

# MPRA

Munich Personal RePEc Archive

## **An Online Recruitment System for Economic Experiments**

Greiner, Ben

2004

Online at <https://mpra.ub.uni-muenchen.de/13513/>  
MPRA Paper No. 13513, posted 20 Feb 2009 15:36 UTC

---

# An Online Recruitment System for Economic Experiments

Ben Greiner  
University of Cologne  
Department of Economics

## *Abstract*

In this paper we introduce the Online Recruitment System for Economic Experiments (ORSEE). With this software experimenters have a free, convenient and very powerful tool to organize their experiments and sessions in a standardized way. Additionally, ORSEE provides subject pool statistics, a laboratory calendar, and tools for scientific exchange. A test system has been installed in order to visually support the reader while reading the paper.<sup>1</sup>

---

<sup>1</sup>See <http://www.orsee.org> for a test system, downloads, and a complete manual.

## 1 Introduction

Laboratory experimentation has been a growing field in economics for the last decades.<sup>2</sup> But the more experiments have been conducted in economics, the more the issue of an appropriate methodology and organization has been raised.

At the moment, there are the following items which are commonly agreed to be symptomatic for economic experiments (compared to human subject experiments in psychology and other social sciences):

- Subjects are payed for their participation.
- Payment should reflect subjects' performance in the experiment, i.e. the strategy space should translate to the payoff space.<sup>3</sup>
- Subjects should be volunteers motivated by the experimenters' payment.
- Subjects should not be deceived.

However, there is a wide variety in the procedures of maintaining a subject pool and organizing experiments. In this paper we introduce the Online Recruitment System for Economic Experiments (ORSEE), which aims

- to simplify the organization of economic laboratory experiments,
- to standardize the procedures of experiment organization,
- to depersonalize the experimenter-subject interaction,
- to allow the conduction of simple internet experiments,
- to provide information and statistics about the subject pool.

ORSEE has been implemented and has been online in Jena, Germany since March 2003. Currently, it is used at four institutions.<sup>4</sup> The software is maintained at `sourceforge.net`.<sup>5</sup> There you find the orsee-announce mailing list, a bug report and a feature request tracker. In order to support the reader while going through this paper a test system has been installed.<sup>6</sup>

Section 2 lists the functions of ORSEE and some technical parameters. Next, we describe the two essential views of the system: the public and the administration area. Section 5 and 6 show how laboratory and online surveys can be conducted in ORSEE, respectively.

Before starting, some terms used throughout this paper should be defined: A 'session' is defined as processing an experiment at a certain time at a certain location. An 'experimenter' is a person who conducts and/or administrates

---

<sup>2</sup>For an introduction into experimental methodology and an overview about history and topics of experimental economics see Davis and Holt (1993), Friedman and Sunder (1994), and Kagel and Roth (1995).

<sup>3</sup>See Harrison (1989).

<sup>4</sup>Max Planck Institute for Research into Economic Systems in Jena, Humboldt University Berlin, University of Bonn, and University of Cologne.

<sup>5</sup><http://sourceforge.net/projects/orsee/>

<sup>6</sup><http://www.orsee.org>

an experiment. A 'subject'/'participant' is a person who is recruited to participate in an experiment. Using ORSEE, experimenters create experiments which may consist of several sessions and invite subjects. Invited subjects may register themselves at one of the experiments' sessions in order to participate.

## 2 Features

### 2.1 General Features

- multiple laboratory/subject pool/experimenters/experiment types support
- attribute query selection (e.g., select female participants, select participants who have not participated in experiment X)
- random recruitment of subjects out of subject pool
- structured public and internal experiment calendar including lab reservation for maintenance etc.
- reputation system (number of no-shows, i.e. the number of times a participant registered for a session but did not show up)
- automated mailing for registration process
- subjects are informed by automated e-mails about the sessions they registered for
- rule based automated session reminder mailing
- subjects are able to manage their own account (without password, using an individualized URL)
- overview about registration state
- experimenters are informed about session's state by automated e-mails
- calendar and session's participants lists in printable format (pdf)
- upload / download section
- build-in module for designing and conducting complete online surveys
- regular e-mails with experiment calendar and subject pool statistics to experimenters
- multiple experimenter/subject language support
- easily configurable via the web interface
- customizable layout
- open source

