

Article

Under the Same Sky: Science, Knowledge, and Modernization in the Kazakh Society of Altay

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Abstract: Drawing on phenomenological anthropology and Science and Technology Studies (STS), this ethnography examines how modernization, state infrastructure, and digital networks are reshaping the local knowledge and everyday practices of Kazakh pastoralists in Altay, China. It begins by questioning the outsider assumption that nomadic herders use celestial bodies as abstract tools of navigation, and instead shows pastoral mobility as a form of "dynamic dwelling" grounded in embodied experience and everyday taskscape. Through comparisons between traditional wooden yurts and standardized iron frames, experiential weather knowledge and algorithmic forecasts, and local healing practices and modern biomedicine, I argue that modernization does not simply replace local knowledge in a linear process. Rather, pastoralists selectively adopt, combine, and negotiate new technologies through processes of sociotechnical translation and ontological multiplicity, while traces of earlier practices and bodily memory continue to persist as "vestigial infrastructures." The study therefore questions technological universalism and argues for a more plural understanding of knowledge, in which scientific abstraction and situated *mētis* can illuminate different aspects of the same world and, in doing so, deepen human understanding of the cosmos.

Keywords: Kazakh pastoralists; local knowledge; modernization; Science and Technology Studies (STS); epistemological plurality; sociotechnical systems

1. Introduction

In Kazakh civilization, the Big Dipper is known as "Arqan," meaning "noose"-the handle of the dipper represents the rope, and the bowl represents the noose.

I was taken aback when I first learned this; having grown up with the widely accepted "ladle" imagery of the Big Dipper, I had hardly ever considered that these seven stars might have entirely different stories, uses, and meanings in another civilization.

As I sought to understand these perceptions of the sky, I gradually realized that they were not merely a set of experiences regarding celestial phenomena, wind directions, and lunar phases, but rather a knowledge system formed through long-term pastoral practices and continuously perpetuated through those very practices. In anthropology and Science, Technology, and Society (STS) studies, this type of knowledge-rooted in specific cultures, environments, and practices-is typically referred to as "local knowledge."

Since the 1980s, fields such as anthropology, STS, and environmental studies have consistently emphasized the value of local knowledge. Geertz pointed out that meaning and knowledge must be interpreted within specific cultural contexts and local understandings; Ingold further emphasized that knowledge is not information stored in the mind, but rather is continuously generated through the ongoing interaction between people and their environment; in recent years, an increasing number of studies have begun to reexamine the relationship between modern science and local knowledge, focusing on how to understand, document, and preserve these knowledge systems.

I came to Altay out of curiosity about how another culture understood the sky, and because I had been thinking for long time about the relationship between modern science

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and local knowledge. By talking with local Kazakh people, spending time with them, and sharing parts of their daily lives, I learned how stars, lunar phases, wind, and other natural signs had once been used in herding to judge direction and weather. I also saw how much herders' lives have changed. Some have settled, some now move between settled and nomadic ways of life, and others have entered different kinds of work, including tourism. As these changes have taken place, knowledge of nature that was once widely used in pastoral life has gradually become less necessary and, in some cases, is being lost as science and technology take on more of its practical functions.

At the same time, the tools and knowledge used by Kazakh herders in their pastoral work are rapidly evolving and becoming closely intertwined with science and technology. These changes have brought the local people entirely new drivers of development, ways of life, and expectations, while also evoking complex emotions; the same technologies elicit strikingly different impacts and feelings in different individuals.

Through my daily interactions with the local Kazakh people in Altay, I have observed the intricate and complex process of change underlying this renewal and evolution; national policies, economic conditions, educational development, and science and technology all play a role in shaping the lives of local people within this process. The reality is multidimensional and multifaceted; therefore, this paper argues that the changes in knowledge application-and even in lifestyle-occurring within this community cannot be simplistically interpreted as modern technology replacing local knowledge. Instead, they should be understood within the context of a wider range of influencing factors, social backgrounds, complex real-world situations, and specific individuals.

Numerous scholars have highlighted the importance of local knowledge to human society. Having witnessed these changes firsthand, I not only wish to document and preserve the Kazakh herders' local knowledge of the sky itself, but also-drawing from the actual production and daily lives of the Kazakhs in the Altay region-to present as comprehensively as possible the process by which their understanding of this knowledge has evolved, to explore the mechanisms behind these changes, and to earnestly ask: For local knowledge that grows out of practice and must survive through practice, when science and technology can, to some extent, replace its practical utility, leading to the potential loss of such knowledge, how do people confront this loss of knowledge and the earth-shattering changes in their lives that result? In this process, what is it that people truly hope to perpetuate and preserve?

2. The Kazakh Sky-Knowledge Generated from Daily Life

2.1. How the Sky Is Read

Altay is a land very close to the sun. This was my thought one early morning as I sat in Aiguli's courtyard watching her scoop a bucket of freshly milked milk-I had just been awakened by the cows and sheep that had been roaming and bleating outside the felt yurt where I'd spent the night, starting at six o'clock. I recalled what the eldest child in the family, Alman, had told me before I fell asleep: they didn't know why, but no matter what time they went to bed the night before, they always woke up punctually before eight o'clock the next morning. Still a bit groggy, I was bathed in the sun's warmth, which had finally begun to shine, and suddenly began to understand how this daily rhythm meshed with the early mornings on the pasture.

Spending the night at Aiguli's home was unexpected for the three of us. As our car drove into the China-Mongolia border checkpoint at sunset, it began to jolt violently up and down along a completely unpaved dirt road. As always on this vast grassland, the cell signal came and went intermittently. After about twenty minutes of this drive, we spotted a stream; the Aiguli family's three yurts were situated just a few dozen meters from its banks. After being warmly treated to *la tiao zi* and plain boiled hand-torn lamb, it had grown almost completely dark outside. The Milky Way, visible to the naked eye, was a rare sight for me, though naturally not for the people who lived here. The family's three children usually live in town but come to the summer pasture every year during

summer vacation. Seeing me eagerly set up my camera, they asked me to confirm whether the Big Dipper they'd previously photographed with their cell phones was accurate.

Grandpa Mulat and Grandma Algul, however, remained seated inside the yurt and did not come out-perhaps that starry sky was so familiar to them that it had become almost mundane. Both elders are traditional herders who have spent their entire lives on the pastures and grasslands. When Grandpa Mulat was young, he enlisted in the military at the government's request and served as a part-time border guard along the China-Mongolia border until he was 70. In the days before cell service and other modern technology, when they herded their livestock to the border at night, they would use the Big Dipper to navigate, and they also watched for a "star that shines very brightly just before dawn"-a star invisible in the dead of night or after daybreak; seeing it meant the sun was about to rise. During the day, they would gauge the time by the shadows cast by trees; when the shadows had almost vanished, it was time for lunch.

"We can know more than we can tell." [1] Michael Polanyi introduced the concept of tacit knowledge. Just as we can recognize a familiar face among countless others but often cannot explain exactly why, Grandpa Mulat did not know the name of that star, nor did he know why it appeared at the same time as dawn, but he knew that its rising signaled the approaching dawn. Similar knowledge was evident in many other herders' homes we visited. Grandpa Yerken had also been a herder in his youth; after his son was born, coinciding with a national initiative encouraging herders to settle down, he began a settled life in Burqin County on the basis of fifty mu of land allocated by the government. Although the nomadic life now seemed somewhat distant to him, Grandpa Yerken still remembered it vividly. He, too, spoke of the Big Dipper and the star that symbolizes dawn-a star whose name in Kazakh literally means "Bright Star." During our visit in mid-July, it would appear around 5:00 a.m. As for the Big Dipper, in addition to helping determine direction, Grandpa Yerken also told us that its position affects grass growth: "The orientation of the Big Dipper is related to the amount of rainfall, which in turn affects the growth of pasture grass."

In contrast to the stars, the moon is also crucial for herders in predicting the weather. While visiting herders in the Altay summer pasture region, the piece of wisdom I heard most often concerned the orientation of the crescent moon-nearly all the elderly herders, including Grandpa Yerken, told us: "Look at the new moon. If it lies more horizontally, it means the weather will be very cold; conversely, if it is closer to vertical, the weather will be warm." This is also mentioned in G. U. Eshbekova's record of Kazakh folk weather forecasting methods [2].

Among the herders who shared this wisdom was Grandpa Nurlan, who, like Grandpa Mulat, still leads a nomadic lifestyle to this day. It was our very first afternoon at the summer pasture; it had rained here the night before. We sat on a patch of grass by the entrance of the yurt, and the sunlight-especially bright after the rain had cleared-shone on our faces so intensely that I could barely keep my eyes open.

