Supplementary Information for

A variable refractory period increases collective performance in noisy environments

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This PDF file includes:

Legend for Movie S1
Figures S1 to S9

Other supplementary materials for this manuscript include the following:

Movie S1

Movie S1. Video in real time of a hunting sequence in the social spider *Anelosimus eximius*. The lure triggering the hunt is located on the right side of the video outside the shooting frame.

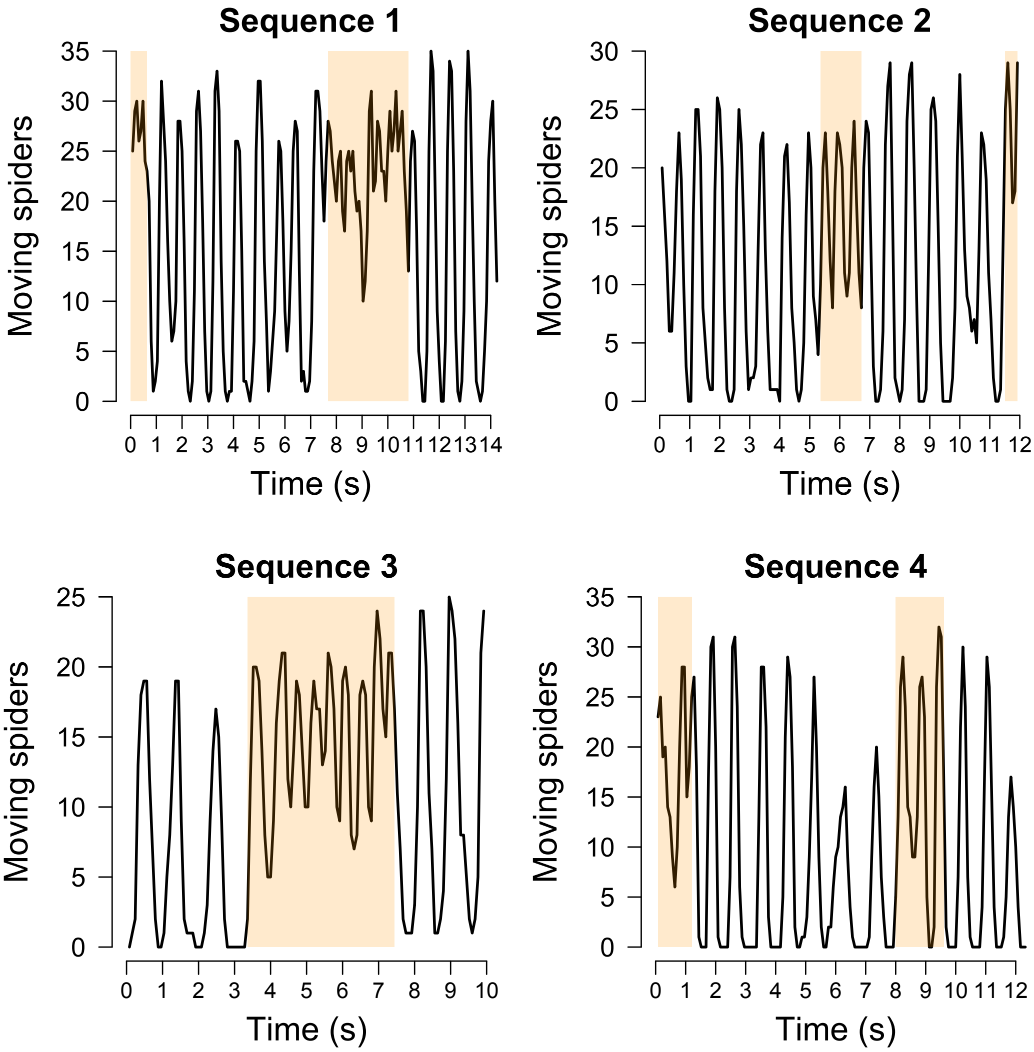

Figure S1. Observed activity patterns during collective hunting in spiders. Each plot gives the number of moving spiders as a function of time in presence or absence of the lure in four distinct hunts. These 4 sequences were used to quantify the individual behavioral rules. Colored areas indicate when the lure was present.