### 2.2 Technical Features

- LAMP application
  - runs on *Linux*
  - *Apache* webserver recommended

- uses *MySQL* database
- implemented in *PHP*
- data is completely separated from the application
- recommended system: Linux on i386/i686 processors, other unices and Windows Server should work as well
- further requirements: *PHP* on command line, *webalizer* for usage statistics, *cron daemon* for regular jobs

### 3 The Public Area

The public area is the part of ORSEE which visitors and (potential) subjects can access without having a password. All information provided at these pages can be edited in the administration section.

The **rules page** displays the general experiment rules set by the institution. These can include rules for laboratory experiments, internet experiments, video experiments, or online surveys. The rules should contain information about the reputation system used, and the experimenters' policy of handling no-show-ups and late-comers. They should also contain general information about the normal procedure of an experiment, if there are payments or not, and so on. In order to deal with legal requirements and to provide trust to potential participants ORSEE provides a **privacy policy page** which should state the policy of the institution regarding the data in the recruitment system and the data collected in experiments.

Subjects regularly have questions about details of the registration procedure, the use of the system and the practices you are using to organize and conduct experiments at your institution. The **FAQ page** answers these questions. They are ordered by an evaluation number, which is the sum of different participants who thought that this note answered their question. The answer page opens in a separate small window.

The **calendar** contains an overview of all experiments and their sessions. The information about a session contains the (public) name of the experiment, the time, date, duration and location of the session, and the status of the session. The latter is denoted as *free places* if the registration time has not expired and there are free places left, and as *completed* otherwise. Thus, sessions which are not full already but whose registration period has expired are marked as complete at the *public* area.

To register in the system, potential subjects click on the appropriate link in the menu. First participants have to choose their own sub-subjectpool. The page will only show up if different subgroups are defined. After having selected their subgroup, people see the rules for experiments and the privacy policy. They have to accept both by clicking on the acceptance button before coming to the registration page.

On the **registration page** (see Figure 1) people can enter their data. Only the e-mail address, the last name, and the first name are required. A text shown above the form indicates that providing additional personal information can lead to more invitations. These details include gender, phone number, begin of study, field of study, and profession (depending on sub-subjectpool).

Fig. 1: Participant Registration Form.

After submitting the registration form by clicking the button, the data is checked for doubletons with already registered participants and will be inserted only in a temporary table. The candidates are informed that they will receive an e-mail to the account given to confirm their registration. This aims to avoid nonsense registrations. In their confirmation e-mail participants receive a link to click on. This brings them to a page confirming their successful registration. Now the data will be inserted in the regular participant table.

Every **e-mail** participants get from the system contains a link in the footer, which leads to the participant data editing page. Here a form similar to the registration form allows the user to change his data or to unsubscribe in order not to get further invitations. To keep database integrity the account is not deleted internally. If the subject tries later to register again with the system, the system recognizes him and an experimenter can reactivate his account by hand. On the privacy policy page we use to declare that we will delete personal data on written request (see next Section 4).

An experiment invitation e-mail (see Figure 2) includes another link which leads to the participant's **experiment registration page** (see Figure 3). This page consists of three parts:

- a list of future sessions of all experiments the participant has been invited

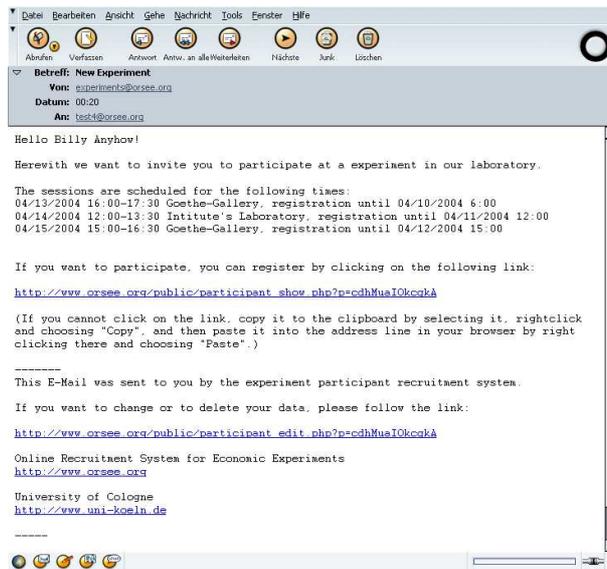


Fig. 2: Experiment invitation e-mail.

