

AI-assisted authoring tools for expressive scientific multimedia

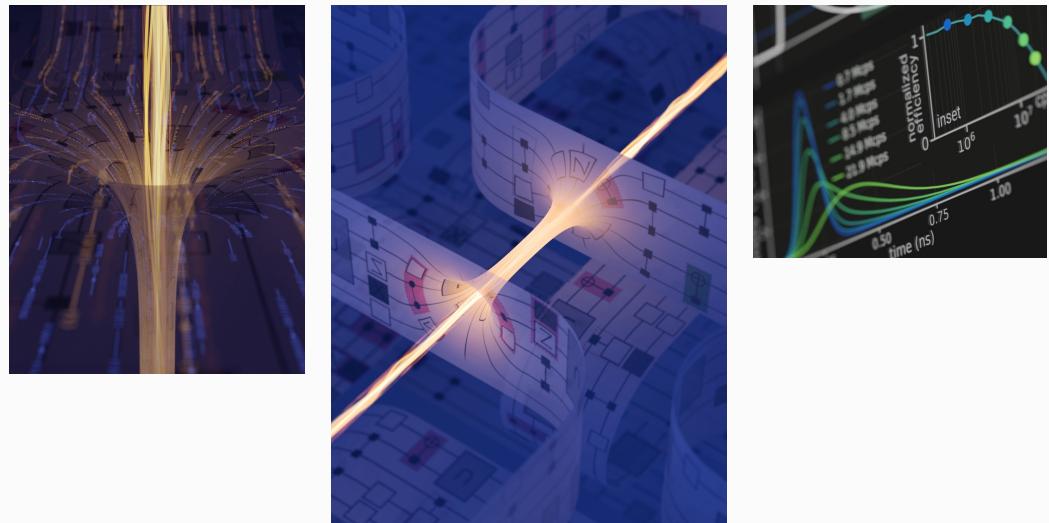
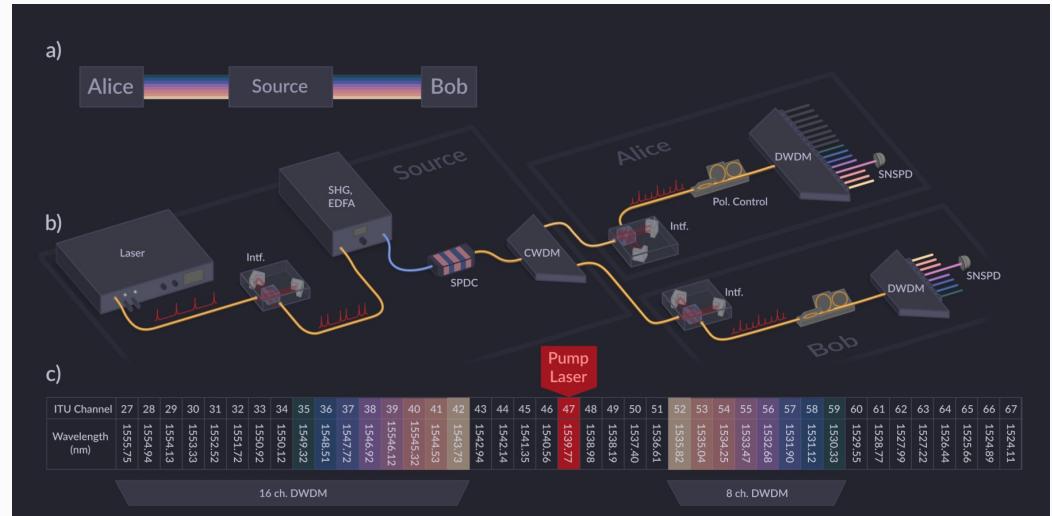
Andrew Mueller

