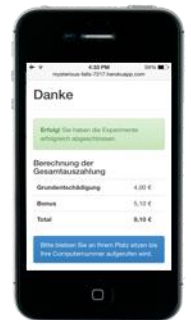
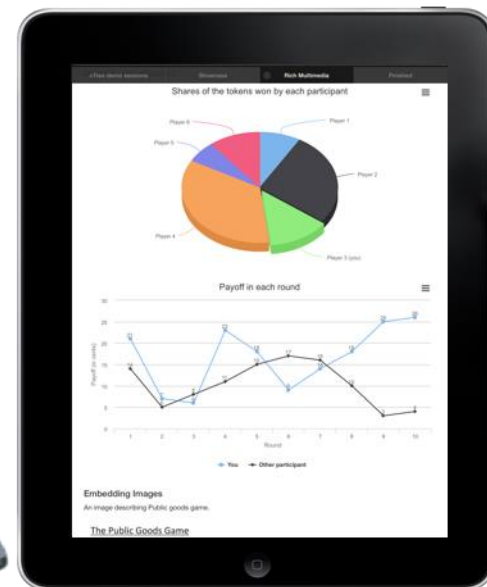
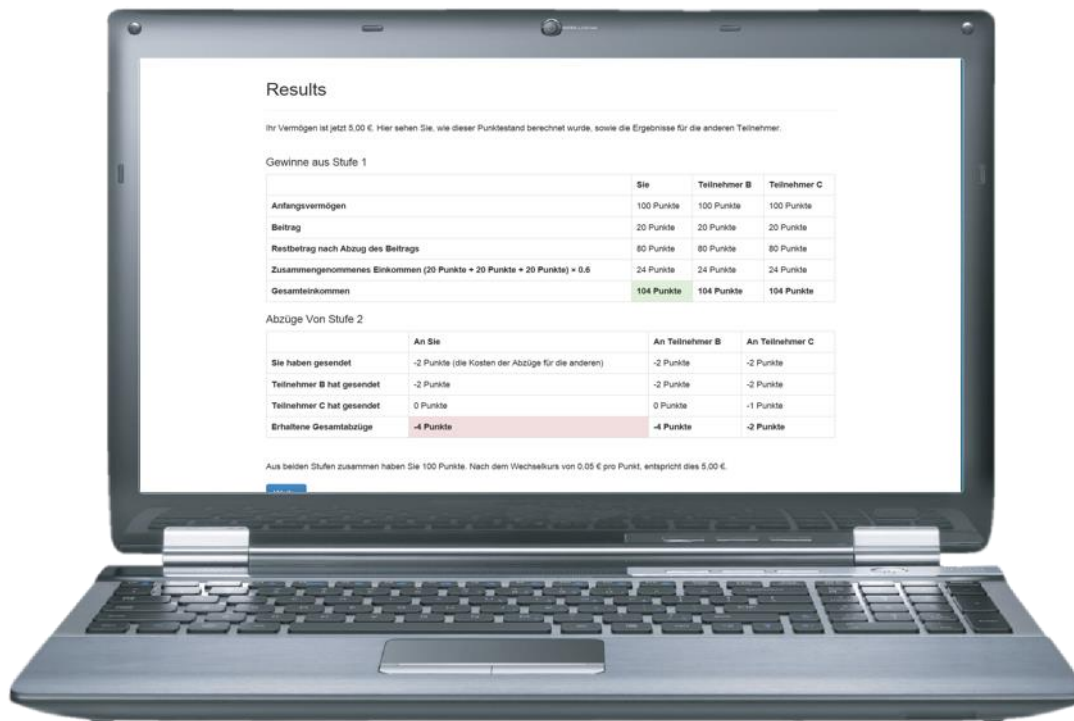


