Uncertainty affects planning effort, but not plans

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Overview

1 The future is uncertain, which makes planning difficult. How does uncertainty affect planning behavior?

2 We designed three online tasks where participants face different forms and levels of uncertainty.

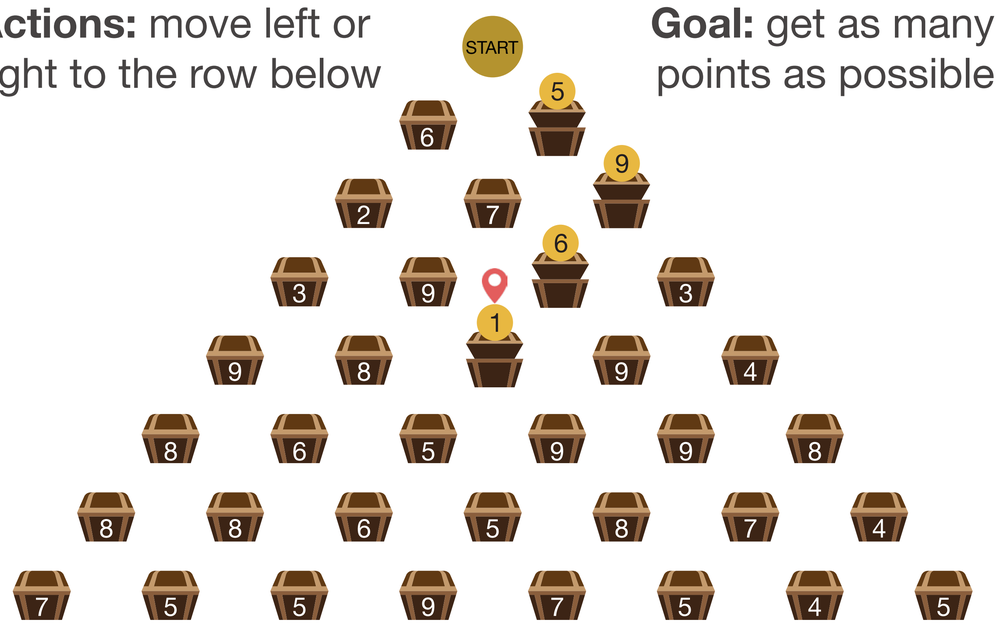
3 Participant behavior is best fit by a model that implicitly adapts to uncertainty by scaling planning depth.

4 Uncertainty decreases planning depth, which is reflected in the first-move response times.

Task

Actions: move left or right to the row below

Goal: get as many points as possible



Models

P(move left) = logistic[β(V(F(left subtree) - V(F(right subtree))]

Function F: which nodes people consider

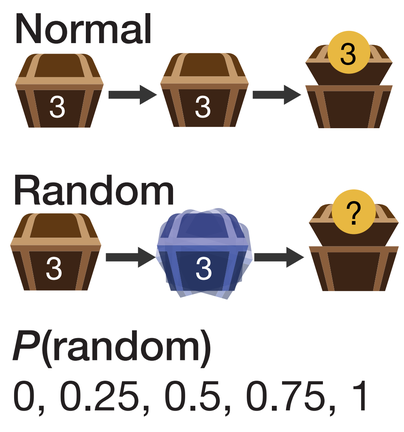
Depth: consider the board up to depth d
Value: consider only the top k values

Value function V

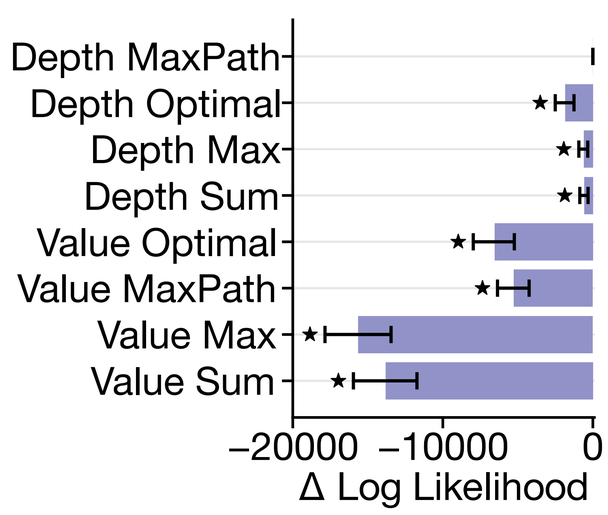
Optimal: the maximum expected sum along any path, taking into account uncertainty
Max Path: the maximum sum along any path, ignoring uncertainty
Max: the maximum value, ignoring uncertainty
Sum: the sum of all values, ignoring uncertainty