Force11 2024

Andrew Mueller

PhD in Applied Physics | Caltech

- Quantum networks
- Single photon detectors



Overview

- Software that constructs visuals from natural language

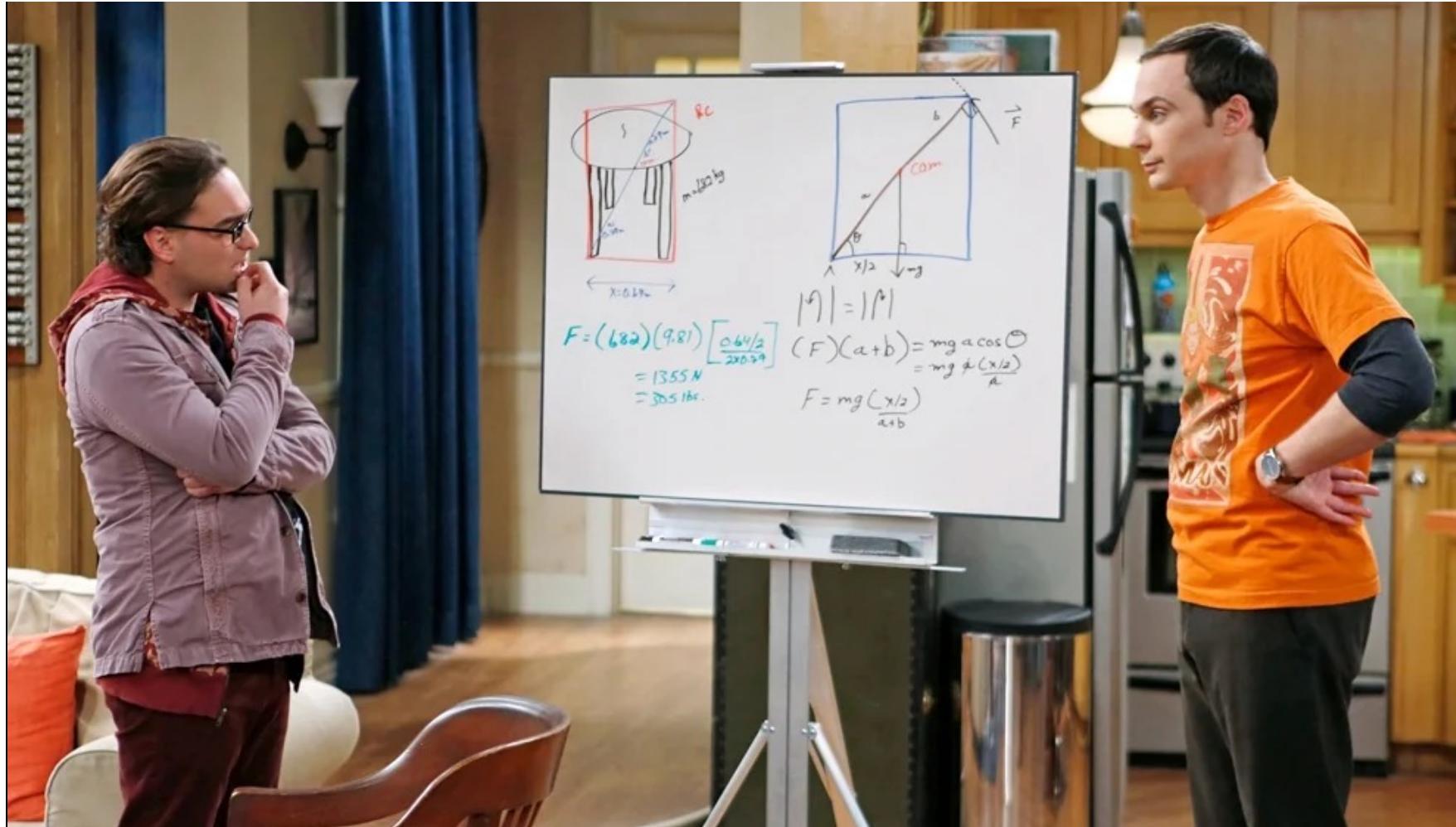
Overview

- *Why make software that constructs visuals from natural language?*
- Software that constructs visuals from natural language

