

## **Supplementary Information**

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# **Vector-based navigation in desert ants: the significance of path-integration vectors**

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**Table S1** Original data of the two-feeder experiment and the one-feeder control experiment. In the two-feeder experiment, feeder B during training was to either the left (L-training) or the right (R-training) of feeder A. Between the two training conditions, the tape measure was flipped so that feeder B always was at the 12.4-m mark. In the control experiment, the tape measure always started at the right-hand side of the test channel. In all experiments, the starting point of the ants' search was at the 8.3-m mark. (Note that for the analyses the data were transformed, so that in figures the starting point would be at the 0-m mark, and the right and left test-channel segment would align with positive and negative distance values, respectively.) Three-letter acronyms (first column) refer to the color code of individual ants. Time is local standard time of the ants' test run; numbers 1 to 10 are the positions (m) of the ants' first ten U-turns within the 16.6-m long test channel.

| <b>Two-feeder experiment, L-training</b> (right channel end at 0 m; left channel end at 16.6 m) |             |          |          |          |          |          |          |          |          |          |           |
|-------------------------------------------------------------------------------------------------|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| <b>Ant</b>                                                                                      | <b>Time</b> | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> | <b>7</b> | <b>8</b> | <b>9</b> | <b>10</b> |
| ywl                                                                                             | 11:21       | 10.60    | 10.10    | 11.30    | 9.10     | 9.60     | 8.50     | 11.10    | 8.60     | 11.30    | 8.80      |
| ylr                                                                                             | 10:53       | 13.50    | 13.20    | 13.60    | 12.50    | 13.00    | 10.70    | 13.10    | 9.80     | 10.10    | 8.70      |
| rry                                                                                             | 11:22       | 11.00    | 9.40     | 12.60    | 8.40     | 12.95    | 7.80     | 11.60    | 10.20    | 13.35    | 8.50      |
| rbr                                                                                             | 11:12       | 15.40    | 10.90    | 11.60    | 10.80    | 15.45    | 8.40     | 9.60     | 8.70     | 11.00    | 10.70     |
| rbl                                                                                             | 11:42       | 8.05     | 11.10    | 10.20    | 11.60    | 10.70    | 11.10    | 10.00    | 11.10    | 8.20     | 8.90      |
| wrw                                                                                             | 11:52       | 8.60     | 7.80     | 11.85    | 8.40     | 11.20    | 9.70     | 15.10    | 13.10    | 15.20    | 13.70     |
| wwb                                                                                             | 11:12       | 8.15     | 9.50     | 7.20     | 9.60     | 7.70     | 8.10     | 5.10     | 13.00    | 12.25    | 15.20     |
| yyr                                                                                             | 12:05       | 10.40    | 5.40     | 8.50     | 8.10     | 11.00    | 7.90     | 8.90     | 4.50     | 10.70    | 8.30      |
| wlw                                                                                             | 10:45       | 6.90     | 11.70    | 11.00    | 11.30    | 10.70    | 11.10    | 10.00    | 10.20    | 8.50     | 11.20     |
| yrr                                                                                             | 11:23       | 8.55     | 7.30     | 10.20    | 5.70     | 9.80     | 5.10     | 9.30     | 8.40     | 9.70     | 8.35      |
| ryy                                                                                             | 16:35       | 9.10     | 7.30     | 13.85    | 7.60     | 11.15    | 10.75    | 13.20    | 2.60     | 3.80     | 1.00      |
| wbb                                                                                             | 16:15       | 9.10     | 8.10     | 8.50     | 8.00     | 8.40     | 7.95     | 13.10    | 9.20     | 13.95    | 11.70     |
| wlb                                                                                             | 16:30       | 8.60     | 8.35     | 9.10     | 7.75     | 8.20     | 7.25     | 11.10    | 7.80     | 8.35     | 8.00      |
| wry                                                                                             | 16:05       | 7.80     | 10.60    | 4.30     | 8.60     | 8.20     | 9.10     | 7.60     | 14.90    | 11.90    | 12.40     |
| wly                                                                                             | 12:27       | 7.30     | 8.60     | 7.80     | 10.00    | 7.60     | 11.10    | 4.30     | 9.30     | 7.45     | 8.35      |
| ylb                                                                                             | 16:40       | 7.80     | 15.60    | 14.55    | 15.30    | 12.35    | 12.60    | 10.55    | 12.55    | 12.20    | 13.10     |
| wwr                                                                                             | 14:25       | 8.50     | 6.80     | 9.45     | 7.30     | 10.30    | 8.30     | 3.80     | 2.70     | 6.40     | 5.00      |

