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A Dog That Seems to Know When His Owner Is Coming Home: Effect of Environmental Variables

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Abstract—Initial observations by Sheldrake and Smart from 1994 through 1997 suggested that a male terrier dog named Jaytee was able to anticipate when Smart was returning home. In a later series of 45 formal videotaped experiments, Jaytee's anticipatory behavior proved to be significantly accurate. Although Jaytee's performance was remarkably accurate on average, sometimes he failed to anticipate his owner's return. Analysis of environmental variables on the days of the tests suggests that Jaytee's behavior was significantly affected by changes in a complex assortment of geomagnetic and other environmental factors.

Keywords: geomagnetism—environment—psi—animal behavior

Introduction

A major challenge in attempting to understand the anomalous informational processes known as psychic or "psi" phenomena is how to separate the information *transfer* from the information *processing* mechanisms. That is, at least half of the mystery about psi perception is how information gets from a remote location to a percipient's brain/mind. The other half is how the brain/mind processes and interprets that information once it arrives. These mysteries have persisted because psi effects observed under controlled conditions are usually quite weak. In rare cases, when evidence for psi is consistently strong, it becomes possible to distinguish between the two processes. Rupert Sheldrake and Pamela Smart (1998, 2000) recently reported such a case involving what appeared to be a telepathic bond between a dog and his owner.

Sheldrake's experiments were motivated by observations suggesting that a male terrier dog, named Jaytee, was able to anticipate when his owner, Pamela Smart, was about to return home. Over a period of several years, Smart's parents noticed that Jaytee adopted a characteristic waiting behavior near the front window shortly before Smart arrived home. As part of a program of testing unusual abilities of animals, Sheldrake tested Jaytee's purported telepathic abilities in a systematic way (Sheldrake, 1999).

I use this case to explore the second mystery, i.e., how psi information is processed. I finesse the first mystery—how information gets from here to there—by assuming something like a holographic model of the universe (Talbot,

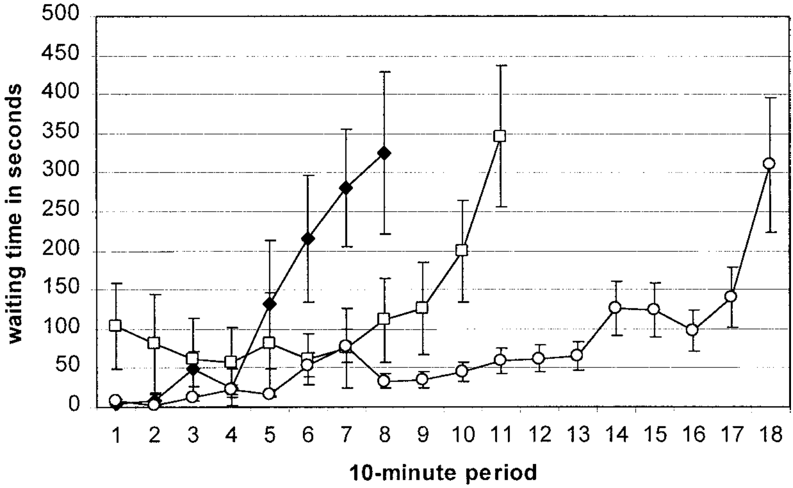

Fig. 1. Average number of seconds (and one-standard error bars) that Jaytee waited in front of the window.

1992), in which all information is enfolded in everything and is available everywhere. Under that holistic model, we need not worry about how information gets from here to there, because all information ‘‘resides’’ at the same place. Of course, such holistic models are also unsatisfying because they are untestable; at least, no one yet has thought of an unambiguous way to falsify them. But they do simplify the search for an explanation of why psi performance varies, because now the mystery is recast into questions involving nervous system activities such as attention and perception, as well as external factors that may influence these abilities.

