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A Dog That Seems To Know When His Owner is Coming Home: Videotaped Experiments and Observations

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Introduction

Many dog owners claim that their animal knows when a member of the household is about to come home. Typically, the dog is said to go and wait at a door, window or gate while the person is on the way home (Sheldrake, 1994, 1999a). Random household surveys in Britain and the United States have shown that between 45 and 52 per cent of dog owners say they have noticed this kind of behavior (Brown & Sheldrake, 1998; Sheldrake, Lawlor & Turney, 1998; Sheldrake & Smart, 1997).

Dog owners often ascribe their animals' anticipations to telepathy or a "sixth sense", but there could be more conventional explanations:

First, the dog could be hearing or smelling its owner approaching. Second, the dog could be reacting to routine times of return. Third, it could be responding to subtle cues from people at home who know when the absent person is returning. Fourth, the animal may go to the place at which it waits for its owner when the person is not on the way home; the people at home may remember its apparent anticipation only when the person returns shortly afterwards, forgetting the other occasions. Thus the phenomenon could simply be an artifact of selective memory.

In order to test these possibilities, the dog should be capable of reacting at least ten minutes in advance, the person to whom the dog responds should come home at non-routine times, the people at home should not know when this person is coming, and the behavior of the dog should be recorded in such a way that selective memory can be ruled out (Sheldrake, 1994). This recording of the dog's behavior can be done most effectively by means of time-coded videotape.

In this paper we describe a series of videotaped experiments and observations with a dog called Jaytee, belonging to Pamela Smart (PS).

Jaytee's anticipatory behavior

PS adopted Jaytee from Manchester Dogs' Home in 1989 when he was still a puppy, and soon formed a close bond with him. She lived in Ramsbottom, Greater Manchester, in a ground-floor flat, adjacent to the flat of her parents, William and Muriel Smart, who were retired. When she went out, she usually left Jaytee with her parents.

In 1991, when PS was working as a secretary in Manchester, her parents noticed that Jaytee used to go to the French window in the living rrom almost every weekday at about 4:30 PM, around the time she set off to come home. Her journey usually took 45-60 minutes, and Jaytee would wait at the window most of the time she was on her way. Since she worked routine office hours, the family assumed that Jaytee's behavior depended on some kind of time sense.

PS was laid off from her job in 1993, and was subsequently unemployed. She was often away from home for hours at a time, and was no longer tied to any regular pattern of activity. Her parents usually did not know when she would be returning, but Jaytee still continued to anticipate her return. His reactions seemed to occur around the time she set off on her homeward journey.

In April 1994, PS read an article in the British Sunday Telegraph about the research Rupert

Sheldrake (RS) was doing on this phenomenon (Matthews, 1994) and volunteered to take part. The first stage in this investigation was the keeping of a log by PS and her parents. Between May 1994 and February, 1995 on 100 occasions she left Jaytee with her parents when she went out, and they made notes on Jaytee's reactions. PS herself kept a record of where she had been, how far she had traveled (usually at least 6 km and sometimes 50 km), her mode of transport, and when she had set off to come home. On 85 of these 100 occasions, Jaytee reacted by going to wait at the French window in the living room before PS returned, usually 10 or more minutes in advance.

When these data were analyzed statistically, a linear regression of Jaytee's waiting times against PS's journey times showed that the times when Jaytee began waiting were very significantly ($p<0.0001$) related to the times that PS set off (Sheldrake & Smart, 1998). It did not seem to matter how far away she was.

Jaytee's anticipatory reactions usually began when PS was more than 6 km away. He could not have heard her car at such distances, especially against the background of the heavy traffic in Greater Manchester and on the M66 motorway, which runs close to Ramsbottom. Moreover, Mr and Mrs Smart had already noticed that Jaytee still anticipated PS's return when she arrived in unfamiliar vehicles.

Nevertheless, to check that Jaytee was not reacting to the sound of PS's car or other familiar vehicles, we investigated whether he still anticipated her arrival when she traveled by unusual means: by bicycle, by train and by taxi. He did (Sheldrake & Smart, 1998).

PS did not usually tell her parents in advance when she would be coming home, nor did she telephone to inform them. Indeed, she often did not know in advance when she would be returning after shopping, visiting friends and relations, attending meetings or after an evening out. But it is possible that her parents might in some cases have guessed when she might be coming, and then, consciously or unconsciously, communicated their expectation to Jaytee. Some of his reactions might therefore be due to her parents' anticipation, rather than depending on some mysterious influence from PS herself.

To test this possibility, we carried out experiments in which PS set off at times selected at random after she had left home. These times were unknown to anyone else. In these experiments, Jaytee started to wait when she set off, even though no one at home knew when she would be coming (Sheldrake & Smart, 1998). Therefore his reactions could not be explained in terms of her parents' expectations.

Our first series of investigations involved the recording of Jaytee's reactions in a notebook, and hence necessitated a subjective assessment of his behavior. In this paper we describe a pre-planned series of 12 experiments with randomly-chosen return times in which Jaytee's behavior was recorded throughout the entire period of PS's absence on time-coded videotape. We also discuss 4 videotaped experiments with randomly-chosen return times carried out with Jaytee at our invitation by Richard Wiseman and Matthew Smith (Wiseman, Smith & Milton, 1998; Sheldrake, 1999b).

In addition, we describe 95 videotaped observations of Jaytee's behavior in three different environments. We made these observations to find out more about the natural history of the dog's anticipatory behavior. On these occasions, PS did not return at randomly-selected times, but rather at times of her own choosing. She went out and about shopping, visiting friends or members of her family, attending meetings or visiting pubs and returned when she felt like it. Her journeys varied in distance between 7 and 22 km away from home. They took place at various times of the day or evening and followed no routine pattern. When she left Jaytee with members of her family, they were not informed when she would be returning, and she usually did not know in advance herself. On 50 occasions, Jaytee was left on his own.

We also carried out a series of 10 control observations in which Jaytee was filmed continuously on evenings when PS was not returning home, or was returning unusually late.

Methods

In these experiments, when PS went out she left Jaytee either in her parents' flat with her parents, William and Muriel Smart; or alone in her own flat in Ramsbottom, Greater Manchester, next door to her parents' flat; or with her sister, Cathie MacKenzie, in the nearby town of Edenfield. Having left Jaytee, PS traveled a minimum distance of 7 km. She recorded in a notebook the details of where she had been to, when she set off to come home, how long her journey took and her mode of transport. In some cases she traveled in taxis or in cars belonging to her sisters or friends, but in most cases she traveled in her own car, since we had already established that Jaytee's anticipatory behavior still occurred when she traveled in unfamiliar vehicles, and hence could not be explained in terms of the dog hearing her car (Sheldrake & Smart, 1998).

While PS was out, Jaytee's visits to the window and his absences from it were monitored continuously on videotape. The videotaping procedure was kept as simple as possible, so that the filming of Jaytee could be done routinely and automatically. The video camera was set up on a tripod, and left running continuously in the long-play mode with a long-play film, with the timecode recorded on it. In this way up to 4 hours of continuous observation was possible without anyone needing to attend to the camera. PS switched the camera on just before she left, and switched it off when she returned. Because of the need to keep Jaytee's visits to the window under continuous surveillance, all experiments involved absences of less than 4 hours.

