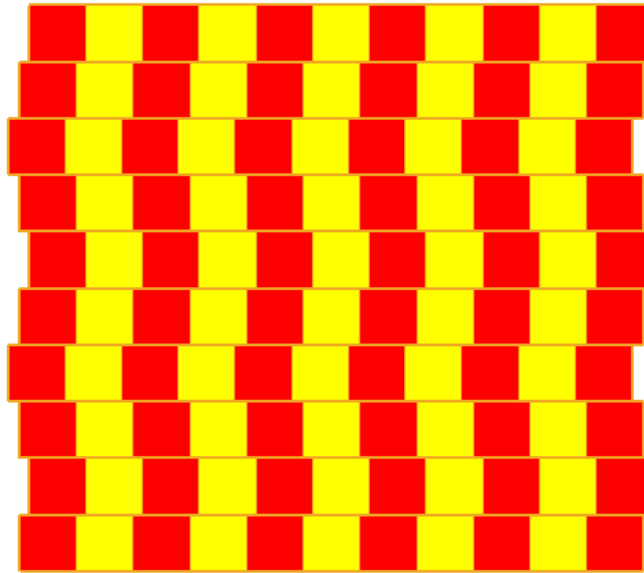# Parallel Lines? in SketchUp

Look at the orange lines between the rows of red and yellow squares. Are they parallel?

Of course you know they are, but they sure don't look parallel. This project shows how to make this eye-confusing model.

For this project, it helps to have some basic knowledge of SketchUp (though detailed instructions are provided). In particular, it's important to know how to zoom and pan the view. If you need more information on how to get started, and a description of some basic tools, please read 3DVinci's Getting Started Guide (PDF).
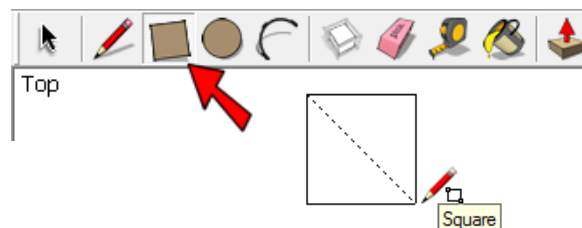
PC users: go to http://www.3dvinci.net/SketchUp_Intro_PC.pdf.
*Mac users: go to http://www.3dvinci.net/SketchUp_Intro_MAC.pdf.*

1. Start a new SketchUp file and make sure you're in **Top** view (**Camera / Standard Views / Top**).

2. Activate the **Rectangle** tool and draw a square. (Be sure to click the second point only when you see the "Square" popup.)

3. To make the first row, we need to copy the square. Start by activating **Select**, and click the square face to select it.
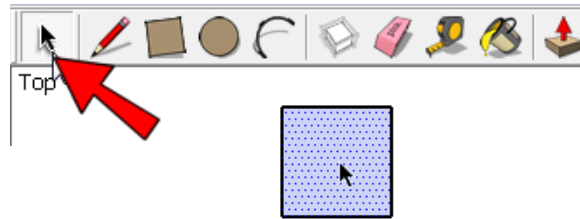
4. Then activate **Move** and press the Ctrl key (PC) or Option key (Mac) to make a copy. (Don't keep this key pressed, just tap it once to add the "plus" sign to the cursor.) Click the two move points shown below to place a copy of the square immediately to the right of the original.
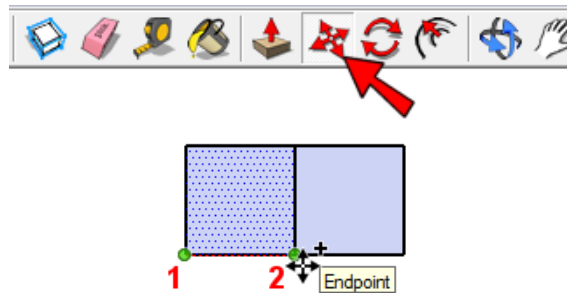
5. Just after the first copy is made, type 10x, which appears in the **Length** field in the lower right corner. (Don't click inside this field, just type and the numbers will appear). Press Enter, and you should have 10 copies of the square, for 11 total.