The Experiments

Given some success with an initial series of observations of Jaytee, Sheldrake initiated a series of 45 videotaped experiments. These were conducted from 1995 through 1997 (Sheldrake & Smart, 1998, 2000). In these studies, the front window of Jaytee’s house (in most cases) was continuously recorded on videotape while Smart was out of the house, and the video record was later examined by independent judges to measure the amount of time that Jaytee spent at the window. These experiments included three kinds of sessions: those in which Smart spontaneously decided when she would return home, sessions in which distant experimenters remotely signaled her (via a pager) to return home at a randomly determined time, and sessions conducted by investigators skeptical of Jaytee’s purported abilities (Wiseman et al., 1998).

The hypothesis in these experiments was that Jaytee would spend little or no systematic waiting time at the front window until Smart intended to return home,

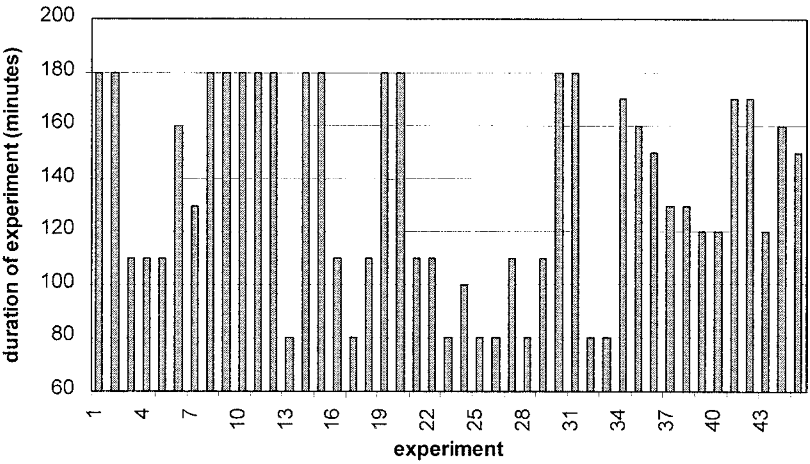

Fig. 2. Duration in minutes of the 45 experiments with Jaytee, in chronological order.

whereupon Jaytee would then wait there until she arrived. To assess the results of these sessions, Sheldrake asked independent judges to record the number of seconds in successive blocks of 10 minutes in which Jaytee waited at the front window, for all 10-minute blocks in each experiment. The average waiting times are shown in Figure 1 for experiments of short, medium, and long duration (this is a composite of Figure 4 in Sheldrake & Smart, 2000). Note that the terminal points in these three graphs represent the last 10 minutes before the period that Smart intended to return home.

Sheldrake (1999) and Sheldrake and Smart (1998, 2000) discussed possible alternative explanations for these results, including human behavioral cues, subliminal sensory cues, and shared human and dog habits, but they rejected these alternatives in favor of a genuine anomaly, such as a telepathic bond. By contrast, in four independent tests, Wiseman et al. (1998) used as a criterion for success the first time that Jaytee "inexplicitly visited the porch for more than 2 minutes." By this criterion, three of four of the Wiseman et al. tests were failures. But that same data analyzed by Sheldrake's method showed that Wiseman et al.'s experiments produced waiting-time graphs that were virtually identical to those reported by Sheldrake (1999). Consequently, Wiseman et al.'s conclusions, especially as they were portrayed in the British press (e.g., "Psychics pets are exposed as a myth," *The Daily Telegraph*, August 22, 1999) may have been premature.

Besides being difficult to explain as an artifact of sensory cueing, the experimental results also resist the explanation that Jaytee learned to increase his waiting time over the course of a day until Smart's return, because, as seen in Figure 1, the data show that the final, fast rise in waiting time depended upon the length of the experiment. But what about other potential artifacts? Figure 2 shows the duration of successive experiments. The autocorrelation (lag 1) for

TABLE 1
Correlation Between Jaytee's Performance and Three Factors

	Time of day	Experiment length	Days elapsed between experiments
Correlation	−0.24	0.03	−0.02
p (two-tailed)	0.11	0.82	0.91

these durations is r = 0.35 (p = 0.02, two-tailed); thus, in principle, Jaytee might have learned that there was a small tendency for shorter experiments to be followed by longer experiments. However, even with explicit knowledge of this tendency, it is doubtful that this would have influenced the dog's behavior because these tests were conducted an average of 20 days apart (minimum of 1 day to maximum of 126 days).

