Learning to Wait: Dynamic Persistence in Uncertain Environments

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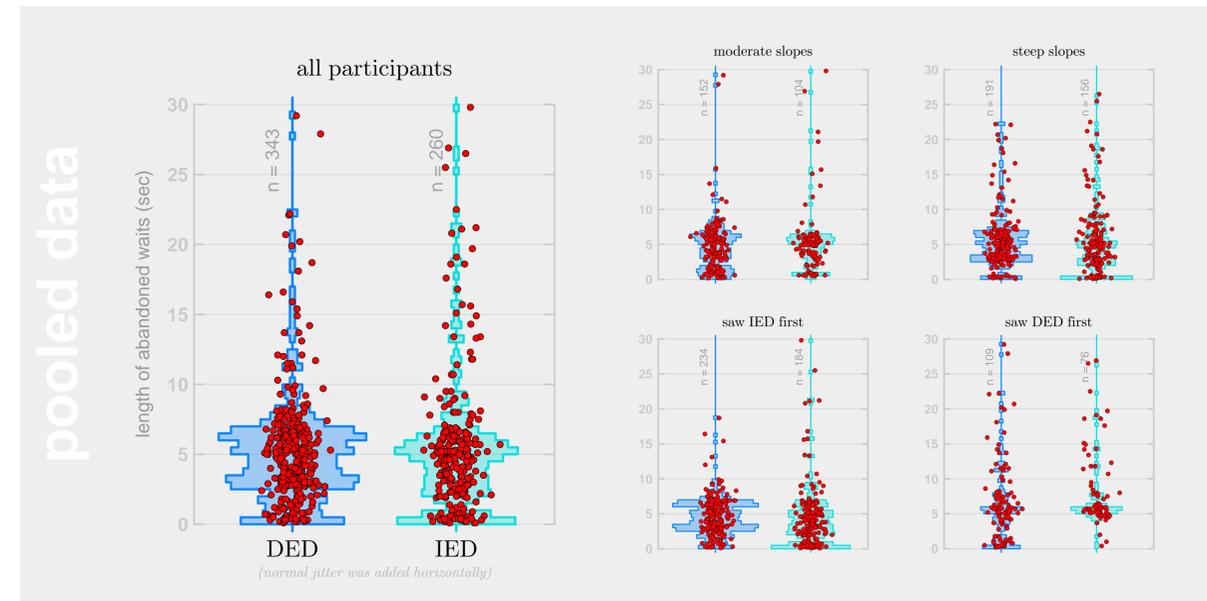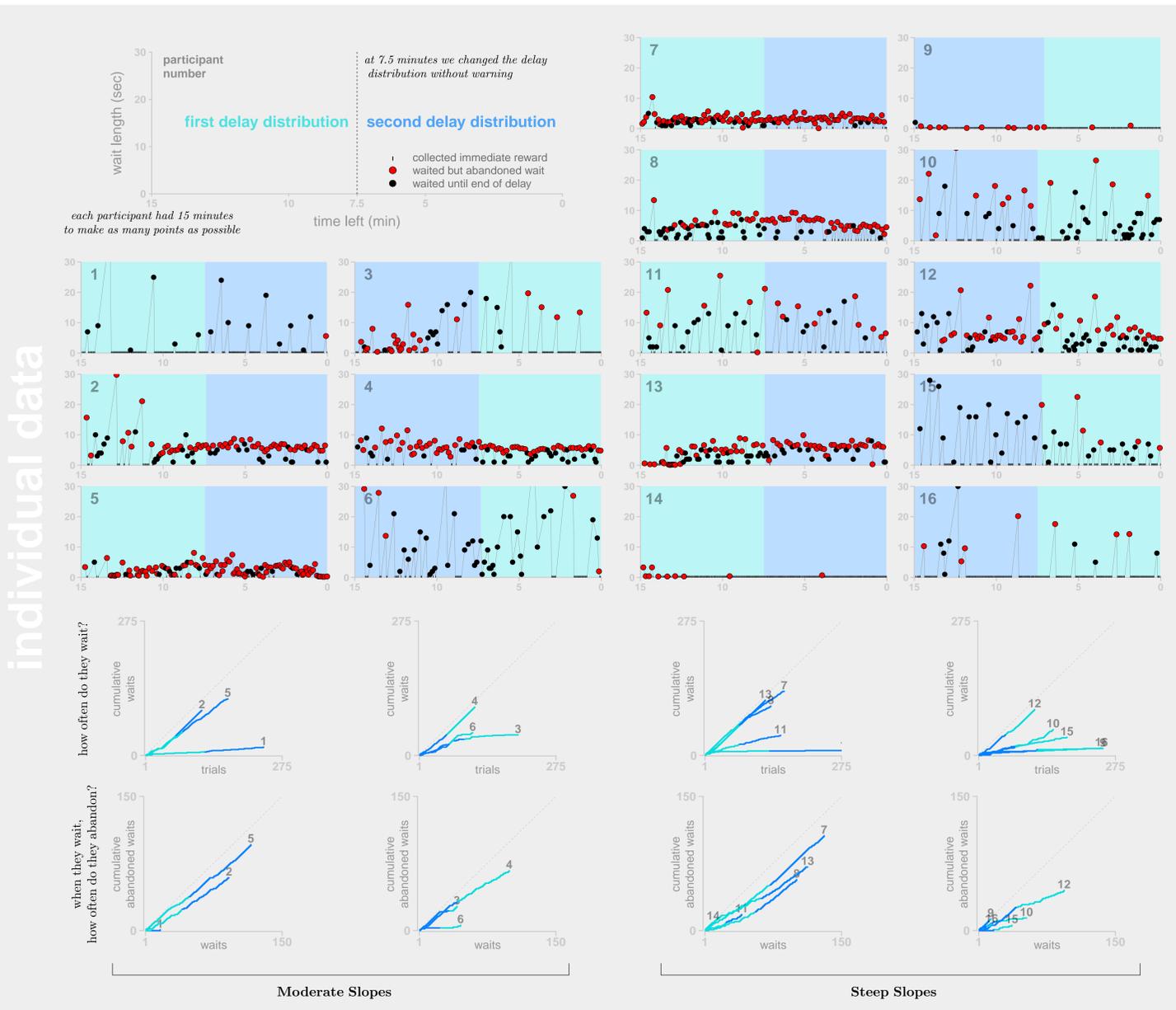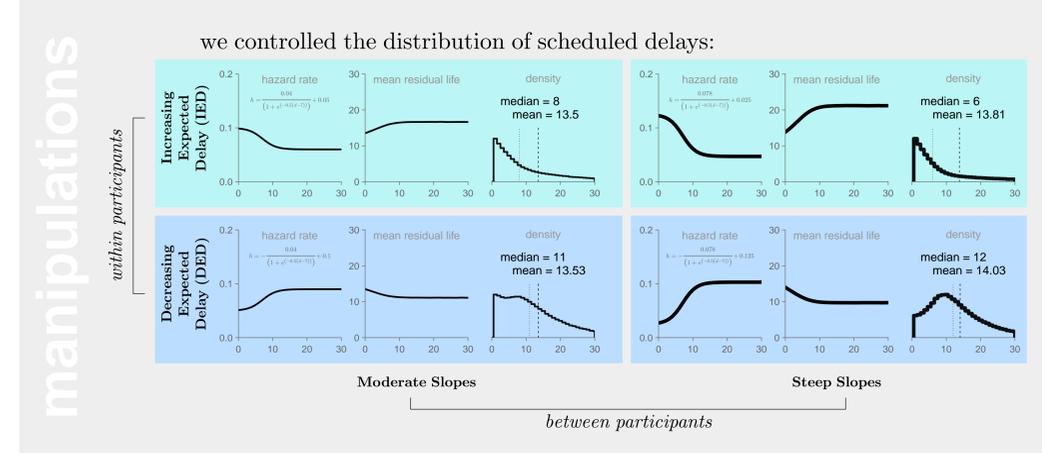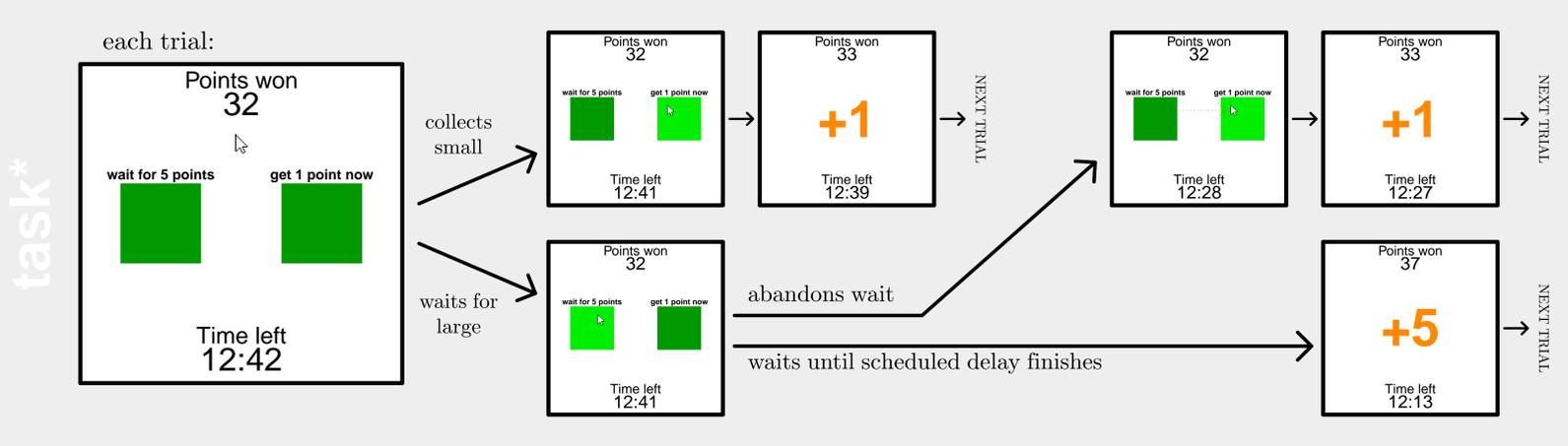
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Previous research suggested that humans are willing to wait for a delayed reward depending on the expected time to obtain it. Specifically, if the expected time decreases as time passes, participants are willing to keep investing time and wait for the reward; in contrast, if the expected time increases as time passes, people eventually give up the wait.
We attempted to replicate this result and to extend it to situations where the relationship between elapsed time and expected wait suddenly reverses within the same session.
A first look at our data provides no evidence of adaptation to the shape of the expected wait as a function of time, either at individual or group levels, nor reveals clear effects of dynamic changes in the function.

