Home, Sweet-smelling Home

Do bears "follow their noses" to find their way back?

by Lynn Rogers

The notion that mammals, including humans, might have a special homing ability has been around for a long time. Walt Disney's film The Incredible Journey portrayed the prodigious navigational powers of a lost dog and cat, but the movie and the book of the same name are entirely fictitious. In real life, most pets that get lost stay lost.

Occasionally, however, a dog or cat does something spectacular and unexplainable - like Snooky, the ginger tomcat that returned 135 miles from his new home in Gloucaster, England, to his old home in Balsham in just twenty-two days. A white-tailed buck that was captured and transported 350 miles in Texas also seemed to know the way home. It took him nearly two years, but he somehow made it back to the Arkansas National Wildlife Refuge on the Gulf of Mexico. And a female wolf that had spent her entire life in a pen in Barrow, Alaska, needed only four months to return home after she was released 175 miles away. Other examples abound. One involves an immature female deer mouse, probably only three or four months old, that was released two miles from her home in Wyoming. She returned in two days. Before that, she probably had spent her entire short life in an area of a few acres.

Nevertheless, scientists still question whether mammals truly possess a navigational ability akin to that of homing pigeons. True navigation implies the ability to orient homeward, or toward some other point beyond immediate sensory contact, from a previously unvisited area. This capacity differs from simple piloting based on familiar landmarks and from the ability to migrate in a particular direction without reference to landmarks. It requires not only a compass sense to determine direction but also a mental map to determine location relative to home or some other goal. The navigational ability of mammals is questioned because for each animal that comes home, dozens or thousands of the same species go in the wrong direction or just stay put when released. Scientific studies have not been convincing; the mammals that returned usually did so over short distances from release sites that may not have been beyond sound or smell of home. The anecdotal cases of spectacular homing over long distances usually lack the details that might provide simple explanations.

The wolf that returned 175 miles in Alaska, for example, may have homed in on the sounds of large jets at the Barrow airport near its pen. Jets can be heard for tremendous distances across the treeless tundra on still, cold nights, and the familiar sounds of the planes would have been focused toward Barrow from the wolfs location. A second wolf in that experiment moved to a different airport 100 miles in the wrong direction. Similarly, the deer that returned home 350 miles may have scented the Gulf of Mexico when moist breezes blew from the home direction. In all, seven deer returned home in that experiment, all moving at least eighty miles, while more than 8,000 others either went the wrong way or remained where released. A similar story may explain the homing mouse. The experimenters Olaus and Adolf Murie had been camping in the mouse's home range for most of its young life, and the sounds and smells of their camp and campfires on the quiet Wyoming mountain could have signaled home. The release site was directly downslope from camp, exactly where the campfire smoke would likely drift in the evening. Both the camp and the release site were along Whetstone Creek, which also could have guided the mouse. Aside from that mouse and a few others that returned to the camp in that study, homing by deer mice and other small mammals seldom exceeds a few hundred yards, approximately the distance one would expect the sounds and smells of home areas to reach.

Mice and other small mammals may not be the best subject for homing studies. They normally do not travel far, and they have a consuming abhorrence of predators. When they find themselves in a strange place beyond sensory contact with home, they usually stay put rather than risk extensive travel where escape routes are unknown.

But bears are not overly concerned about predators and are not afraid to make diligent efforts to get home though unfamiliar country. They are among the land mammals most likely to show true navigational ability if it exits in a mammal. Black bears depend upon berry and nut crops that often fail, requiring them to make long searches into unfamiliar range and to return home through the same unfamiliar territory. In many instances the search route is wandering and circuitous while the return is direct, which means the bear must have a sense of place and a sense of direction.

Black bears that get in trouble raiding garbage provide great opportunities for testing navigational abilities. Wildlife managers, game wardens, and wildlife researchers in nine states and two Canadian provinces have trucked offending bears to remote areas, usually while the bears slept off tranquilizers. The bears were ear-tagged so if they were ever shot, recaptured, or sighted, the officials could learn whether they returned home or not. One hundred and fifteen (64 percent) of the 179 bears returned home. The question is: How do they do it? Are they familiar with huge areas? Do they wander randomly or in expanding search patterns until they find an area they know? Or do they use some means of navigation?

