

# Meaningful Learning

Naoki Watanabe  
Keio Business School

April 23, 2020

round x out of 60

remaining time tt (30 sec)

Choose one of the following two vote apportionments for 4 members of a committee who decide how to allocate 120 points.

The committee adopts a proposal if  $Q$  votes are voted in a favor.

You have 30 seconds to choose.

1	player	YOU	Player 2	Player 3	Player 4
	votes	V1	V2	V3	V4

2	player	YOU	Player 2	Player 3	Player 4
	votes	W1	W2	W3	W4

# Information on a voting rule (not played actually)

- (1) Each member can propose an allocation or approve a proposal made by another member at any time (in continuous time), but **only one proposal or approval** is allowed at a time.
- (2) In proposing an allocation or approving a proposal, **all the votes** each member has will be cast to support the proposal or approval.
- (3) The **first proposal** which obtains the quota or more votes is adopted.

round x out of 60

remaining time tt (30 sec)

Choose one of the following two vote apportionments for 4 members of a committee who decide how to allocate 120 points.

The committee adopts a proposal if 14 votes are voted in a favor.

You have 30 seconds to choose.

1	player	YOU	Player 2	Player 3	Player 4
	votes	5	3	7	7

2	player	YOU	Player 2	Player 3	Player 4
	votes	5	4	6	7

Round x out of 60

remaining time tt (10 sec)

- You chose the following distribution of votes.

1	player	YOU	Player 2	Player 3	Player 4
	votes	5	3	7	7

- The committee decided to distribute 120 points this time as follows.

Player	YOU	Player 2	Player 3	Player 4
Points	0	0	60	60

OK

Round x out of 60

remaining time tt (10 sec)

- You chose the following distribution of votes.

1	player	YOU	Player 2	Player 3	Player 4
	votes	5	3	7	7

- The committee decided to distribute 120 points this time as follows.

Player	YOU	Player 2	Player 3	Player 4
Points	40	40	0	40

OK

Round x out of 60

remaining time tt (10 sec)

- You chose the following distribution of votes.

1	player	YOU	Player 2	Player 3	Player 4
	votes	5	3	7	7

- The committee decided to distribute 120 points this time as follows.

Player	YOU	Player 2	Player 3	Player 4
Points	40	40	40	0



Round x out of 60

remaining time tt (10 sec)

- You chose the following distribution of votes.

2	player	YOU	Player 2	Player 3	Player 4
	votes	5	4	6	7

- The committee decided to distribute 120 points this time as follows.

Player	YOU	Player 2	Player 3	Player 4
Points	40	40	40	0

OK



Round x out of 60

remaining time tt (10 sec)

- You chose the following distribution of votes.

2	player	YOU	Player 2	Player 3	Player 4
	votes	5	4	6	7

- The committee decided to distribute 120 points this time as follows.

Player	YOU	Player 2	Player 3	Player 4
Points	40	40	0	40

OK

Round x out of 60

remaining time tt (10 sec)

- You chose the following distribution of votes.

2	player	YOU	Player 2	Player 3	Player 4
	votes	5	4	6	7

- The committee decided to distribute 120 points this time as follows.

Player	YOU	Player 2	Player 3	Player 4
Points	40	0	40	40

OK

Round x out of 60

remaining time tt (10 sec)

- You chose the following distribution of votes.

2	player	YOU	Player 2	Player 3	Player 4
	votes	5	4	6	7

- The committee decided to distribute 120 points this time as follows.

Player	YOU	Player 2	Player 3	Player 4
Points	0	40	40	40

OK

Please wait for a while (10 sec).

round 41 out of 60

remaining time tt (30 sec)

Choose one of the following two vote apportionments for 4 members of a committee who decide how to allocate 120 points.

The committee adopts a proposal if 6 votes are voted in a favor.

You have 30 seconds to choose.

1	player	YOU	Player 2	Player 3	Player 4
	votes	1	2	3	4

2	player	YOU	Player 2	Player 3	Player 4
	votes	1	1	4	4

## What is **meaningful learning** ?

あなたはある状況（1st problem）を経験することで学んだことを、似てはいるが異なる状況（2nd problem）に直面したときに適用して、正しく意思決定できたましたか？

## full-feedback information vs. no-feedback information

次のどちらがより尤もらしい説だと思えますか？

- A. 意志決定直後に利得に関する情報を多く得られる環境の方がことがあなたにとっての「意味のある学習」を促進する。
- B. そのような情報をすぐには得られない環境の方があなたにとっての「意味のある学習」を促進する。

# Measures of voting power

- Shapley and Schubik (1954, APSR)...SSI
  - Banzhaf (1965, Rutgers Law Rev)...BzI
  - Deegan and Packel (1978, IJGT)...DPI
- 
- **Choice 2** should be chosen.



