
uchi
illusion

Course
Visual Ergonomics and Human Perception

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Communication Design

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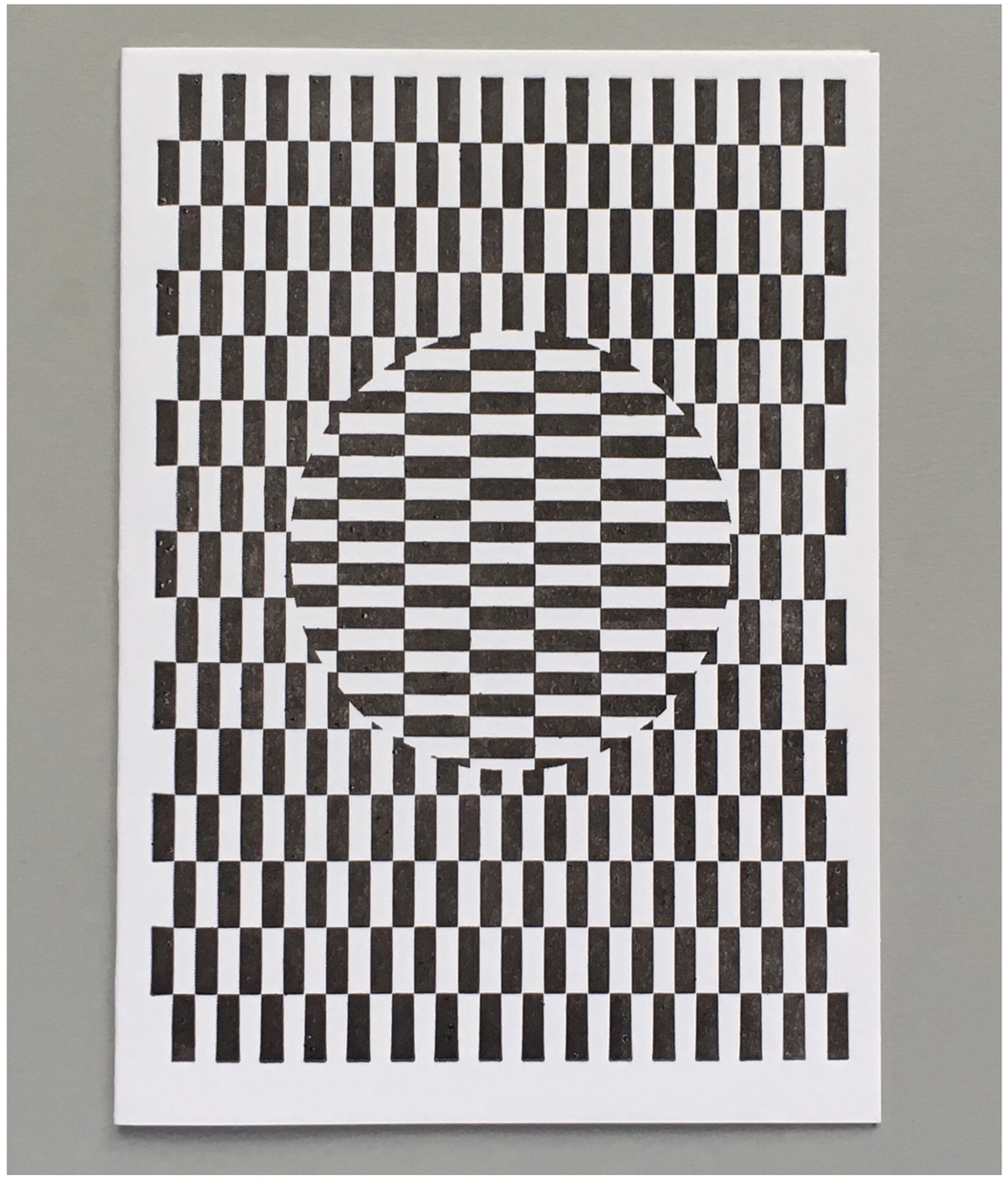


The Passenger Press, inspired by The Japanese Optical & Geometrical Art by Hajime Ouchi (1977)

Try to move this page around in small circular motions or diagonally. What do you see?

If you see a very minor jittery motion in the circular region and the circle as a separate entity floating above the background, read on to find out more about the illusion.

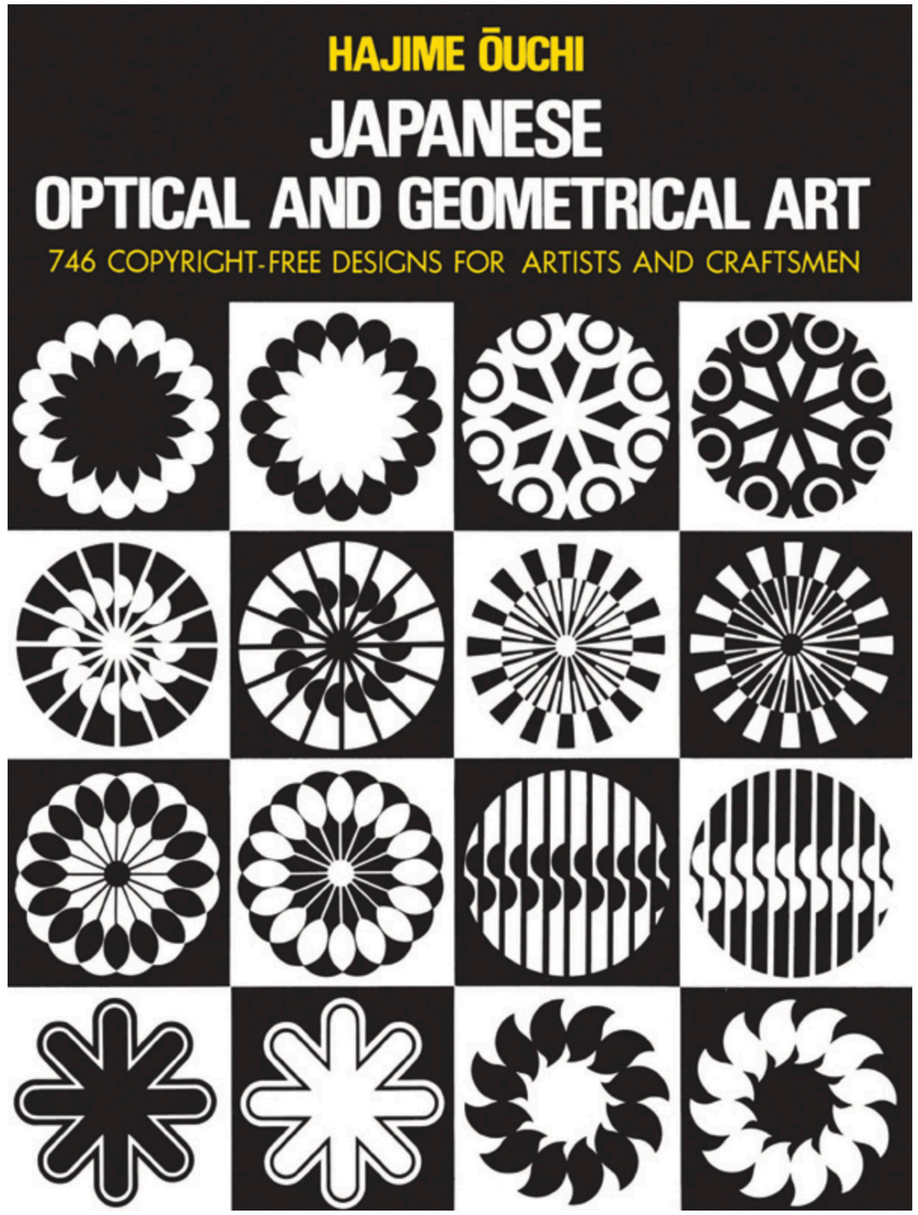
What is the Ouchi Illusion?

In 1977, Hajime Ouchi (pronounced Ha-jee-meh Oh-u-chi) published a book entitled Japanese Optical and Geometrical Art that contained a concentric figure, consisting of horizontal checks in the centre and vertical checks in the surround.[1]

It is only one of the 746 designs contained in the volume but this particular design came to be known as the Ouchi illusion as it gave us new insights about visual phenomena and human perception.

The Ouchi Illusion is an illusion of relative motion, most vividly seen if the image is moved slowly diagonally or in a circle.

The rectangles in the circular region are oriented at right angles to those in the rest of the figure. This creates an impression of relative motion when the whole pattern is moved.



How does the illusion work?

It helps to notice that 2 things are simultaneously happening when we look at the Ouchi Illusion.

1. The ‘decoupling’ of the circular checkered region in the centre from the checkered background. Additionally, this circular disk appears to float atop the background.
2. Jittery movement of the rectangles in the circle when the **whole** image is moved.

Let us try to understand each of these phenomena separately.

The eye and decoupling

The eye executes vertical and horizontal movements separately. The background in the Ouchi illusion demands vertical movement whereas the centre demands horizontal eye movement. This leads to the eye interpreting the centre as separate from the background.

The eye and relative motion

The relative motion of the rectangles at the centre circle is caused by the excitation of spatially overlapping ON and OFF regions of the centre-surround receptive fields of retinal neurons.

