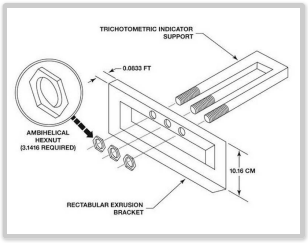
Visual Illusions

seeing how the mind sees



George Matthews, Plymouth State University

2020

Theories of knowledge

rationalism

- Mind deduces the basic nature of things from fundamental concepts; knowledge results from thinking things through carefully.

empiricism

- Mind passively recieves information from outside; knowledge requires dropping pre-concieved ideas about what things are like and letting the data speak for itself.

constructivism

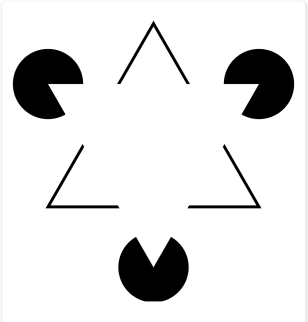
- Mind organizes raw data into a coherent picture of reality, so knowledge involves building models and testing them against new information.

? *If the world that we experience is a mental construct, how does this affect our ability to know what things are really like?*

Completing the picture

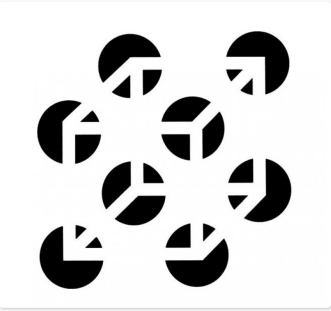
HINT: Can you see the dog?

Completing the picture



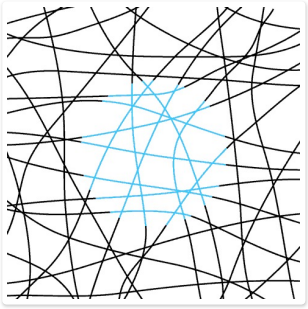
Is there a white triangle here or not?

Completing the picture



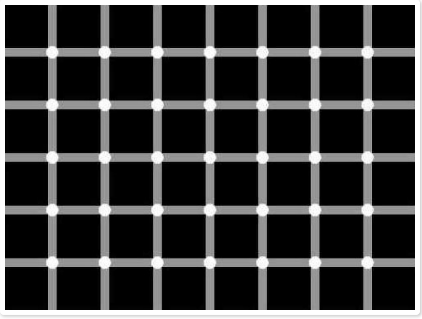
Are you looking up at the bottom of the cube or down at the top?

Completing the picture



Our visual systems soften the differences between contrasting elements if they seem to evoke a pattern.

Completing the picture

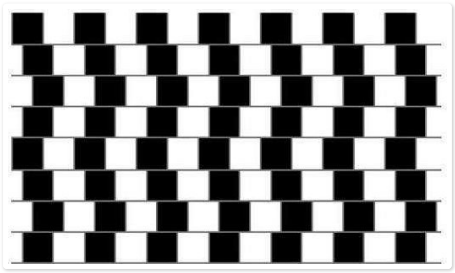


Why does the color of the intersections change depending on whether you are looking straight at them or not?

Completing the picture

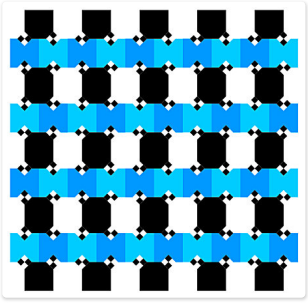
- Our minds are "anticipation engines" -- we identify patterns and use them to anticipate what happens next in time, space or action.
- By default we leap to conclusions only later filtering them through critical thinking.
- The ease with which we can connect the dots enables us to thrive in complex and novel environments.
- It also leaves us vulnerable to seeing patterns that aren't really there.

Orienting things in space



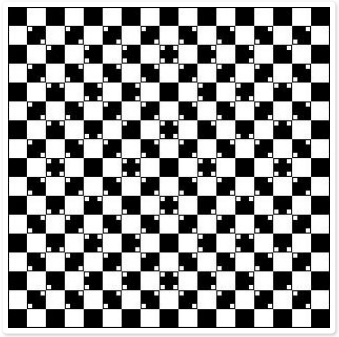
All horizontals are parallel. Check it with ruler! Why can't we SEE this even though we KNOW it?