"To predict whether it will rain, we look for a sudden, unusually high temperature a few days beforehand. After the heat wave, mice will start digging burrows, and there will be a sudden surge in the number of flies-this indicates a high probability of rain the following day. The reason the mice dig burrows is that an unusually large number of eagles appear before it rains; the mice dig to avoid being preyed upon by the eagles."

"When setting out on a journey, we also observe the sun. For example, if there's a halo around the sun, it means the weather is about to change. An unusually red sunset also signals that it will rain the next day, so it's not a good time to travel far."

"If a northwest wind suddenly blows on a sunny day, it means clouds are gathering, and it's going to rain here again. If a southeast wind blows, however, the weather will stay clear."

At this point, Grandpa Nurlan narrowed his eyes and glanced at the distant sky. With a hint of a smile, he told us it would rain again tomorrow. I followed his gaze toward the sky; at that moment, the thick cumulonimbus cloud had just been blown away, and we could still see a small portion of the mountain peak. The sky was completely clear, and

there was absolutely no sign of rain. So the next day, I paid extra attention to the weather. Just as Grandpa Nurlan had predicted, a thick, dark cloud drifted in the following morning, and by around 2:00 p.m., it began to rain again on the pasture.

The weather on the grasslands is often unpredictable. Some of this knowledge comes from what their parents taught them, while some stems from their own personal experiences. When discussing these matters, Grandpa Nurlan didn't often bring up those experiences on his own; instead, he used the situation at hand to explain how to assess the weather in such circumstances. Similarly, the herders who spoke with us rarely imparted an abstract framework of knowledge that could exist independently of the specific context. Tim Ingold understands the acquisition of craft as an "education of attention." As he puts it, "In short, learning is not a transmission of information but—in Gibson's (1979: 254) words—an 'education of attention.' As such, it is inseparable from a person's life in the world, and indeed continues for as long as he or she lives"[3]. In such a context, knowledge is no longer merely the transmission of a set of pre-established rules from one generation to the next; rather, experienced individuals guide beginners in specific situations to pay attention to features of the environment that might otherwise be overlooked, enabling them to gradually develop the ability to judge and act in those contexts through continuous practice.

This may explain why this knowledge stems not only from parental instruction but also from the herders' repeated experiences of life on the grasslands. Parents can tell their children to observe the angle of the new moon, the direction from which the wind blows, or any unusual behavior in animals, but what truly transforms these clues into judgmental abilities is the repeated experience of recognizing the connections between the phases of the moon, the wind, the clouds, animal behavior, and changes in the weather. What Grandpa Nurlan saw was not merely the clear sky that I, too, could see; his long-term life experience had taught him to notice things in that sky that I had not yet learned to notice.

In this process, tacit knowledge and explicit knowledge are not strictly separate; herders can encode some of their experience into rules that can be transmitted orally, but these rules do not exhaust the capabilities required for actual judgment. The intergenerational transmission of local knowledge may therefore involve both the teaching of rules and the training of attention.

When this process is viewed within the broader context of knowledge practices, the difference between local knowledge and modern science may not lie in one being practice-dependent while the other is entirely detached from practice; indeed, in this process, we may even discern a certain commonality between the two systems—they may both, through different methods, work to make the world knowable and understandable. Messeri's discussion of "place-making" in *Placing Outer Space* suggests that distant celestial bodies do not naturally become places of significance to humans merely by virtue of their physical existence; rather, scientists within the modern scientific system gradually transform outer space into a world that can be known and imagined through naming, mapping, simulation, and visualization [4]. Similarly, the sky I observed in Altay does not exist merely as an objective backdrop. Elements such as stars, the moon, and clouds continually become woven into people's everyday actions through the long-standing practice of pastoral life, thereby transforming the sky into an environment that can be interpreted, familiarized with, and lived within. The key point here is not that different groups live under different physical skies, but rather that the same sky is imbued with different meanings through different practices, thereby producing different forms of knowledge; this interrelationship will be revisited and analyzed in detail in the subsequent discussion.

2.2. How Heaven and Earth Are Inhabited

While various forms of experience related to weather forecasting continually emerge, experiences concerning directional navigation are relatively rare. Even techniques such as identifying the Big Dipper—which are known to people who do not lead a nomadic

lifestyle-are rarely mentioned by many herders. When asked, some of them told us that they almost never rely on the stars to determine direction.

So, in the absence of cell service or navigation systems, how do herders determine direction and route during transhumance or grazing? This mystery was solved late one night while chatting with Xiao Mu at the summer pasture-Xiao Mu is one of our guides; he grew up on the pasture as a child, living a traditional nomadic life alongside his elders. During the years when tourism began to flourish in Altay, he and his classmate Ashar began working in the tourism industry and gradually made it their primary occupation. Today, he still owns a herd of cattle and sheep on the pasture. Like many herders who have now settled down or moved away, these animals are entrusted to herders who still live on the pasture to care for them.

As usual, I asked the same question: "Back when you were herding on the pasture and there was no cell service or internet, did you use the stars to determine the routes and directions for grazing and moving the herds?"

"Do you need any tools to find your way within a five-kilometer radius of your neighborhood in the city?"

Xiao Mu asked us in return, and this counter-question left me speechless on the spot. Xiao Mu's answer reminded me that the reason the pasture seemed so hard to navigate to me was, first and foremost, because I was a newcomer.

I once asked Grandpa Nurlan's wife, Grandma Gulinar, if she had any memorable stories from her life as a herder. Her answer was brief: "It's all just daily life-where would there be any stories?" This answer pointed in the same direction as Xiao Mu's counterquestion, and it finally led me to reexamine the assumptions underlying my own questions. Before arriving in Altay, I had viewed the vast pastures-devoid of urban roads and man-made signs-as a natural space requiring "navigation," and I tended to regard the starry sky as a traditional technology capable of replacing maps, road signs, and GPS. However, for those who have lived there for a long time, river valleys, hillsides, and pastoral trails are just as familiar a part of their daily lives and movements as the intersections, convenience stores, or subway stations we know so well in the city.

In his discussion of maps and wayfinding, Tim Ingold points out that the tendency to view local practical knowledge as a set of "cognitive schemas" that can be separated from the specific environment and stored in an individual's mind may stem precisely from an outside observer's own lack of practical mastery of the local environment; when faced with an unfamiliar landscape, outsiders rely on a model of possible paths to compensate for this unfamiliarity [3]. In his discussion, familiarity with the environment does not necessarily mean that the actor holds an abstract map in their mind and uses it to determine their own position; finding one's way can also occur through continuous movement and perception, as people gradually learn, through long-term practice, to pay attention to changes in terrain, direction, and the environment along the way [3]. From this perspective, Xiao Mu's description of familiarity as "like a residential neighborhood" does not imply a "lack of knowledge"; rather, it may mean that certain knowledge has become so deeply embedded in daily practice that it no longer manifests as a set of rules requiring active recall or explicit articulation [3].

At the same time, Xiao Mu's response does not necessarily contradict what Grandpa Mulat, a part-time border patrol officer, said about "determining direction using the Big Dipper." Practical familiarity with the environment can form the basis of everyday movement, while in specific situations-such as at night, along the border, or over long distances-clear celestial cues like the Big Dipper can be temporarily called upon. Practical familiarity and explicit navigational cues are not mutually exclusive or replacement for one another; rather, their use is considered and chosen based on the specific context.

Similar notions of space kept emerging in subsequent conversations. As we drove away from the pastoral area along that dirt road, we passed dozens of herders' homes on that ranch. Along the way, Tokhtar, the local herder driving the car, kept greeting herders-who might have been herding sheep on motorcycles or carrying buckets to fetch water-

and exchanging a few words of small talk with them. Since these greetings covered such a wide area, we finally couldn't help but ask, "Do you know all these people?"

Tokhtar told us, "Of course-they're all neighbors. Everyone within a hundred kilometers of here is a neighbor."

