

NATURE | NEWS

Electronics' noise disorients migratory birds

Man-made electromagnetic radiation disrupts robins' internal magnetic compasses.

Jessica Morrison

07 May 2014

[Print](#)

Delpho/ARCO

European robins are among the bird species that orient by detecting magnetic fields.

Interference from electronics and AM radio signals can disrupt the internal magnetic compasses of migratory birds, researchers report today in *Nature*¹. The work raises the possibility that cities have significant effects on bird migration patterns.

Decades of experiments have shown that migratory birds can orient themselves on migration paths using internal compasses guided by Earth's magnetic field. But until now, there has been little evidence that electromagnetic radiation created by humans affects the process.

Like most biologists studying magnetoreception, report co-author Henrik Mouritsen used to work at rural field sites far from cities teeming with electromagnetic noise. But in 2002, he moved to the University of Oldenburg, in a German city of around 160,000 people. As

Top picks
from **nature** news

- Fast genetic sequencing saves newborn lives
- The first South Americans: extreme

part of work to identify the part of the brain in which compass information is processed, he kept migratory European robins (*Erithacus rubecula*) inside wooden huts — a standard procedure that allows researchers to investigate magnetic navigation while being sure that the birds are not getting cues from the Sun or stars. But he found that on the city campus, the birds could not orient themselves in their proper migratory direction.

living

- Infectious disease: Ebola's lost ward

“I tried all kinds of stuff to make it work, and I couldn't make it work,” Mouritsen says, “until one day we screened the wooden hut with aluminium.”

Peace at last

Mouritsen and his colleagues covered the huts with aluminium plates and electrically grounded them to cut out electromagnetic noise in frequencies ranging from 50 kilohertz to 5 megahertz — which includes the range used for AM radio transmissions. The shielding reduced the intensity of the noise by about two orders of magnitude. Under those conditions, the birds were able to orient themselves.

When the team disconnected the grounding, the aluminium plates failed to keep the artificial noise out, and the robins could not find their way. To further test whether electromagnetic noise was responsible, the researchers simulated it using a commercially available signal generator. The birds again became disoriented.

Before sharing the results, the team spent seven years conducting double-blind tests, independently replicated by different generations of students. “We wanted to make sure that we could really document that what we were seeing was real,” says Mouritsen.

Navigational error

The findings imply that the birds' navigation is controlled by a biological system sensitive to artificial electromagnetic noise, but the biophysical mechanism is unclear. Even so, the work raises the controversial prospect that it might be necessary for humans to stop using the relevant part of the electromagnetic spectrum, says Joseph Kirschvink, a geobiologist at the California Institute of Technology in Pasadena, and the author of a commentary accompanying the paper².

Roswitha Wiltschko, a bird navigation researcher at the University of Frankfurt in Germany, has not seen the effect in her own work. “We never used any shielding, and our birds were perfectly oriented,” she says. “This is really a surprising thing for me that there can be such a strong disrupting field.”

Wiltschko cautions against concluding that electromagnetic noise affects migratory birds in all cities, but other researchers report seeing evidence of the phenomenon. “These effects are real,” says John Phillips, a sensory biologist at Virginia Tech in Blacksburg. Phillips conducts behavioural studies related to navigation and spatial memory in other species, including mice and newts, and shields them from electromagnetic interference that he contends could skew experiments. “You wouldn't study a vision mechanism with flashbulbs going off at irregular intervals,” he says.

Related stories

- Pigeons may ‘hear’ magnetic fields
- ‘Magnetic cows’ are visible from space
- Built in compass helps bats find their way home

More related stories

Mouritsen plans further work on the effects of electromagnetic noise, in part to examine the precise workings of the birds' magnetic sense. But he says that noise could already be causing practical problems for birds: "If birds can't use one of their most significant compasses when they are in towns, what effect will that have on survival?"

Nature doi:10.1038/nature.2014.15176

Read the related News and Views.

References

1. Engels, S. *et al. Nature* <http://dx.doi.org/10.1038/nature13290> (2014).

Show context

PubMed ISI

2. Kirschvink, J. L. *Nature* <http://dx.doi.org/10.1038/nature13334> (2014).

Show context

PubMed ISI

Related stories and links

From nature.com

- **Pigeons may 'hear' magnetic fields**
26 April 2012
- **'Magnetic cows' are visible from space**
25 August 2008
- **Built in compass helps bats find their way home**
06 December 2006

From elsewhere

- **Henrik Mouritsen**
 - **Joseph Kirschvink**
 - **Roswitha Wiltschko**
 - **John Phillips**
-

For the best commenting experience, please login or register as a user and agree to our Community Guidelines. You will be re-directed back to this page where you will see comments updating in real-time and have the ability to recommend comments to other users.

Comments for this thread are now closed.