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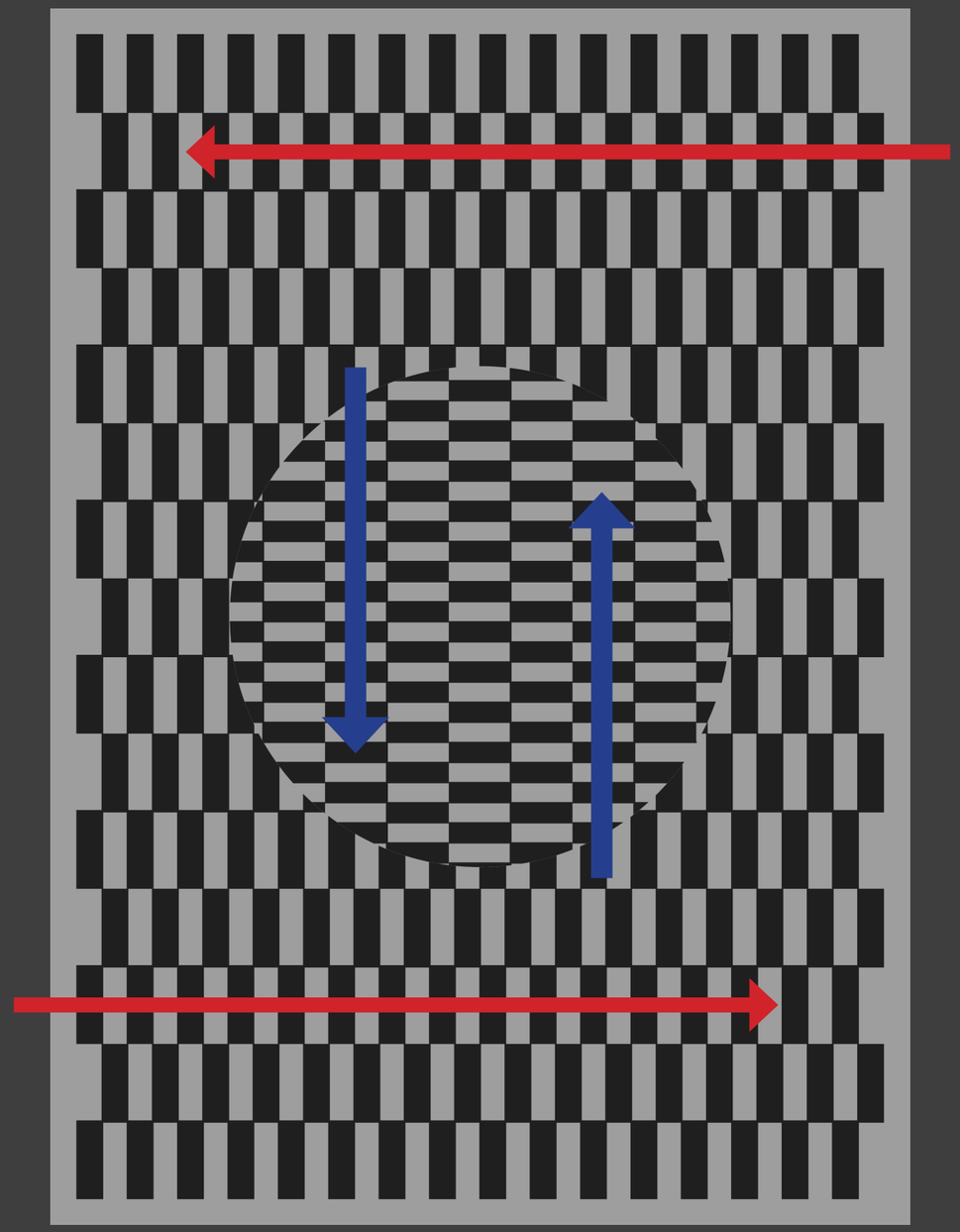

The classic Ouchi Illusion and the vertical and horizontal continuity of rectangles in the image, and the resulting separation of circular disk from the background

Horizontal continuity of rectangles

Vertical continuity of rectangles

Exploration 1

Bigger rectangles at the centre

Decoupling

The sense of decoupling of the circular disk from the background appears very strongly, possibly as result of scaling up of the rectangles at the centre exponentially as compared to the background.

Relative motion

The relative motion of the rectangles at the centre circle is still apparent but does not seem to appear as strongly as the original illusion because there are lesser ON and OFF regions at the centre to trigger retinal neurons.

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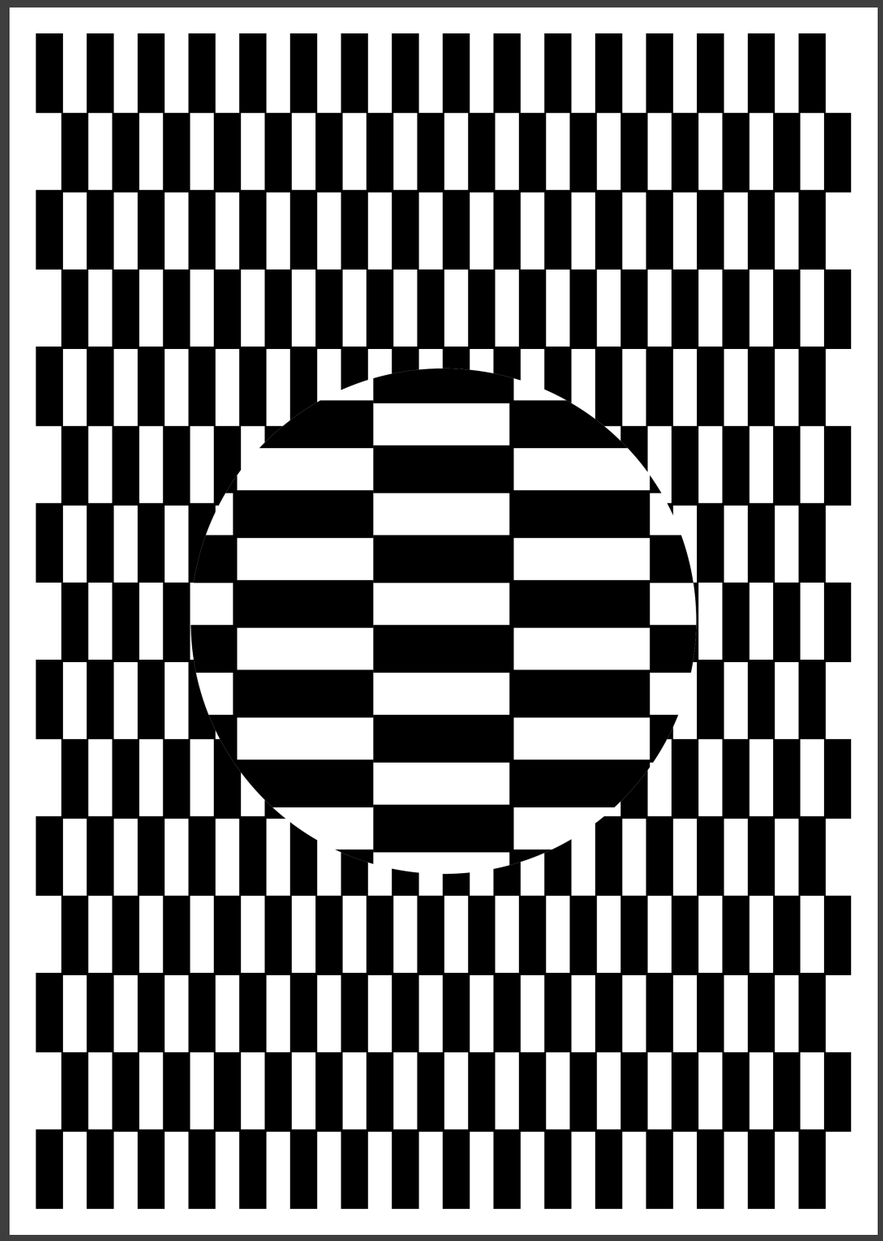

Lesser ON and OFF regions at the centre

Exploration 2

Smaller rectangles at the centre

Decoupling

The sense of decoupling of the circular disk from the background appears very strongly, possibly as result of scaling down of the rectangles at the centre exponentially as compared to the background.

Relative motion

The relative motion of the rectangles at the centre circle is appears very strongly as compared to the original because of more ON and OFF regions at the centre, as a result of which more retinal neurons are triggered.

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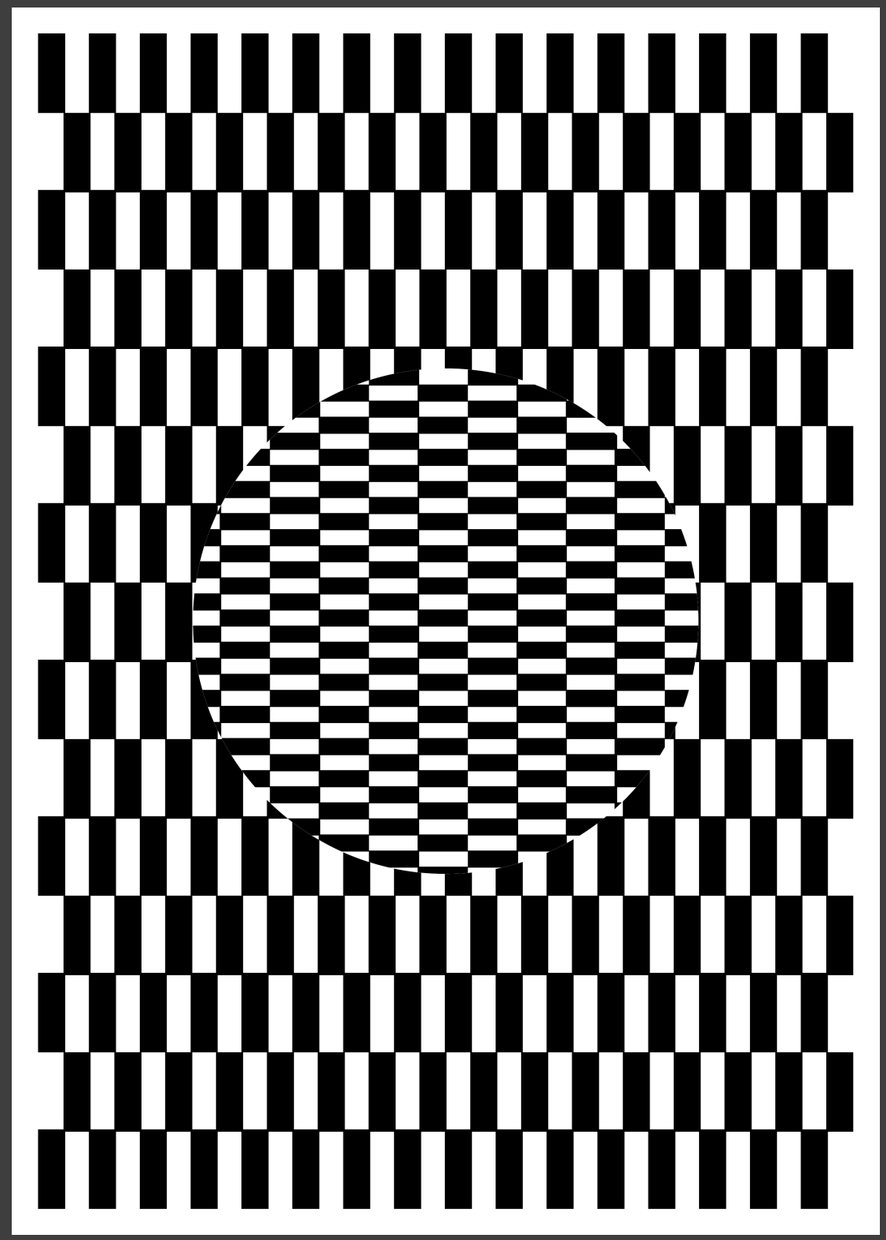

Larger number of ON and OFF regions at the centre

Exploration 3

The original rotated 45°

Decoupling

The segregation of the centre from the surround appears very strongly because the checkered patterns are still organised perpendicular to each other while the whole image is rotated 45°

Relative motion

The relative motion of the rectangles at the centre circle is very strong even with side to side motions.

