The Influence of Brain Injury on Belief Updating: Evidence for Insular Involvement

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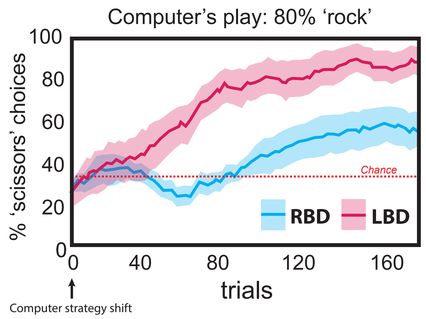
Updating can be impaired following right brain damage[a,b]

- Right brain damaged (RBD) patients detect changes, but fail to update[b].

- The specific brain regions contributing to these impairments are not well understood[c].



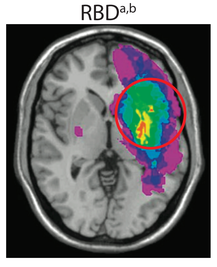
Which right hemisphere brain regions could be causing updating impairments?

- Lesion and Imaging studies suggest that the right anterior insula could be crucially involved.

Healthy Adults[d]

Anterior Insula

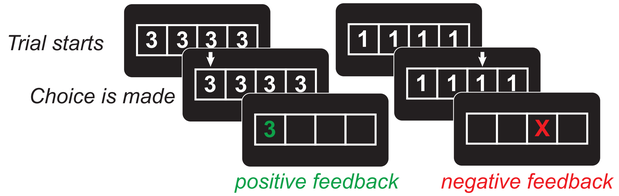
RBD[a,b]



Right and Left mid/frontal brain damaged patients performed an adaptive learning task[e]

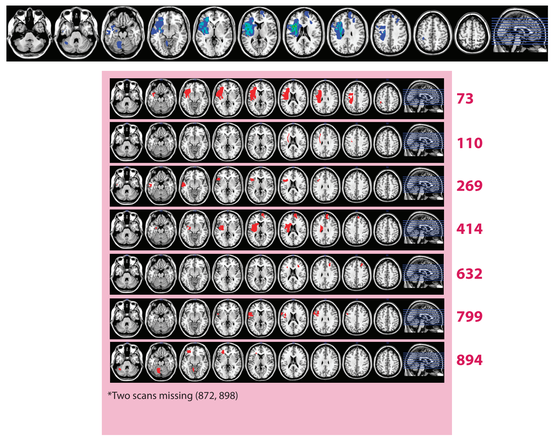
PROBE task:

- Participants learn stimulus-response rules through trial feedback
- Rules change every 33-48 trials
- Feedback is noisy (10% incongruent)

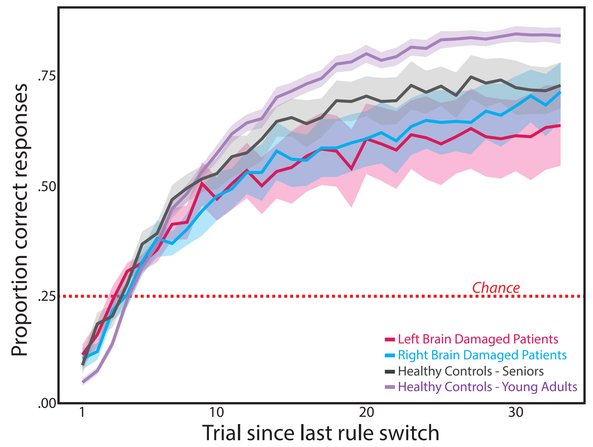


Updating performance did not differ between Left and Right brain damaged patients.

