Lesson #10: Dec. 01st 2014

Lecture plan:
VISUAL ILLUSIONS

THE STUDY OF VISUAL ILLUSIONS VISUAL ILLUSIONS (CONT.)

ILLUSIONS OF BRIGHTNESS AND CONTRAST;
ILLUSIONS OF COLOUR;
MOTION ILLUSIONS

REPRESENTATION OF REALITY IN VISUAL ART

WHOLE/PART RELATIONSHIP
THE OP ART

Extended lesson summary:
VISUAL ILLUSIONS

THE STUDY OF VISUAL ILLUSIONS VISUAL ILLUSIONS (CONT.)

ILLUSIONS OF BRIGHTNESS AND CONTRAST

Hermann grid and Scintillating Grid
You can read more in:
http://en.wikipedia.org/wiki/Grid_illusion

The Hermann grid illusion is a visual illusion reported by Ludimar Hermann in 1870. The illusion is characterized by "ghostlike" grey blobs perceived at the intersections of a white (or light-colored) grid on a black background. The grey blobs disappear when looking directly at an intersection.

An example of the Hermann grid illusion.
The scintillating grid illusion is a visual illusion, discovered by E. Lingelbach in 1994, that is usually considered a variation of the Hermann grid illusion. It is constructed by superimposing white discs on the intersections of orthogonal gray bars on a black background. Dark dots seem to appear and disappear rapidly at random intersections, hence the label "scintillating". When a person keeps his or her eyes directly on a single intersection, the dark dot does not appear. The dark dots disappear if one is too close to or too far from the image.

Classical explanation:
Günter BAUMGARTNER (1960) involving the concepts of receptive field and lateral inhibition
http://en.wikipedia.org/wiki/Receptive_field

Schematic Retina Showing a Receptive Field

Orange are excitatory inputs into the receptive field.
Blue are inhibitory inputs into the receptive field.

Receptors
Horizontal Cells
Bipolar Cells
Amacrine Cells
Ganglion Cells
Question: why don't we see the grey blobs when we try stare at them?
This happens because when we stare at one intersection, the proximal stimulus of that intersection forms in the fovea, where perceptive fields are much smaller than in peripheral regions of retina.

**Criticism to the Baumgartner theory from Janos GEIER:**

- The illusion is not present in different grids which nevertheless maintain the same structural properties of Hermann Grid;
- Our brain at the level of the visual cortex, undoes the retinal encoding through a process of spatial integration in order to get closer to a true perception of luminosity.
Classical Hermann Grid
- the illusory effect is evident

Sinusoidal grid
- NO illusory effect

Wave like grid:
NO illusory effect

Nodular grid:
NO illusory effect
Seminodular grid:
NO illusory effect

Humped grid:
NO illusory effect

Conclusions from GEIER
- Main cause of Hermann Grid illusion is straight nature of the boundaries between black and white (blurred effect on the grid semimodular);
- The width of the white lines do not have any significant role in the illusion.

Criticism the Baumgartner theory from Schiller Lab (MIT)
- Arguments:
  - the width of grid lines is irrelevant
- The effect can be obtained with a reversal of the contrast.

- The effect disappears in different grids but that nevertheless retain the structural features affecting the presumed relationship between the stimulus and the receptive fields.
• The alignment of the specifically oriented elements is important

- The effect is not amplified when the hypothetical antagonism between central receptors and surrounding inhibitory receptors of the receptive field is increased. According to Baumgartner theory, in the grids below, illusory effect should be greater in the example on the right.

- Resposta menor
- Resposta muito menor
• The difference in contrast of lines can accentuate the illusion, but only when the lower contrast lines overlap the lines with higher contrast, as we can see in the next images – strong effect on the left and almost no effect on the right.

![Image of two sets of lines with different contrast]

• The colour of the illusory spots is defined by the colour of the lines that appear in the foreground. Blobs of different colours on the left image and grey blobs on the right image.

