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Abstract:	This will be the first release of the Platform, available for use by members of the HBP Consortium. The Platform will include brain models, brain-to-robot (BIBI) transfer functions, a Closed Loop Engine, a World Simulation Engine, and the "Neurorobotics web cockpit" featuring the Experiment Simulation Engine.		
Keywords:	Neurorobotics, virtual experiment, virtual room, braitenberg vehicle, brain models, neurobot		

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1. The Aim of this Document

This document provides the information needed to access the Neurorobotics Platform v1 - preliminary release for internal Consortium use (Deliverable D10.4.3, Milestone 194). This release is called internally the First Internal Release (FIR), and will be referred to as such later on.

2. How to Access the HBP Neurorobotics Platform

2.1 Immediate Access:

The current v1 Platforms are a preliminary release for internal Consortium use. A username and password is required to access them, and this is also true for the Neurorobotics Platform. Users must be accredited by EPFL to access the internal network via Virtual Private Network (VPN). For accreditation and HBP username requests, please contact neurorobotics@humanbrainproject.eu. For information on how to set up your VPN access, please refer to <http://epnet.epfl.ch/Remote-Internet-Access>.

There is direct access to the Platform via a dedicated server: <http://bbpce011.epfl.ch>.

2.2 Access via the HBP Collaboratory:

All HBP Platforms will be accessible via the HBP Collaboratory (formerly Unified Portal).

Collaboratory: <https://collab.humanbrainproject.eu/#/collab/>

MIP on the Collaboratory: <https://collab.humanbrainproject.eu/#/collab/71/nav/405>

Access to the Collaboratory requires a login account. To request an account, please go to <https://services.humanbrainproject.eu/oidc/account/request>

3. Platform User Instructions

The user manuals for the Neurorobotics Platform are available online at the following address:

<https://developer.humanbrainproject.eu/docs/projects/Neurorobotics%20Platform/0.1/index.html>

You must be connected to the EPFL network to access this server.

4. Help and User Feedback

Everything users need to start using the Platform quickly should be found in the online user manual mentioned above. If users need further help, please contact: neurorobotics@humanbrainproject.eu.

To provide user feedback, a web survey form is available from the Neurorobotics homepage. Alternatively, you can send us an email. We are particularly interested in feature requests and ideas for scientific applications, such as new virtual experiments, brain manipulation capabilities and transfer functions. To report a bug, please use the web bug reporting form that is available from the Neurorobotics homepage.

When reporting a bug, users should provide precise version numbers (accessible from within the application), browser and OS versions, and a detailed description of steps that led to the failure.



5. Annexes

Annex 1: Tools & Features Available in this Platform Release

Annex 2: Screenshots of Tools & Features Available in this Platform Release

Annex 3: Scientific Key Performance Indicators



Annex 1: Tools & Features Available in this Platform Release

Tool / Feature	Responsible	Milestone / Remarks	Keywords	Available at	Description/Screenshot
Robot Designer and Brain Interfaces and Body Integrator	WP10.5 Paul LEVI	MS297	Internal release (alpha release)	http://bbpce011.epfl.ch	Robot Designer Brain Interfaces and Body Integrator
Environment Designer and Experiment Designer	WP10.6 Paul LEVI	MS301	Internal release (alpha release)	http://bbpce011.epfl.ch	Environment Designer Experiment Designer
Closed-Loop Engine, World Simulation Engine and Experiment Simulation Viewer	WP10.7 Paul LEVI	MS305	Internal release (alpha release)	http://bbpce011.epfl.ch	Experiment Simulation Viewer Display Wall Experiment Simulation Viewer Web Browser

In this First Internal Release, we provide an extensive version of the Experiment Simulation Viewer in the web cockpit (Neurorobotics Platform). We also have a complete Experiment Simulation Viewer working on the Display Wall in Geneva. Users can actually conduct experiments on a tablet using the web version, and visualise them on the Display Wall.

For all this to work, we provide on our servers a quasi-complete World Simulation Engine component, a minimal Brain Interfaces & Body Integrator, a Nest brain model, and a functional Closed Loop Engine that makes everything run synchronously at a rate of approximately 10 ms loop cycle time.

The designers: Robot, Environment and Experiment designers are in a minimal form for now, as we are using a combination of off-the-shelf tools and scripts for these features. Details about the status of each component are presented on the components' pages, accessible from the Neurorobotics Platform's homepage.