The camera pointed at the area where Jaytee usually waited. In both PS's parent's flat and in PS's own flat (a ground-floor flat adjacent to her parents') this was by the French window in the living room, through which he could see the road outside where PS drew up and parked her car. In PS's sister's house, Jaytee jumped up onto the back of a sofa from which he could see out of the window.

Experiments with randomly selected return times

In a pre-planned series of 12 experiments with randomly selected return times, Jaytee was left at PS parents' flat and PS did not know in advance when she would be returning. Nor were her parents informed. In all these experiments, PS travelled in her own car.

PS was beeped on a telephone pager when it was time to set off home. On most occasions, the random selection of the times and the beeping of PS were done by RS, who was in London, over 300 km away. On two occasions (on 19 November 1996 and 1 July 1997) the selection of random times and the beeping was done by another person in London who was unknown to PS or Jaytee.

These "beep" times were within a pre-arranged period, between 45 and 90 minutes long. This period commenced 80 minutes to 170 minutes after PS had gone out. The "beep window" was then divided into 20 equal intervals, and one of these was selected at random by throwing a die three times, to determine the page, row and column in standard random number tables (Snedecor and Cochran, 1967). Reading downwards from this point looking at the first two digits of each random number, the first pair of digits between 01 and 20 determined the time at which the beep was to be given.

Three of the 12 experiments were carried out in the afternoon, with beeps at 2:22, 3:04 and 3:36 PM; the remaining experiments were carried out in the evening with beeps at a range of times between 8:09 and 9:39 PM.

Observations in different environments

We carried out a pre-planned series of 30 observations in PS's parents' flat between May 1995 and July 1996. Seven of PS absences were in the daytime, at various times in the morning and afternoon, with PS's times of return ranging from 11:13 AM to 3:36 PM. Twenty-three were in the evening, with PS returning at a range of times between 7:30 and 10:45 PM. The length of her absences ranged from 85 to 220 minutes.

In PS's parents' flat we also carried out a pre-planned series of 10 control experiments on evenings when PS was not returning or coming home unusually late. Her parents were not informed that she would not be returning during the 4-hour period that the videotape was running.

This series of observations was made between July and November 1997, during the period when we were doing experiments with randomly-selected return times.

We also carried out a pre-planned series of 50 observations in PS's own flat, where Jaytee was left on his own, between May 1995 and September 1997. On 15 of these occasions, PS went out and returned in the morning, with times of return ranging from 9:59 to11:57 AM; on 34 occasions she returned in the afternoon, at a range of times between 12:20 and 4:50 PM; and on one occasion she returned in the evening, at 9:27 PM. The length of her absences ranged from 81 to 223 minutes.

The 5 observations at PS's sister's house were conducted between October 1995 and June 1996, 2 in the morning and 3 in the evening, with absences ranging from 93 to 199 minutes.

Analysis of videotapes and tabulation of data

The videotapes were analyzed "blind" by Jane Turney and/or Dr Amanda Jacks, who did not know when PS set off to come home or other details of the experiments. Starting from the beginning of the tape, they recorded the exact times (to the nearest second) when Jaytee was in the target area near the window, and made notes on his activities there: for example that he was barking at a passing cat, sleeping in the sun or sitting looking out of the window for no apparent reason. In cases where the same tape was scored blind by both people, the agreement between their records was excellent, showing occasional differences of only a second or so. (Although the scoring was carried out blind, when the end of the tape was reached and PS was seen entering the room, the judges then knew at what time she had arrived, and hence were no longer blind. But by this time the data had all been recorded and were not subsequently altered.) Some of the videotapes were also scored independently by PS and RS to see how well their records corresponded to each other and to the blind scores by Jane Turney of Amanda Jacks. Again the agreement was excellent, with occasional differences of only a second or two.

For the tabulation of the data, two methods were used. First, all the visits of Jaytee to the window were included, even if he was there for reasons that seemed to be unconnected with his anticipatory behavior, for example if he was simply sleeping in the sun, barking at passing cats or watching people unloading cars. In this way any selective use of data was avoided, although the data were "noisy" because they included irrelevant visits to the window that had nothing to do with PS's returns. Second, these visits to the window that seemed to have nothing to do with Jaytee's anticipatory behavior were excluded. This set of data was "cleaner" but more dependent on subjective assessments. However, since these assessments were done "blind" they should not have involved any systematic bias.

Statistical analysis

We used two main ways of analyzing the data. The first provided a simple way of averaging and comparing different experiments. For each experiment, the percentage of the time that Jaytee spent by the window was calculated for three periods:

1. The first ten minutes after PS got into her car and started traveling homewards (the "return period"). In the case of experiments with randomly-selected return times, this return period was deemed to begin at the time PS received the beep signaling that she should set off. All homeward journeys lasted at least 13 minutes. Thus Jaytee's reactions in the last 3 or more minutes of PS's journey were omitted from the analysis in case he could have been responding to the sounds of her car approaching. In fact most journey-times were more than 15 minutes long, so more than five minutes of Jaytee's behavior were omitted. In cases where the journey time lasted 23 minutes or more, the percentage of time for the combined first and second 10-minute periods of the return journey was also calculated, and a separate statistical analysis was carried out for comparison with the usual method involving only 10-minute return periods.

2. The 10-minute period prior to the return period (the "pre-return period").

3. The time when Pam was absent prior to the pre-return period (the "main period"). Because the experiments varied in length, the length of the main period ranged between 50 and 200 minutes.

The percentage of the time that Jaytee spent by the window in these three periods were analyzed statistically by a repeated-measures analysis of variance, and comparisons of pairs of periods were made using the paired-sample t test.

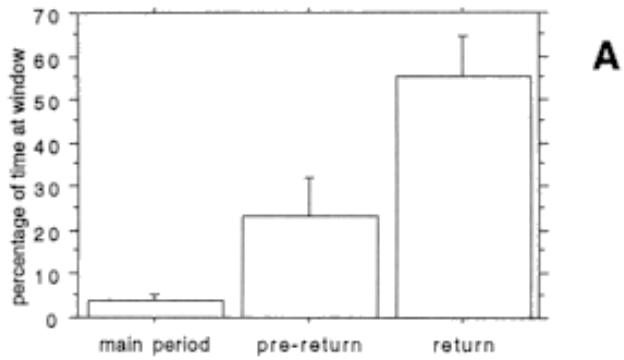
The second method of analyzing the data also involved ten-minute return periods, but the main period was also divided up into ten-minute intervals, defined in relation to the time at which PS was beeped to come home. The total number of seconds that Jaytee spent by the window in each of these ten-minute periods was then plotted on graphs. In cases where PS's return journey lasted 23 minutes or more, data for two 10 minute return periods are shown on the graphs, representing the first 20 minutes of her homeward journey.

A statistical analysis of the time-course data was carried out for us by Dr Dean Radin using a randomized permutation analysis (RPA) (Good, 1994; Hjorth, 1994). For each dataset, he calculated the correlation between time-at-the-window versus the 10-minute segment number of the original data (as plotted in the graphs in Fig. 4). These correlations showed strong positive trends. The RPA calculations made the assumption that under the null hypothesis, Jaytee should have spent about the same amount of time at the window in each of the 10-minute periods. The z scores were formed as z = (original correlation - average permutated correlation)/ (standard deviation of permutated correlations), based on 500 random permutations. The RPA tests converged very rapidly; typically only about 100 random permutations were needed, so the estimated z scores with 500 permutations were quite accurate.