Other questions that could be asked include: Did the length of a given experiment influence Jaytee's performance? Or the time of day when the experiment started? Or the number of days that elapsed between successive experiments? To explore these questions, correlations were determined between these factors and Jaytee's performance per experiment (measured by the value ψ, described later). As shown in Table 1, none of these correlations were significant predictors of Jaytee's performance. In addition, in a series of 10 control tests where Smart did not return home the same day, Jaytee's waiting time was essentially flat (Sheldrake, 1999; Sheldrake & Smart, 2000).

Because Jaytee's performance appears to reflect a genuine psi-type ability, motivation for the present analysis was not to try to explain the experimental successes, but to examine possible causes for the failures. That is, the fact that Jaytee did not always correctly anticipate Smart's return home may provide hints about the mechanisms underlying his ability. Sheldrake and Smart speculated that some of the failed sessions may have been due to periods when Jaytee was feeling ill, or was distracted by neighborhood cats, or sleeping, or hiding from Smart's father. These are plausible explanations, but there may be others.

Psi and the Planetary Geomagnetic Field

A growing number of studies suggest that the Earth's fluctuating geomagnetic field (GMF) affects both human and animal physiology and behavior (e.g., Braud & Dennis, 1989; Ganjavi et al., 1985; Lukacova & Tunyi, 1988; Olcese et al., 1988; Persinger, 1983, 1985, 1987a,b, 1991; Persinger & Levesque, 1983; Persinger & Nolan, 1984; Radin, 1996a; Roney-Dougal & Vogl, 1993; Stehle et al., 1988; Thomas et al., 1986; Watanabe et al., 1994). Of particular interest here is evidence indicating that the accuracy of psi perception in humans increases during days with small changes in planetary GMF and decreases during days with large changes in GMF. This correlation has been observed both in case studies of spontaneous psi experiences and in controlled laboratory experiments (e.g., Adams, 1986, 1987; Arango & Persinger, 1988; Berger & Persinger, 1991; Haraldsson & Gissurarson,

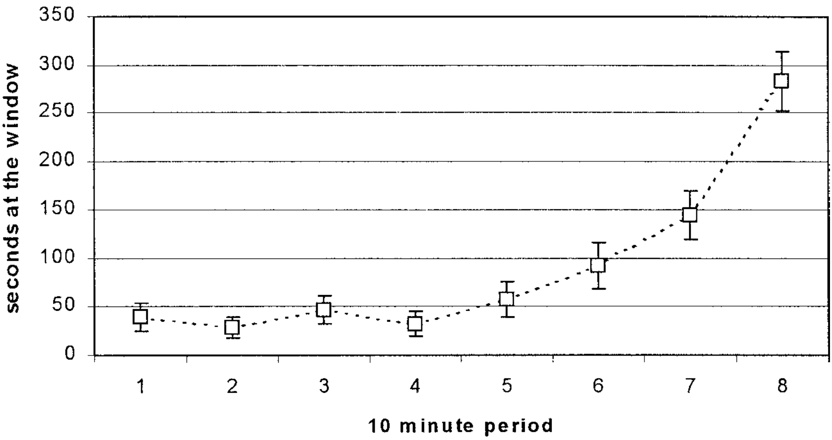

Fig. 3. Average waiting time and one standard error bars for all 45 videotaped experiments, rescaled to a uniform 80 minutes in duration.

1987; Lewicki et al., 1987; Makarec & Persinger, 1987; Persinger & Krippner, 1989; Persinger & Schaut, 1988; Radin, 1992, 1993, 1996b; Radin et al., 1994; Schaut & Persinger, 1985; Spottiswoode, 1990, 1997b; Wilkinson & Gauld, 1993).