"One hundred kilometers" and "neighbors"-two concepts that, in my experience, are almost mutually exclusive-were naturally juxtaposed in his answer. When Xiao Mu had previously compared the pasture to a "neighborhood," I initially understood it only as an analogy regarding familiarity; It wasn't until Xiao Mu's childhood memories led to this car ride that I gradually realized this metaphor might also point to another layer of distinction: Massey Doreen (Space, Place, Gender, p. 147) argues that people's perception of space is inextricably linked to their movement and interaction across spaces, the geographical extension of social relationships, and their perception of all these elements [5]. The scale of space is shaped by more than physical distance. It also takes form through repeated movement, social interaction, and the routines of everyday life. In a city, 100 kilometers may cross several administrative boundaries. On the summer pasture, however, families spread across that same distance can still be regarded as "neighbors" because they remain connected through seasonal migration, herding, visits, and everyday contact.

Thinking about space in this way shifted my attention from how herders find their way across the grasslands to a more basic question: how they live within this environment.

The structure of the yurt, as well as the patterns inside it, carries symbolic meaning. Xiao Mu's father is a craftsman who builds yurts for local herders. From Xiao Mu's explanations and my visits to several yurts, I learned that in a traditional yurt, the sky forms the roof and the earth the floor. There is no specially constructed flooring. The yurt stands directly on the ground, with its poles set into the earth. The structure of the roof is also fascinating: the woolen straps used to secure the wooden beams-numbering anywhere from a few to several dozen-are loosely wrapped around the willow wood supporting the yurt's dome, symbolizing the constellations in the sky. There is often a circular opening in the center of the yurt's dome, with two crossbeams intersecting at the opening to support the dome. These represent the Milky Way and the line connecting the stars Vega and Altair. The cross-shaped opening faces the entrance, symbolizing a smooth journey ahead. At night, the opening in the yurt's roof is covered with a piece of felt; during the day, the felt is pulled aside to reveal the sky. When it rained at the summer pasture, I was inside the yurt of Grandpa Nurlan's family. At first, when the rain was moderate, we all sat on the kang, and the circular opening in the roof remained open; even as rain seeped in, no one pulled up the felt used to cover the opening. It wasn't until the rain grew heavier that the oldest child in the yurt got up, went outside, and pulled the felt over the opening. Instantly, the interior of the yurt plunged into semi-darkness, with only the open door maintaining the light inside. Herders on the summer pastures never turn on lights during the day-even when household appliances are charging right beside them, a testament to the reliability of the power supply. The circular opening in the yurt's roof symbolizes the sun during the day and truly functions as one.

The yurt does not merely symbolize the concept of human coexistence with heaven and earth; this concept is directly embedded in daily practice-the yurt's foundation is the earth itself, with willow poles once again taking root in the soil, standing firmly between heaven and earth, while sunlight streaming through the circular opening in the dome provides illumination during the day. This concept of symbiosis is equally reflected in the herders' daily routines. Similar to the schedule of Aiguli's family that I described at the beginning, Grandmother Gulinar also mentioned the rhythm of rising with the sun and resting at sunset when describing her family's daily routine: As soon as the sun rises, they begin their respective tasks-herding sheep, fetching water, milking cows, and drying provisions. The three daily meals serve as key breaks in their work; by the time they finish dinner, it is nearly dark, and the entire family retires for the night (As shown in Figure 1).



Figure 1. The Circular Opening in the Roof of a Herder's Felt Yurt That Serves as a Light Source

However, simply interpreting these architectural structures and rhythms of life as "symbols" of a pre-existing worldview may still fall short of describing the relationship between people and their environment. Tim Ingold's "dwelling perspective" specifically opposes the view that humans first form mental representations of the world and then reshape the external environment based on those representations. In his argument, human understanding of the environment arises from the ongoing practice of "dwelling within" it; the environment is not an external world separate from human life, waiting to be observed and imbued with meaning [3].

From this perspective, the symbolic meaning of the yurt-where "the sky is the roof and the earth is the floor"-cannot be completely separated from its practical function. The alternation of day and night carries cultural significance regarding the order of heaven and earth, while also directly structuring the timing of milking, herding, meals, and rest. Here, the sky is not merely an object for herders to observe, interpret, and symbolize; it also directly participates in daily life through light, weather, and time.

2.3. How People Respond to Nature

Xiao Mu told us that the patterns covering the walls of traditional yurts represent the horns of argali sheep, and that the lead sheep of an argali herd holds sacred power in the hearts of the Kazakh people. As Xiao Mu recounted, this is a story he's heard since childhood: "There was an elderly man in town who went hunting often. Twenty days before he passed away from stomach cancer, he told his son that he wanted to go hunting one last time. He hunted a brown bear and ate it. This hunter, when he was young, once came across a herd of argali with some friends. After shooting and killing several argali, they encountered the lead male of the herd the next day. Only this male leader in the herd had such horns, so they dared not shoot it anymore, knowing it possessed divine power." (As shown in Figure 2).



Figure 2. "Argali Horn" Motif Inside a Yurt

Similarly, the Kazakh people have a legend about swallows: "The reason a swallow's tail has a notch, like a pair of scissors, is that long ago, the Snake King wanted to drink the finest blood of all living creatures. Only the mosquito told him that human blood was the best. So, to protect humans, the swallow ate the mosquito. Upon learning this, the Snake King sought to devour the swallow. As the swallow took flight to escape, a piece of its tail was bitten off, which is why it looks the way it does."

At first, I recorded this story as just one among many animal legends. It wasn't until later, when I spoke with Ashar, another guide traveling with me, about the nomadic life of the past, that "swallows" came up again in our conversation. He told me that people who lived on pastures for long periods in the past often felt very lonely and bored, and "if a swallow flew in, we'd all be very happy." And if a swallow built a nest inside a yurt, even when it was time to move to new pastures, some herders would rather leave their yurts behind than dismantle them and destroy the swallow's nest.

The existence of such a relationship and interaction between herders and swallows does not necessarily constitute the origin of this myth-in fact, almost no one knows the origins of these myths anymore, and the same is true for the legend about the argali mentioned above. But the significance of these stories need not be understood solely by tracing their historical origins or scrutinizing the content of the stories themselves. "Doing ethnography is like trying to read (in the sense of 'construct a reading of') a manuscript-foreign, faded, full of ellipses, incoherencies, suspicious emendations, and tendentious commentaries, but written not in conventionalized graphs of sound but in transient examples of shaped behavior." [6] Geertz's approach to culture suggests that, rather than searching for a single universal rule behind cultural symbols, we should understand them within the particular networks of meaning in which they appear through "thick description." From this perspective, I cannot claim that the herders' affection for swallows directly gave rise to the legend of the swallow's tail. Still, when swallows appear in stories as protectors, in herders' memories of loneliness on the pasture, and in the practice of leaving a yurt undisturbed to protect a swallow's nest during migration, these different materials seem to echo one another. Swallows are not simply animals to be observed and classified. They also enter the herders' experiences of companionship, protection, and living together. Ashar later described this as a "real connection in daily life" between herders and swallows, and it is this connection that gives the legend a concrete setting in which it can be understood and passed on. Eagles occupy a similar place. Grandpa Yerken told us that Kazakh herders have long trained eagles for hunting, bringing them directly

into everyday practices of work and survival. Their respect for eagles, then, is connected not only to ideas of sacredness, but also to this long history of cooperation.

The story of the argali shows a similar connection between legend and everyday practice. What stands out in Xiao Mu's account is that the hunters do not refuse to hunt argali altogether. What stops them is the lead ram, distinguished by its unusual horns and believed to possess sacred power. In other words, the story does not simply establish a rule that "argali must not be hunted." Instead, it draws a distinction within the herd itself: the lead ram is separated from other potential prey and placed in a position where it should not be killed.

Kazakh legends therefore do more than describe the world. They also help shape how people act within it. The argali story marks certain animals as ones that should not be hunted, while the swallow story places the swallow in the role of a protector. In everyday life, herders may in turn change what they do with a yurt when swallows build nests inside it. I do not mean to suggest a simple chain in which "legend causes behavior." Rather, myths remain meaningful because they are embedded in social life. Stories give existing practices a form that can be told and passed on, while everyday actions continually give those stories new and tangible meaning.

Eduardo Kohn's discussion of "anthropology beyond humanity" pushes this question further, shifting the focus from "how humans ascribe meaning to animals" to "how animals genuinely participate in human life." Kohn points out that if anthropology merely studies how different societies represent non-human beings, it will overlook the actual relationships that occur between humans and other living beings; the ways in which other living beings act and respond to humans can equally alter human behavior and ways of life. As he mentions in *How Forests Think*: "In their mutual attempts to live together and to make sense of one another, dogs and people, for example, increasingly come to partake in a sort of shared trans-species habitus that does not observe the distinctions we might otherwise make between nature and culture; (p. 132)" [7].

