**Methods**

*Participants*

30 healthy participants (15 females; average age 23.4 ± 2.6 years) from the Paris metropolitan area in France were recruited into our behavioral study through local advertisements. ﻿Participants had no history of neurological or psychiatric disease and had normal or corrected-to-normal vision by means of contact lenses, as well as no color vision deficiencies. Participants obtained an average of 3.3 years of post-secondary education. 3 participants were excluded from all analyses due to less-than-chance performance on several sessions during the testing phase. ﻿All participants gave written informed consent before taking part in the study, which received ethical approval from relevant authorities (**include approval here**). Participants received a fixed monetary compensation for their participation in the study, which lasted for at maximum 1 hour.

*Experimental Protocol*

Participants were asked to play two-armed bandit games on three digital “slot machines”. Participants were to maximize their gain by maximizing the number of times they chose the *correct* reward source amongst two, depicted by distinct black shapes. The potential payoff (from 1 to 99) from choosing any shape on any given trial were drawn from Gaussian distributions whose means were fixed at 45 and 55, for the incorrect and correct shape, respectively. Participants were instructed that the desired payoff was one that was higher than 50 points. The standard deviation of the distributions was set to 7.413 to force a 25% the false *negative* rate of the distribution with the higher mean (negative, as receiving lower than 50 points is undesirable). They were instructed that the points were shown were there to guide them in choosing the correct shape. The experimenter reinforced the fact that their performance will be based on the number of correct choices rather than the accumulation of the points shown.

In the experiment, there were two colored machines (blue and orange) that maintained the same two shapes throughout the course of the experiment. There was also another machine (gray) that changed shape at every new instance of a block, but not during one. Participants were instructed that the two, colored machines were calibrated by two technicians (one female, one male, displayed above the machine before the start of each block) that employ a specific but constant strategy in determining the correct shape on each block. Participants were explicitly told that one strategy was to maintain the same shape throughout, and the other is to change the correct shape from one to the other after each block.

Participants underwent 3 training blocks before beginning the true sessions. Instructions were given before and during training, and the experimenter posed several verification questions to ensure that the participant properly understood the various elements of the experimental task.

The experiment was divided into 8 sessions of 6 blocks each, each block containing 16 trials. Within each session, there were 2 blocks each of the 3 machines, sequentially interleaved within a session, and pseudorandomly shuffled from session to session. After every 2 sessions, participants were prompted to fill out a questionnaire that asked them about what they thought the strategy was behind each of the colored machines. They were also asked about how confident they were in this judgment (ranging from 0 to 100).

The unique aspect of our experimental design is that it drives participants to consider rewards as the number of times they choose the correct shape rather than the value of the points offered by the choice. Thus, participants must use points they obtain to learn the correct shape to gain reward, which in turn, will be used to learn the structure of the colored machines.

*Pupillometry*

We recorded pupillometric data from all subjects (right eye) using an Eyelink II CL v4.594 eye-tracking device.

*Pupillometric Analyses*

To account for drifts in the pupil area not caused by experimental variables, we used the detrending tools from NoiseTools, a MATLAB toolbox developed by Alain de Cheveigné.