for, yet has not participated or registered so far and for which the registration period has not expired

- a list of the future experiment sessions the participant has already registered for
- a list of former sessions a participant was registered for, including a summary of *finished* sessions

While the two latter parts only have informational character, the first list contains small *register* buttons on the right side. If a user clicks on one of these buttons, he registers for the corresponding session. A text above the page informs participants about the binding character of the registration. At the same time an e-mail is sent out to the participant's e-mail address to inform him again about the successful registration, containing the date, time, and location of the session.

At a time specified at the administration page for the session a subject has registered for (e.g., 48 hours before the session starts), a session reminder e-mail is sent out to the participant.

ORSEE provides no mean for subjects to deregister from a session. We rather encourage subjects to check thoroughly if they are available for the time of the session at the moment of experiment registration. However, if there are reasons beyond his control, the participant can write an e-mail as a reply to his registration e-mail, and the experimenter will deregister him.

**Experiment registration**

**Experiments you are invited for:**  
Please check your availability for a date BEFORE you register for it. A checkout is in principle not possible, except for good reasons like illness etc.

**Exp2**

04/13/2004 16:00-17:30, Goethe-Gallery, registration until 04/10/2004 16:00	Register
04/14/2004 12:00-13:30, Intitute's Laboratory, registration until 04/11/2004 12:00	Register
04/15/2004 15:00-16:30, Goethe-Gallery, registration until 04/12/2004 15:00	Register

**Exp1**

04/13/2004 15:00-16:00, Intitute's Laboratory, registration until 04/10/2004 15:00	complete
------------------------------------------------------------------------------------	----------

**Experiments you are already registered for: ([PRINT VERSION](#))**

Laboratory addresses

Goethe-Gallery	Second floor entry right beside the animal shop
Intitute's Laboratory	Max Planck Institute Kahlsche Strasse 10 Basement

**Experiments you participated:**

Registered for: 0  
Not shown up: 0

Experiment	Date and Time	Location	Showup?
testexp1	03/22/2004 14:30-16:00	Goethe-Gallery	???

Fig. 3: Experiment registration page.

## 4 The Administration Area

To access the administration area, an experimenter has to log in first. Usernames, passwords, and user rights are provided by a superuser administrator.

Beside the experiment organization logic, the administration area provides a bunch of useful functions. In the **options section** nearly all settings regarding the system can be done. These are general settings as system e-mail sender address, defaults for forms and output, colors used, professions and fields of study known by the system, the schedule of regular tasks to be done automatically by the system, default e-mail texts, the page content for the public pages, and the FAQs listed in the public area.

In this section, also the laboratories the system serves on can be registered. You may create different public experiment types to which participants may subscribe and match them with the internal experiment types implemented in ORSEE (laboratory and internet experiments, online surveys).

Different sub-subjectpools can be set up. At time of registration, subjects self-select to a subject pool by a provided self description. This allows you to administrate different populations, for example undergraduate students at your university, professional internet experiment participants, PhD students, and so on.

A special strength of ORSEE is its multilingualism. Every output by the system (e-mails, pages, pdf files etc.) is configured in a huge language table. Thus, every experimenter and even every participant may select the language to communicate with the system given that the language is installed. You may edit all output via the web interface, and even create a new language. To do this, you have to translate the terms of an existing language to yours.

April 2004						
Mo	Tu	We	Th	Fr	Sa	Su
			01	02	03	04
					12:00-13:30 Institute's Laboratory Testexp2 hgreiner 1 (3,1) [Participants]	
05	06	07	08	09	10	11
04:00-20:00 Goethe-Gallery lab maintenance hgreiner [Edit]	08:00-05:00 Goethe-Gallery lab maintenance hgreiner [Edit]					
12	13	14	15	16	17	18
15:00-16:00 Institute's Laboratory Testexp hgreiner 1 (1,0) [Participants]						
19	20	21	22	23	24	25
26	27	28	29	30		

Fig. 4: Internal Experiment Calendar.