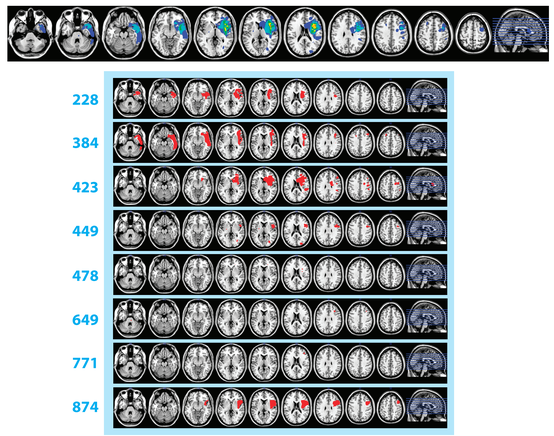
Left Brain Damaged Patients*



*Two scans missing (872, 898)



Right Brain Damaged Patients



LBD Patient Information

Age Range: 55 - 80 years
Gender: 2 female, 7 male
Years of Education: mean = 11.4 years
Time Post-Stroke: mean = 27.8 months
MoCA: mean score = 22.3

HC - Seniors

Age Range: 63 - 87 years
Gender: 8 female, 4 male
Years of Education: mean = 15.8 years
MoCA: mean score = 28.0

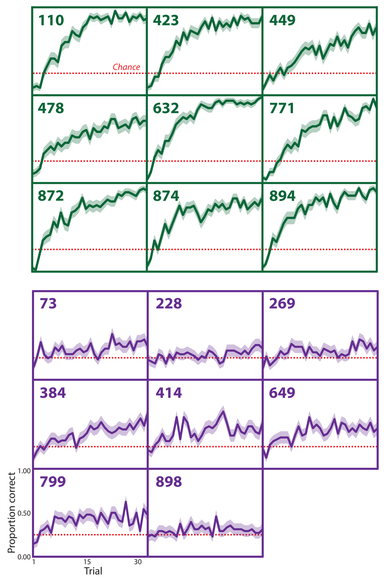
HC - Young Adults

Age Range: 17 - 25 years
Gender: 17 female, 21 male
Education: university undergraduates

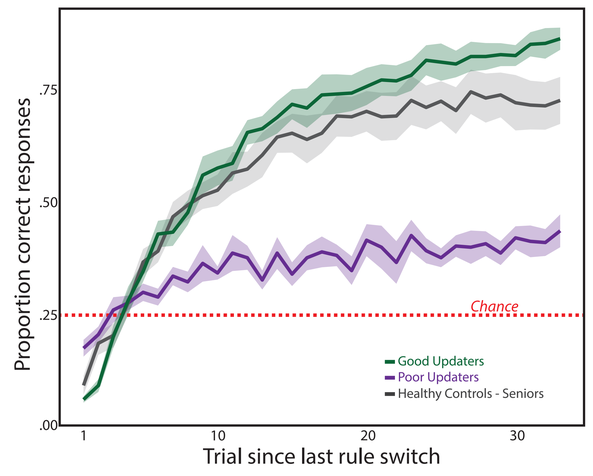
RBD Patient Information

Age Range: 55 - 86 years
Gender: 2 female, 6 male
Years of Education: mean = 13.0 years
Time Post-Stroke: mean = 35.3 months
MoCA: mean score = 24.7

Patients across both hemispheres were divided into good or poor updaters.



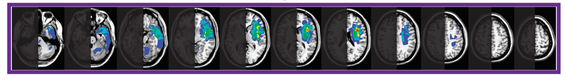
Good updaters performed as well or better than Healthy Older Controls, while poor updaters performed much worse.



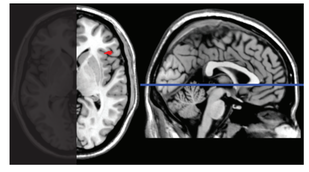
Lesion overlays on flipped scans reveal that poor updaters have common anterior insular damage.

Good Updaters

Poor Updaters



Voxel-based Lesion-Symptom Mapping (VLSM) suggests that poor updating performance is related to anterior insular damage.



Conclusions

- Mid/Frontal damage can impair updating in both RBD and LBD patients.
- These impairments seem related to anterior insular damage.
- Posterior regions may explain previous hemispheric updating effects (e.g., posterior parietal cortex).

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