



SFB/Transregio 266

ACCOUNTING FOR  
TRANSPARENCY

# botex: Using LLMs as Experimental Participants in oTree

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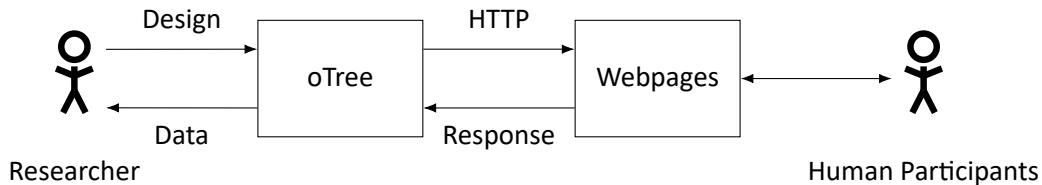
Humboldt-Universität zu Berlin and University of Amsterdam

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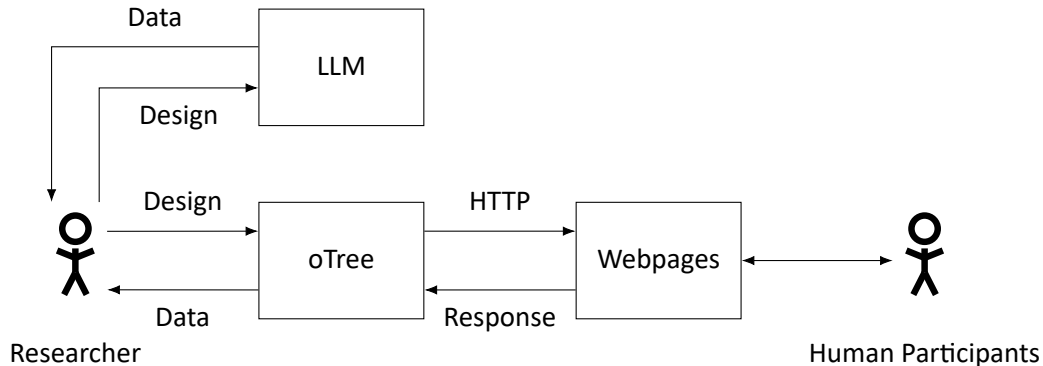
## Motivation

- 1 Designing experiments is hard and small differences in experimental materials can have significant impact on experimental findings. Wouldn't it be great to have a "cheap" way to pretest experimental designs without bothering humans?
- 2 Understanding how LLMs act in behavioral experiments - on their own and interacting with humans - is an emergent and rapidly evolving research field. Providing an infrastructure to run such experiments should be beneficial for the profession.
- 3 Applied experimental work often uses context framing in their experimental designs without explicitly hypothesizing and assessing its effect on findings. LLM based experiments might inform priors in that regard.

## Traditional oTree Setup

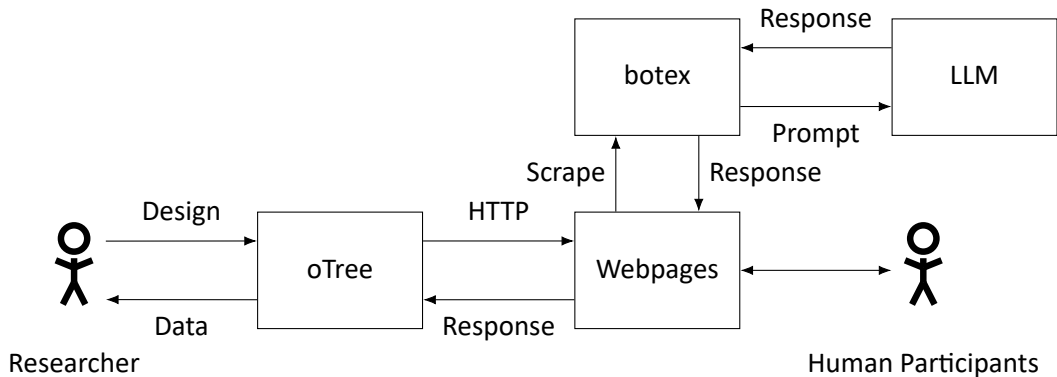


## oTree + Alter Ego



Engel, Grossmann and Ockenfels (2024, SSRN)

## oTree + botex



## Research Question

How does business context framing affect the response behavior of LLMs?

