Supplemental Material: Visual Constraint Optimization Network

Pallavi Mishra, Sébastien Hélie

February 2020

1 Novel Stimuli

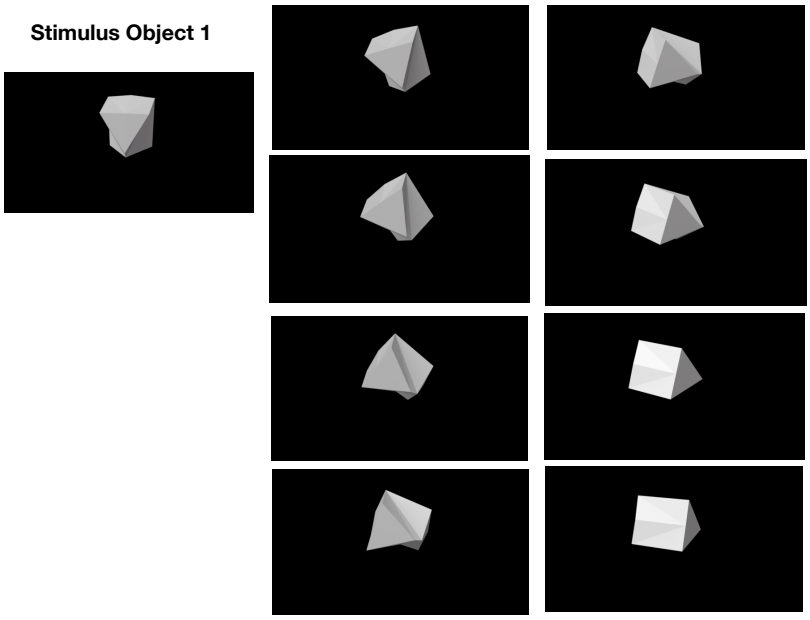
The shape perception experiment requires subjects to consistently identify objects presented from more than one viewing angle. For a reliable test of consistent 3D perception from different viewing angles, it was necessary that subjects used no previous knowledge about the shape but only the information presented to them in the experiment. Therefore, a set of novel and unfamiliar stimuli were constructed for the purpose of testing reliable shape perception in the experiment.

3D perceptual representation is reliable in case of structured 3D objects but not in the case of unstructured objects. Shape constancy from novel views can only be achieved if structured novel objects obey some regularity constraint (such as symmetry). Therefore all the novel shapes were constructed so that they had a pronounced regular structure for unique shape perception. These stimulus objects displayed mirror symmetry along one axis only.

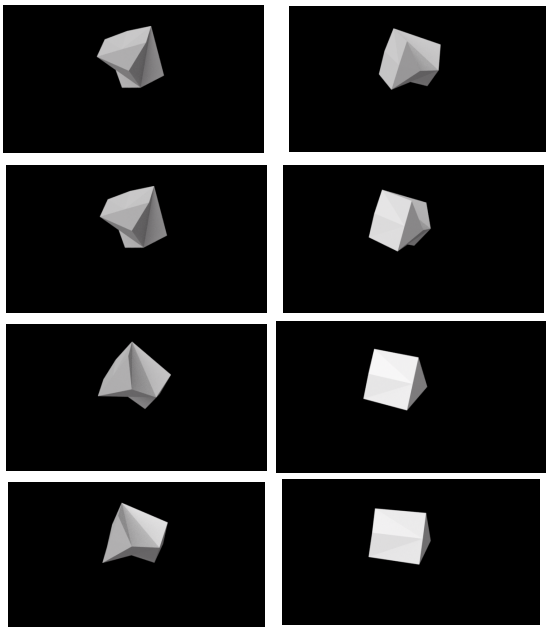
The selection of these specific shapes was based on the results from several iterations of pilot versions of the experiment. It was observed that without any regularity in the stimuli, there was no consistent shape recovery as measured by our previous experiment. Some examples of objects in the pilot test that failed to be recovered above chance level are shown in Section 2.

