# Modeling “Spatial Purport of Perceptual Experience”: Egocentric Space Perception in a Semi-Realistic 3D Virtual Environment

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## Introduction

Space perception in human (and mammalian) brain is realized by two primary neural systems: **egocentric** and **allocentric**, with differing functions, representations, mechanisms, and relevant neural regions. Studies have mainly focused on the allocentric system (e.g., Moser et al., 2008), leaving aside – or taking for granted – issues surrounding egocentric system and the relations between the two (see e.g., Filimon, 2015).

One notable exception comes from the work by Rick Grush, who has provided a developed computational model of egocentric space perception, building on existing accounts of the operation of the posterior parietal cortex (e.g., Pouget et al., 2002) and his “emulation theory of representation” (Grush, 2004), a predecessor of increasingly popular predictive approaches to cognition (in the form of e.g., predictive processing, see Hohwy, 2020).

The **“skill theory v2.0”** (Grush, 2007) describes how emulation performed over multimodal sensory inputs and motor skills should give rise to the phenomenal experience of egocentric space, what Grush calls “**spatial purport of perceptual experience**”. Spatial purport is best understood in terms of an **embodied and embedded agent’s experience of distance, direction, and self-location, which enable and are enabled by the agent’s ability to act** (Rorot, 2020).

## The question

### How to simulate phenomenal qualities of egocentric space perception?

Figure 1. ViZDoom – 3D, vision only, based on game DOOM

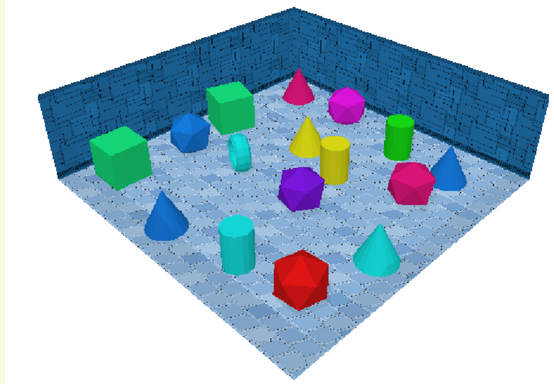

Figure 2. PyBullet Arm-in-a-room – 3D, vision and proprioceptive inputs, simple robot arm simulation

## More

https://wiktor.rorot.pl/blog/SPP-2021.html

## References

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## Simulating experience?

Grush’s “skill theory” remains a theoretical posit, which has not been tested thus far.

First, Grush has not provided a clear definition of “spatial purport”, which would allow for operationalizing the notion and experimenting with – or simulating – his model. I have attempted to provide a definition previously (Rorot, 2020), only to highlight the second issue**: spatial purport refers to phenomenal, qualitative, and ephemeral components of experience**. To attempt at simulating Grush’s model, we need to develop a framework or a benchmark for phenomenal qualities (of space).

Such a framework needs to meet the following requirements:

1. embodied and embedded agent with first person sensory experience;
2. complex 3D environment with objects to perceive and interact with;
3. the agent has some stakes in the skillful performance of a task;
4. evaluating internal representation and/or behavioral outputs.

For example, conditions 1-3 can be easily implemented in ViZDoom (Wydmuch et al., 2018), while condition 4 is realized by simulations by Laflaquière and Garcia Ortiz (2019).

Combining this work could provide a framework for simulating spatial purport of perceptual experience.