How to Draw Invisible Programming Concepts - Part One

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This is a long, overdue case study showing how I make an agilized course illustration.

It spans everything from cognitive metaphor theory to Photoshop rendering so I hope you have a hot, caffeinated beverage with you.

It also covers 4 four parts.

Part 1	Part 2	Part 3	Part 4
Metaphorical Introduction You are here	Cultural and Historical Research	Lateral Thinking and Creative Play	Composition, Colour and Completion

An Introduction

For the last half decade I've been the art director & lead illustrator over at agilized.

We're a company / website / collection of humans who teach web development. We use a mix of tutorial videos, code challenges, articles, illustrated series, workshops, and whatever other medium we feel like. As you might expect, it's a whole lot of JavaScript, React, GraphQL, Vue, classic HTML & CSS, and other internet technologies.

It's my job to take all these abstract, hard to explain programming concepts, and make them visible in a way that helps people understand. Sometimes through illustrations, or animations, or illustrated series, or diagrams, or interpretive dance on some rock.

One part of that is making **course illustrations**, which we like album cover art for all the courses we publish.

Here's a few of them...

CSS Selectors in Depth | Course Transitions with React Transition Group

Reduce Redux Boilerplate with Redux-Actions | A Journey with Vue Router

And a couple more...

So far I've made over 150 of these things, and I'm almost beginning to think I know what I'm doing.

Part Zero – What are we doing?

The guinea pig for this case study is going to be Mike Shurer's course on Web Security Essentials.

Here's a quick overview of the course – it shows you how to protect a website against common attacks like man-in-the-middle interceptions, cross site scripting, and cookie hijacking. All your classic internet fees.

The first step in starting a design task of any kind – illustration, innovative sandwich recipe, or curbside capture technology – is making the challenge you're facing nice and clear. So let's write ourselves a challenge statement:

Create an illustration that clearly communicates the idea of "Web Security"

That might seem dumb and obvious, but it's surprising how easy it is to get off track without stating the goal up front.

At this point, it's good to make clear that "Web Security"is not a simple, physical, made of atoms and quarks object in the world.

Then begins our problem.

How do you draw a thing that's not a thing?

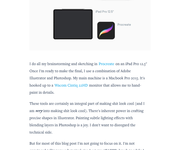
It's a good question. One I've slightly obsessed with.

Drawing well is difficult in its own right. Making a dog look like a dog or hand look like a hand requires a lot of training, practice and patience. It's a whole extra challenge to figure out what the thing you're going to draw is in the first place.

Now do you see a Sisyphean, never-ending, cultural concept like "Web Security", and condense it down to a single image?

The answer, in short, is **a mix of cultural symbols and visual metaphor**. Though there's a little more to it than that.

Good, meaningful illustration works in four layers. I like to think of it as a cake:



You start with a solid base of visual metaphor. Add on a layer of clear, well constructed drawing. Then you think about designing an aesthetically pleasing composition with general principles. And finally you throw fancy lighting and pretty colours over the top.

Text Talk

A whole lot of people out about the whipped cream and cherries stirring at the very top of that cake.

"What app is that?"

This happens in every industry – the more visible top layer of any creation feels like the most important part of it. Asking what tool someone uses is a very logical and legitimate question.

So let's get the tool talk out of the way. Here's my tech stack:

I do all my brainstorming and sketching in Procreate on an iPad Pro 12.9' Once I'm ready to make the final, I use a combination of Adobe Illustrator and Photoshop. My main machine is a MacBook Pro circa. It's hooked up to a Wacom Cintiq 24HD monitor that allows me to hand-paint in details.

These tools are currently no integral part of making this tech cool (and I am surprise making this look cool). There's inherent power in crafting precise shapes in Illustrator. Painting subtle lighting effects with blending layers in Photoshop is a joy. I don't want to disrupt the technical side.

But for most of this blog post I'm not going to focus on it. I'm not convinced telling you what pixel size I set my SHAPPY brush to while I carefully render diffuse light across a reflective metallic surface like a pedantic performance is helpful.