Annex 2: Screenshots of Tools & Features Available in this Platform Release

Robot Designer - Screenshot

Robot Designer

The Robot Designer development will start soon.

The Robot Designer will allow a user to easily set up a virtual robot for a given simulated experiment. The word "easily" is here very important since the user may be a neuroscientist, and unfamiliar with robotics details. The robot shall be integrated into an environment later on.

In the first version of the Robot Designer, to be completed at the end of the ramp-up phase, the Designer will provide the user with pre-assembled robots from a "robot library", or from imported files for quick customisation.

The team is currently implementing two robots for the platform: The Clearpath Husky robot and a biologically inspired mouse model. The Husky is a realistic model of a mobile robot distributed by a company called Clearpath. It will therefore be a good demonstrator for the transition from simulated to physical robotics experiments, which are planned for the FPA phase of HBP. The mouse model caters to the needs of neuroscientists and the plans to run behavioural experiments in simulation.

Meanwhile...

The neurorobotics platform is built on top of [Gazebo](#). Any robots created for Gazebo is therefore compatible with the platform. Gazebo uses the SDF format. If you want your robots to be available, you need to upload the corresponding SDF file(s) and assets through the portal document browser. In order for it to be recognised by the platform, the main sdf file needs to be edited:

- The content type should be changed to **nrp/robot**
- A custom attribute **nrpDescription** with a string containing the description of the robot needs to be added.
- A custom attribute **nrpName** with a string containing the name of the robot needs to be added.
- An optional attribute **thumbnail** with the **uuid** to an image uploaded to the portal representing the robot can be added.

The husky robot main file (model.sdf) properties:

Edit file

Name model.sdf

Description file's description

Content's type nrp/robot

External URI external URI to file
(optional) if this parameter is specified the file will be treated as external and you won't be able to upload content to it.

User defined properties:

nrpDescription This robot is a 4-wheeled outdoor robot designed

thumbnail 36980a02-c2d4-4f93-835a-139ca1ea340e

nrpName Clearpath Husky Robot

Add attributes



Brain Interfaces and Body Integrator - Screenshot



Brain Interfaces & Body Integrator

The Brain Interfaces & Body Integrator development will start soon.

One of the biggest challenges for neurorobotics experiments is the coupling between brain models and the various sensors and effectors of a robot. In the Neurorobotics Platform, this task is solved by the Brain Interfaces and Body Integrator (BIBI). The Brain Interfaces & Body Integrator (BIBI) will let the user choose a brain simulator and a brain model to run on it, and then it will let the user connect it to a virtual robot. These connections are then used during the simulation to transfer data from the sensors of the virtual robot to the desired parts of the brain model and from the brain model back to the actuators of the virtual robot.

BIBI is used to specify the connections between brain model and robot during design time. During the simulation, the Closed-Loop Engine is responsible for transferring the respective data between brain simulation engine (e.g. NETSIM) and the World Simulation Engine. So-called transfer functions offer the user a programmatic framework to transform the data that is exchanged between brain and robot model (see SP 10 specification document). For example, transfer functions are the way to translate spikes and current coming from a neural simulation into the physical signals for robot servo-motors or activation signals for abstract muscle models.

Meanwhile...

The first neural simulator that the platform will support is NEST () . The platform will support PyNN () as another way to write your simulation scripts. You can start writing these scripts.

The transfer functions describe how spikes from the neuronal simulation are to be translated into commands for a robot and how the sensor data from the robot should be translated back to spikes. This translation is specified by the users of the Neurorobotics project, which are neuroscientists. Thus, a framework is provided to make the specification of these transfer functions as easy as possible for the users and abstracting away as much as possible technical details. This framework is referred to as Transfer Functions framework (TF framework).