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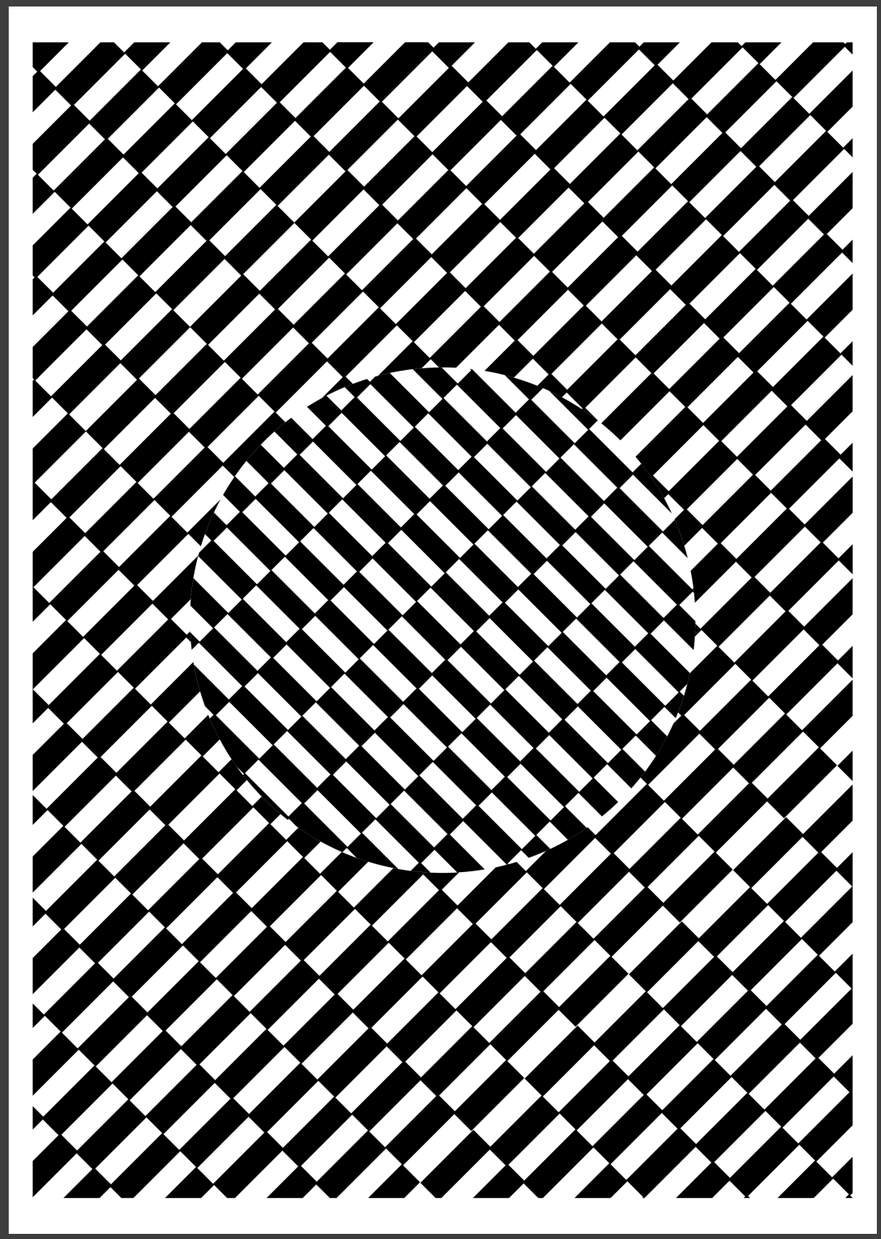

Exploration 4

Red rectangles at the centre

Decoupling

Changing the colour of the checkered rectangles at the centre to red results in a very strong separation from the surround.

Relative motion

Relative motion also appears more strongly in this case, possibly due to the high frequency of red as compared to the background.

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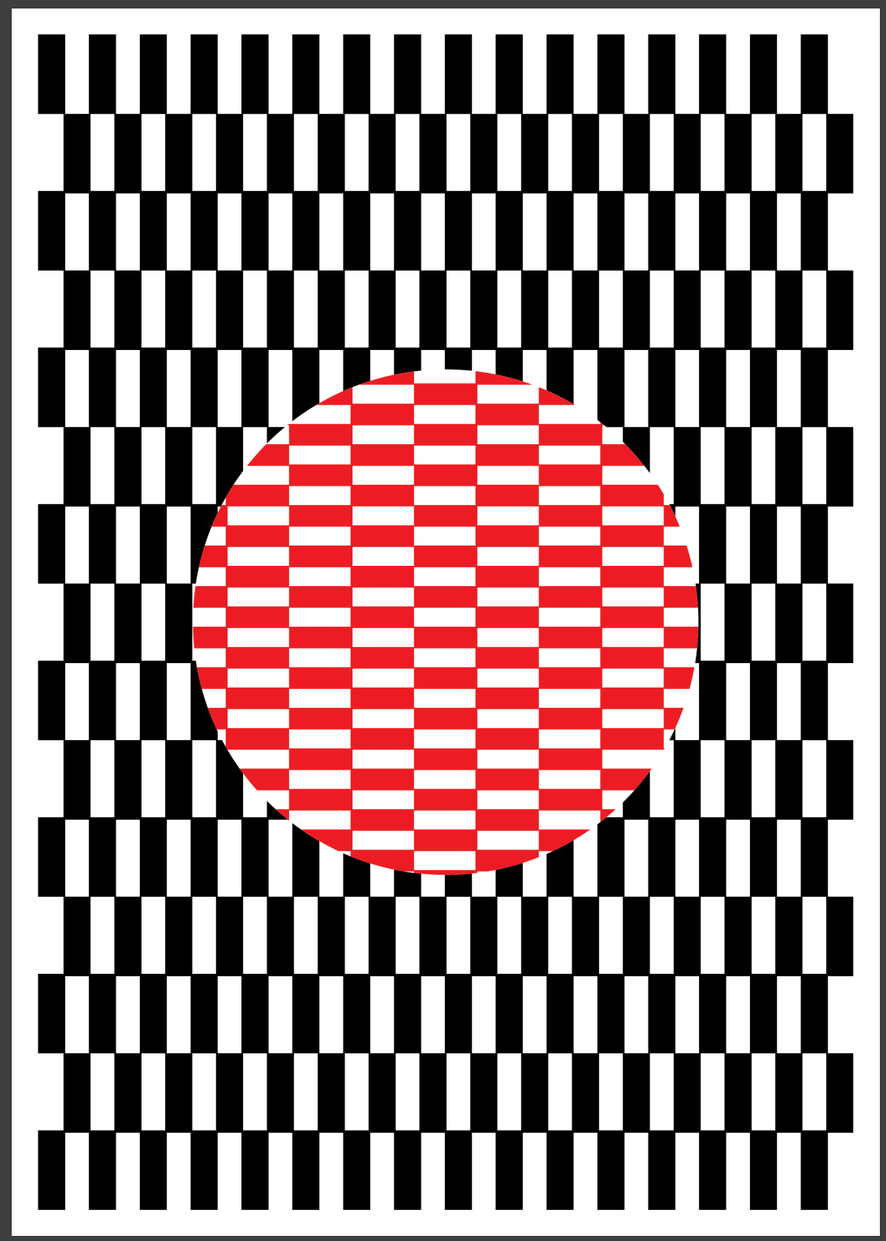

Usage of higher frequency colours such as red at the centre possibly excites retinal neurons more, leading to a strong sense of relative motion.

Exploration 5

Red checkered background

Decoupling

The decoupling is strong for the same reasons as Exploration 4 but the colour of the rectangles in the checkered background is now changed to red.

Relative motion

The relative motion does not seem to appear as stringly as in exploration 5 because the ON and OFF regions at the centre are of a lower frequency as compared to the background.

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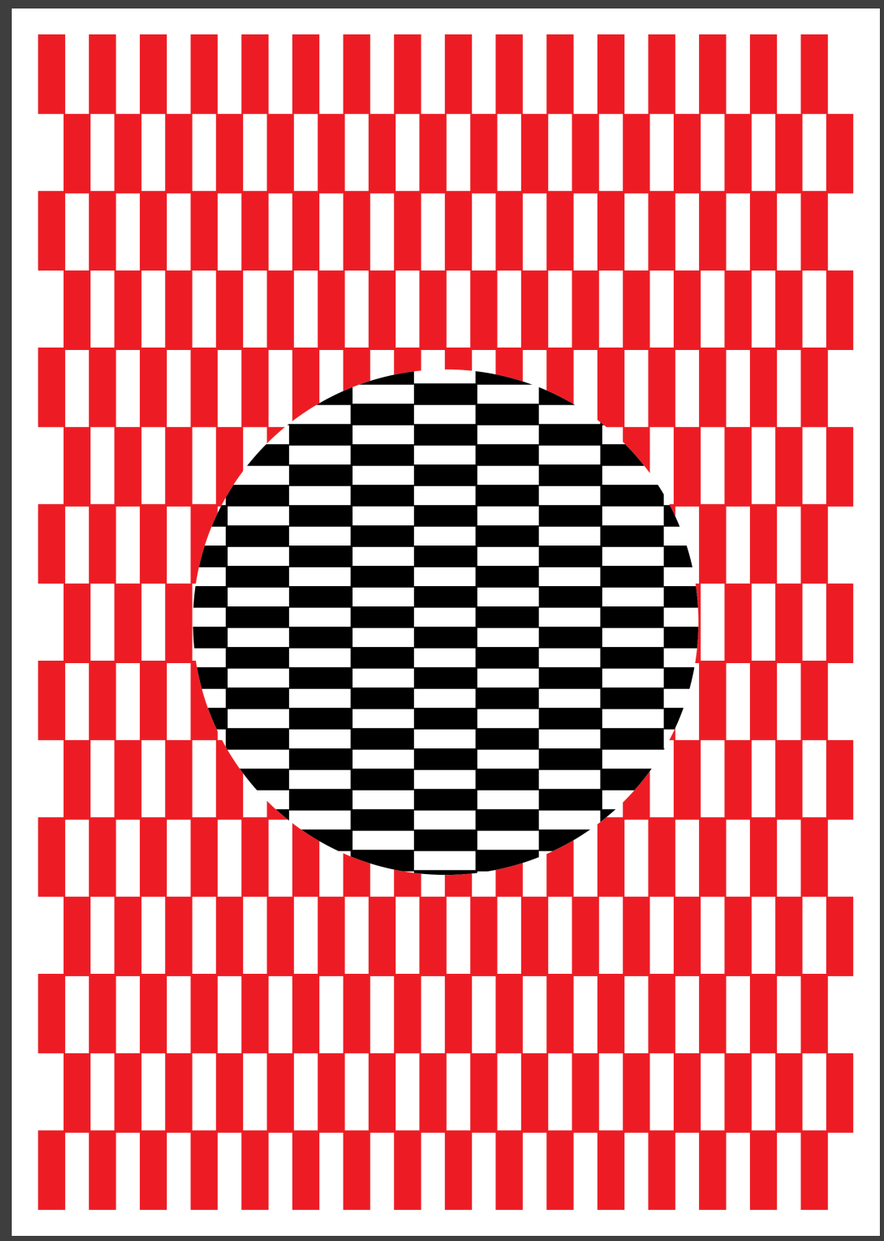

Usage of higher frequency colours such as red for the surround as compared to the low frequency of the centre leads to less relative motion.

