
Chapter 1

Perception

1.1 Introduction

Central to the production and experience of art, be it visual art, music, dance, or any other kind, is the fact that we as human beings experience it through our senses. Perception is strongly related to this kind of experience, and having some understanding of how we perceive things, physically, can give valuable input that might influence the creation. Understanding how our work will be perceived – by ourselves and by others – is invaluable to the creative process.

In this chapter we introduce the phenomena of perception and cognitive processes; these concepts are taken further in Volume 2 of the subject guide, where visual and audio perception are examined more closely.

How we experience something is not only governed by the physical stimuli of our senses, by light, or sound waves, or touch. There are aspects of perception that are related to cognition and psychology: how our brains put together information, and also what we have experienced in our lives already.

Although we consider these aspects only briefly during this subject, you should be aware of the connections between this and the more direct aspects of perception, and should also develop a basic understanding of some of the concepts and issues in this area.

1.2 Cognitive and psychological aspects of perception

In the Level 1 course in Creative Computing, you saw examples of the Gestalt principles of similarity, proximity, etc., and how this affects how we perceive visual images. What is happening here is that there is an image, which we see because of the light waves that exist in our environment, and because of how our eyes operate on a physiological level. However our brains, as well as processing the signals from our eyes, also put together parts of the visual stimuli, to create more abstract entities than only elements of light or colour. This is what we use to make sense of the visual stimuli, and this is what relates to perception. For example, amodal perception (which was not included in the Gestalt descriptions of perception) describes the ability we have to ‘see’ a cup, when we only have the visual stimulation of part of a cup. Reification describes the fact that we perceive parts of an image that are not actually there, if doing so ‘completes’ the image (cognitively) for us.

So, perception relates to how our senses are stimulated, and how we then make sense of those stimuli that are essentially neurological. As well as the purely physical aspects, these can be examined from a cognitive standpoint, or from a psychological standpoint. The Gestalt descriptions are focused mainly on the cognitive aspects – and also tend to focus on visual perception – whereas more general psychological

aspects would include things like how our experience in our lives up to the point of stimulation might influence the perception we then have. Although much of the Gestalt and subsequent work has been related to visual perception, a good musical example comes from Christian von Ehrenfels – a member of the original Gestalt school. Take a 12-note melody, and play it in one key. Now change it to another key and play it again. There may not be any notes that are the same in the two playings, yet most people listening are able to recognise that it is the same melody. What psychologists have tried to figure out for centuries is what it is that makes us know, somehow, that it is indeed the same tune: is it a property of the melody itself, the environment in which the melody exists, our own experience and emotions, a combination of these, or even something else?

It is not straightforward to distinguish between cognition and psychology as they overlap in various ways. Cognitive studies focus on how we understand and make sense of things; this might include things like reasoning, argument, logic and perception. Examination of cognition is usually a part of a more general psychology, which may also include things like how emotion, experience and intelligence contribute to our understanding and our responses.

There are a variety of views on how perception works, such as the constructivist view of Richard Gregory¹ which argues that perception is an hypothesis that the brain ‘constructs’, based on prior knowledge and experience, of what is expected from a stimulus. James Gibson² has argued that Gregory’s approach and the Gestalt viewpoint ignore the reality of 3-D in visual perception. A century earlier, Hermann von Helmholtz (1821–1894) is sometimes credited with being the first person to identify visual perception issues, and also took a constructivist view. Von Helmholtz also contributed significantly in the beginnings of signal processing, as you will see later in this subject.

In general, the psychological and cognitive aspects of audio perception have received less attention than the visual ones, and it is argued that Western culture emphasises the visual over the audio. It is also true that a larger part of the cortex is devoted to visual processing than to dealing with any other single sensory input.

Haptic technology is introducing tactile perception to various digital applications, and is a newly emerging area for research and development in perception.

Learning activity

Find out more about the constructivist and ecological views of perception, and contrast them. Use this research to write an explanation in order to tell a fellow student what the important differences are. Decide which approach you think is most correct, and back up your choice with reasoned argument and evidence.

1.3 Abstraction in perception

Abstraction is a concept you should have come across in other subjects you have studied. For example, in computing, we often distinguish between the abstract properties of a data type, and how it actually (concretely) gets implemented in the

¹Gregory, R.L. Knowledge in perception and illusion. *Philosophical Transactions of the Royal Society of London*. B1997; 352: 1121-1128.

²*The Ecological Approach to Visual Perception*. (Psychology Press, 1986) [ISBN 978-0898599596].

computing machinery.

Here is an example in perception: imagine a chair. When we look at the chair, we do not usually perceive it as being an object made of wood, metal and leather. We perceive it as a chair. It is also the case that if we see the chair from the opposite side of a table, we still see it as a chair, even though what we actually see might only be the top part of it. It is possible to perceive it as a couple of pieces of wood, covered in leather and held together by bits of metal. It is possible to perceive it as the top part of a chair-back. But usually, we perceive it as an abstract entity, which we call a chair. Philosophical views on abstraction are not new; many philosophers have discussed and argued about these kinds of ideas, as far back as Plato.

On a physiological level, what we actually see are those particles, or molecules, that make up the physical part of the object, that are in a space in the room where the light rays that bounce off it come into our eyes. Signals bounce around the room, and our senses (in this case, the sense of vision) receive the signals and process them. While it is essential that this does happen, and it is important to understand these mechanisms on a physical and physiological basis, it is also the case that how these signals then get put together, by our brains, contributes to how we perceive the objects (or in some cases, the results of signals, such as in the audio domain).