oTree: An open-source platform for lab, web, and field experiments

Chris Wickens

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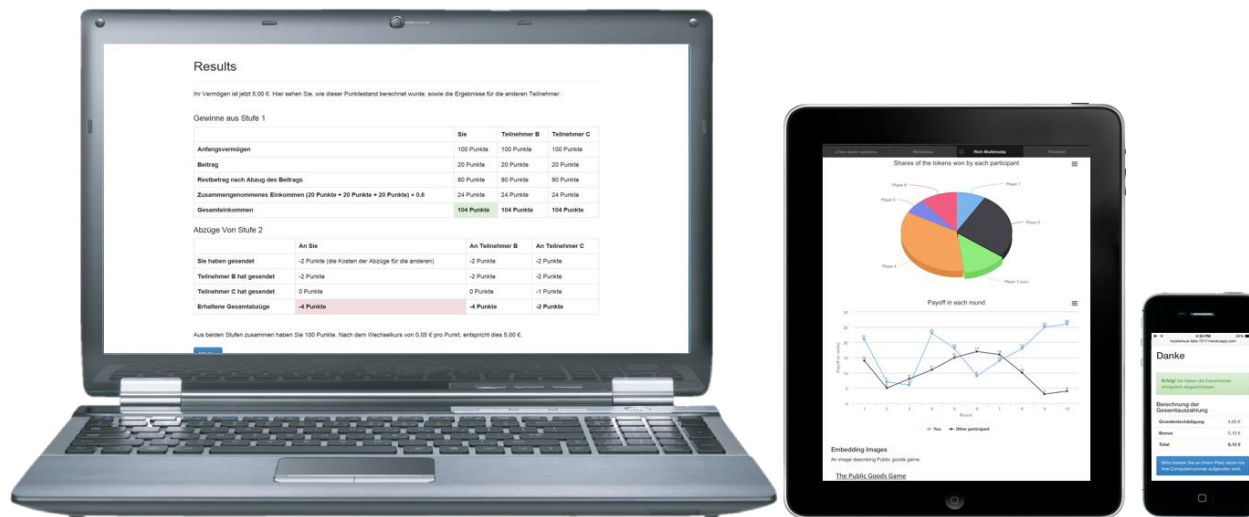
www.oTree.org



What is oTree?

A platform for lab, web and field experiments

- Open source
- Online (runs in browser)
- Object oriented programming



Background

- oTree started in 2013 at ETH Zurich, Daniel Chen group
- Created it for our own research
- We were not satisfied with any of the existing tools
 - Ease of use
 - Flexibility
- Decided to release oTree publicly in hopes others would find it useful

Paper

- Paper recently published (also available at <http://www.otree.org/oTree.pdf>)
- Please cite us if you use oTree for your research

OTREE - AN OPEN-SOURCE PLATFORM FOR LABORATORY, ONLINE, AND FIELD EXPERIMENTS

DANIEL L. CHEN, MARTIN SCHONGER, AND CHRIS WICKENS*

oTree is an open-source and online software for implementing interactive experiments in the laboratory, online, the field or combinations thereof. oTree does not require installation of software on subjects' devices; it can run on any device that has a web browser, be that a desktop computer, a tablet or a smartphone. Deployment can be internet-based without a shared local network, or local-network-based even without internet access. For coding, Python is used, a popular, open-source programming language. www.otree.org provides the source code, a library of standard game templates and demo games which can be played by anyone.

JEL Codes: A20, C88, C90

Keywords: experimental economics, software, laboratory experiments, field experiments, online experiments, classroom experiments



FIGURE 1.— oTree on different devices and operating systems

Experimental economics has become an established field. The common procedure is to conduct incentivized experiments in dedicated university

*Toulouse Institute for Advanced Studies; Center for Law and Economics, D-GESS, ETH Zurich. For comments on the oTree software or the paper, we thank the people at the experimental econ laboratories in Magdeburg, Hamburg and ETH Zurich, Juan Cabral, Donja Darai, Som Datye, Gregor Muellegger, Kelly Reeve, Alexander Sandukovskiy, and Stefan Wehrli. Stefan Bucher provided superb research assistance.

4 usage scenarios

1.) Lab

- Can run in any lab
- Multiple labs simultaneously

2.) Online

- Surveys and interactive games
- Hybrid approaches possible (lab + online)
- Amazon Mechanical Turk integration

3.) Field

- Internet access not necessary
- e.g. remote village – bring 30 tablets and server laptop

4.) Classroom

- Post a URL and have students play on their own devices
- Play live in class



Demo

Usage

- Researchers at 40 universities
- Special collaborations with several groups
- Many disciplines (economics, psychology, sociology, political science, neuroscience)

Sample games

22 simple games (with source code) available at:
demo.otree.org

[Demo Game](#)

[Public Goods Game](#)

[Prisoners' Dilemma](#)

[Trust Game](#)

[Dictator Game](#)

[Cournot Competition](#)

[Bertrand Competition](#)

[Stackelberg Competition](#)

[Common Value Auction](#)

[Private Value Auction](#)

[Volunteer's Dilemma](#)