The **experiment calendar** (see Figure 4) provides the current state of laboratory booking, but also the timing and registration state of sessions etc. You may access the experiments, sessions and participant lists directly from the calendar. The calendar is sent to subscribed experimenters as a regular system task.

In the **downloads section** all general uploads like the system's manual and files for experiments (like instructions, programs, presentations) uploaded by experimenters can be found. This facilitates collaboration and learning between experimenters.

The **participants section** allows the experimenter to maintain the subject pool. You have the option to search through the current subject pool or 'deleted' participants (see below), to add new participants or to send out bulk mails to selected subjects. At each participant's page, you will see a complete history of his experiment registrations and participation (see Figure 5). To keep database integrity, in ORSEE you cannot really delete a participant from the database. There are three options you have:

Gender:  male  female

Main field of studies:  OR Profession:

Begin of studies:

Rules signed?:  Yes.  No.

Remarks:

History for laboratory experiments

Experiment Type	Date and Time	registered	Location	shown-up	participated
<a href="#">testexp2</a>	Laboratory from 04/13/2004 to 04/15/2004	No.	-	-	-
<a href="#">mmm</a>	Laboratory 03/22/2004 14:30-16:00	Yes.	Goethe-Gallery	???	???

History for online surveys

Experiment	Type	Date and Time	participated	finished
------------	------	---------------	--------------	----------

[Main](#)

Fig. 5: Participant Edit Page.

1. You can unsubscribe the subject. This is what the participant can also do himself at his personal data page. An unsubscribed participant will not receive any invitations to experiment sessions anymore.
2. You can exclude the subject. This is nothing else than the unsubscription with an additional flag set that it was not the participant's choice to get unsubscribed. A reason for exclusion might be that the subject has not shown up at his booked experiment sessions for a certain number of times.
3. You may empty the subject's personal data. This option is included due to privacy issues. Only the subject's ID will be kept in the system, but all personal data will be deleted. You may recover unsubscribed and excluded participant entries, but not emptied ones.

A comprehensive **statistics section** provides user with summarizing data. All actions of participants in the public area, experimenter actions in the administration area, and all runs of regular tasks by the system are logged to the database. In this section you can surf these log files.

Moreover, you may have a look at the complete webserver statistics for the system's server directory (generated by *webalizer*), graphs and tables for experiment participation and user actions, and full subject pool statistics for gender, profession, field of studies, experience, no-shows per month and per count, which can be restricted to sub-subjectpools (see Figure 6).

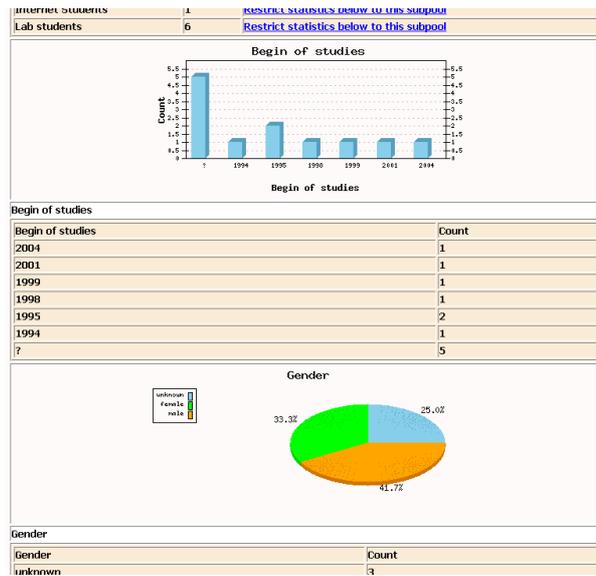


Fig. 6: Subjectpool Statistics.

## 5 Conducting a Laboratory Experiment

In this section we will describe the procedure of organizing a laboratory experiment with ORSEE. The **experiment overview page** lists the current experiments already registered in the system (see Figure 7). To list only the experimenter's or already finished experiments, use the links in the menu on the left side.