Kohn therefore suggests that ethnography should not treat humans and animals only as separate entities, but should also pay attention to the relationships that form between them. A swallow does not become meaningful only once it enters a legend. It flies into yurts, builds nests, and keeps company with herders who may spend long periods alone. Its nesting can even affect what people do with their dwellings when it is time to move. The argali, too, is first of all a real animal: it runs away, is pursued and encountered by hunters, and at certain moments can cause them to stop what they are doing.

Seen in this way, the relationship among legend, knowledge, and action in these materials is better understood as an ongoing interaction than as a one-way chain of cause and effect. Actions help stories remain meaningful, while stories give actions a form that can be expressed and passed on. New actions can then reinforce that meaning in turn. Culture takes shape through stories, objects, and everyday practices, while ways of thinking and ways of acting remain closely connected. Taken together, these materials suggest that the relationship between herders and nature is not simply one of observing and making use of an external "nature." It is closer to an ongoing process of living together, reading, responding, and exercising restraint.

Grandpa Yerken once told us that local herders would sprinkle yogurt or milk on the ground when praying for rain. This practice does more than read signs from natural phenomena. Through offering and prayer, people also actively address and respond to heaven and earth. In this relationship, the sky, or nature more broadly, is not only a source of resources and guidance in daily life. It is also something of particular value, something that calls for respect and response.

3. When the Sky Changes-How Modernization Reshapes Life

Traveling across the vast grasslands, the temperature quickly dropped from the sweltering 33 degrees Celsius at Altay Snow Capital Airport as the mountain road wound its way down. Standing at a roadside observation deck and gazing out at the summer pastures, the breeze blowing up from the valley already felt slightly cool. Just past seven

o'clock, the afternoon sun shone on the green grass, and the images captured by the camera resembled early autumn, with hints of yellow.

To meet the needs of tourists, many roads in the Altay region have viewing platforms along the way. Some are beside rivers, while others are built near the mountains, giving visitors wide views over the pastures. These platforms also point to one important reason for the expansion of local roads: the rapid growth of tourism.

According to the "Twelfth Five-Year Plan for the National Nomadic Herders Resettlement Project" [8], since late 2008, the state has fully launched the nomadic herders resettlement project in seven provinces and autonomous regions. Its primary objectives include improving the production and living conditions of herders, promoting the transformation of traditional livestock production methods, strengthening grassland ecological conservation, and enhancing the level of public services in pastoral areas through the construction of infrastructure such as water, electricity, roads, communications, education, and healthcare.

Building on this foundation, beginning in the mid-to-late 2010s, the explosive growth of tourism further elevated it to a leading industry in the Altay Prefecture's regional development. While the rapid expansion of tourism was not the original intent of the nomadic resettlement policy, it unexpectedly converged with the existing goals of resettlement, infrastructure development, and economic restructuring in subsequent developments. The impact of modernization efforts related to tourism has not only affected tourists but has also brought about dramatic changes to the lives of local herders.

Before heading to the summer pastures, we visited the Party branch secretary of Botobek Pastoral Village, a settlement established after local herders were resettled. The local village committee regularly conducts surveys on herding conditions in the summer pastures, so he has a good understanding of both the summer pastures and the living conditions of the resettled herders.

He told us that the ongoing expansion of cell phone coverage in the summer pastures is due to the rapidly developing tourism industry. Tourism has driven road construction; around 2014, when Lan Jie, the manager of the Burqin County campsite, was hiking in Kanas, there were no cell towers-and consequently, no signal at all. Signal coverage has emerged because, in recent years, with the rapid development of tourism in Altay, road construction has become increasingly essential, and during the construction process, signal coverage has likewise become a necessity. What the village secretary said aligns with what Ashar said: there was no signal here last year, and it wasn't until this summer that the surrounding summer pastures were fully covered by signal.

The growth in tourist numbers has driven the continuous expansion of infrastructure-including roads, transportation, and communications-into pastoral areas, while also providing new employment and income opportunities for some families that previously relied solely on animal husbandry.

Ashar used to be a villager in Burqin County, where he owned several old houses. When tourism in the Altay region was just beginning to flourish, he happened to meet a horse owner who earned a living by letting tourists ride horses and take photos. At first, he was called upon to help lead the horses; for each ride, the owner would charge 50 yuan, and Ashar would receive a few yuan from that. So, after working for a while, he saved up enough money to buy a horse of his own. Riding the wave of the tourism boom, he met Sister Lan from Beijing. The two hit it off immediately. They renovated the old house on Ashar's family property, painted the exterior walls a vibrant blue-green reminiscent of Mediterranean architecture, landscaped a small courtyard, and renamed it "Rainbow Bulak Villa." While running the homestay business, they also leveraged Ashar's local network to partner with educational institutions in organizing field camps.

Similarly, another local guide named Xiao Mu, Tokhtar-the owner of a homestay at summer pasture-and Bahati, the eldest son of Grandpa Nurlan, have also embarked on entirely new paths in the wake of these changes.

Bahati is the son of Grandpa Nurlan and Grandma Gulinar. He, too, grew up on the pasture and moved with his parents as they herded their livestock. In recent years,

keeping pace with the development of Altay's tourism industry, he has worked as a guide, welcoming many tourists from all over the country.

The opportunities brought by tourism extend beyond becoming a guide or directly interacting with tourists. The village secretary also told us that many villagers near Altay rent out their homes during the peak tourist season. Before 2019, the annual rent for a house was only a few thousand yuan, but after 2019, it rose to between 70,000 and 80,000 yuan per year.

Bahati has used live-streaming to promote the beef and mutton he raises on his summer pastures, thereby increasing his income. He explains: "I live-stream on Taobao every day. Since many people selling Altay beef and mutton these days aren't actually offering authentic local products, I've partnered with local slaughterhouses. By broadcasting our pastures and farming environment on Taobao and Douyin, I ensure that people can trust what they are buying."

Beyond supporting occupational change and income growth, modernization has also made many aspects of daily life more convenient for local herders. Herders frequently mentioned access to weather forecasts, faster communication with family and friends, and the use of GPS to track livestock. Infrastructure development has also improved access to medical care, as many summer pasture areas now have clinics that allow herders to contact medical personnel more quickly in emergencies. Motorcycles are increasingly used in place of horses for herding, while lost livestock can often be located more efficiently through WeChat groups.

Ashar just installed GPS tracking devices on his horses this year. Previously, his horses often got lost and when they did, he would go to the local witch doctor for help to determine the direction the horse had gone. This year, many signal towers were built in the summer pasture, and Ashar finally managed to install GPS positioning on his horses. He was also the first in the village to use GPS to locate his horses. He showed me the location of each of his horses in the pasture using a mobile phone software. The interface of the software was very clear and the operation was relatively easy.

Even the yurts where herders live have undergone dramatic changes with the widespread adoption of modern materials. Xiao Mu told us that because steel yurts are so affordable, almost no one asks his father to build traditional wooden yurts anymore: "A traditional yurt of the 'sixty-pole' size (here, 'sixty poles' refers to the number of vertical beams in the yurt, which is an indicator of its size) costs about 30,000 yuan. It takes a month to build one of these. Now, with iron and electric welding, you can buy a yurt with a five-meter radius for just 2,400 yuan. Plus, iron yurts are lighter—one person can assemble it by simply tightening the screws, and then load it onto a truck to move."

However, steel yurts offer more than just cost savings: "Steel yurts last no more than two years; after three years, they're scrapped because they start leaking and aren't sturdy enough to withstand strong winds. Traditional yurts stay warm at night and aren't too stuffy during the day, whereas steel ones can get very stuffy."

The contrast between steel yurts and traditional wooden yurts brings into view the tension between abstract and practical knowledge that Scott discusses. In the final section of *Seeing Like a State*, Scott uses the term "mētis" to describe forms of experiential knowledge that are built through long-term practice and cannot easily be separated from the contexts in which they develop. His concern is especially with what forms of practical knowledge are lost when complex local practices are reduced to comparable and standardized indicators through what he calls "thin simplification" [9].

From the perspective of material and labor costs, the advantages of steel yurts are easy to identify and compare: just over 2,000 yuan rather than 30,000 yuan, and installation by one person rather than a month of manual work. Yet the qualities Xiao Mu mentioned afterward, including resistance to wind, leakage, temperature changes between day and night, and lifespan, point to a different set of considerations that become visible only through actual use. Traditional yurts are more than an older architectural form. They also contain the practical experience that artisans and herders have developed over long periods of living with local climatic and residential conditions. The spread of

steel yurts, then, is not simply a case of a more efficient technology replacing a less efficient one. It reflects a different balance among cost, durability, and comfort.