It was observed from the pilot tests that objects with fewer number of vertices were more difficult to recover. Based on this finding, sufficiently complex but regular and novel set of shapes were created. These set of shapes were then divided into Blocks based on their level of complexity for the final version of the experiment. The set of stimuli used for training and testing the model and those used to test human subjects were the same. This requirement was imposed in order to make direct comparison between the performance of the model and the experiment outcome.

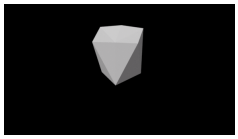
Each of the novel, unfamiliar and structured stimuli objects are presented in this section.

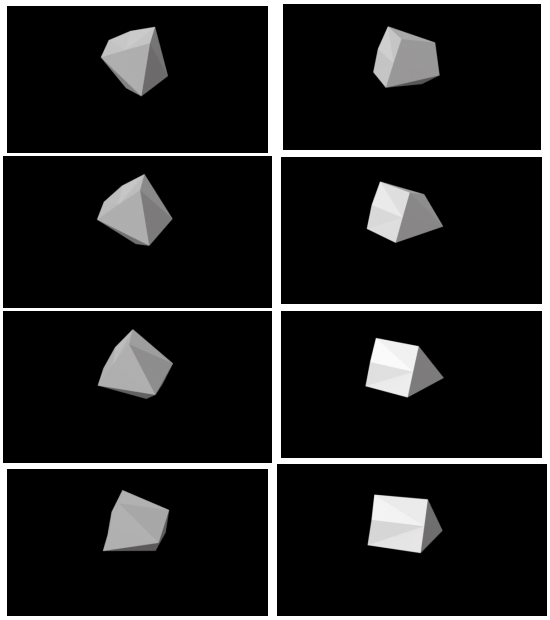

Stimulus Object 1

