Supporting Information

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SI Experimental Procedures

Experiment 1 (Fig. 2*A*). In the coherent condition, the RDM signal strength was randomly chosen on each trial from a pool of six coherence values (10%, 20%, 30%, 40%, 50%, or 60%) and presented to one eye for 700 ms. In the random condition, for the first 400 ms, the RDM consisted of purely random motion (0% coherence). This presentation was then followed by 300 ms of coherent motion randomly chosen on each trial from a pool of the same coherence values. In both conditions, the mask stimulus was presented to the other eye for the first 400 ms only.

A tone sounded at the end of the stimulus presentation to communicate to the participants when they were required to report the direction of motion using the left and right arrow keys on a standard keyboard as quickly and as accurately as possible. Participants had 1,000 ms to make their response. If a response at this stage was not made, the next trial would appear, with missed trials repeated at the end of the block. After the motion direction response, the fixation point changed color to blue, prompting the participants to report whether they saw any part of the suppressed stimulus (1 = saw part/all of the stimulus; 2 = stimulus was completely suppressed for the entire duration).

Trials were arranged in blocks of 200, with each block consisting of 100 random and 100 coherent trials. The order of presentation was randomized. Participants completed 4 such blocks for each coherence value (24 total blocks) spaced over several days. Participants were encouraged to take regular breaks in between blocks to reduce fatigue and potential eyestrain.

Experiment 2 (Fig. 2*B*). In both conditions, the mask stimulus was presented to one eye for 300 ms. In the coherent condition, the RDM signal strength was randomly chosen on each trial from a pool of four coherence values (10%, 20%, 40%, or 60%) and initially presented to the other eye for 300 ms. In the random condition, for the first 300 ms, the RDM consisted of purely random motion (0% coherence). In both conditions, this presentation was then followed by coherent motion that remained on the screen until the participant gave a response using the left or right arrow keys. In the coherent condition, the motion direction and coherence level were consistent with the first part of the trial. In the random condition, the signal strength was randomly chosen from the pool of four coherence values.

A tone sounded after 300 ms to communicate to the participants that they should report the direction of motion as quickly and as accurately as possible. The stimulus remained on the screen until this response was made, after which the fixation point changed color to blue, prompting the participants to report whether they saw any part of the suppressed stimulus (1 = saw part/all of the stimulus; 2 = stimulus was completely suppressed for the entire duration).

Trials were arranged in blocks of 200, with each block consisting of 100 random and 100 coherent trials. The order of presentation was randomized. Participants completed 4 such blocks for each coherence value (16 total blocks) spaced over several days. Participants were encouraged to take regular breaks in between blocks to reduce fatigue and potential eyestrain.

Experiment 3 (Fig. 2*C*). Experiment 3 followed a similar structure to experiment 1, only with the visible RDM stimulus being presented before the suppressed RDM stimulus for 300 ms. Like before, the motion during the suppressed RDM (400 ms) was either random or coherent, and if coherent, it was the same direction and coherence as the subsequent RDM. All other parameters were the same as in experiment 1.

Experiment 4 (Fig. 3*A*). During the first 400 ms of each trial, a coherent dot motion stimulus with a coherence value of 10%, 30%, or 60% was presented simultaneously with the mask stimulus. In the last 300 ms of each trial, only the dot motion stimulus was presented with purely random motion (0% coherence). A tone was sounded at the end of each stimulus presentation to indicate to the participants that they were required to report the direction of motion; the screen remained blank until the response was made. After this response, participants were asked to report whether they saw any part of the RDM stimulus during the first one-half of the stimulus presentation (1 = saw all/part of the stimulus; 2 = stimulus was completely suppressed for the entire duration). Each participant completed 4 blocks of 200 trials for each coherence level for a total number of 12 blocks. All other parameters were the same as in experiment 1.

Experiment 5 (Fig. 3*B*). In the coherent condition, the gray dot motion stimulus was presented for 400 ms with a coherence value of 10%, 30%, or 60% simultaneously with the mask stimulus. In the random condition, random motion was presented for 400 ms simultaneously with the mask stimulus. In both conditions, this presentation was then followed by a visible yellow dot motion stimulus for 400 ms with a coherence value of 10%, 30%, or 60%. In the coherent condition, the yellow dots traveled in the same direction and at the same coherence value as the initial gray dots.

Each participant completed four blocks of 288 trials, including 40 catch trials. In one-half of the catch trials, only the mask was presented in the first one-half of the presentation (the correct response would be to press 2, because this type of catch trial would have the same effect as the stimulus being completely suppressed). In the other one-half of the catch trials, both the mask and gray dots were presented to both eyes during the suppression period, and only one-half of the mask dots were presented, simulating a break in suppression (the correct response would be to press 1). All other parameters were the same as in experiment 1.