This process can also be understood through Callon's concept of "translation" [10]. Translation does not simply refer to the acceptance of a technology because of its apparent advantages. It describes a process in which different actors, needs, and resources are redefined and connected through interaction, so that interests that were not initially aligned can gradually be brought into the same network. From this perspective, the spread of steel yurts cannot be explained simply by assuming that they are technologically superior as buildings. Their lower price responds to concerns about cost; rapid assembly reduces the time and labor required for production and installation; steel frames are easier to manufacture in standardized forms; steel and fasteners can be obtained through existing commercial supply chains; and the yurts can be dismantled, loaded directly onto vehicles, and transported in ways that fit the current road network and motorized transport system. It is precisely because these needs—which originally belonged to different spheres—have gradually been interconnected that iron yurts have gained a foothold in the lives of contemporary herders more easily than traditional wooden yurts. In other words, the fact that a technology ultimately prevails does not necessarily mean it outperforms its predecessor in every respect; rather, it may indicate that it has successfully established a socio-technical network better capable of coordinating diverse contemporary needs. Similarly, technologies such as weather forecasting and GPS are not necessarily more effective than herders' traditional knowledge. However, the networks established by science—including satellites, weather stations, data models, government agencies, and mobile apps—are more stable than the networks of local knowledge linked to the experiences of elders, the local environment, and bodily perceptions.

From this perspective, it is difficult to explain these changes simply as the arrival of individual technologies in pastoral areas. In his discussion of technology and society, Matthewman argues that technology should not be understood only as a physical object. It can also include material devices, activities, forms of knowledge, organizational arrangements, and the socio-technical systems produced through their combination. Technology and society, in this sense, do not exist as two separate domains; they continually shape one another through interaction.

In Altay, roads, communication networks, GPS, and mobile phones did not enter pastoral life independently. They developed alongside the expansion of tourism, local government infrastructure planning, and new occupational choices among herders, gradually forming a broader socio-technical network. Tourism encouraged the extension of roads and communication infrastructure, while these infrastructures in turn reshaped employment, grazing practices, and everyday life. Rather than treating this as a simple process in which technology enters society, it is therefore more useful to understand it as a process through which technology and local social life are reorganized together [10].

Accordingly, modernization has not brought only positive impacts to the lives of local herders. For example, the village secretary mentioned, "With more people come more trash. Moreover, there are always tourists who are unfamiliar with the mountain roads, leading to an increase in traffic accidents, and there are always tourists who drive over the herders' pastures, causing a great deal of trouble for the local herders."

The village Party secretary recalled what it was like to work without cell service. When heavy snow cut off access to the mountains, he would live alone in a wooden cabin in the mountains, unable to contact anyone else. Under such conditions, overtime and remote work were impossible, and consequently, he did not have to submit daily reports or as much information as he does now. Sister Lan also harbors some negative feelings about this. As a hiking enthusiast, in her view, she pointed out from the perspective that comprehensive cell phone coverage and the construction of modern infrastructure, such as paved roads, have damaged the natural wilderness scenery and diminished the hiking experience.

The effects of socio-technical systems often extend beyond the purposes they were originally designed to serve. In his discussion of the unintended consequences of

technology, Matthewman argues that once a technology becomes embedded in a complex social environment, its effects can spread through new relationships in ways that are not fully determined by its original design goals. The development of modern infrastructure in Altay shows a similar pattern. Roads and communication facilities that were expanded to support tourist travel have also become important for herders, allowing them to contact family members, access weather information, locate livestock, obtain medical services, and conduct online transactions. At the same time, denser road networks and growing tourist traffic have created new problems, including litter, traffic accidents, and damage to grasslands caused by vehicles. Communication technologies can likewise bring greater convenience while also increasing the frequency of online work. The effects of technology, then, do not move in a single direction. They vary according to users, contexts, and the social relationships in which technologies are embedded [10]. Chapter 3 will examine these differences in greater detail by focusing on how herders respond to the specific changes taking place in their lives.

These changes reveal that the modernization experienced by the Altay pastoral region is not a process in which a single technology enters traditional life in a unidirectional manner, nor is it merely a one-way regulation of local life by the state. State-driven settlement and public service development, the subsequent rapid expansion of the tourism industry, road and communication networks, internet platforms, and the herders' own choices regarding new occupations and tools-all entered the pastoral region at different times and for different purposes, gradually interconnecting with one another to collectively reorganize the conditions of local life. Technologies that appear unrelated-such as GPS, weather forecasts, mobile live streaming, and iron yurts-cannot therefore be understood in isolation from the social contexts and specific situations in which they are applied; the functions they acquire always depend on the social relationships into which they are embedded.

The outcomes of this reorganization are equally not one-sided. On the one hand, roads and communications have improved herders' access to healthcare, information, and market opportunities, while new materials and technologies have reduced some production and living costs; on the other hand, they have also brought new work pressures, environmental issues, and changes in lifestyle. Consequently, the real changes extend beyond the mere appearance of more roads, cell towers, and cell phones on the pastures; they also encompass how people are able to act, what they rely on for their livelihoods, and which previously unfeasible choices have now become possible. However, changes in the conditions of action do not mean that everyone will accept and understand these changes in the same way. Faced with weather forecasts, GPS, and traditional knowledge that is gradually becoming detached from daily practice, how different herders choose, evaluate, and adapt to these developments still depends on their individual life experiences and judgments. This shifts the question from "how technology enters the pastures" to "how people continue to live under a new sky that has already taken shape."

4. Different Perspectives under the Same Sky-How People Choose, Understand, and Negotiate Old and New Knowledge

4.1. Different Answers-How Technology Enters Different Lives

On our final morning at the summer pasture, we worked alongside Grandpa Nurlan's family. On a whim, my companions and I offered to help fetch water from the spring. Bahati usually went alone to fetch water, securing two 25-liter buckets in the dedicated holders on the back seat of his motorcycle. But since all three of us wanted to go, riding the motorcycle was out of the question, so we decided each of us would carry one bucket back.

But we had clearly underestimated the weight of 25 kilograms of water. The distance from the stream to the yurt was about 500 meters, and it took the three of us taking turns carrying the buckets to finally stumble our way back to the yurt where we'd started.

Drenched in sweat and already feeling the muscles in my arms and back begin to ache, I finally understood what Bahati had mentioned yesterday: traditional nomadic life is truly grueling. The heavy physical labor of daily herding, hygiene issues, and lack of rest-as well as the extreme weather, illnesses, and accidents encountered during seasonal migrations-all made him deeply grateful for the benefits brought by the development of tourism and clearly more fond of modern life: "In the past, herding sheep was really hard work. You had to follow the cattle and sheep as they grazed, constantly keeping up with them, with no cell service. It would drive you crazy-you know, it was so boring." When speaking of these things, Bahati's tone was exceptionally firm; he even seemed puzzled when we asked if modernization had ever caused him any trouble.

Sister Lan added that she once chatted with a child from a herder's family and asked what they did without cell service-did they read books? The child told her they had no energy to read; they slept during the day and counted sheep and stars at night. Otherwise, she asked, why would there even be a book called *The Alchemist*?

Not only are the conditions of nomadic life harsh, but in today's society, the income from it is gradually proving insufficient to make ends meet-Bahati told us: "Every year, the livestock eat hay bales and corn during the winter; those costs alone run into hundreds of thousands. Then there are labor costs. These days, raising cattle and sheep just doesn't turn a profit."

Given all these reasons, it's not hard to imagine that after Bahati bought a house in town, he once wanted to bring his parents-Grandpa Nurlan and Grandma Gulinar-to live with him out of filial piety. But unexpectedly, his parents turned down the offer.

"This is his home; he feels miserable if he doesn't come back here. This is his whole world. If you were to take him to a comfortable apartment right now to take a nice shower, he'd get depressed-he'd actually get sick. These days, if he doesn't ride a horse for a single day, his whole body aches."

At that moment, we were sitting at the entrance of the yurt, on a patch of grass in the small courtyard enclosed by a wooden fence, while Ashar translated Grandpa Nurlan's words for us. This pasture had only gained cell service coverage last year, but even though Bahati had taught his parents how to use a cell phone, Grandpa Nurlan believed the weather forecasts were unreliable. He said the weather on the summer pasture always changes quickly, so when predicting the weather, he still chose to rely on the experience and knowledge he had accumulated over the years.