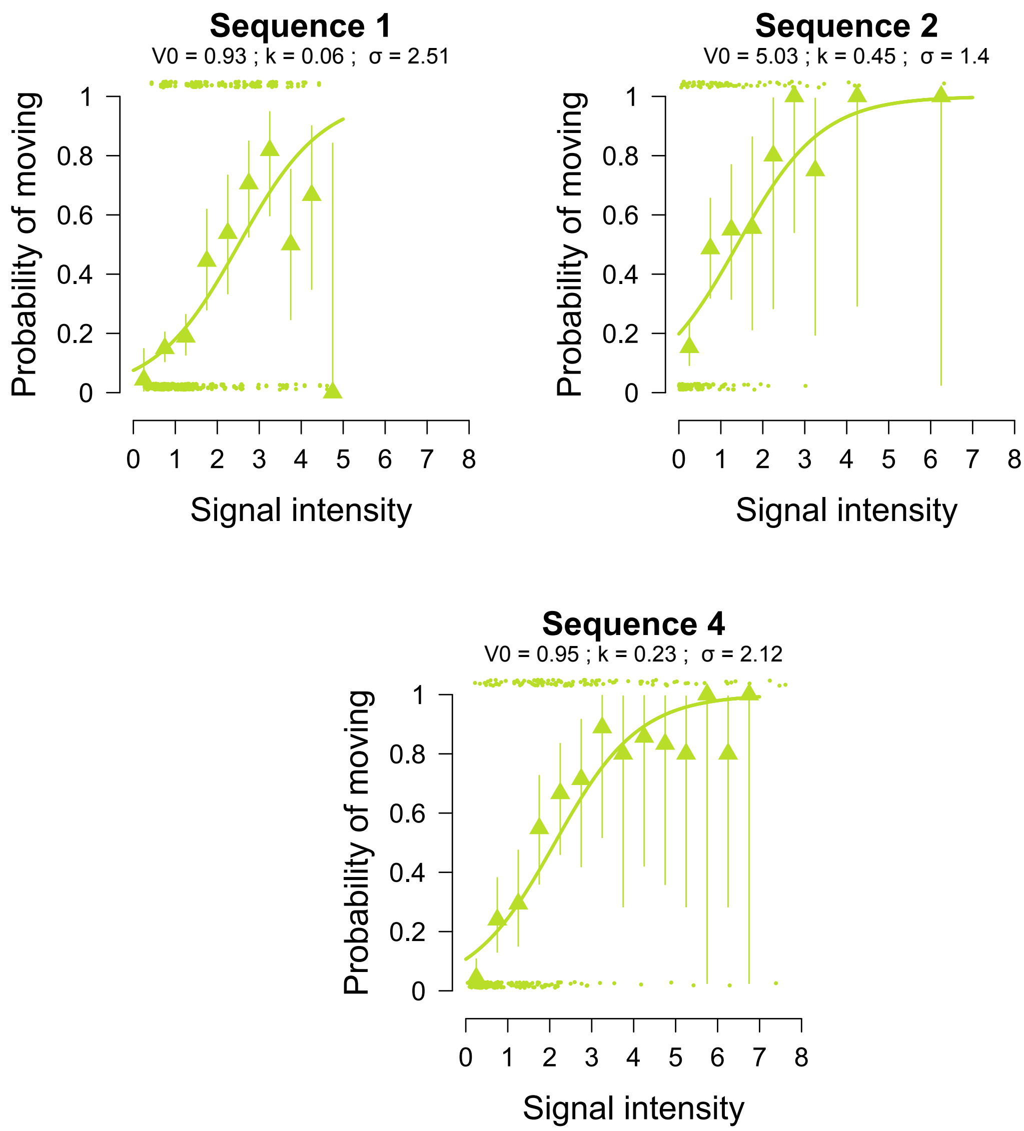

Figure S2. Probabilities of moving in response to vibrations produced by spiders for three of four hunting sequences analyzed by eye. The dots give the observed events (move or not) as a function of the intensity of the signal received by a stopped individual at the preceding timestep (the positions of the dots were shifted along the Y-axis for illustrative purpose). The triangles indicate the experimental proportion ± 95%CI of spiders that moved as a function of signal strength by 0.5 interval. The lines give the predicted probabilities obtained with Equation 4 with the parameters $V_{0_{spider}}$, k_{spider} and σ_{spider} obtained for each sequence whose values are indicated above each plot. No plot is presented for Sequence 3 because there were too few