RL with temporal representation captures phenotypes of adaptive persistence behavior

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Introduction

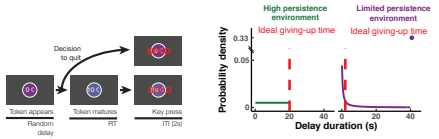
Individual-specific RL parameters fit to simple choice tasks have been shown to associate with cognitive and biological processes.

Can *Temporal RL* parameters capture phenotypes of time-dependent stay-or-go choices?

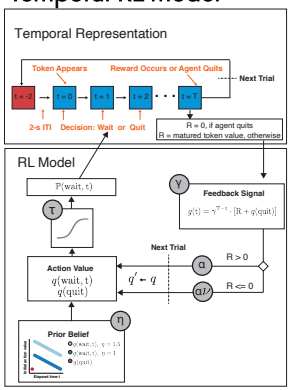
Does inter-individual variation in task-derived RL parameters show *trait-like* test-retest reliability?

Experiment

Task: decide how long to continue waiting for a token
Goal: maximize total earnings in a fixed period



Temporal RL model



Key notation

t: elapsed time in a trial
T: when a trial terminates
R: trial-wise payoff

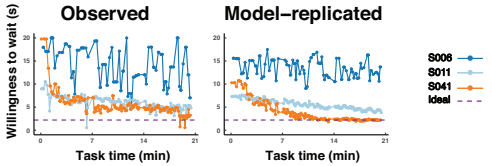
Individual-specific parameters

Learning rate α
Valence-dependent bias ν
Inverse temperature τ
Discounting factor γ
Prior belief parameter η

Results

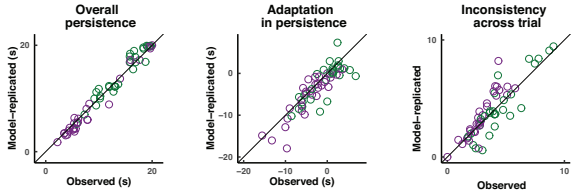
1. Behavioral findings: participants in the high-persistence environment waited longer on average, yet individuals differed.

2. Temporal RL fits reproduced variation in learning dynamics



Data are from three participants in the limited persistence environment.

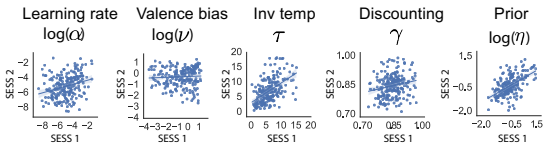
3. Temporal RL fits captured multidimensional individual differences



Each point represents descriptive statistics for one participant.

'Adaptation' was calculated as final-minus-initial persistence level.

4. Test-retest reliability of model parameters



ρ = 0.287 ρ = 0.155 ρ = 0.553 ρ = 0.244 ρ = 0.606

Source: an independent test-retest online study (n = 283)

Participants performed a 20-min task twice, three weeks apart.

Spearman's rho values are shown in red.

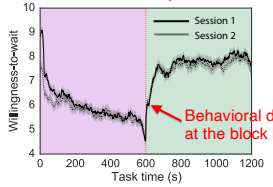
Additional results

1. An *R-learning* variant behaved similarly to the Q-learning variant shown here.
2. Similar results were observed in two additional within-participant data sets.

Future steps & points for discussion

1. To augment the model with a resetting process at the break between contiguous task blocks.

Source: the independent test-retest online study



2. To investigate associations between task-derived model parameters and self-report measures.

References

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Extended abstract

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