Mouse-tracking instructor class

20190321

The pilot paradigm

- Repeated choices between 2 choices to get a probabilistic outcome
- Probability 0.9/0.1
  - Probabilities will change (alternate)
- (Practice: 2 blocks (Gain / Loss) x 10 trials)
- 2 blocks (Gain / Loss) x 100 trials
- Trials can be either learning trials (points don’t count)
  or test-trials (points DO count)

The pilot paradigm

- The probabilities either change often or rarely:
  - 2 conditions – High and Low Volatility
    - A condition lasts for at least 10 trials
  - Low Volatility = no probability change
  - High Volatility = 50% probability of switching/trial

- 12 test-trials / Condition (High/Low) & Block (Gain/Loss)

Mouse-tracking – design decisions

- Start, several possibilities
  - Start by clicking
  - Mouse cursor programmed to appear at same starting position
  - See stimuli/targets only after start of movement
- Layout
  - Same distance to targets recommended (at least not biased)
  - Randomization of positions recommended
- Timing
  - Speeded decisions?
  - Unlimited duration/self-paced?

Preprocessing

- Practice trials removed
- Timing aligned – first measure of each trial starts at 0
- Paths are flipped – the top left choice is always chosen
- Start position remains the same
- Paths rotated and rescaled so target is always at -250, 350
- Cursor positions rounded to whole pixels

- Exclusion?

People with messed up data
taking toooo long - something went wrong
visual inspection - but be careful
Can look into how good they were at a task - as a proxy for being attentive
e.g. If people perform below chance

Data description

Subject ID

Gain/Loss block

Volatility condition (H/L)

Trial nbr within block

TestTrial (1 = yes)

Choice (1 = optimal choice)

Outcome (-1/0/1)

Time in ms

Position in pixels

```
> head(df)
     ID GainLoss Volatility Trial TestTrial Choice Outcome   Time_ms Pos_x Pos_y
1 105955     Gain          L     1         0      0       0  0.000000     0     0
2 105955     Gain          L     1         0      0       0  4.419036     0     0
3 105955     Gain          L     1         0      0       0 24.330614     0     0
4 105955     Gain          L     1         0      0       0 43.557091     0     0
5 105955     Gain          L     1         0      0       0 60.058041     0     0
6 105955     Gain          L     1         0      0       0 76.760160     0     0
>
```

File: MT_Pilot20190314.R

Vizualization tasks

- Visualization
    1. Plot single trajectories (Everybody should do at least this)
    2. Plot several trajectories on top of each other
    3. Plot aggregated trajectories

Use the plotting function of your choice (ggplot?)

Test different linetypes or vary alpha.

If you want, include color coding and/or faceting for Volatility, ID…

Hypothesis?

- Choice certainty reflected in mouse path
  - Choice certainty is higher during the Low velocity condition
  - Choice certainty is lower during the High velocity condition

- Gain/Loss is reflected in mouse path

But how?

If there's a difference in mousepath

Measures of interest…?

Measure	Description
X-flips	Number of directional changes along x-axis
Y-flips	Number of directional changes along y-axis
MAD (Maximum Absolute Deviation)	Maximal deviation between real path and hypothetical direct path
AD (Average Deviation)	Average deviation from direct path
Curvature	Area between real path and direct path
Idle time	Amount of time when the cursor is paused
Motion time	Amount of time when the cursor is moving
Latency	Latency at the start of the movement
Dwell time	Dwell time before committing to the final response
MaxVel	Maximum velocity
MaxAcc	Maximum acceleration
MaxPull	Maximum pull towards non-chosen option
MaxAng	Maximum severity of angle towards non-chosen option while in motion

Manual analysis

Do at least one of the following:

- Trajectory length (easy)
- Number of pauses (easy -medium)
- Number of x-flips (medium - hard)

You can begin with a single trial.

Then loop or tapply… if there is time.

R packages

- mousetrack (Coco & Duran, 2015)
  - Mainly developed to analyze data coming from mouse-tracking experiments
  - 40 DVs
  - Simple (8 page manual)
- mousetrap (Kieslich, Wulff, Henninger, Haslbeck, Brockhaus, 2019)
  - Functions for importing, preprocessing, analyzing, aggregating, and visualizing mouse-tracking data (mainly collected through own open source software)
  - Steep learning curve but versatile (first impression at least)
  - Complicated/complex (99 page manual)

Testing the mousetrap package

- https://cran.r-project.org/web/packages/mousetrap/mousetrap.pdf
- Data description, MTrap_Pilot20190314.R :

mt, large list (quick & dirty version instead of)

1st element – Data

data frame, 9 columns

GainLoss, Volatility, ID, Trial, TestTrial, Choice, Outcome,
mt_id (mousetracking path ID)

2nd element – Trajectories

3-dimensional array:

mt-IDs / samples (chronological) /variables (timestamps, xpos, ypos)

Testing the mousetrap package

- mt_derivatives()
- mt_measures()
- mt_plot()
- mt_heatmap()