Results

Experiments with randomly-selected return times

The overall results summarized in Fig. 1 show that Jaytee was at the window far more when PS was on her way home than during the main period of her absence. When all Jaytee's visits to the window were included in the analysis (Fig. 1A), he was at the window for an average of 55 per cent of the time during the first 10 minutes of PS return journey, as opposed to 4 per cent of the time during the main period of PS's absence. During the 10-minute pre-return period he was at the window 23 per cent of the time. These differences were highly significant statistically (repeated measures ANOVA, F-value (df 2,22)=20.46; $p<0.0001$; paired-sample t test comparing main period with return period $p=0.0001$).



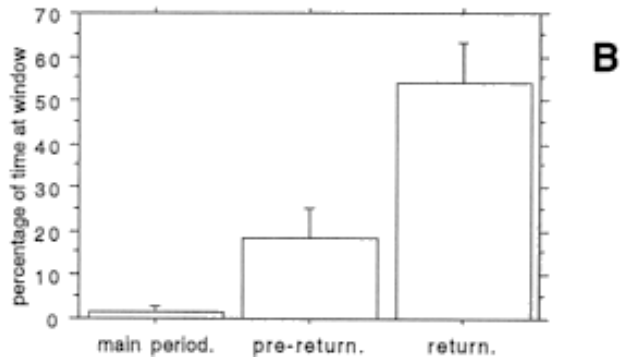


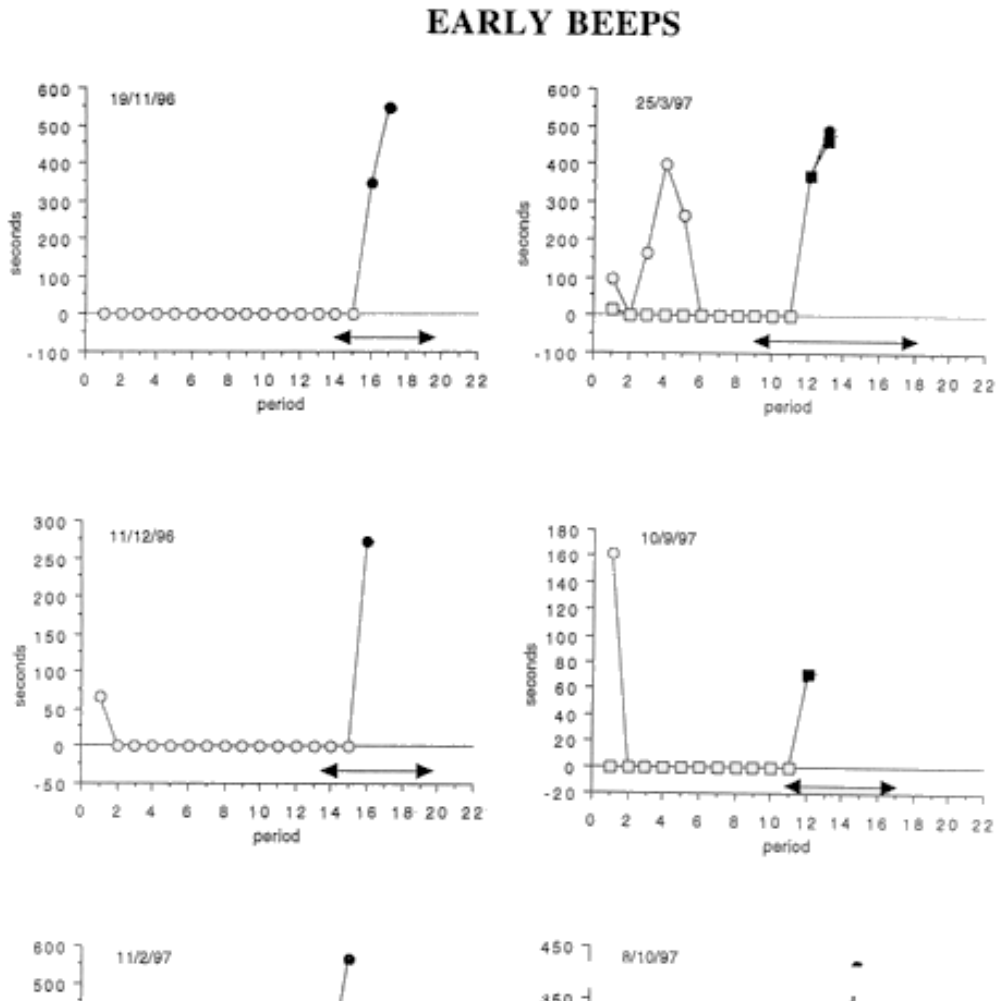
Fig 1. The average percentage of time spent at the window by Jaytee during the main period of P.S's absence (main period) during the 10 minutes prior to her setting off to come home (prereturn), and during the first 10 minutes of her homeward journey (return). Standard errors are indicated by bars. (A) Data for all visits to the window. (B) Data excluding irrelevant visits.

When Jaytee's irrelevant visits to the window were excluded from the analysis, the general pattern was very similar (Fig. 1B), but the percentage of time at the window was of course somewhat lower. In the main period Jaytee spent 0.5 per cent of the time by the window; in the pre-return period 18 per cent and in the return period 54 per cent. The significance of these differences was higher than when all Jaytee's visits were included (repeated measures ANOVA, F-value (df 2,22) 24.36; p=3x10-6).

In 6 out of the 12 experiments, PS's return journeys took more than 23 minutes and hence included two 10-minute periods rather than just one. In the analysis shown in Figs 1A and 1B, only the first 10-minute return period was included. When both 10-minute return periods from these experiments were included in the analysis, the average percentage of time at the window during the return period increased from 55 to 61 per cent when all visits to the window were included, and from 54 to 59 per cent when irrelevant visits were excluded. The statistical significance of the differences was even higher than before (repeated measures ANOVA, F values (df 2,22) 25.43 and 29.03 respectively).

The increased percentage of time the Jaytee spent at the window during the 10-minute pre-return period was statistically significant (paired-sample t test comparing main period with pre-return period for data the included all visits to the window, p=0.04). The difference between the pre-return and return periods was very significant (p=0.0009). However, Jaytee did not visit the window in the pre-return period in all experiments, but only in 7 out of 12.

The detailed time courses for all 12 beep experiments are shown in Fig. 2.



