

# Tug of war

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## Contents

<b>1</b>	<b>Research question</b>	<b>2</b>
<b>2</b>	<b>Experiment 1: How strong?</b>	<b>2</b>
2.1	Methods . . . . .	4
2.1.1	Design . . . . .	4
2.1.2	Procedure . . . . .	4
2.2	Results (N = 39) . . . . .	5
<b>3</b>	<b>Experiment 2: Asking many questions</b>	<b>6</b>
<b>4</b>	<b>Experiment 3: The omniscient commentator</b>	<b>6</b>
<b>5</b>	<b>Experiment 4: How much effort?</b>	<b>6</b>

## 1 Research question

- exploring the probabilistic language of thought hypothesis as a model for human inference in tug of war world
- demonstrate compositionality and productivity of thought

## 2 Experiment 1: How strong?

Table 1: Games used in Experiment 1. Participants were always asked about the strength of player 1. *Note:*  $>$  indicates that team1 won against team2;  $<$  indicates that team1 lost against team2.

id	team1	winner	team2
1	1	$>$	2
1	1	$>$	2
1	1	$>$	2
2	1	$>$	2
2	2	$>$	3
2	2	$>$	4
3	1	$>$	2
3	2	$<$	3
3	2	$<$	4
4	1	$>$	2
4	1	$>$	3
4	1	$>$	4
5	1,2	$>$	3,4
5	1,2	$>$	5,6
5	1,2	$>$	7,8
6	1,2	$>$	5,6
6	1,3	$>$	5,7
6	1,4	$>$	5,8
7	1,2	$>$	5,6
7	2,3	$<$	5,6
7	2,4	$<$	5,6
8	1,2	$>$	5,6
8	2,3	$>$	5,6
8	2,4	$>$	5,6
9	1,2	$>$	5,6
9	1,3	$>$	7,8
9	1,4	$>$	9,10
10	1,2	$>$	3,4
10	1,3	$>$	2,4
10	1,4	$>$	2,3
11	1	$<$	2
11	1	$<$	2

id	team1	winner	team2
11	1	<	2
12	1	<	2
12	2	<	3
12	2	<	4
13	1	<	2
13	2	>	3
13	2	>	4
14	1	<	2
14	1	<	3
14	1	<	4
15	1,2	<	3,4
15	1,2	<	5,6
15	1,2	<	7,8
16	1,2	<	5,6
16	1,3	<	5,7
16	1,4	<	5,8
17	1,2	<	5,6
17	2,3	>	5,6
17	2,4	>	5,6
18	1,2	<	5,6
18	2,3	<	5,6
18	2,4	<	5,6
19	1,2	<	5,6
19	1,3	<	7,8
19	1,4	<	9,10
20	1,2	<	3,4
20	1,3	<	2,4
20	1,4	<	2,3
21	1,2	>	3
22	1	<	2,3
23	1,2	>	4,5,6
23	2	>	4,5
24	1,4	>	5,2,3
24	1,5	>	2,3,4
25	1,2,3	>	4,5,6
25	2,3	>	4,5,6
26	1,2	<	3
27	1	>	2,3
28	1,2	<	4,5,6

id	team1	winner	team2
28	2	<	4,5
29	1,4	<	5,2,3
29	1,5	<	2,3,4
30	1,2,3	<	4,5,6
30	2,3	<	4,5,6

## 2.1 Methods

### 2.1.1 Design

### 2.1.2 Procedure

**Instructions**

In this experiment, your task is to judge how strong you think different players are, based on their performance in a tug-of-war tournament.

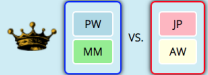
In each game, a player either competes as part of a team, or individually. For example, in the Tournament shown below, PW and MM competed against JP and AW in Game 1. The crown indicates which team won the game. Here, PW and MM won against JP and AW.

In Game 2, PW lost the game against JP.

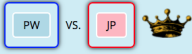
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**Tournament**

Game 1



Game 2



Note that a player's strength remains constant throughout a tournament. For example, PW was equally strong in Game 1 and in Game 2. A player neither gets stronger nor weaker between games.

