Part VI

Advanced concepts, questionnaires and crashes

Advanced concepts, questionnaires and crashes

Arrays

Arrays are *indexed variables*. In an index set, every finite, equidistant subset of numbers is allowed (e.g *1,2,3,...*; but also *5, 10, 15, ...*).

The index set needs to be defined *before* the first use of the array.
This is done with one of the following instructions:

- `array arrayname[]` → defines an array with indices from 1 to the number of subjects
- `array arrayname[n]` → defines an array with indices from 1 to n
- `array arrayname[x,y]` → defines an array with indices from x to y
- `array arrayname[x,y,z]` → defines an array with indices x, x+z, x+2z,..., y.

Arrays - an example

```
//the index set of array p is 10, 15, 20
array p[10, 20, 5];

p[10]=1;
p[15]=5;
p[20]=2;

p[30]=3; //sets p[20] to 3
x = p[10] + p[20]; // x=4
```

`arrayname[indexvalue]` reports the element of array `arrayname`, corresponding to the index `indexvalue`.

Note: the expression `indexvalue` is rounded to the nearest possible index.

iterator

Loops can be programmed with the statements `repeat` and `while`.

Another way of programming loops is by using `iterators`.

An iterator creates a *small temporary table* that contains only one variable.

When a table function or a do-statement is applied to an iterator, it corresponds to a **loop over the values contained in the table**.

iterator - example

This example provides two possible ways of calculating the sum of the square of the first five natural numbers:

```
SquareSum= 1 + 4 + 9 + 16 + 25 = 55
```

First way:

```
SquareSum = iterator(i, 1, 5).sum(power(i,2));
```

Second way:

```
SquareSum = 0;
iterator(i,5).do{
 :SquareSum = :SquareSum + power(i,2);
}
```

iterator - example

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Second way:

```
SquareSum = 0;
iterator(i,5).do{
 :SquareSum = :SquareSum + power(i,2);
}
```

Note the use of the **scope operator** to refer to a variable that is in the table *which contains* the table on which the program is running.

iterator: syntax

An iterator has the following **syntax**:

- `iterator (varname)` → variable `varname` runs from 1 to the number of subjects.
- `iterator (varname, n)` → variable `varname` runs from 1 to n.
- `iterator (varname, x, y)` → variable `varname` runs from x to y.
- `iterator (varname, x, y, z)` → variable `varname` runs from x to y with steps of z.

Retrieving data from previous periods

In z-Tree, the subjects database is set up freshly in every period, so the information about earlier periods is not available directly.

However, the tables of the previous periods can be accessed with the prefix OLD.

So, if you want to copy some `variable` from the previous period, you can write:

```
if (Period >1) {
 variable=OLDsubjects.find(same(subject),variable);
}
```

This way, you can only access data from the previous period. To access data from earlier periods, a different procedure should be followed.

Data from previous periods - example

Suppose you want to run an experiment with the following structure:

1. N periods
2. in every period, each subject earns a certain amount of points
3. the subject's profit is determined at the end of period N:
   - three of the periods are drawn at random by the subject
   - the profit is set equal to the sum of the points earned by the subject in these three periods

