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Systems diagramming

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About this free course

This free course provides a sample of level 1 study in Computing & IT http://www.open.ac.uk/courses/find/computing-and-it

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There you'll also be able to track your progress via your activity record, which you can use to demonstrate your learning.

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Contents

Introduction

Pictures speak louder than words. But how can you use diagrams to help you? This course, *Systems diagramming*, looks at how diagrams can be used to represent information and ideas about complex situations. You will learn how to read, draw and present diagrams to help illustrate how ideas or processes are connected.

This OpenLearn course provides a sample of level 1 study in Computing & IT.

Learning Outcomes

After studying this course, you should be able to:

- appreciate diagrams as a powerful aid to thinking and acting
- distinguish between systems diagrams and diagrams helpful in systems work
- demonstrate sufficient skills to ‘read’ and ‘draw’ a wide range of diagrams, following given conventions, that help improve an understanding of a situation
- select diagrams suited to the needs of the situation being investigated and the purposes/preferences as the diagrammer.

1 How to use this course

This course is a learning resource. Like all resources, there are different ways to use it depending upon what you are trying to achieve. Whatever you are trying to achieve it is important that you not only read the text thoroughly but also undertake the Activities (there are no 'set' answers to these Activities as they are personal to you but I have provided my own, or other people's, responses). After all, this is a course that helps with systems *thinking* and *practice*, and without practising your thinking using diagrams you may not learn how powerful such tools can be.

This course also has visual materials that deal with the mechanics of using diagrams in a way that text alone cannot convey. So further practice will come from viewing the animation.

Some people seem to have a natural talent for diagramming, just as some have a natural talent for playing the piano. But many people find it rather awkward and difficult at first. In a way, that is an encouraging sign: it shows that you are genuinely coming to grips with something unfamiliar; and, after all, there is no point in studying what you already know how to do. But it will require perseverance and you can't expect to grasp it all straight away.

In particular this course looks at how diagrams can be used to represent information and ideas about complex situations and in particular for identifying and working with systems of interest. You can often summarise how ideas or processes are connected much more neatly in a diagram than in words; you can also show someone else how something works by drawing a diagram of it. This means that you need to be confident with using diagrams in systems work. You need to learn how to *read* diagrams about complex situations – extracting information from them and interpreting what they mean. You also need to learn how to *draw* diagrams of your own, so that you can capture your own ideas and interpretations of a complex situation on paper. And finally you need to know how to *present* diagrams so that others can successfully read them.

The sections of this course cover the range of what? when? how? why? and who? questions on aspects of diagrams and diagramming:

Section 2 discusses how diagrams are representations or models of situations used to capture 'information' in a visual form, showing multiple relationships between 'things' in a non-linear fashion. It also looks at the relationships between 'events/activities/entities' on the one hand and between 'thoughts' on the other – with some diagrams mixing the two together.

Section 3 notes that diagrams are generally used to help your own understanding of written text; to help your own thinking about a situation; to convey understanding to others – to do that you need to be able to read them effectively.

Section 4 claims that diagrams are used in systems thinking and practice to capture as much information as possible about a situation, to help explore a situation, to help to analyse a situation, to represent a system of interest, to plan and implement changes to a situation, to help in decision making and to help with quantitative model building.

The course has a link to an animated tutorial that covers the purposes, elements and conventions of specific types of diagrams most widely used in systems studies. It also acts as a glossary of the major diagramming types used in systems work.

2 What is a diagram?

Diagrams are all around us. We all try to make sense of the world around us and this sense is displayed in two ways.

1. We all have our own ‘internal models’ of how things work based on our experiences and our interpretation of those experiences. These ‘internal models’ shape our thoughts and actions and lead us to expect certain outcomes from certain activities. They change and evolve with new experiences or (hopefully) when challenged by new information. They are the means by which we make sense of the world by searching for familiar patterns or creating new ones out of all the information we receive.
2. Although ‘internal models’ are personal we also use them to share our ideas and understandings by comparing them with those held by others through the conversations we have and the things we do. This enables us to build up ‘external models’, where patterns of ideas, things or activities are recognised and understood by many people at the same time, e.g. a table of the physical properties of matter.

   Such ‘external models’ underpinned by shared assumptions are commonplace, often to the point where we take them for granted. This can be particularly so where we try to use diagrams to represent and communicate complex information simply and quickly.

Activity 1

Try to think of three examples of diagrams you see regularly in your home.

Write down what they represent to you.

Say what you use them for.

Here are my responses

1. The first thing I had to hand was a ‘do it yourself’ (DIY) manual (being used a lot because I have just moved into a new house). This was full of diagrams of bits of rooms, fixtures, fittings, tools and other equipment that I might want to build or use myself around the house.
2. Next I picked up a road map from the hall. This is a very colourful diagram that uses many types of symbol, but I find it easy to follow, using the key, and invaluable in planning my car journeys. It ‘represents’ how certain features in the real world relate to each other in terms of distance. So I know that the distance from Milton Keynes to Birmingham is about 110 kilometres and that I can drive there in just over an hour (given the right traffic conditions!).
3. The last diagram I noted was the symbols on my wristwatch. This has a mixture of thick and thin lines around the outside of a circular face, but no numbers. I know from experience these lines represent the hours in half a day and minutes in a full hour and help me to ‘tell’ the time.

I can see a pattern in the examples I used in my answers. I started off with diagrams of real world objects albeit displayed in a way that makes things clearer than just a

photograph of the finished item. Then I chose a road map, which is a very simplified diagram of what I would see if I were looking down from a plane. This diagram sets out to highlight certain things – such as roads, service-stations and motorway junctions – that are relevant to car journeys. Yet although the diagram shows things that are actually there for my eyes to see, it does not aim to look at all *like* what my eyes would see. It is symbolic and much easier to 'read' than an aerial photograph, because it leaves out a lot of unnecessary detail and has standard symbols for representing the things I need to know about. Finally, I ended up with a diagram of something you can't actually see, though it is a model of something you 'know' exists – time, represented by a sequence of minutes and hours. This last example is a more abstract representation of 'reality' than the earlier ones, but is still an efficient way of organising information.

Another impression I get from these examples is that they are all reasonably familiar. We all 'understand' and 'use' certain types and styles of diagrams from an early age, e.g. reading the time from a watch face. However the types and uses of diagrams are often rooted in different cultural, social or academic settings. Thus a modern map looks quite different to an eighteenth century map while digital watches have replaced analogue ones for many people.

2.1 Diagrams as models

Diagrams come in many forms and uses, but for systems thinking and practice it is useful to think of them as *models* (meaning 'representations of reality' in everyday usage). The term 'model' is used in a variety of contexts, even when there is a more commonly used term especially appropriate to its own context: models of terrain are usually called 'maps'; models of electrical components wired together are usually called 'circuit diagrams'; and models of the configuration of the planets within the zodiac are called 'horoscopes' (see Figure 1).