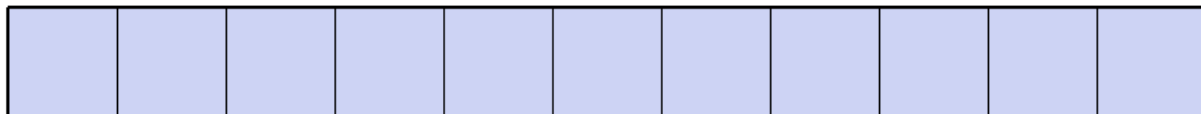
6. Click the **Paint Bucket** tool and paint the squares alternating red and yellow (use these colors for now - you can use your own colors after you're done with this example).
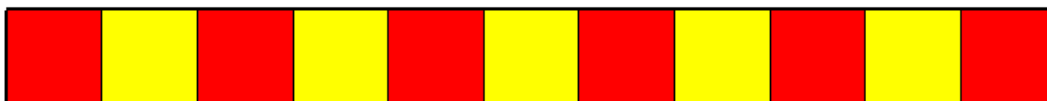
7. To make this entire row into a single object (making it easier to select and move it), select the entire row. You can either activate **Select** and drag a selection window around all the squares, or just press Ctrl + A or Cmd + A to select everything. Then right-click on any selected face and choose **Make Group**.
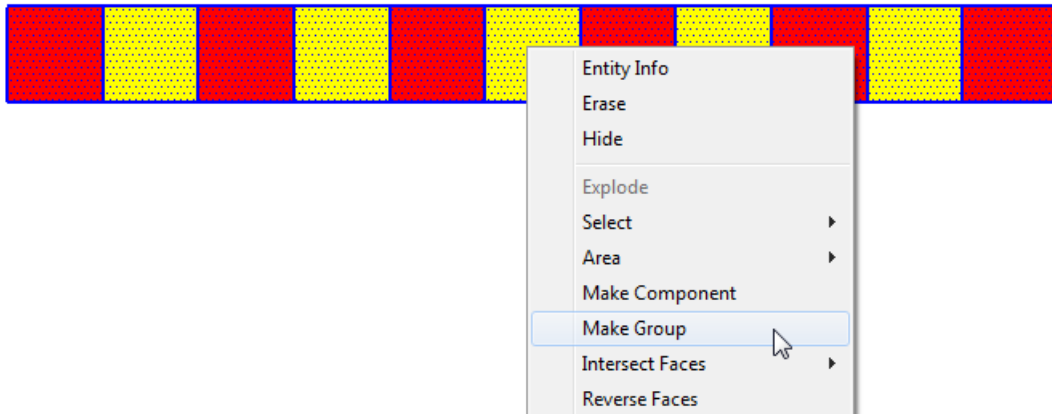
8. When the group is created, it is highlighted by a blue box to show that it is selected. Leave it selected, activate **Move**, press Ctrl / Option, and click the points shown below to make an adjacent copy of the row.