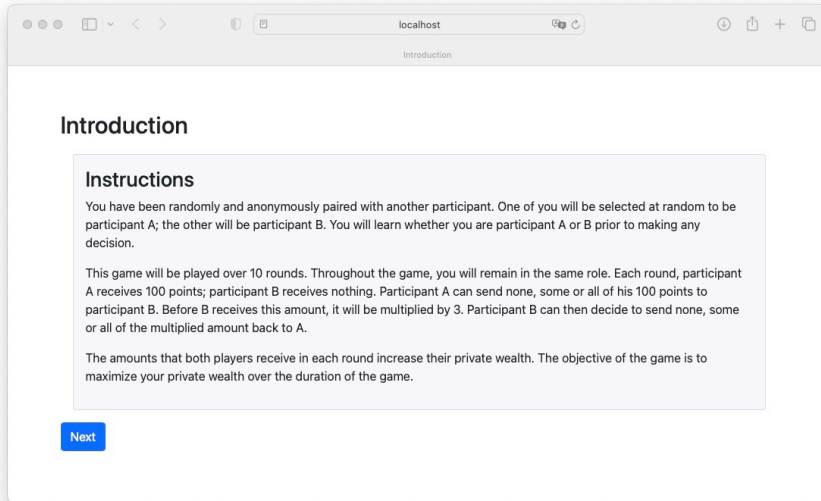
- Context frames are common in the applied experimental literature
- Prior work has shown that their effect can be significant (e.g., Liberman, Samuels and Ross Pers Soc Pschol Bull 2014, and for investment trust games Al-Ubaydli, Houser, Nye, Paganelli, and Pan, PLOS One 2013; Cronk and Wasieleski, J of Evolutionary Psychology 2008)
- Then again, they are rarely hypothesized or even explored in the accounting literature
- LLMs reflect the priors of the average population in terms of, e.g., first order beliefs and social desirability biases. Thus, they might inform us how a general participant pool might react to contextual frames

## Some First Examples

- Multi-round investment trust game (Berg, Dickhaut and McCabe, Games and Econ Behav 1995)
- Deception (Gneezy, AER 200)
- Honesty in budgeting (Evans et al., TAR 2001)



# Trust: The Neutral Frame



# Trust: The Investor/Manager Frame

## Introduction

### Instructions

This is an experimental study to learn how investors and managers interact. You have been randomly selected to act either as an investor or as a manager and anonymously paired with another participant who will be playing the other role. You will learn whether you are an investor or a manager prior to making any decision. Please try to impersonate your role very closely when taking any decision and think about how you would act if you are a real investor or a manager of a publicly-listed firm.

This experiment will be run over 10 rounds. Throughout it, you will remain in your role. Each round, first the investor receives a private wealth of 100 points that he can decide to invest into the firm of the manager or to keep. The firm is very profitable meaning that the invested amount will be multiplied by 3 to create the firm returns. Next, the manager has to decide how much of the firm returns to return to the investor as a dividend. The remaining amount is paid out to the manager as compensation.

The dividends and compensation that both players receive in each round increase their private wealth. In the experiment, please try to maximize your private wealth.