[Principal Agent Game](#)

[Stag Hunt](#)

[Battle of the Sexes](#)

[Coordination Game](#)

[Matching Pennies](#)

[Traveler's Dilemma](#)

[Survey](#)

[Divide a Pie](#)

[Guessing Game](#)

[2 x 2 Matrix Game](#)

[\(Symmetric\)](#)

[2 x 2 Matrix Game](#)

[\(Asymmetric\)](#)

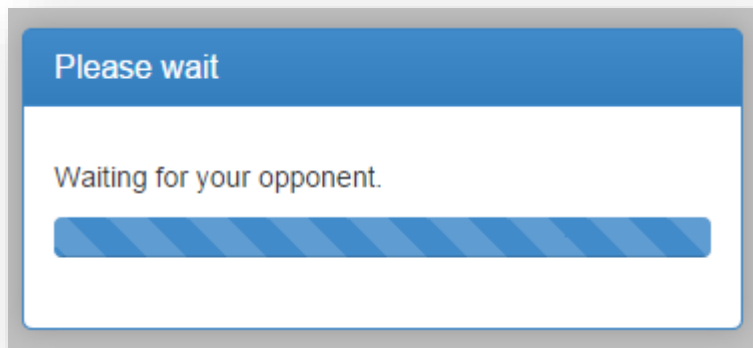
Amazon Mechanical Turk

- Publish to MTurk through oTree's admin interface
- We have run many multi-player games on Mechanical Turk
- Approve worker submissions and send payments
- Filter workers based on location, skill level, etc.



HTML5 user interfaces

- Radio buttons, dropdowns, money input
- Localization: supports any language or currency
- Customizable color theme, header, footer
 - e.g. branding



Bid

The value of the item is estimated to be €3.40. This estimate may deviate from the actual value by at most €1.00.

Please make your bid now. The amount can be between €0.00 and €10.00, inclusive.

Bid amount:

€

Next

Pre-loaded charts

HIGHCHARTS

LINE CHARTS

AREA CHARTS

COLUMN AND BAR CHARTS

PIE CHARTS

SCATTER AND BUBBLE CHARTS

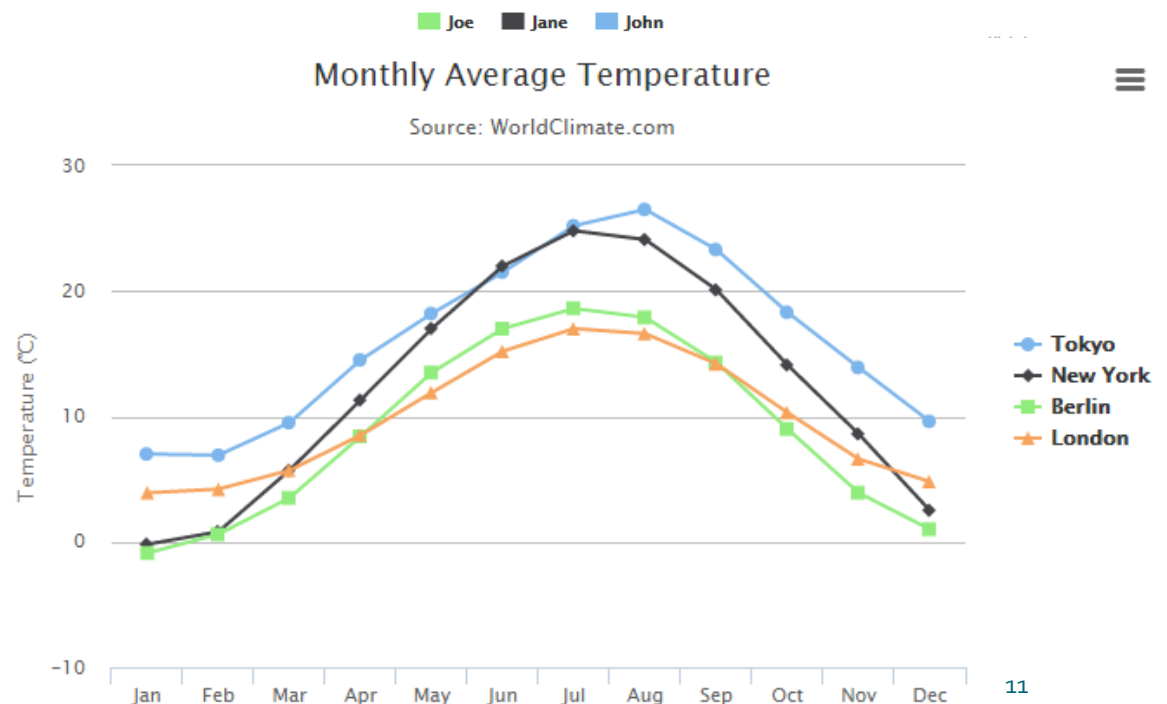
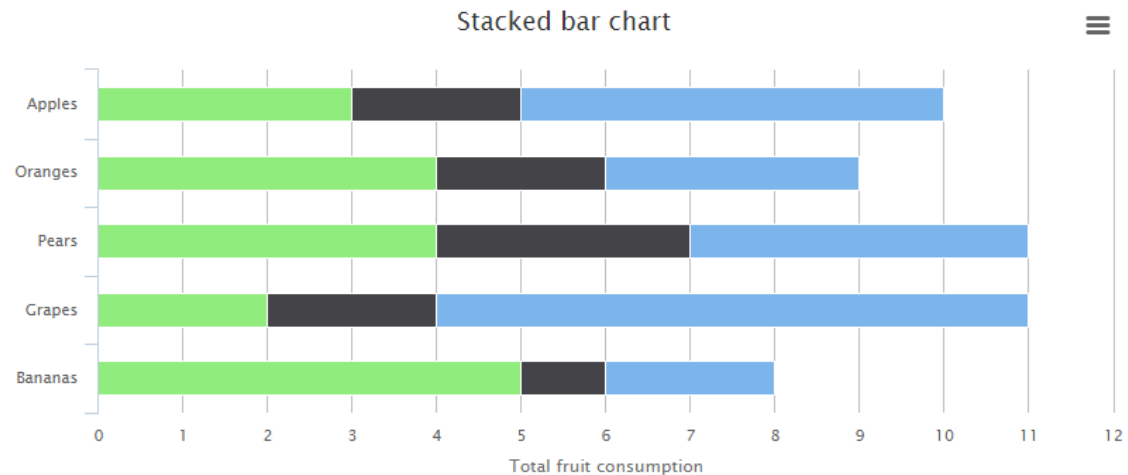
DYNAMIC CHARTS