Example: values_from_previous_periods.ztt

Data from previous periods - I

YOUR PONITS IN THE PAST 10 PERIODS

Period	Points
1	1
2	7
3	6
4	9
5	9
6	5
7	2
8	9
9	3
10	5

click the button to select one period

draw a number

click the button to select one period

draw a number

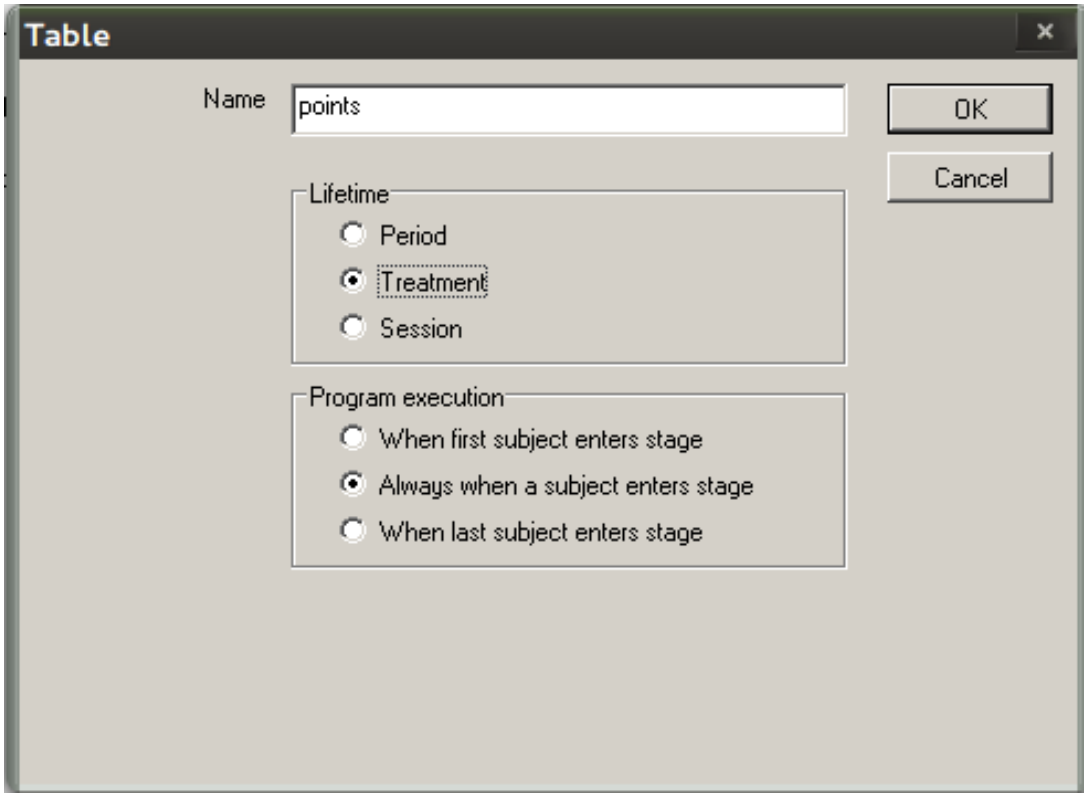
click the button to select one period

draw a number

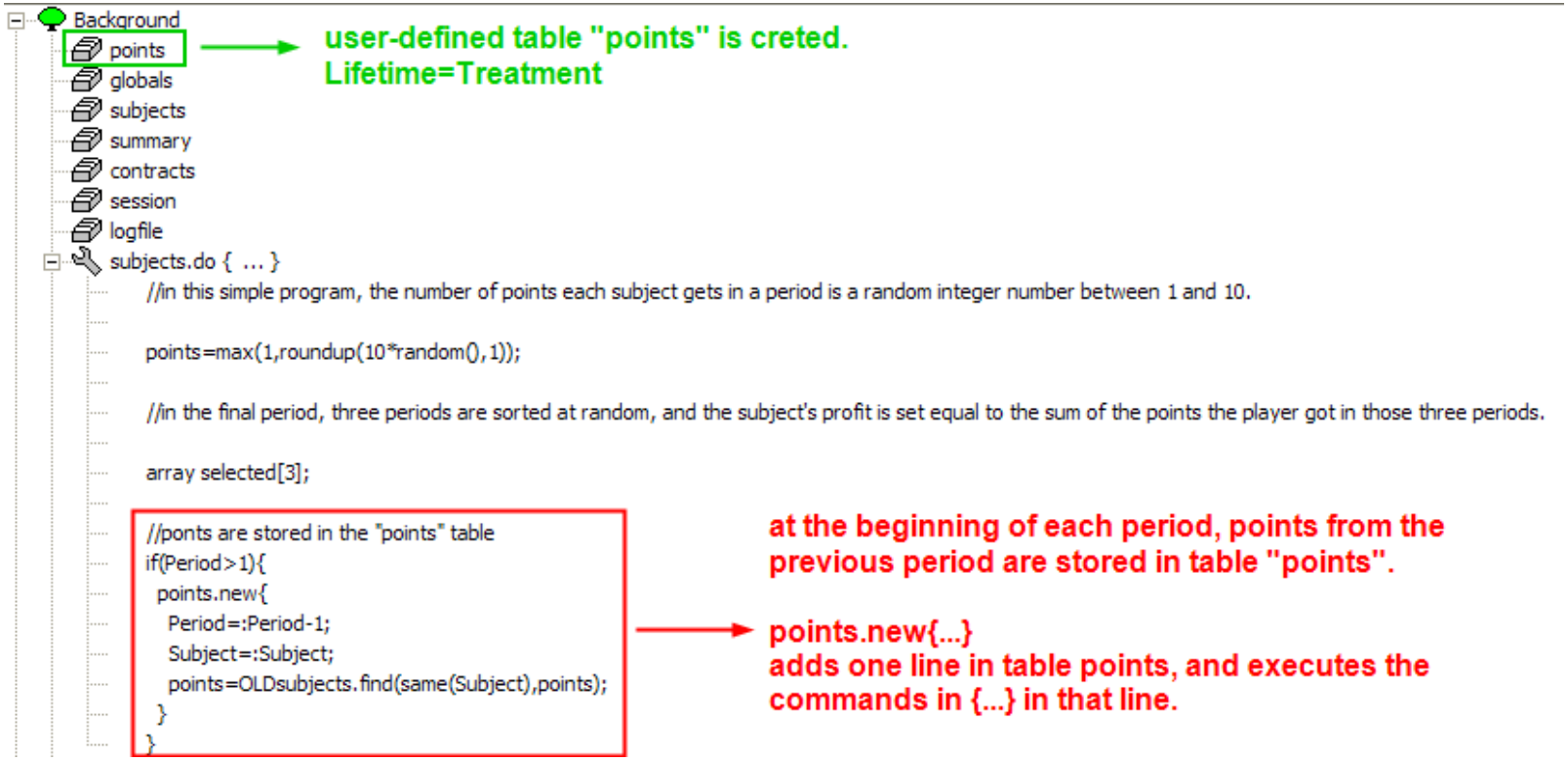
Data from previous periods - II

To retrieve data from all earlier periods, these data have to be stored in a **user-defined table** with `lifetime` set to `Treatment` or to `Session`.

From the menu, select `Treatment`→`New table`



Data from previous periods - III



Note: again, here we use the `scope operator` to refer to variables in the `subjects table` from the `points table`

Data from previous periods - IV

```
Final Stage =|= (30)N
  subjects.do { ... }
    Participate=if(Period==NumPeriods,1,0);
    if (Period==\NumPeriods){
      points.new{
        Period=:Period;
        Subject=:Subject;
        points=:points;
      }
    }
  Active screen
    Standard
      <>YOUR PONITS IN THE PAST <\NumPeriods|1> PERIODS
    Contract list: points( Subject==:Subject ), sorted by: Period
      Period: OUT( Period )
      Points: OUT( points )
    first draw
      click the button to select one period
      draw a number
        subjects.do { ... }
          selected[1]=max(1, roundup(\NumPeriods*random(),1));
          while(selected[1]==selected[2]|selected[1]==selected[3]){
            selected[1]=max(1, roundup(\NumPeriods*random(),1));
          }
    first draw - done
      Period drawn:: OUT( selected[1] )
    second draw
    second draw - done
    third draw
    third draw - done
    calc profits
      press the button to calculate your profits
      calculate
        subjects(Subject).do { ... }
          iterator(i,3).do{
            :Profit=:Profit+points.find(Subject==::Subject&Period==::selected[i],points);
          }
    profit
      Your profit is equal to: OUT( Profit )
      End
  Waitingscreen
```

1. store points form the last period
2. draw a random period NB. this box is shown only if the draw is yet to be done. `Display condition: selected[1]==0`
3. calculate the profit, using the iterator.

Bankruptcy - I

Tip: try to design the experiment in order to avoid possible losses.

If losses occur, can be covered by the following sources:

- profits from previous periods and treatments
- show-up fee
- money injected by the experimenter during the session

Example: bankruptcy.ztt

Bankruptcy - II

If previous profits are not enough to cover all losses, but the **show-up fee** is, a message appears on the subject's screen.
This message informs the subject that he can choose *either to use the show-up fee, or to drop out of the experiment*.

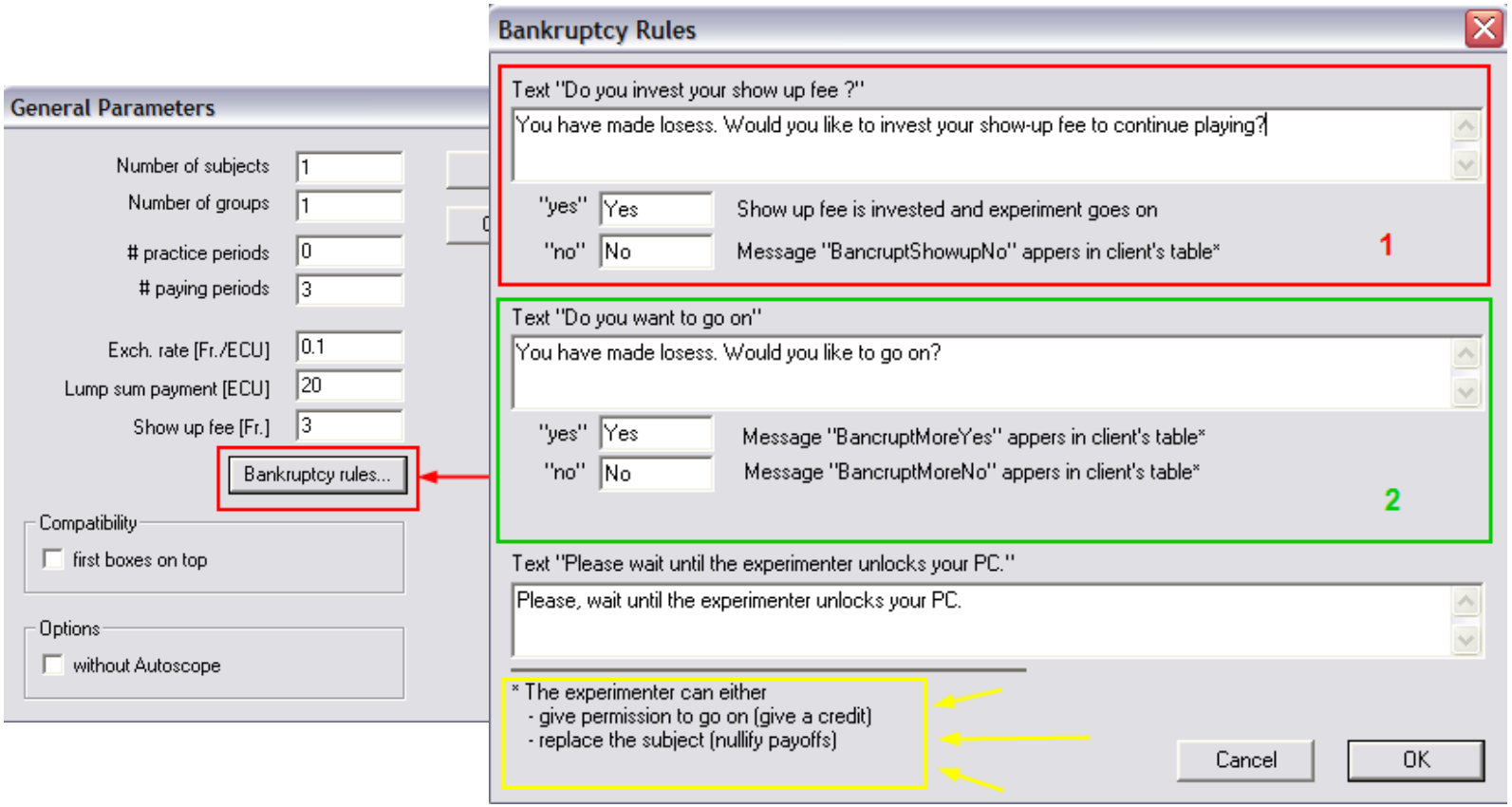
- if the subject chooses to use the show-up fee, he may simply play on.
- otherwise, the subject reaches the state `BankruptShowupNo` (which you can read in the clients table), and the experimenter has to release him manually from the server.