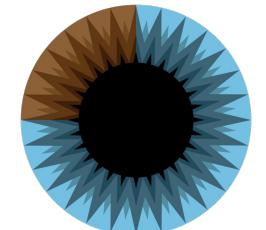
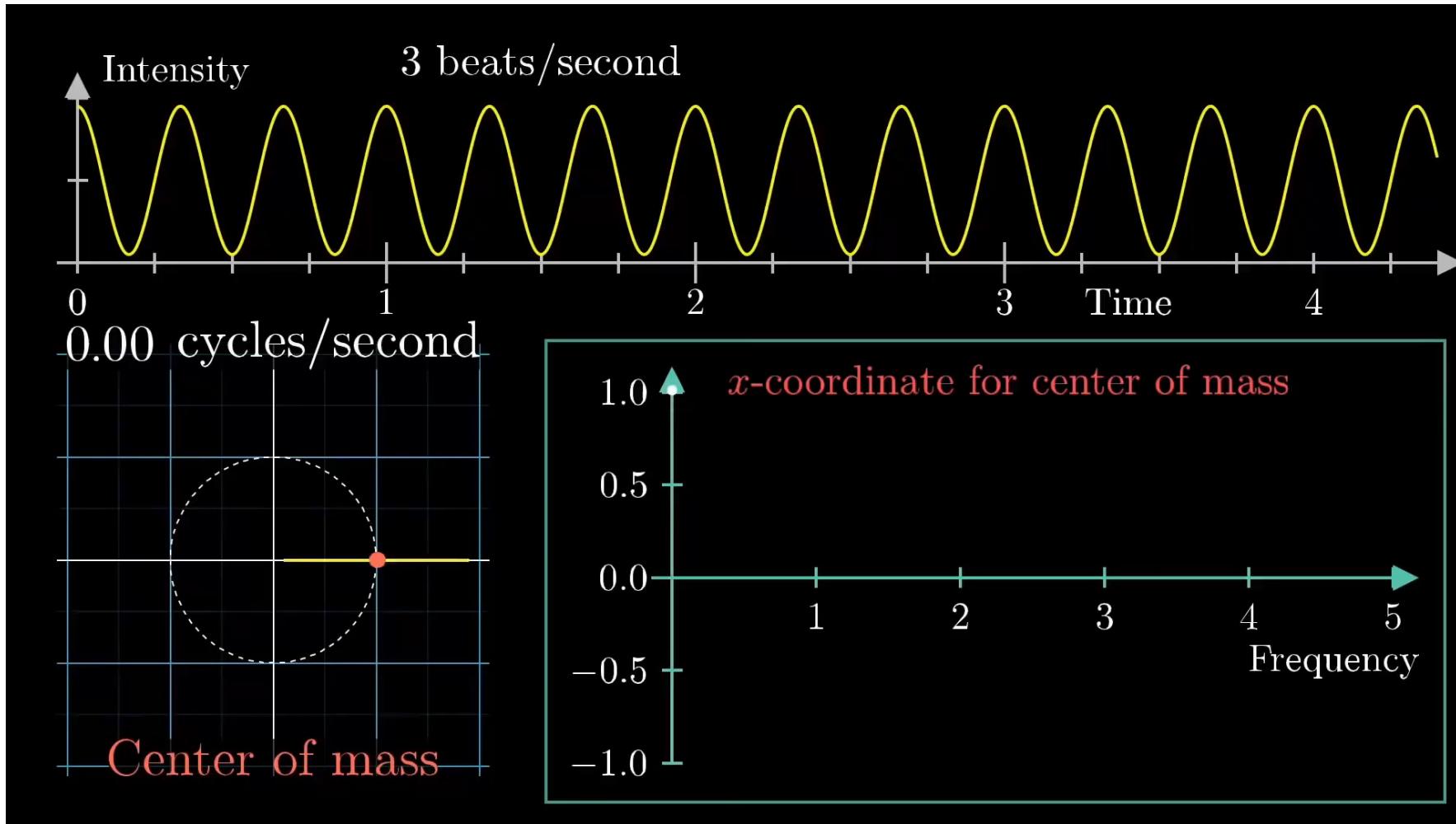
Overview

