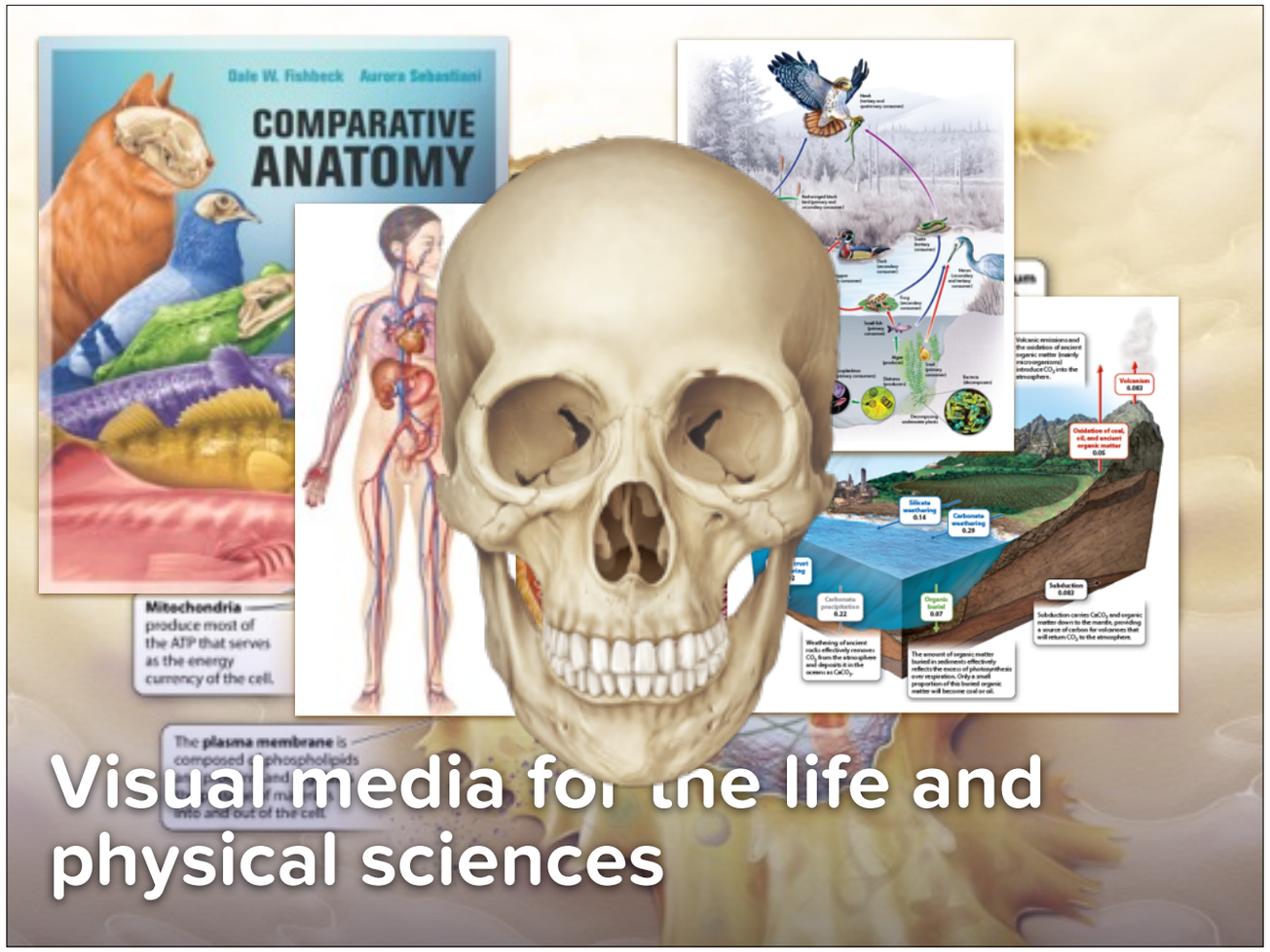
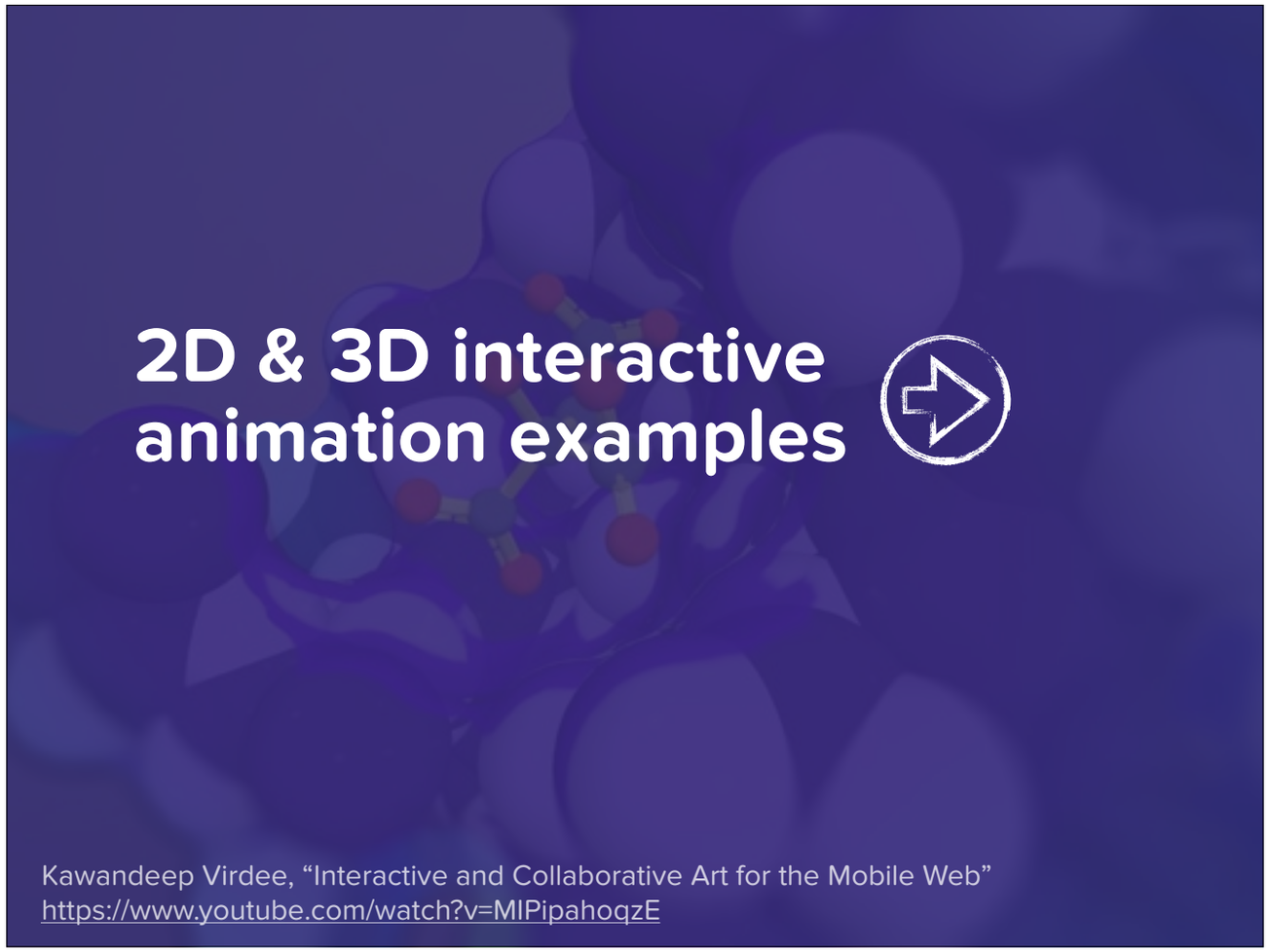
Today I’m going to be speaking about some of what I’ve experienced in the past two years creating digital content for the web @Imagineeringart (which is also the company’s twitter handle).



