Prosaccades and antisaccades under risk: penalties, rewards, and their spacial effects

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Reward, Penalty and spatial effects

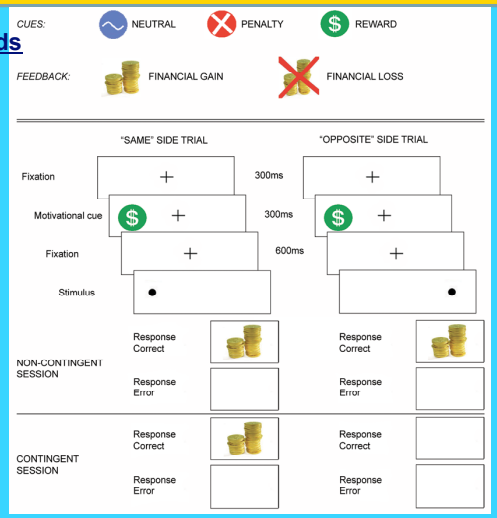
In monkeys, reward may enhance attentional selection at the location of a reward cue even though its location is irrelevant to the likelihood of reward. This suggests that reward may modulate visual rather than motor selection in LIP, differing from previous hypotheses about "action value".

Peck et al (2009) Reward Modulates Attention Independently of Action Value in Posterior Parietal Cortex. The Journal of Neuroscience 29:1182-1191.

Objectives

- Does this occur in humans?
- Study influence of both reward AND penalty
- Are effects greater with a more attentionally demanding task like the antisaccade?
- How does this compare to a situation where reward IS contingent on the location of the cue (action value)?

Methods



- 16 subjects, Eyelink 1000
- Motivational cue appears left or right (reward, penalty, neutral)
- After 600ms interval, stimulus appears either left or right
- Session 1 – consequences **not contingent** on stimulus location
- Session 2 – consequences **contingent** on stimulus/cue location

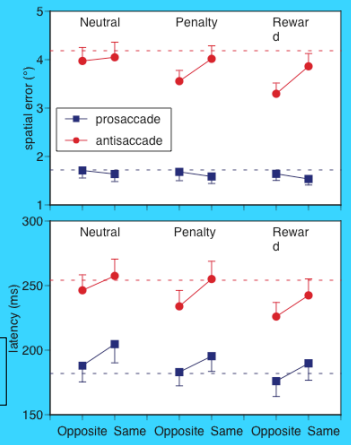
Results

1. NON-CONTINGENT SESSION

All responses faster, antisaccades more accurate when the stimulus located opposite to cue (IOR-like).

Reward does NOT change this (!) but enhances IOR effect slightly in antisaccade accuracy.

Motivation effects on latencies: neutral>penalty>reward

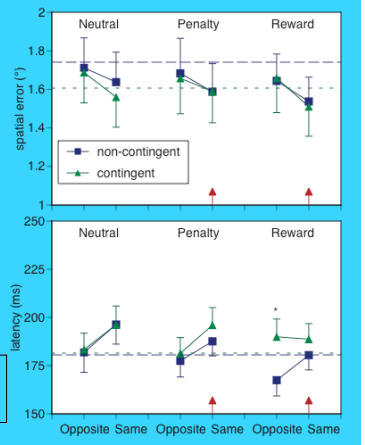


'Same/opposite = relation of stimulus to motivational cue location.
Dotted lines = baseline no-cue condition.
Error bars = 1 standard error.

2. PROSACCADES – EFFECT OF CONTINGENCY

Contingency had little effect on accuracy.

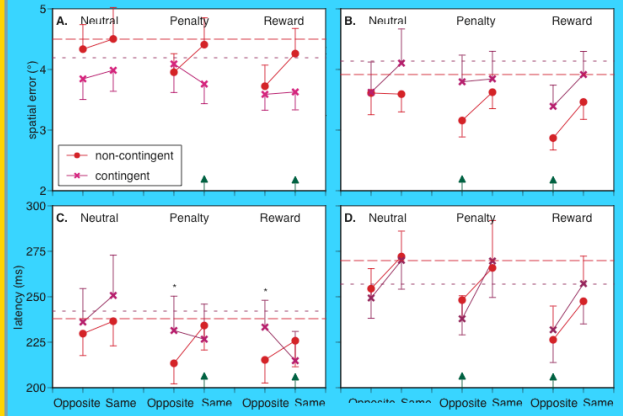
For latency, in the reward condition the speeding of responses seen in the non-contingent session was retained at the rewarded location but lost at the unrewarded location.



Arrows = trial type rewarded in the contingent sessions
Asterisk = significant difference between non-contingent and contingent sessions.

3. ANTISACCADES – EFFECT OF CONTINGENCY

LEFT GRAPHS: reward contingent for stimulus coinciding with cue location
• contingency reverses the IOR effect in latency, with loss of efficiency at unrewarded site.



RIGHT GRAPHS: reward contingent for saccade goal coinciding with cue location.

Action value would merely reinforce the IOR-like effect.

No difference found between contingent and non-contingent blocks.

Conclusions

- General benefit of motivation on latency and accuracy of all saccades.
- 'Inhibition of return' like effect for all cues
- Contrary to monkeys, motivational value of cues did not modulate the influence of cue location of prosaccades
- Penalty effects similar to reward but intermediate in magnitude
- Effects similar for prosaccades and antisaccades, motivational cues slightly enhance IOR effect in antisaccades.
- Compared to the non-contingent sessions, when reward is contingent on location, subjects maintain enhancements at rewarded locations but lose them at unrewarded locations. This 'focusing of attention' is consistent with 'action value' hypotheses..