|     |       |       |       |       |       |       |       |       |       |       |       |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| ow  | 15:20 | 9.20  | 7.50  | 9.50  | 7.30  | 13.20 | 7.80  | 13.60 | 12.50 | 13.30 | 8.00  |
| rwb | 13:50 | 8.90  | 8.10  | 10.50 | 8.10  | 10.10 | 8.10  | 10.40 | 8.50  | 11.20 | 8.55  |
| wrl | 14:20 | 8.70  | 5.10  | 8.90  | 8.10  | 13.00 | 12.60 | 16.00 | 12.80 | 13.20 | 8.20  |
| wyb | 14:42 | 6.60  | 6.80  | 0.00  | 8.30  | 8.20  | 14.85 | 14.60 | 16.60 | 13.10 | 14.10 |
| yry | 14:45 | 12.30 | 11.90 | 13.70 | 13.40 | 16.60 | 12.90 | 13.40 | 12.50 | 12.90 | 8.10  |
| wby | 14:55 | 10.00 | 5.90  | 9.90  | 7.90  | 8.10  | 7.60  | 11.60 | 10.65 | 11.40 | 8.30  |
| ybb | 15:10 | 6.50  | 12.40 | 12.20 | 15.30 | 12.25 | 12.60 | 12.10 | 12.60 | 12.10 | 14.50 |
| ywr | 13:45 | 9.20  | 7.40  | 9.10  | 7.40  | 9.60  | 8.50  | 10.30 | 7.95  | 9.05  | 7.90  |
| ywy | 14:10 | 8.90  | 8.20  | 9.20  | 7.30  | 11.70 | 9.90  | 13.85 | 12.60 | 13.70 | 11.70 |
| yww | 15:10 | 15.20 | 14.80 | 15.15 | 14.00 | 15.30 | 13.50 | 14.10 | 13.80 | 15.00 | 14.40 |
| wyr | 12:34 | 7.80  | 15.00 | 10.60 | 15.80 | 6.80  | 7.90  | 7.70  | 11.10 | 5.50  | 6.10  |
| yrl | 12:40 | 8.50  | 7.60  | 10.85 | 8.20  | 8.65  | 7.20  | 7.70  | 6.40  | 11.85 | 11.00 |
| wwl | 12:50 | 9.20  | 4.50  | 10.40 | 8.40  | 9.25  | 8.90  | 12.80 | 11.25 | 14.50 | 13.80 |
| wrb | 13:30 | 8.10  | 8.50  | 4.80  | 7.65  | 7.10  | 13.20 | 12.00 | 14.80 | 0.00  | 1.10  |

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**Two-feeder experiment, R-training** (left channel end at 0 m; right channel end at 16.6 m)