COMBINATIONS

3D CHARTS

GAUGES

HEAT MAPS



Dynamic elements

Your choice

The other player was selected to give money first, and chose to give €0.15 of the initial sum. The experimenter tripled this amount; you have therefore received €0.45 in addition to your initial €1.00.

Please select how much of the now-tripled amount you wish to give back to the other player.

How much would you like to give back?

----- ▼

€0.00

€0.05

€0.10

€0.15

€0.20

€0.25

€0.30

€0.35

€0.40

€0.45

Results for Rounds 1–3

This is a summary of the rounds played.

Round	Player and outcome	Points
1	You were Player 1 and won	100
2	You were Player 1 and lost	0
3	You were Player 2 and won	100

You earned 200 points. In addition to that, you get a participation fee of 50 points.

In total, you receive 250 points.

To complete the study, please answer the questionnaire that will now follow.

[Next](#)

Instructions

In this study you will play three rounds of "Matching Pennies"

Modern programming



- Python is easy to learn , popular, and versatile
- Good skill investment
- Can recruit developers with Python/Django expertise

Automated testing with bots

- Bots can simulate hundreds of participants (deterministic or Monte Carlo)
- Detect programming errors as well as design errors (e.g. negative payoffs)
- Saves time by reducing manual testing

```
class PlayerBot(Bot):  
  
    def play_round(self):  
        self.submit(views.Introduction)  
        self.submit(views.Question, {"question": 92})  
        self.submit(views.Feedback)  
        self.submit(  
            views.Contribute, {  
                "contribution": random.choice(range(0, Constants.endowment))  
            }  
        )  
        self.submit(views.Results)  
  
    def validate_play(self):  
        pass
```

Group matching

```
groups = [[P, P],  
          [P, P],  
          [P, P],  
          [P, P],  
          [P, P]]
```

Groups are represented as a matrix, which you can permute any way you want

```
for group in groups:  
    group.reverse()
```