Bankruptcy - III

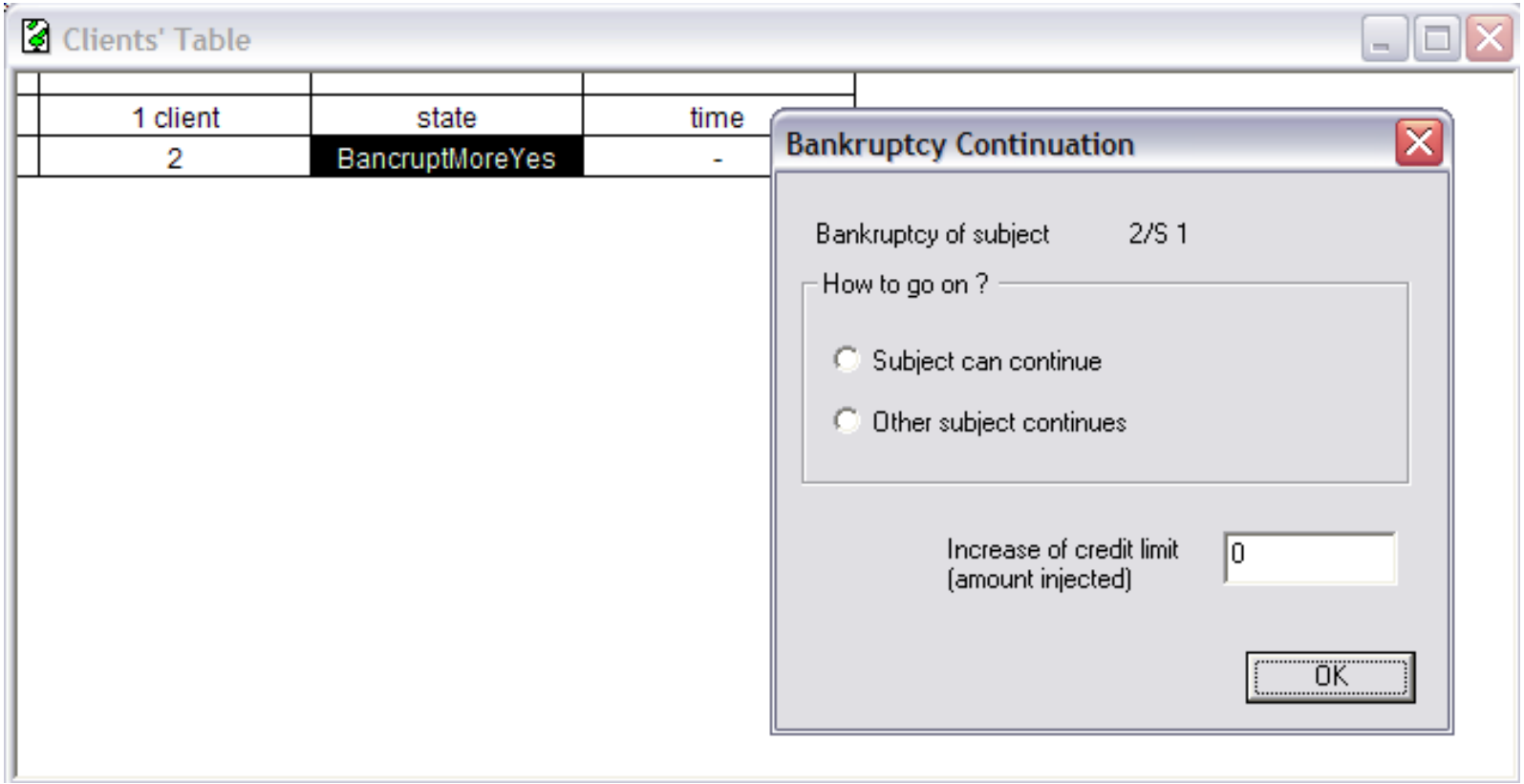
If the **show-up fee cannot cover the losses** (or has already been exhausted) a message informs the subject that he has incurred a loss.
This message can be concluded with a question.

- By answering "no", the subject enters the state `BankruptMoreNo`. In this case, the experimenter has to release the subject from the server.
- If the subject answers this question with "yes", he enters the state `BankruptMoreYes`. In this case, there are 3 possibilities:
  1. Allow the subject to continue, by injecting into his account an amount of money higher than his current losses
  2. Another subject takes the role of the subject released
  3. The subject drops out

Bankruptcy - IV



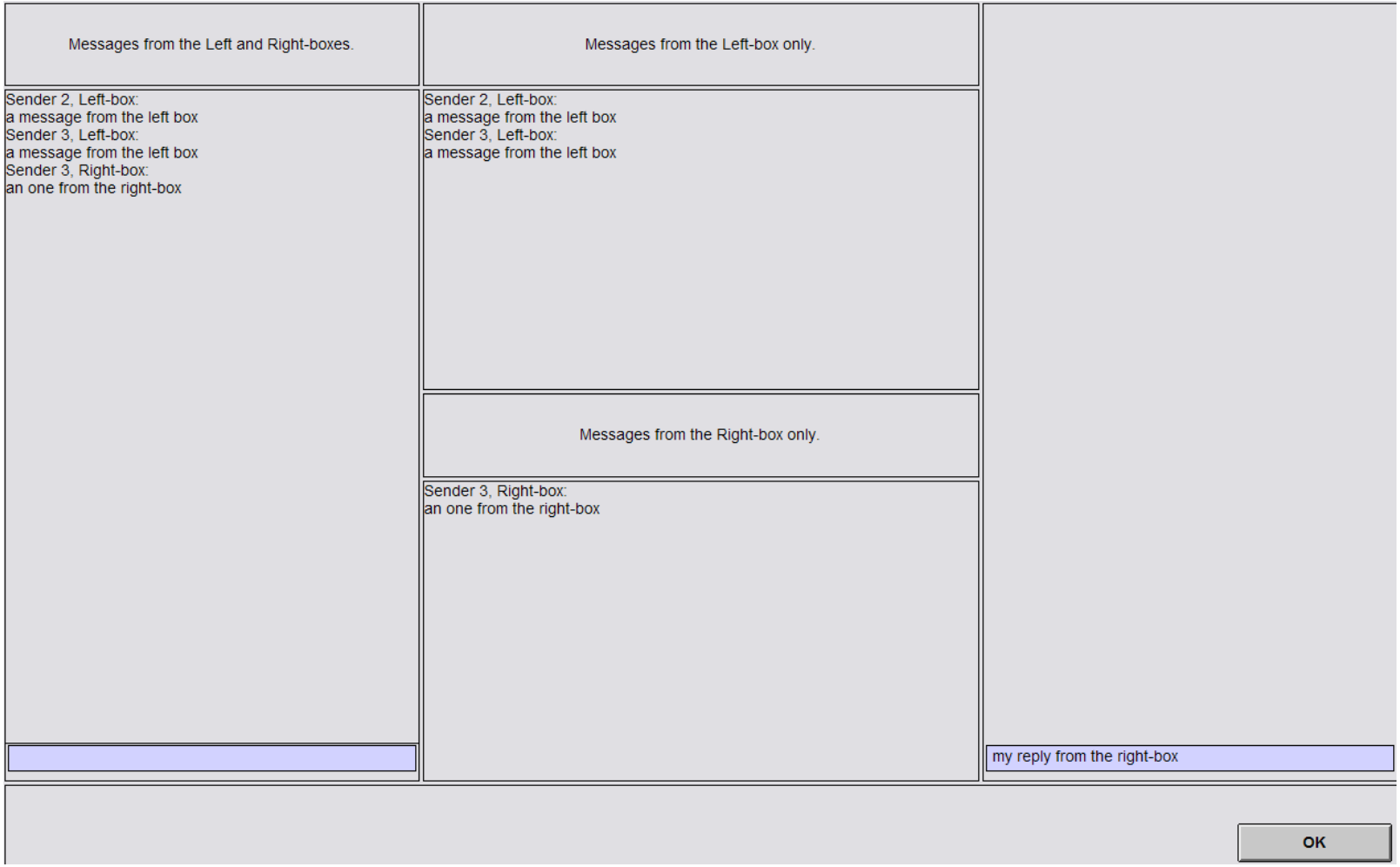
Bankruptcy - V



session table

Subject	FinalProfit	ShowUpFee	ShowUpFeeInvested	MoneyAdded	MoneyToPay	MoneyEarned
1	-4.7000000000	3	1	3	1.2999999999999	-1.7000000000000

