

# Introduction to Concept Mapping

David D. Thornburg, PhD  
Executive Director, Thornburg Center for Space Exploration  
dthornburg@aol.com



This document provides a short introduction to a powerful tool that lets you easily express your knowledge about a topic in a way that highlights areas where you might want to learn more, celebrate what you have already learned, and share your expertise with others. This tool is called Concept Mapping, and while concept maps can be made with paper and pencil, we'll show you how to use a computer program, Cmap, to easily build your own maps.

Let's start by exploring maps in general. You've seen plenty of maps of neighborhoods, cities, states, countries, and even maps of the world. Why do people build maps? There are lots of reasons. One that first comes to mind is that maps provide a compact representation of a big area, and can be used to find directions on how to get from one place to another. Almost everybody knows about Mapquest ([www.mapquest.com](http://www.mapquest.com)), a powerful online tool for finding directions from (for example) your home to a new shopping center. Today, it is common to find, in portable GPS devices, mapping tools that provide step-by-step driving directions to a particular destination. We can all agree that maps are very powerful tools for navigation.

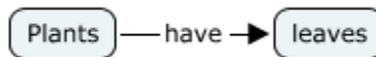
But helping navigation is not their only purpose. Maps can also be used to provide a "big picture" view of a region. Think about this: a map of the world shows every country, and is useful to look at, even if there are many countries you have no interest in visiting. The spatial relationship between countries can be found by looking at an accurate map. For example,

Canada lies mostly north of the United States. Brazil is in South America, *etc.* By looking at a map of the world, you can start to develop an understanding of how regions of the world interconnect.

When thinking about concept maps, the first thing we realize is that they are not geographical... They do not show countries or cities. However, they do share characteristics with geographic maps. At this point you may be asking yourself: how can that be? First, they allow you to find the pathway that connects one region of the map with another. Second, they provide a “big picture” view of their subject.

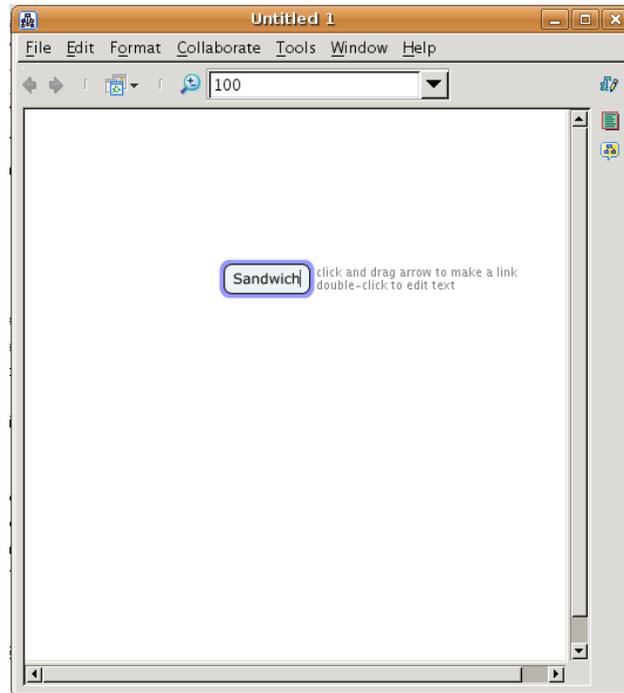
So, just what is a concept map? A concept map is a visual representation of your knowledge about a topic you might be exploring, where the different concepts associated with this topic are connected to each other. The process of building a concept map quickly highlights those areas of a topic you totally understand, and reveals those areas where you may need to do some more studying.

The central element of a concept map is the “proposition” (don’t worry, this sounds more complex than it really is!) A simple proposition is a statement made by connecting two concepts with a verb or a verb phrase. For example, you might have a proposition related to plants that says: Plants have leaves. Instead of writing this out as a sentence, you would represent this proposition by placing the concepts in boxes that are connected by the verb like this:



The goal in building a map is to keep going until you run out of propositions to create. For example, suppose you wanted to create a concept map on “sandwiches.” We’ll show you how to build your own “sandwich” map using the free Cmap software you can download from (<http://cmap.ihmc.us/>).

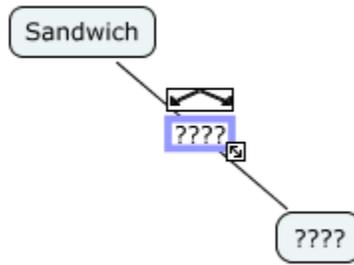
We are going to start by launching the Cmap software and choosing **New Cmap** from the **File menu**. This will open a blank map screen to the right of the original Cmap window and a window labeled Styles. For now, just focus on the blank window, as shown in the example below. Double-click your mouse anywhere in this window to create your lead concept and enter the text “Sandwich.”