I will cover that workflow more in Part 4 of this series. But they're not The Thing We're Doing. Which is learning how to draw invisible things. So let's get back to talking about the messy stuff.

Part One - Making Metaphors

Let's start at the bottom of the cake with Metaphors.

Metaphors are fundamental to how we visualize anything that's a non-physical, abstract **idea**.

Drawing an octopus is fairly straight forward. Drawing freedom, financial crashes, social isolation, teamwork, speculation, database management, capitalism, or productivity all relies on metaphor.

So, what is a Metaphor?

The first step to getting good at metaphor is understanding what it is. Let's make sure we're all on the same page:

> A metaphor is when we understand one thing in terms of another.

The power of metaphor is it helps us see something we *theorize* understand something we *don't know*.

We may not yet understand Thing B. But we know enough about Thing A, and can **map** its qualities onto Thing B. Which at least gives us a starting point.

I can tell you a quantum computing bit is like a spinning coin that is neither one heads or tails, but kind of both. And now you're *ready* to understand how a quantum computer works.

Sometimes we actually know a lot about Thing A, but thinking about it in terms of Thing A gives us insights we never noticed before.

In metaphor-speak terms we call Thing A the **source** and Thing B the **target**. The source is like a *frame* that we look at the target object through.

It "frames" how we see Thing B.

Just like a window frame, the **source** frame gives us a limited view of the world. Anything outside the frame *gets hidden*, while anything within the frame gets *highlighted*.

Qualities that both the source and target share are highlighted. While qualities that don't share are *hidden* away outside the frame.

Let's look at an example of this in action.
We often talk about **time** through the metaphorical frame of **money**.

> That delayed flight *cost* me an hour.
> Can I *steal* a few minutes of your time?
> I don't know if *spending* all day on that is *worth* my while.

The way we speak about time shows we project the qualities of money onto our idea of time.

Our Time is Money metaphor highlights the qualities of time that *overlap* with money:

- Time is a quantifiable substance we can count
- Time is a valuable, limited resource
- Time is a something we can give to, and take from other people

There are plenty of time's qualities hidden by the frame of money. Unlike money, we all experience time as a relative, amorphous flow. It shifts form and length based on where we are, who we're with, what we're doing. One minute in a freezing cold shower does not feel the same one minute in the midst of a deep Netflix binge. One minute is not one minute in the same way one pound is one pound. [1]

Money isn't the only metaphor for time. We also compare it to a moving object when we say *"that train flew by"* or a container when we say *"tomorrow is pretty full."* We're perfectly capable of using multiple, overlapping metaphors for a single concept. And we're able to switch between them without confusing ourselves. Very handy.

> Which metaphor we pick depends on what qualities we want to highlight or hide. We focus us on what's *important* about the target, and downplay irrelevant details.

This is why metaphors are so good at explaining complex ideas. We get fine-grained control over what's most important about the concept, and can ease all the noise.

Beyond just being useful for learning complex concepts, and framing old ideas in new ways, metaphor is the base of nearly every thought we have. It's a fundamental building block of human cognition that shapes the way we perceive and interact with the world. [2]

Programming the Metaphors

Metaphorical thinking is especially useful when we're trying to explain and illustrate programming concepts.

The kind of topics we teach at *ugbook* are always:

- fundamentally abstract
- It haven't been around long enough for our culture to develop a set of meaningful icons and visual symbols for them.

Yes, for a moment to imagine what "Typescript with Rust" visually looks like. Or "a server-rendered React.js Application with Vertx.js". Or the "Joint Mutual in Serialize".

Not exactly a vivid picture in your mind, right?

This is partly because programming is an abstract activity. It has to be. Vanta literally programming involves running meaningless, complex sequences of electrical currents. On a microscopic scale. Inside our machines.

That world isn't human friendly. We can't see what's going on in control what happens without a thick layer of symbolic software in the middle.

