**Old MonkeyLogic (Oct 2014 version)**

**Comparison between the old MonkeyLogic and NIMH MonkeyLogic**

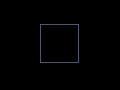
● The old MonkeyLogic (ML) depends on the legacy interface of MATLAB Data Acquisition (DAQ) Toolbox.

→ MATLAB DAQ Toolbox does not read out new data samples as frequently as necessary for near-realtime behavior monitoring. To work around this problem, the old ML requires two DAQ devices.

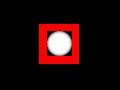
→ The legacy DAQ interface is available only in the 32-bit MATLAB and therefore the old ML cannot run on the 64-bit version. This has been a major obstacle to running ML in the up-to-date computing environment, because the latest MATLAB (R2016a or later) does not provide the 32-bit version any more.

● Graphics in the old ML are based on XGL Graphics Library, which was written for Window XP ten years ago. (<http://svi.cps.utexas.edu/software.shtml>)

→ XGL supports only one monitor, so the objects are presented normally on the subject screen but drawn in diagrammatic form on the control screen.

  
**Subject screen Control screen**

→ Transparent graphics are not supported in the old ML. As shown in the example below, the unpainted background of the white fixation point occludes the red square in the back.



**NIMH MonkeyLogic (Feb 17, 2017)**

● NIMH ML uses an in-house developed DAQ Toolbox (NIMH DAQ Toolbox) that is compatible with MATLAB’s toolbox and supports both 32-bit and 64-bit versions.

→ NIMH DAQ Toolbox fetches new samples whenever requested, so there is no need of additional DAQ hardware. This allows users to save the cost for MATLAB DAQ Toolbox ($997 as of Mar 2015) and the duplicate DAQ device (>$1,000 in a typical NIMH setup).

→ NIMH DAQ Toolbox enables not only NIMH ML but also the old ML to run on the 64-bit MATLAB, which ensures the availability of ML on the latest computing environment and hence continuity of research.

● NIMH ML uses a new graphics library, MonkeyLogic Graphics Library (MGL), which is written for ML with 3D APIs.

→ MGL displays the same scene on both subject screen and control screen (“what you see is what your monkey sees”).

   
**Subject screen Control screen**

→ In NIMH ML, the red square is not occluded by the unpainted part of the white circle. MGL supports transparent images by both alpha blending (PNG format) and color keying.



→ To play movie stimuli, the old ML requires loading all the frames into memory beforehand, which practically limits the playable length of movies to a few tens of seconds.

● The old ML does not support hardware acceleration in audio, so the latency in sound output is relatively longer (typically a few hundred milliseconds, but it varies depending on the system performance).

● Touchscreen is not supported in the old ML.

● The old ML requires MATLAB Image Processing Toolbox ($997/copy as of Mar 2015) to run its eye calibration tool.

● The old ML needs two monitors and DAQ hardware even when running in the simulation mode for testing.

● The old ML supports only one single line of output for reward triggering. This limits the type of reward devices that we can use.

→ MGL supports movie streaming. There is no limit in the movie length that NIMH ML can play.

● NIMH ML supports low-latency audio output (as short at 25 msec in private tests), using Microsoft XAudio2 APIs.

● NIMH ML supports mouse/touchscreen input as well as USB-type joysticks. (Some touchscreens that do not translate touches into mouse messages are not compatible.)

● NIMH ML provides a new calibration method that does not require Image Processing Toolbox.

● NIMH ML can be run with just one monitor and it does not require a DAQ device in the simulation mode. There is no need to go to the lab just to test new tasks.

● NIMH ML allows users to assign multiple digital lines for reward and easily customize the reward function so that multi-channel reward devices can be used.