



Orientation Discrimination: Lesson 4

In this lesson, you will learn how to:

- define a stimulus onset asynchrony using a timeline event,
- control the blending of a stimulus with previously drawn stimuli through OpenGL hardware acceleration.

This lesson assumes you have been through [Lesson 1](#) of this tutorial and became familiar with adding and inspecting the various types of events.

Difficulty: 1/5

Duration: 15 mn

SPATIAL & TEMPORAL CONTEXTUAL EFFECTS

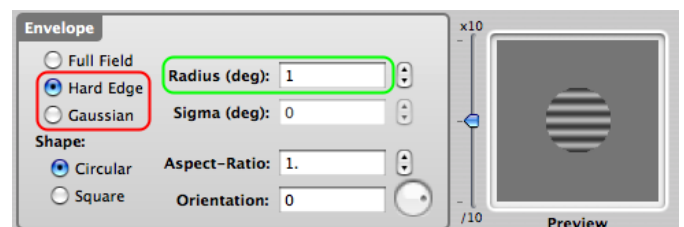
This lesson makes the basic orientation discrimination task more elaborate by displaying a surrounding stimulus to investigate both spatial and temporal contextual effects.

First, duplicate the original experiment, rename the copy **Orientation Discrimination 4**, and move it to the top of the **Designer** table. Reveal its whole hierarchy by option-clicking on its arrow.

Step 1: Creating a Center-Surround Stimulus

Rename the **Gabor** stimulus to **Center**. Edit the **Center** stimulus properties to change the envelope shape from **Gaussian** to **Hard Edge**. Set its radius to **1** deg.

Click on the **OK** button to validate the changes.





Create a new stimulus just above the **Center** stimulus. Set its sub-category to **Visual Stimulus/Grating** and name it **Surround**. You may also simply duplicate the **Center** stimulus and edit its copy.

Edit the properties of the **Surround** stimulus as follows:

Select the **Grating** tab if necessary. Set the carrier type to **Grating** with a **Sinusoidal** profile.

Set the envelope to **Hard Edge** and its radius to **3 deg** (this must be larger than the radius used for the **Center** stimulus).

The spatial frequency, phase, and orientation of the **Surround** carrier are the properties that are likely to modulate the contextual effects on the orientation discrimination for the **Center** stimulus. For example, the cross-orientation effect could be investigated by leaving the **Surround** orientation at **0 deg** if the **Center** orientation varies close to **90 deg**.

Click on the **OK** button to validate the changes.

Title	Category	Settings	Lock
ψ Orientation Discrimination 4	Experiment	⌵	🔒
Staircase	Method	⌵	🔒
2IFC	Procedure	⌵	🔒
Surround	Visual Stimulus	⌵	🔒
Center	Visual Stimulus	⌵	🔒
ψ Orientation Discrimination 3	Experiment	⌵	🔒
ψ Orientation Discrimination 2	Experiment	⌵	🔒
ψ Orientation Discrimination	Experiment	⌵	🔒
Storage		⌵	
Trash		⌵	

Examples Shape **Grating** Checkerboard Custom Ishihara

Common Properties

Position (deg): x 0.0 y 0.0
Cartesian →
Duration (s): 0.5

Color Space
R 1.0 G 1.0 B 1.0
Achrom... → Contrast 50 %

Carrier Grating +

Square-Wave Sinusoidal
Frequency (cpd): 0.5 Orientation (deg): 0
Phase (deg): 0

Envelope

Full Field Hard Edge Gaussian
Radius (deg): 3 Sigma (deg): 0
Shape: Circular Square
Aspect-Ratio: 1 Orientation: 0

Preview

Step 2: Adding a Timeline Event

Create a **Timeline** event inside the **2IFC** event as you did in **Orientation Discrimination Lesson 2**. Move the two stimuli (**Surround** and **Center**) inside the **Timeline**, so they appear indented, as illustrated; they can be selected together and then dragged & dropped onto the **Timeline**.

Title	Category	Settings	Lock
ψ Orientation Discrimination 4	Experiment	⌵	🔒
Staircase	Method	⌵	🔒
2IFC	Procedure	⌵	🔒
Timeline	Composed Stimuli	⌵	🔒
Surround	Visual Stimulus	⌵	🔒
Center	Visual Stimulus	⌵	🔒
ψ Orientation Discrimination 3	Experiment	⌵	🔒
ψ Orientation Discrimination 2	Experiment	⌵	🔒
ψ Orientation Discrimination	Experiment	⌵	🔒
Storage		⌵	
Trash		⌵	



Edit the properties of the **Timeline** event (select the **Timeline** tab if needed).