Visual media for the life and physical sciences

Imagineeringart has, for the past 20 years, been creating visual media for the life and physical sciences, for educational publishers and museums. 2D static art has been its bread and butter for the majority, but lately, along with educational publishers, we've been transitioning to digital media production.



There’s been an increase in opportunities to create content for the web using technologies such as HTML, CSS, JavaScript and WebGL. Here is an example of a 3D interactive animation and a 2D interactive animation (arrow link). Let me expand on what that signifies:

In scientific illustration design ***for print*** you are worrying about imagery, colour, layout, and typography. Things that only engage the mind: people look at the image and hopefully think about it, leading to learning. With scientific media design ***for the web***, in addition to imagery, colour, layout and typography, you have sound, animation, and touch/gesture/ and mouse APIs that you can leverage. When you’re designing for the web you’re engaging both mind and hands. You’re designing interactions. The nice thing about interactions, is that ‘interactivity gives people agency. You are involved in it, and you can be expressive.’, as Kawandeep Virdee described in his FITC talk this year.

Today I want to cover the four main lessons we've learned and are still learning about creating digital content for educational publishers. The four topics are analysis paralysis, accessibility, editing (by which I mean testing), and learning experience design.

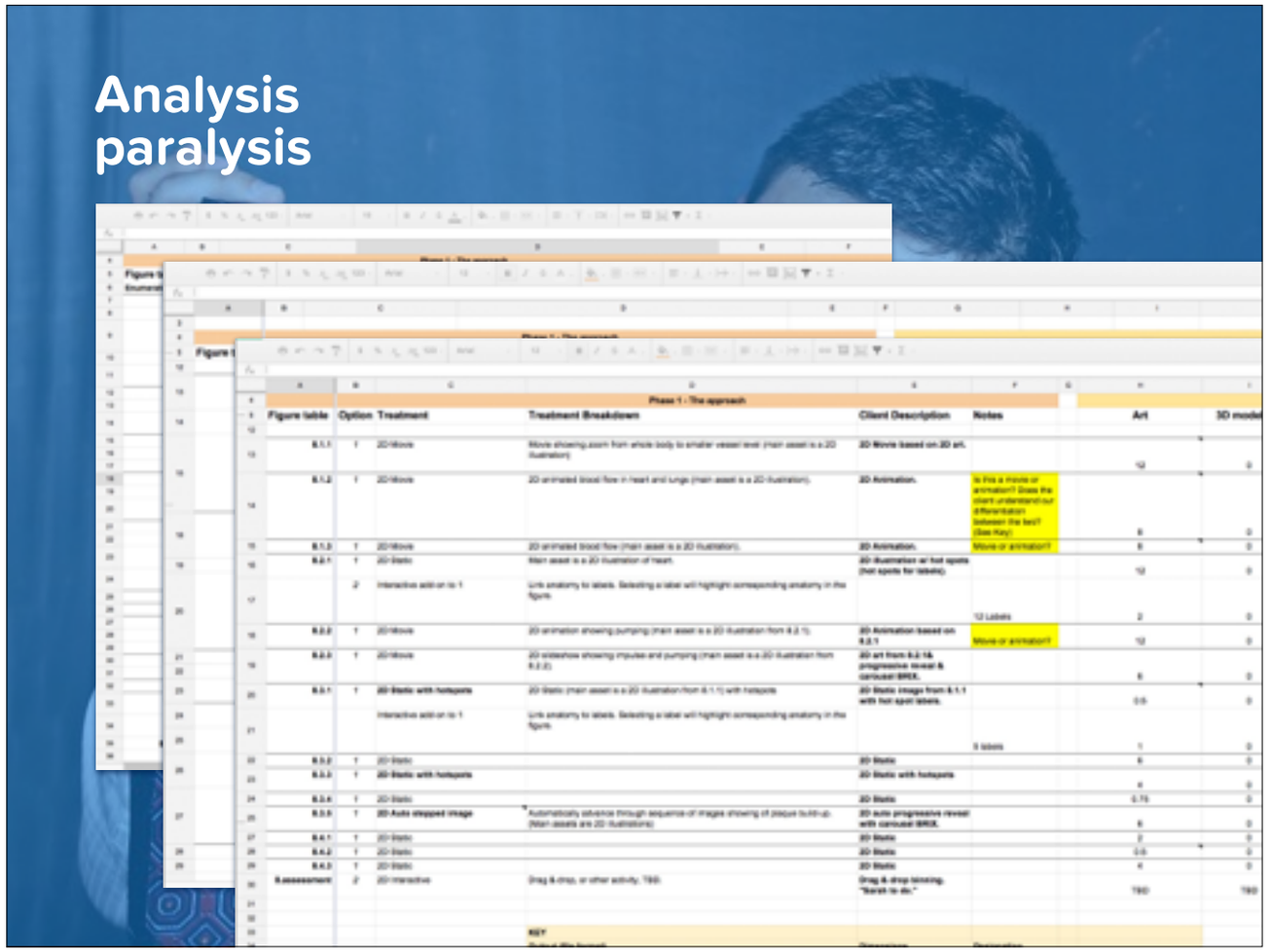
The first lesson learned is dealing with the ‘analysis paralysis’. As I previously alluded, the scope of what you can create when you’re designing for the web is much broader (mind *and* hands), but the abundance of options can cause a project to stall.