Here is a python example of a transfer function. The package NeuroboticsFramework can be installed via `pip install --pre -i http://bbpsrv19.epfl.ch:9090/simple python-cle`.

```
1 __author__ = 'GeorgHinkel'
2
3 import NeuroboticsFramework as nrp
4 from husky import Husky
5
6 # Transfer functions may in general have some state
7 # in this case, we reserve memory for a global double variable
8 right_arm_v = 0
9
10 # The annotation Neuron2Robot registers this function as a transfer function
11 # As the parameter neuron0 is not explicitly mapped, the framework will assume a mapping
12 # to the neuron with the GID neuron0
13 # The structure of the imported Husky module is generated from the robot model
14 @nrp.Neuron2Robot(Husky.RightArm.pose)
15 def right_arm(t, neuron0):
16     global right_arm_v
17     if neuron0:
18         right_arm_v = 1
19     else:
20         right_arm_v /= 2
21     return right_arm_v
```



Environment Designer - Screenshot

Environment Designer

The Environment Designer development will start soon.

The Environment Designer will allow users to design virtual environments for interactions with simulated robots in the context of virtual experiments. The user can either refer to a library of pre-build parts and design primitives, or design new objects by specifying their appearance and their physical properties.

Meanwhile...

The neurorobotics platform is built on top of [Gazebo](#). Any environment created for Gazebo (and made of simple primitive or Collada objects) is therefore compatible with the platform. Gazebo uses the SDF format. If you want your environments to be available, you need to upload the corresponding SDF file(s) and assets through the portal document browser ([show](#)). In order for it to be recognised by the platform, the main sdf file needs to be edited:

- The content type should be changed to **nrp/environment**
- A custom attribute **nrpDescription** with a string containing the description of the environment needs to be added.
- A custom attribute **nrpName** with a string containing the name of the environment needs to be added.
- An optional attribute **thumbnail** with the uid to an image uploaded to the portal representing the environment can be added.

The virtual room environment main file (virtual_room.sdf) properties:

Edit file

Name	virtual_room.sdf
Description	file's description
Content's type	nrp/environment
External URI	external URI to file <small>(optional) If this parameter is specified the file will be treated as external and you won't be able to upload content to it.</small>

User defined properties

nrpDescription	The Virtual Room is a 3D model of a virtual extensi	✕
thumbnail	1441211f-bf84-47cd-8b64-f8b60e98118b	✕
nrpName	Virtual Room	✕

[Add attributes](#)



Experiment Designer - Screenshot

Experiment Designer

The Experiment Designer development will start soon.

The Experiment Designer will offer a graphical interface to design a whole experiment:


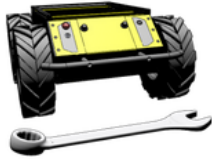
- choose a robot
- choose an environment
- choose a brain
- choose/edit a bibi brain-robot mapping scheme
- define start and stop conditions for experiment as well as timeout and loop cycle times
- create events, define user interaction possibilities
- design a time sequence diagram and plan experiment

Meanwhile...

The existing experiments have been predefined by us. The brain, robot, environment have been put together statically in the experiment description files on our servers. Still, if you go to the Experiment Simulation Viewer page, you will be presented a list of predefined experiments, which means that you have the choice among different combinations of brains/robots/environelements.

In the near future, you will be able to choose this combination by yourself through a page that should resemble the one hereunder.

New neurorobotics experiment

<p>Environment ⚠ Select one !</p> <p>The robot will evolve in the selected environment. An environment consists in a SDF file.</p> 	<p>Robot ⚠ Select one !</p> <p>The robot model to use along with the brain. A robot consists in a SDF file.</p> 
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Experiment Simulation Viewer Display Wall- Screenshot

The Experiment Simulation Viewer - Display Wall

The Experiment Simulation Viewer - Display Wall development is in good progress.