Stimulus Object 2

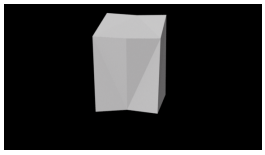


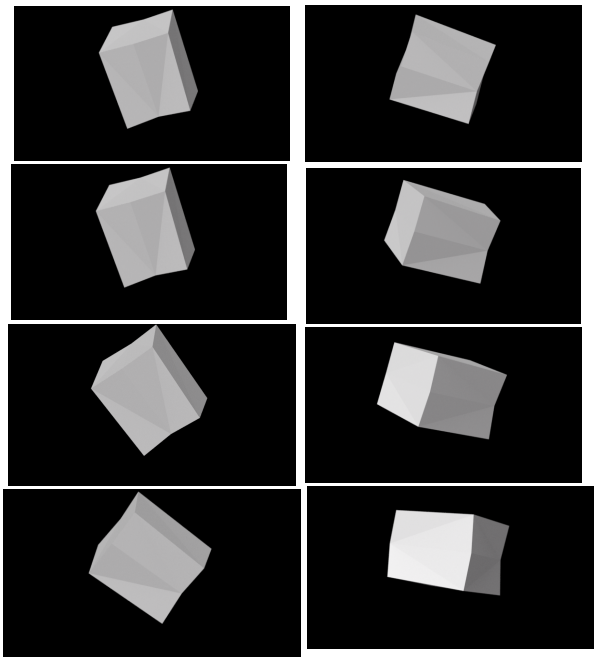
Stimulus Object 3



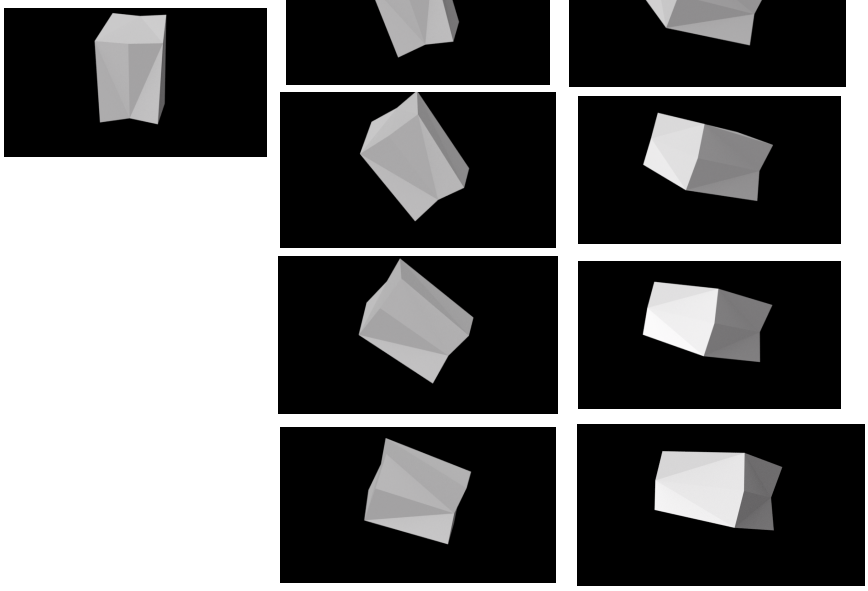


Stimulus Object 4

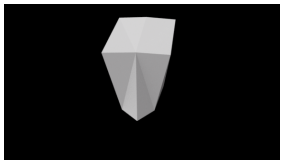


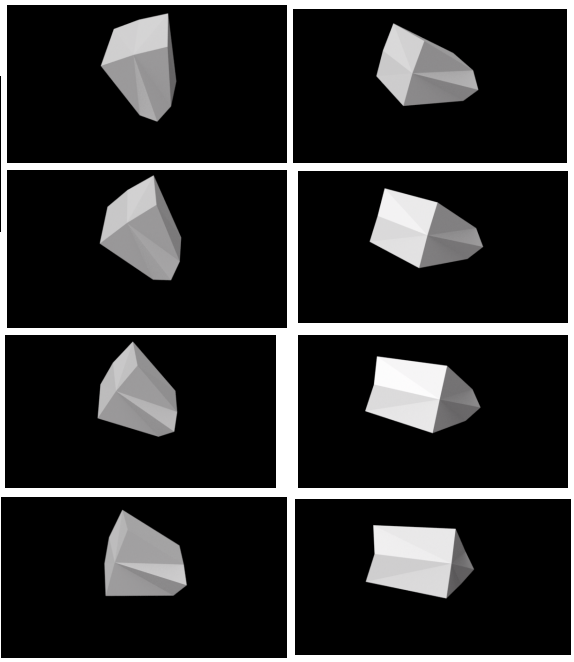


Stimulus Object 5

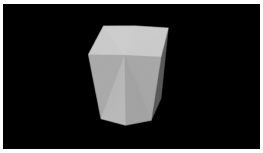


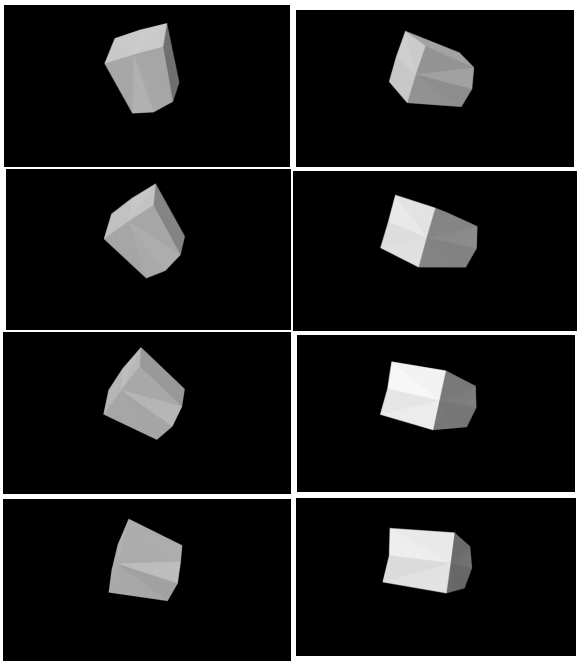
