Multidimensional 3D Visual Stimuli:

Quaddle Generator

Developer’s Manual

VERSION HISTORY

[Provide information on how the development and distribution of the Operations and Maintenance Manual was controlled and tracked. Use the table below to provide the version number, the author implementing the version, the date of the version, the name of the person approving the version, the date that particular version was approved, and a brief description of the reason for creating the revised version.]

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| **Version #** | **Implemented**  **By** | **Revision**  **Date** | **Approved**  **By** | **Approval**  **Date** | **Reason** |
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**UP Template Version:** 12/31/08

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# Introduction

## Purpose

Quaddle2.0 is an open-source software program designed to help researchers in the field of cognitive science create and manipulate a wide range of stimuli for use in their studies. Developed using Blender, the popular 3D modeling software, Quaddle2.0 allows researchers to create complex, multi-dimensional stimuli that can be easily exported to a variety of file formats, including PNG and FBX. The program is designed to be intuitive and user-friendly, making it accessible even to researchers who may not have extensive experience with 3D modeling software. The program includes a wide range of features that allow users to manipulate and customize their stimuli, including the ability to adjust the shape, size, and color of objects, as well as the ability to add textures and other visual effects. The program can be used with a variety of other research tools, including Unity, Psychopy, and Psychtoolbox, making it easy to integrate into existing research workflows. With over 1.5 billion potential stimuli variations, researchers can use Quaddle2.0 to create a wide range of different stimuli for use in their studies, including visual, auditory, and tactile stimuli.

## Audience

Primary audiences for Quaddle would include researchers in psychology, neuroscience and cognitive science fields. However, it also caters to a broad audience range, given its features and potential use-cases.

# System Description

Quaddle2.0, being developed with Blender, boasts a high level of system compatibility. This software can be utilized on any operating system capable of supporting the Blender environment, including MacOS, Windows and Linux. It is important to note that the actual performance may depend on the specifications of the individual system, including aspects like RAM, GPU, and CPU capabilities, which are integral for running resource-intensive applications like 3D modeling software.

# Application Installation

## First-Time Users

For the first time users, installation can be very simple.

1. Download Blender app from their website: <https://www.blender.org/download/>
2. Download Quaddle Generator with Assets folder from GitHub: <https://github.com/xwen1765/blender-quaddle>
3. Save files in a new folder and store folder path: *<path>*
4. Turn on Blender app, open makeQuaddle.blend file.

## A screenshot of a computer Description automatically generated

1. In Edit-> Preference-> File Paths change following two paths

A screenshot of a computer

Description automatically generated

1. In Edit->Preference->Add-ons, search for Extra Object and check Add Mesh: Extra Objects. This will provide more object options.

# A screenshot of a computer Description automatically generated

# System Usage

## Instructions

Basic Quaddle has following dimensions allow you to change:

A chart of different shapes and colors

Description automatically generated

You can create Quaddle manually in Blender or call a function to parse an Object Table containing parameters for each dimension.

A screenshot of a computer

Description automatically generated

## Generate in Blender

To manually run the script in Blender, open all the scripts in the folder by click Open Text in the text editor. Find *parser.py* and click Run Script next to it.

A screen shot of a computer

Description automatically generated

A screenshot of a computer

Description automatically generated

And you can change the parameters for each dimension at the end of parser.py script.

A computer screen with text

Description automatically generated

## Generate using Command Line Tool

One of the most powerful ways to connect Blender with your workflow is by running Blender outside of its GUI. This allows you to automate tasks, integrate Blender into your existing workflow, and use Blender as a rendering engine. One example of this is connecting Quaddle Generator to your MATLAB workflow. By doing so, you can generate stimuli without the need for a graphical interface, streamlining the process and making it more efficient.

You simply need to add following lines and change paths to match your device:

%% MATLAB Code

export\_png = 'True';

export\_fbx = 'True';

blender\_path = '/Applications/Blender.app/Contents/MacOS/Blender';

% Change this to your Blender path

blender\_file\_path = '/Users/wenxuan/Documents/Blender/makeQuaddle.blend';

python\_script = '/Users/wenxuan/Documents/Blender/parser.py';

% Change this to your Python script path

input\_path = [pwd '/' iBlockDefPath '/StimuliConfig'];

output\_path = [pwd '/' iBlockDefPath];

command = sprintf('"%s" --background "%s" --python "%s" -- --input\_path "%s" --output\_path "%s" --export\_fbx "%s" --export\_png "%s"', blender\_path, blender\_file\_path, python\_script, input\_path, output\_path, export\_fbx, export\_png);

system(command);

The *input\_path* is the path to the folder storing Object Table files. You can easily create these files and integrate Quaddle generation in your workflow.

## Quaddle Output

Blender, the platform upon which Quaddle2.0 is built, provides an extensive array of file format support given its capacity as a 3D modeling tool. At present, Quaddle2.0 specifically enables the exportation of 3D models in the FBX format, as well as the generation of PNG image files.

However, the flexibility of Quaddle2.0 allows users to manually choose different file formats if needed. To set a different export format, users can navigate through the application menu: select 'File', then choose 'Export'. This will provide a selection of available formats to export your model or image.

A screenshot of a computer

Description automatically generated

When saving your work as an FBX file in Quaddle2.0, note that the textures applied to the 3D model are stored separately in a subfolder. To ensure these textures load correctly when using the FBX file in different software, it's essential to keep the FBX file and its corresponding texture folder together in the same destination folder. This will enable seamless and accurate rendering of your 3D model across various applications.

## Conventions and Error Messages

[Enter information describing specific system rules, error messages, and their associated definition or provide a reference to where it is stored.]

# Dimension Specification

## Body and Head

## Textures: Color, Pattern, Fractals

## Arm, Ear and Beak

APPENDIX A: REFERENCES

[Insert the name, version number, description, and physical location of any documents referenced in this document. Add rows to the table as necessary.]

The following table summarizes the documents referenced in this document.

|  |  |  |
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| **Document Name and Version** | **Description** | **Location** |
| *<Document Name and Version Number>* | *[Provide description of the document]* | *<URL or Network path where document is located>* |

APPENDIX B: KEY TERMS

*[Insert terms and definitions used in this document]*

The following table provides definitions for terms relevant to this document.

|  |  |
| --- | --- |
| **Term** | **Definition** |
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