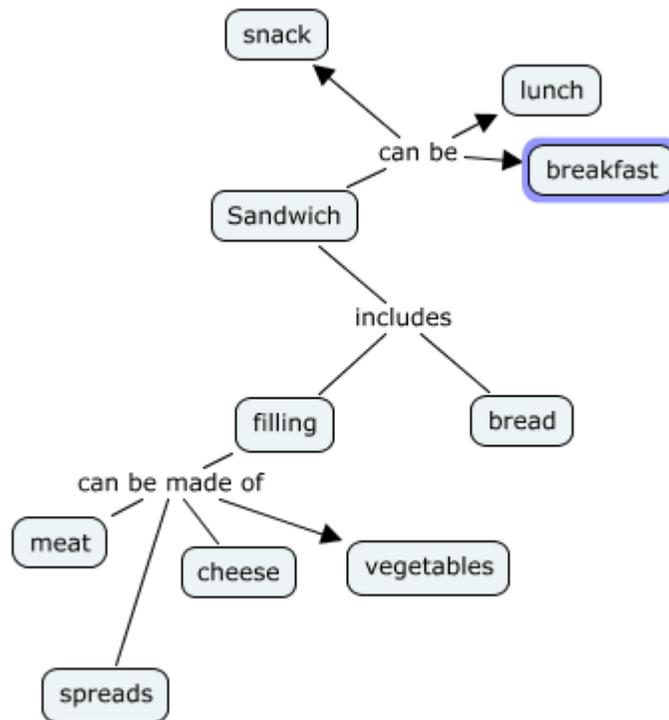
Next, click your mouse outside the oval Sandwich box to deselect it, move the mouse back inside the box and click again. This brings up two arrow lines:



Now, click the mouse inside the arrow box, hold the button down, and drag the mouse down the screen for some distance and let go of the mouse button. This action will add two new text fields, both filled with question marks. The first of these boxes (the one with the rectangular outline) is where you enter the verb or verb phrase, and the second (more oval) box is where you add the next concept. For example, if your sandwich includes bread, then you'd place "includes" in the first box, and "bread" in the second:

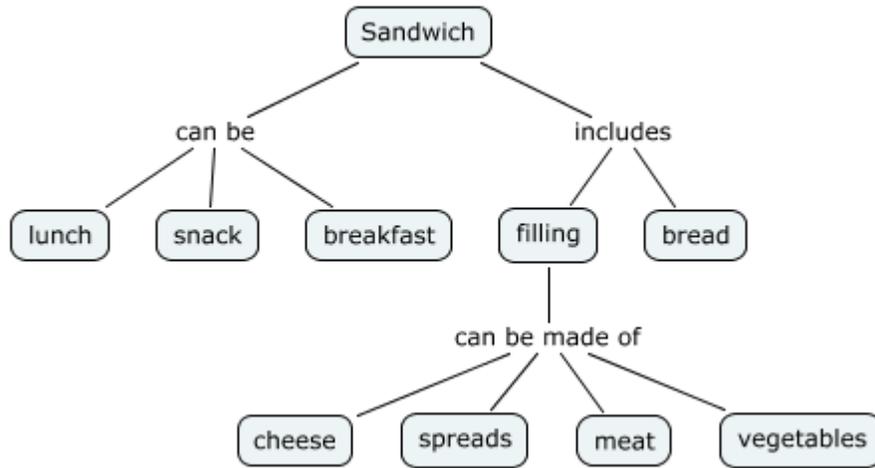


Assuming our sandwich will also have a “filling”, we need to add this word as a new concept. Instead of going back to the Sandwich box, we can start with the verb, “includes,” clicking on it with the mouse, and dragging a new line out for the next concept. We can think about some other concepts we would like to include in our map and just keep adding verbs and words to our initial example. Following these simple steps, we can expand our map creating, as we mentioned before, a better visual representation of concepts (propositions) we think are associated to our main topic. Look at the example below and try to create a similar map. At this point your map could be looking like this one:

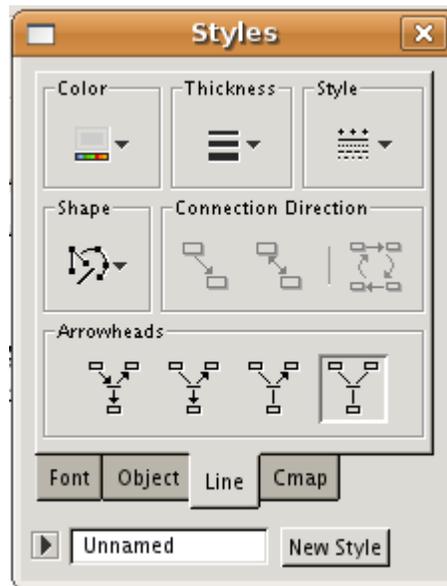


As you keep working on your map you may see some lines with arrowheads, and some without. Actually, they all have them, but some may be hidden from view. To clean up your

map (making it easier to read), simply choose the **Autolayout option** in the **Format menu** of the main map window. The rebuilt map looks quite pretty.