At Imagineering we were recently awarded our first digital only project (not digital first, or digital accompanying material, but digital *only*). This was very exciting for us. The client provided us a manuscript with interactive object briefs, but indicated that they were tentative and wanted our input.

Now the process for static art projects is typically that the manuscript goes to our creative director who establishes the style with client and the complexity of the pieces is evaluated and assigned a cost. I typically don’t see the project until all art is finalized and production is launched in the studio.

The first obvious difference with the digital only project was that
1) We are asked to provide alternative options to the interactive pieces, and
2) in order to do this our developer, 3D animator, myself and the creative director all had to be involved with the project right from the start. This is because in order to provide options and quote on the project we needed to pool our combined expertise (animation, interaction, web development, accessibility and art production). So already the project took up 4x the normal employee time.

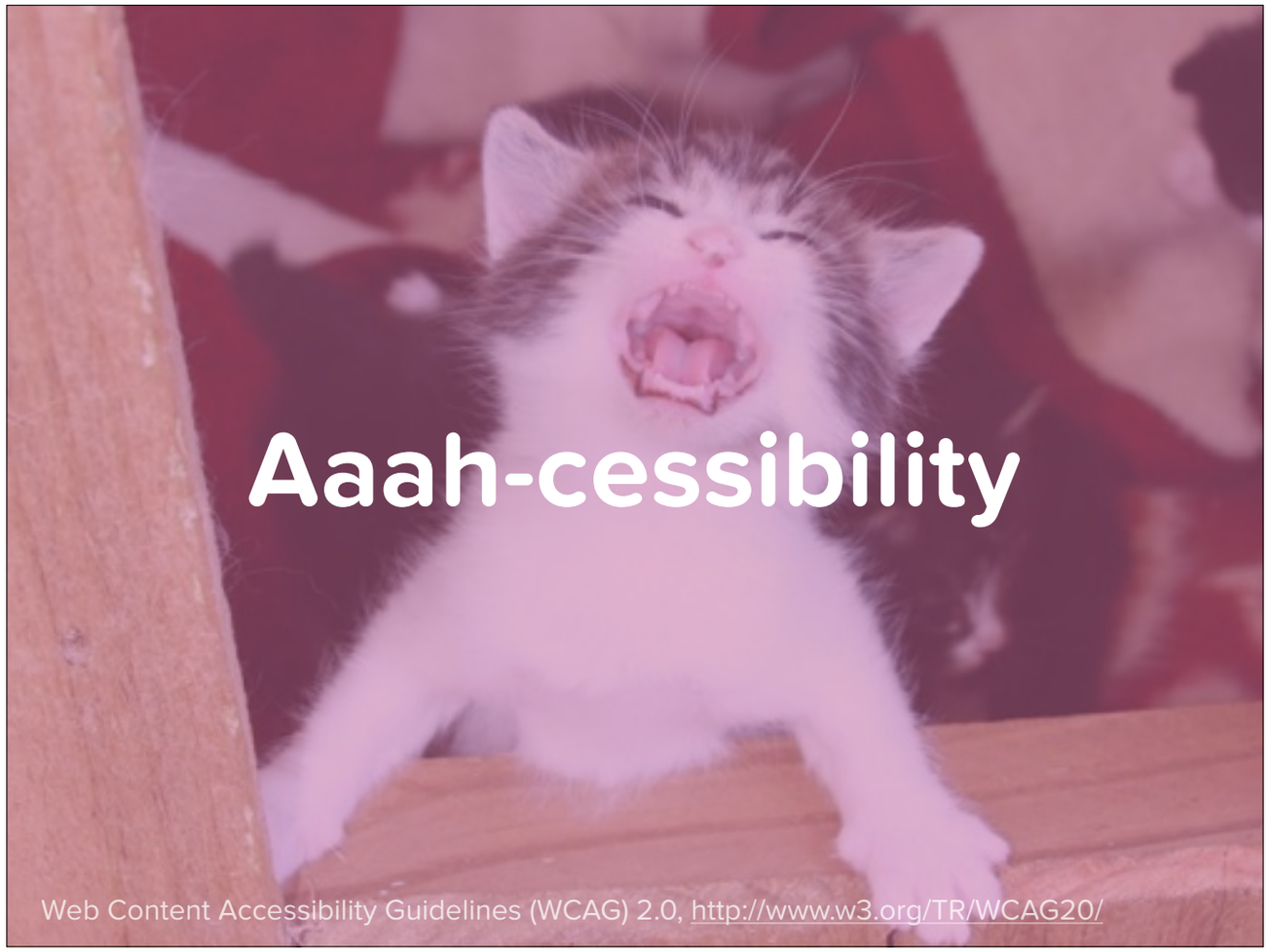
So, as a team we considered the learning objectives for each piece, then prescribed media that might meet these objectives, and then we proposed 2-3 alternatives in addition to their own suggestion, and provided a cost estimate for each that considered art, animation, interactivity, testing and accessibility production time.



