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'Electrosmog' disrupts orientation in migratory birds, scientists show

Date: May 8, 2014

Source: University of Oldenburg

Summary: For the first time, scientists have demonstrated that the magnetic compass of robins fails entirely when the birds are exposed to AM radio waveband electromagnetic interference -- even if the signals are just a thousandth of the limit value defined by the World Health Organization as harmless.

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FULL STORY

For the first time, a research team led by Prof. Dr. Henrik Mouritsen, a biologist and Lichtenberg Professor at the University of Oldenburg, has been able to prove that the magnetic compass of robins fails entirely when the birds are exposed to AM radio waveband electromagnetic interference.

Below a certain threshold value, 'electrosmog' -- human-made electromagnetic noise -- has no impact on biological processes or even human health. That was the state of scientific knowledge up to now. But for the first time, a research team led by Prof. Dr. Henrik Mouritsen, a biologist and Lichtenberg Professor at the University of

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Oldenburg, has been able to prove that the magnetic compass of robins fails entirely when the birds are exposed to AM radio waveband electromagnetic interference -- even if the signals are just a thousandth of the limit value defined by the World Health Organization (WHO) as harmless.

The findings based on seven years of research by nine Oldenburg scientists, in cooperation with Prof. Dr. Peter J. Hore of Oxford University, are now available in a paper entitled "Anthropogenic electromagnetic noise disrupts magnetic compass orientation in a migratory bird," published in the latest issue of the journal *Nature*. *Nature* underlines the importance of this study by making it the cover story of its May 15th issue.

"In our experiments we were able to document a clear and reproducible effect of human-made electromagnetic fields on a vertebrate. This interference does not stem from power lines or mobile phone networks," Mouritsen stresses, explaining that electromagnetic interference within the two kilohertz to five megahertz frequency range is mainly generated by electronic devices. "The effects of these weak electromagnetic fields are remarkable: they disrupt the functioning of an entire sensory system in a healthy higher vertebrate."

It all started with a stroke of luck. For around 50 years it has been known that migratory birds use Earth's magnetic field to determine their migratory direction. Biologists have proven this in numerous experiments in which they tested the birds' navigation abilities in so-called orientation cages. "So we were surprised when robins kept in wooden huts on the Oldenburg University campus were unable to use their magnetic compass," Mouritsen recounts. Dr. Nils-Lasse Schneider, an electrophysiologist and researcher in Mouritsen's work group, then came up with the idea that set things in motion: he proposed covering the wooden huts, along with the orientation cages they contained, with sheets of aluminium.

This did not affect Earth's magnetic field, which is vital for the birds to navigate, but it strongly attenuated the time-dependent electromagnetic interference -- the electrosmog -- inside the huts. The effect was astounding: suddenly the birds' orientation problems disappeared. "Our measurements of the interferences indicated that we had accidentally discovered a biological system that is sensi-

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tive to anthropogenic electromagnetic noise generated by humans in the frequency range up to five megahertz," Mouritsen says. The surprising thing here, the biologist adds, was that the intensity of the interference was far below the limits defined by the International Commission on Non-Ionizing Radiation Protection and the WHO.

Considering the potential importance of the finding, Mouritsen and his team performed a large number of experiments to provide evidence of the effect they observed: "Over the course of seven years we carried out numerous experiments and collected reliable evidence, in order to be absolutely certain that the effect actually exists." Under the leadership of Svenja Engels, Mouritsen's doctorate students conducted numerous so-called double-blind studies. Several generations of students repeated the experiments independently of one another on the Oldenburg campus. What they found was that as soon the grounding of the screens was disconnected or electromagnetic broadband interference was deliberately created inside the aluminium-clad and earthed wooden huts, the birds' magnetic orientation ability was immediately lost again.

Furthermore, the scientists were able to show that the disruptive effects were generated by electromagnetic fields that cover a much broader frequency range at a much lower intensity than previous studies had suggested. This electromagnetic broadband interference is omnipresent in urban environments. It is created wherever people use electronic devices. As expected, it is significantly weaker in rural areas. And indeed, unlike on the University campus, the magnetic compass of the robin did function in orientation cages placed one to two kilometres outside city limits, even without any screening. "Thus, the effect of anthropogenic electromagnetic noise on bird migration is localised. However these findings should make us think -- both about the survival of migratory birds as well as about the potential effects for human beings, which have yet to be investigated," Mouritsen concludes.

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Materials provided by **University of Oldenburg**. *Note: Content may be edited for style and length.*

Journal Reference:

1. Svenja Engels, Nils-Lasse Schneider, Nele Lefeldt, Christine Maira Hein, Manuela Zapka, Andreas Michalik, Dana Elbers, Achim Kittel, P. J. Hore, Henrik Mouritsen. **Anthropogenic electromagnetic noise disrupts magnetic compass orientation in a migratory bird**. *Nature*, 2014; DOI: [10.1038/nature13290](https://doi.org/10.1038/nature13290)

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