From here the experimenter may access the experiment main page of the listed experiments by clicking on the appropriate name, or create a new experiment. On the **experiment creation page** (Figure 8) she fills in the internal and public name of the experiment, a description, the type of experiment, her name and e-mail address. The public name is used to identify the experiment in the subject area of the system, the internal name is used at the administration pages and in e-mails to experimenters.

After adding an experiment, the experimenter uses the **session creation page** (which is accessible from the experiment's main page) to register each of the planned sessions with date and time, laboratory, experiment duration, number of participants needed and over-recruited, the time of registration, and when the reminder should be sent to registered participants (see Figure 9). When creating or editing a session the system checks whether the

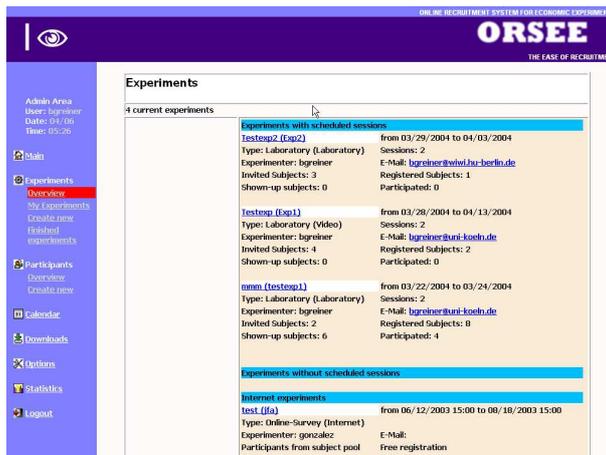


Fig. 7: Experiment Overview.

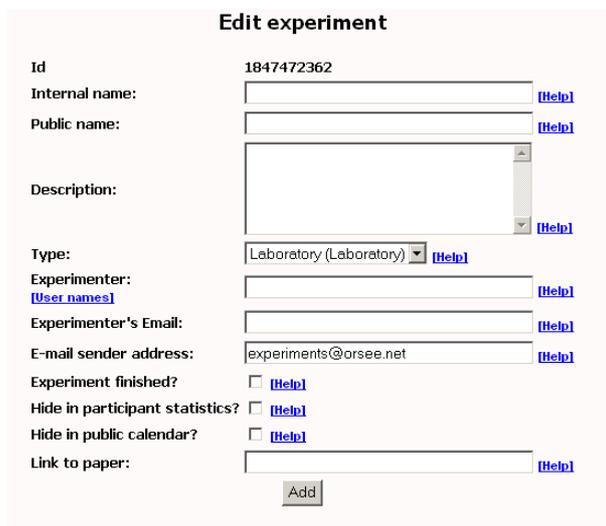


Fig. 8: Experiment Creation Page.

session clashes with another laboratory booking and the experimenter gets a feedback.

Next, she **assigns subjects** registered in the database to her experiment. When doing so, she can use different queries including name, e-mail-address,

**Edit session**

Id: 232720167

Date: 02 / 04 / 2004

Time: 12 : 00

Laboratory: Goethe-Gallery

Duration of experiment: 01 : 00 [\[Help\]](#)

Session reminder (hours before start): 00 [\[Help\]](#)

Send reminder: when as much participants registered as needed, else ask

Needed participants: 24 [\[Help\]](#)

Reserve participants: 03 [\[Help\]](#)

Registration end (hours before start): 72 [\[Help\]](#)

Remarks:

Session finished?  [\[Help\]](#)

[Mainpage of this experiment](#)

Fig. 9: Session Creation Page.

number of no-shows and registrations, sub-subjectpool, gender, profession, field and start of studies, and participation/registration at certain old experiments.

ORSEE provides the feature to select a random subsample of a defined size from the registered participants matching the query. This should be used to prevent a bias regarding the fact that some subjects have immediate and more often internet access than others.

Once participants are assigned, the experimenter sends an **invitation e-mail** which lists the sessions' dates and times and includes a link to the subjects' individualized registration page. Following this link the subject can choose one date out of the sessions available. When registering for a session, a confirmation e-mail is sent to the subject.

