
Virtual Neuroscience Lab

University of Tartu, Estonia


# VRex Toolbox

## User Guide

Version:
January 1, 2016 — VRex version 0.1 *Beta*

**Virtual Reality Experiments** (VREX) toolbox version 0.1 *Beta*. Madis Vasser, Markus Kängsepp, Murad Magomedkerimov, Kälver Kilvits, Vladislav Stafinjak, Taavi Kivisik, Raul Vicente, Jaan Aru 2016 ⓒⓘⓞ.

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**Acknowledgements**
Most of the objects you can use to furnish environments came from the Blend Swap website — www.blendswap.com. We would like to especially point out the works by Jay Hardy, and users PigArt and Cenobi.

Although the toolbox was created by the core team named above there were many others contributing to the project. We would like to thank Kristiina Kompus, Andero Uusberg and Helen Uusberg for early input; Egon Elbre and Ardi Tampuu for consulting on how to build the result database; Iiris Tuvi, Liisi Kööts-Ausmees and Kristiina Kompus for early testing; Computational Neuroscience Lab and Department of Psychology of the University of Tartu.

# Contents

# How to use this User Guide

As it is a version 0.1 *Beta*, it probably has bugs in it. We appreciate if you reported them to us via e-mail: vrex.toolbox@gmail.com. We are sorry for possible inconveniences.

You can locate the topics you are interested in from the table of contents (page 2) or from the index (page 16). The main functionality of the VREX toolbox is explained in the section starting from the main functions section (page 4). Most frequently asked questions have been answered in the FAQ section (page 12).

There is a certain styling used throughout the User Guide to make finding necessary information faster. The style is used as follows:

| | |
|---|---|
| Menu › Navigation | Menu navigation is displayed like the examples on the left and in here: Main Menu › Experiment › New |
| `C:▸Folder▸Path` | Directory paths |
| ctrl + c | Keyboard keys are displayed in square boxes. |
| BUTTONS | The buttons in text are All buttons are written in small capital letters (e.g. NEW, EDIT) |
| **labels** | Labels are formatted in bold (e.g. **name**, **TAG**) |

# 1 Main functions

VREX toolbox was designed to help non-programming psychology researchers to make experiments in 3D virtual reality settings. Memory and change blindness research was primarily kept in mind while developing the toolbox.

The main functionality of the VREX toolbox includes:

- Combining rooms to create environments
- Customizing environments by adding and modifying objects
- Combining environments to create experiments

Basic workflow might look like this (see figure 1):

1. Prepare environments
   (a) Use rooms to either autogenerate or manually build an environment.
   (b) Autofurnish or manually furnish that environment by objects.
2. Add experiment parts
   (a) Add texts or messages (e.g. instructions)
   (b) Add environments
   (c) Add tests (e.g. recognition, free recall)
3. Set the experiment structure
   (a) Group experiment parts you would like to present always in the same order using the Ordered group.
   (b) Group experiment parts you would like to present in a random order using the Randomized group.
4. Pilot and experiment

## 1.1 Environments

Main Menu > Environment

An *environment* is is used as a building block for experiments. They may be seen as experimental conditions. Each environemnt may consist of one or many rooms and may be furnished or not.

Click ENVIRONMENT button from the main menu. You can either create an environment from scratch by clicking NEW or dublicate an already existing environment using the DUPLICATE button and modifying it by clicking EDIT from the top menu.

