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Action-Monitoring Processing is More Sensitive to Gain than to Avoidance of the Loss

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INTRODUCTION

Action-monitoring

- monitors and regulates our action to achieve goals
- is more activated for inappropriate behavior than for appropriate behavior
- not only detects errors but also evaluates the outcome of them

Response-locked ERP (event-related brain potential)

- reflects processes related to the onset of the motor response
- ERN (error-related negativity), which is elicited by the erroneous response, is an effective index of error processing in the action-monitoring.
- CRN (correct response negativity) is sometimes observed in the ERP for correct response, but the functional significance is still unclear.

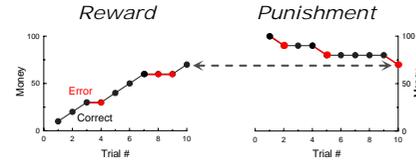
Motivational effect on the ERN (Murata & Katayama, 2006 SPR)

Reward condition

Monetary incentives **increase for correct response**, and **remain unchanged for the error**.

Punishment condition

Monetary incentives given before the task **decrease for the error**, and **remain unchanged for correct response**.



>> Error responses are evaluated differently according to the situation, even if those produce the same conclusive result.

>> Action-monitoring processing makes positive efforts to get the reward.

How about correct response?

The function of the action-monitoring on correct response

- Response conflict is detected → activates the action-monitoring processing
- The significance of the response has been considered not to influence the CRN.

When the correct response is accompanied by response conflict, how does the action-monitoring processing deal with the correct response which provides us some reward?

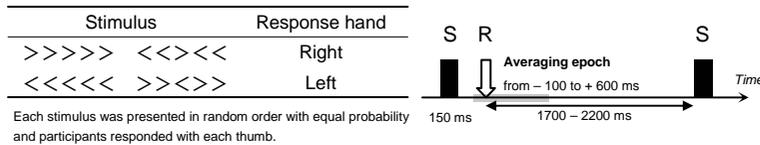
Purpose

To examine the function of the action-monitoring on correct response, which is accompanied with **Reward** or **Avoidance of loss**
 Correct response without conflict vs. Correct response with conflict

METHODS

Participants 12 volunteers (6 males and 6 females)

Task an arrowhead version of the flanker task with the RT deadline



Condition

| Response accuracy | Motivational condition | | |
|-------------------|------------------------|------------|--------------|
| | Control | Punishment | Reward |
| Correct | - | Avoid loss | Gain |
| Error | - | Loss | Fail to gain |
| Late response | - | Loss | Fail to gain |

1 condition = 200 trials (5 blocks X 40 trials)
 Participants earned 1000 yen when their performance was perfect.

Recordings & Data analysis

RT: the time from stimulus presentation to button press
 EEG: Fz, Cz, and Pz (ref.: nose tip, 0.05-30Hz, A/D: 500 Hz)
 EMG: recorded from the right and left forearms
 Excluded trials: RT < 200 ms, RT deadline < RT

Correct without conflict

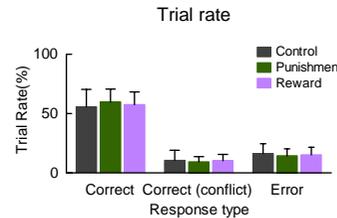
correct trials observed no EMG activity for the incorrect hand

Correct with conflict

correct trials contaminated by the EMG activity for the incorrect hand

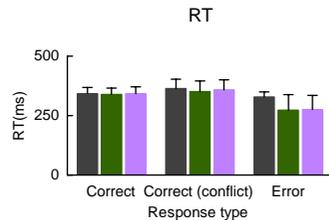
RESULTS & DISCUSSION

Behavioral data



Correct > Correct (conflict), Error

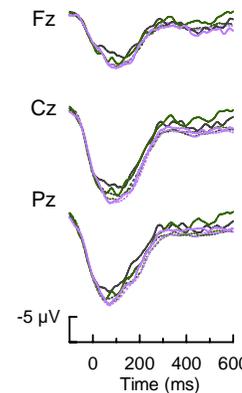
Trial rates did not differ between correct with conflict and error.



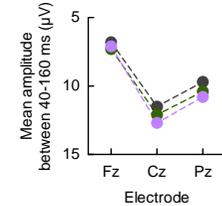
Error: Control > Punishment, Reward

Participants responded quickly when the response was not related to monetary incentives.

Correct ERP data

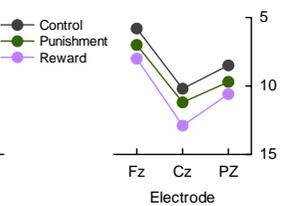


Correct without conflict



n.s.

Correct with conflict



Reward > Control, Cz and Pz > Fz

Evaluation of correct response

The action-monitoring processing did not distinguish the outcomes of correct responses without conflict.

With conflict, action-monitoring processing was sensitive to acquisition of the reward.

Evaluation of error (Murata & Katayama, 2006 SPR)

Failure to gain for error had greater impact than loss for error.

The functional significance of the positivity for correct trials should be investigated in further research.

CONCLUSION

The action-monitoring processing

- evaluates the outcome of correct response with response conflict
- regards gain/failure to gain as more impact event than avoidance of loss/loss

Acquiring reward may have special importance for the human.