- *Why make software that constructs visuals from natural language?*
- Software that constructs visuals from natural language
- Is it useful?

Why - Multimedia



Why - Multimedia



3Blue1Brown



MINUTE
PHYSICS

Minute Physics



Welch Labs

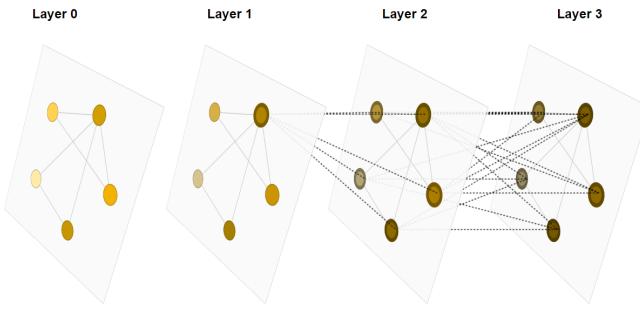
What about publishing?

Rich Documents

Rich Documents



Distill.pub

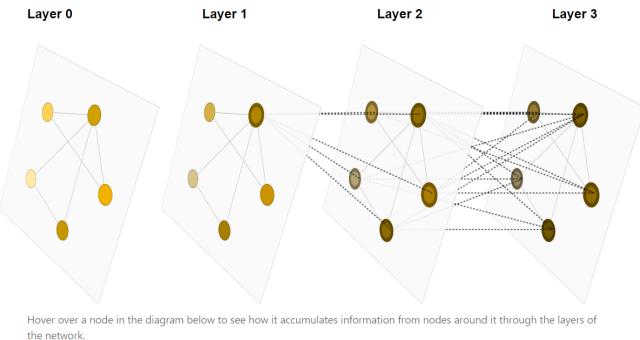


- Produced interactive & animated digital publications about machine learning
- On indefinite hiatus

Rich Documents



Distill.pub



Curvenote

The screenshot shows a web-based notebook interface. The left sidebar contains a table of contents with items like "Future of Research", "Impulse Response", "Forward Problem", "Data Maff", "Model Norms", "Nonlinear Inversion", "Numerical Examples", "Final Examples", "Final Example - J.U. Smith Test Range", "Final Example - Vosey's Bay", "Final Example - Ragan Mine Deposit", "Final Example - Gulf of Mexico", "Presentation - AGU", "Presentation - NALM", "Impulse Response", "RMS Velocity", and "Synthetic Example - Block Model". The main area displays a notebook entry titled "Impulse response of a halfspace" with the following content:

AUTHORS: Rowan Cockett, Steve Purves, and Luz Maga Caprotti
LAST EDITED: Aug 20, 2021
DATE: 12:51 PM, Aug 20
We will compute the α -directed electric field at an offset of $r = 5$ km due to an α -directed electric impulse source, where the upper halfspace is air (Naligian, 1979).

Below the text is a plot titled "Impulse response over a halfspace" showing a bell-shaped curve on a logarithmic scale from 10^{-4} to 10^0 on the x-axis and from 0.0000×10^{-4} to 2.0000×10^{-4} on the y-axis.

On the right side, there is a sidebar with a "Save Version" button and a list of recent activity:

- Steve Purves: I am working on a visualization of this. I was going to use my favorite Notebook now!
- Luz Maga Caprotti: 12:51 PM, Aug 20
- Noel: 12:51 PM, Aug 20
- Luz Maga Caprotti: Can you add a slider or the current value?