Experiment 6. Coherent (30%) motion was presented to one eye for 200 ms. In one-half of the trials, this presentation was followed by random (0%) motion for 250 ms. In all trials, the mask stimulus was presented after 200 ms for 250 ms. In a second condition, this order of presentation was reversed. A tone was sounded at the end of each stimulus presentation to indicate to the participants that they were required to report the direction of motion; the screen remained blank until the response was made. After this response, the fixation point changed color to blue, and participants were asked to report whether they saw any part of the RDM stimulus during the first one-half of stimulus presentation (1 = saw all/part of the stimulus; 2 = stimulus was completely suppressed for the entire duration). The fixation point then changed color to yellow, and participants were additionally asked in each trial to indicate whether they thought that the dot motion stimulus had been presented during the mask. Participants were informed that the dot motion stimulus would be present in exactly one-half of the trials. Each participant completed four blocks of 200 trials for each order of presentation for a total of eight blocks.

An objective measure of stimulus visibility was assessed using type I signal detection theory (1). We calculated sensitivity (d') as follows:

$$d' = z(H) - z(FA),$$

where z indicates the inverse of the cumulative normal distribution, $H = p$(response = present | stimulus = present) and $FA = p$ (response = present | stimulus = absent).

Experiment 7 (Fig. 4*A*). Suppressed coherent motion (10%, 30%, or 60%) was presented for 400 ms followed by visible coherent motion traveling in either the same or opposite direction for an additional 400 ms. The coherence level remained constant in both conditions. Each participant completed four blocks of 288 trials, including 40 catch trials (as specified in experiment 5). All other parameters were the same as in experiment 1.

Experiment 8 (Fig. 4*B*). In the coherent condition, the dot motion stimulus was presented for 250 ms with a coherence value of 10%, 30%, or 60%. In the random condition, random motion was presented for 250 ms. In both conditions, a dot motion stimulus and a mask stimulus was then presented simultaneously for 100, 300, or 500 ms. In the coherent condition, the motion stimulus had the same coherence and direction as in the first portion of the presentation. In the random condition, the motion had 0% coherence. Each participant completed 4 blocks of 200 trials for each coherence and duration pair for a total of 36 blocks. All other parameters were the same as in experiment 1.

Experiment 9 (Fig. S3). All parameters were the same as in experiment 8, with the exception of presentation order: here, variable suppressed motion preceded 250 ms of visible coherent motion.

Experiment 10 (Fig. 4 *C* and *D*). Coherent motion (10%, 20%, 30%, 40%, 50%, or 60%) was presented for 250 ms to one eye followed by either coherent or random motion for 250 ms. The mask stimulus was presented after 250 ms for 250 ms to the other eye. A tone was sounded at the end of each stimulus presentation to indicate to the participants that they were required to report the direction of motion; the screen remained blank until the response was made. After this response, the fixation point changed color to blue, and participants were asked to report whether they saw any part of the RDM stimulus during the first one-half of stimulus presentation. The fixation point then changed color to yellow to prompt the participants to rate their confidence in their direction of motion response on a scale of 1–4, where 1 represents guessing and 4 indicates that they were very confident that their response was correct. Each participant completed 4 blocks of 200 trials for each coherence level for a total number of 24 blocks.

The recently developed meta-d' measure (2) was used to assess metacognition at the individual level. This approach characterizes type 2 (confidence) data in terms of type 1 (accuracy) parameters that best correspond to them according to standard Signal Detection Theory (SDT). The resulting measure meta-d' reflects the d' that you would require to reproduce the observed confidence data assuming that the exact same information was used in both judgments. This approach has been previously used to obtain measures of metacognitive ability for perceptual tasks (3–5).

We calculated sensitivity (d') as follows:

$$d' = z(H) - z(FA),$$

where z indicates the inverse of the cumulative normal distribution, $H = p$(response = right | stimulus = right) + p(response = left | stimulus = left), and $FA = p$(response = right | stimulus = left) + p(response = left | stimulus = right).

The meta-d' measure was computed according to the work by Maniscalco and Lau (2). Maximum likelihood estimation was used to determine the parameter values of the type 1 SDT model that provided the best fit for observed type 2 data. A measure of metacognitive ability that controls for differences in type 1 sensitivity between the coherent and random conditions was then calculated by subtracting the observed d' value from the estimated meta-d' value for each participant. This difference score (meta-d' diff) reflects the extent to which participants used the information used when making their type 1 decision (left or right) when assessing their confidence.