We spent them a version of the spreadsheet shown here. Then, like us, they needed more time to consider all these options (about 2 weeks). And then we did this 2 more times until we met their budget requirements (3 months total), and we hadn't even built anything yet.

And this is what I mean by the risk of analysis paralysis: because it's the web there are many more treatment options to consider, and for each option there is also simply more to consider (art, animation, interactivity, testing, accessibility), and for that you need a larger team to cover the needed domain expertise.

In general, digital projects are always likely take more time than static art projects – I don't think there's any avoiding that – but also my take away from this case is that we are also probably doing the client a disservice by offering so many (3-4) initial options. It's the paradox of choice – many options result in uncertainty and project delays. Instead of presenting a buffet of choices, I think we need to do our job as biomedical communicators and propose a single solution that will achieve the learning objectives.



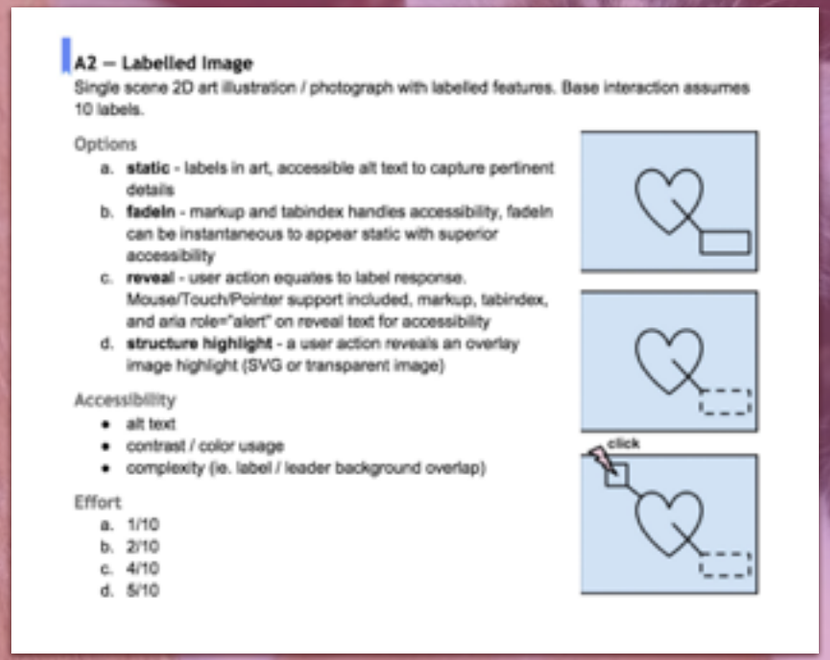
The second lesson concerns accessibility. American clients are bound by the ADA, the American’s with Disabilities Act, which guarantees that people with disabilities have the same opportunities as everyone else. 1 in 7 people have some sort of disability, which is a significant number of people that your limiting the reach of your content to if your site is inaccessible. Section 508 of ADA prescribes Web Content Accessible Guidelines (WCAG) 2.0.

Aaah-cessibility

Web Content Accessibility Guidelines (WCAG) 2.0, http://www.w3.org/TR/WCAG20/

Since there is room for interpretation of the WCAG guidelines however, education publishers such as Pearson helpfully provide a disambiguation checklist for developers follow. In Ontario we must also adhere to the AODA (Accessibility for Ontarioans with Disabilities Act), which also refers to the WCAG 2.0. In short, all our web content for educational publishers must be accessible.

Aaah-cessibility

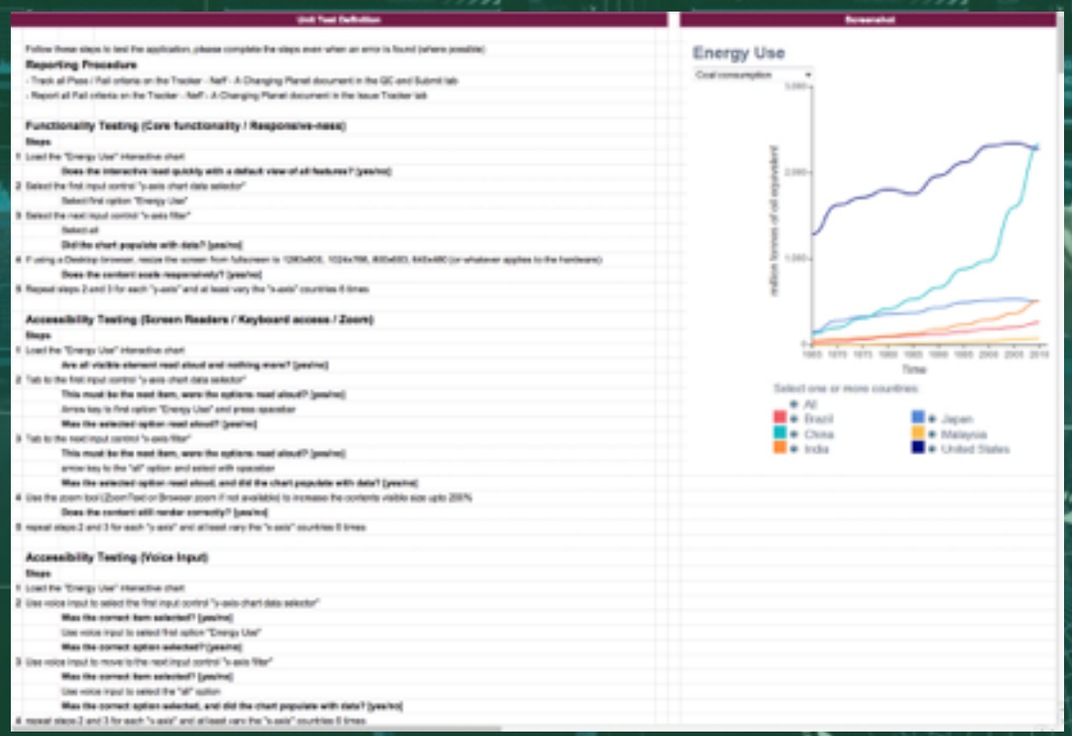


There a quite a number of accessibility guidelines, however those that are relevant to biomedical communicators are those related to Perceivability and generally trying to ensure that there are multiple redundant ways that visual and interactive media can be perceived, such as providing an alternative text description to an image.