Stimulus Object 6



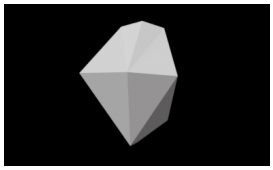


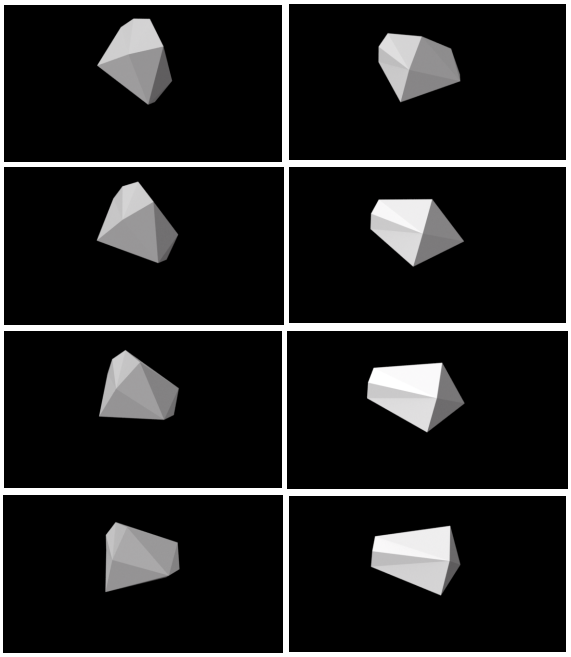
Stimulus Object 7



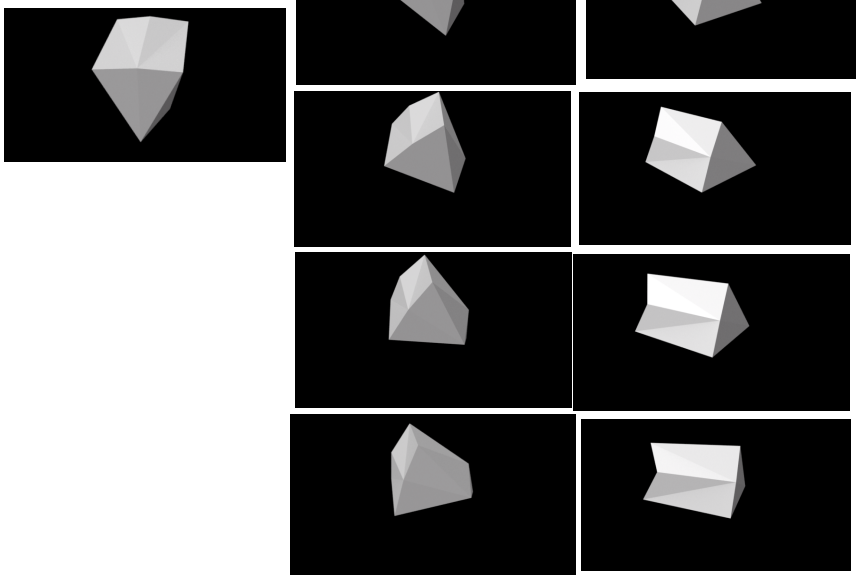


Stimulus Object 8

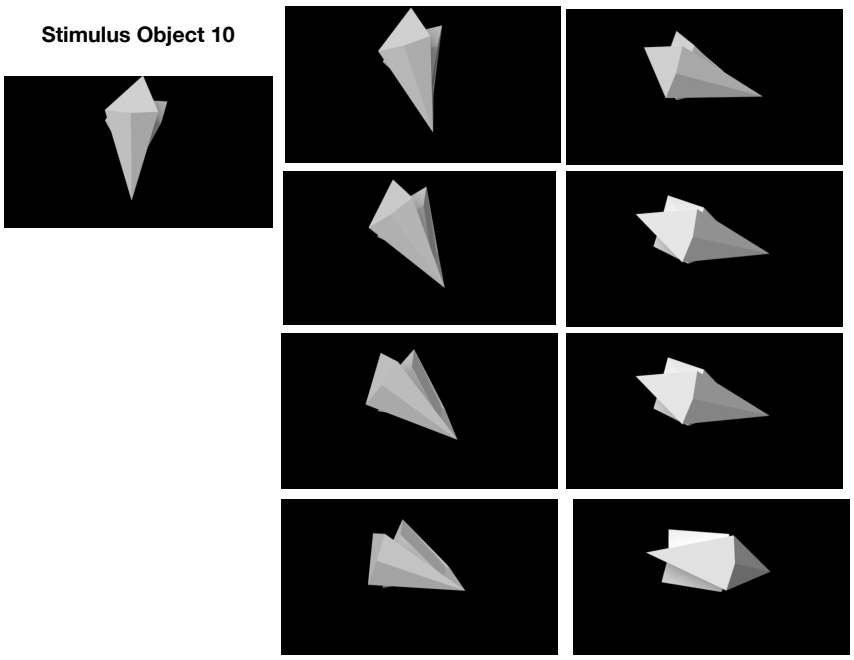




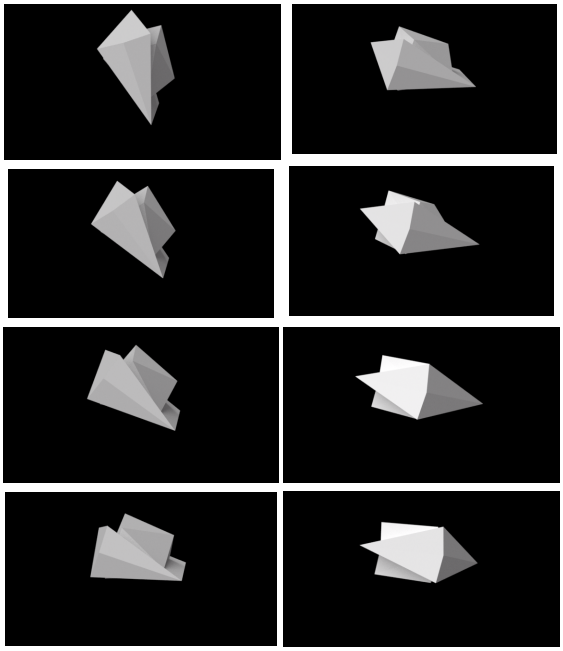
Stimulus Object 9



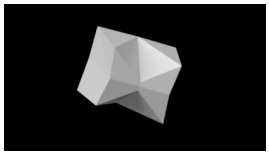
Stimulus Object 10

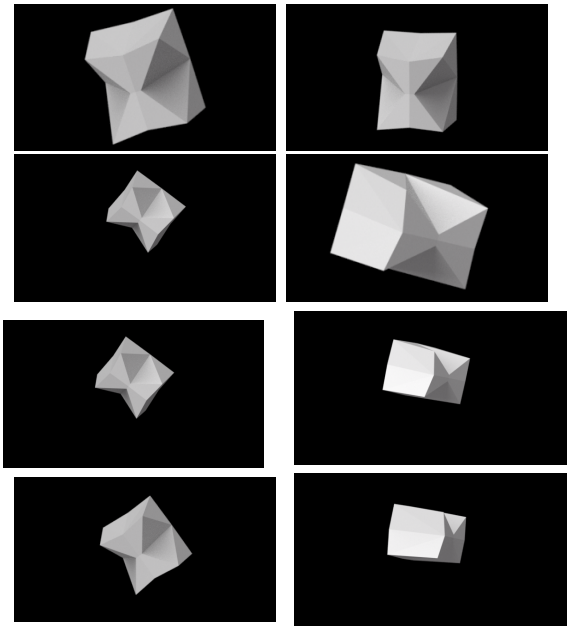