Exploration 6

Background divided into quarters & each quater rotated 45°

Decoupling

The separation of the disk appears strongly because of both the higher frequency red checks at the centre and the fact that the surround is divided into quarters and the orientation of rectangles keep changing in each quarters.

However the disk looks contained within rather than floating above the background.

Relative motion

The relative motion of the rectangles at the centre circle does not seem to appear as strongly despite the use of higher frequency colour such as red for the central checks because:

- The rectangles in the background are not oriented perpendicular to the ones at the centre
- The rectangles in the background also seem to be ‘closing in’ on the central disk.

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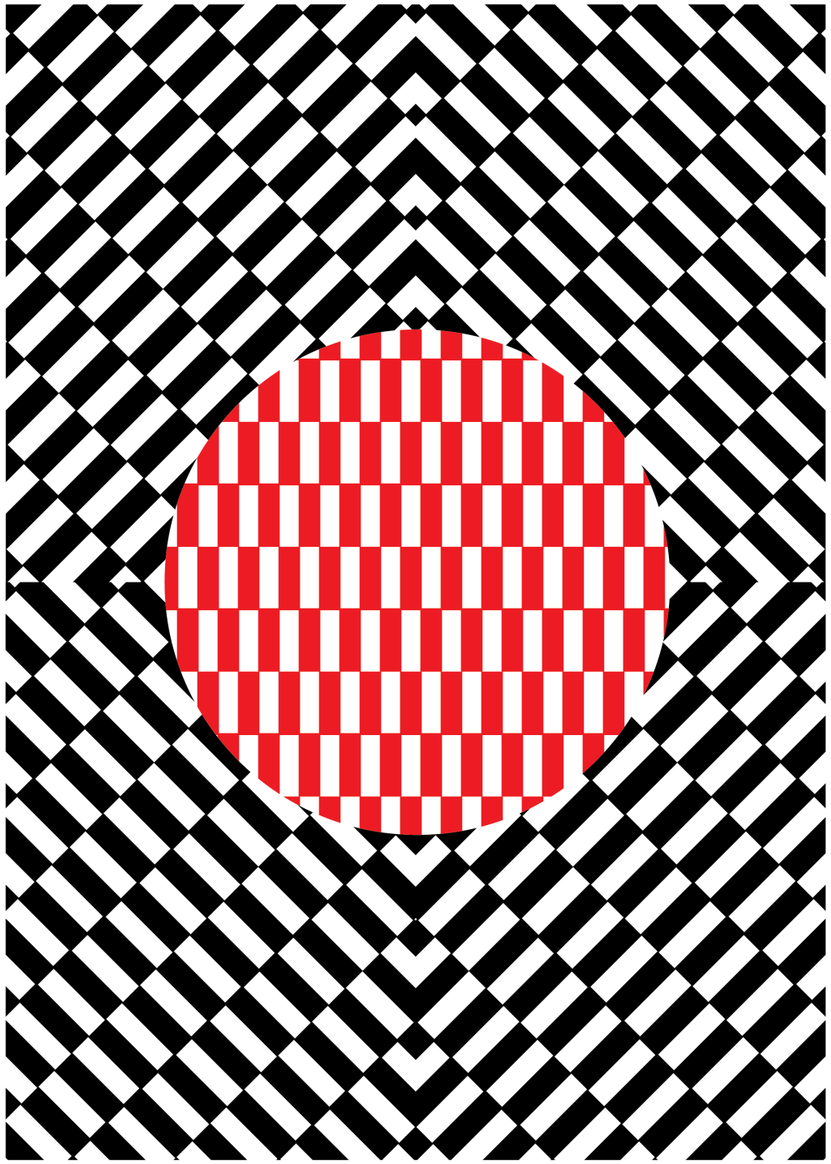

The checkered rotating background seems to ‘close-in’ towards the centre

Exploration 7

Complimentary co-loured rectangles at the centre

Decoupling

The sense of decoupling of the circular disk from the back-ground appears very strongly, again probably due to the usage of higer frequency colours as in the explorations so far.

Relative motion

The relative motion of the rectangles at the centre appears to fail here because the higher frequency yellow ‘bands’* seem to be ‘blocked=off’ by the blue bands.

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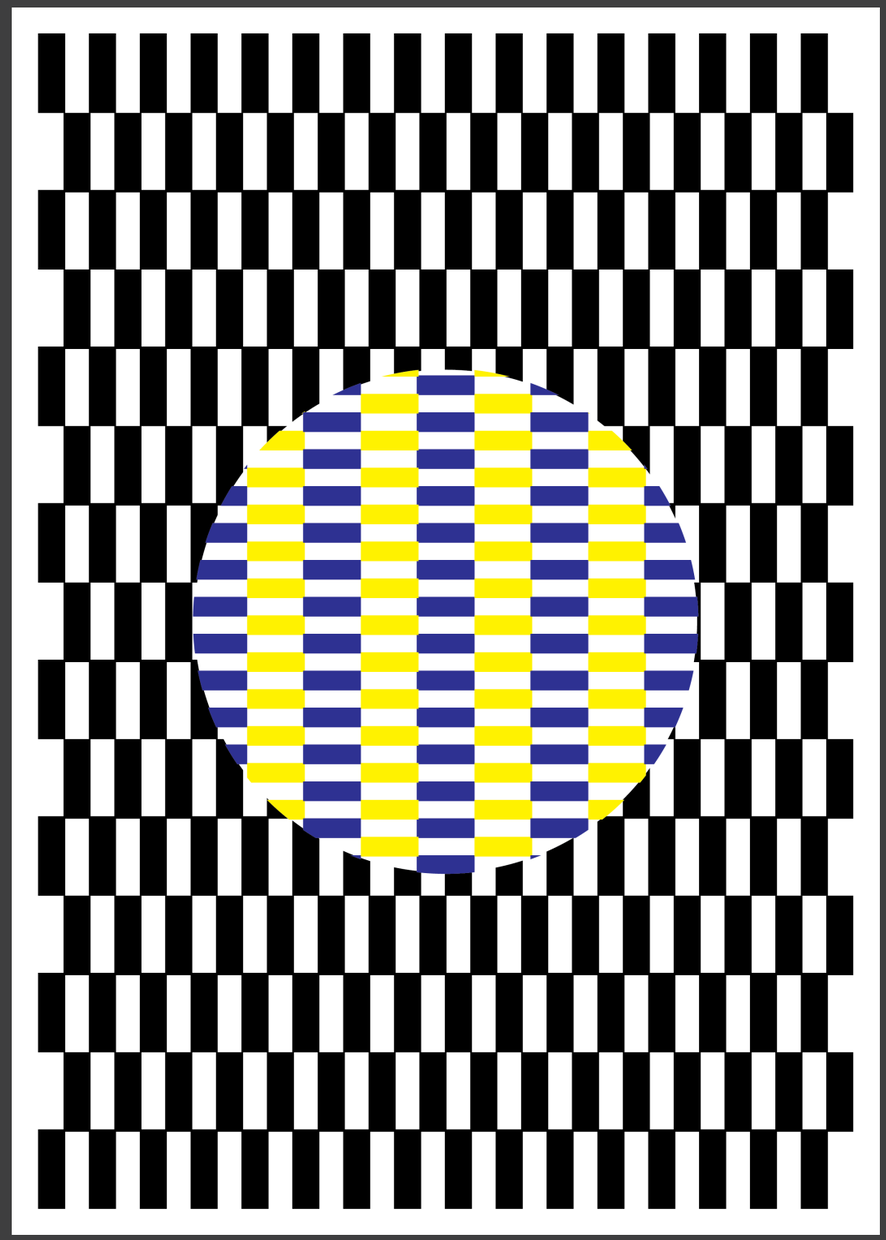

*
the ‘bands’ seem to appear because our brain tends to group similar ele-ments together (The Similarity Principle of the Gestalt law). We are group-ing the contrasting colours together.

Exploration 8

Vertical lines as background

Decoupling

The circular disk at the centre appears to have been very strongly separated from the background and appears to floating above it. Although the patterns of the centre and the surround are completely different (lines vs checkered patterns), the individual elements that make up these patterns are still juxtaposed at right angles to each other

Relative motion

A jittery motion is still present while the whole image is moved around but does not appears as strongly possibly due to more uniform ON and OFF regions.

