**Shaping induces long-term enhancements in pursuit-like smooth movements under image stabilization condition**

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**INTRODUCTION**

It has been shown that under stabilization condition participants were able to produce slow eye movements (Barnes et al., 1995). In one condition the stabilization occurred once while participants were tracing a target and were asked to continue the movement. In another condition the image was stabilized at the start of the trial and subjects attended alternately at the left and right of the centre.

In both conditions the slow eye movements generated were different from pursuit (many saccades, lower eye velocity). Moreover subjects didn’t perform more than 3 to 7 cycles of a striated displacement. Despite studies showing learned long-term changes on pursuit (Darcheville & Knutic, 2005), the effects of learning on eye movements under image stabilization condition have been unclear.

We asked whether:
1) under image stabilization condition participants might learn to produce consistent smooth movements similar to normal pursuit
2) a shaping procedure induces long-term modifications

We applied a shaping procedure — an operant conditioning procedure which consists in the reinforcement of successive approximations of the target behaviour.

**METHOD**

**Participants**

4 participants (normal or corrected vision) (3 men and 1 woman) were authors of the study and previously experienced other learning procedures.

**Phase 1: Pursuit**

With the aid of an auditory cue, the fixation point disappeared and the participants traced the target across the screen for 750 ms.

Target velocity = 22 deg/s.

Eye movements were recorded for the first 3 s of each trial. Only trials in which gaze was detected were analysed.

**Phase 2: Baseline**

The day after we recorded eye movements under image stabilization condition, for 2 sessions of 150 trials each, the participants were instructed to move their eyes in the same manner as they did before, so that the target horizontally moved across the screen.

The effects of the learning procedure on the gain several days after learning were idiosyncratic.

**RESULTS**

**Eye velocity after learning was closer to velocity during pursuit**

Average eye velocity for one session of each condition for a single participant (A).

**Learning induced**

1. long-term enhancements in eye velocity (computed over 1 second, SSS the following pursuit onset)
2. an increase in probability of occurrence of smooth movements under image stabilization condition.

The effects of the learning procedure on the gain several days after learning were idiosyncratic.

**REFERENCES**


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**CONCLUSIONS**

Our learning procedure induced modifications in the probability of occurrence of smooth eye movements under image stabilization condition as well as in the topography of the response (velocity enhancement and saccade reduction).

Eye movements after learning were very similar to pursuit.

Adding a contingent reinforcing auditory stimulus to the merely visual consequences of the object (many saccades, lower eye velocity). Moreover subjects didn’t perform more than 3 to 7 cycles of a striated displacement. Despite studies showing learned long-term changes on pursuit (Darcheville & Knutic, 2005), the effects of learning on eye movements under image stabilization condition have been unclear.

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Eye movements after learning were very similar to pursuit.

Adding a contingent reinforcing auditory stimulus to the merely visual consequences of the smooth eye movements modified the function of these movements.

These results revealed the operant nature of voluntary smooth eye movements, already demonstrated in some previous researches (Darcheville et al., 1999; Darcheville & Knutic, 2005).

The use of a yoked-control group would clarify the roles of the instructions and practice. It would also provide additional evidences of the influence of the learned contingencies in the production of smooth eye movements.

Since the effects of this shaping were still observable several days after learning, this procedure involved long-term modifications. As a consequence it appears that smooth pursuit models should take long-term learning into account.