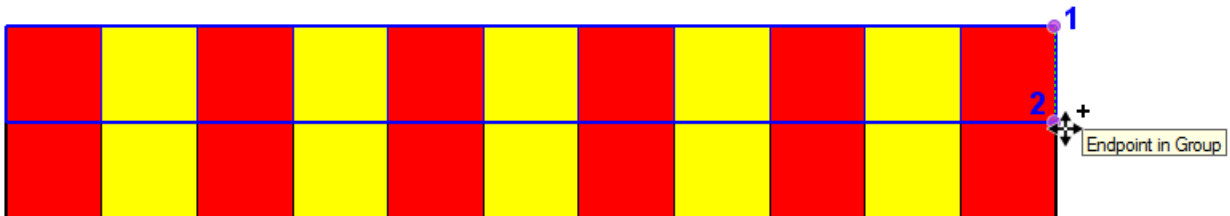
9. Enter 9x to get 10 total rows.
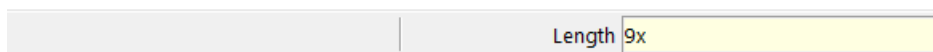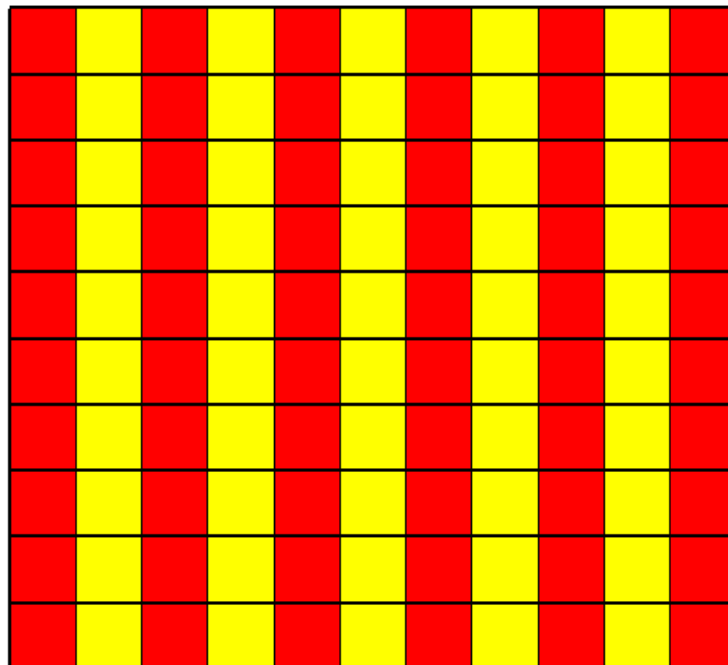
10. So far we have a simple grid, but once we push some of the rows out of alignment, the illusion will become more clear. Activate **Select** again, and press and hold the Shift key, which enables you to select more than one object at one time. Click every other row, so that alternating rows become selected.
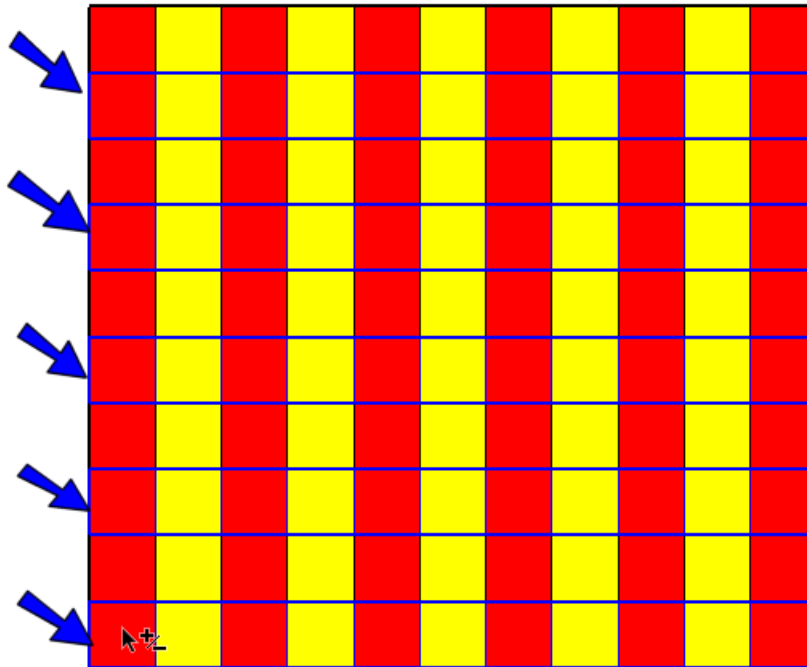
11. Activate **Move**, and click any point to start the move. Move the cursor very slightly to the right or left, sticking to the red direction, and click when the squares look something like this. The lines between rows are already starting to look a bit out of whack.
