Instructions for use

Title

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

Author(s)
MURATA, Asuka; KATAYAMA, Jun'ichi

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
Asuka MURATA & Jun’ichi KATAYAMA
Graduate School of Education, Hokkaido University, Japan
asuka@edu.hokudai.ac.jp

Introduction

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

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 outcome for the performer elicits the larger ERN.
- Some studies reporting the motivational effect on the ERN manipulated the motivational factor by providing or confiscating monetary incentives.

Reward condition
- Monetary incentives increase only for correct response, 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 response.

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.

Purpose
To investigate
1. how 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

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 + 1SD)

Table 1. All stimulus types and response hand assigned to each target

<table>
<thead>
<tr>
<th>Stimulus type</th>
<th>Response hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right (R)</td>
<td>S</td>
</tr>
<tr>
<td>Left (L)</td>
<td>R</td>
</tr>
<tr>
<td>Other (O)</td>
<td>S</td>
</tr>
</tbody>
</table>

Averaging epoch from -100 to +600 ms

Table 2. Three motivational conditions manipulated the reward and punishment

<table>
<thead>
<tr>
<th>Condition</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>0</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 was paid to the participant for perfect performance in PNS and RWD conditions.

Recording & Data analysis
RT: the time from stimulus presentation to button press
EEG: Fz, F3, 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: Peak amp. of the difference wave (error - correct)
CRN: Mean amp. Between 50-150 ms after the button press

Results & Discussion

Behavioral data

Table 3. Trial rate and mean RT for correct and error response in each condition

<table>
<thead>
<tr>
<th>Condition</th>
<th>Correct (CR)</th>
<th>Error (ER)</th>
<th>Late Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Punishment</td>
<td>-¥ 2.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Reward</td>
<td>¥ 2.5</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

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

Stimulus Compatibility Effect on Correct Trials

Fig. 3. Trial rate and mean RT for correct response in each condition

ERN

Fig. 4. Grand-averaged waves for correct and error trials (left) and difference waves (right) in each condition

CRN

Fig. 5. ERP peak amplitude (above) and CRN mean amplitude (below)

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.
2. Different processes evaluate the significance of the correct and error response respectively in the action-monitoring system regardless of the situation.

The 46th Annual Meeting of the Society for Psychophysiological Research 10/25-29, 2006 Vancouver, BC, CANADA