Example: P1 and P2 swap roles

Export data in CSV format

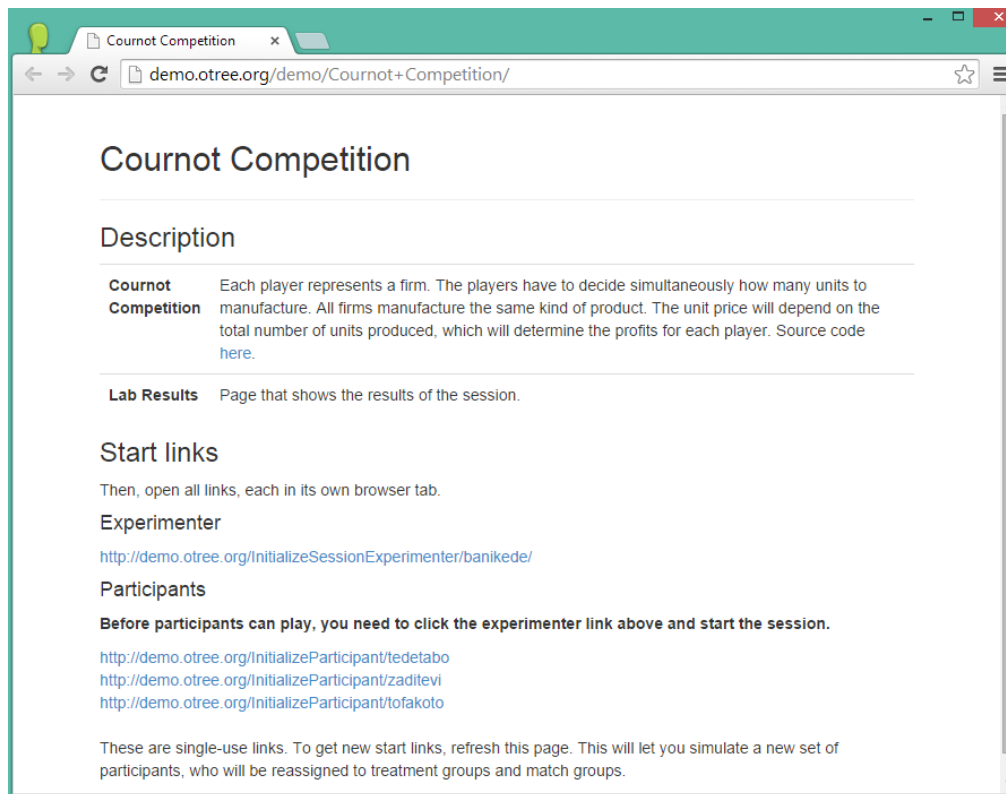
	A	B	C	D	E	F	G	H
1	name	visited	index	bonus	contributed	deduction_noncontrib	deduction_contrib	deduction_1_contrib
2	1	1	3	420	1	-3	-4	-7
3	2	1	3	300	1	-8	-9	-5
4	3	1	1	260	1	-11	-4	-6
5	4	1	2	430	1	0	0	0