Chats

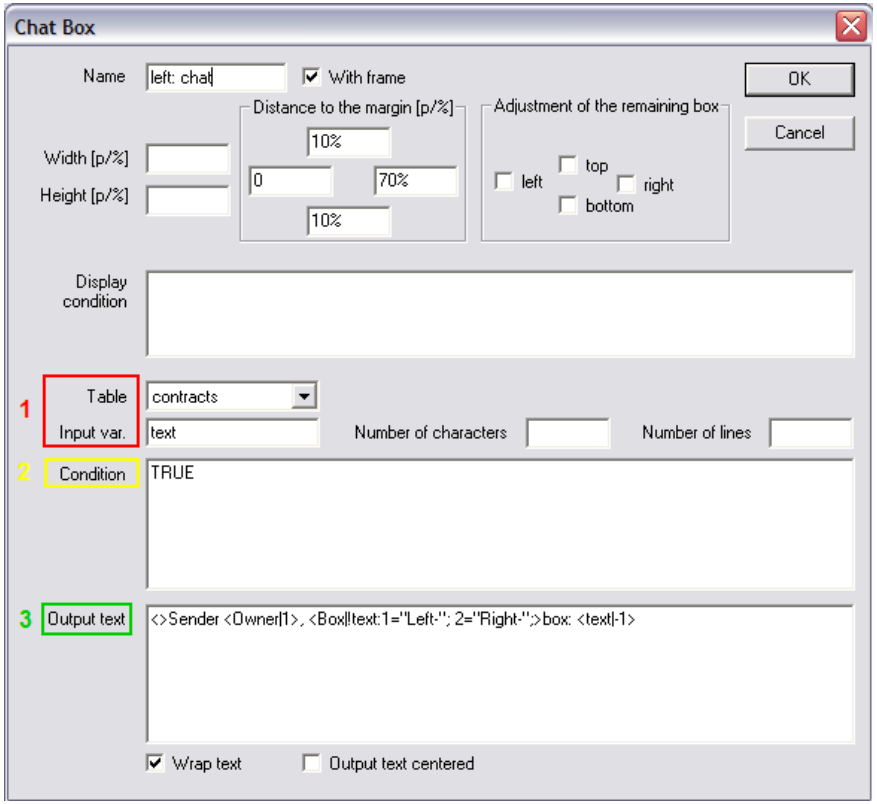


Example: chat.ztt

Chat Box

In a stage, you can add a chat box by clicking on:
`Treatment` → `New Box` → `New Chat Box`

1. specify the table where you want to store the chat data contracts table user-defined table



2. specify what records you want to display on the subject's screen
3. specify the output text

Chat data

zTree - [contracts table]

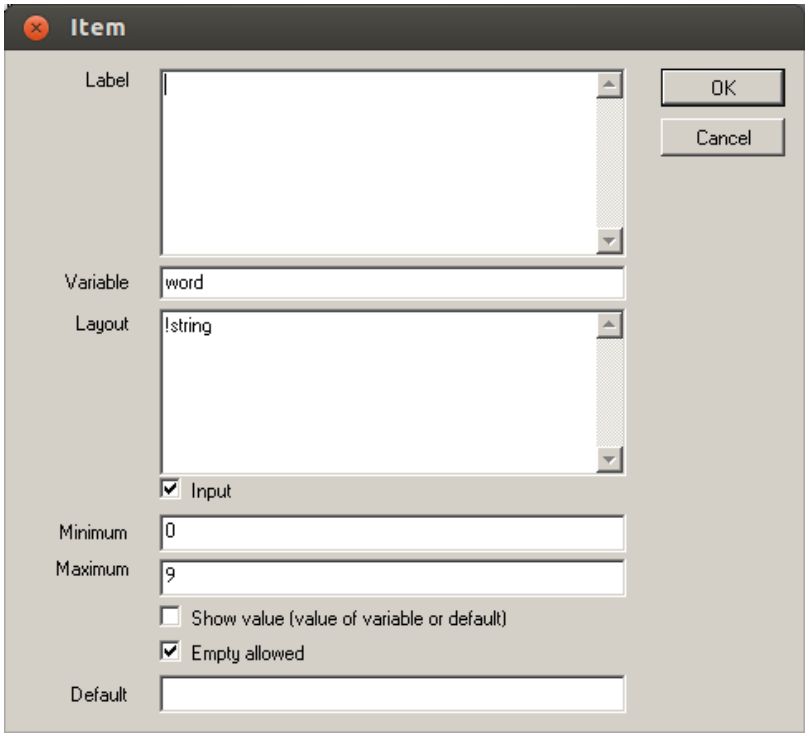
File Edit Treatment Run Tools View ?

Period	Owner	Box	text		TimeStage
1	2	1	"message from the left-box"	-	99999
1	1	2	"message from the right-box"	-	99999
1	1	1	"another message from the left"	-	99999
1	2	2	"and another from the right"	-	99999

- messages are saved in the `contracts table`, or in the user-defined table specified in the Chat-box dialogue.
- The `contracts table` and the user-defined tables were the *only tables* in which text-variables could be saved, until version 3.4.
- To **display** text variables on the screen, write "-1" in the layout filed.

String variables

From z-Tree version 3.4 it is possible to enter text into input variables, using the layout `!string`.



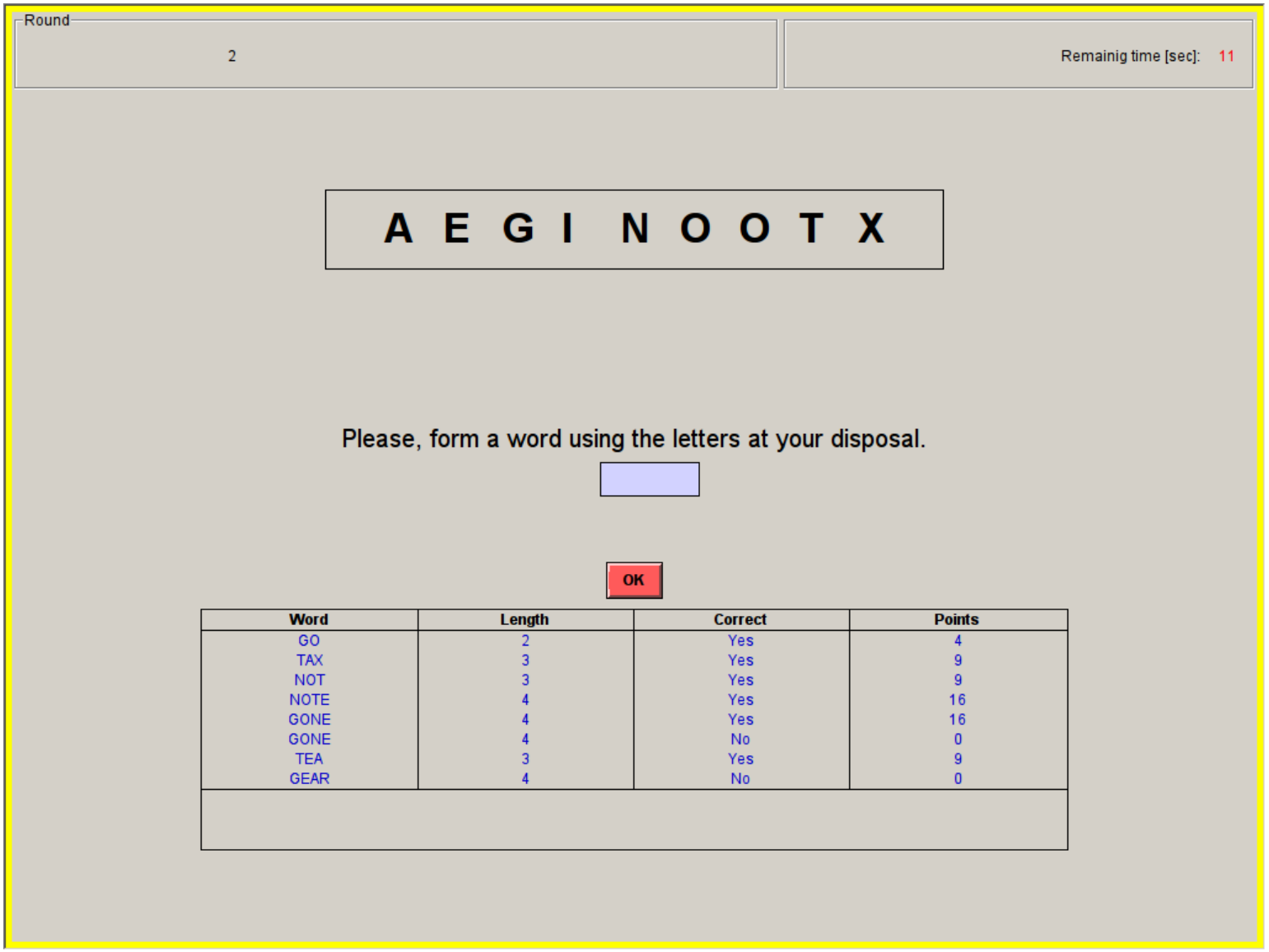
In **output items**, the expression in Layout should be an integer number, and determines how many characters will be reserved for the string output.