It is also well known that many animals, ranging from salamanders to birds, rely on geomagnetic cues for spatial orientation and navigation (Mather & Baker, 1980; Moore, 1977; Presti & Pettigrew, 1980). Humans, too, can apparently use the geomagnetic field for orientation (Baker, 1981, 1987), although this subtle sense is commonly overridden when other information is available, such as terrain landmarks or solar position. When the geomagnetic environment is disrupted, e.g., as a consequence of solar flares, animals that rely on their magnetic compass become disoriented. Although the underlying neurological mechanisms are not well understood, theories postulate that biogenic magnetite in the nervous system may be responsible for this ‘‘magnetic sense’’ (Barinaga, 1992; Deutschlander et al., 1999).

The correlations observed between GMF flux and psi performance raise the possibility that Jaytee's ability to remotely track his owner's whereabouts may be analogous to an orientation or navigational skill. That is, it is conceivable that the processes in a dog's brain that are responsible for ordinary orientation may also be responsible for processing ‘‘non-local’’ orientation information. If this were so, then we could predict that if Jaytee's orientation ability was disrupted during geomagnetic storms, then the purported telepathic link with his human companion would also suffer.

The present analysis was also motivated by a possible psi-lunar relationship (Radin, 1997), by reports indicating that psi performance may be correlated with other factors such as local sidereal time and solar wind (Spottiswoode, 1997a; Spottiswoode & May, 1997), and by evidence that the Earth's magnetic field may be influenced by relationships among the inner planets (e.g., Nelson, 1952).

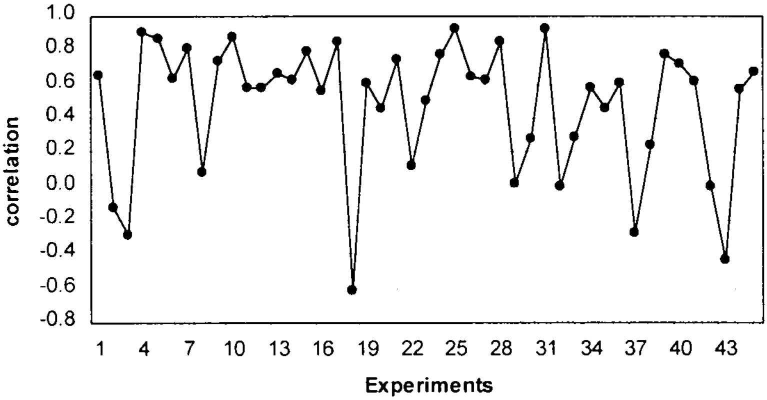

Fig. 4. Values of ψ correlations over the 45 experiments.

Analyses

Environmental Indices

The geomagnetic index used in this study was the A_p index, a daily planetary-wide index of GMF flux. A_p values were retrieved for the days of the experiments, and for days before and after the experiments, from the US National Oceanic and Atmospheric Administration's Web site.[1] Other data retrieved included daily sunspot numbers, 10-cm solar radio flux, percentage of illumination of the lunar disk, latitude of the Moon with respect to the equator, proton flux in the upper atmosphere above 1 MeV, solar wind speed, and the positions of Mercury, Venus, and Mars with respect to the Earth.

Performance Measure

The initial requirement for this analysis was a measure of Jaytee's performance per experiment. This value would be used to correlate against the environmental variables. To create this value, we first normalized the different experimental durations to a uniform 80 minutes. Normalization was employed, rather than simply truncating longer experiments to exactly 80 minutes, because Sheldrake's data indicate that Jaytee's characteristic waiting-time behavior depended on the length of the experiment, as shown in Figure 1, and not on a fixed length of time.