Documentation extracted from comments in source code

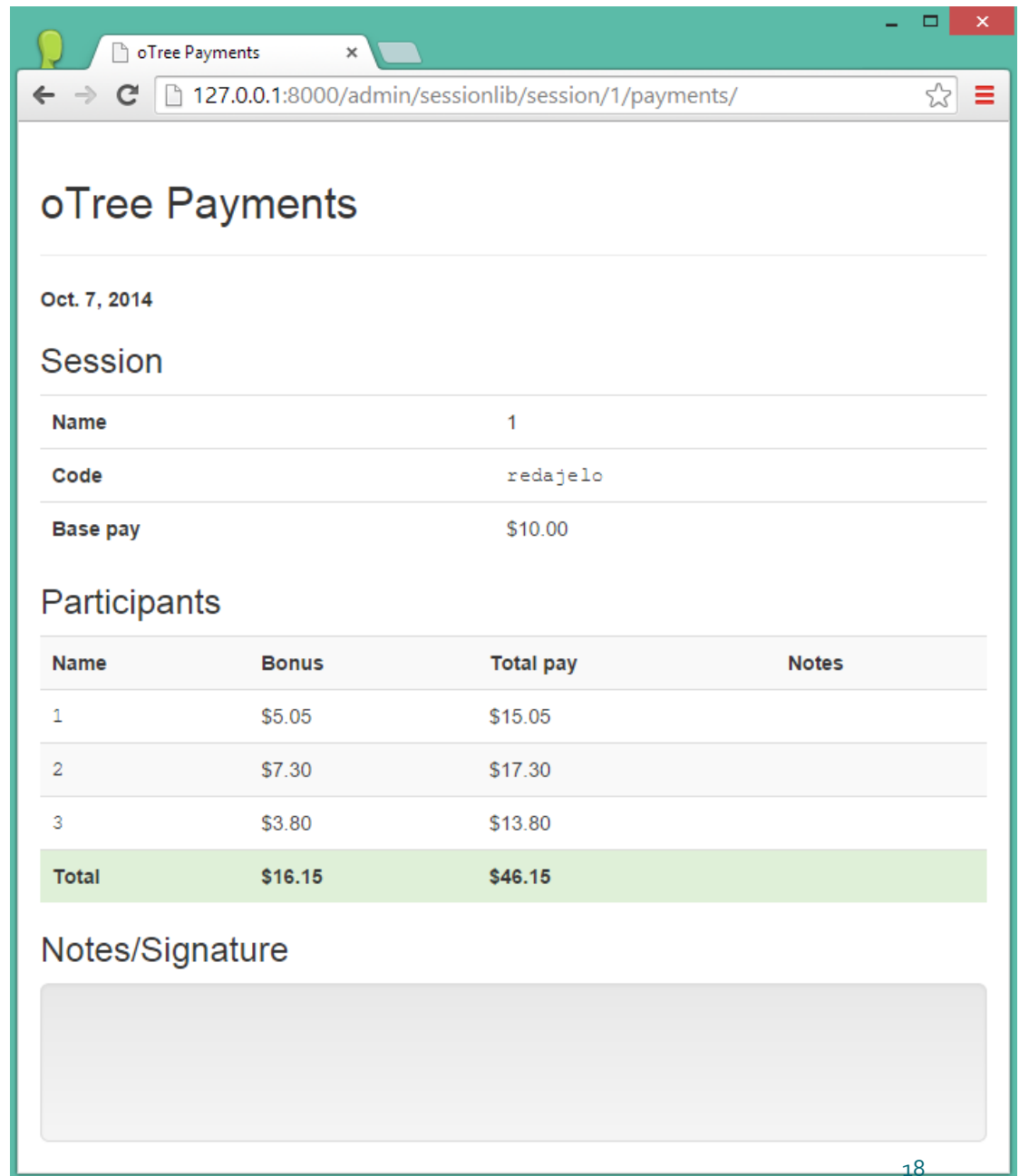
```
Prisoner3 (2014-06-20).txt - Notepad
File Edit Format View Help
index_among_participants_in_match
  type
    positive integer
  doc
    Index starting from 1. In multiplayer games, indicates whether this is participant 1, participant 2, etc.
bonus
  type
    positive integer
  doc
    The bonus the participant made in this subsession, in cents
deduction_to_each_noncontributor
  type
    integer
  doc
    How much to deduct from each, if neither contributes.
    For strategy method, all 4 variables are populated.
    For direct response, we don't populate all 4.
    Only the one(s) that actually correspond to how the game was played.
    For example, if P1 contributed but not P2 or P3, then from P1's perspective, neither of the other participants contributed.
```


Demo mode

- Easy to put your game online (play in browser, no installation or download)
- Send link to co-authors, referees, students
- Example at **demo.otree.org**



Printable payments file



The screenshot shows a web browser window with the title "oTree Payments". The address bar displays the URL "127.0.0.1:8000/admin/sessionlib/session/1/payments/". The page content includes the title "oTree Payments", the date "Oct. 7, 2014", and a section titled "Session". Below this, there are three rows of session details: "Name" with value "1", "Code" with value "redajelo", and "Base pay" with value "\$10.00". A section titled "Participants" contains a table with four columns: "Name", "Bonus", "Total pay", and "Notes". The table lists three participants and a total row. The total row is highlighted in green. Below the table is a section titled "Notes/Signature" with a large, empty text area.

Name	Bonus	Total pay	Notes
1	\$5.05	\$15.05	
2	\$7.30	\$17.30	
3	\$3.80	\$13.80	
Total	\$16.15	\$46.15	

Future work

- Near term
 - Python 3 compatibility
 - More detailed documentation and examples
 - Better performance (100-1000 simultaneous players)
 - Easier to use admin interface
 - Easier server deployment
- Longer term
 - Network games
 - Measuring reaction time, mouse movements, keystrokes
 - Integration of physiological measurements (pupil dilation, eyetracking)
 - Continuous-time games

Thank you

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