Example: string_variables.ztt

String functions

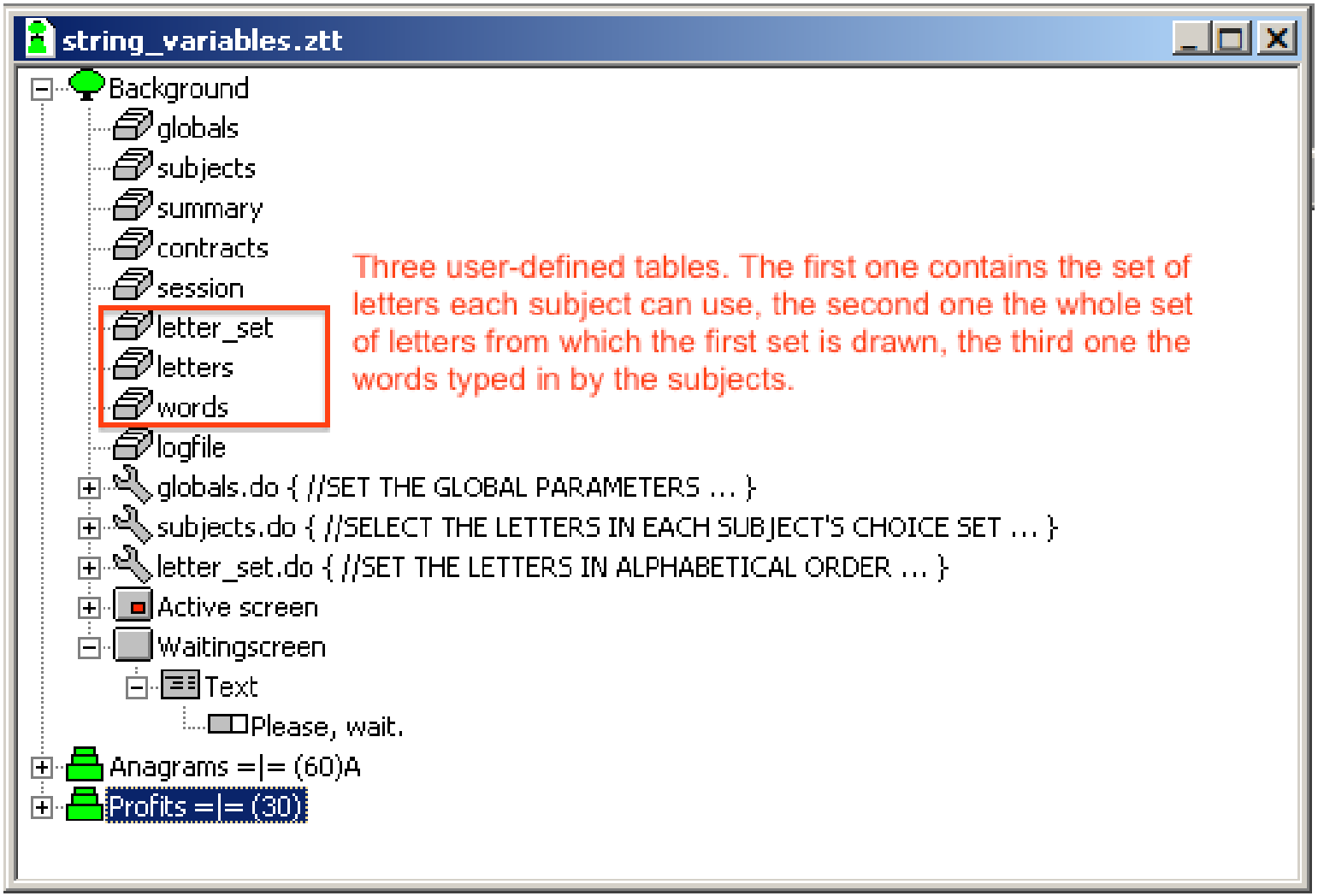
- `mid(str, n1, n2)` extracts *n2* characters from string *str*, starting from character *n1*.
- `pos(srt1, str2, n)` returns the position of *str2* in *str1*, starting the counting process at number *n*.
- `len(str)` returns the number of characters of string *str*.
- `upper(str)` returns string *str* in capitals.
- `lower(str)` returns string *str* in lower cases.
- `trim(str)` removes leading and trailing spaces from *str*.
- `format(n1,n2)` returns *n1* as a string variable, rounded to the precision of *n2*.
- `if(a,str1,str2)` returns *str1* if *a* is true, otherwise *str2*.
- relational operators can be applied to pairs of sting expressions

Example



Word	Length	Correct	Points
GO	2	Yes	4
TAX	3	Yes	9
NOT	3	Yes	9
NOTE	4	Yes	16
GONE	4	Yes	16
GONE	4	No	0
TEA	3	Yes	9
GEAR	4	No	0

Example



Example

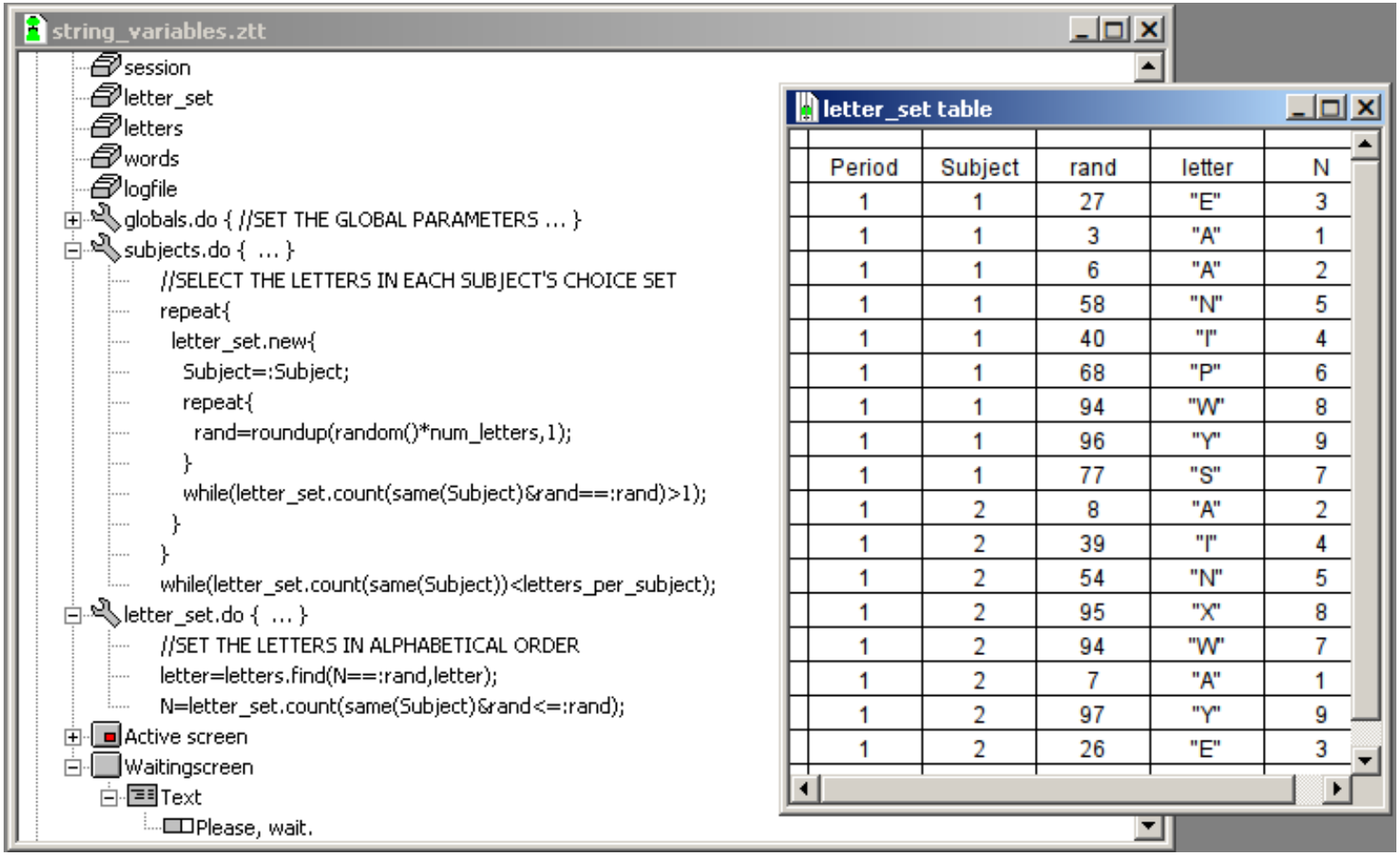
string_variables.ztt

```
logfile
globals.do { ... }
    //SET THE GLOBAL PARAMETERS
    num_letters=98;
    letters_per_subject=9;
    num_rounds=10;

    //LET THE PROGRAM CONTINUE UNTIL THE LAST ROUND
    RepeatTreatment=if(Period<num_rounds,1,0);

    //BUILD THE TABLE WITH THE SET OF LETTERS
    if(Period==1){
    iterator(i,9).do{
    letters.new{
    N=:i;
    letter="A";
    }
    }

    iterator(i,10,11).do{
    letters.new{
    N=:i;
    letter="B";
    }
    }

    iterator(i,12,13).do{
    letters.new{
```

letters table

Period	N	letter
1	1	"A"
1	2	"A"
1	3	"A"
1	4	"A"
1	5	"A"
1	6	"A"
1	7	"A"
1	8	"A"
1	9	"A"
1	10	"B"
1	11	"B"
1	12	"C"
1	13	"C"
1	14	"D"
1	15	"D"
1	16	"D"
1	17	"D"
1	14	"D"
1	15	"D"
1	16	"D"