Orienting things in space



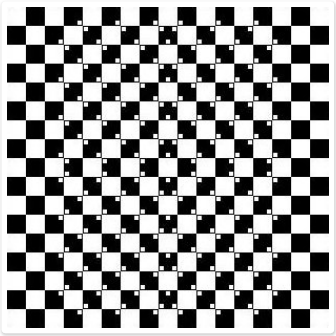
A more extreme case of how we interpret visual data spatially in response to small contextual cues.

Orienting things in space



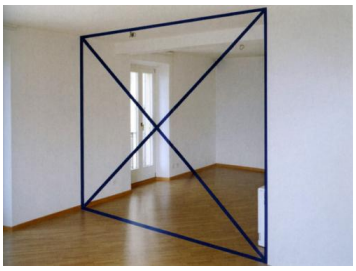
Changing these cues...

Orienting things in space



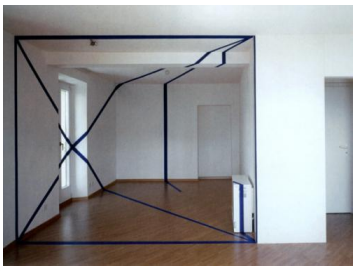
... changes our spatial perception.

Orienting things in space



Sometimes an illusion depends on...

Orienting things in space



... us occupying one particular perspective.

Orienting things in space

Only from such a perspective can we see the illusion.

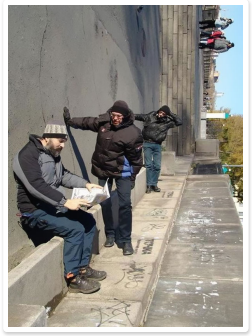
Orienting things in space

It falls apart with a simple change of viewpoint.

Orienting things in space

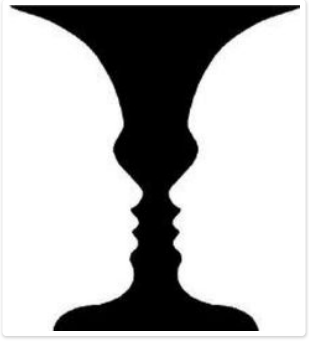
Some artists specialize in tricking our minds into rendering flat images as 3-dimensional objects.

Orienting things in space



Or creating ambiguous scenes.

Interpreting objects

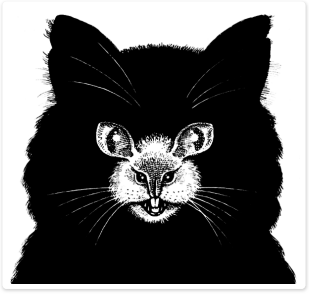


We often have choices about which mental model best captures the reality.

Interpreting objects

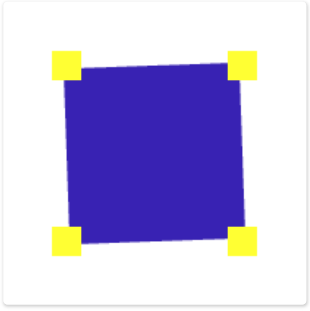
We can flip from seeing this as a duck to seeing it as a rabbit at will.

Interpreting objects



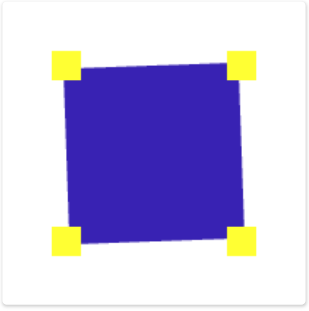
Often unconscious "decisions" enable us to structure input as a coherent and meaningful image or scene.

Interpreting objects



Context can determine how we perceive motion and change.

Interpreting objects



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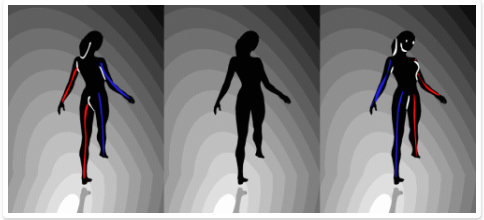
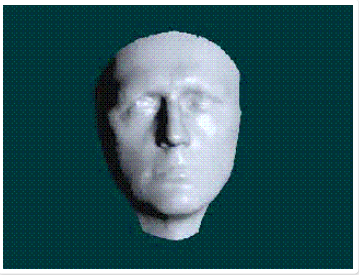
Interpreting objects



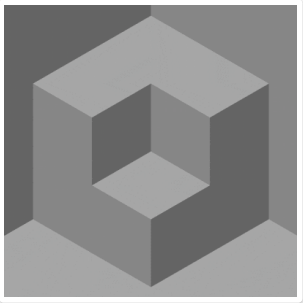
Subtle visual cues on the side dancers cause the direction of rotation to change.