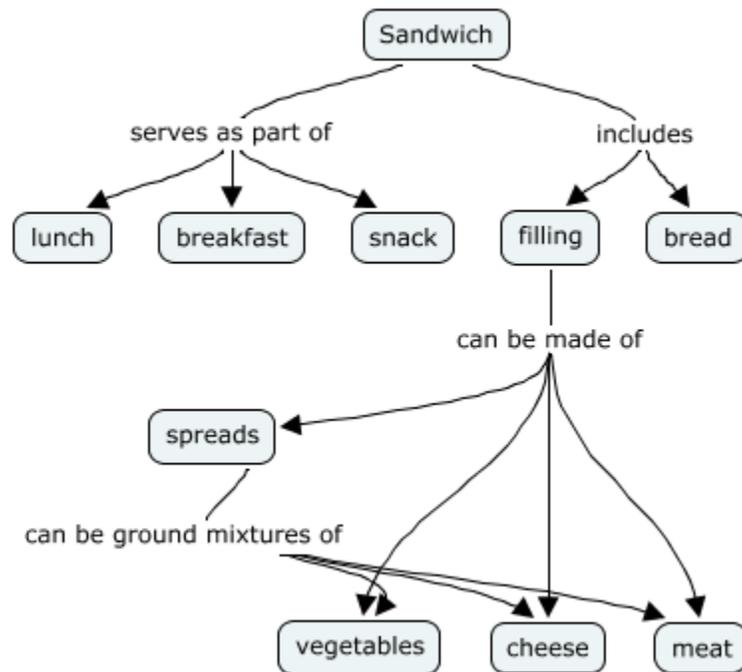


We built this one with no arrowheads by selecting the entire concept map and making the desired arrowhead selection from the style window:



Spend some time experimenting with different layout and style options and give some thought to the fact that your map should be easy to be read by you, your peers or anyone else with whom you may want to share it.

There is another feature of concept maps you should know: sometimes concepts are related to each other. For example: sandwich spreads can be ground mixtures of meat, vegetables or cheese. You would show that in your concept map by making the following connections:



In making this map, I used curved lines and turned on the arrowheads by selecting the entire map, and clicking on the arrowhead selection in the Styles window. I changed some of the text as well. Also, after using Autolayout, I dragged some of the concepts around to make the map easier to read. You should experiment with this yourself to get comfortable with the Cmap tool.

If you want to share your map with others, one easy way to do this is to export it as a web page. This option is found in the **File menu** under “**Export Cmap As...**” Cmap has many other features you can explore, including the ability to attach links to documents, pictures, web sites, etc. It even provides the ability to suggest new concepts for your map by comparing what you've already created with resources it can locate on the Web. In short, you will find lots of amazing capabilities hidden in this one piece of software – enough that you may find yourself using it every day.

But now, you are ready to build your first unique concept map to practice your skills.

### *Personal mapping*

To practice and develop your mapping skills, build a concept map about yourself. Relevant concepts might include family, friends, hobbies and sports, musical interests, computer skills, favorite web sites, and anything else you can think of to provide people with a better visual representation of you. You will probably find that your map will get pretty big pretty fast. Be sure to save your work every few minutes, and clean up the layout of your map frequently to keep it easy to read and help you in organizing your thoughts. Be on the lookout for connections among various concepts you have added. These rich connections always show a deeper understanding of the subject than a simple top-down map.

After working on your map for a while, stop to do something else. The next time you look at the map, you may remember things you forgot to add the first time. Also, when choosing the verbs for your propositions, try to be specific about the relationships between the concepts. For example, you might have a proposition that says, "I like the music of Beyoncé." This could be made more meaningful if you said, "I am deeply moved by the music of Beyoncé." (Of course you may not like her music at all – this is only an example!)

While you will want to build a map to share with your teacher and with the class, you may want to create a very personal map you don't want to share with anyone. That's fine – concept mapping puts you in charge of exploring your own understandings. Just be sure you have one version of the map that you are happy to share.

### *How you will use concept mapping in the Space Exploration Program*

Each year we are going to be offering several large themes. For example, The Space Exploration curriculum for Year One is based on the following themes:

- Why explore space?
- Why is space exploration an international topic?
- What is the impact of space exploration?
- What are the benefits of space exploration?
- Why do we want to live and and work in space?
- Why explore the Moon?
- How do we use space to study the Earth?
- What is the history of rocketry?
- How do rockets fly?
- How do we return from space?
- How do satellites stay aloft?
- How are missions designed?
- Is space empty?

At the very beginning of a new theme, you should build a concept map that reflects what you already know about the topic. This map may be very small or very complex, depending on your prior knowledge. It will also be a great opportunity to capture your thoughts before you start exploring the theme in depth. Then, once you have done some projects in the theme's area, you can build another concept map that will probably be much more detailed. By comparing the two concept maps you've created, you will see how much your knowledge has grown! You will also see if some of your original concepts were based on misinformation or misconceptions. You might even find that you already understood the theme pretty well based on your prior knowledge.

The point is that concept maps, like geographical maps, provide you with a way to see where you are and where you are headed, and to also give you the “big picture” view of whatever it is you are exploring.

While our concern is the role of concept mapping for the Space Exploration project, you will probably find it to be a useful tool in any other area you are studying.