Example



Period	Subject	rand	letter	N
1	1	27	"E"	3
1	1	3	"A"	1
1	1	6	"A"	2
1	1	58	"N"	5
1	1	40	"I"	4
1	1	68	"P"	6
1	1	94	"W"	8
1	1	96	"Y"	9
1	1	77	"S"	7
1	2	8	"A"	2
1	2	39	"I"	4
1	2	54	"N"	5
1	2	95	"X"	8
1	2	94	"W"	7
1	2	7	"A"	1
1	2	97	"Y"	9
1	2	26	"E"	3

Example

When a subjects types in a word, the program:

1. saves the word in the `words` table;
2. checks that the word contains only letters from the available choice set;
3. checks that it is the first time the subjects types in this word.

words table

Period	Subject	word	length	error	letter	position_w	counter_w	word1	checker	counter_s	points
1	2	"TEA"	3	0	"A"	3	1	""	0	2	9.0000000
1	2	"NEAT"	4	0	"T"	4	1	""	0	1	16
1	2	"WE"	2	0	"E"	2	1	""	0	1	4
1	2	"TEEN"	4	1	"N"	4	1	""	0	1	0
1	1	"PEAS"	4	0	"S"	4	1	""	0	1	16
1	1	"SAY"	3	0	"Y"	3	1	""	0	1	9.0000000

The program **does not** check whether a word exists. This should be done in case one really wanted to use this task.

Example


string_variables.ztt
Anagrams =|= (60)A
Active screen
Letters
<>{\rtf \fs50 \qc \b <letter_set.find(same(Subject)&N==1,letter)|1> \tab <lett
Input
{\rtf \fs30 \qc Please, form a word using the letters at your disposal.}
: IN(word)
OK
subjects.do { ... }
words.new{
Subject=:Subject;
word=upper(subjects.find(same(Subject),word));
length=len(word);
error=0;
iterator(i,length).do{
:letter=mid(:word,i,1);
//count how many times the letter appears in the word
:position_w=i;
:counter_w=1;
:word1=mid(:word,:position_w+1,:length-:position_w);
:checker=pos(:word1,:letter,1);
while(:checker>0){
:position_w=:position_w+:checker;
:counter_w=:counter_w+1;
:word1=mid(:word,:position_w+1,:length-:position_w);
:checker=pos(:word1,:letter,1);
}
//count how many times the letter appears in the set
:counter_s=letter_set.count(same(Subject)&letter==::letter);
:error=if(:counter_w>:counter_s,1,:error);
}
error=if(words.count(word==:word)>1,1,error);
points=power(length,2)*(1-error);
}
Contract list: words(same(Subject))

The `subjects` table

Contains *one record per subject*. It is freshly set up for each period. The subjects table of the previous period is available under the name `OLDsubjects`.

In the `subjects table`, the following variables are always defined by z-Tree:

- Period
- Subject
- Group
- Profit
- TotalProfit - this is calculated automatically. It should not be changed manually.
- Participate
- LeaveStage

The `globals table`

This table contains *a single record*, i.e. a single line. It stores values that are the same for all subjects. It is freshly set up for each period. The `globals table` of the previous period is available under the name `OLDglobals`.

In the `globals table`, the following variables are always defined by z-Tree:

- Period
- NumPeriods
- RepeatTreatment

The summary and contracts tables

The summary table

This table contains *one record per period*. It is not destroyed at the end of each period, as the `subjects` and `globals` table, but at the end of each treatment. This table is most useful for observing aggregate data of the treatment.

In the `summary table`, the only variable defined by z-Tree is the variable Period.

The summary and contracts tables

The summary table

This table contains *one record per period*. It is not destroyed at the end of each period, as the `subjects` and `globals` table, but at the end of each treatment. This table is most useful for observing aggregate data of the treatment.

In the `summary table`, the only variable defined by z-Tree is the variable Period.

The contracts table

This table is used mainly for market experiments and chats. New records can be added to this table, and existing records can be changed.

In the `contracts table`, the only variable defined by z-Tree is the variable Period.

The `session` table

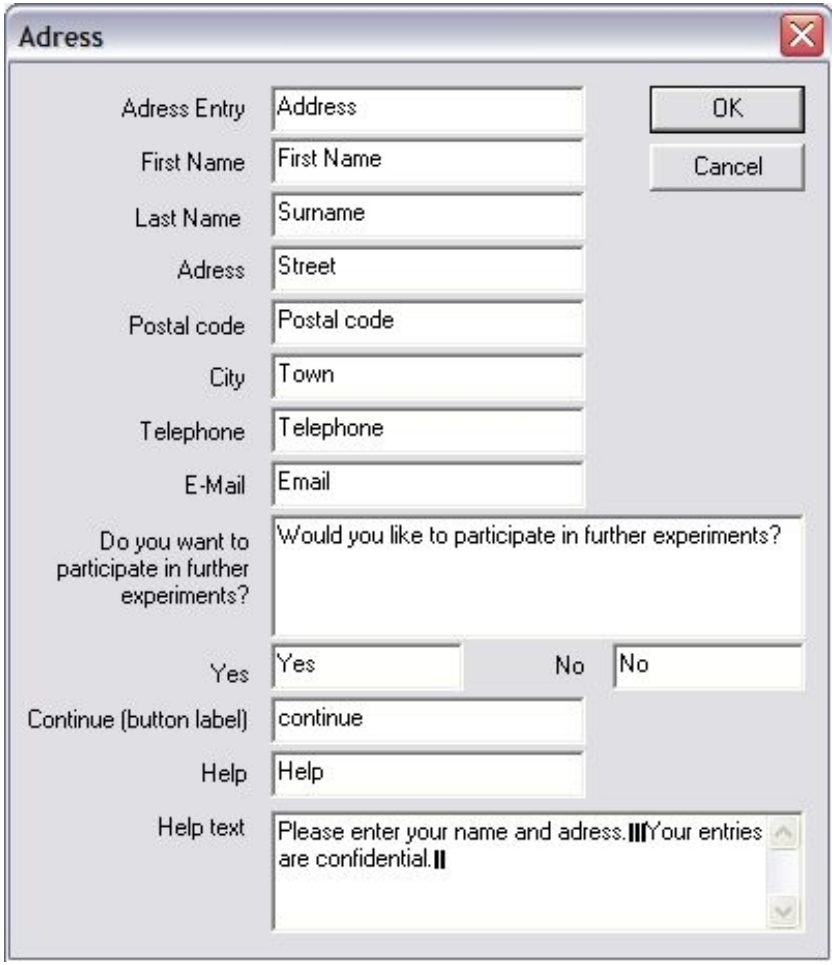
This table contains *one record per subject*. This table is never destroyed during a session, as it stores the aggregate profits earned by subjects in earlier treatments. It can also be used to *exchange information across treatments*, or *from treatments to questionnaires*.

In the `subjects table`, the following variables are always defined and automatically calculated by z-Tree:

- Subject
- Final Profit
- ShowUpFee
- ShowUpFeeInvested
- MoneyAdded
- MoneyToPay
- MoneyEarned

Questionnaires: Address form

Example: questionnaire_complete.ztq

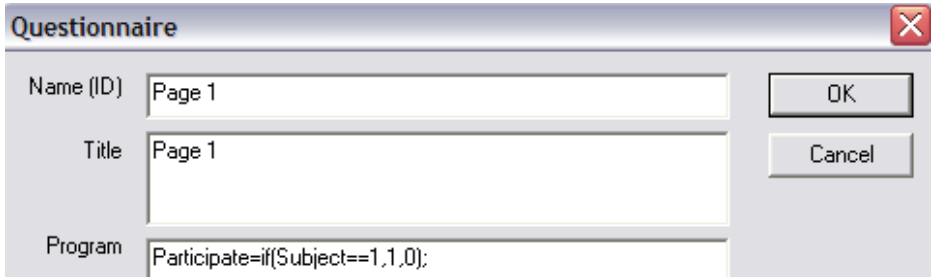


The `address form`:

- usually goes first
- may/may not contain the name and the address of the subject
- as soon as it is filled in by all subjects, the **payment file** is generated by z-Tree.