Grandma Aiguli, who also leads a nomadic lifestyle and spends much of her time living on the summer pasture, has a completely different attitude toward modern technology than Grandpa Nurlan. When I asked during our conversation if she still used the weather-predicting methods passed down from her ancestors, she shook her head and said, "With weather forecasts available now, of course I don't use those anymore." Her daughter and grandchildren now live in town or in other cities; during summer vacation, they come to the summer pasture to stay for a few days-which feels more like a vacation to them. Therefore, when the topic of modern technology came up, Grandma Aiguli spoke enthusiastically about the convenience of communication made possible by cell service-she can always quickly find out how her family and children are doing far away, and she can call them anytime she misses them. Her face beamed with joy as she showed us the messaging apps on her phone.

Here, technology does more than allow herders to carry out existing activities more efficiently. The idea of technological mediation draws attention to the way technology enters into the relationship between people and the world, changing how people perceive, understand, and act. GPS turns the location of livestock into coordinates on a map, while weather forecasts translate wind, clouds, temperature, and precipitation into data that can be read directly. Technology, in other words, does not simply transmit information in an unchanged form. It also shapes how that information is produced, presented, and used [10]. For this reason, deciding whether and how to use these technologies involves more than an attitude toward the devices themselves. It can also reshape how people live, how they understand the world, and how they make judgments within it.

Grandpa Nurlan's continued reliance on the weather knowledge he has built up over many years, therefore, should not be understood simply as resistance to modern technology. The practices discussed in Chapter 1, including reading the stars, observing lunar phases and wind direction, and judging the weather through animal behavior, as well as the stories and practices surrounding swallows, argali, and yurts, cannot be reduced to a set of information that new tools can easily replace. They are habits of judgment and ways of understanding relationships that have taken shape through long-term herding, dwelling, and interaction with nature. When weather forecasts translate wind, clouds, temperature, and precipitation into directly readable data, they change more than the speed or efficiency with which information is obtained. They also reshape judgments about what should be trusted, which forms of experience still carry authority, and how people should relate to their environment. From this perspective, Grandpa Nurlan's decision to continue trusting his own experience can be understood as a continuation of a long-established way of life and its underlying logic. For him, nature is not simply an external object waiting to be measured by technology, but a lived environment that still calls for continuous observation and response. He therefore continues to maintain a relationship with nature that is not mediated through modern technology. What modernization affects, then, is not only how often traditional knowledge is used, but also the relationship between people and nature described in Chapter 1, a relationship sustained through knowledge, stories, and everyday practice.

4.2. Not a Replacement-The Selection, Juxtaposition, and Reordering of Knowledge

In contrast, Grandpa Yerken's family no longer practices nomadism. As mentioned in Chapter 1, in the early 2000s-when the state encouraged herders to settle down-Grandpa Yerken and his wife, Grandma Gulizar, selected fifty mu of land and have lived there for nearly 20 years. Grandpa Yerken was among the first settled herders to strongly support his children's enrollment in the modern school system. His eldest son, Dawulet, holds a master's degree in law from a "Double First-Class" university. He has also received a national scholarship and multiple autonomous region scholarships. Now, he has since left the legal profession to pursue his true passion-education-and while teaching English for the college entrance exam and the CET-4 and CET-6, he is also preparing for the IELTS, hoping to secure a PhD and a full scholarship at a prestigious overseas institution. He told us that when he was a child, his parents never bought new clothes or ate out. People would bring used clothes and women's handbags to his home, and his parents would keep reusing these hand-me-downs. They sold most of their cattle and sheep to cover tuition and daily expenses, spending every penny they saved on their children's education-including enrolling him and his younger brother in tutoring classes.

Grandpa Yerken told us that precisely because he dropped out of junior high school and believed he had missed out on better living conditions and opportunities as a result, he has been deeply committed to his children's education from a very young age. Dawulet told us that his parents rarely shared traditional Kazakh knowledge or stories with him; instead, they taught him to focus his energy on his studies. Perhaps because he grew up in such an environment, Dawu'lete showed far fewer inner conflicts or ambivalence toward modernization. He said that, in reality, he is no different from us or from ordinary people who grew up in the city. When discussing the widespread adoption of mobile internet and computers, his admiration was evident. He had fallen ill during junior high and had to drop out for a while. Around 2015, the first computer arrived in Burqin County; upon seeing that someone in the village had bought one, his parents earned money on their own to purchase one as well. To catch up on the coursework he had missed in junior high, Dawulet taught himself entirely through online math video courses by a teacher named Miao from Beijing No. 4 High School-he even prepared for the college entrance exam using online resources. He therefore believes the internet has transformed his life: "Online courses can go a long way toward bridging the gap in educational resources between regions, and I can choose the teachers and materials that best suit me-that's the

best approach." The IELTS and educational training programs he currently runs also rely entirely on online platforms for remote instruction and promotion.

However, Dawulet has no intention of staying abroad. On the contrary, his reason for wanting to go abroad is precisely to return after completing his studies: "I don't want to go there to stay, but to acquire advanced knowledge from abroad and then come back to use what I've learned to transform Altay." He said he misses his hometown very much and wished me a wonderful vacation, encouraging me to enjoy the fresh air and life here.

Dawu'lete's experience has gradually made me realize that, when faced with modern knowledge and technology, people do not necessarily have to sacrifice their traditional way of life or local identity. The internet has opened up new opportunities for him, and he clearly recognizes the possibilities offered by modern knowledge, yet this has not distanced him from Altay. On the contrary, he has incorporated this new knowledge and technology into a different vision for his hometown's future. In other words, modernization here is not merely a process of distancing oneself from tradition; it can also serve as a resource through which people reinterpret, make choices about, and, in turn, influence local life.

This kind of intertwining is not limited to education or career choices. I encountered a similar pattern in local medical practice, where modern medicine and local healing knowledge were not simply arranged as "new" and "old." Instead, different forms of knowledge were repeatedly selected, placed alongside one another, and reordered according to the situation.

We visited a local Western medicine hospital, a traditional Chinese medicine hospital, and a traditional Kazakh medicine clinic. Among them, the traditional Chinese medicine hospital and the Western medicine hospital were located together. Sometimes, they would conduct consultations to assist in treating patients. Moreover, in the traditional Chinese medicine hospital, there were also doctors specializing in the traditional medicine of Kazakh. I asked doctors working within these different systems nearly the same question: how did they view diagnostic and treatment methods drawn from other medical traditions in their everyday practice? Somewhat to my surprise, several of them gave almost the same answer: "As long as it cures the patient, that's all that matters." This does not mean that the differences between medical systems disappear in practice. Rather, it suggests that the boundaries between them can become less rigid in concrete clinical settings. Therapeutic effectiveness itself becomes an important basis for judgment, allowing methods from different traditions to occupy a place within the same field of practice.

At the same time, some forms of knowledge within traditional Kazakh medicine continue to follow a logic that differs substantially from that of modern medicine. For example, one interviewee at a traditional Kazakh medicine clinic told us that male patients may be treated with herbal medicines understood to have feminine properties, while female patients may receive medicines understood in the opposite way. A similar principle applies to the use of sheepskin, with male patients receiving skin from female sheep and female patients from male sheep. Regardless of how modern medicine interprets this classification, it at least indicates that local therapeutic knowledge is not an incomplete version of modern medical knowledge, but possesses its own logic for organizing the body, disease, and therapeutic efficacy.

However, the existence of this knowledge does not mean that local doctors place it on an entirely equal footing with modern medicine. A doctor at the Summer Pasture Clinic told me: "Sheep stomachs, sheep intestines, and herbal medicines can all treat illnesses. When there were no hospitals, placing sheep intestines on a child's stomach could draw out gas, or some people would drink meat broth to induce sweating as a cure. "I've seen it work, but nowadays many people don't understand these methods anymore-not even children know how to do them." But immediately afterward, he added: "I do know these methods, but generally I still recommend medication as the primary treatment-after all, we are doctors." Here, the doctor acknowledges the effectiveness of certain local therapies while simultaneously giving higher priority to modern medicine within his new

professional context. The memory, recognition, and practical application of traditional knowledge do not always occur simultaneously.

This kind of intertwining and coexistence among different knowledge systems echoes Mol's discussion of "multiplicity" in medical practice. As she writes, "Which entity? A slightly different one each time. Attending to enactment rather than knowledge has an important effect: what we think of as a single object may appear to be more than one" [11]. In practice, the human body and the diseases associated with it do not always appear as a single, unified whole, though this does not mean that they are divided into completely separate entities. Mol's concern goes beyond the idea that different people simply hold different perspectives on the same object. She instead draws attention to the ways in which the object itself is handled and constituted differently within different practices and systems of knowledge.