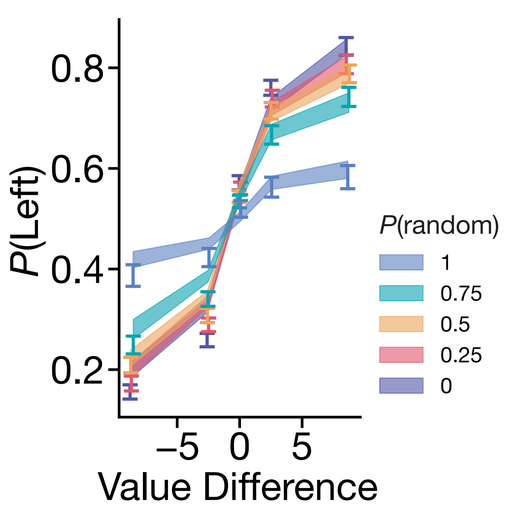
Reliability

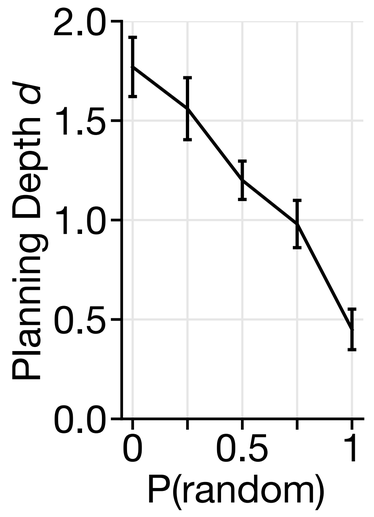
n=100

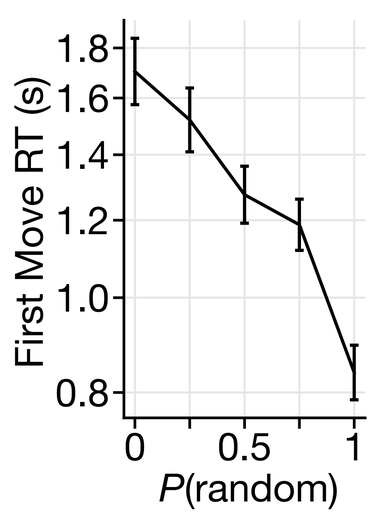


P(random)
0, 0.25, 0.5, 0.75, 1



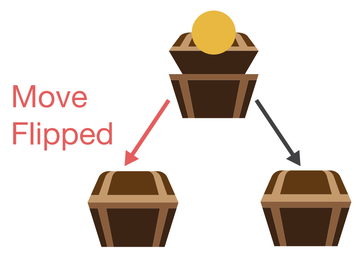




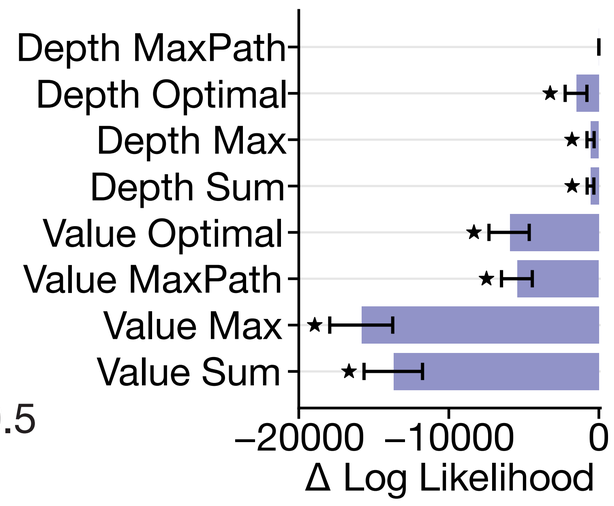


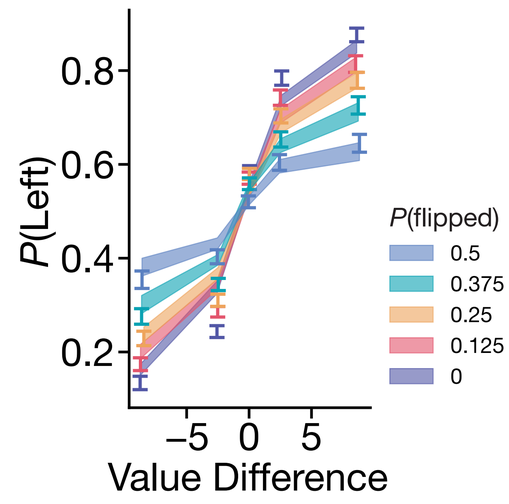
Controllability

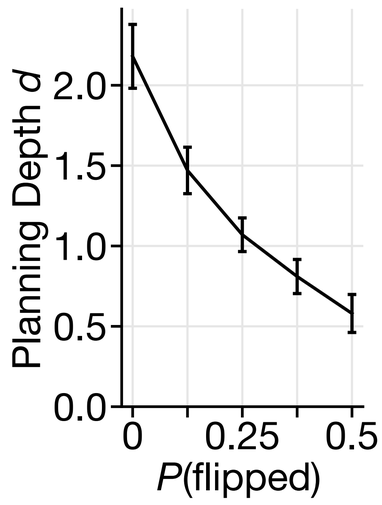
n=100

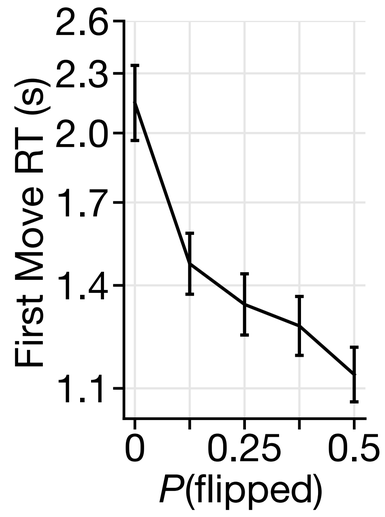


P(flipped)
0, 0.125, 0.25, 0.375, 0.5



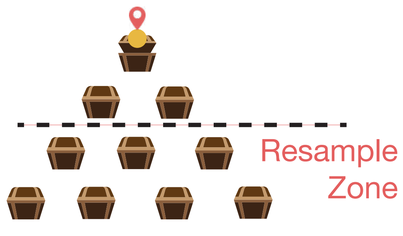






Volatility

n=100



P(resample)
0, 0.25, 0.5, 0.75, 1