A Short Introduction to Diagrams

This is the 4-page section on diagrams that I contributed to Oliver Caviglioli's 2019 book Dual Coding with Teachers.

In it, I look at:

- what diagrams are
- how they can be used
- the different ways elements and relationships can be represented in diagrams
- some diagram archetypes
- a process for creating diagrams
- some tips for creating diagrams.

Dual Coding with Teachers book

Dual Coding with Teachers provides a fascinating introduction to the benefits of combining text and visuals.

It's also a very practical book with exercises and tips for developing graphic skills.

While it's directed to teachers, much of the book is relevant to anyone with an interest in using visual explanation.

UK Amazon link / US Amazon link.

Further reading from my website

An article on 'The Power of Diagrams'

A paper that includes a section on knowledge structures

I am writing an article about knowledge structures at the moment. If you'd like to be notified when it's published, please follow me on Twitter or subscribe to my newsletter.

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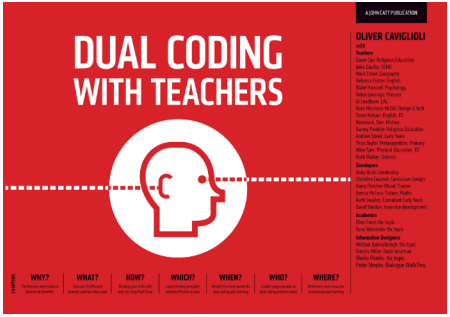

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Diagrams allow learners to understand the structure of an explanation at a glance.

Job: Information/instructional designer
Subject: Using diagrams to improve the quality of thinking, explaining and remembering
Organisation: Self-employed

The importance of diagrams

All knowledge has structure. Each description, concept, idea or argument is made up of different knowledge elements which are deliberately structured in a way that will best express the meaning that the speaker or writer is intending to communicate.

Making sense of any knowledge requires understanding the structure of the explanation. However the linear nature of both the spoken and written word means that learners have to sequentially construct their own understanding of how the different elements of an explanation relate to each other. This often demands more cognitive energy than being able to read off the structure of an explanation from a diagram in seconds..

Understanding diagrams

A diagram can be defined as a visual representation of the relationship between different elements or, to put it another way, as a visual representation of how individual parts relate to a particular whole.

The components of a diagram

Given that almost everything can be expressed in terms of individual elements and the relationships between them, it means that almost anything can be described using a diagram[1].

While diagrams are capable of conveying meaning with precision, economy and elegance, they generally need to be accompanied by spoken or textual explanation so that learners are given all the detail required to get the most out of a diagram.

Where diagrams fit in

The uses of diagrams

While diagrams are already widely used in education, I believe there is potential to use them even more extensively.

There are three particular ways in which diagrams can prove useful.

Thinking: a description or argument that looks solid when written down can suddenly reveal numerous holes when you start to create a diagram and then realise that you are not as clear on the relationships between elements as you thought you were. Diagramming relationships demands an explicit clarity that can get missed when one is just using words.

Explaining: diagrams can be particularly helpful for explanation because they allow teachers to move easily from the big picture to the detail and then from the detail back to the big picture. This helps learners to organise their knowledge and to develop richer schemas.

Remembering: the visual nature of diagrams can make it much easier for students to remember ideas and concepts than when they are solely described in text. The coherence and clarity of diagrams often demand less cognitive effort to memorise.

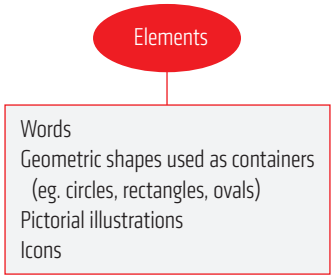
Representing elements and relationships visually

Individual elements

There are many different types of elements that can be described in diagrams[2]. They include:

- individuals
- groups
- objects
- concepts
- ideas.

Descriptions of elements can use words or different types of visual representations — or a combination of both approaches.



Relationships

There are also many different types of relationships that can be described in diagrams. They include:

- causation (causes/results from)
- time (before/after/progress over time)
- actions (done by/done to)
- sequence (prior step/next step)
- hierarchical position (contains/is a part of).

There are three main categories for describing how relationships can be represented in diagrams: connectors, positioning and miscellaneous. Each example in these categories can either be used individually or in combination with other examples.

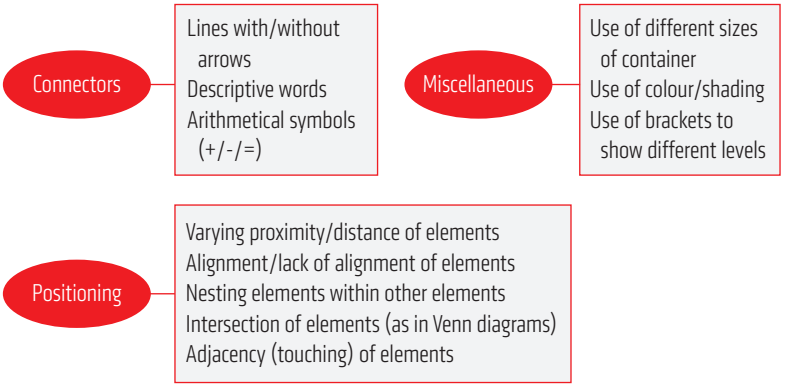
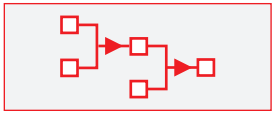


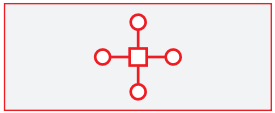
Diagram archetypes

There are several standard structures that we use to explain the world and to order our knowledge, such as classification, causal explanation, story, argument, sequence and relationships. Visual representations of these standard knowledge structures can be described as diagram archetypes[3]. Below are many of the key archetypes.