# The payoffs for 1st problem: DPI

- $[14; 5, 3, 7, 7]$  vs  $[14; 5, 4, 6, 7]$
- Find **MWCs** (minimal winning coalition).
- equal probability of occurrence, equal treatment
  - Expected payoff =  $80/3 = 26.67$ 
    - MWCs and Payoffs for 4 members:
      - $(7_1, 7_2)$  :  $(0, 0, 60, 60)$
      - $(5, 3, 7_1)$ :  $(40, 40, 40, 0)$
      - $(5, 3, 7_2)$  :  $(40, 40, 0, 40)$
    - Expected payoff =  $120/4 = 30$ 
      - MWCs and Payoffs for 4 members:
        - $(5, 4, 6)$  :  $(40, 40, 40, 0)$
        - $(5, 4, 7)$  :  $(40, 40, 0, 40)$
        - $(5, 6, 7)$  :  $(40, 0, 40, 40)$
        - $(4, 6, 7)$  :  $(0, 40, 40, 40)$

# The payoffs for the 2nd problem

- [6; 1,2,3,4] vs [6; 1,1,4,4]
  - Expected payoff =  $40/3 = 13.33$ 
    - MWCs and Payoffs for 4 members:
      - (3,4) : (0,0,60,60)
      - (2,4) : (0,60,0,60)
      - (1,2,3) : (40,40,40,0)
  - Expected payoff =  $80/3 = 26.67$ 
    - MWCs and Payoffs for 4 members:
      - (4,4) : (0, 0,60,60)
      - (1<sub>1</sub>,1<sub>2</sub>,4<sub>1</sub>) : (40,40,40,0)
      - (1<sub>1</sub>,1<sub>2</sub>,4<sub>2</sub>) : (40,40,0,40)

# Win-Stay-Lose-Shift Strategy

good outcome => keep intact

bad outcome => change choices

(Novak and Sigmund, 1993, Nature)

# 1. Pairs of choice problems

- Problem A, 1: [14; 5,3,7,7] vs 2: [14; 5,4,6,7]
  - Expected payoffs:  $80/3$  vs 30
- Problem B, 1: [6; 1,2,3,4] vs 2: [6; 1,1,4,4]
  - Expected payoffs:  $40/3$  vs  $80/3$
- Problem C, 1: [14; 3,5,6,8] vs 2: [14; 3,6,6,7]
  - Expected payoffs:  $80/3$  vs 30
- Problem D, 1: [9; 1,3,5,6] vs 2: [9; 1,2,6,6]
  - Expected payoffs:  $40/3$  vs  $80/3$

Binary choice problems are **fixed** in some rounds.

A Mouse-Tracking Experiment  
conducted at the University of Tsukuba  
in 2017

round x out of 60

remaining time tt (30 sec)

Choose one of the following two vote apportionments for 4 members of a committee who decide how to allocate 120 points.

The committee adopts a proposal if  $Q$  votes are voted in a favor.

You have 30 seconds to choose. (values in red are hidden.)

A	player	YOU	Player 2	Player 3	Player 4
	votes	V1	V2	V3	V4

B	player	YOU	Player 2	Player 3	Player 4
	votes	W1	W2	W3	W4

Round  $r$  out of  $x$

remaining time  $tt$  (10 sec)

- You chose the following distribution of votes (**values in red are hidden.**)

A	player	YOU	Player 2	Player 3	Player 4
	votes	X1	X2	X3	X4

- The committee decided to distribute 120 points this time as follows. (**values in red are hidden.**)

Player	YOU	Player 2	Player 3	Player 4
Points	p1	p2	p3	p4



Round x out of 60

remaining time tt (10 sec)

- You have obtained **yyy** points this time.
- You have obtained **zzz** points so far.

(**values in red are hidden.**)

A blue rectangular button with a white border and a slight shadow, containing the text "OK" in white capital letters.

