

Dogs are sensitive to small variations of the Earth's magnetic field.

Hart *et al.* Frontiers in Zoology 2013

<https://frontiersinzoology.biomedcentral.com/articles/10.1186/1742-9994-10-80>

Abstract Introduction: Several mammalian species spontaneously align their body axis with respect to the Earth's magnetic field (MF) lines in diverse behavioral contexts. Magnetic alignment is a suitable paradigm to scan for the occurrence of magnetosensitivity across animal taxa with the heuristic potential to contribute to the understanding of the mechanism of magnetoreception and identify further functions of magnetosensation apart from navigation. With this in mind we searched for signs of magnetic alignment in dogs. We measured the direction of the body axis in 70 dogs of 37 breeds during defecation (1,893 observations) and urination (5,582 observations) over a two-year period. After complete sampling, we sorted the data according to the geomagnetic conditions prevailing during the respective sampling periods. Relative declination and intensity changes of the MF during the respective dog walks were calculated from daily magnetograms. Directional preferences of dogs under different MF conditions were analyzed and tested by means of circular statistics.

Results: Dogs preferred to excrete with the body being aligned along the North–South axis under calm MF conditions. This directional behavior was abolished under unstable MF. The best predictor of the behavioral switch was the rate of change in declination, i.e., polar orientation of the MF.

Conclusions: It is for the first time that (a) magnetic sensitivity was proved in dogs, (b) a measurable, predictable behavioral reaction upon natural MF fluctuations could be unambiguously proven in a mammal, and (c) high sensitivity to small changes in polarity, rather than in intensity, of MF was identified as biologically meaningful. Our findings open new horizons in magnetoreception research. Since the MF is calm in only about 20% of the daylight period, our findings might provide an explanation why many magnetoreception experiments were hardly replicable and why directional values of records in diverse observations are frequently compromised by scatter.

Experiment

Record dog's direction of body axis while pooping or peeing.
Also capture date/time and location.

Dog:

Name: "Sonic Boom"

Breed: American Pit Bull Mix

Dog age at start of experiment: *14 weeks approx

*Date of Birth is unknown. A 6 week age estimate was given by veterinarian on January 18, 2019 after examining the dog's deciduous (baby) teeth.



Fig 1: "Sonic Boom" photographed on March 30, 2019

Data Capture

Spyglass iOS Application

Version: 3.9.9

Author: Pavel Ahafonau (<http://paully.com>)