The result of this normalization is shown in Figure 3. It is worth noting that the difference in Jaytee's average waiting times between periods 7 and 8 is highly significant ($p = 0.0007$, two-tailed), suggesting that something alerted the dog prior to his owner's return. Recall that the last period in the test (period 8 in the normalized curve) represents the 10 (normalized) minutes *before* the period in which Smart returned home. Thus, this sudden rise in waiting time is

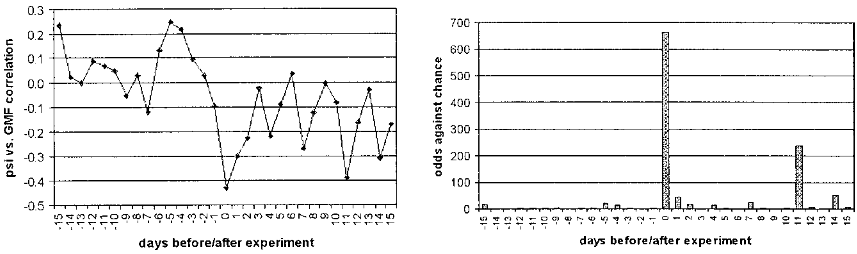

Fig. 5. (Left) Correlation between ψ and A_p index on the day of the experiment (day 0), and A_p 15 days before and after the experiment. (Right) Associated one-tailed odds against chance.

unlikely to be due to subliminal cues associated with, say, the sound of Smart's automobile or bicycle coming down the road.

The next step is to use the curve in Figure 3 to create a relative measure of performance. If Jaytee adopted his characteristic waiting behavior only in anticipation of greeting Smart, then the waiting time for all 10-minute periods prior to Smart's return would be zero, and the 10-minute period of her return would be some number greater than zero. However, because of many uncontrolled elements in Jaytee's actual environment, including times when the dog went to the front window because of some noise or attractive movement, we may assume a progressively rising waiting time rather than an ideal step-function.

Thus, for a relative measure of Jaytee's performance per experiment, I calculated the Pearson correlation (call it ψ) between a second-order polynomial fit to the curve in Figure 3 versus Jaytee's normalized performance per experiment.[2] The more positive the value for ψ, the more that Jaytee's performance in a given test resembled a fast-rising curve, as shown in Figure 3. The resulting values for ψ, shown in Figure 4, indicate that in many of the tests Jaytee's anticipatory behavior was remarkably good, but in at least 10 tests he hardly responded at all or spent progressively less time at the front window.

Results

Figure 5 shows the correlation across all 45 experiments between ψ and natural log of the A_p index[3] for the day of the experiment (shown as day 0) and the associated one-tailed odds against chance for these correlations (assuming negative correlations). Then, to examine environmental lead and lags, similar correlations were calculated using the A_p index up to 15 days before and after the experiment.[4] The significant negative correlation on the day of the experiment confirms previous observations suggesting that stormy geomagnetic days are associated with poorer psi performance. Figures 6 through 8 show similar results, with time-shifts of plus and minus 50 days from the day of the experiment, against other environmental factors.

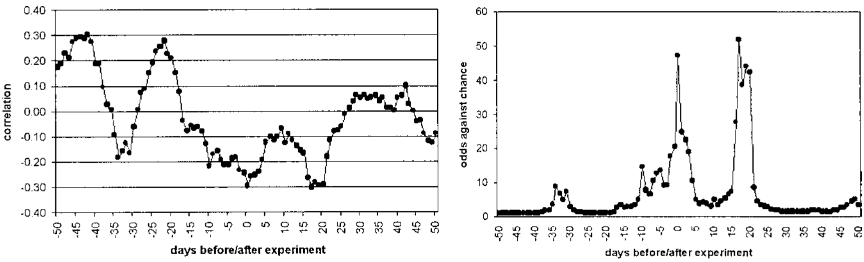

Fig. 6. (Left) Correlation between ψ and 10-cm solar flux on the day of the experiment, and for 50 days before and after the experiment. (Right) One-tailed odds against chance for these correlations.

Multiple Regression Model

The graphs above indicate that Jaytee's performance (ψ) on the day of the experiment was significantly negatively correlated with four environmental factors: geomagnetic flux, sunspots, 10-cm solar radio flux, and synodic lunar phase. Of course, because some of these environmental factors are strongly cross-correlated, if one of the correlations is negative, then it is to be expected that some of the others would be negative as well. And because these factors are also autocorrelated, it is expected that some of the lead and lag-shifted correlations would also be significant.