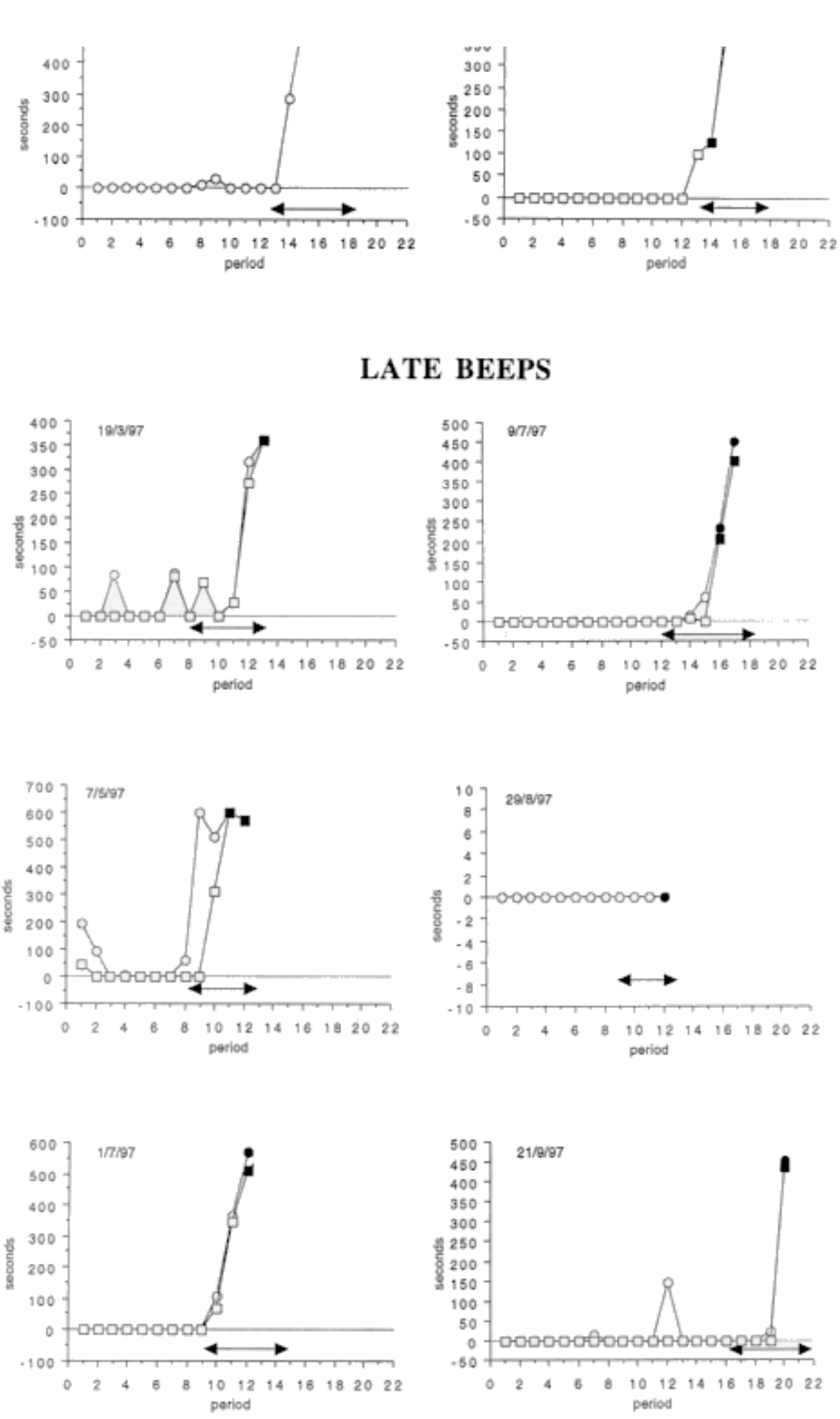


Fig. 2 . The time courses form all 12 experiments in which P.S. came home at randomly selected times in response to being beeped. The ordinate shows the total number of seconds that Jaytee spent at the window in each 10-minute period, the abcissa the series of 10-minute periods defined in relation to the time at which P.S was beeped to come home. Data for all Jaytee's visits to the window, including irrelevant visits, are indicated by circles, and data from which irrelevant visits have been excluded are indicated by squares. The beep window is indicated by a line with two arrowheads, and this represents the period during which P.S could have received the signal to come home. Experiments with beeps in the first half of the beep window (early beeps) are on the

left, and those with beeps in the second half of the beep window (late beeps) are on the right. The points for the 10-minute periods immediately following thebeep during which P.S was returning are indicated by filled circles or squares. The graphs show the duration of all Jaytee's visits to the window in each 10-minute period, both with and without the exclusion of irrelevant visits. In one of these experiments, Jaytee did not go to the window at all, but in all the others he was at the window for the highest proportion of the time when PS was on her way home.

In 6 of these experiments, PS was beeped to come home in the first half of the "beep window" ("early beep") and in the other 6 she was beeped in the second half ("late beep"). Inspection of the graphs show that Jaytee responded in the pre-return period in only 2 of the early-beep experiments, whereas he did so in 5 of the late-beep experiments (3 when irrelevant visits to the window were excluded).

Thirty ordinary homecomings

In order to observe how Jaytee behaved under more or less "natural" conditions, we made a pre-planned series of 30 videotapes of Jaytee at PS's parents' flat while PS went out and about. She returned at times of her own choosing, ranging from 11:13 AM to 10:45 PM, with absences ranging from 85 to 220 minutes. PS did not tell her parents when she would be returning, and usually she did not know in advance herself.

The overall results are shown in Fig. 3A. The general pattern is clear. On average, Jaytee was at the window for the highest proportion of the time (65%) in the "return" period, when PS was on her way home. He was at the window 31% of the time in the 10-minute "pre-return" period, and only 11% of the time during the main period of her absence. These differences were highly significant statistically ($p<0.0001$). Using the paired-sample t test (two tailed), the difference between the main period and return period was significant at $p<0.0001$; between the pre-return and return period at $p=0.008$; and between the main period and pre-return period at $p=0.0009$.

A number of interesting details are hidden by this averaging process. First of all, although on 24 occasions Jaytee spent more time at the window when PS was on her way home, on six occasions he did not. On five (all in the evening) he did not go to the window at all during the first ten minutes of her homeward journey. On the sixth (in the morning) he did so for only 10 seconds. On some of these occasions he was unusually inactive, and may have been exhausted after long walks, or sick. But irrespective of the reasons for his unresponsiveness, the fact is that he did not show his usual signs of anticipation on 6 out of 30 occasions.

Second, in the daytime Jaytee was generally more active and alert than in the evening, and on average was at the window more (Fig. 3B). There was more activity outside for him to watch, and on sunny days he tended to snooze by the window in the sunlight.

Third, the effect of "noise" on the pattern of Jaytee's response can be examined directly by comparing "noisy" experiments with "normal" experiments (Fig. 3C). Noisy experiments were defined as one in which Jaytee spent more than 15% of the time at the window in the main period. By this criterion 7 out of the 30 experiments were "noisy". Most "noisy" experiments occurred in the daytime when there was much activity outdoors that Jaytee went to the window to watch. Also, on sunny days he tended to lie down by the window in the sun and go to sleep. Nevertheless, in both "normal" and "noisy" experiments Jaytee was at the window least in the main period, more in the pre-return period and most when PS was actually returning. These differences were highly significant for both "normal" and "noisy" experiments analyzed separately ($p=0.0004$ and $p=0.0001$ respectively).

Fourth, the question of whether Jaytee's pattern of response changed with time can be examined by comparing the average of the first ten experiments (from May to September 1995) with the second (from September 1995 to January 1996) and third batches of ten experiments (from January to July, 1996). The pattern was similar in all three groups (Fig. 3D).