When the registration period expires, a **regular job** of the system checks the state of registration for the experiment. For each session, the experimenter gets an e-mail informing her about the number of subjects registered, and having attached a pdf-file containing the list of the names of participants. In case of too few registrations the experimenter may now extend the registration period, or cancel the session at the very end. At the time specified at the sessions' edit page the session reminder e-mail will be sent out.

During the whole registration process, the experimenter can observe the current state of each session at the experiment main page. There are four states of a specific session:

1. *Not complete*: There are not enough participants.
2. *About complete*: There are as much participants as explicitly needed for

**Testexp2**  
**Assign subjects**

12 possible participants in database for laboratory experiments  
12 participants assigned to this experiment

Select all ... [Reset query form](#)

1.	<input type="checkbox"/>	where	<input type="text" value=""/>	in	anyOne
2.	<input type="checkbox"/>	AND	who have a number of no-show-ups	<=	0
3.	<input type="checkbox"/>	AND	who have a number of registrations	<=	0
4.	<input type="checkbox"/>	AND	where subjectpool is		not specified
5.	<input type="checkbox"/>	AND	where gender is		male
6.	<input type="checkbox"/>	AND	where begin of studies was in year	<=	
7.	<input type="checkbox"/>	AND	where field of studies is		
8.	<input type="checkbox"/>	AND	where profession is		
9.	<input type="checkbox"/>	AND	only	subjects who have participated on ONE of the following marked experiments	<input type="checkbox"/> mmm (bgreiner.43222044)
10.	<input type="checkbox"/>	AND	only	subjects who have participated on ALL of the following marked experiments	<input type="checkbox"/> mmm (bgreiner.43222044)
11.	<input type="checkbox"/>	AND	only	participants were assigned to one of the following experiments	<input type="checkbox"/> test (gonzalez.06122003) <a href="#">extend list</a>
12.	<input type="checkbox"/>		and the maximum number of participants is		

[Mainpage of this experiment](#)

Fig. 10: Participant Query.

the experiment, but not enough reserve participants.

3. *Complete*: The number of required participants plus the reserve is reached.
4. *Finished*: All data was filled in for the session. The participation data will be used for the reputation system.

We distinguish between five different independent states (flags) of a participant with regards to a certain experiment:

1. *Assigned*: The participant is allowed to register for a session of this experiment.
2. *Invited*: The participant received an invitation e-mail from the system.
3. *Registered*: The participant is registered for a certain session of a laboratory experiment.
4. *Showed-up*: The participant was at the right location at the right time.
5. *Participated*: The participant really played the game.

The experimenter may also visit the actual **participant list** for each session (Figure 11).

When everything is o.k., the experimenter conducts her experimental session in the laboratory. She fills in the show-up and participation data for all participants. When all data is filled in, she marks the session as finished, and its data will be included in the calculation of reputation score for the participants. When all sessions are done, the experimenter marks the experiment as finished, and it will be listed in the "old experiments" section.

**Testexp2**  
**Registered Subjects**

[PRINT VERSION](#)

Query: SELECT \* FROM or\_participants, or\_participate\_at, or\_sessions WHERE or\_participants.participant\_id=or\_participate\_at.participant\_id AND or\_sessions.session\_id=or\_participate\_at.session\_id AND or\_participate\_at.experiment\_id=353719537 AND or\_participate\_at.session\_id=2570262513 AND registered=1 ORDER BY session\_start\_year, session\_start\_month, session\_start\_day, session\_start\_hour, session\_start\_minute, lname, fname, email

