Appendix 1 to Roux P, Passerieux C, Ramus F, et al. An eyetracking investigation of intentional motion perception in schizophrenia. *J Psychiatry Neurosci* 2014.

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Eye-tracking calibration procedure and analysis of eye-tracking accuracy

Before the beginning of each experiment, the eye tracker was set to obtain the best pupil and corneal reflection images for each participant. Another calibration procedure was carried out after the training phase of each experiment. We used the calibration routines of the eye tracker (9 dots routine for the chasing experiment, 3 horizontal dots routine for the smooth pursuit experiment), presenting dots 1 at time in fixed locations on the screen. In the smooth pursuit experiment, a calibration was done before each of the 5 trials. In the chasing experiment, a calibration procedure was done every 18 trials. Before each trial, a "drift correct" marker was presented in the centre of the screen. Participants were required to look at the dot and press a response button when fixation was attained. This constrained the initial position of fixation and triggered a new calibration if the eye drift was greater than 5°.

In the remote/head free configuration of EyeLink 1000, no head stabilization was required because the position of the head was independently tracked and head movements were compensated for. However, one might argue that the eye-tracking accuracy may have been lower in individuals with schizophrenia than in controls because of increased involuntary head movements (due for example to extrapyramidal side effects of antipsychotic medication). To ensure that the quality of eye-tracking recording was not different between the groups, we ran repeated measures analyses on postcalibration validation data with group as a between-subjects factor, separately for the chasing and smooth pursuit experiments because the calibration procedure was different. The effect of group was significant neither for the smooth pursuit experiment ($F_{1,56} = 2.2$, $p = 0.14$) nor for the chasing experiment ($F_{1,56} = 0.05$, $p = 0.83$). Thus, eye-tracking was as precise for patients as for controls in both experiments.

To ensure that individuals with schizophrenia didn't blink more often than controls (due, for example, to side effects of antipsychotic medication, such as xerophtalmia), we ran a repeated measures analysis on the number of blinks, with experiment as a within-subjects factor and group as a between-subjects factor. There was a main effect of experiment ($F_{1,56} = 30.9$, $p < 0.001$): there were fewer blinks for chasing (mean: 0.58 ± 0.94) than for smooth pursuit (mean: 4.42° ± 5.78°) because the duration of smooth pursuit trials was greater than that of chasing trials. But there was no main effect of group ($F_{1,55} = 0.8$, $p = 0.39$) and no interaction between group and experiment ($F_{1,56} = 0.2$, $p = 0.67$). Thus, patients didn't blink more often than controls.

Steady-state smooth pursuit task

The visual target was a white circle with a diameter of 0.6° of visual angle on a black background. It moved horizontally with an amplitude of 22° with a constant velocity of 17.13°/s. A trial consisted of 15 traverses in each direction (30 segments per trial) with a pause of 500 ms at each extremities of the screen. Five trials were run for each participant, preceded by a training trial. Eye-tracking data were filtered for artefacts, such as blinks. Horizontal velocity was computed on the 30 segments, starting 400 ms after the onset of the traverse and ending 200 ms before its end. Any ocular sample whose velocity was above 40°/s was considered as a saccade and was consecutively excluded from the analysis. Samples adjacent to these high-velocity portions were also considered as part of a saccade if their velocity was above 20°/s. The gain was computed by dividing the mean velocity of the eye by the mean velocity of the target separately for each of the 28 segments after exclusion of the first 2 segments. Mean gain was computed by averaging the best 75% values of the 28 segments in each of the 5 trials.

Chasing detection paradigm

When viewed from 62 cm, the 5 moving circles had a diameter of 1.2° and were drawn as white outlines with a 0.12° stroke. They moved on a black background (38° × 24°) at a constant speed of 17.4°/s and bounced on the background limits. Each trial lasted 10 seconds. On chasing-present trials, there were

- 3 distractors and 1 sheep that moved in an identical manner. On each frame, an agent had a 9.8% probability of changing its direction within a 120° window.
- 1 circle was the wolf. In the first 100 ms, it moved similarly to the distractors and the sheep. Then, it had a 9.8% probability of changing its direction within a window centred on the position held by the sheep 100 ms earlier, plus or minus the chasing efficiency angle (0°, 30° or 60°).

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At the beginning of a trial, the position of each circle was randomly set with the condition that the wolf and the sheep should be distant by more than 19.2°. Chasing-absent trials were obtained with the same algorithm as chasing-present trials, except that the sheep was removed and replaced by another distractor. This ensured that any difference between the 2 conditions would be due to the contingency between wolf and sheep rather than to the peculiar motion pattern of the wolf.

