**Pupil Dilation**

**Methods**

**Apparatus**

Eye position and pupil size were measured by a video-based eyetracker (EyeLink 1000 Plus Desktop Mount; SR Research, Osgoode, ON,Canada) at a rate of 500 Hz. Pupil area was assessed in a centroïd pupil-tracking mode with a monocular setup (25-mm lens, 500 Hz sampling), using participants dominant eye. Stimulus presentation and data acquisition were controlled by E-Prime (Psychology Software Tools, Pittsburgh, PA) and Eyelink software respectively. Stimuli were presented on a 23.6-inch CRT monitor (ViewPixx; VPixx Technologies, Quebec, Canada), at a screen resolution of 1920x1080 pixels (120 Hz refresh rate). Responses were recorded using a Logitech F310 Gamepad (Logitech, Romanel-sur-Morges, Switzerland).

**Stimuli**

This task involved sequential presentation of 90 scenes selected from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2005). IAPS scenes are ranked according to the valence (unpleasant = 1 to pleasant = 9), and arousal (calm = 1, unpleasant = 9) of each depicted scene. IAPS images were matched on valence and arousal ratings across blocks. Stimuli order was randomly determined within each block. The size of each image subtending approximately 4° by 4° of visual angle. Pupil size is sensitive to variation of luminance levels (Winn, Whitaker, Elliott, & Phillips, 1994). To limit this effect, each IAPS scene was equalized (12.0 cd/m2) to match mean luminance distribution. Both room luminance and task-related screens were matched to mean luminance as well.

**Procedure**

Participants were seated in a dark room and the experiment con-

sisted of 210 trials lasting approximately 40 min (Fig. 1A). Each

trial began with the appearance of a central ﬁxation point (FP) (0.6°

diameter; 6 cd/m

2

) on a gray background (11 cd/m

2

). After 1–1.4 s

of central ﬁxation, a peripheral visual stimulus (0.6° diameter) was

presented for 100 ms to the left or right of the FP (8° eccentricity

on the horizontal axis) on a subset of trials (90 trials) and partici-

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The experiment consisted of three blocks of 30 trials lasting approximately 40 min. Participants were seated 60 cm from the computer screen. Ocular dominance was then determined by using a modified version of the near-far alignment test (Miles, 1930). The task began with a thirteen-point calibration routine used to map eye position to screen coordinates. Calibration was accepted only once there was an overall difference of less than 0.5° between the initial calibration and a validation retest. After completing calibration, participants were informed that the task would soon begin and all instructions would be presented on the computer screen. Participants were instructed to view the images naturally, as if they were watching a slideshow. Further, they were also instructed to look at the fixation cross prior to each trial in order to standardize the starting location of their gaze. Each trial began with the appearance of a central ﬁxation cross (FC) for 2000 msec. Participants were required to maintain gaze of central ﬁxation (subtending 2° by 2° visual angle), for a duration window of 500 msec. If central fixation was not detected within 2000 msec, online drift correction procedures were conducted using the FC. The drift correction FC was then shown until a button-press from the experimenter indicated they were looking at it. Immediately following FC, visual stimulus (IAPS) appeared for 5000 msec. A blank screen (postIAPS) replaced visual stimulus for 1000 msec, before beginning the next trial. The three task blocks were completed sequentially with a self-paced break between them. Pupil size and gaze position were measured during the entirety of the trial.

**References**

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2005). International affective picture system (IAPS): affective ratings of pictures and instruction manual. Technical Report A-6. Gainesville, FL: University of Florida.

Miles, W. (1930). Ocular dominance in human adults. Journal of General Psychology*.* 3(3)412–420. doi: 10.1080/00221309.1930.99182180022-1309

Winn, B., Whitaker, D., Elliott, D. B., & Phillips, N. J. (1994). Factors affecting light-adapted pupil size in normal human subjects. Investigative Ophthalmology & Visual Science. 35(3)1132–1137

The experiment consisted of two sessions of approximately 2 h

duration each, and subjects completed a total of 44 9 3-min runs

(MIB: 6; Replay: 38). Subjects completed 16 low-, 16 medium- and

6 high-surprise Replay runs. Different numbers of runs per hazard

function were used to obtain a similar number of trials for each of

the three conditions (the high-surprise condition yielded more trials

per unit time). Subjects performed the MIB and high-surprise

Replay conditions in one session, and the medium- and low-surprise

Replay conditions in the other session. The two types of runs in

each session were presented within two separate blocks to allow

subjects to learn the event distributions of each condition as much

as possible. The order of blocks within a session and the order of

sessions were counterbalanced across subject