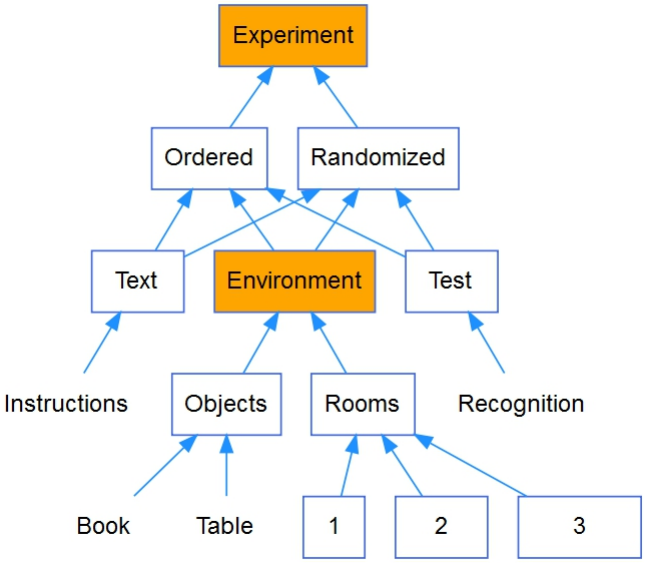


Figure 1: From building environments to experiments

### 1.1.1 Create environments from scratch

Main Menu > Environment > New > Build

Click ENVIRONMENT button from the main menu. Then click NEW from the top panel, then BUILD.

You can now AUTOGENERATE the setting of rooms or combine rooms manually. For autogeneration of rooms — just specify the number of rooms and objects using a slider, then click BUILD to autogenerate the setting of rooms and FURNISH to put the objects in place. Click the BUILD and FURNISH until you are satisfied with the result. You can also insert or modify the objects later using the environment editor.

It is possible to connect the rooms manually one by one by clicking the MANUAL button. You can:

- Select a room type using number keys [1], [2] and [3].
- Move rooms from door to door using arrow keys [↑] [←] [↓] [→] or [W] [A] [S] [D] keys.
- Rotate rooms using [R] and [T].

When you have found a satisfactory solution click SAVE to give your environment a **name** that will remind you of the environment and a **tag** which will be used in files and folders.

### 1.1.2 Create environments from templates

Main Menu > Environment > New > Template

Click ENVIRONMENT button from the main menu. Then click NEW from the top panel. Choose a **name** that will remind you of the environment and a **tag** to which will be used in files and folders. Then select an environment from the existing templates and click CREATE. You can furnish the created environment using the environment editor.

### 1.1.3 Create environments using existing environments

Main Menu > Environment > Duplicate > Edit 3D

Click ENVIRONMENT button from the main menu. Then select an environment you would like to duplicate and click DUPLICATE. After giving the dublicate a new **name** and a **tag** you continue to modify it for your needs using the **environment editor** by clicking the EDIT 3D button.

### 1.1.4 Envrionment editor

Main Menu > Environment > Edit 3D

Environment editor allows you to customize an environment. You can **add**, **remove** and **modify** objects.

#### Basics

1. Getting help inside the toolbox
   (a) Move a mouse over a nearby [?] button.
   (b) or, click HELP from the top panel.
2. Looking and moving around in the Environment Editor
   (a) Click and hold Left Mouse Button (LMB) to look around.
   (b) Click and hold Right Mouse Button (RMB) to move around.
3. Select/deselect an object
   (a) Select by clicking LMB on an object
   (b) or, click SHOW from the left side panel, then click on an object on the list
   (c) Deselect by clicking RMB
4. Move an object
   (a) Use arrow keys [↑] [←] [↓] [→] or [W] [A] [S] [D] to move
   (b) Use [Q] or [PgDn] to sink and [E] or [PgUp] to lift an object.
   (c) Use [R] or [T] to rotate.
   (d) Use [ctrl]+[R] or [ctrl]+[T] for smooth rotation.
   (e) or, use the position, rotation and scale sections of the right side of the object panel.

#### Adding objects to environments

1. Enter the environment editor.
2. Click **Add** on from the left side panel.
3. Click on the object you would like to add (e.g. StartPoint — place where player starts in an environment).
4. Modify the parameters of the added object from the right side panel.

### Modify and delete objects

1. Enter the environment editor.
2. Click **Show** on from the left side panel.
3. Click on the object you would like to modify or delete.
4. Click Objects » Delete or del key on your keyboard to delete the selected object.
5. Modify the parameters of an object using the panel on the right.

### Change object color

Environment Editor » Select Object » Object Panel » Color

1. Enter the environment editor.
2. Click on an object whose color you want to change.
3. Select a new color for an object from the color matrix from the right side panel.
4. Additional color options can be accessed by clicking the + button.
5. See the section about adding effects to change the color of the object during experiments.

### Add effects to objects

Environment Editor » Select Object » Object Panel » Effect

**Effects** are changes that take place while the object is out of the field of view of the subject. allow to take advantage of the controlled virtual reality environment.