events (=3 phases) where all spiders were stopped before moving (in the three other sequences, there were between 8 and 10 phases where spiders were all stopped, see Fig. S1).

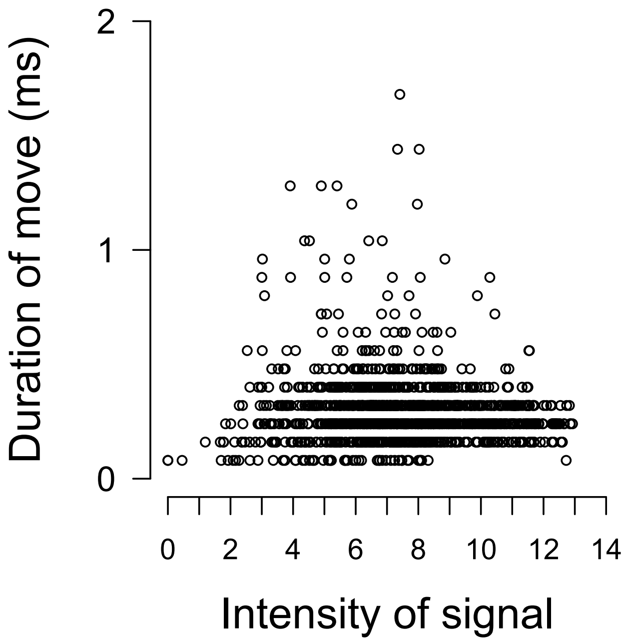

Figure S3. Duration of moves (N=858) as function of the maximal intensity of the signal produced by spiders (calculated with Equation 3) that was perceived by individuals during their moves in the absence of the lure.

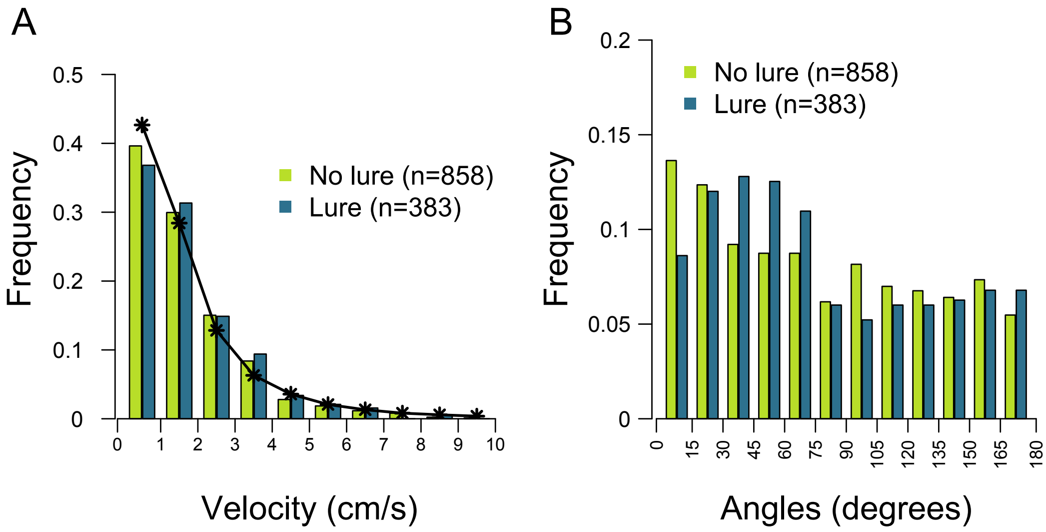

Figure S4. A) Histogram of the velocities recorded for spiders that moved in presence or absence of a lure. The black curve gives the theoretical values obtained with a geometric mean ×/ SD = 0.17 ×/ 0.93. B) Angular distribution of spider's moves with respect to the current or former position of the lure when it was active or not.