	Lastname	Firstname	E-Mail-Address	Phone number	Gender	Main field of studies/Profession	Ho-shows	Session	shown-up	participated	Rules signed?
1	banni	benni	experimens@orsee.org		?	Anthropology ()	0/1	03/29/2004 15:00	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Greiner	Ben	bt@tmail.de	1234	m	Business Administration (1998)	0/0	03/29/2004 15:00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3	Greiner	Ben	bt@tmail.de	2333	f	Dentistry (1995)	0/0	03/29/2004 15:00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	Greiner	Ben	hgreiner@webkju-berlin.de	123456	m	Archaeology (1995)	1/1	03/29/2004 15:00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
5	greiner	ben	webmaster@orsee.org		?	Prehistory and early history ()	0/1	03/29/2004 15:00	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
6	kjhkhk	kjhkh	hbhc@orsee.org		f	English Language and Literature Studies (British/America) ()	1/1	03/29/2004 15:00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
7	Renaerg	Heb	hgreiner@uni-koeln.de	7876	m	Geography (1999)	0/0	03/29/2004 15:00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
8	Seeräuber	Sindbad	test@orsee.org		m	German Language and Literature Studies (1999)	0/0	03/29/2004 15:00	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	test	nochn	no@orsee.org		f	Bioinformatics ()	0/0	03/29/2004 15:00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
10	testu	test	hbhc@orsee.org		?	Nutrition science ()	0/0	03/29/2004 15:00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
11	thjhi	testt	hbhc@orsee.org	110	m	Engineering (2004)	0/0	03/29/2004 15:00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Fig. 11: Participant List for a Session.

## 6 Conducting an Online Survey

A special experiment type implemented in ORSEE is an 'Online Survey'.<sup>7</sup> After creation of the experiment, the experimenter fills in a **special properties page** stating the start and stop time of the survey, the browser window size, and a short description of the experiment (mentioning required technology for participation and so on). The experimenter can restrict the participation to invited subjects from the known subject pool or can allow for free registration, specifying whether unknown participants have to fill in a personal data form.

An online survey may consist of an introductory page, an instruction page, the personal data form, a number of questions, and an ending page. Each part is freely configurable in ORSEE. Questions are of a certain type, have certain predefined answering options, and are organized in items. ORSEE supports 'text lines' and 'text fields', 'select fields' for numbers and text, 'checkboxes' and 'radio buttons'. The latter two can be presented as matrices. Questions and items can be given a numbered or random order.

After having created and configured all pages and questions, the survey is ready to start. Invited subjects can follow a link in their invitation e-mail to participate, and if free participation is enabled, the experiment is listed in the 'Internet Experiments' section of the public area. From the time specified as the start time of the survey subjects are allowed to fill in the questionnaire.

<sup>7</sup>For the implementation of this module, we used methods described in Greiner, Jacobsen and Schmidt (2003).

While the survey is running, the experimenter can observe the participation rate and some simple average statistics of answers.

When the survey time runs out, no subject can start the survey anymore. The experimenter may extend the time or end the survey by marking it as finished. Participant and decision data may be downloaded separately as excel spreadsheets.

## 7 License

The Online Recruitment System for Economic Experiments is available under a special open source license called 'Citeware'. Specifically, the source code may be copied, modified and distributed under terms complying with the Open Source Definition of the Free Software Foundation. However, the use of derivative products is restricted in a way that any academic report, publication, or other academic disclosure of results obtained with the use of this software will acknowledge the software's use by an appropriate citation of this paper.

### *Acknowledgements*

I would like to thank Philipp Euskirchen, Jens Großer, Imke Jungjohann, Nikoletta Kiss, Carsten Schmidt, and participants at the ESA European Meeting 2003 in Erfurt for valuable comments and suggestions on this paper, and the Strategic Interaction Group at the Max Planck Institute in Jena, Germany for testing first version of the system. The financial support of the Max Planck Society is gratefully acknowledged.

### *References*

- Davis, D. D. and Holt, C. A.: 1993, *Experimental Economics*, Princeton, NJ: Princeton University Press.
- Friedman, D. and Sunder, S. (eds): 1994, *Experimental methods : a primer for economists*, Cambridge: Cambridge University Press.
- Greiner, B., Jacobsen, H.-A. and Schmidt, C.: 2003, The Virtual Laboratory Infrastructure for Controlled Online Economic Experiments, in K. Kremer and V. Macho (eds), *Forschung und wissenschaftliches Rechnen 2002: Beiträge zum Heinz-Billing-Preis 2002*, GWDG Bericht 62, Göttingen : Ges. für Wiss. Datenverarbeitung, pp. 59–73.
- Harrison, G.: 1989, Theory and misbehaviour of first-price auctions, *American Economic Review* **79**, 749–762.
- Kagel, J. H. and Roth, A. E. (eds): 1995, *The Handbook of Experimental Economics*, Princeton, NJ: Princeton University Press.