Stimulus Object 11

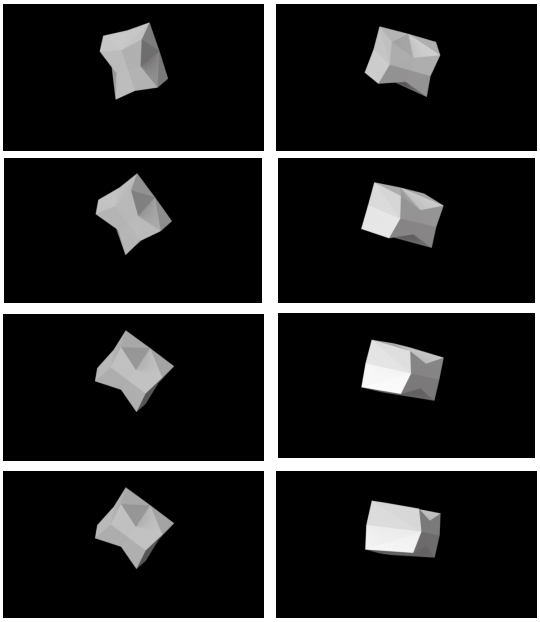


Stimulus Object 12





Stimulus Object 13



2 Stimuli from Pilot Versions of Experiment

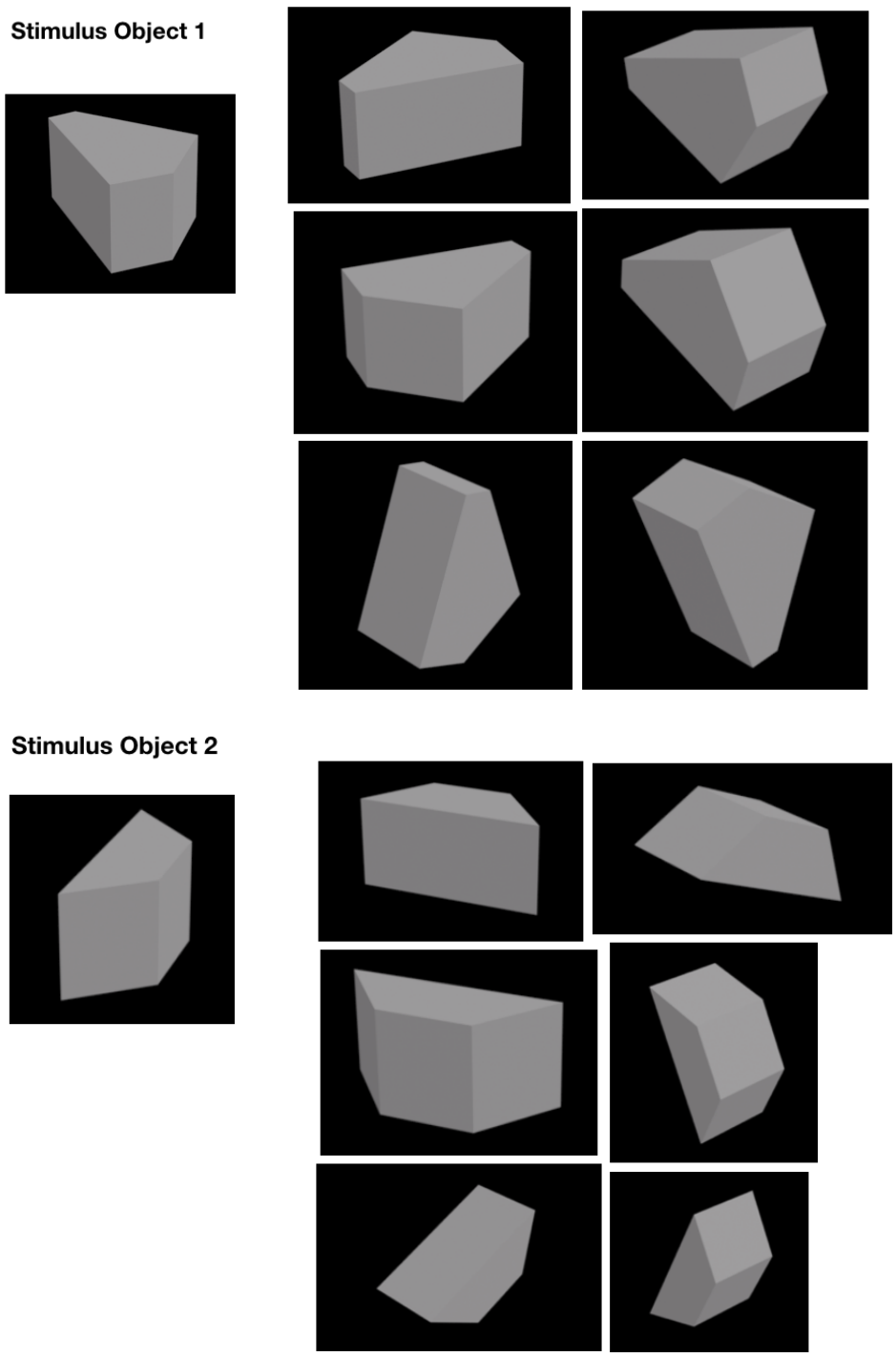


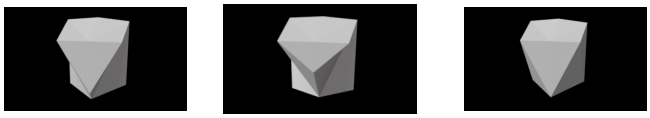
Figure 1: Stimulus objects lacking regularity and enough complexity failed to be consistently recovered during the pilot versions of our experiment. Complexity is related to the number of vertices and faces in the object. Objects with eight vertices were not recovered consistently during pilot tests.

3 Experiment Results

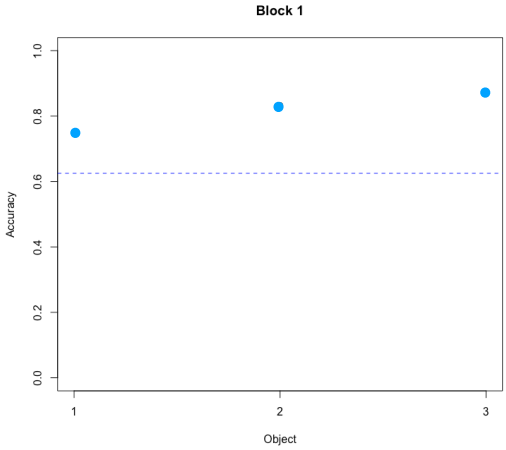
3.1 Block-wise Task Performance by Subjects

For each of the blocks, the accuracy of response for all objects is presented in this section.

