TITLE

ACTION-MONITORING SYSTEM REGARDS THE FAILURE TO GAIN AS MORE SIGNIFICANT THAN THE LOSS

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CITATION

The 46th Annual Meeting of the Society for Psychophysiological Research

ISSUE DATE

2006-10

DOC URL

http://hdl.handle.net/2115/15866

TYPE

conference presentation

NOTE

10/25-29, 2006. the Hyatt Regency Hotel, Vancouver, BC, CANADA.

POSTER SESSION 2・Friday, October 27, 2006 : 87

FILE INFORMATION

06SPR_Asuka.pdf

Hokkaido University Collection of Scholarly and Academic Papers : HUSCAP
**ACTION-MONITORING SYSTEM REGARDS THE FAILURE TO GAIN AS MORE SIGNIFICANT THAN THE LOSS**

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**Action-Monitoring System**
- monitors and evaluates our action to achieve goals
- relates to response correction and adaptive behavior
- The ERN and the CRN are effective indices of action-monitoring system.

**Error-Related Negativity; ERN**
- negative deflection elicited by the erroneous response
- observed clearly in response-locked ERP
- peaks at around 100 ms after the response and shows a frontocentral scalp distribution

**Correct Response Negativity; CRN**
- ERN-like negative deflection following the correct response
- smaller than the ERN

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**Motivational effect (reward or punishment)**

The ERN reflects evaluation of the outcome of the error as well as detection of the error.
- The outcome of the response always accompanies our action, and more significant for the performer elicits the larger ERN.
- Some studies reporting the motivational effect on the ERN manipulated the motivational factor by providing or confabulating monetary incentives.

**Reward condition**
- Monetary incentives increase only for correct responses, and remain unchanged for the error (FAILURE TO GAIN).
**Punishment condition**
- Monetary incentives given before the task decrease only for the error (LOSS), and remain unchanged for correct responses.

It has been reported that the CRN does not reflect the significance of the outcome.
- In the reward condition, monetary incentives did not influence on the CRN.

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**Participants**
12 volunteers (6 males and 6 females) ages between 21 – 31 yrs.

**Task**
an arrowhead version of the flanker task with the RT deadline (mean RT of the practice trial + 150)

**Condition**
Table 2. Three motivational condition manipulated the reward and punishment

<table>
<thead>
<tr>
<th>Response category</th>
<th>Correct (CR)</th>
<th>Error (ER)</th>
<th>Late Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (CNT)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Punishment (PNS)</td>
<td>-2.5</td>
<td>-2.5</td>
<td>0</td>
</tr>
<tr>
<td>Reward (RWD)</td>
<td>+2.5</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

1. condition = 200 trials (5 blocks X 40 trials)
   √ 1000 is paid to the participant for perfect performance in PNS and RWD conditions.

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**Behavioral data**

**Stimulus Compatibility Effect on Correct Trials**

**Results & Discussion**

**Introduction**

**Purpose**
To investigate
1. how does the action-monitoring system evaluate FAILURE TO GAIN and the LOSS
2. whether the motivational effect is specific to the error-processing or not in reward and punishment condition

**Methods**

**Recordings & Data analysis**
RT: the time from stimulus presentation to button press
EEG: Fz, FCz, Cz, and Pz (ref.: nose tip, bandpass: 0.05-30 Hz, A/D: 500 Hz)
EMG: the right and the left forearms
Averaging epoch: 700 ms (including 100 ms preceding the button press), Artifact rejection: ±100 µV
Excluded trials: RT < 200 ms, RT deadline < RT, and the trials contaminated by response conflict or correction
ERN: Mean amp. of the difference wave (error - correct)
CRN: Mean amp. of the difference wave (correct - error)

**Conclusion**

1. Action-monitoring system
   - evaluates erroneous behavior differently according to the situation, even if those produce the same conclusive result.
   - makes positive efforts to get the reward.
   - Different processes evaluate the significance of the correct and error response respectively in the action-monitoring system regardless of the situation.

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**Results**

**Stimulus Compatibility Effect on Correct Trials**

**Correct trial rate:** Comp. > Incomp. Correct RT: Incomp. > Comp.
- Motivational factor does not influence the response-generation process related to stimulus compatibility.

**ERN**
- The significance of the error was not evaluated according to the persistence of monetary reward or punishment.
- It was the most important issue for the participants whether participants could increase their reward in RWD compared to PNS and CNT conditions in which participants have no chance to increase their reward.

**CRN**
- Motivational effect was not significant
- This result supports the report that motivational effect is specific to error processing.

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**Figures**

**Fig. 1.** The time course of one trial,
**Fig. 2.** Trial rate and mean RT for correct error and response in each condition.
**Fig. 3.** Trial rate and mean RT for correct response in each condition.
**Fig. 4.** Grand-averaged waves for correct and error trials (left) and difference waves (right) in each condition.
**Fig. 5.** ERN peak amplitudes (above) and CRN mean amplitude (below).

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The 46th Annual Meeting of the Society for Psychophysiological Research 1025-29 2006 Vancouver, BC, CANADA