Viewed through this lens, when Western medicine, traditional Chinese medicine, and traditional Kazakh medicine approach the body, disease, and treatment, their differences cannot be reduced to several competing explanations of the same illness. Different diagnostic and therapeutic systems may focus on different features of the body, classify diseases in different ways, and rely on different criteria for judging whether a treatment has worked. These differences do not necessarily require practitioners to first decide which system is ultimately "correct." In actual medical practice, different forms of knowledge are often brought together according to treatment outcomes, patients' needs, and the particular clinical situation.

The response that "as long as it cures the patient, that's all that matters," therefore, does not mean that differences between knowledge systems have disappeared. It is better understood as a form of practical negotiation. Different medical systems may retain their own ways of classifying the body and disease while still occupying a place within the same process of diagnosis and treatment around the shared aim of improving the patient's condition. The relationship between older and newer forms of knowledge, then, does not always take the form of one completely persuading or replacing the other. More often, people continue to judge in practice which body of knowledge is most appropriate to draw on in a particular situation.

4.3. Between Nostalgia and Gratitude-Why the Experience of Modernization Is So Contradictory

In Altay, there is another group of people who hold even more complex perspectives-local tourism workers. They grew up in a completely traditional nomadic lifestyle during their childhood and youth, yet they were also among the first and most extensively exposed to the wave of modernization. Perhaps precisely for this reason, they often harbor more complex and conflicted attitudes toward lives reshaped by modernization.

This is precisely the case for Ashar and Xiao Mu, the two local guides who accompanied us. The Rainbow Bulak Villa Camp that Ashar now runs was built from an old house renovated with funding from a tourist he met-Sister Lan-back when his tourism business was just taking off. Sharing similar sentiments to Grandpa Nurlan, he was always eager to tell us about his deep attachment to the grasslands. In his eyes, city life wasn't as carefree as life here; he worried he wouldn't be able to find a group of family and friends who could be called upon at any moment to share delicious skewered meat. Compared to a luxury villa in Beijing, he was more drawn to the thrill of riding a motorcycle across the grasslands and the soft grass where he could lie down. While chatting at Grandpa Nurlan's house about the disagreement between Bahati and his parents regarding whether to settle down or continue a nomadic lifestyle, Ashar said that Bahati grew up in a town. He compared his own lifestyle to his parents' and felt that life in town was more comfortable, but their different lifestyles led to completely different perspectives-his parents simply couldn't accept living in town permanently. Ashar said that if his parents felt the same way, he would be willing to let them continue living on the grasslands, but he would also arrange for them to have regular health checkups, provide them with medication, and install solar panels so they could listen to the radio and watch TV.

Xiao Mu expressed this inner conflict more directly. He never hesitated to praise and express gratitude for the benefits brought by modern life and the development of tourism, yet at the same time, he continued to harbor a deep longing for the traditional nomadic life of the past. While at the summer pasture, he once took me up the mountain on his motorcycle to his own section of the pasture—a place that still feels like home to him. He can effortlessly pick out his own cattle and sheep from the vast herds scattered across the mountains and valleys. When I asked him in bewilderment how he managed to do that, he couldn't really explain it. Perhaps, just as he told us that this pasture is to him what our neighborhood is to us, the cattle and sheep are neighbors—or even friends—who have grown up alongside him. On a night at the summer pasture, he spoke of his childhood: "Back then, there was no cell service and no cell phones. Every day, I would sit on my father's horse, leaning against him as we slowly rode around the pasture. The rest of the time was spent looking for calves—the cows would hide their newborns before going off to graze and drink water, and often even I didn't know where they were hidden. I remember one time I searched for an entire day before finally finding that calf in a very deep pile of grass."

Xiao Mu made no secret of his nostalgia for those days. He said that back then on the grasslands, every day was spent living among the cattle and sheep, and those times were, of course, wonderful: "Nature is our home. You are the argali sheep of the city, while we are the argali sheep of the grasslands."

The image of the argali reappears: on the iron frame of Grandpa Nurlan's modern metal yurt hangs a woolen strap that has long since lost its practical function yet is still preserved. It no longer serves its original purpose, yet it hasn't been removed simply because it's become obsolete. Of the dozen or so that should have been there, only one remains, hanging quietly as if symbolizing something. Stepping out of the yurt, one often finds a horse tethered beside the motorcycle parked at the entrance: while the latter now enables faster herding, transportation, and travel, the former has not yet completely faded from the herders' lives. They stand side by side on the same patch of grass, much like Xiao Mu's attitude toward the past and the present.

This preservation and juxtaposition is not limited to the objects themselves. The Kazakh people were almost all followers of Islam in the past, but with the promotion of national policies and the demands of modernization, many young people no longer believe in religion, and for those who still do, they are no longer allowed to perform prayers or visit mosques on a daily basis. However, the teachings still exist in their hearts.

"Allah exists in this world, so as long as Allah is in your heart, that is enough."

When it comes to the topic of Islam, Ashar, who still practices the religion, told me this. He believes that religion is merely having a belief in one's heart, which is that people should do good deeds. The remaining aspects such as sects, rituals, and so on might not be as important compared to this.

Old things do not vanish the moment they lose some of their practical functions, nor do new technologies always enter our lives by completely replacing the old; more often than not, they coexist in the present-day routine through remnants, juxtaposition, repurposing, or simply by continuing to be cherished (As shown in Figure 3, 4).



Figure 3. A Wool Felt Strip Preserved Inside an Iron Yurt



Figure 4. A Motorcycle and a Horse Outside the Felt Yurt

The concepts of ownership, control, access, use, and unintended consequences proposed by Matthewman offer an explanation for the recurring conflicting emotions expressed by interviewees when facing modernization. People do not engage with technology solely as "supporters" or "opponents." The same individual may benefit directly from gaining access to and the right to use a particular technology, yet lack the control to determine how that technology enters their life, at what pace it expands, and what consequences it ultimately produces [10]. Signal technology allows herders to stay in constant contact with distant family members, and roads make healthcare, education, and markets more accessible-conveniences that are sufficient to generate genuine gratitude. At the same time, however, the pace of life, the space for practicing traditional knowledge, and even the original relationship between people and their local environment may undergo changes in the very same process. Thus, nostalgia for the past and gratitude for the present coexist, and may stem precisely from a person's simultaneous experience of both the opportunities offered by technology and the losses it brings. The reason modernization tends to evoke seemingly contradictory emotions is precisely because it is not something that can be accepted or rejected in its entirety.

Amid the complex and varied attitudes toward modern knowledge, technology, and lifestyles, the following question emerges: Is there a single narrative that can encapsulate "what happened after technology entered pastoral areas"? In discussing Woolgar and Cooper's analysis of artifacts, Matthewman points out that people's experiences with artifacts are inherently diverse; consequently, narratives about a given technology are constantly evolving and cannot be fixed into a single version. The meaning of technology is not determined by its intended purpose the moment it enters society, but is continuously generated through each user's subsequent engagement, rejection, and actual use [10].

The agency people exercise in their encounters with technology is often much richer than a simple narrative of "modern technology replacing traditional knowledge" suggests. Grandpa Nurlan can choose not to use weather forecasts as his main basis for judgment; Grandma Aiguli can welcome the convenience of mobile phone communication while continuing to live on the summer pasture; Dawulet can use the internet to enter a broader educational system and later direct what he has gained back toward his hometown; and the clinic doctor can remember and recognize local therapies while still giving modern medicine greater priority in professional practice. People are not simply passive objects reshaped by technology. They also continue to decide what particular technologies come to mean in their own lives.

At the same time, stressing human choice does not mean that such choices are made under conditions of complete freedom. Bijker develops this point through the idea of technological "obduracy": once a technology becomes embedded in a stable socio-technical system, it can acquire a structural force that is difficult to change. He distinguishes between two forms of this hardness. "Closed-in hardness" describes situations in which users become so deeply incorporated into a technological framework that everyday action increasingly depends on its established rules and devices. "Closed-out hardness," by contrast, refers to situations in which the requirements of the technological system effectively exclude those who lack the necessary resources, knowledge, or capacities [10].