Finally, the length of time that Pam was away from home varied considerably. Did Jaytee behave in a similar way when she returned after short absences and after longer ones? To explore this

question, we have divided the data up into three groups: long, medium and short absences, defined respectively as 180 minutes or more; 110-170 minutes; and 80-100 minutes . The general pattern in all three groups was similar, but in the short absences the experiments were noisier, and Jaytee showed more anticipation in the pre-return period (Fig. 3E).

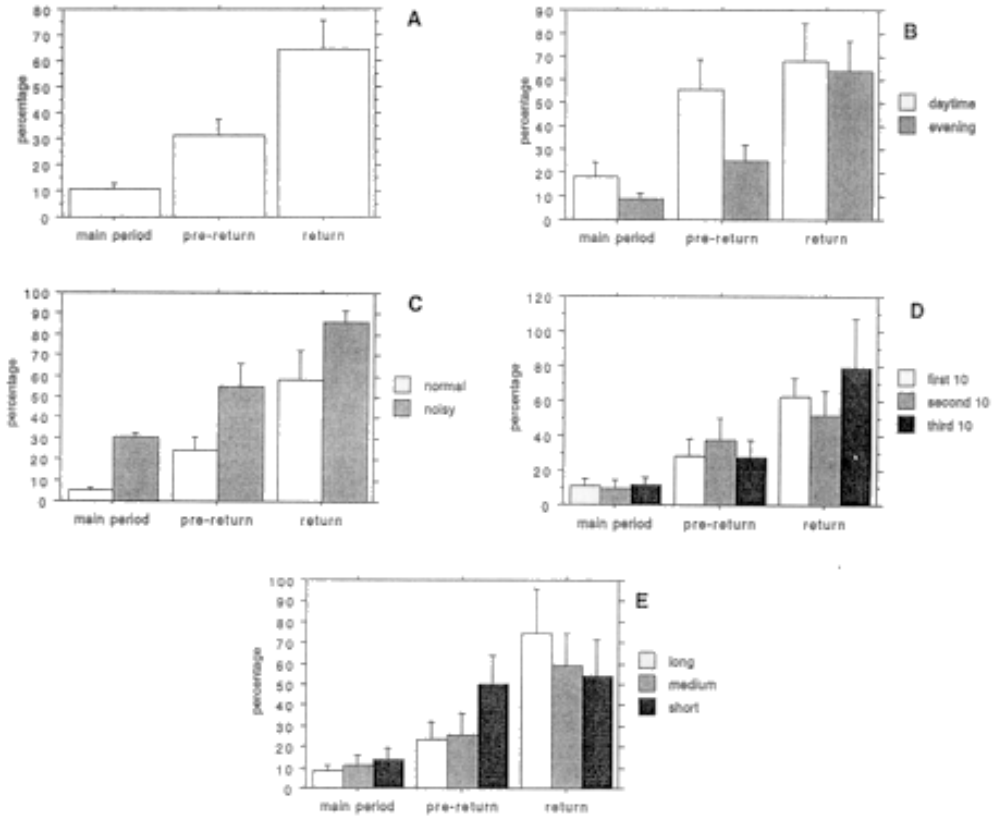


Figure 3. Percentage of time spent at the window by Jaytee during the main period of P.S's absence during the 10 minutes prior to her setting off to come home (prereturn), and during the first 10 minutes of her homeward journey (return). Standard errors are indicated by bars. (A) Averages from 30 ordinary homecomings. (B) Comparison of experiments in the daytime (7) and in the evening (23). (C) Comparison of normal experiments (23) and noisy experiments (7) in which Jaytee was at the window for more than 15% of the time during the main period of P.S.'s absence. (D) Comparison of the first, second and third groups of 10 experiments. (E) Comparison of long (13), medium (9) and short (8) experiments.

Since Jaytee was at the window most in the final period, when PS was on the way home, could it be that Jaytee simply went to the window more and more when PS was out? If he did so, he would automatically be at the window most in the final period whatever the length of the experiment, and more in the penultimate period that in the previous periods.

The going-to-the-window-more-and-more hypothesis can be tested by looking in more detail at the average timecourses of long, medium and short experiments in Fig. 4. This Figure shows data from all the experiments, and also from the "normal" experiments after the exclusion of the minority of "noisy" experiments, which tended to obscure the usual pattern.

The data in Fig. 4 show that Jaytee's waiting at the window occurred soonest in the short experiments, later in the medium experiments and latest in the long experiments. In other words, Jaytee's behavior was more closely related to PS's impending return than to the amount of time that had elapsed since she went out. If Jaytee had simply gone to the window more and more as time went on, there should have been little or no difference between the time he spent there in the long, medium and short experiments in any given period. This can be tested statistically. (In the following analyses, all the data were included, with no exclusions of "noisy" experiments.)