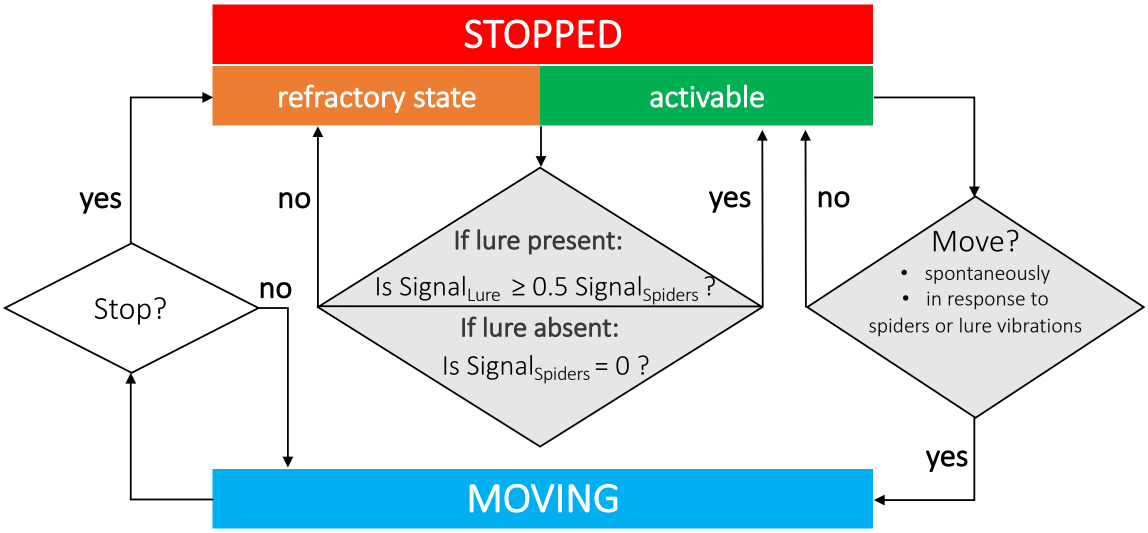

Figure S5. Description of the behavioral algorithm implemented in Monte Carlo simulations. The flow chart summarizes all rules used in simulations to govern the transitions between states. The rules of decision mentioned in the lozenge filled in grey involve social interactions.