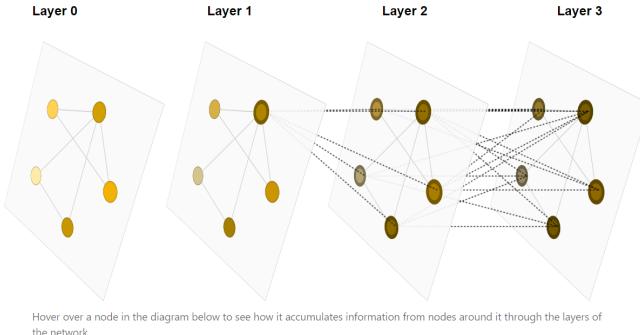
- Produced interactive & animated digital publications about machine learning
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- Writing platform supporting interactive and data-centric content
- Building with MyST markdown

Rich Documents



Distill.pub



- Produced interactive & animated digital publications about machine learning
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Curvenote

The screenshot shows a web-based interface for a research article. The title is "Impulse response of a halfspace". The left sidebar contains a table of contents with items like "Future of Research", "Impulse Response Notes", "Linear Theory", "Forward Problem", "Data Maff", "Model Norms", "Nonlinear Invasion", "Numerical Methods", "First Examples", "RJ Smith Test Range", "First Example - Vosey's Bay", "First Example - Ragan Mine Deposit", "First Example - Gulf of Mexico", "Presentation - AGU", "Notes", "Impulse Response", "RMS Velocity", "Synthetic Example - Block Model", and "Article 2 blocks". The main content area shows a plot of "Impulse response over a halfspace" with a bell-shaped curve on a logarithmic scale. The right side features a sidebar with user comments and a "Save Version" button.

- Writing platform supporting interactive and data-centric content
- Building with MyST markdown