Bears that were moved only five to forty miles were probably released in familiar range or close enough to familiar range that random wanderings could conceivably account for homing. Of those bears 81 out of 100 returned. But how many bears would be familiar with areas beyond forty miles? Not many, according to the results of twenty-two studies of bear movements. In seventeen of those studies, at locations across the continent, no bear traveled that far. In each of four other studies, only one bear traveled that far. Only in the less fertile forests of Minnesota did an appreciable number of bears travel forty miles or more, and most of those were young males making one-time moves from their mothers' territories to their adult living areas. Young females usually established living areas near their birthplaces and did not make the long dispersal movements. Adults of both sexes explored distant feeding areas, but only three journeys of more than 40 miles (52, 57, and 126 miles) were recorded during seven years in which the movements of forty-eight adults and forty-five younger bears were radio tracked.

Nuisance bears that researchers and wardens moved more than forty miles would be the ones that could reveal whether black bears have any real navigational ability. Since it is possible that even a few of those might be helped by familiar areas, the "more than forty mile" bears were divided into two groups for analysis: those that were moved 40 to 75 miles and those that were moved 75 to 169 miles. Since the latter would be less likely to find familiar areas, fewer of them would be expected to move homeward (if homeward orientation depends upon finding familiar areas). In fact, slightly more moved homeward from the greater distance. Bears that moved in the homeward direction, or within 22.5 degrees of it, included thirty-five (65 percent) of fifty-four bears from the first group and seventeen (74 percent) of twenty-three bears from the second group. Apparently, familiarity with the release area or vicinity was not the key to homeward orientation. Unfortunately, the rigors and dangers of strange country took their toll on the bears released at greater distances. Although more of them did head homeward, fewer of them made it. Half made it home from 40 to 75 miles away, and 30 percent made it home from 75 to 169 miles away. The rest gave up, were shot, or were hit by vehicles.

The longest successful homing was 142.5 miles by an adult female that El Harger, a research biologist with the Michigan Department of Natural Resources, moved in Michigan's Upper Peninsula. Another female that Harger moved 168.5 miles probably would have bettered that record if she had not been killed. For sixty days after release, this mother and her cub moved forty-three miles directly toward home. The cub was then killed on a highway. Traveling alone, the mother made fifty-five miles in the next six days until Keweenaw Bay in the Upper Peninsula interrupted her movements and funneled her along to the baytip town of L'Anse. Hungry after traveling so quickly through unfamiliar country, she peeked in a window on the outskirts of town and was shot. She had moved ninety-eight miles toward home in sixty-six days.

I had long wanted to watch a homing bear on the move to see if I could learn anything about homing movements and directional cues. Big Mac, a radio-collared eleven-year-old that lived in northern Minnesota, gave me my only opportunity. A drought and berry crop failure had forced him 126 miles outside his usual range, the longest move outside an established range ever recorded for a black bear. He foraged south and west in a big meandering arc through forested terrain. When it came time to den up, he turned directly homeward, moving northeast through open farmland and residential areas rather than returning by the safer, more forested route. My assistant, Bob Hodorff, and I monitored his progress. We soon learned that he traveled only at night, moving as if on directional autopilot with little regard for terrain or obstacles. His route was so predictable that on the fourth night we parked where we anticipated he would cross a gravel road.

Our location was perfect. "Here he comes!" Bob whispered as Mac emerged from the forest and angled across the dark road toward our car. He plodded around the car and continued down the road a short way. The road nearly paralleled his route, and we wondered if he might use the curving road to get around the tangled patch of forest at that point. The road would have taken him perhaps twenty degrees off course. He chose the forest. "Right on course," said Bob as he listened to the bear's radio signal grow fainter.

During the next three days and nights the sky was so overcast that there was no sun by day and no stars by night. Wind and snow blew out of the northwest, creating a crosswind for Mac. Somehow he maintained direction and speed. Late into his ninth night of travel, Mac reached his usual range. His behavior changed. He began using the curving forest roads even though they took him a bit off course. He used well-worn shortcuts where available and unhesitatingly left a road to cross a river on rocks rather than on a shaky old bridge that was ahead. He seemed to know the easy routes, many of which were forest roads. He stopped to rest at dawn but resumed walking in midmorning. This was the first time he had been active by day since he began his return trip, although he normally was active by day in his established range. About noon he left a road, walked over a hill, and entered an old den – a rock crevice just big enough for his 450-pound body. Somehow he had maintained direction through more than a hundred miles of unfamiliar range, regardless of weather.