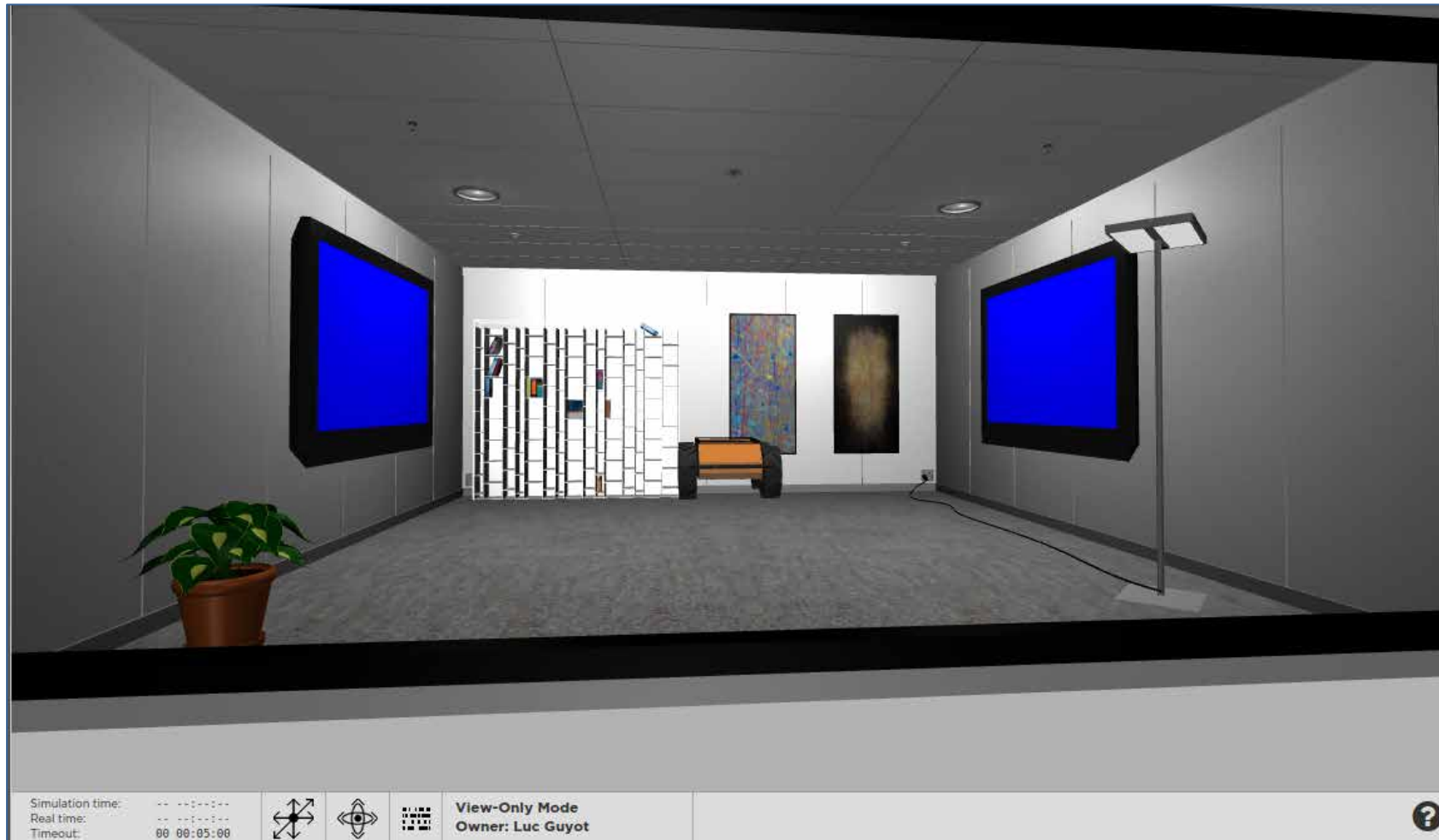
The first version could be started with the following procedure:

```
5 cd /nfs4/bbp.epfl.ch/user/peppicel/public/
6 source setup-gzserver.sh
7 export GAZEBO_MASTER_URI=http://bbpca030.epfl.ch:11345
8
9 # Start ESVRender
10 cd ESVRender/build/bin
11 ./ESVRenderDemo --eq-client --eq-listen bbplxviz04.epfl.ch:1234
12
13
14 # Connect to the vizcluster / worker process
15 ssh bbplxvizuser@bbplxviz04
16 # Load Gazebo
17 cd /nfs4/bbp.epfl.ch/user/peppicel/public/
18 source setup-gzserver.sh
19 export GAZEBO_MASTER_URI=http://bbpca030.epfl.ch:11345
20
21 # Start ESVRender
22 cd ESVRender/build/bin
23 ./ESVRenderDemo --eq-config
24 ../../apps/ESVRenderDemo/Configs/LausanneDisplayWall/displaywall-direct-nodes3and4-without-
25 local,eqc --ini-cfg
```





Experiment Simulation Viewer Web Browser - Screenshot





Annex 3: Scientific Key Performance Indicators

Scientific Key Performance Indicators (SKPIs) are available from the HBP Science and Technology Office. [View them here.](#)