Block 1

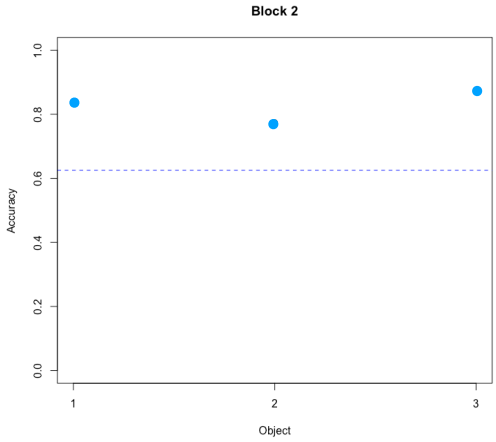


Object 1 Object 2 Object 3

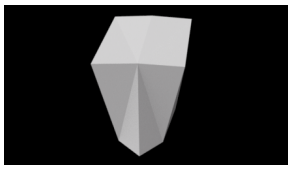


Block 2

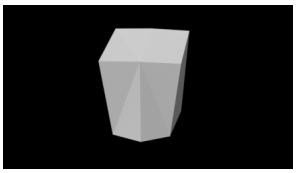
Object 1 Object 2 Object 3



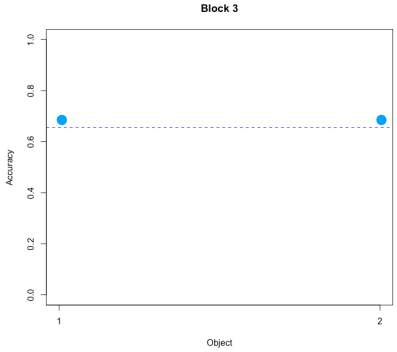
Block 3



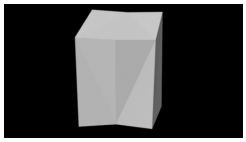
Object 1



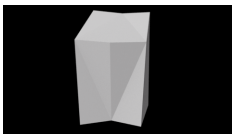
Object 2



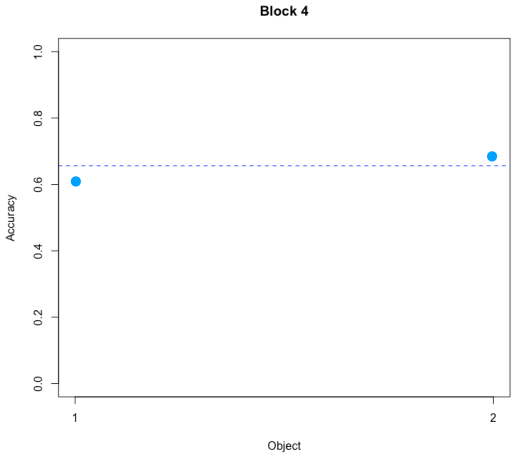
Block 4



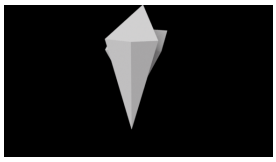
Object 1



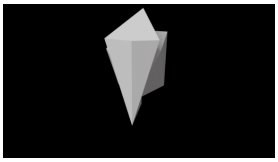
Object 2



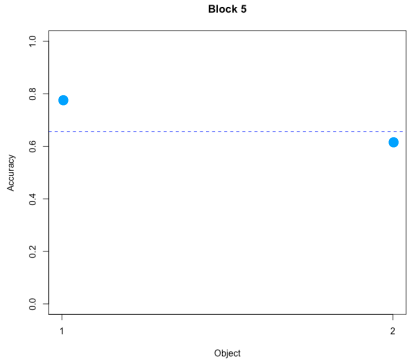
Block 5



Object 1

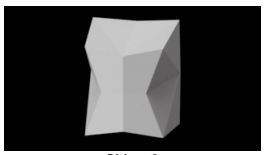


Object 2

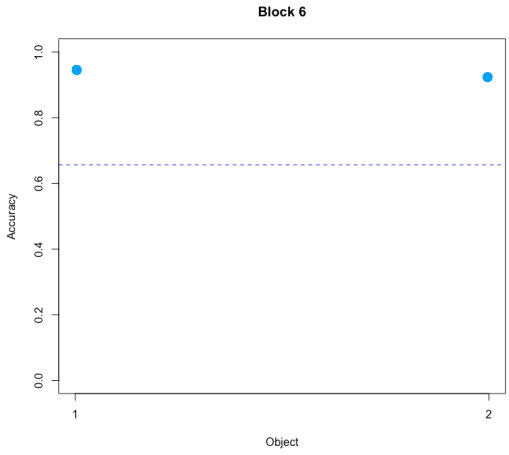


Block 6

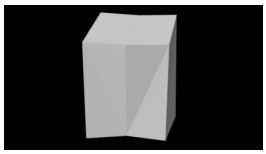
Object 1



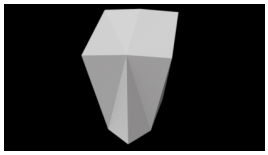
Object 2



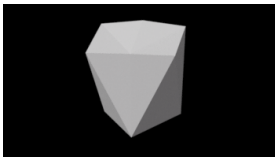
Block 7



Object 1



Object 2



Object 3