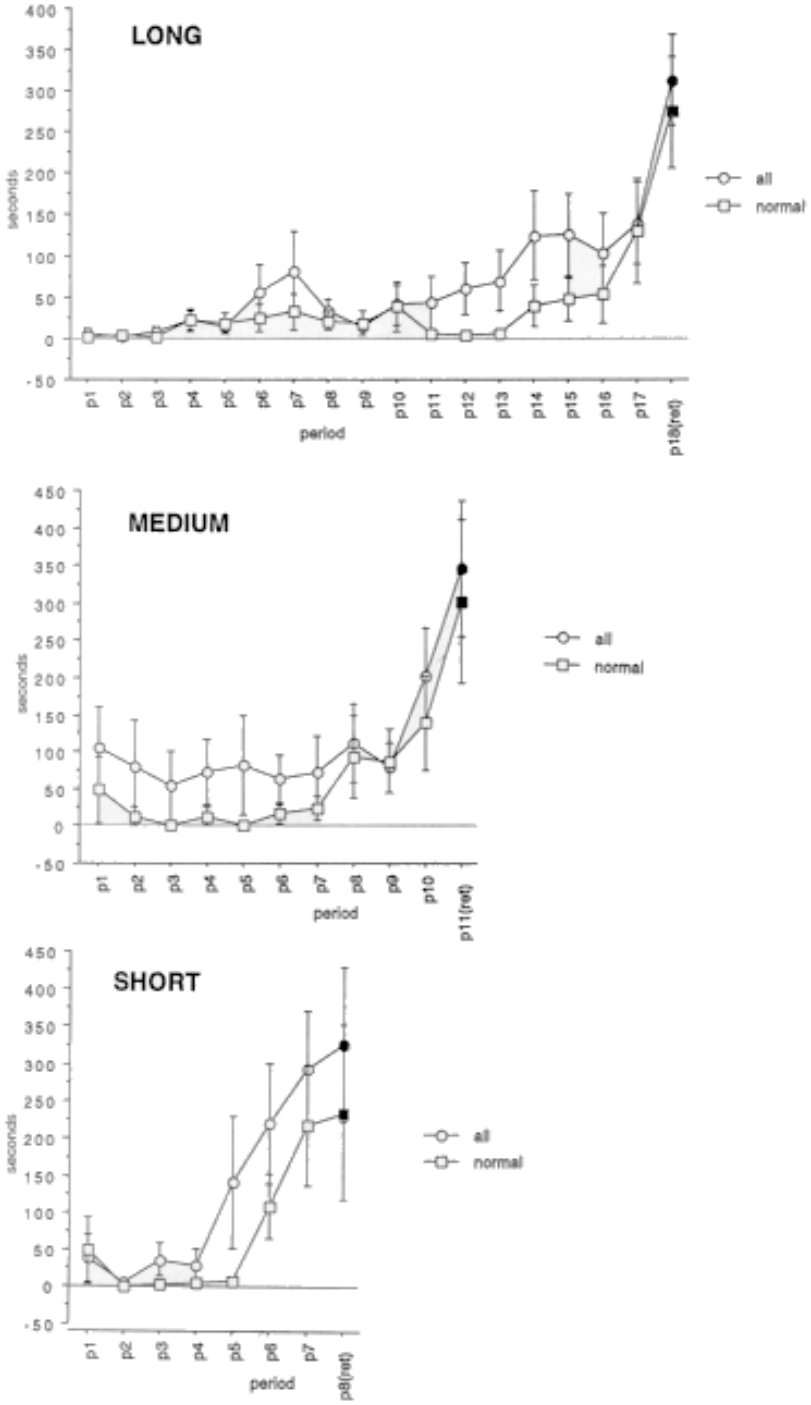


Figure 4. The time courses of Jaytee's visits to the window during P.S.'s long, medium and short absences. The horizontal axis shows the series of 10-minute periods (p1, p2, etc.). The vertical axis shows the average number of seconds that Jaytee spent at the window in each 10-minute period. Data for all 30 experiments are shown, as well as data for normal experiments after the exclusion of the seven noisy experiments. The last period shown on the graph represents the first 10 minutes of P.S.'s return journey (ret), the point for this is indicated by a filled circle of square. The bars show standard errors. When PS was returning in the short experiments in period 8, Jaytee was at the window a significantly higher proportion of the time than in period 8 of the medium and long duration experiments (by a factorial analysis of variance, p=0.004). Likewise, Jaytee spent a significantly higher proportion of the time at the window when Pam was on the way home in the medium experiments in period 11 than in period 11 of the long absences, when she would not be returning for more than another hour (p= 0.003).

In a Randomized Permutation Analysis (RPA), the observed timecourses were tested against the null hypothesis that Jaytee should have spend about the same amount of time at the window in

each of the 10 minute periods. The probabilities that the observed pattern of data differed from the null hypothesis by chance were:

Long experiments $p<0.0008$
Medium experiments $p<0.01$
Short experiments $p<0.008$
Combined $p<0.000003$

Jaytee's behavior when PS was not returning

In order to study Jaytee's behavior when PS was not coming home, we filmed him at PS's parents's flat on 10 evenings when PS was either spending the night away from home, or coming home at least one hour after the filming period had terminated. Fig. 5 shows the average time he spent at the window in the series of 10-minute periods between 6:30 and 10:00 PM. In these control observations, Jaytee made a number of visits to the window for a variety of reasons, as usual, but he did not go to the window more and more as the evening went on.

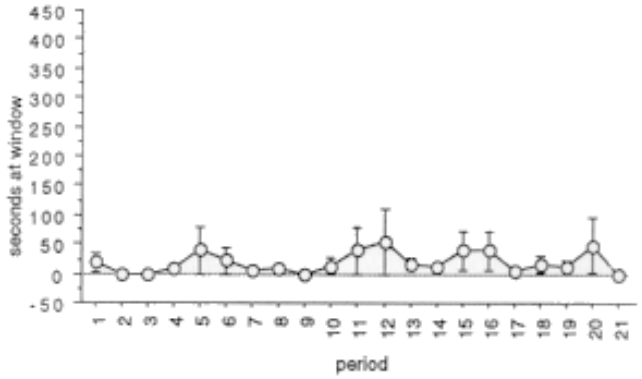


Figure 5. Time sent by Jaytee by the window on evenngs when PS was not coming home. The first of the 30-10 minute periods was from 6:30 top 6:40p.m., the last form 9:50 to 10:00p.m. The figures shown are averages from 10 evenings. The bars show standard errors. Observations on Jaytee at PS's sister's house

PS sometimes left Jaytee at her sister's house, and here too he usually went to the window when she was coming home. PS did not tell her sister when she would be retrurning, but her sister usually knew when she was on her way because of Jaytee's behavior.

In this house, in order to look out of the window Jaytee had to balance himself on the back of a sofa. Unlike the situtation in PS's parents flat and in her own flat, Jaytee could not wait by the window comfortably, and rarely stayed for long. Nevertheless, in a series of 5 videotaped experiments, his general pattern of response (Fig. 6A) was similar to that in PS's parents' flat (Fig. 3), although the percentage of time spent at the window was lower, the variability was greater and differences were not statistically significant.

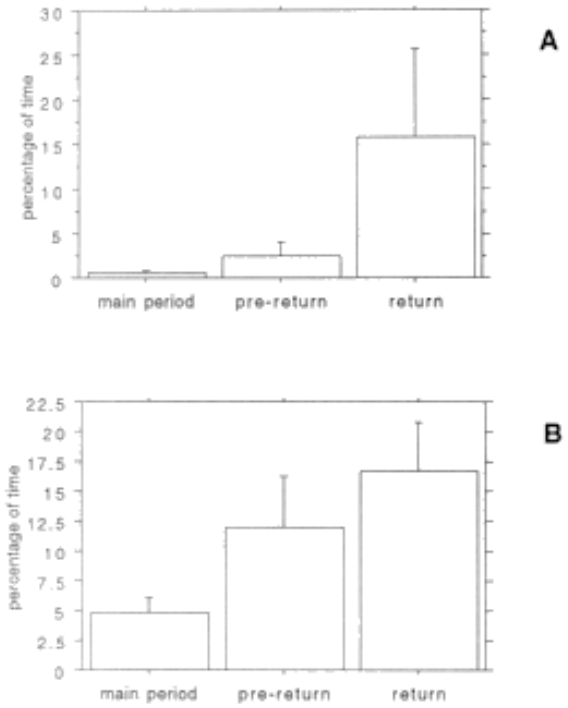


Figure 6. Percentage of time spent by the window by Jayteeduring the main period, prereturn and return periods. The bars show standard errors. (a) In PS's sister's house (average of 5 experiments). (b) Alone in PS's flat (average of 50 experiments).

Observations on Jaytee left on his own

We carried out a pre-planned series of 50 videotaped experiments in which Jaytee was left by himself in PS's own flat while she went out. The overall pattern (Fig. 6B) was similar to that in PS's parents' flat (Fig. 3) and her sister's house (Fig. 6A). The differences were significant statistically (repeated-measures ANOVA, $p<0.01$; paired-sample t test comparing the main period with return period, $p<0.005$). But the average proportion of the time at the window was lower than in PS's parents' flat.

A closer analysis of the data revealed that Jaytee showed two different patterns of response. In most of the tests (35 out of 50) Jaytee did not go to the window when PS was on her way home. In fact he made few or no visits to the window during the entire time she was absent. One reason may be that the view from the window was largely obscured by a bush, so there was not much scope for watching activities outside, although it was still possible to see the road on which PS approached in her car.