Next

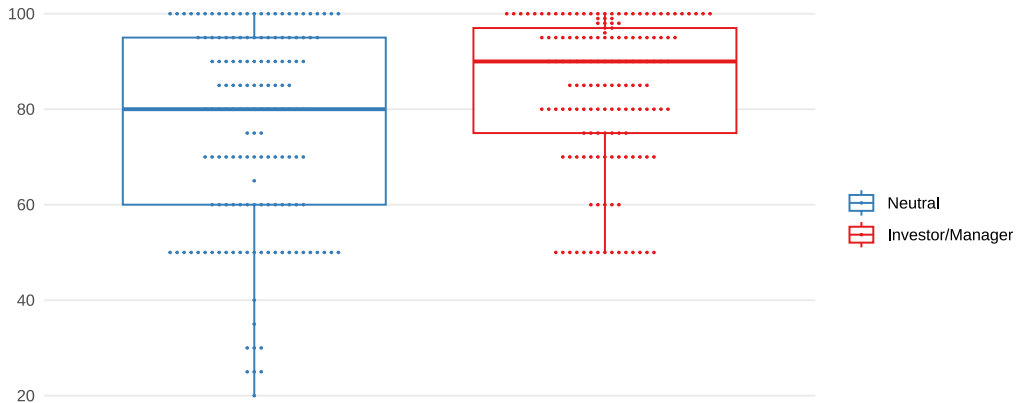
## Trust: Sample Composition

	Sender	Receiver
Neutral Framing	15	15
Investor/Management Framing	15	15
Total	30	30

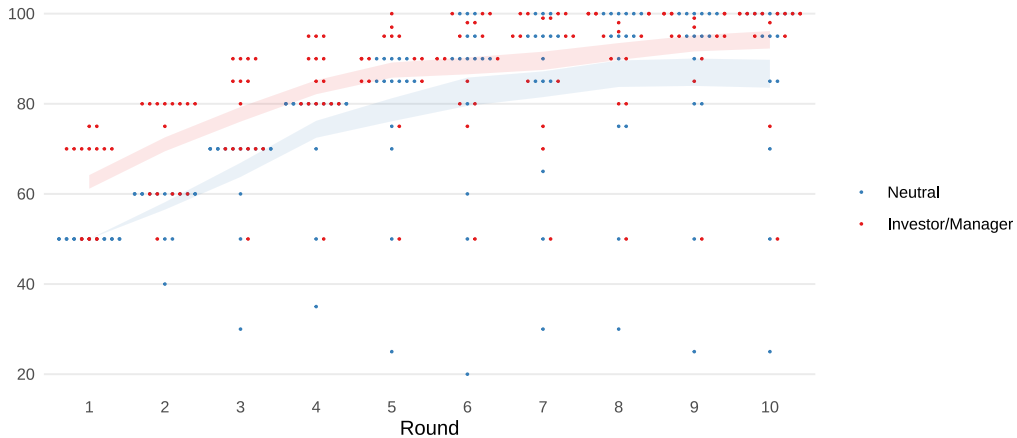
## Trust: Descriptive Statistics by Framing

	Neutral Framing				Investor/Management Framing			
	N	Mean	S.D.	Median	N	Mean	S.D.	Median
Amount sent	150	75.30	21.06	80.00	150	83.96	15.66	90.00
Amount returned	150	114.44	29.80	120.00	150	128.98	26.61	135.00
% returned	150	0.51	0.05	0.50	150	0.51	0.04	0.50

## Trust: Sent Amount by Framing



## Trust: Sent Amount by Round



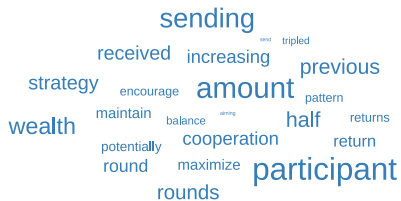
## Trust: Regression Results

	(1)
(Intercept)	52.689*** (2.693)
Round	4.111*** (0.434)
Investor/Management	13.644*** (3.809)
Round × Investor/Management	-0.906 (0.614)
Num.Obs.	300
R2 Adj.	0.356

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## Trust: Some Verbal Response