This means that the changes in Altay cannot be simply understood as herders freely choosing between tradition and modernity on a daily basis. As roads, cell phones, formal education, weather forecasts, modern medicine, and internet platforms gradually become the infrastructure of daily life, people can of course still choose how to use them, but the very scope of their choices has already changed. A child can still learn the methods their ancestors used to observe lunar phases and animal behavior, but when families no longer rely on this knowledge for daily herding, when parents devote more time and resources to formal schooling, and when weather forecasts can provide direct guidance, the opportunities to learn and repeatedly practice this knowledge are themselves diminishing. Local knowledge is not explicitly rendered obsolete by a particular technology on a specific day; rather, it is more likely to gradually lose the practical contexts that originally made it necessary and enabled its transmission, as another set of socio-technical networks becomes increasingly entrenched.

5. Conclusion and Outlook: The Sky of the Past, Present, and Future-What Is Preserved Amid the Torrent of Change?

"There is, however, something deeply paradoxical about this argument. For to separate tradition from locality, or culture from place, is also to divorce traditional knowledge from the contexts of its production in the environmentally situated experience of practitioners." [3]

In *The Perception of the Environment*, Ingold discusses the consequences of stripping local knowledge of its place-just as the moment in Chapter 1 when Xiao Mu posed a rhetorical question to me continues to echo in my mind, and I, in turn, keep pressing for an answer-can this knowledge be preserved by stripping it of its familiar terrain and transplanting it into a completely new environment that no longer belongs to the place where it grew and was practiced?

The difficulty in transmitting local knowledge lies in the fact that teaching the knowledge itself does not mean the learner can truly acquire it: Because it is so closely tied to practice, this knowledge often requires people to learn it through actual experience. Just as an elder might tell his grandson where the lushest pastures lie on a certain mountain or what weather conditions a particular breeze portends, the grandson-who no longer needs to graze on that mountain and has never experienced that breeze-will find it difficult to translate this knowledge into the ability to make sound judgments and take appropriate action.

However, this does not mean that highly abstract knowledge-capable of being transmitted across geographical boundaries-therefore becomes the antithesis of local knowledge. When Scott discusses *mētis* at the end of *Seeing Like a State*, what he is truly wary of is not highly abstract modern knowledge itself; he acknowledges that such knowledge provides us with important insights into the world and points out that, in practical reality, it can never be completely separated from *mētis*. The real danger lies in the notion that, because a form of knowledge can be standardized and universally applied, other ways of understanding the world are deemed unnecessary. Unlike this kind of universalism, *mētis* does not attempt to provide the same answer for every place; it relies on practices within specific contexts and, as a result, accommodates differences and variations among localities. In *Seeing Like a State*, Scott cites the example of agricultural scientists who start with practical problems raised by farmers and then bring local innovations back to the laboratory for refinement [9]. Here, scientific knowledge and local practices do not compete with one another for ultimate supremacy but continue to produce new knowledge through mutual engagement and refinement.

Taking this line of thought further, I find it increasingly difficult to accept the notion that one form of knowledge must progress by eliminating another. Learning is not, by its very nature, a process of constantly erasing the past to leave only a single correct answer. We rely on highly abstract knowledge, such as incorporating atmospheric pressure, temperature, and wind speed from different locations into a single model, so that even someone who has never set foot in Altay can understand the weather that might occur there. We also rely on practical experience that cannot be easily detached from the local context-knowing where clouds will come from after a gust of wind sweeps over a particular mountain, and knowing when to adjust the next day's plans based on the simultaneous occurrence of specific temperatures, seasons, and animal activity. The former is powerful precisely because it transcends place; the latter cannot be easily replaced precisely because it delves deeply into place. They reveal different scales and levels of the same world.

And having come this far, I've begun to wonder whether what truly needs to be preserved is "knowledge" itself. When I first arrived in Altay, I intended to document something that could easily be listed: how the Big Dipper is used to determine direction, how the moon foretells cold or warmth, and which winds bring rain. If these answers could be recorded in writing, it seemed as though I had preserved something that was in the process of disappearing. But as I ventured deeper into the summer pastures, I increasingly felt that there was more to it than that. What truly stays with me from Chapter One is not merely the rule that "a northwest wind means rain might fall," but rather the gesture Grandpa Nurlan made-squinting and looking up at the distant sky-after he spoke, as well as the relaxed expression on his face as he sat on that grassy slope; nor is it simply the legends surrounding the argali, swallows, and eagles, but rather how these animals are spoken of, respected, and treated, and the relationships they have formed with people through long periods of shared life.

Here, knowledge is more like a trace left behind. It tells us that there were once people who viewed the sky in this way and lived in this world in this manner. And so, what truly fades away along with this knowledge is not merely a set of "old answers," but the entire range of possibilities for connecting with the world that these answers once embodied.

This is precisely why I ultimately do not believe that so-called "preservation" means requiring the next generation to return to the way of life of their ancestors. Bahati has no obligation to return to a form of herding life that he finds difficult; Dawulet can use online education to pursue opportunities beyond his immediate surroundings; and Grandma Aiguli can choose to rely on weather forecasts rather than the methods used by earlier generations. These choices are themselves part of how they live their lives. What deserves our concern, then, is not change itself, but the possibility that change may eventually leave only one way of living and understanding that is recognized as legitimate. The pluralism emphasized by Scott perhaps takes on a broader significance here than the mere preservation of traditional knowledge: what should be preserved is not a literal replica of

all knowledge, but rather the world's continued remembrance that there once existed a particular perspective through which people understood the world, a channel for communicating with nature, and a way of living within this universe-and that there remains space for different experiences and forms of cognition to coexist and engage in dialogue.

Through living and interacting with local people, I gradually became aware of the assumptions and prejudices I had once brought to local knowledge and, more broadly, to their ways of life. At the same time, I came to see how complex the reality was: even when people faced similar situations and questions, they often arrived at different answers, and their own agency continued to shape how these changes unfolded.

Xunzi said, "The course of heaven is constant: it does not survive because of the actions of a Yao; it does not perish because of the actions of a Jie." In the simplest sense, the sky over Altay has, of course, never changed because of any of this. Roads now lead into the pastures, signals traverse the pastures, and the weather is observed and calculated by satellites and models before appearing on cell phone screens via communication networks-yet the stars still rise along the same paths. What is constantly changing is what people notice, what questions they ask, and how they relate to the sky as they stand beneath it.

Looking back at Chapter 1 from this perspective, I realized that my earlier statement-that "the same sky is imbued with different meanings in different practices"-may still have fallen short of capturing the essence. As mentioned in Chapter 1, the concept of "place-making" discussed by Messeri in *Placing Outer Space* has helped me reinterpret this point: scientists, too, rely on naming, mapping, simulation, and visualization to gradually construct those extremely distant celestial bodies into a world that can be understood, discussed, and imagined. Science does not lose its objectivity as a result, but objectivity does not imply a universe that is unmediated and directly accessible to humans. Herders and modern science certainly face the same material world; what truly differs is how this world enters human life through their respective practices. They do not merely superimpose different interpretations onto a sky whose form and meaning have already been fully defined; rather, within the same material world, they make different relationships significant and raise different questions, thereby forming distinct worlds in which people can live and act.

Therefore, what the decline of local knowledge truly warns us against is the gradual transformation of people's interpretation and construction of the world into a one-way street: When the data, theories, and specialized language within the modern scientific knowledge system no longer help people reinterpret the world they point to, but instead begin to circulate solely within existing forms of knowledge; when a highly standardized form of knowledge gradually becomes the default standard of understanding-the other relationships and imaginations that people were once able to establish with the world find it increasingly difficult to secure the space for practice and expression. Abstraction, obscurity, and complexity play important roles as tools in the exploration of knowledge, but they should not be blindly pursued or exalted as ends in themselves. Science cannot abandon abstraction, nor is there any need to abandon complexity. But the truly important capacity of a body of knowledge may lie not only in its ability to remove the world from human direct experience, but also in whether it can return to the world that humans help construct: after the sky has been transformed into atmospheric pressure, humidity, and precipitation probability, it should ultimately still help a person better determine how to travel, how to work, and how to live. And this is the true value that both systems of knowledge bring to people-each illuminates aspects that the other cannot fully reach. Genuine growth of knowledge may occur precisely at this intersection: in every interaction between abstraction and concrete practice, we supplement the parts of the world we previously could not see, and in doing so, we return to the world with more than we had before, re-entering the realm of action, experience, and authentic relationships.

The sky remains the same, whether in the past, present, or future. What we truly cannot afford to lose is perhaps the variety of ways we still possess to engage with it, connect to it, and live more fully within it.

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