| <b>Ant</b> | <b>Time</b> | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> | <b>7</b> | <b>8</b> | <b>9</b> | <b>10</b> |
|------------|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| wrw        | 11:25       | 9.30     | 6.40     | 11.40    | 10.65    | 11.60    | 11.00    | 11.50    | 10.80    | 11.30    | 10.80     |
| wyl        | 12:00       | 9.50     | 8.00     | 11.30    | 8.90     | 11.70    | 6.40     | 11.55    | 10.00    | 13.50    | 6.50      |
| wlr        | 12:06       | 8.85     | 8.30     | 9.80     | 8.40     | 15.40    | 14.20    | 15.30    | 12.10    | 15.35    | 14.30     |
| wrb        | 13:10       | 8.00     | 8.70     | 8.30     | 11.70    | 11.30    | 11.50    | 8.60     | 11.90    | 5.20     | 8.50      |
| yby        | 11:02       | 9.10     | 8.60     | 9.25     | 8.30     | 10.00    | 9.70     | 10.70    | 6.70     | 8.70     | 6.90      |
| ybr        | 11:21       | 8.50     | 8.10     | 8.50     | 7.20     | 9.90     | 3.80     | 8.60     | 8.00     | 8.70     | 8.20      |
| wgg        | 11:11       | 7.60     | 9.70     | 7.20     | 9.35     | 8.55     | 10.30    | 8.30     | 10.00    | 6.80     | 12.30     |
| ryr        | 11:45       | 9.30     | 8.20     | 11.70    | 6.70     | 11.30    | 11.00    | 15.55    | 8.80     | 11.60    | 9.30      |
| ryy        | 11:50       | 9.10     | 8.90     | 9.30     | 7.10     | 10.30    | 9.80     | 11.10    | 10.40    | 11.30    | 7.80      |
| wrb        | 12:01       | 8.60     | 7.90     | 8.50     | 7.30     | 9.20     | 3.90     | 4.25     | 2.50     | 7.90     | 4.70      |
| yrr        | 13:03       | 11.10    | 9.45     | 12.30    | 9.90     | 10.40    | 8.35     | 12.50    | 12.00    | 15.60    | 13.75     |
| yyy        | 11:23       | 8.50     | 7.90     | 8.60     | 7.00     | 9.10     | 7.70     | 9.00     | 6.80     | 7.50     | 7.00      |
| ybw        | 11:58       | 10.60    | 9.50     | 10.70    | 7.60     | 13.20    | 11.00    | 14.10    | 11.60    | 12.80    | 10.70     |
| rgy        | 12:56       | 8.60     | 8.00     | 10.30    | 7.70     | 10.80    | 6.10     | 9.20     | 3.70     | 8.10     | 2.20      |

|     |       |       |       |       |       |       |       |       |       |       |       |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| wrl | 13:05 | 9.25  | 8.00  | 10.30 | 7.40  | 11.60 | 8.05  | 8.60  | 4.65  | 11.50 | 4.50  |
| yrb | 10:32 | 8.00  | 9.30  | 8.00  | 8.80  | 8.20  | 10.20 | 8.00  | 9.80  | 7.80  | 9.40  |
| wyb | 10:56 | 7.90  | 11.50 | 8.40  | 16.40 | 13.20 | 16.60 | 13.25 | 16.60 | 12.90 | 13.60 |
| wyr | 14:30 | 8.10  | 10.00 | 7.10  | 12.60 | 5.10  | 10.40 | 4.60  | 7.10  | 3.50  | 4.30  |
| wbr | 14:45 | 9.60  | 6.80  | 16.60 | 12.30 | 16.55 | 14.60 | 15.00 | 13.80 | 14.80 | 6.80  |
| wyw | 14:52 | 8.50  | 6.30  | 9.40  | 6.90  | 16.00 | 5.50  | 9.60  | 3.90  | 5.40  | 4.90  |
| wrr | 16:00 | 7.70  | 11.40 | 7.05  | 15.40 | 7.20  | 14.20 | 13.50 | 14.30 | 9.50  | 11.70 |
| wby | 14:19 | 9.80  | 7.90  | 13.70 | 6.25  | 14.50 | 7.30  | 8.80  | 8.10  | 9.70  | 8.60  |
| wll | 15:25 | 8.10  | 10.40 | 7.00  | 7.40  | 4.60  | 11.70 | 5.30  | 10.50 | 9.20  | 9.50  |
| wrw | 14:30 | 8.10  | 16.60 | 16.20 | 16.60 | 14.90 | 16.60 | 8.00  | 8.30  | 8.10  | 9.30  |
| yyb | 15:05 | 16.50 | 12.10 | 16.50 | 10.25 | 15.80 | 9.30  | 11.75 | 4.30  | 7.70  | 2.80  |
| rrr | 15:27 | 9.10  | 7.80  | 10.55 | 6.50  | 7.70  | 5.80  | 7.80  | 6.80  | 8.10  | 2.20  |
| wbr | 10:27 | 5.90  | 6.50  | 4.30  | 7.50  | 6.40  | 8.25  | 7.80  | 8.70  | 7.90  | 8.30  |
| wrr | 10:24 | 9.00  | 8.40  | 9.20  | 7.20  | 11.60 | 10.80 | 13.40 | 10.00 | 10.70 | 10.10 |
| wrr | 10:26 | 7.90  | 9.70  | 7.50  | 11.40 | 9.30  | 13.10 | 11.80 | 12.50 | 9.00  | 12.95 |