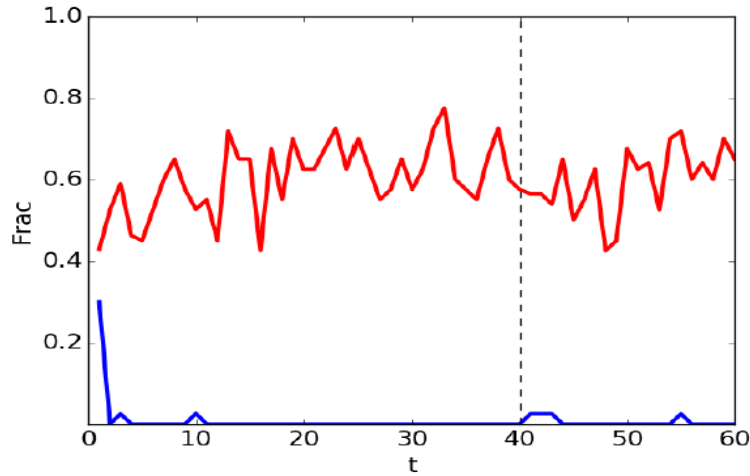
OK



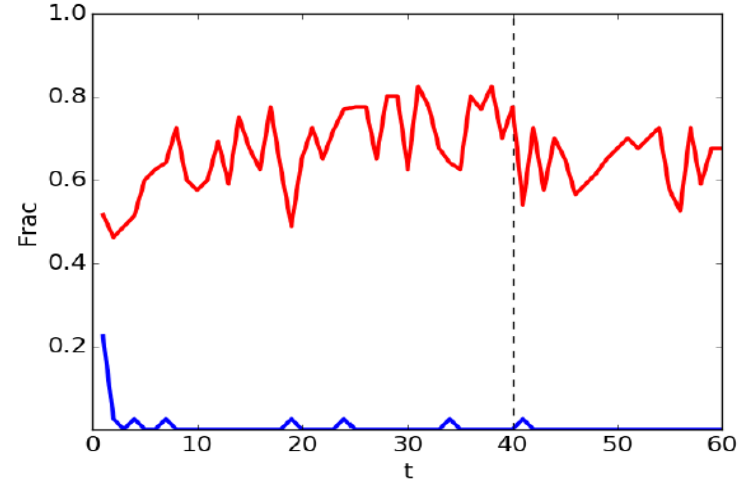
# 4. Overview: time series

Red: correct choice. Blue: no choice

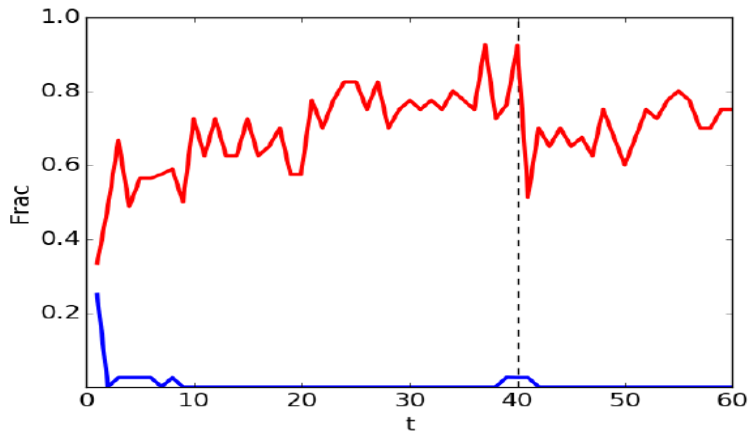
A->B



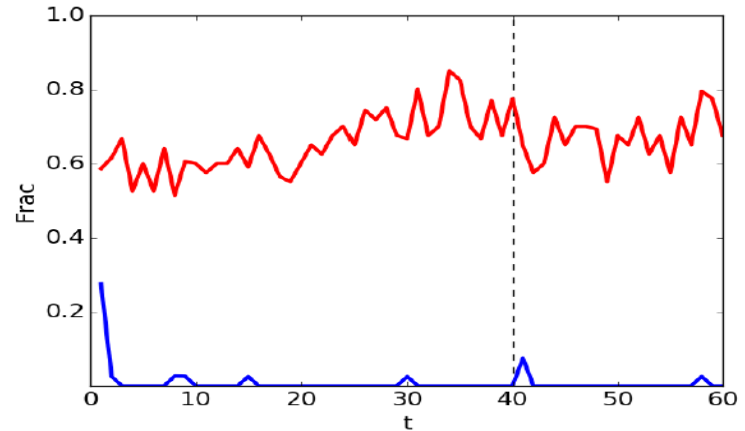
B->A



C->D



D->C

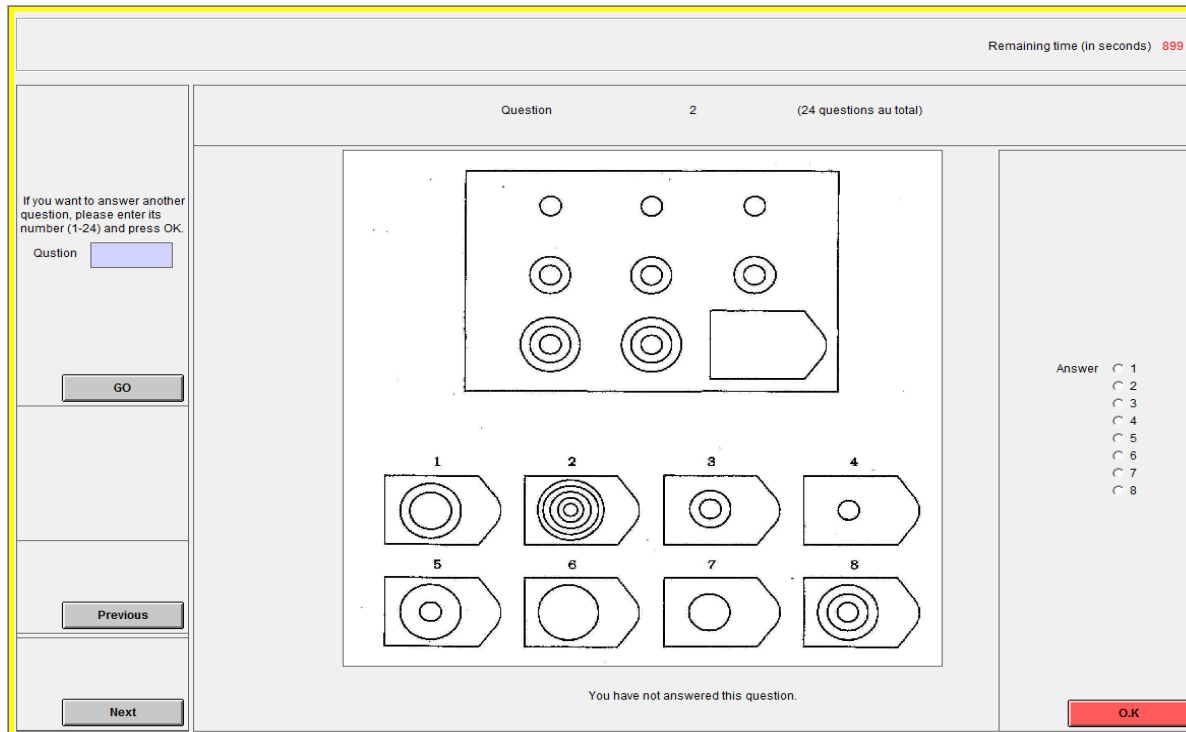


What are important factors for **meaningful learning** ?

赤字で隠された情報のうち、「意味のある学習」に成功したひとと失敗したひとの間で最も明確な違いが観察されたものはどれだと思いますか？

# Raven APM test: cognitive ability

- short version (16 questions): 12.29 (Osaka), 12.30 (Tsukuba), 7-8 (non-student adults in Kansai area)



# Literature Review I

- Models of learning need some explicit feedback.
  - Reinforcement learning (Erev and Roth; 1998, AER)
    - Realized payoffs
  - Belief-based learning (Cheung and Friedman; 1997, GEB)
  - EWA learning (Camerer and Ho; 1999) or regret-driven learning (Marchiori and Warglien, 2008, Science)
    - both Realized and foregone payoffs
- Learning **without** explicit feedback?
  - Introspective thinking
    - Yes: **Rick and Weber (2010, GEB)** Learning to do the iterated elimination of dominated strategies in p-beauty contest game
    - No: Neugebauer et al. (2009, JEcoPsy) public goods game.

# Literature Review II

- Meaningful learning (**transfer of knowledge**)
  - Generalization of experiences from one situation to a similar but different situation
    - Cooper and Kagel (2003, AER; 2008, ET)
      - signaling game
      - Providing context helps
      - Having a pair of subjects discuss their choices between themselves helps.
    - Rick and Weber (2010, GEB)
      - Withholding immediate feedback promotes meaningful learning.
    - Haruvy and Stahl (2012, GEB)
      - dominance solvable games
      - a rule learning model (Stahl; 1996, GEB)

**How will you spend at KBS?**

What is meaningful learning  
for you?