![Image of two sets of lines with different coloours]

• Discharge mechanisms as well as the distribution of retinal ganglion cells, and the spatial arrangement of receptive fields, are not those assumed by the theory of Baumgartner.
Conclusions

1. The illusion occurs in a wide range of widths of light bars;
2. The illusion is reduced by the use of curvilinear and discontinuous bars;
3. The use of configurations that increase the antagonism central cells/peripheral cells decreases the effect;
4. The effect is increased with different luminosities bars, but only when the bars less contrasting are in the foreground;
5. The spatial arrangement of retinal ganglion cells and of the receptive fields does not conform to the theory advocated by Baumgartner.

- Simple Cell Theory S1. This theory suggests that a role is played by the visual cortex neurons (simple cells s1) specialized in the orientation detection in v1 area of the visual cortex.

Wertheimer-Kofka Ring Illusion

When the continuity in the grey ring is interrupted (by the pencil in the next example) the half the ring in the left white side looks darker than the half on the ring on the darker, right, side.

You can find animated examples at:
http://web.mit.edu/persci/gaz/gaz-teaching/flash/koffka-movie.swf
http://www.michaelbach.de/ot/lum_wkoffka/

- Perceptual mechanisms at the base of the illusion:
  - Two levels:
  - Low-level mechanisms - lateral inhibition: — the interaction between the photoreceptor cells of the retina;
  - Gestaltic type high-level cognitive mechanisms: — when we see the ring as a complete object, higher level brain mechanisms of integrative type let us perceive the ring as a single entity, all of the same colour.
Addleson Checkerboard Illusion
In the next image the squares marked as A and B are exactly the same shade of grey, although square A looks much darker than B.

For an animated version:
http://web.mit.edu/persci/people/adelson/checkershadow_illusion.html

- **Perceptual mechanisms at the base of the illusion:**
  - Two levels:
    - **Low-level mechanisms - lateral inhibition:** the interaction between the photoreceptor cells of the retina;
    - **High-level cognitive mechanisms:**
      A. **Local contrast:** the perception of shades of grey is exaggerated in order to accentuate the contrasts;
      B. **Nature of change of luminosity:** the shadows are soft and poorly-defined limits, painted surfaces (such as grid cells) have clearly defined limits. Our visual system ignores the gradual changes of brightness level so that you can determine the color of surfaces without being fooled by shadows projected on them.
COLOUR ILLUSIONS

Troxler Effect
If you stare at the red dot for some time you will notice that the grey ring around it fades away and you don’t see it. But, as soon as you move your eyes, even slightly, you see the grey ring again.

In the next page you will see another version of this illusion.
If you stare at the black dot for some time you will notice that the grey shading around it fades away and you don’t see it. But, as soon as you move your eyes, even slightly, you see the grey ring again.

Troxler’s fading, or the Troxler Effect, is an optical illusion affecting visual perception. When one fixates on a particular point for even a short period of time, an unchanging stimulus away from the fixation point will fade away and disappear. Recent research suggests that at least some portion of the perceptual phenomenon associated with Troxler’s fading occurred in the brain.

You can read more on:
http://en.wikipedia.org/wiki/Troxler%27s_fading
  - Perceptual mechanisms on the basis of the illusion:
    - factors related to of adaptation of cells in the visual system (photoreceptor and signal transmission cells).
Lilac-chaser Illusion

In this case IT IS ESSENTIAL to see the animated version:
http://www.michaelbach.de/ot/col-lilacChaser/index.html

- Perceptual mechanisms at the base of the illusion:
  - Combined action 3 types of effects:
    1. **Phi (φ) Motion**: illusory perception of movement without a form;
    2. **Image aftereffect**: - negative image due to the adaptation of the rods and cones of the retina;
    3. **Troxler effect** resulting from the depletion of photoreceptors and signal transmission cells of the retina.
Neon color spreading illusion

Version from Dário DARIN, 1971, Milan University, Italy

A version from Harrie VAN TUIJL, 1975, Nijmegen University, The Netherlands

For an extended Reading on this illusion:
http://en.wikipedia.org/wiki/Neon_color_spreading
And an animated version:
http://www.michaelbach.de/ot/col-neon/index.html
Look carefully at these examples:

When we have achromatic segments embedded in chromatic grids, the illusory figure is dyed in the color complementary to the color of the outside lines.