7 comments

Subscribe to comments



Sanal Madhusudana Girija · 2014-05-12 06:14 PM

I am skeptical about the observations and conclusions presented in this paper on the effect of radio waves on spacial position sensing in birds. The paper raises more questions than answers. This paper needs scrutiny. Metal wire meshes are used to block electromagnetic waves (depending on the frequency). I did not understand how electric grounding attenuated electromagnetic noise and it came back when the circuit was open (see the accompanying video). Why the birds are sensitive to AM frequency range 50 kHz to 5 MHz? What is the evolutionary logic by which birds are sensitive to electromagnetic waves at this frequency? The earth has a magnetic field, but how it generates electromagnetic waves in this frequency range? To my knowledge there is something called "Schumann resonances" but it is unlikely that birds will evolve a mechanism to use this to sense directions. The main background in this Schumann spectrum, beginning at 3 Hz and extend to 60 Hz, and peaks at extremely low frequencies 7.83 (fundamental), 14.3, 20.8, 27.3 and 33.8 Hz. The solar radiation and its effect on the earth's atmosphere is another source of naturally occurring electromagnetic interference besides the lightning. It is also not clear in the paper about the orientation of the huts with respect to the earth's magnetic field and the position with reference to the sun. However the authors seem to admit that the previous efforts to show the influence of electromagnetic noise (excluding heat and visible light!) were not reproducible. How much electromagnetic energy (in radio frequency) was received by these birds during the procedure? Please see the Pubpeer link as well :<http://pubpeer.com/publications/5B13EF1964CA0AD9D50CC948011ECE>



Venkatasubramanian Sivakumar · 2014-05-12 06:38 AM

This study and its outcomes are to be viewed seriously as the number and use of mobile phones are growing day by day. Previous studies indicate that Sparrow species is endangered and not seen frequently in Indian cities as earlier, i.e. before the arrival of mobile phones. I am living in Chennai and from my experience, I can say this is applicable to Chennai and I don't know whether the same with regard to Sparrow is applicable to all cities. Therefore, from the above study, I fear that the RF waves from cell phone towers which are posted in most of the places, may badly affect all the birds, since they are involved in causing disturbances to their migration. In my opinion most of the birds are surviving because of seasonal migration (longer or shorter) as one of their resources in order to have better eco-system based on climate, water, food etc. suitable for them. Even in Chennai at Pallikarani lake, birds from abroad are arriving seasonally, as generally practiced in one of the famous bird's sanctuary at Vedanthangal near Chennai. Therefore, we should frame guidelines for restraining those activities which may endanger living beings of nature and nature. We should respect and safe guard our nature; rather than exploiting this same.



sheri hathaway · 2014-05-12 03:51 AM

Today sitting near a window on the fourth floor of a hotel nearing sunset I heard a thump as something hit the window. There were a few downy white feathers adhered to the glass. I believe the setting sun shining directly on the window polarized the glass causing disruption of the birds innate magnetic properties. Unexplained phenomena occurs when large flocks of migratory birds fall from the sky to their deaths for no apparent reason. Migratory fish possessing this same inborn magnetism, which enables them to travel thousands of

miles to their birthplace, have met the same fate as the birds (New Years Eve 2011). I believe the cause was the same as why the bird hit the window. The disruption of electromagnetism can be caused by natural occurrences such as refracted sunlight on glass, solar flares or man made EMP's. There are bacteria that also possess magnetotactic properties. My guess is if an experiment were to be performed on these bacteria using a low pulse electromagnetic wave you would see the same results (disruption of polarity).



Javed Mir • 2014-05-10 01:55 PM

--the internal magnetic compasses of migratory birds-- A wonder that how this universe is mutually connected but the writer failed to tell us where that internal compass is located in the bodies of the birds?



Einar Flydal • 2014-05-08 03:09 PM

Great that these results are published in Nature! These research results confirm what several other studies have confirmed over the last decades: Modern, wireless society is on collision course with nature. For a person having worked almost four decades in ICT and telecom, that is depressing news. For my attempt to sum up what I found on this after I retired and took a little time to dive into literature, see: <http://www.slideshare.net/einarflydal/are-we-killing-the-bees-30-min-lecture-march-2014> You will see that the findings from this recent study is hitting spot on on a huge and critical topic - by some called "the disaster of the 21st century". Now is the time to look for alternatives to the radio waves based society.



L K • 2014-05-08 04:00 AM

Interestingly, this article only comments on AM bandwidth, yet the EMFs put out in the cell phone frequency range are what have proliferated millions of times since the 1980s. It would be useful for the authors to investigate whether certain frequencies have this effect. Or whether the untoward saturation with frequencies contribute. If they had done this experiment in a city in the 1970s or 1950s would their findings be different?



Astilbe Martin • 2014-05-07 06:22 PM

This elicits questions about Schumann resonance, too - especially for people - and high power military ELF transmitters toward submarines. Could the Flynn effect arise from decoupling brains from Schumann resonance frequency bands?

See other News & Comment articles from *Nature*

Nature ISSN 0028-0836 EISSN 1476-4687

© 2014 Nature Publishing Group, a division of Macmillan Publishers Limited. All Rights Reserved.

partner of AGORA, HINARI, OARE, INASP, CrossRef and COUNTER