Interpreting objects



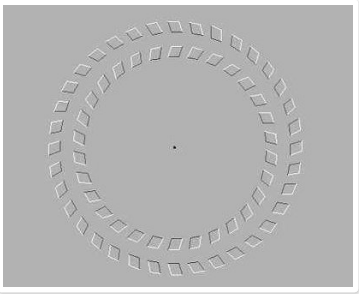
Since we never see behind anybody else's face we can't see the back of the mask as hollow. Our brains compensate by switching direction of apparent motion.

Interpreting objects



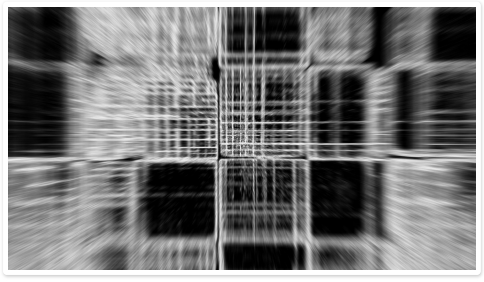
When exactly do figure and ground reverse?

Perceiving motion



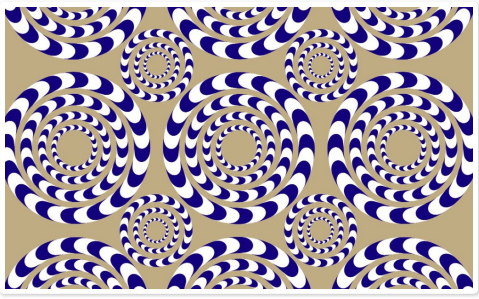
Focus on the dot in the middle and move year head back and forth. What do you notice?

Perceiving motion



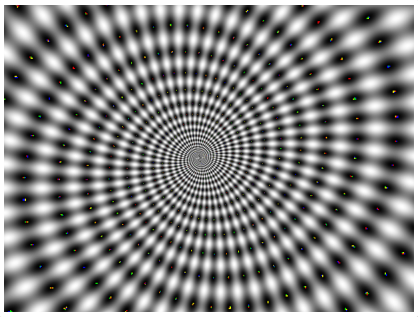
Some static images suggest motion with patterns of distortion and displacement.

Perceiving motion



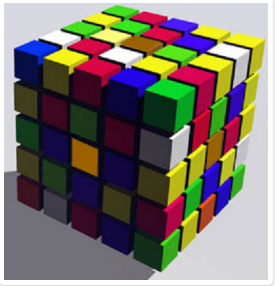
When our eyes see motion but our bodies register stillness we can feel ill....

Perceiving motion



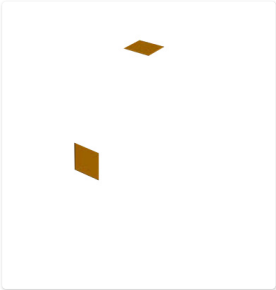
... This is because we evolved to associate this mismatch with poisoning, which often results in perceptual/motor disconnects. Consider the effects of alcohol.

Perceiving color



Are the center squares on the faces in the light and the shadow different colors...

Perceiving color



...or the same color?

Perceiving color

Stare at the colored dots on her nose for 30 seconds then go to the next slide while holding your eyes still.

Perceiving color

What did you just see?

Perceiving color

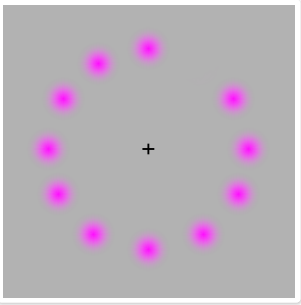


Image and after-image are opposite colors which cancel each other out. What happens when you fix your gaze on the plus sign in the middle?

Perceiving color

We wouldn't be done here without "The Dress That Broke The Internet" in 2017. It is of course colored white and gold.

find out more

- Perception and Perceptual Illusions: explores some of the mechanisms behind the scenes.
- 136 Optical Illusions: lots of examples and explanations of the causal mechanisms.

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