These known interrelationships provide the potential to devise more optimal predictive models of Jaytee's performance. For example, one approach is to determine a multiple regression on ψ with lunar phase, A_p index, sunspot number, and 10-cm solar flux. Performing such a regression results in a highly significant multiple $R = 0.5$, as shown in Figure 9. This same regression model was then applied to the environmental data shifted in time by plus and minus 50 days to see if their joint contributions on the day of the experiment were uniquely meaningful. Although this model appears to have impressive predictive power, because of the large auto- and cross-correlations among these environmental factors, the odds against chance shown in Figure 9 are inflated beyond their true levels of statistical significance.

To judge the significance of a multiple regression model given this environmental data, and to compare the results to ±7 days from the day of the experiment, a randomized permutation method was used. The following steps were followed:

(1) Randomly select seven environmental variables out of a pool of eleven such variables.[5]
(2) Determine a multiple linear regression on ψ (call it **R**) using these seven variables.
(3) Repeat steps 1 and 2 a total of 500 times, keeping track of the resulting **R**s.
(4) Find those environmental factors associated with the maximum value of **R** in step 3.

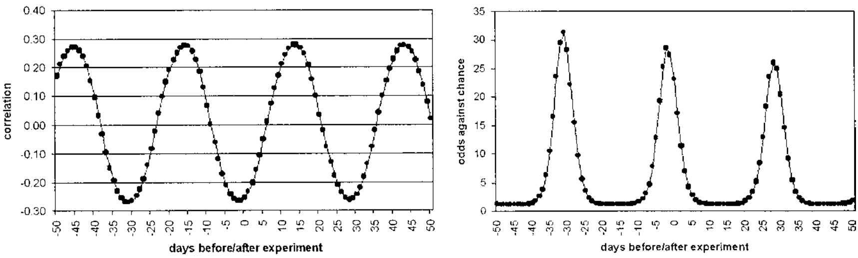

Fig. 7. (Left) Correlation between ψ and synodic lunar phase. (Right) One-tailed odds against chance. The correlation curve appears to be a uniform sine wave, but the amplitude of this curve changes slightly as the lunar phase leads and lags, as revealed in the odds graph.

(5) Now calculate $\mathbf{R}_j$ using the seven variables found in step 4, where j ranges from −7 to +7, and j indicates the number of days to lead or lag the environmental factors.
(6) Randomly permute the order of the original 45 ψ values.
(7) Calculate $\mathbf{R}_{jp}$ using the seven variables found in step 4, where j ranges from −7 to +7 as in step 5, and the p in $\mathbf{R}_{jp}$ indicates that these values are based on a permutation of ψ.
(8) Repeat steps 6 and 7 a total of 1,000 times, keeping track of the values of $\mathbf{R}_{jp}$, and counting the number of times that $\mathbf{R}_{jp} > \mathbf{R}_j$. Call these counts $\mathbf{C}_j$.
(9) The probability associated with $\mathbf{R}_j$ is $p_j = \mathbf{C}_j/1000$.
(10) Run steps 5 through 9 again, using the same set of environmental variables except using the values *shifted* +60 days after the days of the original experiment. These results act as a control test of the randomized permutation method.

The seven environmental factors selected after following this procedure included the phase for the Moon and for Mercury, latitude of the center of the Moon, brightness of Mercury as observed from the Earth, sunspot number, solar wind speed, and proton flux. Interestingly, the optimal variables selected did not include A_p. This should not be too surprising, however, because the present procedure was not designed to select the strongest individual correlations, but rather the set of variables providing the strongest overall predictive capability.