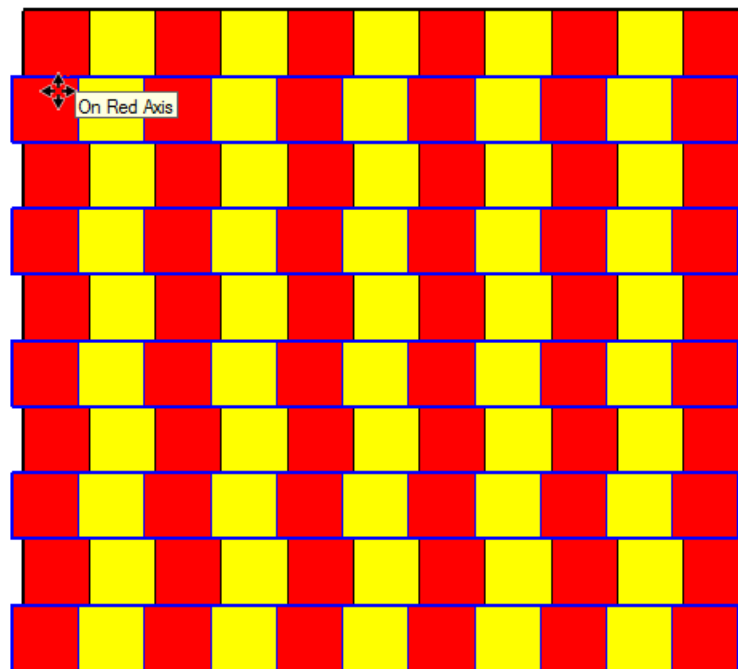
12. To make the illusion more dramatic, we'll move more rows. This time select the 3rd and 7th rows.
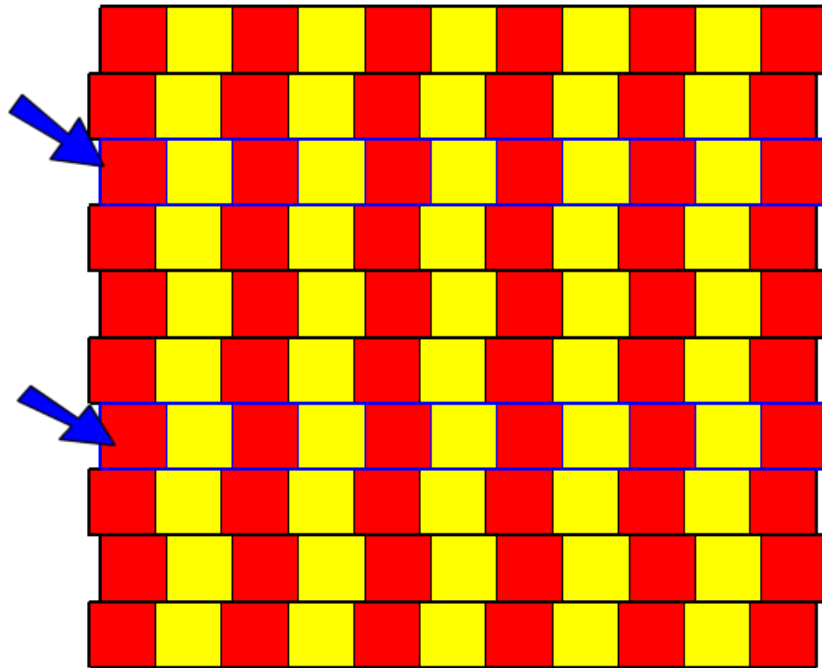
13. Move these rows to the right or left, so that the squares become more staggered.
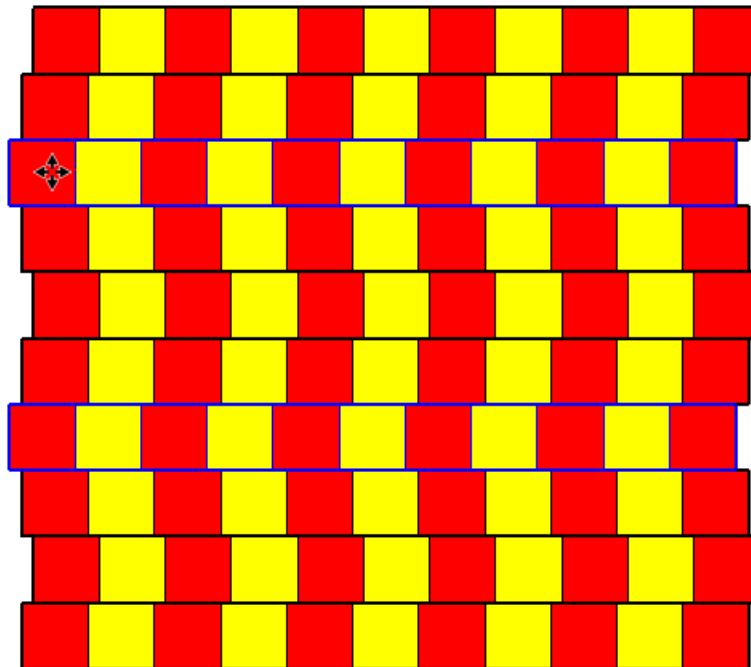
14. To make the illusion easier to see, the edge color should blend in – something between the red and yellow of the squares themselves. To change the edge color, open the **Styles** window (choose **Window / Styles** from the main menu). Click the **Edit** tab, then at the top of that tab click the first icon, which opens the **Edge** settings.