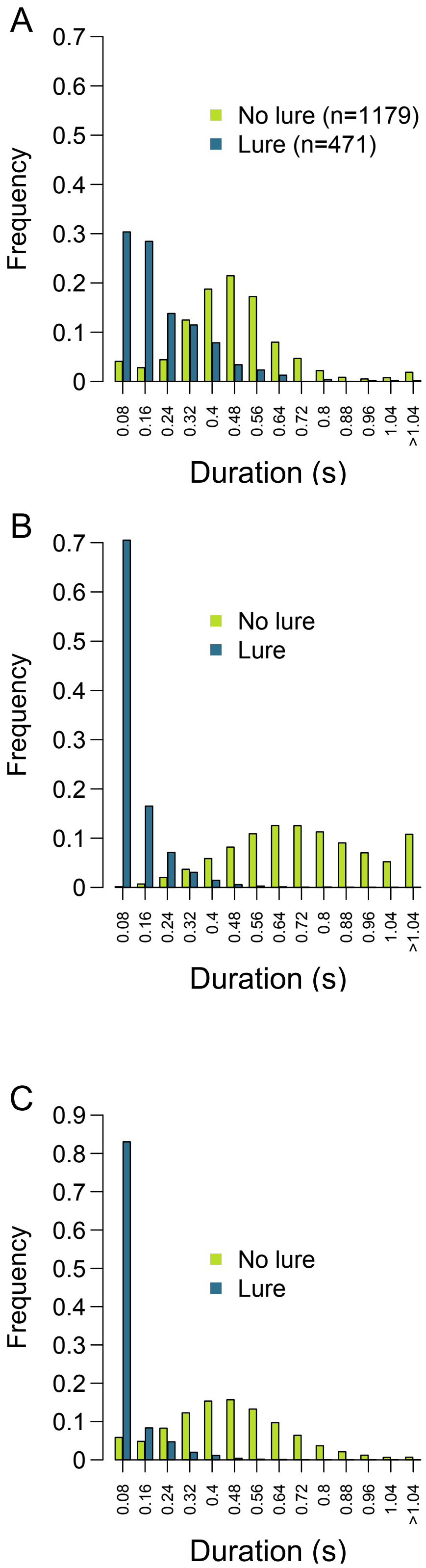

Figure S6. A) Histogram of the duration of stops when the lure was active or inactive in 20 experimental hunting sequences. B) Histogram of the duration of stops in 20 simulations of each of the 20 experimental hunting sequences. C) Histogram of the duration of refractory states in 20 simulations of each of the 20 experimental hunting sequences.