1. Enter the environment editor.
2. Click SHOW on from the left side panel.
3. Click on the object to which you would like to add an effect.
4. Click Scroll down the right side panel to the effects section and choose an effect.
   (a) **No effect**.
   (b) **Flicker** — Makes the object disappear and appear.
   (c) **Color** — Makes the object color change between the color specified under the object color and the color specified under the effect section.
   (d) **Position** — Makes the object position change between the position specified under the object position and the position specified under the effect section.
5. Set the minimum time between changes. There is no time restriction by default.

## 1.2 Experiments

Main Menu > Experiment

Experiments are made up of *texts*, *environments* and *tests*. **Texts** are messages (e.g. instructions) which are displayed to the participant in an empty room. **Environments** consist of one or many rooms and with or without objects in it. Several different means of **testing** (e.g. recognition, free recall) can be used to test what does the participant remember after going through the environment. The environment structure is specified by groups **ordered** and **randomized**.

See the environments section for further details about how to create new and modify already existing environments. Environments can usually be seen as experimental conditions.

### 1.2.1 Create experiments from scratch

Main Menu > Experiment > New

1. Click EXPERIMENT from the main menu.
2. Click NEW from the top panel.
3. Enter a **name** and a **tag** (max 8 characters and numbers) for your experiment.
4. Click SAVE.
5. Continue by setting the experiment structure.

### 1.2.2 Create experiments using existing experiments

Main Menu > Experiment > Duplicate > Edit

1. Click EXPERIMENT from the main menu.
2. Click DUPLICATE from the top panel.
3. Enter a **name** and a **tag** for your experiment.
4. Click SAVE.
5. Continue by setting the experiment structure.

### 1.2.3 Set the experiment structure

Main Menu > Experiment > New
Main Menu > Experiment > Duplicate > Edit

1. Start a new or modify an existing experiment.
2. From **Experiment details** scroll down to the **Experiment structure**
3. Group all parts you want to display in a specific order using ordered groups.
4. Group all parts you want to display in a randomized order using randomized groups.

5. Add texts (e.g. instructions, end of experiment message)
6. Add environments
7. Add tests (e.g. recognition, change blindness test)
8. Repeat previous stages if necessary.

### Present environments in fixed order

Experiment structure » Add » Ordered group

1. Click on the group where you would like to add an **ordered** group.
2. Click Experiment structure » New » Ordered group.
3. Select the added Ordered group and add **texts**, **environments** and **tests** you prefer.

### Present environments in random order

Experiment structure » Add » Randomized group

1. Click on the group where you would like to add a **randomized** group).
2. Click Experiment structure » New » Randomized group.
3. Select the added Randomized group and add **texts**, **environments** and **tests** you prefer.

### Adding texts to experiments

Experiment structure » Add » Text

1. Click on the group where you would like to add the instruction message (i.e. **experiment**, an existing **ordered** or **randomized** group).
2. Click Experiment structure » New » Text and type in the instructions.

### Adding environments to experiments

Experiment structure » Add » Environment

1. Click on the group where you would like to add environments (i.e. **experiment**, an existing **ordered** or **randomized** group).
2. Click Experiment structure » New » Environment
3. Select environments for you expreiment by clicking on them in the order you would like them to be presented.
4. If you want the environments to be presented in a random order then select the the **randomized order** option. The environments will then be presented in a randomized order.

### Adding tests to experiments

Experiment structure » Add » Test

You only need to add tests for **Memory** experiments. **Change blindness** experiments have the testing built into them.

1. Click on the group where you would like to add a test (i.e. **experiment**, an existing **ordered** or **randomized** group).
2. Click Experiment structure » New » Test
3. Select a testing method.
   (a) **Recognition — Field**. Forced-choice conditon where objects from the environment(s) are presented on a field together with distractors experimentator has selected. Subjects task is to find all objects that were presented to him/her and select them.
   (b) **Recognition — Yes/No**. Free-choice condition where objects from the environment(s) are presented one at a time in a random order together with the distractors you have selected. Subjects task is to indicate which objects he/she has seen before.
   (c) **Free recall — Keyboard**. Subject needs to type in the answer.
   (d) **Free recall — Microphone**. Subject needs to tell the answer to a microphone.
   (e) **Cued recall**. Will be added with next versions.
4. Select an environment(s) to be tested.