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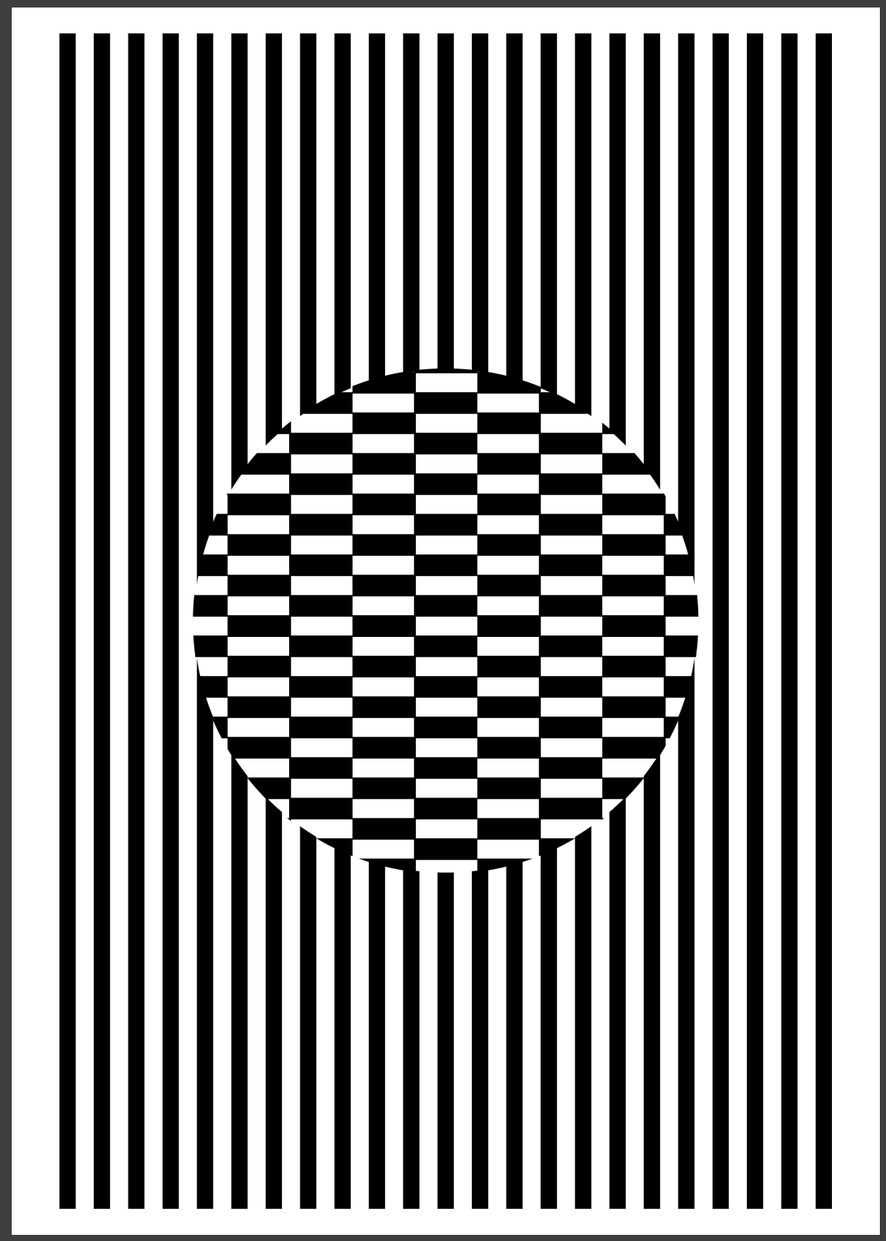


Exploration 9

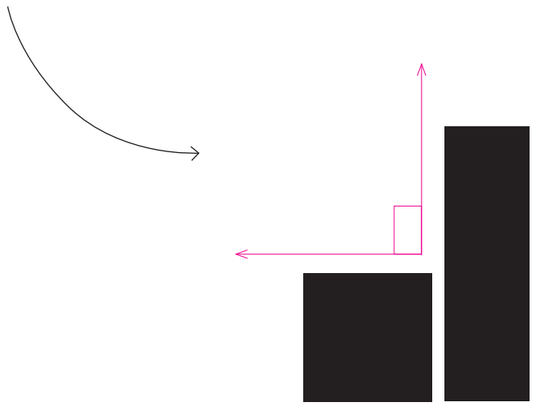
Square checkered background

Decoupling

Stong decoupling because of different kinds of checkered patterns at the centre and surround.

Relative motion

The large number of ON and OFF regions still creates slight jittery motions, possibly due to the checkered pattern at the centre is more elongated as compared to the background, and hence some perpendicularity is still maintained.



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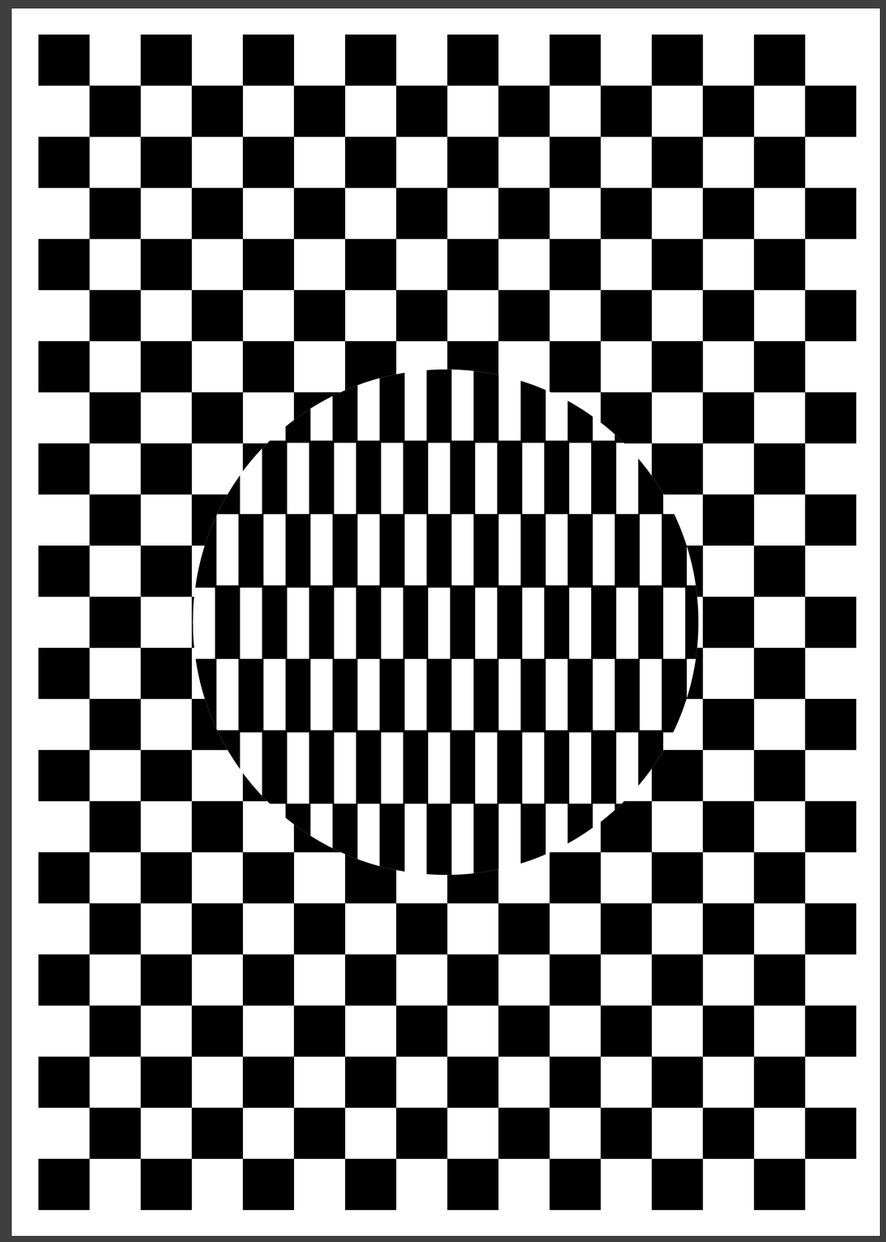


Exploration 10

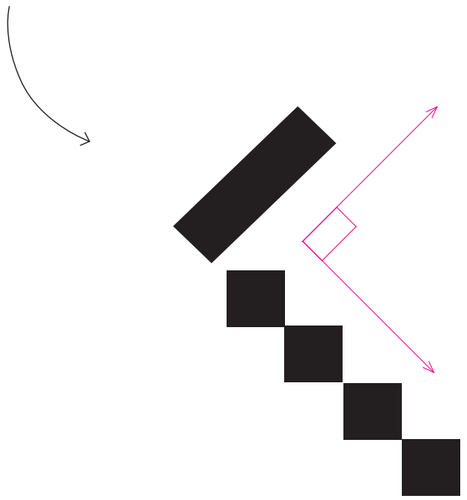
Square checkered centre

Decoupling

Centre-surround segregation because of different kinds of checkered patterns at the centre and surround but does not appear as strongly becayse of their relative sizes. The pattern of the surround is also rotated 45°, providing a contrast as comparred to the centre.

Relative motion

Slight jitter motion due to the eye still being able to percieve a slight perpendicularity.



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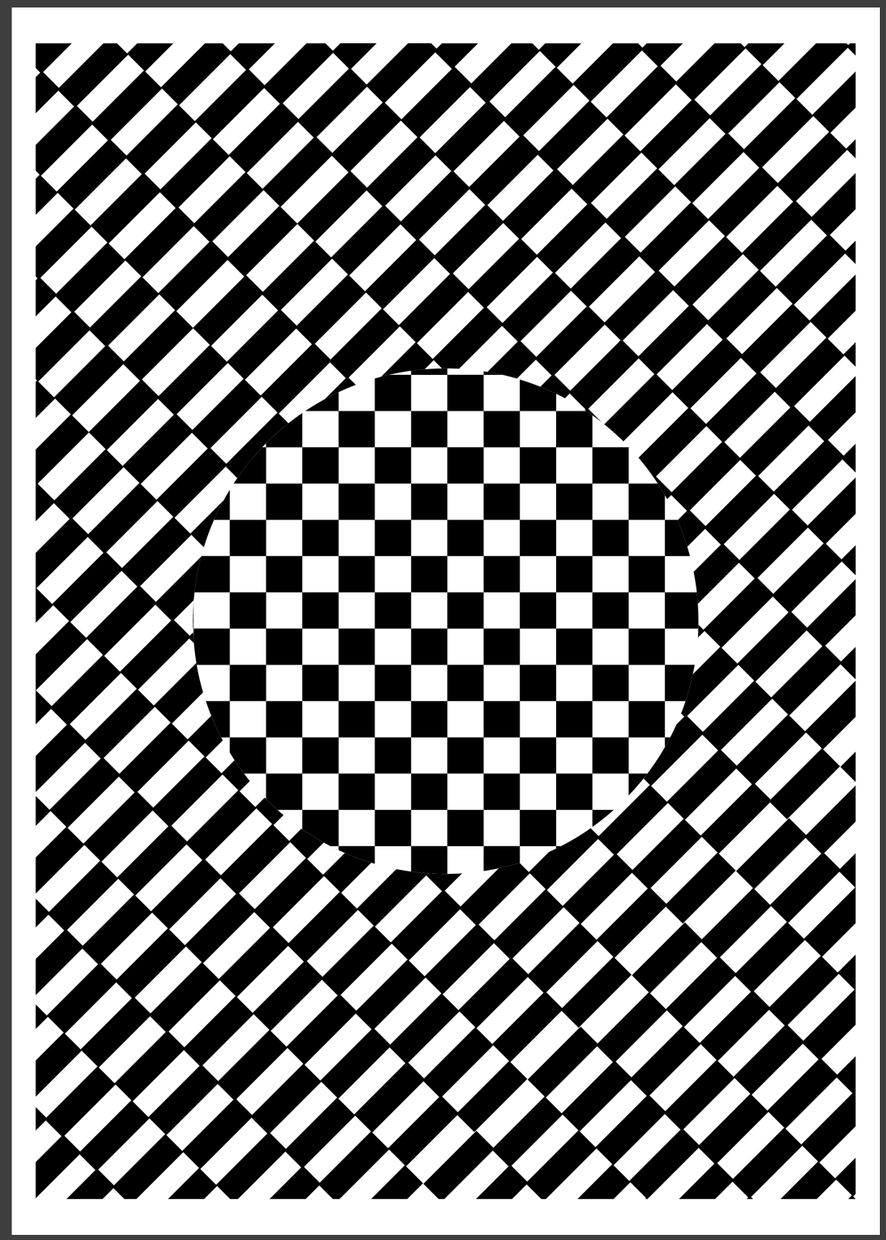