To streamline the process of determining what accessibility guidelines apply to us, Imagineering is building an ‘interactive style guide’. So, for example, here we have a labelled image. So far we’ve identified four interactive flavours for a labelled image, and the three accessibility guidelines that will need to be considered for an image.

The third lessons concerns the editorial process. All 2D static art at Imagineering undergoes an editorial review. We have a dedicated editor that ensures art matches publishers specifications (colours, fonts, spacing, art rendering style). For interactive art our editorial process has had to change and testing is now our editorial pass.

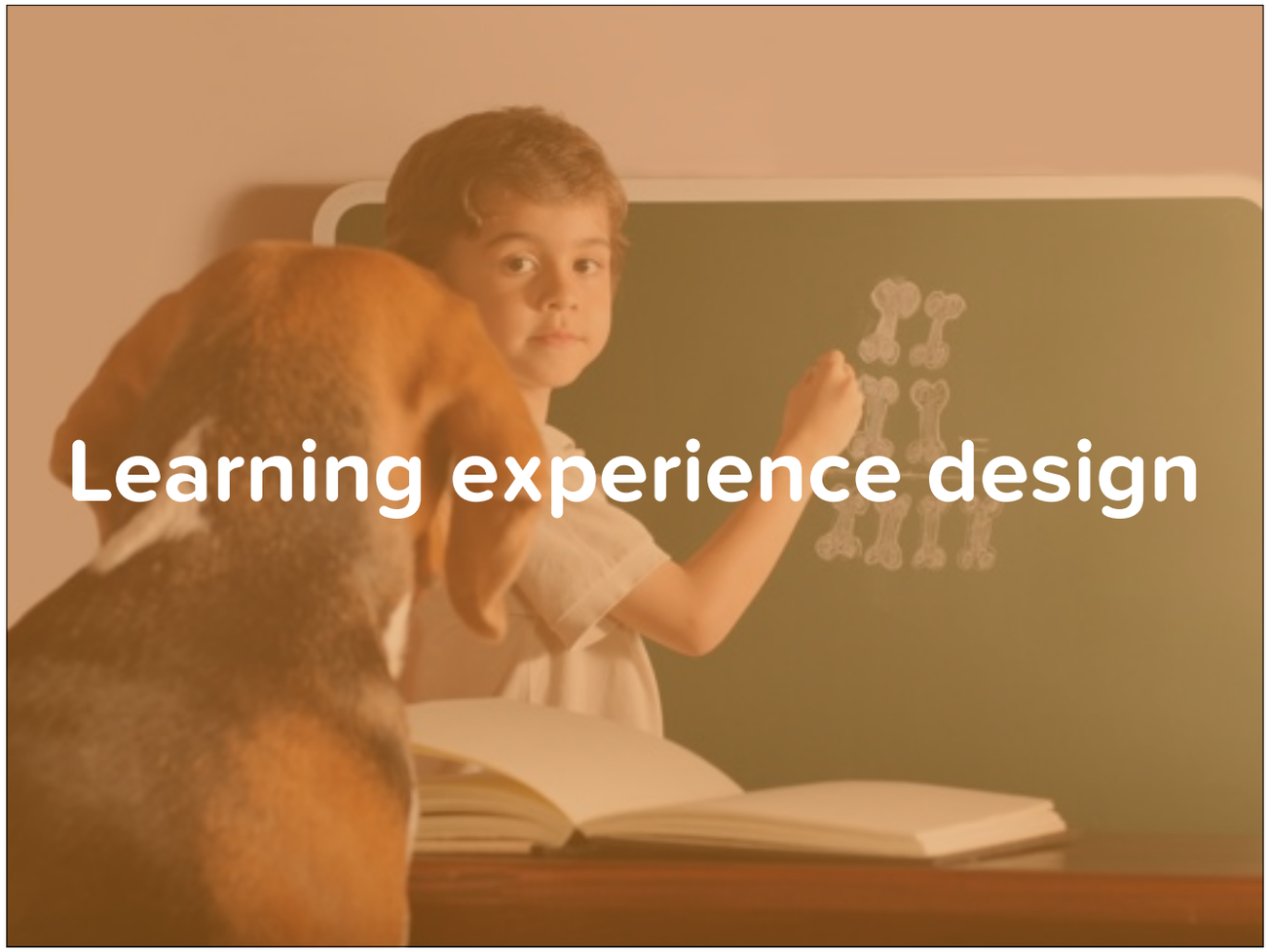
~~Editing~~ Testing



Unit Test Definition	Screenshot
Follow these steps to test the application (please complete the steps even when an error is found (where possible) **Reporting Procedure** - Track all Pass / Fail criteria on the Tracker - NatF - A Changing Planet document in the QC and Submit tab - Report all Fail criteria on the Tracker - NatF - A Changing Planet document in the Issue Tracker tab **Functionality Testing (Core functionality / Responsive-ness)** **Steps** 1 Load the "Energy Use" interactive chart **Does the interactive load quickly with a default view of all features? [yes/no]** 2 Select the first input control "y-axis chart data selector" Select first option "Energy Use" 3 Select the next input control "x-axis filter" Select all **Did the chart populate with data? [yes/no]** 4 If using a Desktop browser, resize the screen from fullscreen to 1280x800, 1024x768, 800x600, 640x480 (or whatever applies to the hardware) **Does the content scale responsively? [yes/no]** 5 Repeat steps 2 and 3 for each "y-axis" and at least vary the "x-axis" countries 6 times **Accessibility Testing (Screen Readers / Keyboard access / Zoom)** **Steps** 1 Load the "Energy Use" interactive chart **Are all visible element read aloud and nothing more? [yes/no]** 2 Tab to the first input control "y-axis chart data selector" **This must be the next item, were the options read aloud? [yes/no]** Arrows key to first option "Energy Use" and press spacebar **Was the selected option read aloud? [yes/no]** 