# 2 Troubleshooting

## 2.1 Problems with the order of environments

Please read the paragraphs about the experiment structure, ordered environments and randomized environments first. If you want to present environments in a random order, then you should select the **randomize order** option when you add or edit environments. Adding **environment groups** to a **randomized group** will not randomize the environments inside the environment group. It will only randomize the order of each group, text and test.

# 3 FAQ

## 3.1 How to set the player starting point in environments?

Environment Editor > Objects > Add > StartPoint

1. Enter the environment editor.
2. Add an object **StartPoint**.
3. Place it where you want it.

## 3.2 Why is there a name and a tag for experiments and environments?

**Name** is a mnemonic name you give for your environements and experiments to easily distinguish it inside the program. But it would be too long to be used in files and folders. **Tags** with a maximum length of 8 characters and numbers are used there instead.

## 3.3 Can I change the color of the walls?

No, the VREX version 0.1 *Beta* does not support changing the color of walls. See the section about changing the color and adding effects to objects.

## 3.4 Can I use modify rooms after the environment has been created?

No, the VREX version 0.1 *Beta* does not support modifying the rooms after the environment has been created. You can only modify how rooms connect to each other while creating an environment from scratch.

Although you can not modify the rooms after they have been created, you can modify what objects are in the environment using the environment editor.

## 3.5 What data are collected during experiments?

VREX logs experiment flow to be exported later for data analysis. The log file is saved onto the local hard drive. It is not shared with anyone else without your permission. There are several things in VREX 0.1 *Beta* that are logged, but easy export is not yet supported. We are working on supporting more ways to export the data in upcoming versions. The following data are collected:

1. Experiment details
   (a) Experiment tag
   (b) Experiment starting time
   (c) Experiment type
   (d) Structure of an experiment
2. Subject ID

3. Environments and test results
   (a) Environment tag
   (b) Order among other environments
   (c) Test type for this environment
   (d) Objects in an environment
4. Results
   (a) Change blindness experiment
      i. Score (1 for a correct answer, 0 for a false answer)
      ii. Number of changes before subjects chose an answer (i.e. +1 for both disappearing and appearing of an object)
      iii. Target object (e.g. object that changed)
      iv. Subject's choice (e.g. object the subject chose)
      v. Time it took to make a choice
   (b) Memory experiment — Recognition
      i. Score — number of correct answeres. Left empty if the environment was not tested.
      ii. Number of objects in an environment
      iii. Number of distractors in a test
      iv. Time it took to complete the test
      v. Necessities for analysis based on signal detection theory (SDT) — number of hits, false alarms, correct rejections, misses
   (c) Memory experiment — Free recall (* — keyboard only)
      i. Score — left empty
      ii. Subject's answer*
5. Coordinates of subjects in each environment
6. Camera angles of subjects in each environment

## 3.6 How to report bugs?

We appreciate it when you report any failures or errors you encounter when using the toolbox. Just send us an e-mail to vrex.toolbox@gmail.com. Please include:

- "Bug Report" as a title
- Where did it happen (e.g. main menu, environment editor, experiment structure)
- What were you doing right before (e.g. clicked Main Menu > Experiments > New, pressed ctrl+c)
- What happened

## 3.7 Can I propose additional functionality to the VRex toolbox?

Yes, we appreciate if you share what functionality should be added to the VREX toolbox. Just send us an e-mail to vrex.toolbox@gmail.com. Please include:

- "Functionality" as a title
- Description of the proposed functionality
- Why would it be particularly useful?

## 3.8 How to contribute to the VRex project?

You can help to improve the VREX toolbox mainly by:

- Reporting bugs (see page 13)
- Proposing additional functionality (see page 14)
- Promoting the use of VREX toolbox for research
- Promoting VREX development as a possibility for bachelor and master thesis in computer science, psychology and related fields
- Joining the developers team

You can join the developers team or find specific topics for bachelor and master theses by contacting us via e-mail (vrex.toolbox@gmail.com).

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# 4 Further help

Additional information can be found visiting our homepage or writing us an e-mail.

Homepage: http://vrex.mozello.com/
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