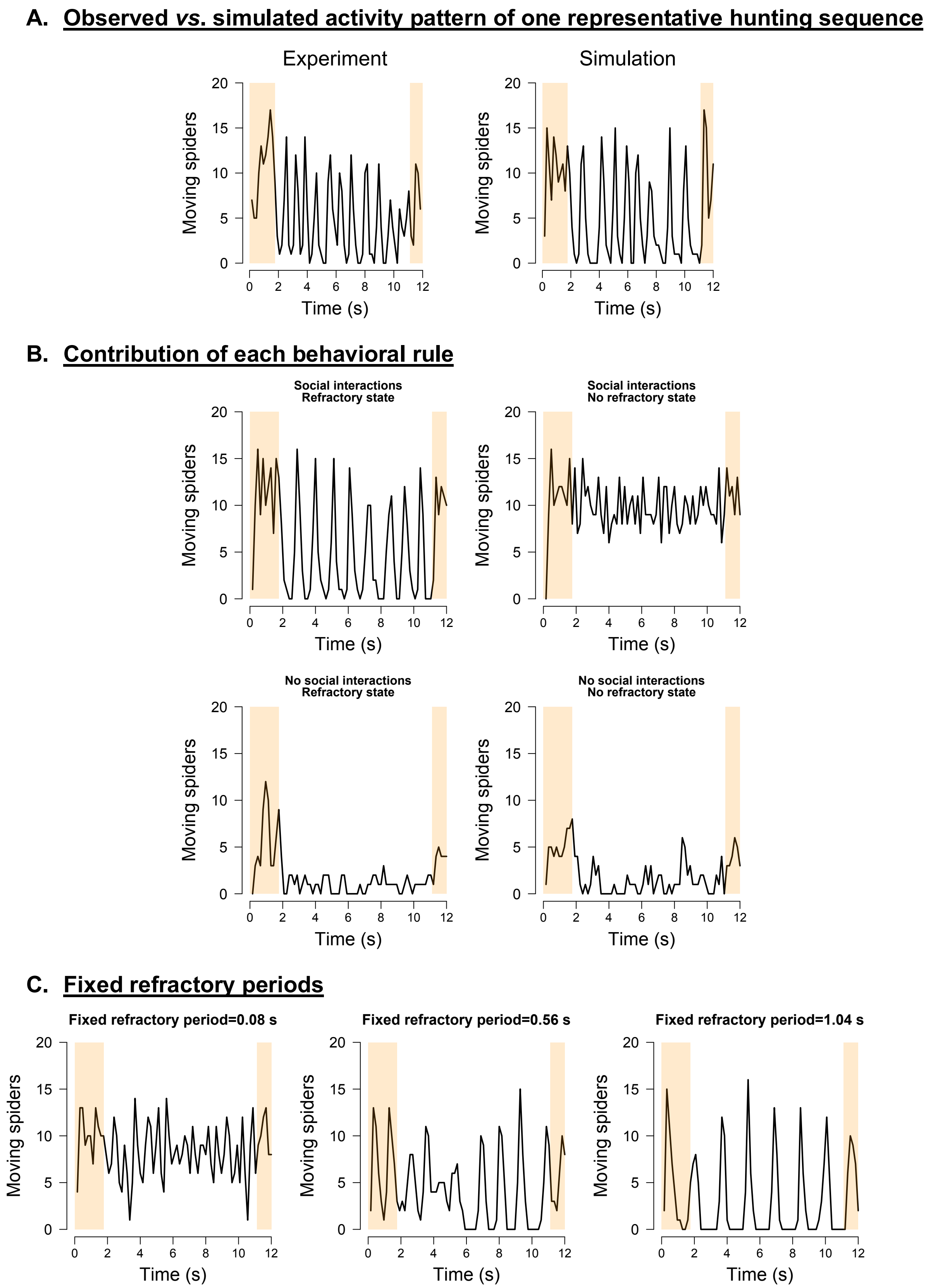

Figure S7. Representative patterns of activity in simulations exploring the contribution of different behavioral rules. Each panel gives the number of active spiders for a simulation for the different conditions tested in Figure 5.

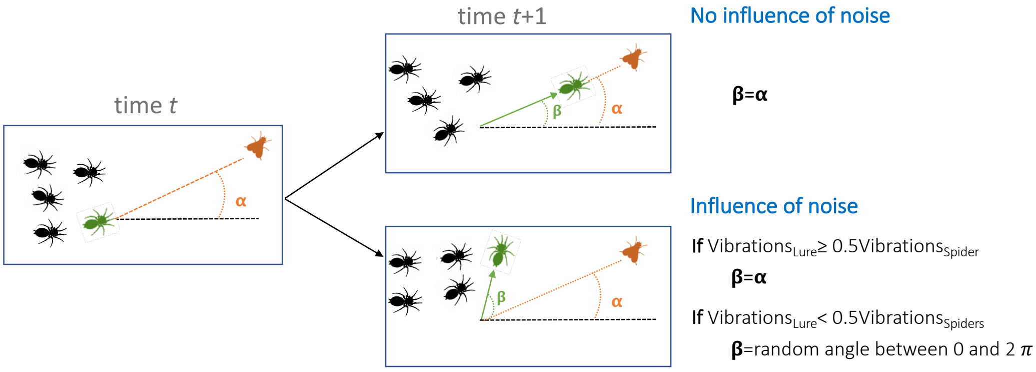

Figure S8. Illustration of the influence of noise produced by moving spiders on the orientation of individuals toward the lure. When the noise has no impact, the individual moves directly towards the lure (*i.e.* $\beta=\alpha$) irrespective of the amount of spider vibration. When noise is influential, a spider moves towards the lure ($\beta=\alpha$) when it perceives that lure signal was greater than or equal to half the signal strength of other spiders but it determines its direction randomly between 0 and 2π otherwise.

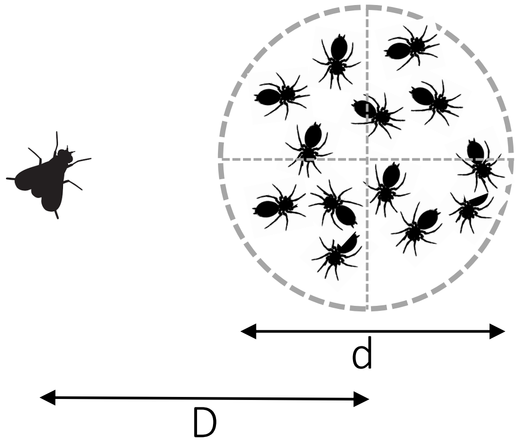

Figure S9. The spiders were randomly distributed in a circle of diameter *d* positioned at a distance D from the lure. The value of *d* was modified when group size was changed to preserve the initial density of spiders (ca. 1 spider per 4 cm^2).