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**One-feeder control experiment** (right channel end at 0 m; left channel end at 16.6 m)

| <b>Ant</b> | <b>Time</b> | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> | <b>7</b> | <b>8</b> | <b>9</b> | <b>10</b> |
|------------|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| wbb        | 10:55       | 10.60    | 8.20     | 8.60     | 2.20     | 3.65     | 0.00     | 0.20     | 0.00     | 0.30     | 0.00      |
| bww        | 10:40       | 7.10     | 11.00    | 6.20     | 8.50     | 8.30     | 16.60    | 16.40    | 16.60    | 15.90    | 16.30     |
| wbl        | 12:30       | 7.50     | 8.70     | 7.70     | 10.00    | 6.00     | 11.20    | 5.40     | 8.30     | 7.70     | 9.60      |
| wrb        | 09:58       | 8.45     | 7.80     | 8.70     | 5.40     | 8.30     | 4.70     | 9.10     | 7.00     | 8.30     | 8.20      |
| wrw        | 10:08       | 7.90     | 9.10     | 7.00     | 9.60     | 4.10     | 8.40     | 8.20     | 10.40    | 3.60     | 5.50      |
| yyy        | 10:15       | 7.40     | 9.10     | 6.60     | 9.20     | 8.20     | 8.90     | 8.20     | 8.40     | 7.40     | 8.70      |
| bby        | 10:49       | 8.10     | 12.50    | 9.60     | 10.00    | 8.30     | 8.60     | 7.60     | 9.00     | 3.00     | 5.20      |
| yyg        | 12:23       | 8.50     | 7.90     | 9.50     | 7.50     | 8.70     | 5.90     | 9.90     | 7.50     | 11.25    | 9.20      |
| bbb        | 14:18       | 9.50     | 6.00     | 16.60    | 9.70     | 11.10    | 1.00     | 13.60    | 10.00    | 16.60    | 16.40     |
| www        | 16:00       | 8.60     | 8.20     | 16.60    | 15.20    | 16.60    | 0.00     | 15.50    | 0.00     | 0.50     | 0.00      |
| rww        | 13:54       | 8.70     | 6.60     | 10.30    | 5.00     | 9.00     | 7.60     | 10.40    | 8.20     | 8.60     | 4.50      |
| www        | 13:45       | 10.20    | 8.30     | 8.50     | 7.70     | 10.50    | 8.00     | 9.10     | 5.60     | 8.60     | 8.30      |
| rwg        | 14:25       | 9.10     | 7.60     | 10.10    | 7.90     | 10.10    | 8.10     | 8.60     | 8.10     | 8.40     | 8.30      |

|      |       |      |       |      |       |      |       |      |       |      |       |
|------|-------|------|-------|------|-------|------|-------|------|-------|------|-------|
| wrr  | 14:35 | 8.10 | 11.00 | 7.30 | 11.10 | 3.60 | 9.80  | 7.50 | 10.90 | 5.30 | 11.00 |
| rw b | 15:55 | 7.40 | 9.70  | 5.90 | 10.50 | 7.50 | 8.10  | 5.90 | 11.90 | 9.00 | 10.35 |
| wgg  | 16:20 | 7.40 | 8.40  | 7.20 | 9.50  | 7.60 | 9.20  | 5.20 | 7.50  | 6.50 | 10.55 |
| wbw  | 16:40 | 7.80 | 9.30  | 8.10 | 8.70  | 3.30 | 12.70 | 9.70 | 10.40 | 4.80 | 8.90  |

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