3 Tab to the next input control "x-axis filter" **This must be the next item, were the options read aloud? [yes/no]** arrow key to the "all" option and select with spacebar **Was the selected option read aloud, and did the chart populate with data? [yes/no]** 4 Use the zoom tool (ZoomTool) or Browser zoom if not available) to increase the contents visible size upto 200% **Does the content still render correctly? [yes/no]** 5 repeat steps 2 and 3 for each "y-axis" and at least vary the "x-axis" countries 6 times **Accessibility Testing (Voice Input)** **Steps** 1 Load the "Energy Use" interactive chart 2 Use voice input to select the first input control "y-axis chart data selector" **Was the correct item selected? [yes/no]** Use voice input to select first option "Energy Use" **Was the correct option selected? [yes/no]** 3 Use voice input to move to the next input control "x-axis filter" **Was the correct item selected? [yes/no]** Use voice input to select the "all" option **Was the correct option selected, and did the chart populate with data? [yes/no]** 4 repeat steps 2 and 3 for each "y-axis" and at least vary the "x-axis" countries 6 times	Energy Use Coal consumption million tonnes of oil equivalent Time Select one or more countries All Brazil China India Japan Malaysia United States

Testing is not something I do personally, but I do know that it can be time consuming, depending on client requirements. Here is an example of a unit test for a single interactive plot. Testing involves ensuring functionality, accessibility, as well as cross-browser and cross-device compatibility.

And because sometimes testing can be as much as half the effort of producing the interactive, it important that the client is aware of the additional cost and that it is included in the estimate up front.

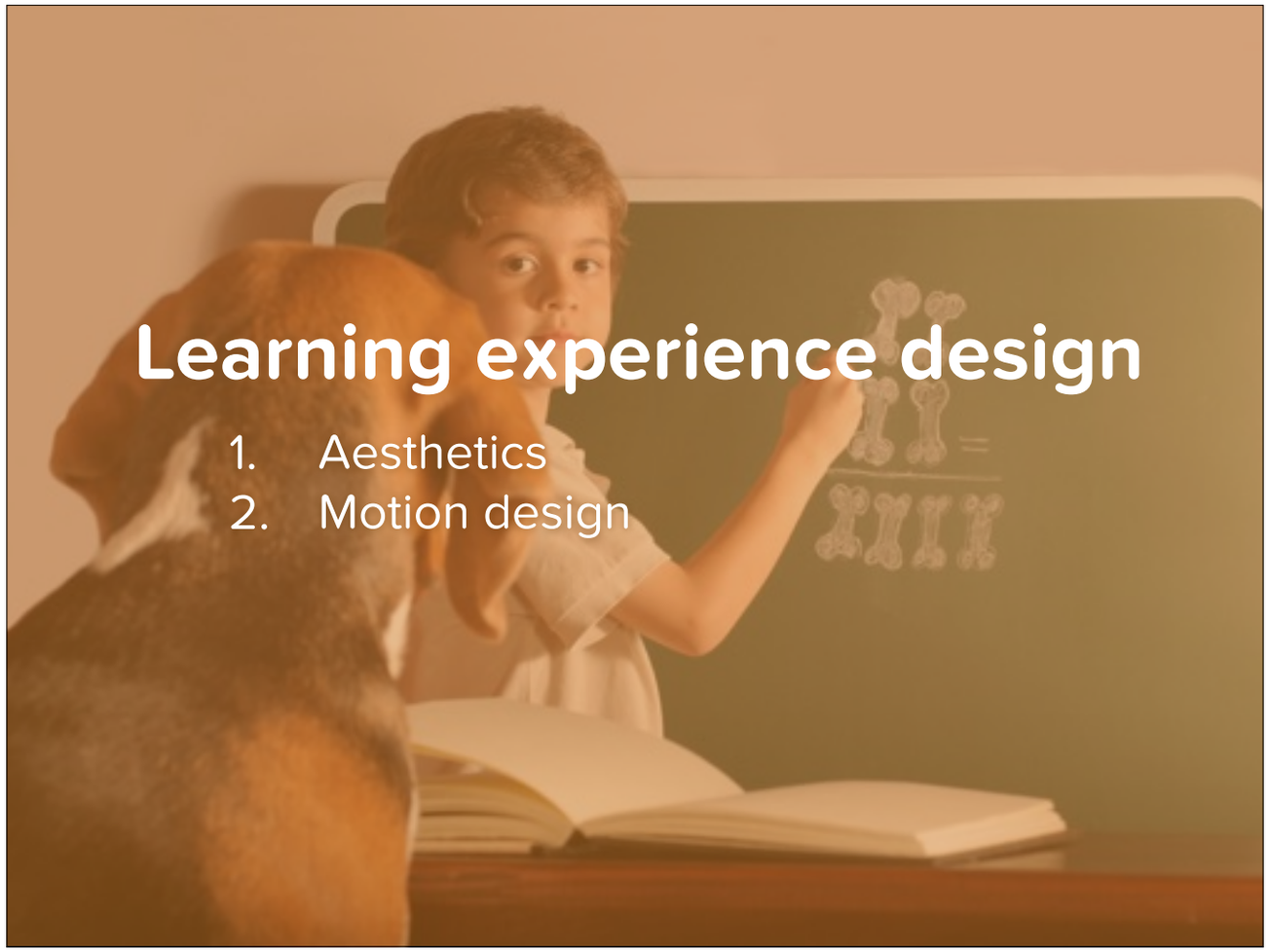


The final lesson concerns “learning experience design”. To put this in context, a field that has been recognized as indispensable to web design in the past few years is “user experience design”. User experience or UX design can be defined as designing based on research into the user’s psychology and behaviour. It is not limited in application to web design, but usually means that.