Exploration 11

Checkred centre at 45° to the background

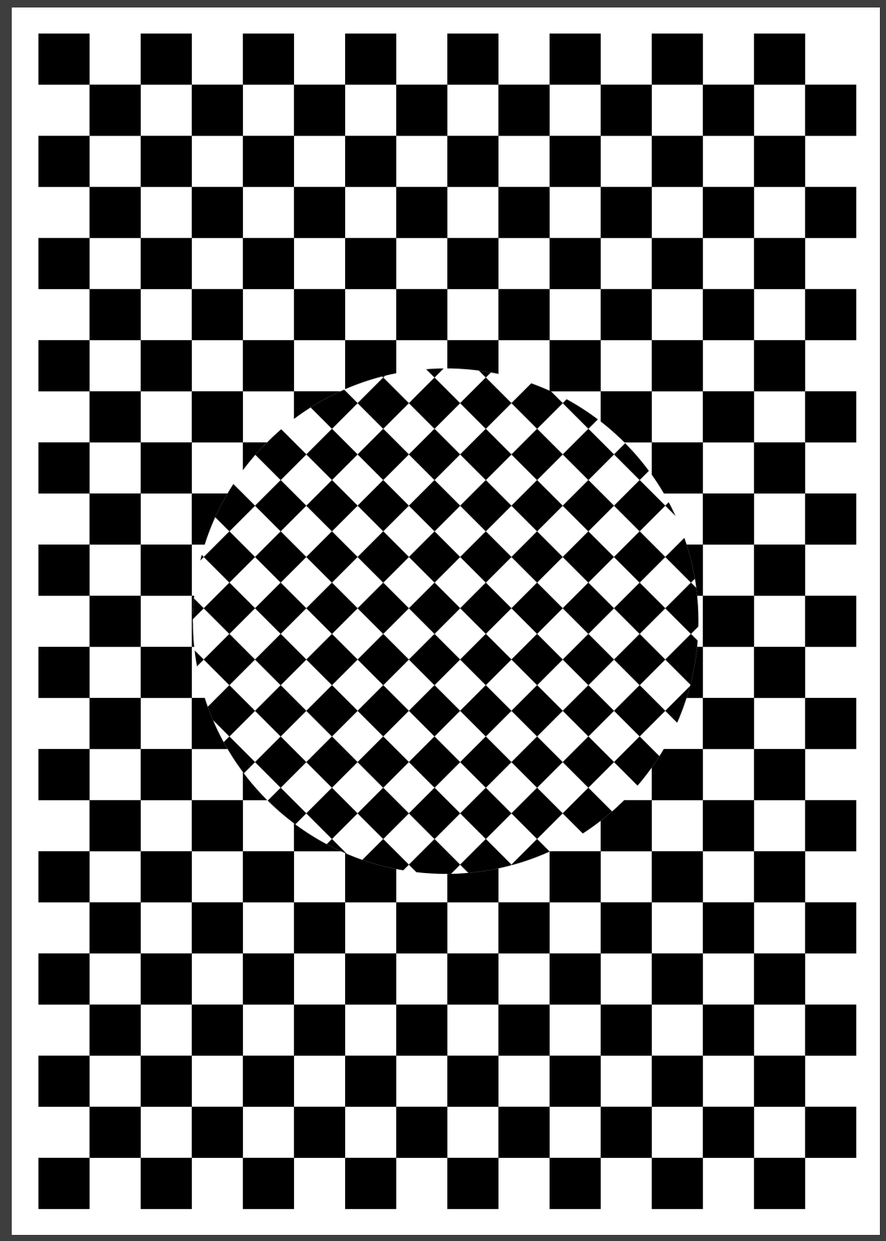
Decoupling

The sense of decoupling of the circular disk from the background appears very strongly, possibly as result of scaling up of the rectangles at the centre exponentially as compared to the background.

Relative motion

The relative motion of the rectangles at the centre circle is still apparent but does not seem to appear as strongly as the original illusion because there are lesser ON and OFF regions at the centre to trigger retinal neurons.

Try moving this page around in small circular motions, diagonally, or side to side



Exploration 12

Hexagon patterned background

Decoupling

Very strong decoupling is percieved here because the background makes use of hexagons and unequal distribution of negative space between these hexagonal elements.

Relative motion

A lack of relative motion because the central disk appears to sit on a very uniformly patterned background (which can almost be percieved as one solid colour) which does not have as many ON and OFF regions for the retinal neurons to percieve. And angularly, the elements of the background are at 45° angles to the checkered pattern.

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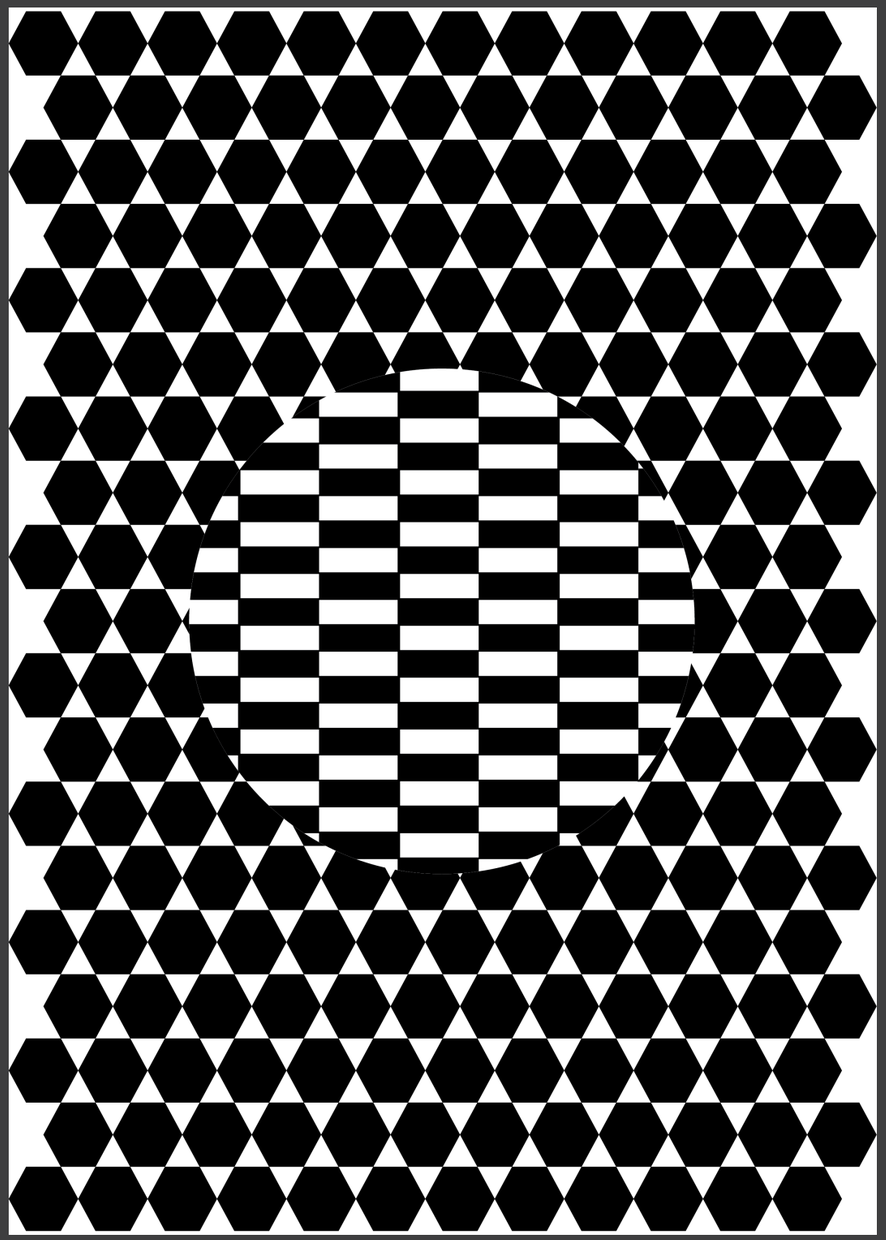

Exploration 13

White circles overlapping the rectangles

Decoupling

Decoupling apparant due to the relative size of the individual elements of the centre and surround checkered patterns.

Relative motion

A lack of relative motion is percieved in this case despite lots of ON and OFF regions, and perpendicular elements. The vertical columns of the central disk appear to fixed in place.

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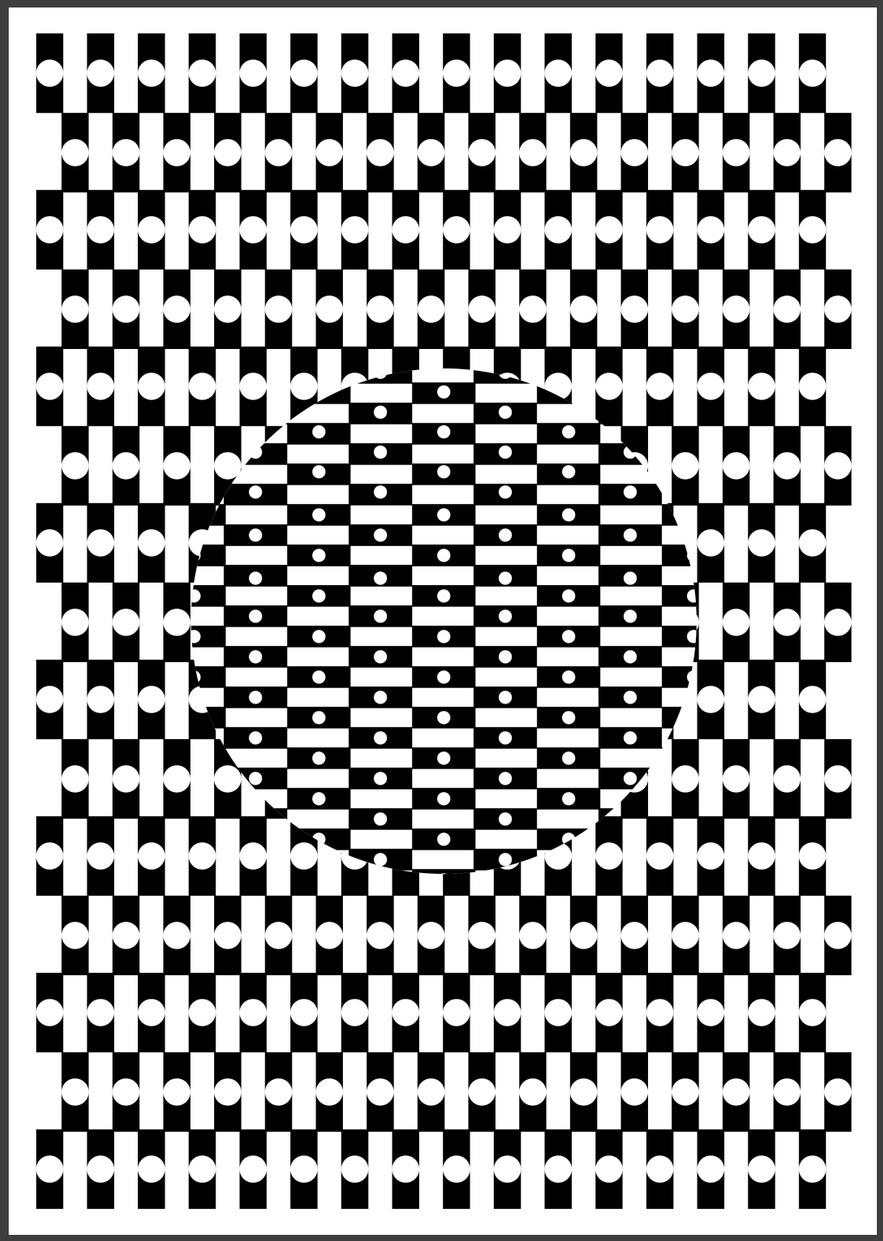