By contrast, in 15 out of 50 experiments (30 percent), Jaytee behaved much as he did at PS's parents flat and showed his usual anticipatory waiting while PS was preparing to come home and while she was on her way.

An independent replication

During the course of our research with Jaytee, at our invitation Richard Wiseman and Matthew Smith carried out four experiments with Jaytee, three at PS's parents' flat and one at her sister's house. During these experiments, Wiseman filmed Jaytee while Smith accompanied PS and returned with her at randomly-selected times in cars unfamiliar to Jaytee (Wiseman, Smith & Milton, 1998).

In all three experiments at PS's parents' flat, the pattern of response was very similar to the pattern we observed, with Jaytee at the window most when PS was returning. Using the same definition of the main, pre-return and return periods used in Fig. 1, the average proportion of the time that Jaytee spent at the window was 4 per cent in the main period, 48 per cent in the pre-return period and 78 per cent in the return period. The differences between the periods were significant (by

repeated measures ANOVA, p=0.02; comparison of the main period with return period by the paired-sample t test, p=0.03). When the time courses were plotted following the same method used in our Fig. 2, they showed a very similar pattern (Fig. 7).

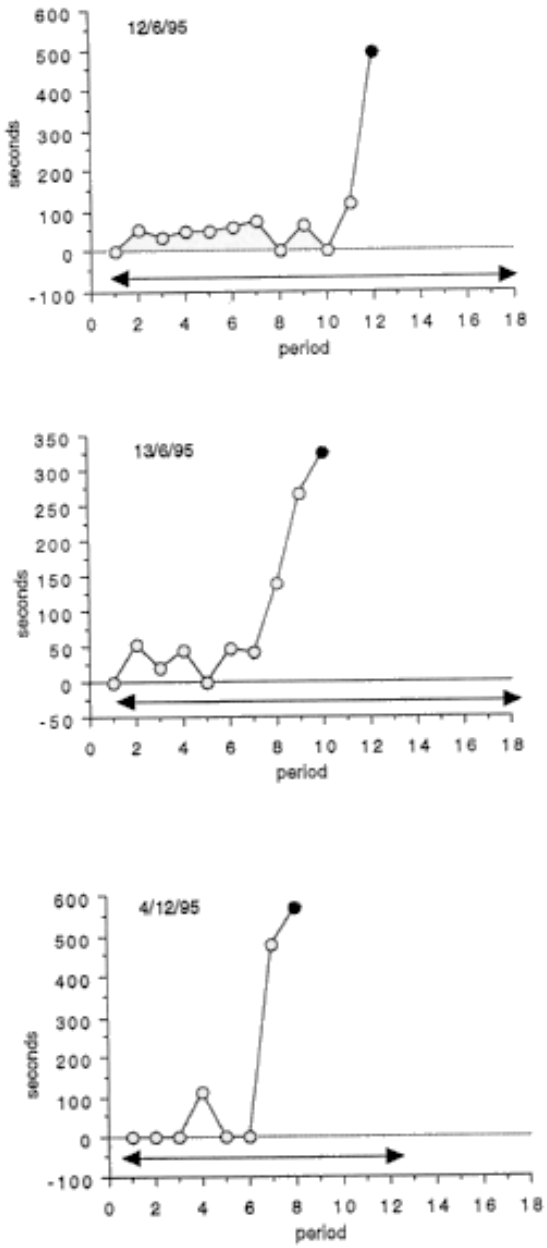


Figure 7. The time courses form the three experiments conducted by Wiseman and Smith with Jaytee at P.S.'s parents' flat. The data are taken form Wiseman, Smith and Milton (1998); the graphs are plotted in the same way as those in figure 2 and show the total amount of time that the dog spent at the window in successive 10-minute periods, defined in relation to the randomly selected time at which P.S. was told to return home. The final point on each graph, indicated by a filled circle, represents the first 10 minutes of P.S.'s return journey. Wiseman. Smith and Milton recorded Jaytee's behavior only during the experimental period during which PS could have been asked to go home, and have no data on his behavior during the preceding period, up to 90 minutes long, from the time that PS left home until the beginning of the experimental period. This is the main difference between the graphs from Wiseman and Smith's experiments and our own.

In Wiseman and Smith's experiment at PS's sister's house, the first time Jaytee went to look out of the window for no apparent reason coincided with PS setting off to come home.

In spite of these striking effects, Wiseman, Smith and Milton (1998, 2000) portrayed their results as a refutation of Jaytee's ability to anticipate PS's returns. They arrived at this conclusion by the

use of narrow and arbitrary criteria for Jaytee's "signal", based on his going to the window for no apparent external reason for a brief period (less than a minute in one experiment, and for at least two minutes in the others). They disregarded the rest of their own data, and did not plot graphs.

Unfortunately Wiseman, Smith and Milton based their criteria not on the waiting behavior of Jaytee that we had already observed and documented on more than 100 occasions before they carried out their tests (Sheldrake and Smart, 1998), but rather on a "claim made by the media" about Jaytee's behavior. They showed, unsurprisingly, that statements on popular television shows are sometimes oversimplified. Ironically, the way their own skeptical conclusions were publicized in the media provided several striking examples of misleading claims (Sheldrake, 1999b, 2000).

Discussion

"Normal" explanations of Jaytee's behavior The data presented in this paper imply that Jaytee's waiting by the window when his owner is coming home cannot be explained in terms of any of the following hypotheses:

1. Routine. Jaytee's anticipatory behavior when PS was coming home occurred at various times in the morning, afternoon and evening and did not depend on a routine time of return. This was apparent in the series of 30 ordinary homecomings (Figs 3 and 4) as well as in our experiments with randomly-selected return times (Figs 1 and 2; see also Sheldrake & Smart, 1998). The data from the experiments of Wiseman, Smith and Milton (1998) with randomly-selected return times replicate and confirm our own findings (Fig. 7). Moreover, in control observations when PS was not coming home Jaytee did not start waiting at a particular time (Fig. 5).

2. Hearing a familiar vehicle . In many experiments, Jaytee's anticipatory behavior was already apparent in the pre-return periods (Figs 2, 3, 4, and 6) before PS had actually set off in a vehicle, and hence before he could have heard any characteristic sounds. When she was actually traveling home, Jaytee was waiting at the window when the vehicle was at least 7 km away, and in some cases more than 25 km. Although dogs can hear higher pitches than human beings, their general sensitivity to noise levels is similar to that of people (Shiu, Munro & Cox, 1997; Munro, Paul & Cox 1997). It is not possible that Jaytee could have heard the sounds of familiar cars at such distances against all the background noises of Greater Manchester, and in a manner independent of the direction of the wind. Moreover, Jaytee also waited for PS in a similar way when she was traveling in taxis or other unfamiliar vehicles (Sheldrake & Smart, 1998; Sheldrake, 1999a), an effect replicated by Wiseman, Smith and Milton (Fig 7).

3. Picking up clues from people at home. PS did not tell her parents or her sister when she would be coming home, and often did not know in advance herself. But perhaps in some of PS's ordinary homecomings, her parents or her sister might have guessed approximately when she would return and consciously or unconsciously communicated their expectation to Jaytee. But this possibility cannot account for Jaytee's behavior in the trials with randomly-selected return times (Figs 1,2 and 7) nor when he was alone (Fig. 6B).