The resulting values for $\mathbf{R}_j$ and their associated one-tailed odds against chance as determined by the randomized permutation analysis (as well as similar values for the control test) are shown in Figure 10. The results indicate that only the combined environmental factors on the days of the actual experiments were significant. This suggests that a variety of global and extraterrestrial environmental factors can indeed predict Jaytee's performance.[6]

Discussion

The primary problem posed by these results is that the electromagnetic and magnetic fields generated by common household devices are hundreds to

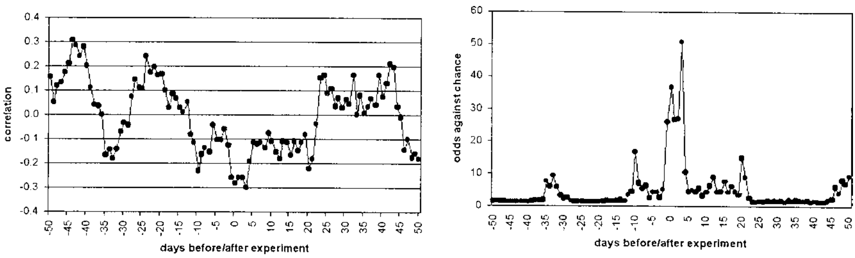

Fig. 8. (Left) Correlation between ψ and sunspot number. (Right) One-tailed odds against chance for these correlations.

thousands of times stronger than the natural fluctuations in the Earth's geomagnetic field, and millions of times stronger than electromagnetic influences associated with, say, the position of Mercury with respect to the Earth. Until recently, it was widely assumed that the amount of energy absorbed by living organisms through Earth-strength magnetic field fluctuations was too weak to affect biology at the cellular level (e.g., Adair, 1991). Nevertheless, a growing bioelectromagnetics literature continues to suggest that exquisitely small variations in electromagnetic flux are associated with cellular and behavioral changes in a very wide range of living organisms (e.g., Barinaga, 1992; Becker, 1990; Watanabe et al., 1994).

In the present case, although the underlying mechanisms are uncertain, it is clear that Jaytee's performance suffered on days when the Earth experienced higher global geomagnetic flux. For example, if we simply separated the 45 experiments into the 5 most and 5 least geomagnetically active days, we find that Jaytee's average performance was significantly higher on the calm days as compared to the stormy days ($p = 0.05$, one-tailed).

I speculated that because the ability of many animals to orient and navigate in space is modulated by geomagnetic flux (Baker, 1981, 1987; Moore, 1977), then if Jaytee's performance was similarly modulated, we may infer that the neurological processes that allow organisms to locate objects in space may also

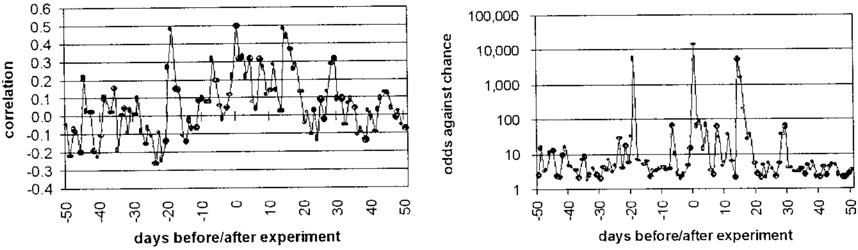

Fig. 9. Multiple regression model on ψ using lunar phase, A_p index, sunspot number, and 10-cm solar flux, and the associated odds against chance for ±50 days from the day of the experiment.

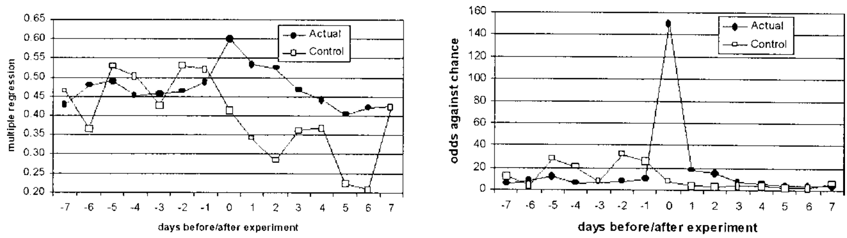

Fig. 10. (Left) Correlation between ψ and seven optimal environmental factors on the day of the experiment (shown as day 0), and ±7 days from the day of the experiment. This is shown for the actual data and for an identical analysis using environmental variables time-shifted by +60 days as a control test. (Right) One-tailed odds against chance for the observed correlations, as determined by randomized permutation analysis.

be responsible for locating objects in space-time. Of course, a more mundane explanation is that when we're exposed to disturbing electromagnetic conditions, the nervous system simply operates less well than at "quieter" times. At such unfavorable times, presumably any measure of performance would decline, including normal anticipatory behavior.