Exploration 14

Background: Horizontal waves

Decoupling

The central disk is very strongly separated from the background due to the usage of different types of patterns.

Relative motion

A large number of ON and OFF regions can be percieved, the patterns, despite their different nature, are perpendicular to each other. This causes visual jitter or relative motion.

Interestingly, the visual jitter can also be sensed in the background of this particular exploration.

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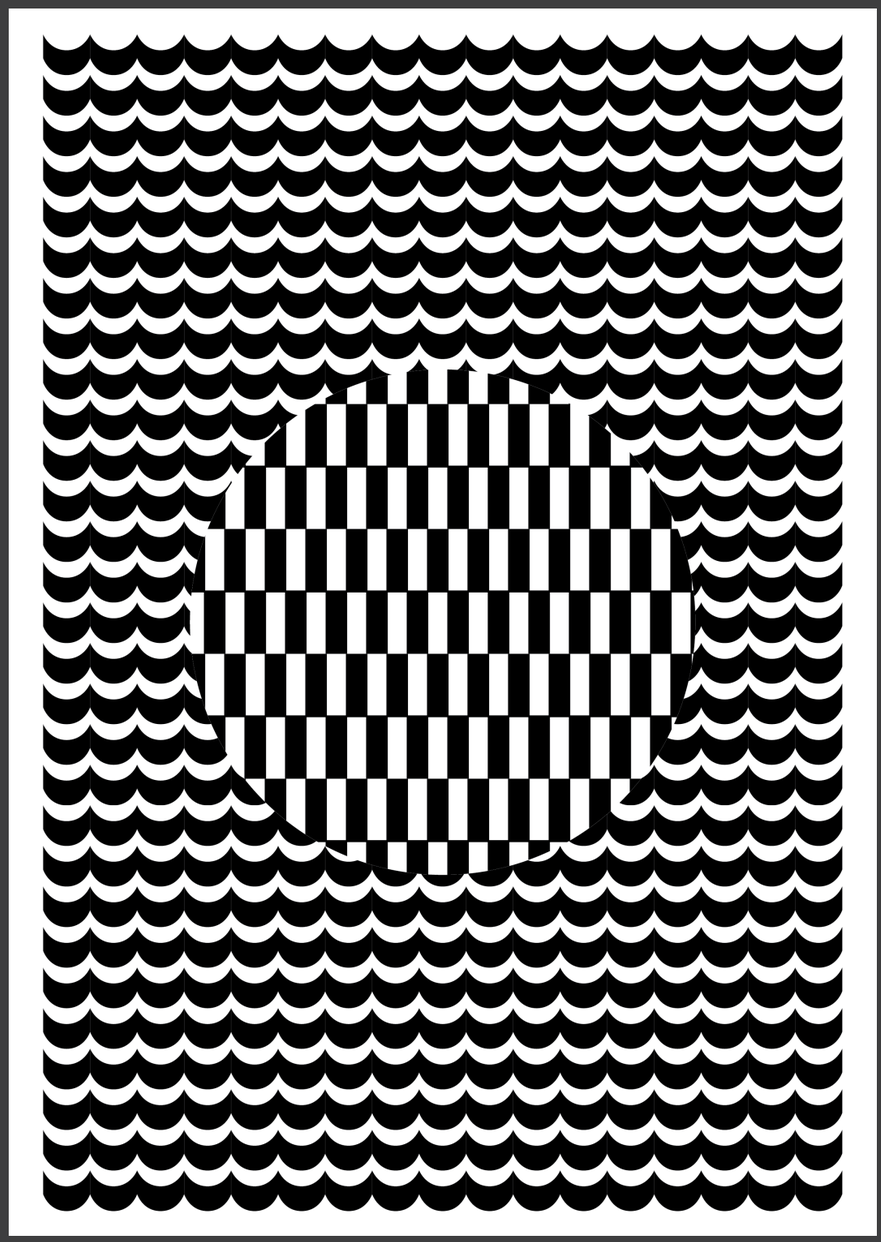

Exploration 15

Waves at the centre at 45° to background

Decoupling

A sense of decoupling of the circular disk from the back-ground appears strongly because of the orientation of the way patterns in relation to each other.

Relative motion

A lack of relative motion owing to the fact that the patters are very obiovusly not perpendicular to each other. A slight visual jitter is possible due to a large number of ON and OFF regions for the visual system to process.

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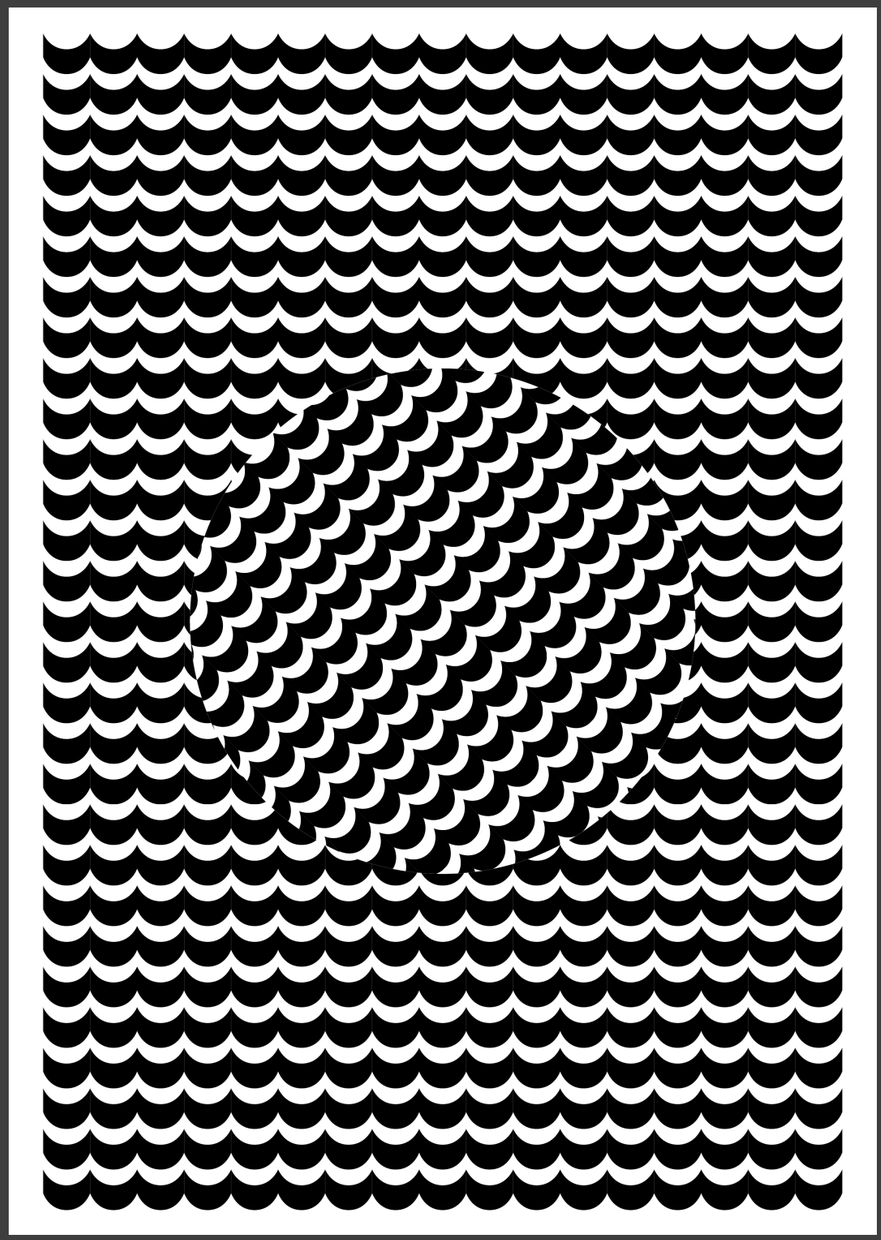

Exploration 16

Abstract checkered background

Decoupling

Appearance of a circular disk floating above the surround owing to the different natures of the checkered patterns used and the relative sizes of their individual units.

Relative motion

Very minute eye jitter due to a relative lack of perpendicularity (both the background and the centre seems to be interpreted as horizontal rows when looked at as a whole) between the two patterns.