task*

each trial:

Points won
32

wait for 5 points | get 1 point now

Time left
12:42

collects small →

Points won 32 — wait for 5 points | get 1 point now — Time left 12:41

Points won 33 — +1 — Time left 12:39 — NEXT TRIAL

Points won 32 — wait for 5 points | get 1 point now — Time left 12:28

Points won 33 — +1 — Time left 12:27 — NEXT TRIAL

waits for large →

Points won 32 — wait for 5 points | get 1 point now — Time left 12:41

abandons wait →

waits until scheduled delay finishes →

Points won 37 — +5 — Time left 12:13 — NEXT TRIAL

manipulations

we controlled the distribution of scheduled delays:

within participants

Increasing Expected Delay (IED)

hazard rate | mean residual life | density — median = 8, mean = 13.5

hazard rate | mean residual life | density — median = 6, mean = 13.81

Decreasing Expected Delay (DED)

hazard rate | mean residual life | density — median = 11, mean = 13.53

hazard rate | mean residual life | density — median = 12, mean = 14.03

Moderate Slopes | Steep Slopes

between participants

individual data

participant number

at 7.5 minutes we changed the delay distribution without warning

first delay distribution | second delay distribution

wait length (sec) | time left (min)

- collected immediate reward
- waited but abandoned wait
- waited until end of delay

each participant had 15 minutes to make as many points as possible

(participant panels 1–16)

how often do they wait?

cumulative waits / trials

when they wait, how often do they abandon?

cumulative abandoned waits / waits

Moderate Slopes | Steep Slopes

pooled data

all participants

length of abandoned waits (sec)

n = 343 (DED) | n = 260 (IED)

(normal jitter was added horizontally)

moderate slopes: n = 152 | n = 114

steep slopes: n = 191 | n = 159

saw IED first: n = 234 | n = 181

saw DED first: n = 109 | n = 70

discussion

Participants appear to behave similarly under different distributions of delays; changes in direction of the mean residual life seem to have little effect, if any, over individual willingness to wait or to persist.

Across participants, time spent waiting before giving up shows a similar distribution under both shapes of mean residual life, even when controlling for between—subject factors.

These preliminary analyses contrast with previous reports (see references). We suggest discrepancies may be due to several uncontrolled characteristics between delay distributions used in precedent studies, such as the expected value of the delay distribution.

McGuire, J. T. and Kable, J. W. (2012). Decision makers calibrate behavioral persistence on the basis of time—interval experience. *Cognition, 124,* 216:226.

McGuire, J. T. and Kable, J. W. (2013). Rational temporal predictions can underlie apparent failures to delay gratification. *Psychological Review, 120,* 395:401.

* The task was proposed by J. T. McGuire and J. W. Kable (2012). Our version is largely based on theirs.

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