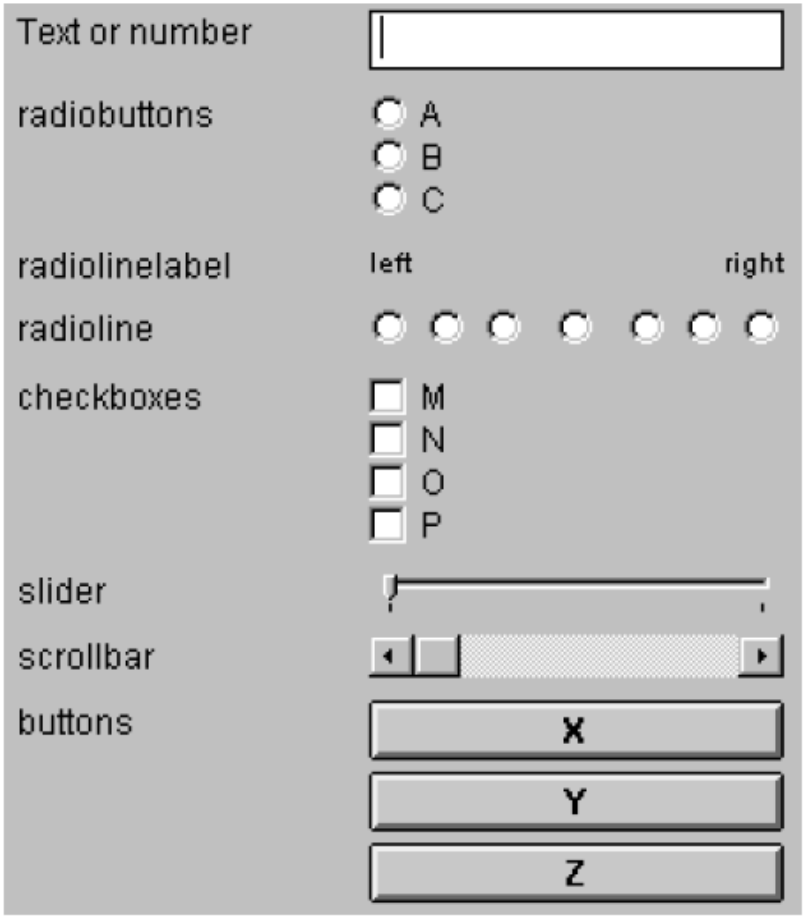
Question forms(s)

- contain several questions with different possible layouts.
- answers in questionnaires are of no consequences $\Rightarrow$ no earnings can be made in questionnaires.
- answers are saved as text and cannot be used in programs.
- the last question form of a questionnaire remains on the users' screen until you continue (with a new treatment, a new questionnaire, or simply shutting down z-leaf).
- Therefore, the final question form *cannot contain a button*.

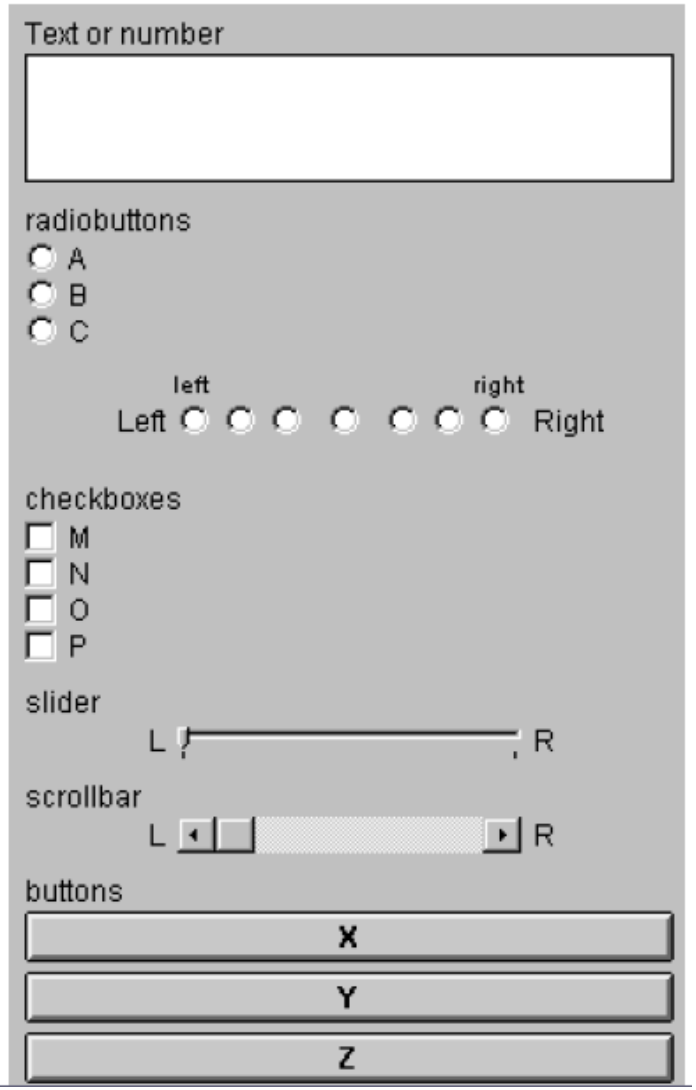


Layout of the questions

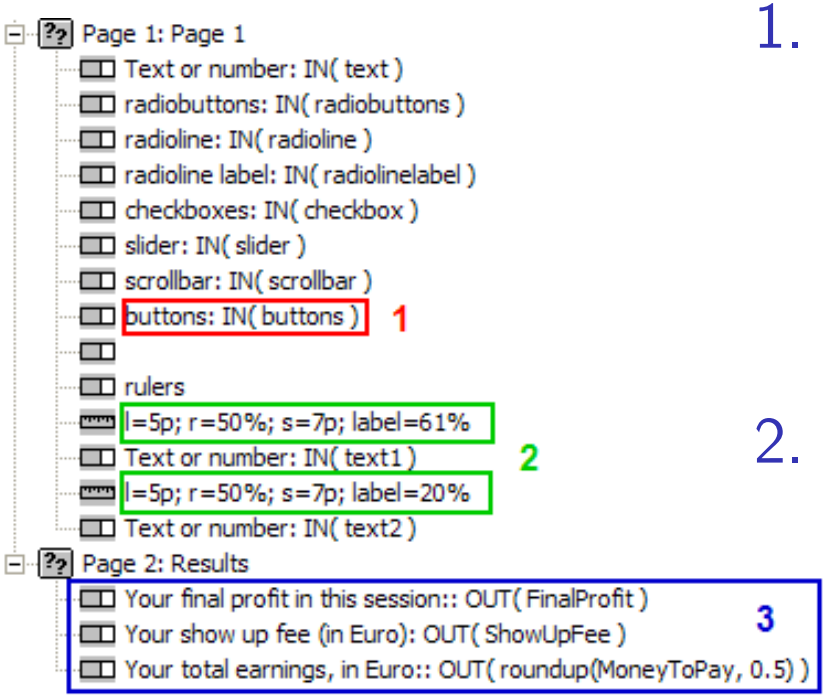
Example of normal layout (not wide):



Example of wide layout:



Buttons, rulers, and variables



1. buttons: maximum one per question form.
   $\Rightarrow$ clicking a button closes the question form, if possible
2. rulers: are used to set the regions where labels and questions are positioned.
3. In questionnaires, only variables from the session table can be retrieved. If you need to retrieve a specific variable from a treatment, you have to store it in the session table with a command in the treatment program (.ztt).

Crash of a client PC - I

When a subject's PC disconnects from the server, the clients appears in parentheses in the clients table.

Clients' Table

3 clients	state	time
(1)	*** Stage ***	-
2	*** Stage ***	-
3	*** Stage ***	-
4	*** Stage ***	-

Crash of a client PC - I

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Clients' Table

3 clients	state	time
(1)	*** Stage ***	-
2	*** Stage ***	-
3	*** Stage ***	-
4	*** Stage ***	-

First solution:
Try to **close** the Leaf program on the subject's PC, and to **restart** it.

Crash of a client PC - II

If the first solution does not work, you can try to **move the subject to a different computer**.

1. Start a new PC and launch z-Leaf from there.
2. From the client table, **drag the name of the new client on the name of the client that does not work**. This will release the old client, and replace the old with the new client.