Mathematica



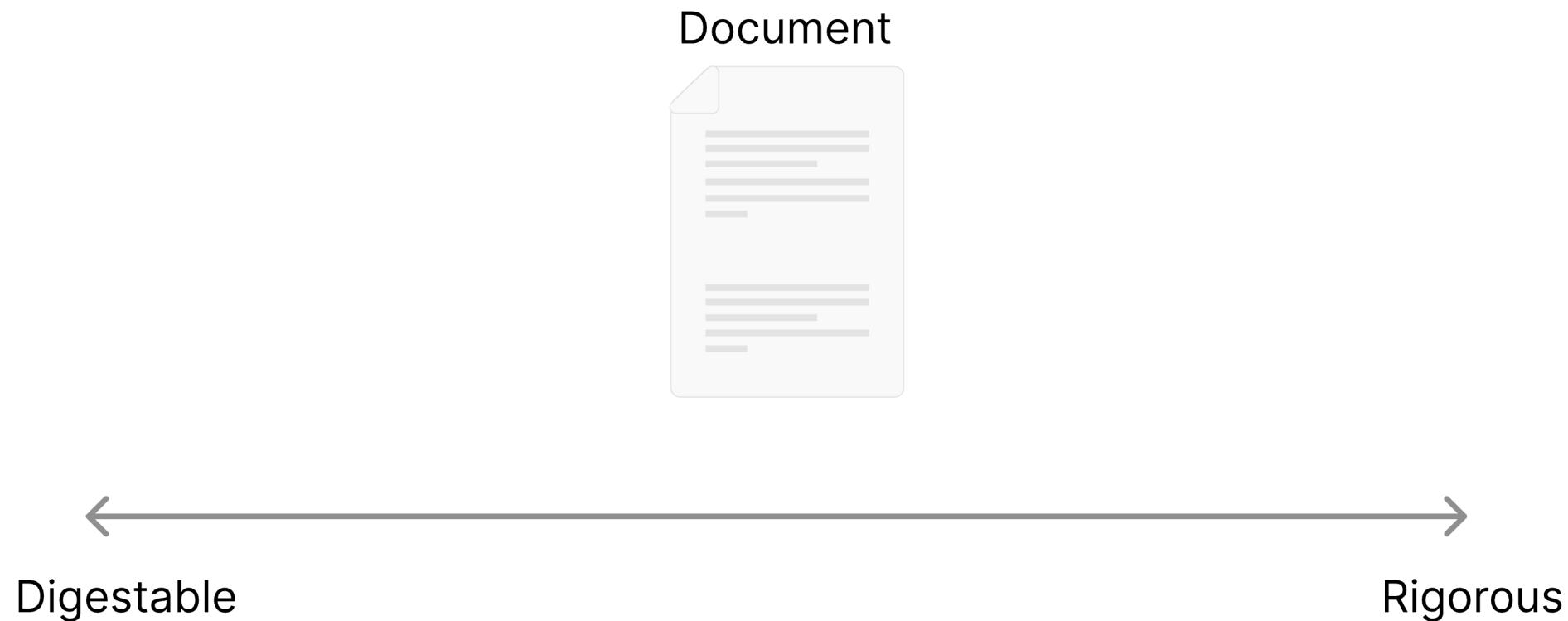
MyST Markdown, Jupyter



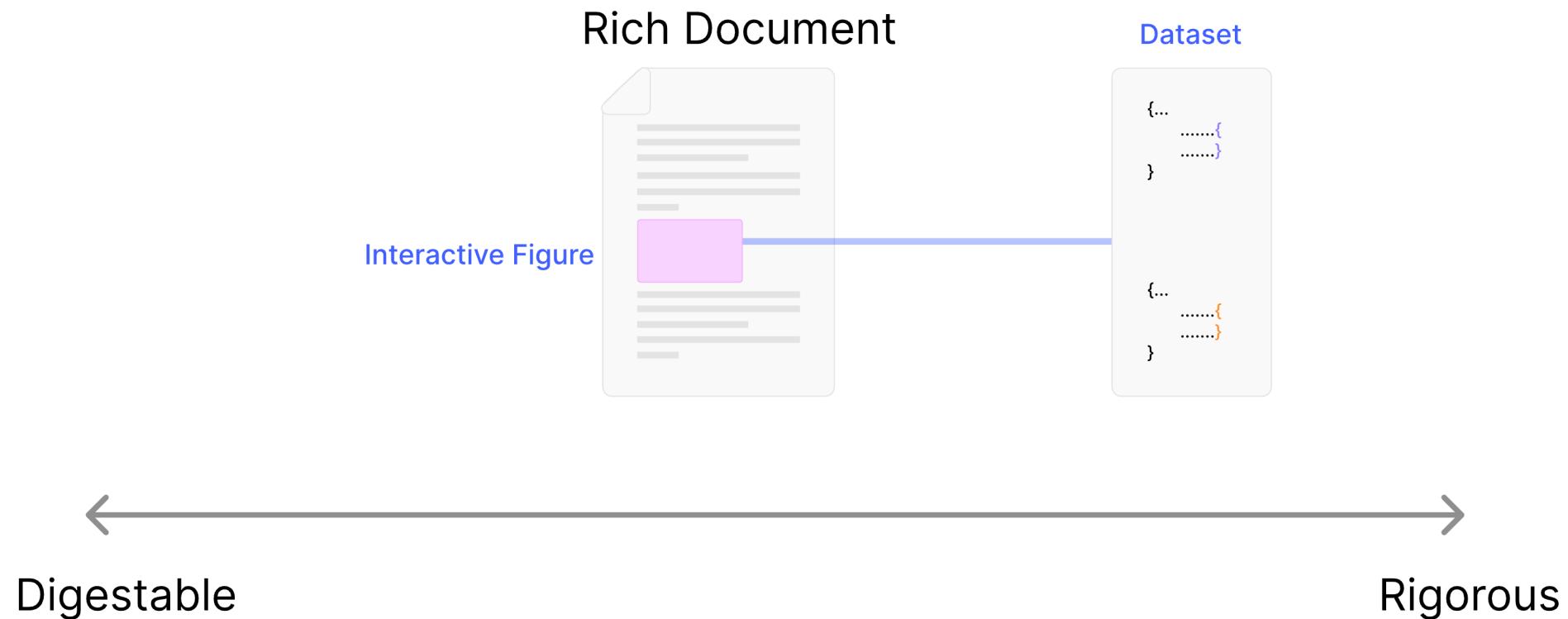