A dramatic examples of the impact of UX was the redesign of a check-out form on the Expedia.com website. They found during usability testing that users were misinterpreting the optional “company” data field, and entering the name of their bank instead. That caused problems during checkout and purchase failures. Deleting the data field led to 12 million dollar increase in online sales.

So the point of that story is that if that’s what better design can do for profits, think of what it can do for learning.

Hence learning experience design and the idea that we need to understand the learner’s psychology and behaviour when we design interfaces for our learning interactives. We need to take principles from UX, but prioritize learning instead of conversions, and add what we know from pre-existing decades of research into education.



Two aspects of learning experience design I wanted to mention today are aesthetics and motion design.

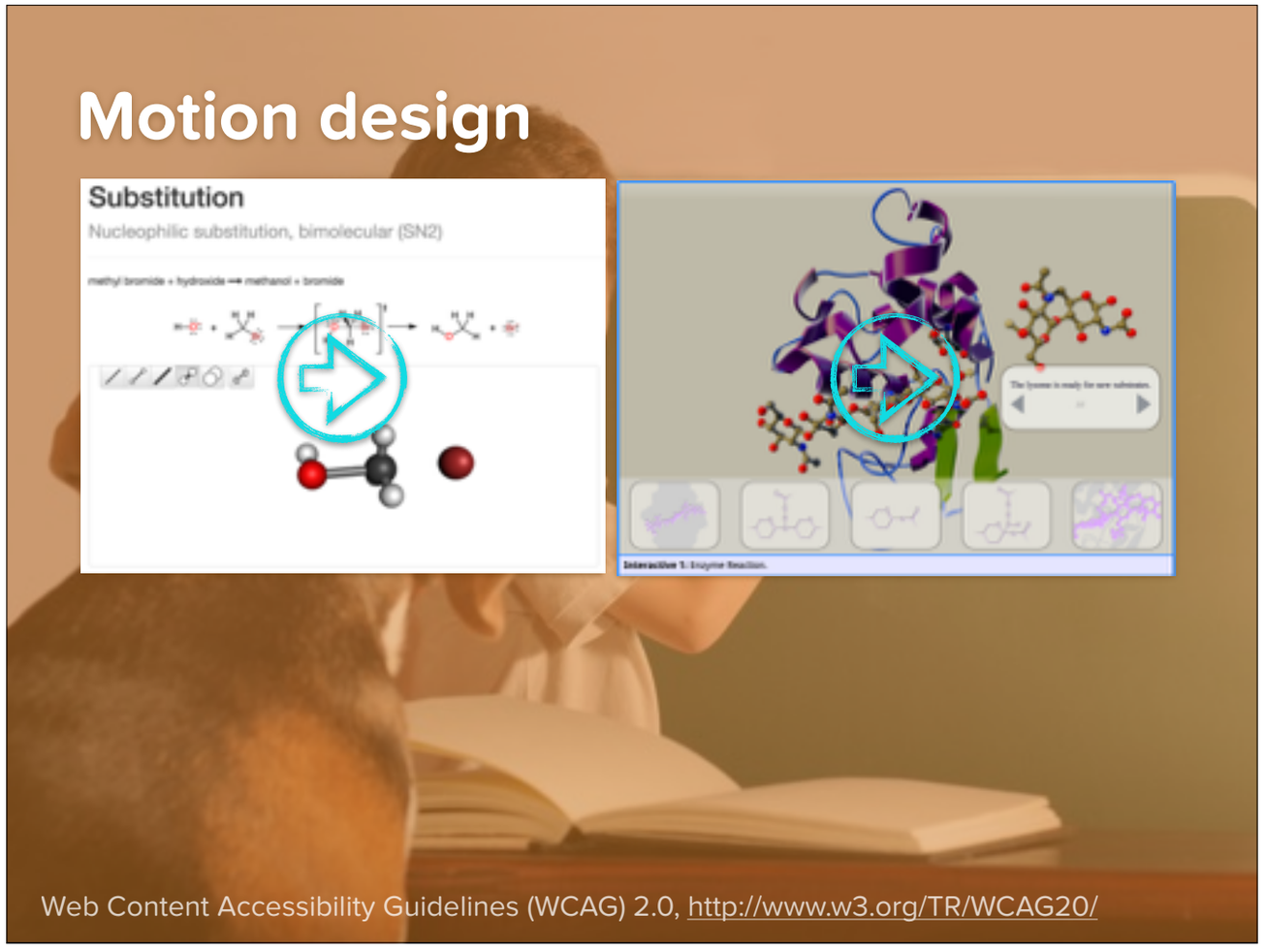
Aesthetics

Appearances are important to learning. I think science sometimes tends not to prioritize aesthetics, and that's quite reasonable if your a researcher, but when you're teaching and designing educational content it's important to prioritize aesthetics.

This is because where two interfaces are functionally the same,
the more attractive one will be considered easier to use, and because it's considered to use, it actually is. This is known as the Aesthetics-usability
effect. Appealing design does not make the the interface more effective, but makes US more effective at using it – the rational behind that is aesthetically appealing interfaces tend to make us happier and more forgiving. And while we want to design the UI to be visually pleasing and clear, we don't want to embellish it beyond what is needed to communicate function. We don't want to distract from the content, which should always be the focus.