However, each player has a certain chance of being lazy in any given game. If a player decides to be lazy, then that player only pulls with half their strength. For example, it's possible that PW pulled with all his strength in Game 1 but decided to be lazy in Game 2.

A team's strength is determined by the sum of the strengths of its players. The team with the greater overall strength wins the game.

Please press 'Start' to proceed. We will ask you a few test questions to check that you've understood how everything works.


Figure 1: Instructions.

**TEST QUESTIONS**

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**Games**

Game 1



Please answer the following question about the tournament shown above:

Who won the above game?

Figure 2: Test question.

Progress 1/30

Below you see the outcomes of games in a tug of war tournament. Remember that the crown indicates which team won each game. You can move the mouse over a player to see which games the player participated in. Please try to figure out, based on the information you see, how strong player **PN** is.

**Games**

Game 1

PN	vs.	KK	Crown
JX		PC	

Game 2

PN	vs.	IH	Crown
JX		JG	

Game 3

PN	vs.	HO	Crown
JX		JW	

Please answer the following question:

Based on the results above, how strong do you think player **PN** is?

very weak  very strong

Continue

Figure 3: Trial.

## 2.2 Results (N = 39)

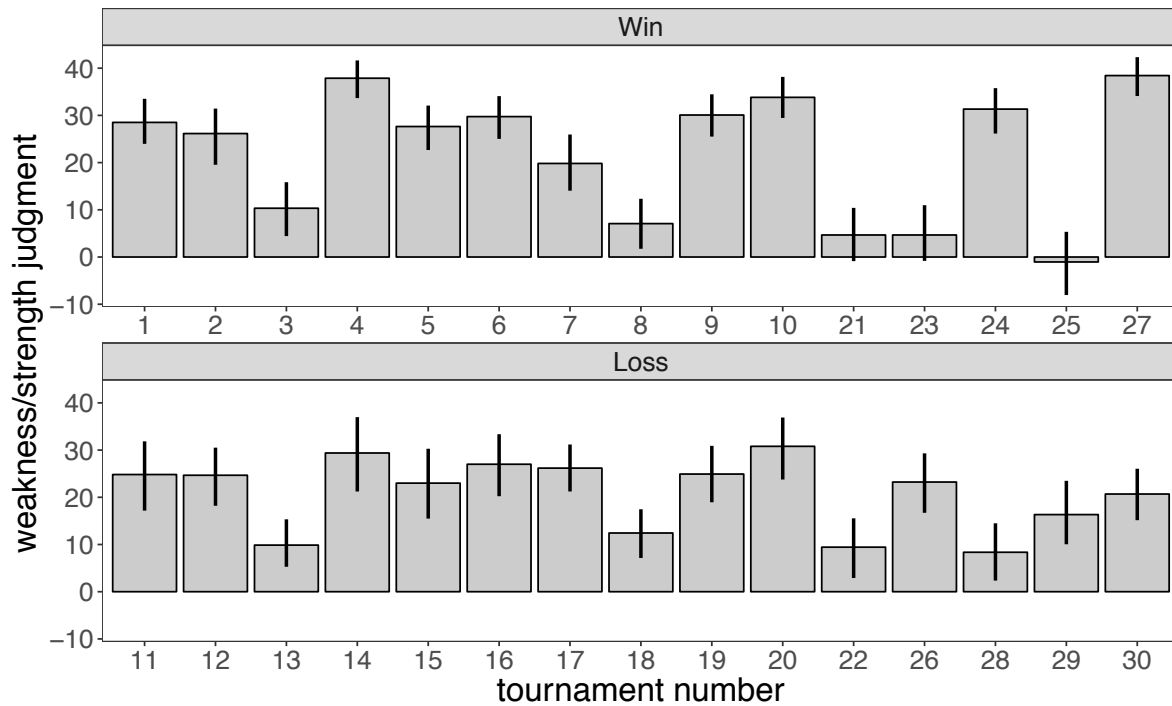


Figure 4: Mean weakness/strength judgments across the 30 tournaments. *Note:* Error bars indicate 95% confidence intervals.

- 3 Experiment 2: Asking many questions
- 4 Experiment 3: The omniscient commentator
- 5 Experiment 4: How much effort?

## References