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flashMOOCs – Transcript

With the flashMOOCs video series, the University of Bern is giving you an insight into interesting educational content on current scientific and social issues.

Video: «Reality: How Perception Creates the World»

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Link: https://www.flashmoocs.unibe.ch/videos/reality_and_perception/index_eng.html

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1. Introduction

We perceive the world around us as distinct and unambiguous and take information for granted. Our perception is our reality. We hold on to this reality. Even when we are shown to be wrong. We have seen it, therefore it must be real. Take conspiracy theories as an extreme example. As a matter of fact, reality is not what it appears to be. The world around us is ambiguous, noisy, and by no means as distinct as our perception would have us believe. But how does our brain process information? And how is the reality we perceive created?

The world as we perceive it is the result of multiple processing steps inside our brain. What we are looking at right now is not the physical world. What we see is the result of our own perception. The process of perception is not bottom-up. We must constantly filter the incoming information and grasp the real meaning of the outside world.

Perception takes place in real-time. In the real world, we must act quickly, immediately, and rely on our perception. Real-time perception is essential to rapidly identify and categorize objects, recognize people, know where we are in space and guide our actions. Perception also helps to assess the emotional state of people we are facing and determine whether we consider an environment as being trustworthy. When it comes to understanding perception, we rely not only on our senses but also on prior information, such as our beliefs, experiences, and expectations.

Perception results at least as much from inside out as from outside in, and it is not always evident, how we weight information and what criteria we finally rely on. And people may take different decisions even though they are looking at exactly the same environment.

Let's start with an example.

Look at this neighborhood. Would you like to go for a walk here? Take a good look around. Is it a dangerous area? Should we stay away from it at all costs? Or is it safe and we have nothing to worry about? What do you decide? Are you staying or walking away?

Click on one of the buttons to continue the video.

Whatever option we choose, we inevitably make a decision based on our perception. In this video, we will have a look at several examples that compellingly demonstrate how perception works. We will illustrate the concept of perceptions with examples about colors, imagination, and eye movements. Click on the buttons to navigate to the chapter that interests you the most.

2. Colors

Do you remember the dress? What did you see? Was it blue and black or white and gold?

The dress is actually blue and black, but some people perceive it as white and gold. How does this happen?

It is important to know that colors do not exist outside of our mind. They are indeed a construction that takes place in our head. The only information we gather from the outside world is electromagnetic waves, but these waves are not colored.

They are defined by their frequency and amplitude, that's it. It's not until the light hits the retina of the eyes that the color appears. Light interacts with the receptors and the brain analyzes the information. In order to analyze the incoming data, the brain uses prior assumptions.

And this is why we have color constancy. This is the ability to perceive roughly the same colors, despite dramatic changes of the ambient light. However, color constancy is not perfect. Sometimes the same color may appear differently in a different context.

Let's look at another example:

Compare the color of these two squares. Which square is darker?

Select the darker square by clicking on it.

In reality, both squares have exactly the same color. The context of the colored squares made our brains think that one is darker than the other. If you cover this part of the image with an object you will see, that both squares have exactly the same tone of grey. The context makes it look like the bottom square is brighter than the top one.

Color constancy is not only influenced by context, but also differs individually. The dress has attracted a lot of attention and indeed it is striking, how individuals can differ in color perception. Rumor says that some couples have gotten divorced because they just could not resolve their disagreement on the color. As a matter of fact, there is no right or wrong. The differences are absolutely valid. The reason are individual differences in how the composition of the surrounding light is compensated.

Some people unconsciously assume a blue bias in the light and therefore see the dress white and gold where others assume a more yellowish bias and they see it in black and blue. This shows the importance of the internal computation since the picture itself is the same for everyone.

Click on the buttons to navigate to the chapter that interests you the most.

3. Imagination

Human imagination is anchored in perception, and perception is shaped by imagination. See what you can do with your mind by the following exercise.

Imagine a capital D. Rotate it in your mind 90° counterclockwise. Leave it there. Now imagine a capital J and connect it with the rotated D so that the upper part of the J lies exactly in the middle of the horizontal line of the rotated D.

What do you see?

When ready, click on the button to see the solution.

You created an umbrella in your mind. We were not aware of the umbrella when asked to imagine a D and a J. This means that you can discover new information through imagination.

Imagination is a key component of creativity. It goes beyond perception because you can reassemble parts in new ways. In ways that you may have never seen before, but you can imagine them. This is a powerful source of innovation.

Imagination is like perception in offline mode without limitations from any sensory input. Imagination is the inside-out part of perception. Typically serving perception, imagination can just as well run on its own. We simulate possible actions, counterfactual scenarios, a plan for the future using our imagination. Click on the buttons to navigate to the chapter that interests you the most.

4. Eye Movements

What happens on the retina when we move our eyes? The retinal images jump with every movement we make. Which is two to three eye movements per second.

Nevertheless, the world as we perceive it, does not jump. How come that we can maintain the perception of a stable world around us despite the fact that the retinal images are steadily changing?

What do you think?

A) Are we just getting used to the moving retinal images?
B) Does the brain recognize in real time the commands sent to the eye muscles?
C) Do the retinal images move too fast to be recognized?

The correct answer is B).

The brain recognizes in real time the commands sent to the eye muscles. To do so, the brain actually uses a trick. The command to the eye muscles telling the eyes to move is copied. This copy is used to anticipate the sensory consequences of our own movements. Jumping images on our retina are thus simply filtered out.

And this happens in real-time. By the way, this is the reason why we can distinguish whether a movement is our own or whether it is the result of external influences. This is also the reason why we cannot tickle ourselves. We know the sensory consequences of our own movements beforehand

and therefore we cannot tickle ourselves. We get tickled by movements of someone else because they are much less predictable.

5. Conclusion

Let's go back to our neighborhood.

In your opinion, is the neighborhood safe or unsafe?

Compared to the neighborhood scene we saw at the beginning of the video; this scene contains ambiguous elements which are neither positive nor negative. The opening scene clearly had negative elements.

Your initial view of the scene probably biased your brain, which now sees the ambiguous scene as a rather negative scene.

Previous impressions shape how we perceive now. We are biased. In real life, we rely very much on what we perceive, for us it is the reality. But remember, we use prior information in combination with sensory data to create our reality. The visual system alone uses a huge number of the neurons in our brain to analyze visual data. And we tend to believe what we see.

The truth is, however, that no everything we see is real. We quite often see unreal things. This does not just apply to the simple exercises we did in this video. It is a principle that applies to more complex contexts, such as reading the news, trusting politicians, voting behavior, purchase behavior, partnerships and so forth. Higher-level information such as knowledge, expectation and beliefs can overrule the sensory evidence.

This makes us vulnerable to biases and potentially misleading information, to fake news and conspiracy theories, but that's the way it is. It is good the way it is, we need this higher-level information because relying on sensory information alone would be too slow, imprecise, and highly ambiguous. We would lose all our flexibility that makes us so powerful. Meaningful perception requires far more than what the receptors can tell us about the state of the world. Seemingly complex social phenomena rely on the same mechanisms that are involved in human perception. It is not the world that creates perception, perception creates the world.

Further information: www.flashmoocs.unibe.ch