Here is a sample style guide for educational web content. Establishing a style guide is a way of setting the aesthetic bar for a project, and are documents everyone can refer to to achieve a consistent look.

As an aside I think chemistry suffers from an aesthetics problem in general, and that if we could fill textbooks with more beautiful and engaging imagery students might not find the subject so difficult.

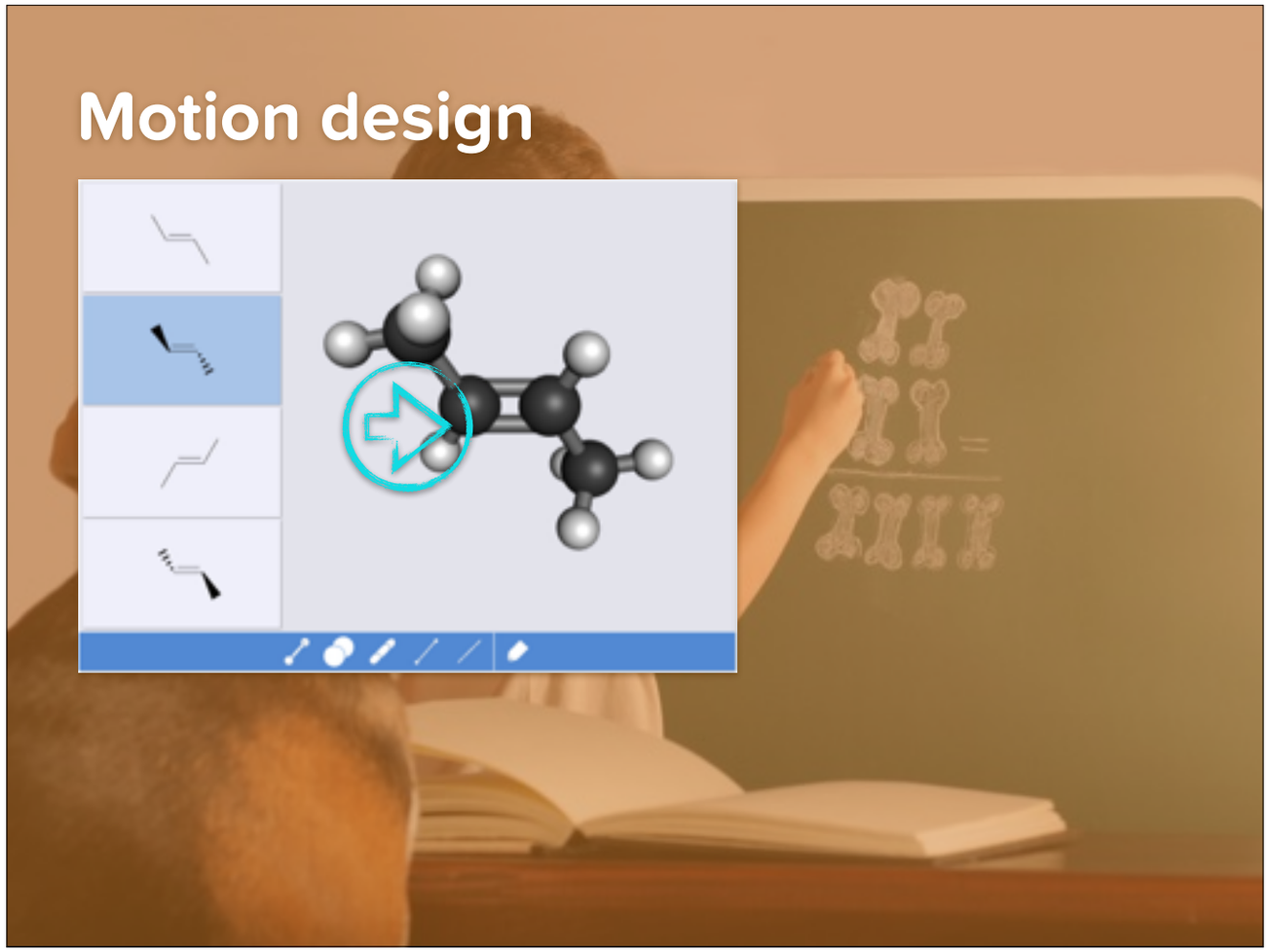


The other Learning Design aspect I wanted to touch on is motion design.

Web animation when mainstream in 2014, thanks to Google's Material Design style guide, and someone somewhere declaring 2015 the year of web animation. Web animations are important for user interfaces since it improves their usability, and they are also important for content. Animation timings affect perceived relationships and how the audience interprets the message and so they can affect learning as well.

For instance these two animations show a molecular reaction:
I created Lab3D for a masters research project. The Lab3D animation tells us something about the relationship of the two atoms. This lyzozyme animation was a demo for showing how a 3D, WebGL interactive could be embedded in an ePub. The lysozyme is very mechanical, and in my opinion says nothing about what is driving the reaction.

Interestingly, there is some evidence that a video is ideal for showing physical process, like how-to-videos of setting a lab apparatus. Apparently this is because we are evolutionarily hardwired to learn motor skills by observation: it activates the same parts of the brain as if we were actually doing them. By contrast conceptual processes, like how rain forms, are better to show as a slide show, which forces students to make logical connections between them and so doing learn the process. A study by Gonzalez indicates however that the transitions between the slides should be animated, and not abrupt, which it leads to greater accuracy when answering questions about the content later.



In addition to content animations, there are animations that are part of the interface itself. There a different opinions on when and how to use UI micro animations, but I would say they should be used to provide feedback on a user action.

In this example as the user rotates the molecules we're providing feedback on which 2D lewis structure representation the current orientation of the 3D molecule corresponds to, attempting to dynamically link the 3D representation with the 2D.

There’s a lot more to do and learn where it come learning experience design, and right now the literature for this subject is a bit sparse, but here are a few resources I’ve found useful so far. And I do expect to see an uptick in the field as more and more educational content moves online, and investment in eLearning grows.

Thank you!

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