

# Supplement to *Natural experimentation: Active learning in dynamic physical microworlds*: Physics simulator setup

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June 16, 2017

We used a standard open source 2-D physics simulator [Box2D](#). Source code is available at [github.com/erincatto/Box2D](https://github.com/erincatto/Box2D). The simulator is written in C but to integrate it with our psiturk Experimental interface, we used a javascript port ([box2d-js.sourceforge.net](http://box2d-js.sourceforge.net)) of a flash port (<http://box2dflash.sourceforge.net/>) of the original engine.

Demo code for our Experiments is available [here](#). After landing at this locations, right click to view the source code.

Table 1 details the settings for the physics simulator used in our experiments<sup>1,2</sup>:

Table 1: Physics simulator settings

Property	Setting
Number of steps (frames)	2700
Trial length	Experiment 1: 45s, Experiment 2: 30s
Update step size	1/60s ( $\approx 17ms$ )
Ratio (pixels to meters)	100
Object velocity cap	30 m/s
Criterion for refreshing objects (Exp 1 <i>passive</i> )	Fastest object moving $< 0.25$ m/s
Pause on refresh (Exp 1 <i>passive</i> )	500ms
World width	6m (600 pixels)
World height	4m (400 pixels)
Global forces	None
Attractive forces	$+3$ m/s <sup>2</sup>
Repulsive forces	$-3$ m/s <sup>2</sup>
Controlled object attraction to cursor	$.2 \times \text{distance}(\text{cursor}, \text{controlled object})$ m/s <sup>2</sup>
Controlled object damping	10
Puck masses	1kg (or 2kg for heavy target ball)
Puck friction	.05
Puck elasticity	.98
Puck damping	.05
Puck radius	.25 m
Puck object types	Dynamic
Wall mass	n/a
Wall friction	.05
Wall elasticity	.98
Wall damping	n/a
Wall width	.2m
Wall object types	Static

<sup>1</sup>Damping in Box2D slows objects while they are not in contact with any other objects (like wind resistance). The controlled object was given high damping so it would not oscillate for a long time the cursor location.

<sup>2</sup>Friction in Box2D occurs when two objects slide past each other while touching (e.g. a puck sliding along a boundary wall).