4. Selective memory or selective reporting of data. The video recordings permitted all Jaytee's visits to the window to be recorded, and the data presented in this paper include all the visits he made, even when these were obviously related to events going on outside, such as cats passing the window, or when he was sleeping by the window in the sunlight. The videotapes were analyzed "blind" by people who did not know the details of the experiments. Hence there was no scope for selective memory or selective reporting of data. The data from the experiments conducted with Jaytee by Wiseman, Smith & Milton (1998) also show the same pattern of behavior by Jaytee as our own experiments (Fig. 7).

5. Jaytee going to the window more and more the longer his owner was absent. The data in Fig. 4 and the statistical analysis described above show that Jaytee's visits to the window were not explicable in terms of his going there more and more the longer PS had been absent. Nor did he go to the window more and more as time went on in the control experiments (Fig. 5). His waiting by the window was related to PS's returns, rather than to the length of time she had been away

from home.

The possibility of telepathy

Jaytee seemed to be detecting PS's intention to come home in a way that could not be explained in terms of any of the "normal" hypotheses considered above. Perhaps he was responding to her intentions or thoughts telepathically.

The hypothesis of telepathy would not only agree with Jaytee's waiting behavior when PS was actually on her way home, but it could help to explain why Jaytee began to spend more time at the window before she set off. In "real-life" situations when PS returned home at non-routine times of her own choosing, Jaytee's anticipations regularly began in the "pre-return" period, before she started driving home (Figs 3,4 and 6; see also Sheldrake & Smart, 1998). This pattern of behavior is in good agreement with the telepathic hypothesis, because prior to getting into a car and driving, or being driven, PS was forming the intention to go home, and preparing to do so. If Jaytee was responding telepathically to her intention to return, he would be expected to show this anticipation before she actually got into the car.

But Jaytee also showed signs of anticipation in the experiments when PS returned at randomly-selected times, before she received the signal to go home (Figs 1 and 2). How could he have anticipated when PS was going to be beeped?

It is perhaps conceivable that Jaytee was telepathically picking up RS's intention to beep PS from over 300 km away, but we do not take this possibility very seriously. On one occasions (on 1 July 1997) the beeping was done not by RS but by someone neither PS nor Jaytee had met, and Jaytee still responded in advance (Fig. 2). It is also perhaps conceivable that Jaytee had a precognition of when PS would be beeped. But this would involve introducing another "paranormal" hypothesis in addition to the telepathic hypothesis. It is more economical to consider a possible explanation in terms of telepathy from PS.

In all the experiments with randomly-selected return times, PS knew that she would be beeped to come home within a particular time period. Ideally, her mind would have been entirely engaged with other concerns until the beep came. But unavoidably she was sometimes thinking about the signal to go home before it came, especially if it came towards the end of the period of time in which she knew she would be beeped. Jaytee might have picked up these anticipatory thoughts, just as he seemed to respond to a fully-formed intention to go home.

If Jaytee was indeed responding to PS's expectation that she would soon be receiving the signal to return, then this anticipatory effect would be expected to show up more when the beep came towards the end of the period in which she knew she would be beeped than at the beginning. In four out of six of the trials in which PS was beeped in the first half of the beep period ("early beep"), Jaytee did not show any anticipation prior to PS setting off (Fig. 2). By contrast, there were signs of anticipation in all but one of the "late beep" trials. The exception was a trial in which Jaytee did not go to the window at all throughout the entire experiment. Thus Jaytee's anticipation of the beep signaling PS's return may have been related to her own anticipation of the beep, which tended to be greater the later the signal came.

A similar anticipation of PS's setting off occurred in the experiments conducted by Richard Wiseman and Matthew Smith (Fig. 7). Here again, Jaytee's early response may well have taken place in response to PS's anticipation. While she was with Smith waiting for him to tell her when to return, she found it impossible not to think about going home. Smith himself knew when they were going to set off because the randomly-determined time had been set in advance (Wiseman, Smith & Milton, 1998) . He could well have communicated his anticipation to PS unconsciously, for example through an increasing tenseness as the predetermined time approached. Moreover, in all three experiments, the randomly-selected return time was in the second half of the experimental period, corresponding to the "late beeps" in our own experiments (Fig. 2B).

This increasing anticipation by PS that she would soon be going home as the experimental period progressed was an unavoidable feature of the experimental design adopted both by ourselves and by Wiseman, Smith and Milton.

Why did Jaytee sometimes not react the PS's returns?

In all our series of experiments with Jaytee, on some occasions he did not show his usual anticipatory behavior. In our preliminary series of 100 observations, he failed to do so on 15 occasions. On some of these occasions he was tired after long walks; on some he was sick; on others he was distracted by a bitch on heat in a neighboring apartment (Sheldrake & Smart, 1998). But in a few cases there was no obvious reason for his failure to react. In our series of 12 experiments with randomly selected return times, he did not go to the window at all in one experiment (Fig. 2). In the series of 30 ordinary homecomings, he did not show his anticipatory behavior in 6 experiments.

When Jaytee was left in PS's flat on his own, his lack of anticipatory behavior was usual rather than exceptional. On most occasions he did not go to wait for her at the window or indeed visit the window at all. Nevertheless on 15 out of 50 occasions he showed his usual pattern of anticipation, waiting at the window when PS was returning. Thus he seemed capable of anticipating PS's returns when he was on his own, but did not usually do so. Why not? Our guess is that it was a matter of motivation. His waiting at the window while PS was on her homeward journey may have been more for the sake of communicating his anticipation to members of PS's family, as if to tell them she was on her way. When there was no one to tell, he was less motivated to wait at the window. Nevertheless, he sometimes did it anyway.

The difference in his behavior in PS's own flat and in her parents' was a matter of degree. In both places, he sometimes waited by the window when PS was returning, and sometimes failed to wait there. In PS's parents' flat the ratio of occasions on which he waited to those he did not was around 80:20, whereas when he was alone in PS's own flat it was 30:70.

Evolutionary implications

The hypothesis that some dogs, such as Jaytee, can anticipate their owners' arrivals telepathically obviously needs to be tested further. We have already obtained comparable results with several other dogs. Similar anticipatory behavior is said by many animal owners to occur with other domesticated species, especially cats, parrots and horses (Sheldrake & Smart, 1997; Sheldrake, Lawlor & Turney, 1998; Brown and Sheldrake, 1998; Sheldrake, 1999a), and there is a need for experimental research on anticipatory behavior by animals of these species. It would also be worth investigating whether animals in the wild show seem to know when members of their group are coming home: for example, do wolf cubs waiting at their den show signs of anticipation before the return of adults with food?

Although parapsychologists and psychical researchers have conducted much research on person-to-person telepathy (for a review, see Radin, 1997), there has very little previous research on person-to-animal or animal-to-animal telepathy (Sheldrake, 1999a). If it turns out that telepathic communication does indeed occur among non-human animals, then this would imply a biological and evolutionary origin for person-to-person telepathy, and would enable this "paranormal" phenomenon to seem more "normal", at least in the sense that it is biological and has an evolutionary history.

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