Studies of animal homing and navigation attempt to determine what senses and information animals use to form their mental compasses. Scientists speculate that magnetite in the heads of homing pigeons and other species, including some mammals, may serve as tiny compasses, but whether bears have magnetite is unknown. By whatever means, Big Mac showed an incredible sense of direction. He probably combined compass sense and memory to form a mental map during the outbound part of his travels. But how do bears that are drugged and transported form mental maps when they awaken in a strange place?

Recent studies with pigeons suggest that the mental map may be based in part on odors. Italian researcher Floriano Papi studied the role of odors in pigeon homing and hypothesized that "pigeons, during their first months of life, would learn to recognize the odors prevailing in the area of the loft, but when the wind blows, they would also receive information about foreign odors from surrounding areas. At the same time they would associate the different foreign odors with the direction from which they came." In Italy, anosmic pigeons – those with an impairment or loss of smell – neither orient nor return home, although anosmic pigeons in other areas often do, showing the presence of more than one orientation system.

If an odor-based system works for pigeons, it should work even more efficiently for bears. The bears' sense of smell may be the keenest of any mammal in North America: they have an area of nasal mucous membrane a hundred times larger than that of humans. And their brains are the heaviest, relative to body length, of any carnivore. Also, their ability to store information is excellent. Cubs remember, as adults, locations their mothers showed them twenty miles away. An odor-based mapping system could explain why bears that were transported far outside areas they conceivably could smell, such as bears taken from Minnesota to Arkansas (880 to 940 miles), didn't seem to have a clue about home direction. They moved in random directions up to 260 miles from release sites. Such a system may also be the reason that bears released in unfamiliar range often delay starting for a few days or weeks as if taking time to get their bearings, perhaps by smelling winds from different directions as weather patterns change. The learning process that would accompany the formation of mental maps, odor-based or otherwise, may explain why young bears seldom return home after being moved.

A second hypothesis regarding the formation of a mental map is that animals sense the more or less regular changes that occur in the earth's magnetic field. Pigeons may determine their location relative to home by extrapolating local gradients in magnetic field change. Considering the compass sense shown by Big Mac, this may also apply to black bear navigation. Anomalies in the earth's magnetic field could explain why some bears make false starts in wrong directions but, by using magnetic cues, eventually realize their mistake and head home.

The sensory abilities of black bears have not been fully explored. Studies of homing pigeons revealed abilities to detect polarized light, ultraviolet light, very low frequency infrasounds, and changes in atmospheric pressure. Which of these senses might be used to determine homeward direction and which might be shared with black bears is unknown.

Bears that were radio tracked filled in only a few details on homing movements. Most delayed starting. Some made false starts in wrong directions. Others moved directly home, zigzagged home, or settled somewhere else. An adult female that Gary Alt, a bear biologist with the Pennsylvania Game Commission, moved eleven miles in Pennsylvania, stayed within a few hundred yards of the release site for five days and then moved two miles in a wrong direction during the next four days, before moving directly home in two days. Alt watched an adult male for a few hours after moving it twenty miles. Three times he saw the bear stop, pivot several times, and start out toward home. However, the bear did not continue, so the pivoting may not have been related to homing. The bear remained within a few hundred yards of the release site for three days and then set out toward home, where it showed up three days later.

Black bears are not the only bears that have demonstrated homing ability. Among the few grizzly bears that have been moved is a four-year-old male that returned home over 160 miles in Alaska. Seven others traveled more than 125 miles. Polar bears currently hold the bear homing record of 300 miles. Three males and a mother with cubs all returned in fourteen to twenty-four days, moving twelve to twenty-one miles per day. However, the release site was probably familiar to them because it was on a commonly used migration route on the shore of Hudson Bay. Polar bear orientation and navigational abilities are of special interest because there are so few landmarks on the drifting, constantly changing ice. Could an odor-based orientation system explain how polar bears, in their frozen world of minimal odor, keep their sense of place well enough to maintain predictable home ranges from year to year? Possibly. The polar bear's Roman nose may be the keenest nose of all, and there is the possibility that magnetic cues are used, even at the high latitudes where these bears live. Polar bears and other bears probably use several orientation systems, just as people and homing pigeons do.

Bears provide the most compelling evidence for mammalian navigational ability. We now know that they do not rely on random wandering, expanding search patterns, or familiarity with large areas to find home. Whatever method of orientation they use, it apparently is effective for at least 169 miles. Odors and magnetic cues are possible sources of navigational information, but neither idea has been scientifically tested with bears. More systematic studies are needed. Bears, because they can carry radio collars, might unlock some of the secrets of animal orientation and navigation.

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