1. Green DM, Swets JA (1966) *Signal Detection Theory and Psychophysics* (Wiley, New York).
2. Maniscalco B, Lau H (2012) A signal detection theoretic approach for estimating metacognitive sensitivity from confidence ratings. *Conscious Cogn* 21(1):422–430.
3. Vandenbroucke ARE, et al. (2014) Accurate metacognition for visual sensory memory representations. *Psychol Sci* 25(4):861–873.
4. Baird B, Smallwood J, Gorgolewski KJ, Margulies DS (2013) Medial and lateral networks in anterior prefrontal cortex support metacognitive ability for memory and perception. *J Neurosci* 33(42):16657–16665.
5. McCurdy LY, et al. (2013) Anatomical coupling between distinct metacognitive systems for memory and visual perception. *J Neurosci* 33(5):1897–1906.

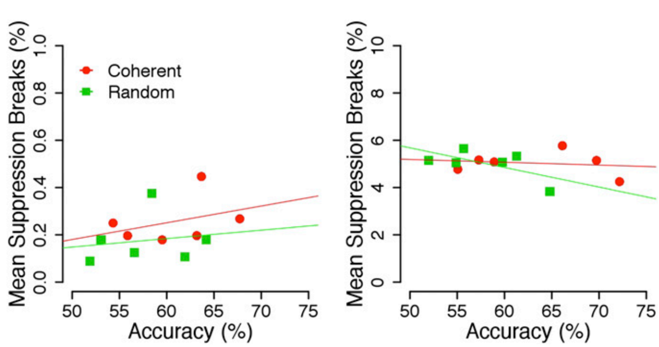

Fig. S1. For each coherence level, the mean percentage of trials on which suppression was broken is plotted against the mean motion discrimination accuracy for the coherent (red) and random (green) conditions (related to Fig. 2 *A* and *C*). Data from experiment 1, where suppressed random or coherent motion was followed by visible coherent motion, are plotted in *Left*. Data from experiment 2, where visible coherent motion was followed by suppressed random or coherent motion, are plotted in *Right*. There were no significant correlations between the number of suppression breaks and accuracy in either experiment 1 [coherent: $t_{(4)} = 0.78$, $P = 0.48$; random: $t_{(4)} = 0.34$, $P = 0.75$] or experiment 2 [coherent: $t_{(4)} = -0.34$, $P = 0.75$; random: $t_{(4)} = -1.64$, $P = 0.18$].

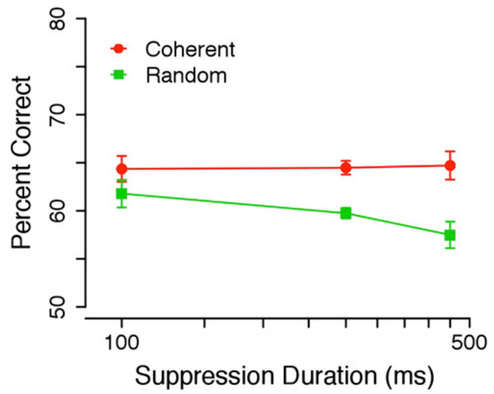

Fig. S2. Results from experiment 9, where visible coherent motion (250 ms) was followed by suppressed coherent/random motion (100, 300, or 500 ms; related to Fig. 4*B*). Accuracy rates (± SEMs) from eight participants were averaged across coherence level for the coherent (red) and random (green) conditions and plotted as a function of suppression duration. Overall, accuracy was again significantly higher in the coherent condition ($M = 62.25$, SD = 1.86) than in the random condition [$M = 58.96$, SD = 1.56; $F_{(1,7)} = 26.56$, $P = 0.001$]. However, accuracy did not significantly change with longer suppression durations in either condition [coherent: $F_{(1,7)} = 0.54$, $P = 0.49$; random: $F_{(1,7)} = 4.57$, $P = 0.07$].

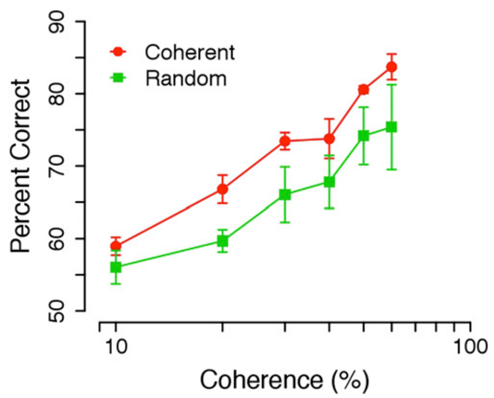

Fig. S3. Mean percentage correct (± SEM) is plotted for five participants in experiment 10 (metacognition) for the coherent (red) and random (green) conditions (related to Fig. 4 *C* and *D*). Accuracy was significantly higher in the coherent condition ($M = 71.56$, SD = 2.27) than in the random condition [$M = 65.65$, SD = 2.85; $F_{(1,5)} = 22.15$, $P = 0.005$].