All participants were trained on 6 trials (chasing-present and chasing-absent trials for each of the 3 degrees of chasing efficiency) with feedback. When participants failed, the trial was replayed. When the failed trial was a chasing-present trial, it was replayed with the wolf drawn in red and the sheep in green. Test trials were presented in a pseudorandom order such that no more than 3 trials with the same expected response were presented consecutively.

Signal detection analysis formulas

Sensitivity: $d' = z(H) - z(F)$

Bias*:* $\ln\beta = -1/2\ (z(H)^2 - z(F)^2)$

H is the hit rate, F is the false-alarm rate and z is the inverse function of the normal distribution. Null values of H and F were replaced by 1/2N, with N being the number of trials per participant (78). When H and F were equal to 1, they were replaced by 1-1/2N.

Visual exploration strategies

No eye-tracking data were available for 1 patient owing to a failure in the calibration procedure. At each sample in the eye tracker recording it was determined whether the gaze was located on an agent, on the barycentre of the agents, or elsewhere (stray-looking). Agent-looking was defined by the eye gaze being located within 2.5 times the radius of an agent (hence within a concentric circle of 1.5° radius). Barycentre-looking was defined by the eye gaze being located within 1.5° of the barycentre (mean coordinates) of the 5 agents. Agent- and barycentre-looking are not mutually exclusive. Finally, stray-looking was defined by neither agent- nor barycentre-looking. Stray-looking rates were calculated by dividing the corresponding number of samples by the total number of samples after blink filtration. Agent, barycentre- and stray-looking rates were calculated by dividing the corresponding number of samples by the sum of barycentre-looking and agent-looking samples.

Agent preference index, ocular and cognitive sensitivities

No eye-tracking data were available for 1 patient owing to a failure in the calibration procedure. The eye-tracking samples for which the gaze fell near an agent (when the distance between gaze position and the centre of any agent was below 2.5 times the radius of an agent) were selected from chasing-present and chasing-absent trials. Agent-looking rates were normalized such that the sum of the 5 agents' looking rates was always equal to 1 for each sample, even when participants looked near several agents at the same time. The 5 agents' looking rates were then averaged across all samples, and the standard deviation was computed. In order to dichotomize the ocular responses into detection and nondetection of chasing, the agent preference index of each trial was compared to the median agent preference index across all trials within each participant. When the actual agent preference index was smaller than the median, the trial was coded as a nondetection of chasing; when it was greater, the trial was coded as a detection. Thus, an ocular hit was defined as an ocular detection of chasing on chasing-present trials, while an ocular false-alarm was defined as an ocular detection of chasing on chasing-absent trials. The ocular sensitivity is a d' based on ocular hits and false alarms. Similarly, a cognitive hit was defined as a chasing-present answer when there was an ocular detection of chasing, while a cognitive false-alarm was defined as a chasing-present answer when there was an ocular nondetection of chasing. The cognitive sensitivity is a d' based on cognitive hits and false alarms.

Association between the presence of chasing, the agent preference index and forced-choice responses

A multiple linear regression was run on the agent preference index as dependent variable, with group and chasing (absent v. present) factors as independent variables. It showed no significant effect of group ($F_{1,55} = 0.9$, $p = 0.36$): the agent preference index was similar between schizophrenia and control groups. This suggests that the

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median split analysis used to compute the agent preference index was equally appropriate for both groups. Furthermore, there was a main effect of chasing ($F_{1,55}$ = 252.3, p < 0.001) and a marginal interaction between group and chasing ($F_{1,55}$ = 3.3, p = 0.08): the effect of chasing was greater in controls ($F_{1,28}$ = 243.4, p < 0.001^{-3} , R^2 = 0.739) than in patients with schizophrenia ($F_{1,27}$ = 71.1, p < 0.001, R^2 = 0.503). In other words, controls' agent preference index was more sensitive to the chase-absent/present distinction than that of patients.

A multiple logistic regression analysis was run to analyze the association between explicit responses as the dependent variable and the agent preference index and group as independent variables. It showed a significant effect of agent preference index (z = 10.4, p < 0.001) and of group (z = –2, p = 0.046) and a significant interaction between group and the agent preference index (z = 3, p = 0.003). Thus, the probability to give a chasing-present answer increased with the agent preference index (estimated coefficient: 16.2 ± 0.7), and was overall larger in controls than in patients with schizophrenia. Furthermore, the association between chasing detection responses and the agent preference index was weaker in patients with schizophrenia (z = 9.7, p < 0.001, pseudo R^2 = 0.207) than in controls (z = 15.1, p < 0.001, pseudo R^2 = 0.343).

These results thus show that the presence of chasing influences the variability of gaze distribution (as quantified by the agent preference index), which in turns influences forced-choice responses, as illustrated in Figure 5 of the main article. Furthermore, they show that the associations among these 3 variables are weaker in patients with schizophrenia than in controls.