- Perceptual mechanisms at the base of the illusion:
  - There is not yet a consensus about the underlying perceptual mechanisms;
  - Research has focused on the study of the conditions under which the illusory effect may or may not be observed;
  - The illusion depends on external lines that act as inducing elements;
  - The illusion is more powerful when the segments are continuous, collinear and equal thickness;
  - Inductive lines should have a shade darker than the lines of colored thread.
MOTION ILLUSIONS

Pinna-Brelstaff Illusion
In the picture below you have the classic example of this illusion.

To see the illusion consider two situations:

1. If you are seeing this in a printed sheet of paper take the sheet of paper with your hand and make a back and forth movement getting it closer to your eyes and then taking it away;

2. If you are seeing this in a computer screen you can make a back and forth movement with your head so that your eyes get a shorter and a longer distance from the screen alternatively.

If all goes well you will have a perception of illusory motion on the rings made of little squares. The outer and inner ring will seem rotate in opposite directions.
In the next picture you see another version of this illusion that should produce a stronger illusory effect.

For an animated version:
http://www.michaelbach.de/ot/mot-PinnaBrelstaff/index.html

- Perceptual mechanisms on the base of the illusion:
  - Several studies suggest that are orthogonal clues resulting from the polarity of the squares that are at the base of the illusion;
  - Two types of factors (see next picture):
    1. The interaction between motion and orientation detectors that is caused by the lighting profile of the elements of the rings;
    2. A gestaltic secondary effect which causes a global perception of rotation of the ring.
Some more recent and powerful examples:
Waterfall Illusion (motion aftereffect)

- **Motion aftereffect** — change in the perception of movement after prolonged observation of a stimulus that moves on a regular basis.

In this case it also essential to see the animated version: http://www.michaelbach.de/ot/mot-adapt/index.html

- Perceptual mechanisms on the base of the illusion:
  - Adaptation of neurons in the visual cortex that respond selectively to motion:
    - neurons have a spontaneous activity;
    - exposure to an object that moves in the same direction systematically destroys this balance;
    - neurons tuned to the opposite direction try to restore balance, in a process of active calibration, thus leading to the illusion.
Isia Leviant Enigma Illusion
The picture below is a work by Israeli op-artist Isia Leviant “The Enigma” (1981).

Stare at the centre of the figure for a while. Some ‘scintillating’ activity will build up in the violet and blueish rings.

Some observers also report a circular rotation within these regions; things will begin to “run around in circles”.

More on:
http://www.michaelbach.de/ot/mot-enigma/index.html
– Perceptual mechanisms on the base of the illusion:
  - There is still no consensus;
  - Role of radial elements — when they are removed from the image the effect disappears;
  - The Enigma effect may be mediated by cortical neurons that respond to "T" type figures;
  - The effect disappears if:
    - the radial lines are skewed in opposite directions in order to annul its orthogonal position vis-à-vis the rings;
    - black radial lines are replaced by dashed lines.
  - One recent study suggests that eye movements (micro-saccades) may also have a role in the illusion.
REPRESENTATION OF REALITY IN VISUAL ART

Whole/part relationship

- Painting and vision are based on relative and comparative processes;
  - effects based of comparisons;
  - relationship between opposites: all/parts; Figure/background.
- Importance of context:
  - Relation of the subject with
    - other objects;
    - with surrounding elements.

The op art

- Op (tical) art: — artistic movement that explores the visual phenomenon and the principles of perception.
  - Visual dynamism which creates effects of visual illusion;
  - Abstract works, convey the impression of movement, flashes or vibration, or sometimes seem to swell or deform.

Artists:

First work of Op art,
Victor Vasarely,
*Zebra* (1938)
Alom, Victor
Vasarely

Squares, Victor
Vasarely
Bridget Riley (Londres, 1931 - ...)
Bridget Riley
*Arrest 1, 1965*

Bridget Riley, *Orient 4, 1970*

Faro, 11/23/2014
Professor in charge of CU:

[Signature]