The next step is to reduce the duration of the **Center** stimulus and introduce an **SOA** (stimulus onset asynchrony) between the **Surround** and the **Center**.

#	Events	Onset	To	Timeline
0	Surround	SOA	NA	500 ms
1	Center	SOA	NA	500 ms

Select the **Center** entry in the timeline table and change its duration to **0.250** seconds.

#	Events	Onset	To	Timeline
0	Surround	SOA	NA	500 ms
1	Center	SOA	NA	250 ms

Set the **Onset** of the **Center** stimulus to **0.125** seconds (this is automatically rounded to the frame duration, for example 0.117 seconds for a 60Hz display), its **Onset** column to **SOA**, and its **to** column to **0: Surround**.

#	Events	Onset	To	Timeline
0	Surround	SOA	NA	500 ms
1	Center	SOA	0: Surround	117 ms 250 ms

The **Center** timeline is now split in two, with the red zone corresponding to the **SOA** period relative to the **Surround** onset.

Click on the **OK** button to validate the changes.



Step 3: Blending the Center & Surround

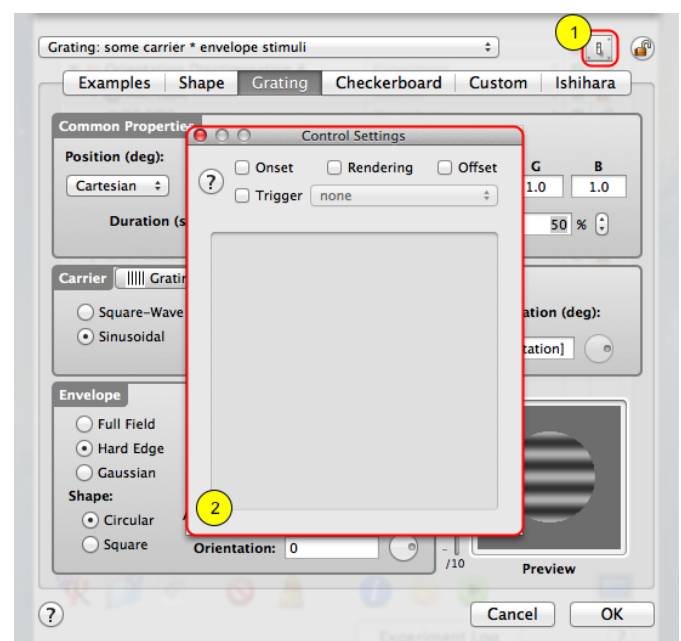
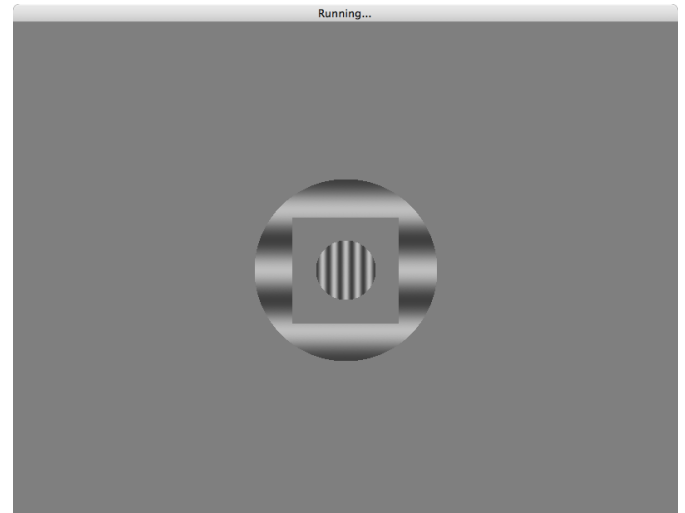
If you ran the experiment as it is defined now, the presentation would look as shown above: a **Center** stimulus inscribed in a gray square superimposed onto the **Surround** stimulus. This is because stimuli are generated on an empty square array regardless of the geometry of their content.

The gray surrounding in the **Center** stimulus should be made transparent so the **Surround** stimulus is only occluded by the circular part of the central grating.

The gray surrounding of the **Center** stimulus can be made transparent using OpenGL blending.

To specify the blending options, edit the **Center** properties and click on the small switch icon (1) in the top right-hand corner of the panel. This opens a palette entitled **Control Settings** (2) which provides further settings for various aspects of the stimuli presentation.

This palette allows you to fine-tune how stimuli are rendered by the OpenGL engine during onset, offset, and rendering times. Initially, this palette displays an empty box with unchecked buttons above it.





