Evidence Found of a Learned Navigational Map in White Crowned Sparrows

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A group of researchers led by Kasper Thorup from Princeton University and the University of Washington, Seattle conducted an experiment in September of 2006 on the navigational abilities of adult and juvenile white-crowned sparrows when they are displaced. This study furthered efforts to understand how birds navigate and the capacity of their navigational abilities. The study followed previous research studies, including one by Perdeck who conducted an experiment displacing over 11,000 starlings from the Netherlands to Switzerland; the results indicated that adult starlings could compensate for displacement and that juveniles could not. However, there is also evidence that contrasts Perdeck's study; a more recent study by Akesson suggests that both adult and juvenile white-crowned sparrows could compensate for displacement. To answer the question of whether adult white-crowned sparrows can adjust their migratory path when displaced, Thorup et al. hypothesized that adult white-crowned sparrows have a navigational map that can be used to adjust for displacement while juveniles do not. In the experiment, they displaced two groups of white-crowned sparrows across the continental U.S., predicting the adult sparrows would be able to adjust for the displacement and fly towards their wintering grounds while the juvenile sparrows would continue flying South due to the lack of a navigational map.

Thorup et al. began their experiment by capturing 15 adult and 15 juvenile sparrows from a stopover point in Central Washington while the sparrows were migrating South from Canada towards the South-Western region of the U.S./North-Western Mexico. After capturing the two groups, they transported the birds by car and commercial airplane to Princeton, New Jersey where they kept the birds in separate cages based on age to avoid confounding variables as a result of birds learning from each other. Thorup et al. further avoided this confounding variable by releasing the adult and juvenile sparrows in locations seven kilometers apart from each other and limited the amount of birds flying away at any given time by releasing them over the span of three days. In order to track the birds' flight paths after their release, Thorup et al. attached small radio transmitters between the shoulders of the sparrows which were then tracked by equipment in cars and small aircrafts that followed the birds. Ten frequencies between 164 and 165 megahertz were used as well as three different, easily distinguishable pulse-rates that were assigned based on the day the bird was released, thus allowing for 30 unique combinations of frequency and pulse rate.

After all of the birds had flown over 25 kilometers away from their release site, Thorup et al. stopped collecting data from the birds and observed their results. The data gathered during the experiment suggested that adult white-crowned sparrows do indeed possess a navigational map, as the results of the tracking showed that all but one of the adult birds flew south-west towards the sparrows' wintering ground. The one that broke this pattern flew South during strong winds which pushed the bird in a South-westerly direction, the same direction as the rest of the adults. The data collected by Thorup et al. also shows that all of the juvenile sparrows flew in a southerly direction which would have brought them to their wintering ground had they not been displaced, thus indicating the juvenile birds used an inherited sense of direction to help them reach their wintering grounds before their navigational map was developed. These results suggest that the navigational map is a learned trait rather than an innate one.

The results of the Thorup et al. study support the findings of the earlier study on starling navigation done by Perdeck; the adults were able to adjust for displacement while the juveniles continued as if no displacement had occurred. The study also showed that the navigational map of white-crowned sparrows, and perhaps other species of bird, span at least the entire length of the continental United States. These results are significant for several reasons, the first being that it supports the idea that many species of bird navigate in similar ways; both starlings and ; white-crowned sparrows seem to develop a navigational map as adults that they do not possess as juveniles. Also, and much more importantly, these results suggest that sparrows, and perhaps other birds, use globally, or at least continentally, identical landmarks to create their navigational maps as the landmarks used by the sparrows would have to be the same on either coast of the continental U.S. For a future study, researchers could explore what landmarks might be used by sparrows and other species of bird, whether they may be the stars, the earth's magnetic field, or even perhaps the sun, though the white-crowned sparrows observed in the study flew mostly at night, suggesting the sun was not used. This study was very well done, finding an easy and accurate way to track the sparrows, as well as keeping them within their potential range; even if the birds do not return to their wintering grounds, they will be able to find a suitable location to survive. The researchers also took care to make sure the radio transmitters would not affect the navigational ability of the birds, as testing showed that any changes in magnetic fields caused by the radio transmitter became negligible in a distance shorter than that of the transmitter to the sparrows' head. A potential weakness with the study is that the sparrows were only tracked until all of the birds had flown over 25 kilometers, or 15.5 miles. This distance is not very far, especially for a migratory bird that usually travels from Canada to the South-Western U.S. and there is the possibility that the adult sparrows could have changed direction or even ceased travelling towards their wintering ground somewhere farther along in their journey. While any change in the adult sparrows' paths after the initial 25 kilometers may or may not change the conclusion of the study, were the birds to deviate away from their wintering ground, or stop to winter only part of the way there, these results might bring about new questions or interesting conclusions of their own.