Installed on device: iPhone 8

Compass Settings

Classic Compass: On

Magnetic north instead of true north: On

Magnetic Declination: On

Gyroscope: On

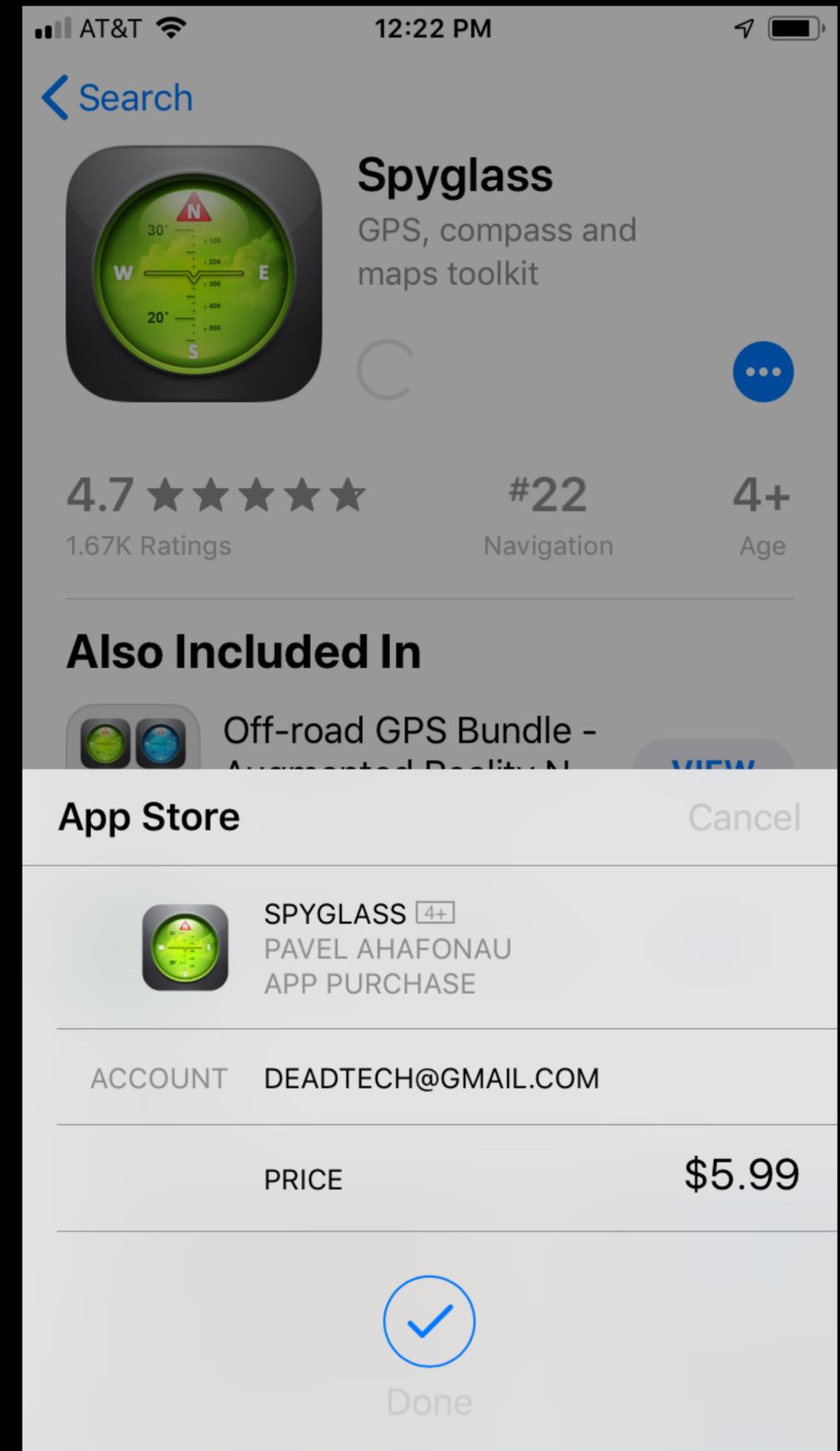
Units

Precise Scales On

Metric Units: On

Display

Show Current Time: On



Data Collected

03.26.19



03.27.19



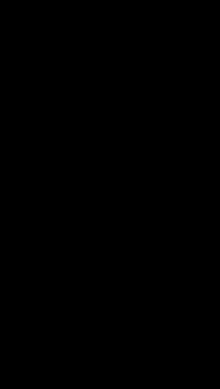
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03.29.19



03.30.19



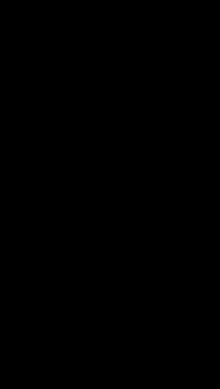
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04.01.19



04.02.19



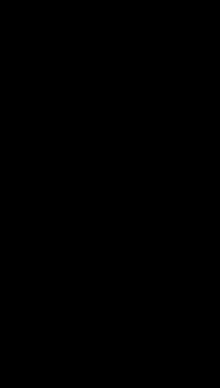
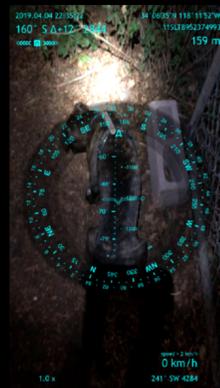
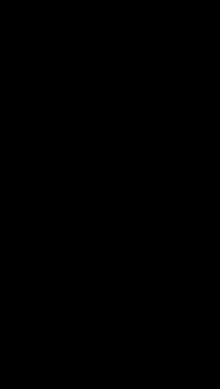
04.03.19



04.04.19



04.05.19



Results also Indeterminate

Inconclusive. Possible reasons for insufficient and indeterminate results include:

Dog age is out of tested range.

Analysis of the alignment during defecation under conditions of stable magnetic declination (0% changes) revealed no significant effect of sex. There may be a slight effect of age: dogs in the age category 2.5-7 years showed a clearer preference than younger or elder dogs (not shown). The effect of the dog breed could not be tested because of small sample sizes.

Pooping vs peeing was not captured

this data for males and females separately we found a slight difference in the patterns between sexes: Pooled data (without the dog M07) and mean values of all males with at least 5 observations revealed a significant angular preference for North-West heading during urination (Table 5). The male borzoi M07 contributed approximately one third of the urination data and was analyzed separately (Table 6); the results were similar to the pooled data of all other males. In contrast, females showed an axial preference for approximately the North-South axis

during urination (Table 7). As in the case of defecation, sorting the data according to the relative changes of declination revealed a significant effect of this factor and a significant axial North-South alignment only under calm MF conditions (for 0% declination change: $\mu = 167^\circ / 347^\circ \pm 16^\circ$, $r = 0.343$, Rayleigh test: $n = 49$, $p = 0.003$, $Z = 5.766$; second order (weighted) statistics: WMV: $173^\circ / 353^\circ$, $r = 0.165$, Hotelling test: $n = 49$, $p = 5.08 \cdot 10^{-4}$, $F = 8.952$; Figure 3, Tables 5, 6, 7). The raw data distributions during changing declination were significantly different from the

Study was not truly blind. Owners intent could have been transmitted to dog.

The study was truly blind. Although the observers were acquainted with our previous studies on magnetic alignment in animals and could have consciously or unconsciously biased the results, no one, not even the coordinators of the study, hypothesized that expression of alignment could have been affected by the geomagnetic

Likelihood of pseudoreplications high. Dog peed and pooped in favorite places in yard and on neighborhood walks.

is lifted are currently under study. All recordings were made outside on open fields, and routes of walks were routinely changed to exclude or limit pseudoreplications which would arise when dogs are defecating or urinating at just a few places within their kennel or house yard.

Photos captured exhibit variations in spine alignment.