Neutral Framing



Investor/Management Framing





## Trust: Manipulation Checks ;-)

		Neutral	Inv/Manag
Answers comprehension question correctly	Yes	30	30
	No	0	0
Remembers role	Yes	29	27
	No	1	3
Characterizes as ...	Human	25	21
	Bot	5	9

## Deception: Descriptives by Framing

	Neutral Framing		Accountant/HQ Framing	
	N	Mean	N	Mean
% lied	60	0.62	60	0.92
% followed	60	1.00	60	1.00

Chi-Square: 13.46\*\*\*

## Honesty: Descriptives

	Neutral Framing				Business Framing			
	N	Mean	S.D.	Median	N	Mean	S.D.	Median
Absolute slack	300	500.00	628.10	100.00	300	641.50	655.81	350.00
% slack claimed	297	0.52	0.50	1.00	292	0.63	0.44	1.00

Absolute Slack: 2.70\*\*\*

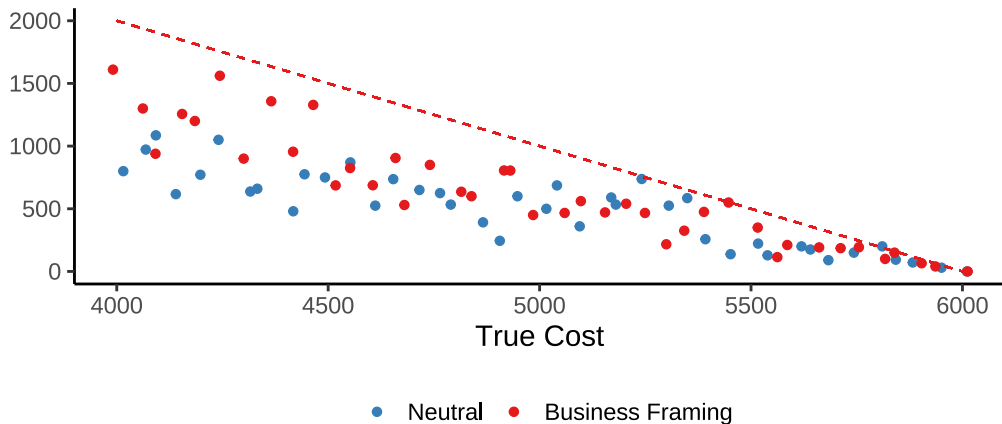
Relative Slack: 3.00\*\*\*

## Honesty: Strategies

	Neutral Framing	Business Framing
Strategy	N	N
All slack	9	11
No slack	13	4
Some slack	8	15

Chi-Square: 7.10\*\*

## Honesty: Average Claimed Slack by True Cost



## Honesty: Absolute Regression Results

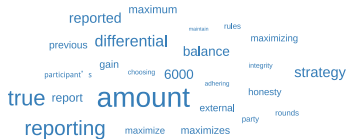
	Slack
Intercept	2574.321*** (279.770)
True Cost	-0.432*** (0.056)
Business Framing	1263.912*** (391.465)
Round	14.020 (11.047)
True Cost × Business Framing	-0.241*** (0.077)
Round × Business Framing	15.939 (15.567)
Adjusted R <sup>2</sup>	0.289
Number of observations	600

## Honesty: Relative Regression Results

	% Claimed Slack
Intercept	0.584*** (0.082)
% Available Slack	-0.183* (0.098)
Business Framing	-0.085 (0.111)
Round	0.005 (0.010)
% Available Slack × Business Framing	0.204 (0.135)
Round × Business Framing	0.017 (0.013)
Adjusted R <sup>2</sup>	0.022
Number of observations	589

# Honesty: Verbal Response

Neutral Framing



Business Framing





## Next Steps

- Implement Fehr, Kirchsteiger, and Riedl (QJE, 1993)
- Decide on experiments to include in first draft
- Finalize experimental materials for those
- Run experiments with reasonable power
- Write first draft
- Later: Compare (selected) findings with results for human participants