In the next volume of this subject guide, you will look in much more detail at the physical aspects of visual and audio perception. At this point though, what is important for you to understand is that what we are looking at is physical signals in the real world, and how they impact on our senses, and how they combine in various ways to make that impact.

Learning activity

Find out what you can about the following:

- depth perception
- colour perception
- amodal perception.

Discuss how they relate to the material in the above sections.

Discuss the relationship between perception and perspective, especially in the context of the work you did in Level 1.

The description of abstraction above focused on a visual example. Try to construct an example that illustrates the concept in the sound domain.

1.4 Ambiguity in perception

A direct example of ambiguity is demonstrated by the Gestalt property of multistability, which is illustrated in Figure 1.1. This is visual ambiguity, where it is possible to see one of two images, and to alternate between them.

More generally, ambiguity is the property of allowing, or admitting, more than one interpretation. It plays an important role in the spoken and the visual domains, and

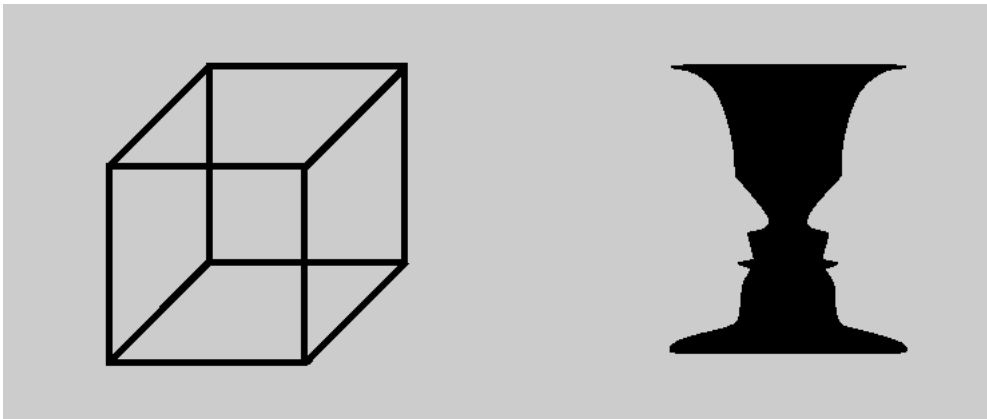


Figure 1.1: Two multistable images.

has historically been studied by philosophers. It is important to note that there is a distinction between ambiguity and vagueness, where vagueness refers to a description (or even an image or sound) that is ill-defined or unclear. Some people use the word ambiguity synonymously with vagueness; this is not strictly correct.

In language, ambiguity is often seen as problematic. All of the following sentences can be interpreted in more than one way:

1. *Sam dropped the book with the picture.*
2. *The duchess can't bear children.*
3. *Children make nutritious snacks.*

While ambiguity has often been seen as a phenomenon that causes difficulties – for centuries, philosophers have argued about linguistic ambiguity, and more recently in computational linguistics, creating computer systems that can distinguish semantically between different meanings of the same phrase or sentence is a current challenge – it also affords a lot of creative potential.

At the most explicit level, visual images such as the multistable ones, can be used to create interesting artworks. Also, playing around with perspective can include ambiguity for creative impact. In the audio domain, different sounds can be heard in different ways.

The work of Dutch artist M.C. Escher made a lot of use of ambiguity in the creation of extremely interesting visual artworks. One such example is called *'Relativity'*. Escher also used other visual and perceptive techniques to create specific effects, and he enjoyed making images that would be physically impossible, yet were visually appealing and stimulating, such as his famous *'Drawing Hands'*. You can see examples of Escher's work at <http://www.mcescher.com/>.

At a more abstract and psychological level, it is possible to create provocative pieces through the use of linguistic ambiguity in an art context. One of the most famous examples is the one you saw in the Level 1 Creative Computing guide, of the Magritte work *'The Treachery of Images'*. Magritte used the ambiguity between the sentence referring to a picture of a pipe and referring to a pipe itself to make a social comment. Many people since then have used this work as the basis for further creative pieces.

1.5 Summary and learning outcomes

This introductory chapter focused on perception: what it is and different views on how perception works at a cognitive level. We also looked at the role that perception has in the creation of artworks.

With a knowledge of the contents of this chapter and its directed reading and activities, you should be able to:

- describe some of the issues regarding how physical stimuli and perceived entities connect
- discuss different views on how perception works
- explain what is meant by ambiguity, and give examples of ambiguity in visual and linguistic contexts
- discuss the role of abstraction in how we perceive entities in the world.

1.6 Exercises

1. What is cognition? What is cognitive science? What is artificial intelligence? How do these areas relate to each other and to psychology?
2. In linguistics, ambiguity can occur in different places. Give examples of each of:
 - lexical ambiguity
 - syntactic ambiguity
 - structural ambiguity
 - semantic ambiguity.
3. What is musical ambiguity? Find some examples of this.
4. What is abstraction? What role does abstraction have in how we understand language? What role does abstraction have in how we experience visual art, or music?
5. There is an excellent article on the use of Gestalt principles in user interface design, at http://www.interaction-design.org/encyclopedia/gestalt_principles_of_form_perception.html.
Read the article and then develop a visual image, such as a book cover, a web page, an advertisement, or some other media item, that incorporates one or more of the Gestalt principles or other principles of perception. You need not restrict yourself only to principles mentioned in the article. Write a short essay that describes which principles you have used and in what way, in your image.
6. Find out more about the work of Escher. Create a piece of digital art or music that connects in some way with one or more of Escher's artworks. Write a brief accompanying description and critique of your work. You may use any software you like for this.
7. Earlier in this chapter, we noted that Western culture emphasises the visual. Discuss this claim, and present evidence that either backs it up or challenges it.