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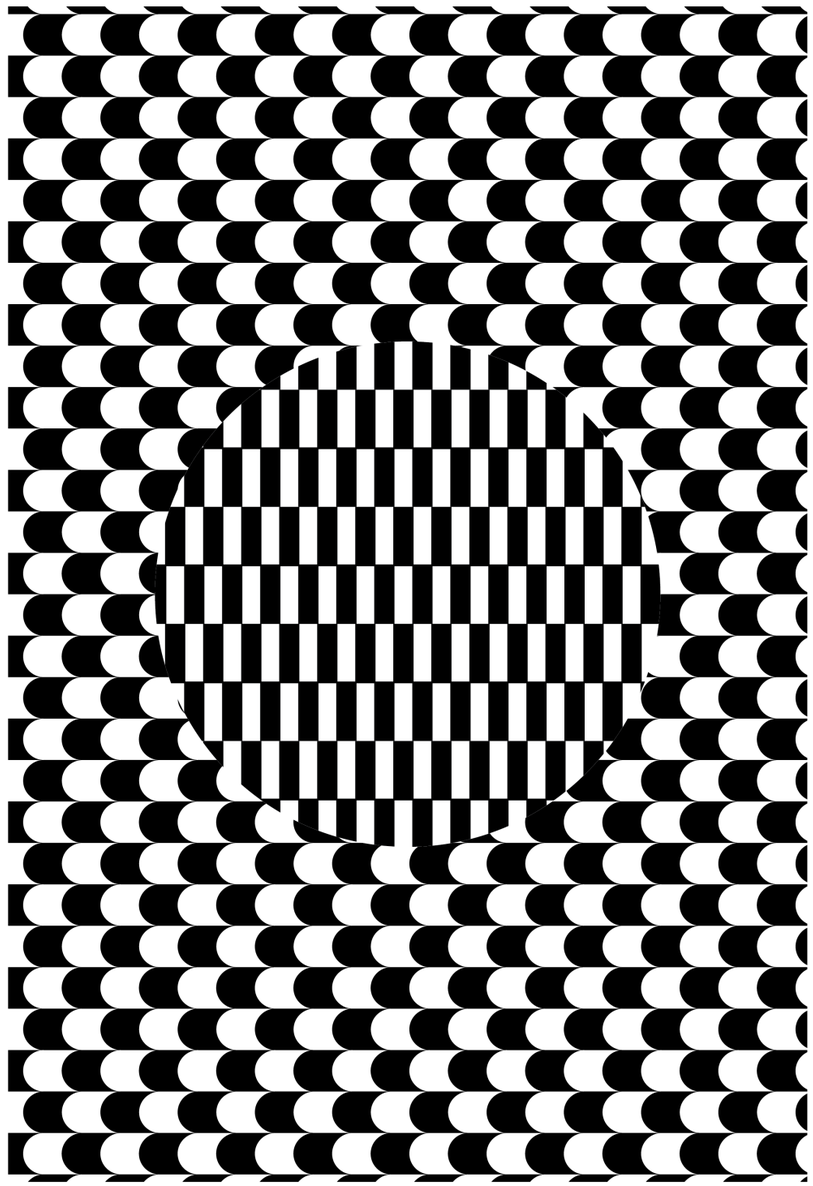

Exploration 17

Background: Groovy Waves

Decoupling

Patterns at right angles, of different types, and the three dimensionality of the pattern in the background creates a very distinct visual segregation. The central disk appears to float atop the background of waves.

Relative motion

Very apparent relative motion because oh high number of ON and OFF regions ans the eye executing vertical and horizontal movements separately.

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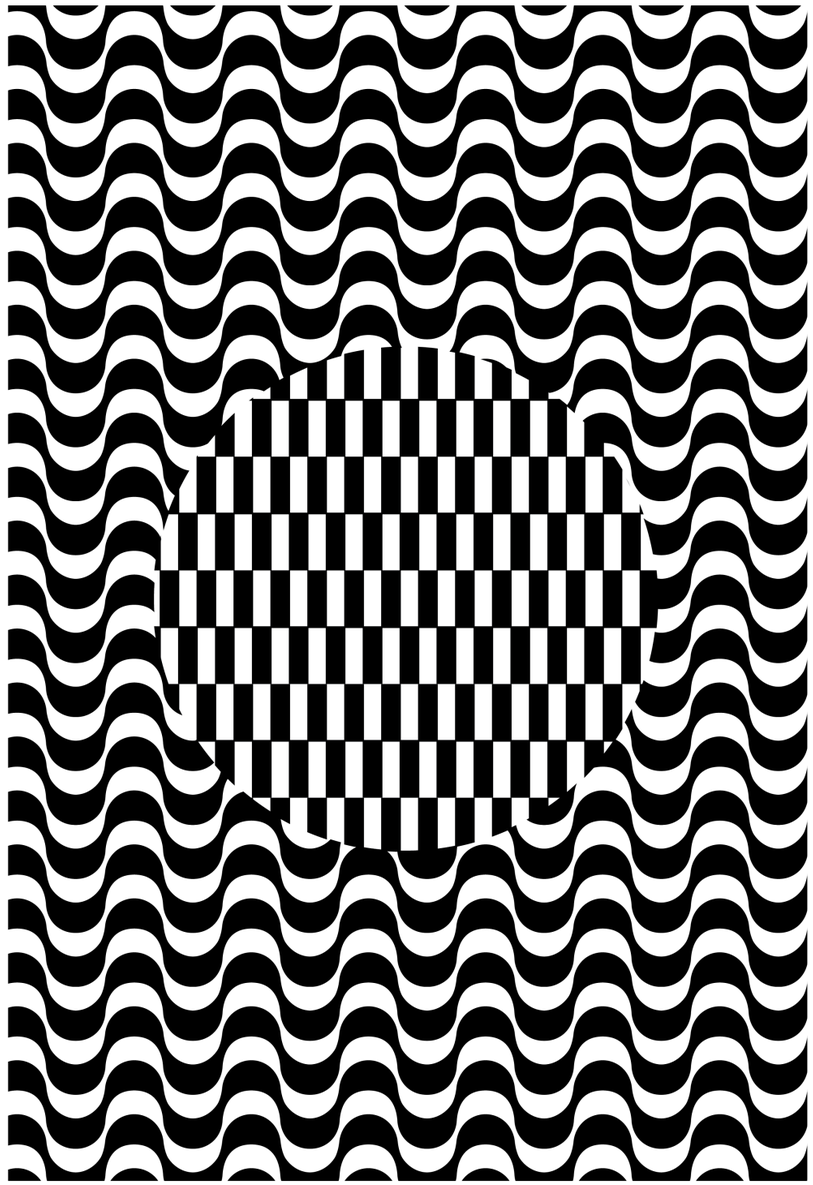

Exploration 18

Groovy Waves at the centre

Decoupling

Visually, the central disk appears to be very strongly segregated and floating above the background not only owing to the difference in patterns used but also becasue the pattern at the centre appears to be three dimensional (a row of convex and concave cylinders).

Relative motion

The patters are at right anles to each other, adn the flowiness of the patter at the centre further adds to the illusion of relative mtoion.

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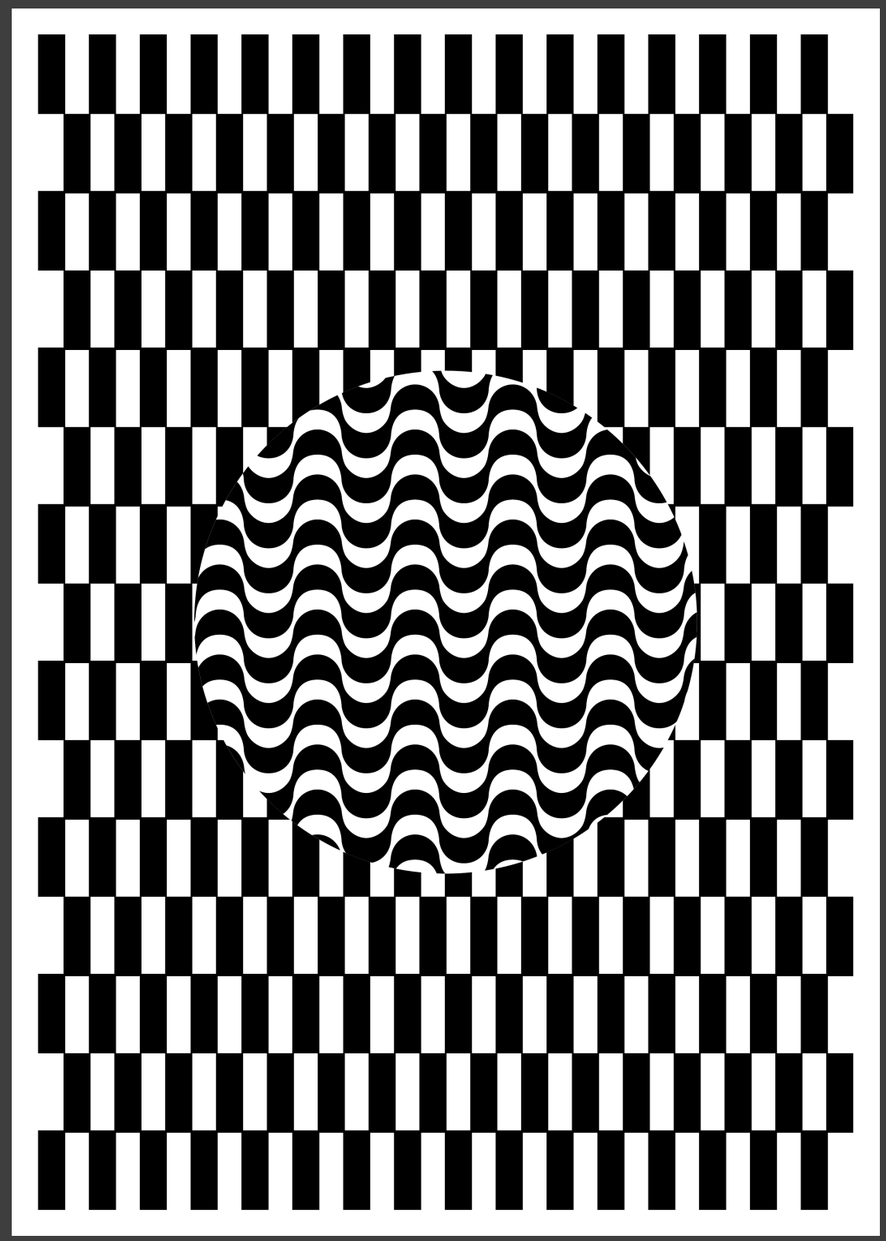


Exploration 19

Background: Vertically joined arrows pointing right.

Centre: Horizontally joined arrows pointing up

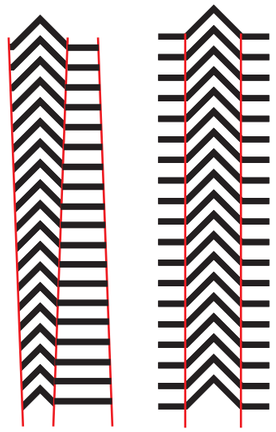
Decoupling

The centre does feel to float atop of the surround due to both their orientation and their relative sizes.

Relative motion

A strong sense of relative motion possibly due to the strong directionality created by the arrows and the arrows are oriented perpendicular to each other. Despite the uniformity, there are a large number of ON and OFF regions for the visual system to process.

What can also be observed is slight Zollner Illusion created due to the parallelness of the patterns. The arrows appears to tapper in opposing directions even when they are perfectly parallel.



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