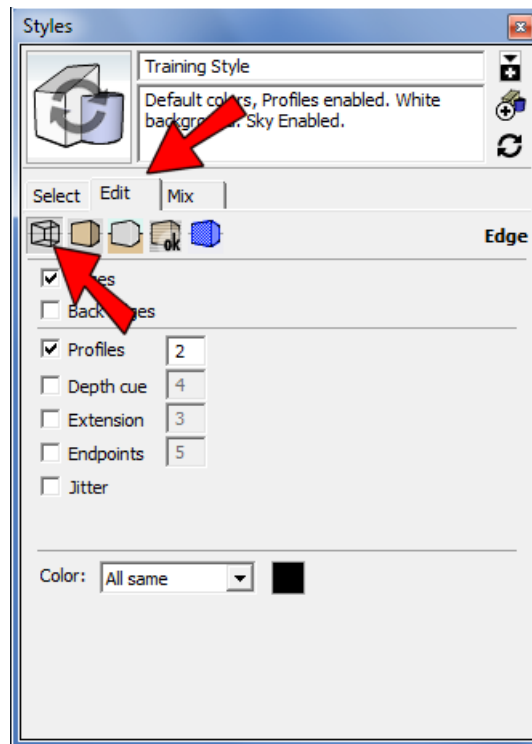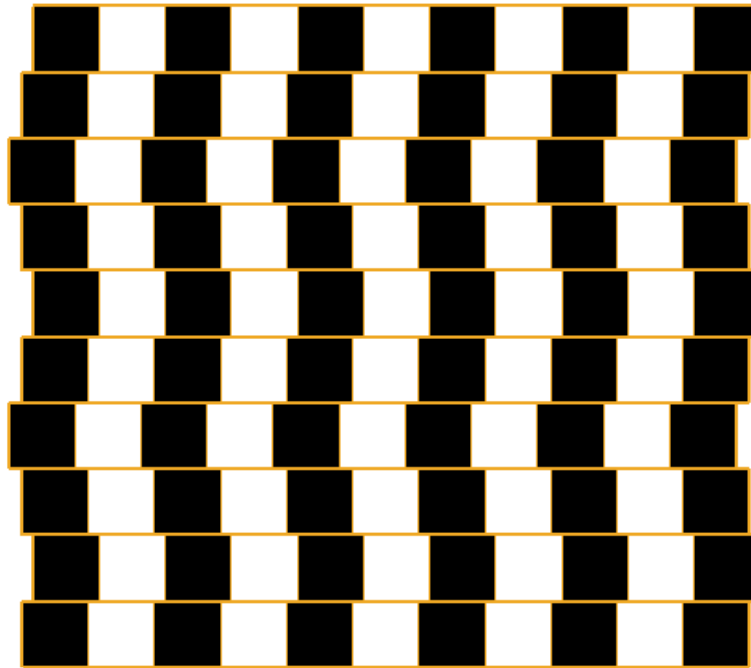

15. Click the color icon, and try orange. Now the lines look quite diagonal.
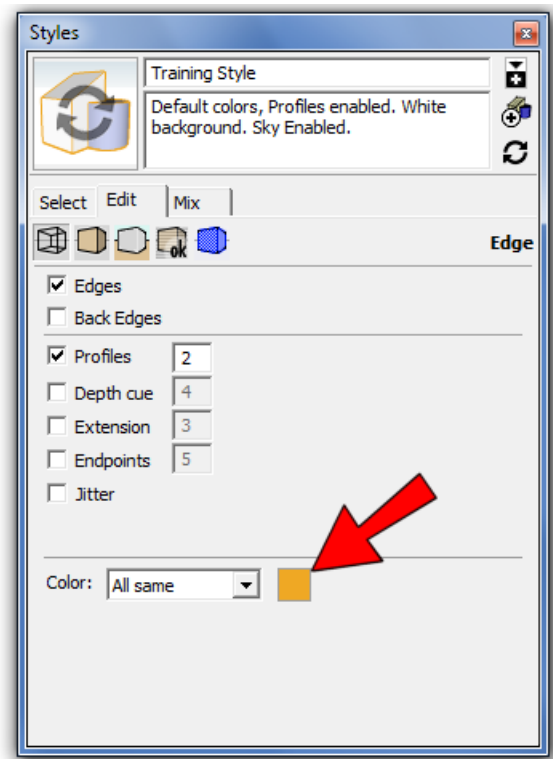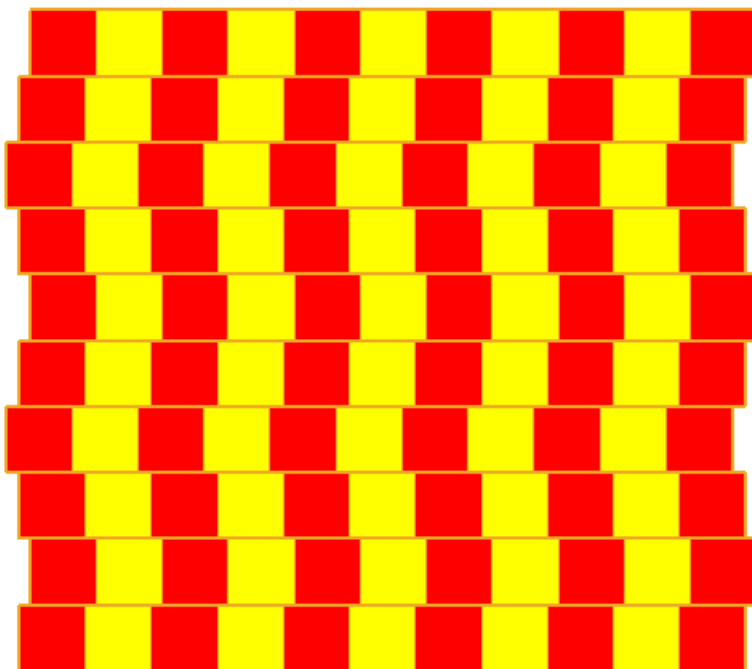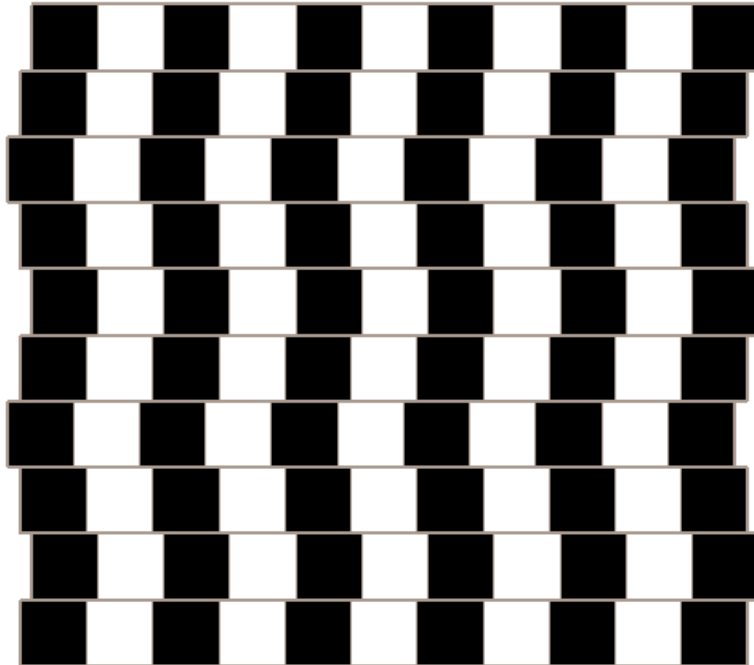
16. If you want to experiment with different colors, click the House icon of the **Materials** or **Colors** window. This shows the two colors used so far in the model. To edit a color, double-click its color square and set the new color.
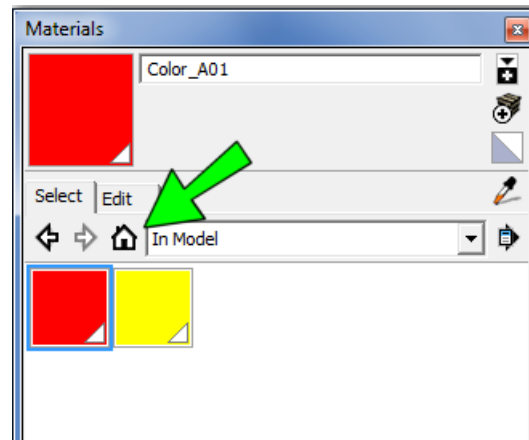
Here's how black and white squares look, separated by orange edges.

I think these colors work better with gray edges.

Or try red and blue squares with purple edges.