Taxonomy A visual classification of elements relating to a particular topic, generally shown in a hierarchical format. Useful for explaining how different parts of a curriculum fit together.

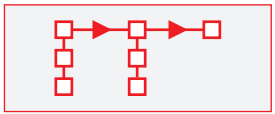


Causal explanation An explanation of the causes that lead to a particular outcome. Useful for showing the outline of complex causal structures.

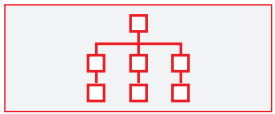


Description An explanation of the parts that make up a particular whole. Showing components visually often highlights them more effectively than a simple text list.

Timeline A listing of events or outcomes shown in order of occurrence. Useful for being able to see at a glance how events or outcomes are spaced across time.

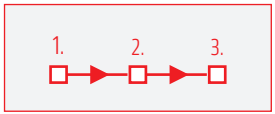


Argument/case A description of the reasoning that leads to a particular conclusion. Useful for showing the main and subsidiary strands that make up an argument.

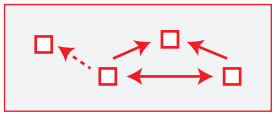


Content structure A visual depiction of how a piece of content (like a lessson or a book) is structured. Useful for showing learners how specific detail relates to the wider context.

Story A map of the events and experiences that occur as a story develops. Useful for showing the progress made and setbacks encountered by the protagonist.



Process/sequence A visual description of the steps involved in a particular process or sequence. Useful for showing students the steps needed for learning particular skills.

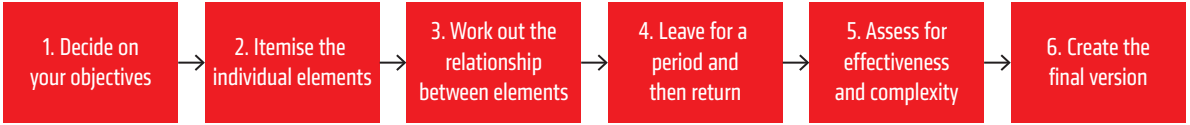


Relationships A description of the specific relationships between individual elements. Useful for showing the relationships between characters in a novel or a play.

References

1. *Diagrammatic Reasoning in AI*,Robbie Nakatsu (Wiley-Blackwell, 2009), 303.
2. ibid.
3. James Kalbach used this term in a slightly different context in his book *Mapping Experiences: A Complete Guide to Creating Value through Jouneys, Blueprints and Diagrams* (O'Reilly Media, 2015), 225.

A process for creating diagrams



1. Decide on your objectives

Decide what you want to achieve with your diagram. What size of topic do you want to cover? What do you want your students to learn from the diagram?

2. Itemise the individual elements

Write down all the individual elements that you want to include in your diagram. You may well need to add in a few more elements or take a few out as your diagram progresses.

3. Work out the relationship between elements

Start working out how the elements relate to each other and how the relationships can best be expressed through the use of connectors and/or positioning.

4. Leave for a period and then return

Take an extended break and, when you return to the diagram, see if it still makes sense. Make any changes needed. Then continue this process until you are happy with the result.

5. Assess for effectiveness and complexity

Assess your diagram for how well it meets your objectives. Also check whether it is likely to confuse readers with excessive complexity. Make any changes needed.

6. Create the final version

Decide how you want the final version to look. Will it work hand-drawn or will it look better produced in a program like Powerpoint? Create the final version and show it to your students.

Tips for creating diagrams

Start with a pen or pencil and paper

Many people find that it's more satisfactory to work on their initial drafts with a pen or pencil and a pad of paper. Personally I find ideas flow more easily this way. Then, if you want, you can produce the final version on a computer. You can also use sticky notes if you're going to be moving elements around frequently.

Be flexible about how long the process takes

When you know a subject well and the topic is simple, you may be able to create a new diagram in a few minutes. When the topic is complex and you're using the diagram to think through new ideas, the whole process (including breaks and returns) can take days, weeks or even months.

Break down complicated diagrams

If your diagram becomes too complicated, break it down into different levels of detail. Start with a diagram that includes all the top-level categories and the relationships between them. Then create subsidiary diagrams for each top-level category with the sub-elements and their relationships.

Further tips for creating diagrams

Ask for feedback Show your draft diagram to some of your colleagues. They will often be able to spot something that you've missed or that's unclear.

Collect ideas Keep a collection of the diagrams you most like (in photographs, hard copy or screenshots) and look at them for inspiration before starting a new diagram.