Clients' Table

4 clients	state	time
(1)	*** Stage ***	-
2	*** Stage ***	-
3	*** Stage ***	-
4	*** Stage ***	-
new_client		

Crash of the server PC - I

After a **crash of z-Tree**, you have to follow this procedure carefully:

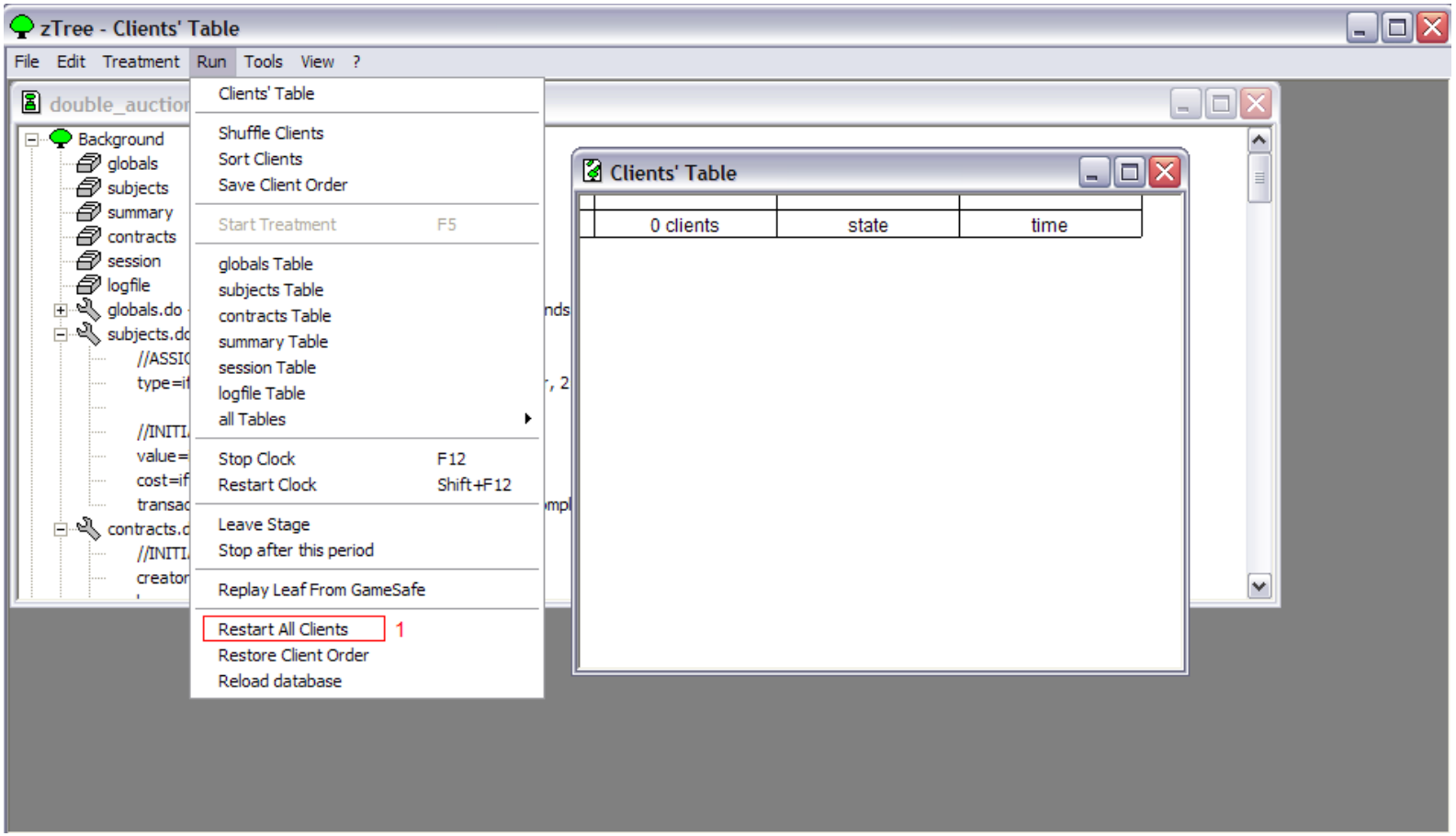
- restart z-tree
- open the client's table
- restart all clients with the menu `Run` → `Restart all clients`.

Crash of the server PC - I

After a **crash of z-Tree**, you have to follow this procedure carefully:

- restart z-tree
- open the client's table
- restart all clients with the menu `Run` → `Restart all clients`.
- If no clients connect you have different options
  - try to restart the clients manually
  - wait (up to 4 minutes) and try again
  - shut down and restart the experimenter's PC, then follow the previous steps
  - start z-Tree on a different computer

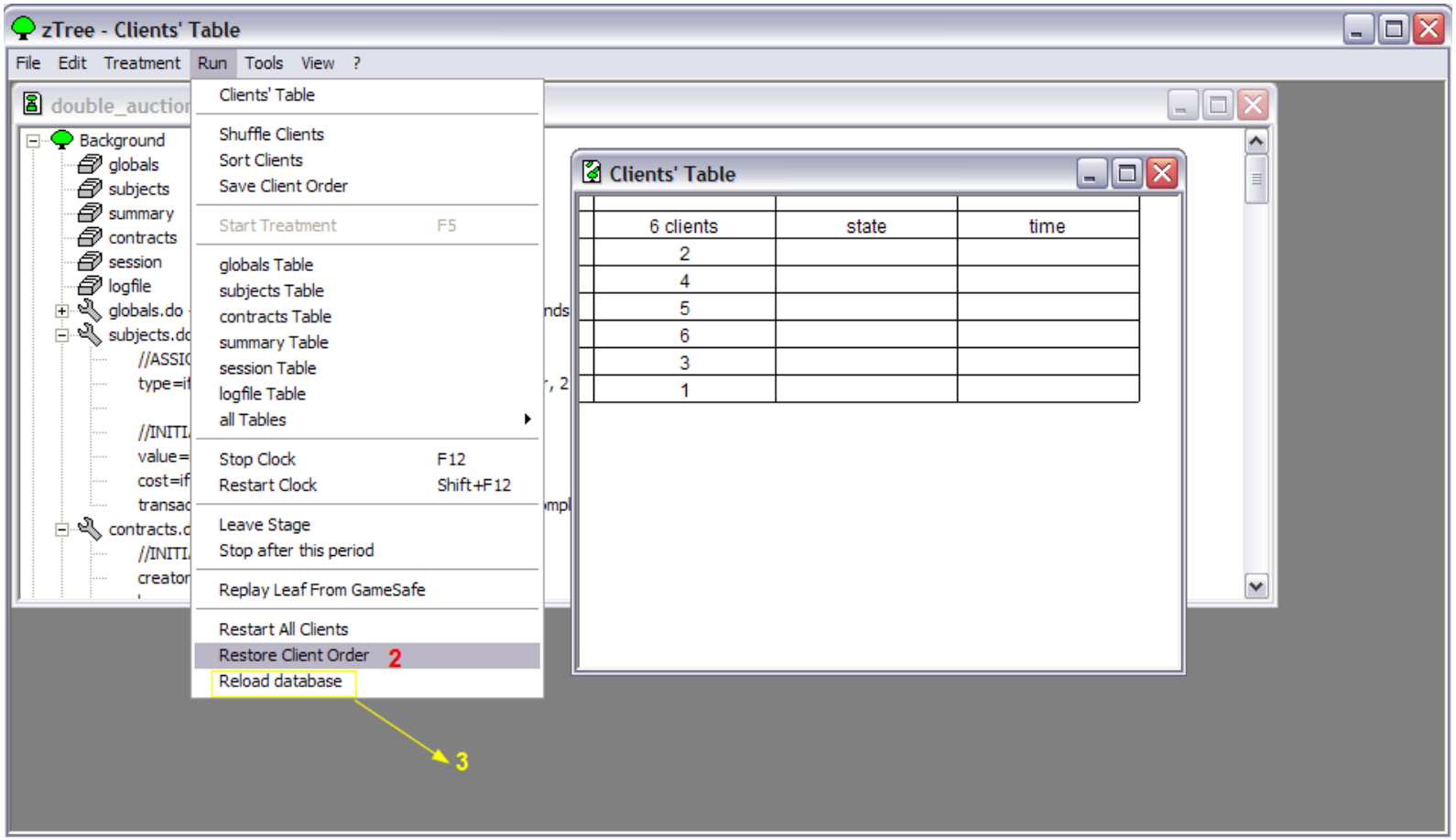
Crash of the server PC - II



Crash of the server PC - III

When you manage to restart all the clients,

- select `Run` → `Restore Client Order` (2).
- then `Run` → `Reload Database` (3).



Crash of the server PC - IV

- check **how many periods have been played** (e.g., from the subjects table)
- open the treatment that was running when the crash took place, and **set the number of practice periods to -n** (where n is the number of periods already played)
- select `Run` → `start treatment`.