So we invented programming languages.
The bootcamp snippet `let finish = human` maps onto a specific set of electrical pulses firing deep inside your hardware.

Its programmer land this is called an abstraction.

Patently enough, it also fits our definition of a metaphor. *Programming is just a giant stack of metaphors.* Each layer of the metaphorical stack moves us further away from machine world, and closer to human world. [3]

Illustrated metaphors that capture the main idea of a programming concept are just one more addition to the top of our human friendly stack.

Learning to Metaphorically See

Now that you're thoroughly soaked in trippy metaphor theory, let's bring it back down to earth with some familiar examples.

One way to hone your metaphor-making skills is to explicitly notice when you're seeing one. We process metaphors automatically and unconsciously. Which means it takes a little effort to consciously understand how they work.

Let's take another look at some of these course illustrations, and work backwards to break down each piece of the metaphor.

I'm going to use the ✨ emoji to label targets, and 🔭 to label sources.

Advanced CSS Selectors

The webpage ✨ is a customizable house 🏠. Individual elements on the webpage ✨ are different parts of the house 🏠. Selecting web elements with specific CSS styles 🔭 is selectively painting parts of the house various colours 🎨.

Redux: Redux Boilerplate with Redux-Actions

Redux 🔭 is the 1970 arcade game Space Invaders 🎮. The Redux-Actions library 🔭 is a modification of the journal, and the two-way spaceships 🚀 control 🎮. Boilerplate redux code 🔭 is the most tedious to get rid of 🔭 in an array of space invaders aliens, being zapped into oblivion by the Redux-Action spaceships 🚀.

Journey with Vue-Router

Vue-Routes 🔭 is an underground subway system with train carriages travelling along 🔭. Each page in a Vue application 🔭 is a station 🚉. The user clicking between pages 🔭 is riding the train between stations 🚉. Building new routes between pages 🔭 is laying down new train tracks and between stations 🚉.

I know this is a little bit wishy-washy, and then explaining why the jokes was funny. It kind of sucks the fun out of it.
But breaking down metaphors helps turn your mind to consciously see how they're built. Stop accepting an metaphor, and understand there's a logical process to moving from abstract ideas to concrete visual.

I keep a giant collection of these for reference. Every time I spot a terribly clever editorial illustration or advertisement, it goes in the file. Two illustrators I consider the crown of the metaphorical crop are Emiliano Ponzi and Matt Chase. Take a look at a few of their creations:

Matt Chase

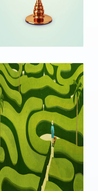
Political Hobbyism

Political activism 🔭 is a spending through a megaphone 🔭. Addictions and passivity 🔭 is lounging around on the couch 🛋.

Emiliano Ponzi

Snake Oil Job Training for Midlife Career Changers

A career 🔭 is a journey along a road 🛣. Paying trouble on a career journey 🔭 is the road turning into a wall 🧱. Snake oil training services 🔭 are a road running upside down and backwards 🔃.



Matt Chase

Prolonged Prosecutions in Guatemalan Courts

The justice system 🔭 is a set of balance scales ⚖. Prolonged and corrupt court cases 🔭 are a tangled mess 🧶.

Emiliano Ponzi

The Art of Improvisation

A challenge 🔭 is a maze 🌽. Performing the traditional rules 🔭 is getting to the centre of a maze by following walls 🧱. Improvisation 🔭 is getting to the centre by inventing a path through the hedges 🌳.

Knowing how to build a good metaphor isn't only useful for illustration. Metaphors come in many forms. You can write metaphors into tutorials and documentation. You can explain a piece of technology to a non-technical co-worker. Or you can finally find a meaningful way to tell your mother what you actually do for work (other than "computers").

In Part Two I'll dive into more specific techniques for creating metaphors.
We'll cover how to do cultural and linguistic research to find existing metaphors. We'll also work through building new metaphors by focusing on core qualities of a concept, and using lateral thinking to generate alternative solutions.

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First Name
Margaret Mead

Email
mead@semiotics.com

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