arctic Astronomy

That the whole-sky constellation *yahdii* has been overlooked by previous observers is not entirely surprising, given that the study of cultural astronomy has focused largely on physical artifacts devoted to astronomical observation and calculations. In contrast, systems of knowledge such as that embodied in *yahdii* have received relatively less attention from cultural astronomers, inviting simplistic analyses by linguists and "just so" explanations for a supposed lack of astronomical knowledge. These explanations ignore important details of high-latitude environments that lend much greater affordance to star knowledge. Although summer daylight obscures stars for much of the year in the North, the darkest time of the year does not correspond to the coldest. Instead, the darkest period occurs in autumn, before winter snows have fallen and while the temperatures are still moderate. It is also during this time that the hunters of the boreal forests are most active traveling across the country to harvest game animals (Nelson 1986). Subsistence activities in the autumn, as well as throughout the winter and spring provide ample time to observe the celestial sphere.

As astute observers of the night sky, the Gwich'in incorporate *yahdii* into systems of time reckoning, navigation, weather forecasting, and cosmology. The circumpolar course of high-latitude stars renders them an ideal clock, and such a stellar clock is a principal feature of all Northern Dene time-reckoning systems. The Gwich'in traditionally delineate different periods of night according to the position of *yahdii* in the sky. This is achieved by noting the direction the figure is facing or by the positions of his hands or tail. A few of these positions are named as indigenous divisions of time. For example, the phrase *yahdii it'ee neezhii łii* (literally, now it seems yahdii went) designates late evening, based on the fact that *yahdii* has rotated or walked to a given position in the sky (Mishler and Ginnis 1986).[12]

The predictable rotation of the whole-sky constellation *yahdii* also renders it an effective tool for orientation. The body-part metaphor embodied in *yahdii* facilitates spatial orientation when combined with a thorough knowledge of the different positions of *yahdii* throughout the night as well as throughout the year. Although the details of Gwich'in stellar navigation are beyond the scope of this paper, it is clear that the Northern Dene developed a functional orientation strategy based on circumpolar stars (see Cannon 2014). Similar orientation strategies have been reported for the Yup'ik of Southwest Alaska (Bradley 2002), demonstrating the functional power of arctic astronomy across language and culture groups. What is unique to the Northern Dene is the unifying power of the single whole-sky constellation. Where Yup'ik rely on external tools to measure angles from a known star or star group, Gwich'in can immediately discern the orientation of all asterisms within *yahdii* by applying a single cognitive map based on the body-part metaphor.

Yahdii also plays a significant role in Dene cosmology. His presence is felt strongly by some Gwich'in consultants, one of whom noted, "He's up there watching over us." In at least some Alaskan Dene languages, the term equivalent to Gwich'in *yahdii* has been extended to the

Christian deity as well (Kari 1986:29; Osgood 1937:174). While our effort to document and understand Dene astronomy is far from complete, the existence of the whole-sky constellation *yahdii*, and its cognates across the Northern Dene territory, is evidence of an extremely rich cultural astronomy. When one observes the night sky, *yahdii* is everywhere. A simple glance is enough to discern a body part and thereby deduce the position of *yahdii* in the sky. That such a dominating cultural-environmental construct should also have important functional and cosmological roles is thus not surprising.

More surprising is that only a few other apparent examples of whole-sky constellations have been noted previously, and none of these is as robustly documented as *yahdii*. The ancient Egyptian goddess Nut is usually depicted as a whole-sky celestial figure, but the evidence for its representation is sparse (Kelley and Milone 2011). Perhaps the best documented example of a whole-sky stellar figure is the Zuni (Pueblo) constellation *téhłiyakkhyacíwanih* (literally, chief of the night) (Young and Williamson 1981:187). Harrington describes this constellation as a "gigantic human figure, even bigger than the whole visible sky" (quoted in Young and Williamson 1981:187). However, only a few of the component asterisms within this constellation have been identified with known stars, and while some of these asterisms are envisioned as body parts, their names do not employ body-part terminology. Similarly, the Skidi Pawnee (Caddoan) associate all the visible stars with the spots of a bobcat or deer fawn, suggesting that the entire sky represents a unified but rather abstract constellation (Chamberlain 1982:130–131). In any case, none of these putative whole-sky constellations is circumpolar, and in contrast to Gwich'in *yahdii* only a portion of the constellation is visible at any given time. Thus, *yahdii* may be the first robustly attested example of a whole-sky constellation. Dene astronomy is not only much richer than previously believed; it also provides evidence for a completely novel and previously undocumented way of conceptualizing the sky—one that is unique to the Arctic and uniquely adapted to northern cultures.

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Endnotes

1. The massive Yup'ik Eskimo Dictionary, recently revised with over 11,000 entries, lists five separate constellations with the definition "a certain constellation" (Jacobson 2012). The extremely detailed Dena'ina Topical Dictionary lists 13 constellation names (excluding dialect variants), only two of which are identified (Kari 2007). While the inclusion of constellation names in works such as these is evidence of linguists' attention to lexicographic detail, the lack of astronomical identification reveals the relatively low importance placed on cultural astronomy.

2. We use the term constellation to denote a cultural construct grouping together certain stars. This is distinct from modern astronomical usage which divides the celestial sphere exhaustively into 88 named regions.

3. We cite Gwich'in and other Dene forms using established practical orthographies; Gwich'in *yahdii* can be rendered in the International Phonetic Alphabet as [jɐhti:].

4. Indeed, other constellations have been documented in Gwich'in, though some, such as *yahdii tsal* (literally, little yahdii) are clearly neologisms calqued from English names. However, the Big Dipper is the only constellation term widely attested across the Northern Dene languages.

5. The accuracy of our documentation was enhanced by the use of a green laser pointer (532nm, 50mW) capable of pin pointing each of the stars identified by our consultants. Further, we recorded field notes and made digital audio recordings (Marantz PMD661) of interviews with each consultant. Our field notes and audio recordings were compared in the field against computer-generated star charts (Stellarium 0.11.4) specific to Fort Yukon.

6. As in other Dene languages, Gwich'in body-part terms are obligatorily possessed and hence must occur with a pronominal prefix indexing the possessor. In the case of the body-part terms associated with *yahdii*, this prefix is the third person singular vi-/va-.

7. The Gwich'in term for "crooked knife" is *vigwiitsii*; however, we were not able to verify that

this term is also used to denote the asterism that is referred to in English as "yahdii's knife."

8. A star is circumpolar, meaning it never falls below the horizon, providing that the sum of its declination and the observing latitude is greater than 90 degrees.

9. Gwich'in *yahdii* derives from the Proto-Dene gerundive form *həsda·ə (sitting), via the regular sound changes *h > y, *s > h, *a >i (see Krauss and Golla 1981; Krauss and Leer 1981). Proto-Dene *həsda· itself is a reduced form of yəχ=sda· (sitting in the house), in which the peg prefix *hə- is dropped in the presence of the noun *yəχ (house); this full form is then borrowed as Tlingit *yaxté* (Jeff Leer, personal communication 2013).

10. The Upper Tanana ethnolinguistic region may represent a transition zone in Northern Dene nomenclature for the humanoid constellation, as some Upper Tanana consultants refer to the constellation as *yihdaa* (cognate to Gwich'in) while others use the term *nek'e'eltiin* (cognate to Ahtna and Dena'ina terms).

11. As with Gwich'in *yahdii*, the motion of the Upper Tanana whole-sky constellation is described as *yaa nałts'aa aahaał* (literally, it is walking around the sky).

12. Time terms based on the position of the humanoid constellation are also documented in Koyukon, Ahtna, and Upper Tanana.

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