Abstraction

While abstraction sounds, well, kind of abstract, it's something we do every day!

Abstraction means focusing on the important aspects of a situation by ignoring unimportant details. For example, if your pan catches on fire, you probably don't need to know what song is playing in the background in order to put it out.

Learning Objectives

At the end of this module, you'll be able to:

1. Define abstraction
2. Define Procedural and Data abstraction
3. Apply both abstraction types to their appropriate contexts
4. Create abstractions for procedures and data

Abstraction can be overwhelming

The following video breaks down abstraction for tasks you are familiar with, chances are you have been using abstraction without realizing it in your daily life.

Abstraction-Computational Thinking-external link-YouTube

Context changes everything when it comes to abstraction.

The key in abstraction is not only deciding what's important in regards to the situation/problem/design, but also deciding what is unimportant. How do we figure out what we need and what we don't need? It all depends on the context.

If we are cooking a curry, we'll need to know what ingredient needs to go in next, but if our pan bursts into flames, suddenly our dinner's seasoning becomes much less important.

Consider the problem of building a house

00:10

Building a house is an excellent example of a situation in which we can use abstraction. In this situation, we're going to be playing the role of a plumber.

Step 1

What kind of information does a plumber need to know?

- The details of where the sinks go
- Where the water lines enter the house
- Where the sewer lines leave the house
- The size of the water and sewer pipes?

Step 2

What kinds of information can the plumber ignore?

- The location of the electrical outlets
- The size of the cabinets in the kitchen
- What color the walls are being painted
- The number of bedrooms

To put it all together

Building a house is a complicated job with lots of moving parts and so is doing the plumbing. As plumbers we really only need to concern ourselves with information regarding the plumbing, or else we're wasting value brain power on stuff that has nothing to do with our jobs!

Abstraction in Action

- The process of abstraction may (often) involve decomposition or pattern recognition.
    - For example, in writing a summary of a book, you may need to decompose the details into categories like characters, settings, and events.
- To answer the question of how to define the abstract term animal, you may need to look at examples to see what characteristics they have in common. What patterns do you see?
    - Do you see fuzzy ears?
    - Do they lay eggs?
    - Do they fly?

Two Types of Abstraction

There are two different types of abstraction: Procedural and Data. Which type you use depends on what you are trying to abstract. Procedural abstraction focuses on processes, whereas are Data Abstraction focuses on abstracting large bodies of data. Expand the accordions below to learn more.

Procedural Abstraction

Procedural Abstraction is all about removing the details of a process so that way we can focus on the process itself rather than the inputs that go into a process. What does it look like?

Here's an example from algebra:

We've all seen expressions that look something like this
(2+3) * 5
We can abstract these into
(a+b) * c

The reason we do this is because we might be more interested learning the process of solving an algebraic expression rather than actually solving it. In this context, what the numbers actually are don't matter, because the process of solving the expression would be the same.

Here's another example from baking:

To bake a cake, you put the ingredients in a bowl, mix them, pour the batter in a baking pan, and then bake it for the required time.

This is an abstraction because the process applies to baking many different types of cakes. The details of what ingredients, how much, and time are not given because we are focused on the process, rather than a specific cake.

Data Abstraction

Data abstraction is when we simplify a collection of data in a way the captures the essence of the data, without all the extra details. This is useful because it helps us understand large sets of data without having to scrutinize every tiny piece of information from the data set.

An example of this is how schools keep student records.

Schools record a large number of attributes about each students in the school like their name, address, grades, tests scores, etc. We can abstract that large set of data by calling it a student record. **By calling it a student record, everyone knows what it is, without actually having to go through all the individual pieces of data.**

Another example is today's weather

When we talk about "today's weather" what we are actually talking is a collection of information like temperature, humidity, and precipitation. **We can abstract all that information by simply calling it "today's weather".** Being able to ask how today's weather is sounds a lot better than having to ask your coworkers for each individual piece of weather data, right?

Learn More

When we show up to the present moment with all of our senses, we invite the world to fill us with joy. The pains of the past are behind us. The future has yet to unfold. But the now is full of beauty simply waiting for our attention.

Abstraction for Computational Thinking - 21things4students

This is an animated video for Thing 21 Quest 4 in 21Things4Students. It is about Abstraction in the Computational Thinking Process. Funded by the REMCAM Association.

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Knowledge Check Abstraction

Now is your opportunity to test your knowledge. Answer each question with the information you learned in the prior module.
You can go back and try again, but you must complete this section before moving on to the next module. Good luck!

Question

01/05

Abstraction is the process of _____ (select all that apply)

- [ ] Focusing on the important aspects of a situation/problem/design while ignoring unimportant details.
- [ ] Focusing on the unimportant details in order to eliminate the tasks.
- [ ] Identifying aspects that are important depending on the context.
- [ ] Organizing the details into categories or common patterns

Question

02/05

What are the two types of abstraction provided in this lesson?

- [ ] Procedural Abstraction
- [ ] Model Abstraction
- [ ] Data Abstraction
- [ ] Complex Abstraction

Question

03/05

Procedural Abstraction is the process of:

- ◯ Simplifying a collect of data in a way that captures the essence of the data without the details.
- ◯ Using equations to build virtual worlds
- ◯ Abstracting away the details of a process for doing something.

Question

04/05

Data Abstraction is the process of:

- ◯ Simplifying a collection of data in a way that captures the essence of the data without the details.
- ◯ Focusing on the unimportant details in order to eliminate the tasks.
- ◯ Abstracting away the details of a process for doing something.

Question

05/05

When discussing the weather for a particular day, the detail includes the high and low temperatures, the relative humidity, wind speed and direction. This is an example of:

- ◯ Procedural Abstraction
- ◯ Model Abstraction
- ◯ Data Abstraction