Conclusion

Analysis of a variety of environmental factors in relationship to a dog's anomalous anticipatory behavior suggests, in accordance with previous literature, that psi-like performance is modulated by environmental factors. Future studies should explore in more detail which aspects of the environment are principally responsible for this modulation, and what those factors suggest about the underlying mechanisms of how psi-mediated information is processed in the nervous system.

Notes

[1] http://www.ngdc.noaa.gov/stp/stp.html.
[2] The resulting curve was $y = 9.4x^2 - 55.1x + 100.1$, where x ranged from 1 to 8. This curve accounts for 95% of the variance in Figure 3.
[3] Throughout this analysis, $\ln(A_p)$ was used because the distribution of A_p is positively skewed.
[4] Data used in this analysis are listed in the Appendix.
[5] The eleven factors were daily average planetary geomagnetic flux (A_p index), sunspot number, 10-cm solar radio flux, proton flux greater than 1 MeV, distance between Mercury and the Earth, phase of Mercury's orbit, brightness of Mercury as observed from the Earth, phase of Venus, inclination between ecliptic and the orbit of Mars, latitude of the center of the Moon, and the synodic phase of the Moon. These variables were selected to provide a broad range of geomagnetic, lunar, and solar activity, as well as local planetary positions.

[6] Although the result is in the form of a correlation, it is unlikely that Jaytee *caused* changes in planetary geomagnetism or other environmental factors, and thus the correlation is assumed to reflect a causal link from the environment to Jaytee.

APPENDIX

Data from 45 videotaped experiments (Date of experiment, A_p index, ψ correlation value, number of 10-minute periods in the experiment, and description of the type of experiment)

Date	A_p index	ψ	Experiment length	Description
5/7/95	24	0.88	18	Pamela Smart self-report (PS)
5/16/95	45	0.13	18	PS
5/22/95	6	−0.32	11	PS
5/29/95	7	0.92	11	PS
5/31/95	30	0.97	11	PS
6/12/95	3	0.76	16	Richard Wiseman et al., 1998 (RW)
6/13/95	2	0.95	13	RW
6/19/95	29	0.22	18	PS
6/27/95	6	0.89	18	PS
7/4/95	7	0.66	18	PS
7/13/95	5	0.80	18	PS
7/18/95	10	0.80	18	PS
8/15/95	14	0.87	8	PS
8/30/95	4	0.83	18	PS
9/10/95	12	0.71	18	PS
9/18/95	3	0.69	11	PS
9/29/95	3	0.99	8	PS
10/4/95	57	−0.19	11	PS
10/10/95	10	0.53	18	PS
10/16/95	7	0.41	18	PS
11/13/95	4	0.95	11	PS
11/20/95	4	−0.14	11	PS
11/24/95	2	0.41	8	PS
12/4/95	16	0.94	10	RW
12/13/95	2	0.71	8	PS
12/20/95	4	0.74	8	PS
1/8/96	4	0.85	11	PS
1/19/96	10	0.74	8	PS
1/31/96	10	0.21	11	PS
2/7/96	7	0.32	18	PS
2/27/96	14	0.81	18	PS
3/18/96	9	0.00	8	PS
7/16/96	5	0.08	8	PS
11/19/96	10	0.80	17	Random beeper experiment (RB)
12/11/96	14	0.77	16	RB
2/11/97	21	0.81	15	RB
3/19/97	3	0.27	13	RB
3/25/97	12	0.46	13	RB
5/7/97	3	0.93	12	RB
7/1/97	4	0.93	12	RB
7/9/97	11	0.83	17	RB
8/29/97	13	0.00	17	RB
9/10/97	19	0.03	12	RB
9/21/97	16	0.79	16	RB
10/8/97	14	0.89	15	RB

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