To modify the way the stimulus is composed with the previously displayed stimuli, check the **Rendering** box.

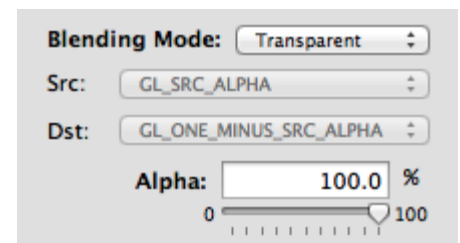
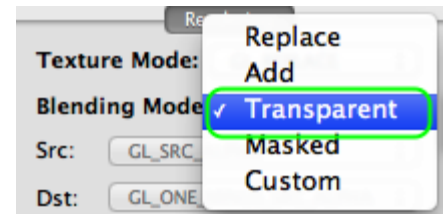
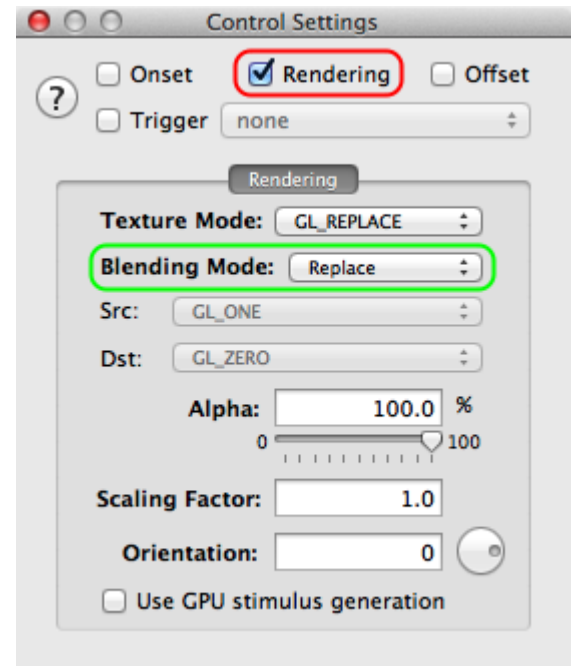
The **Rendering** settings consist of the following:

- Texture mode
- Blending mode that specifies the composing operation (**Replace** by default)
- Source (the current stimulus) and destination (the already drawn stimuli) factors
- Transparency level
- Scaling and orientation to be applied on the fly by the graphics hardware.

Note that all these operations are performed by the graphics hardware and are consequently extremely fast.

Select the **Transparent** option from the blending mode pop-up menu.

The source and destination factors are automatically set to values that implement the transparency for the gray part of the stimulus.

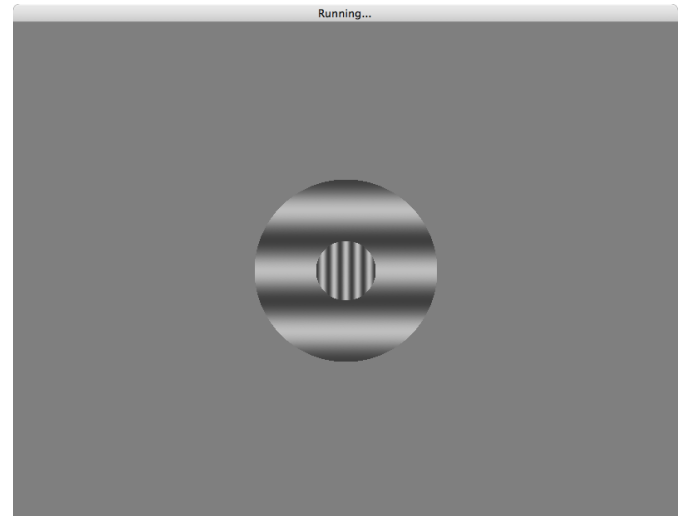




Click on the **OK** button to validate the changes (this also closes the **Control Settings** palette).

Check & run the Experiment!

Shown above is what is produced with the OpenGL transparent blending set for the **Center** stimulus.



Conclusion

In this lesson you learned how to create an SOA between stimuli and properly combine stimuli using OpenGL blending capabilities.

In the last lesson, you will learn how to add motion & dynamics through the use of a 1st-order drifting Gabor ([Lesson 5](#)).

If you are interested in further exploring contextual effects on orientation discrimination, you may try to extend this lesson by investigating the effects of various contextual parameters, such as surround contrast, size, orientation or spatial frequency, . In that case, make sure to go through [Lesson 2](#) of this tutorial as it shows how to configure different experimental conditions and run interleaved staircase methods.