Observable

»Nextjournal

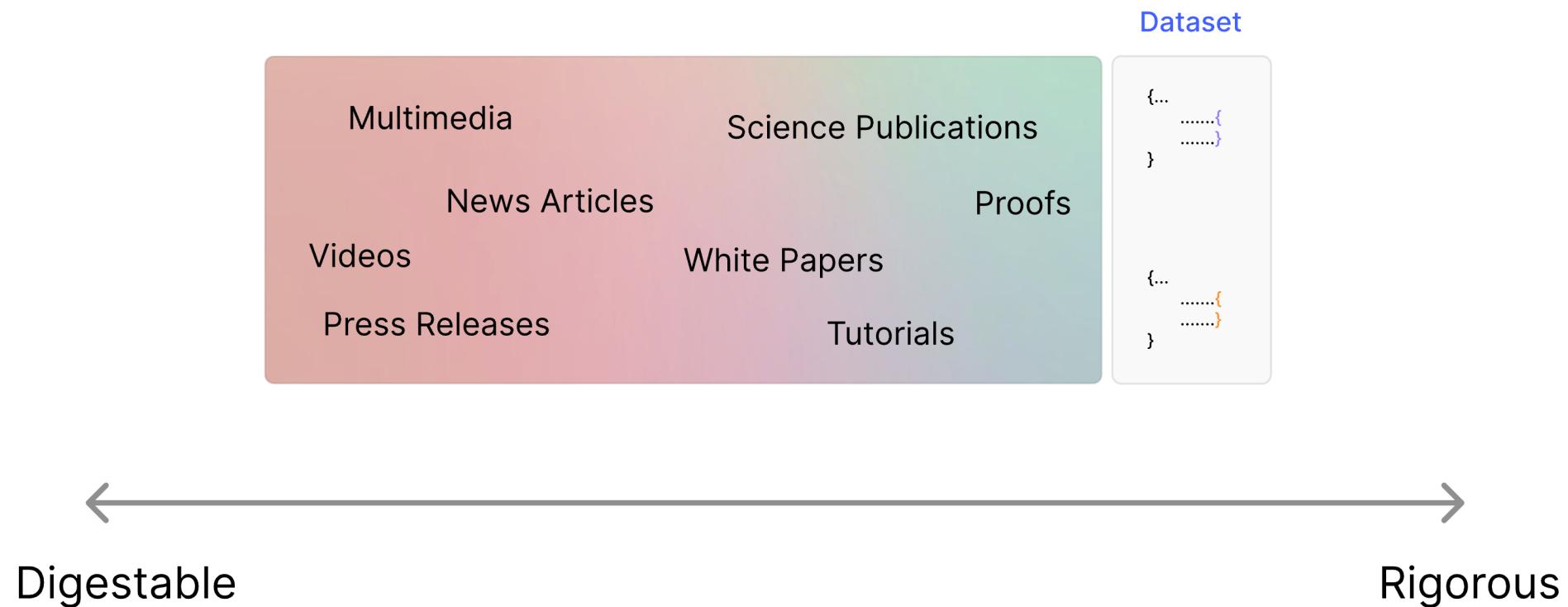
What is a 'Document'?



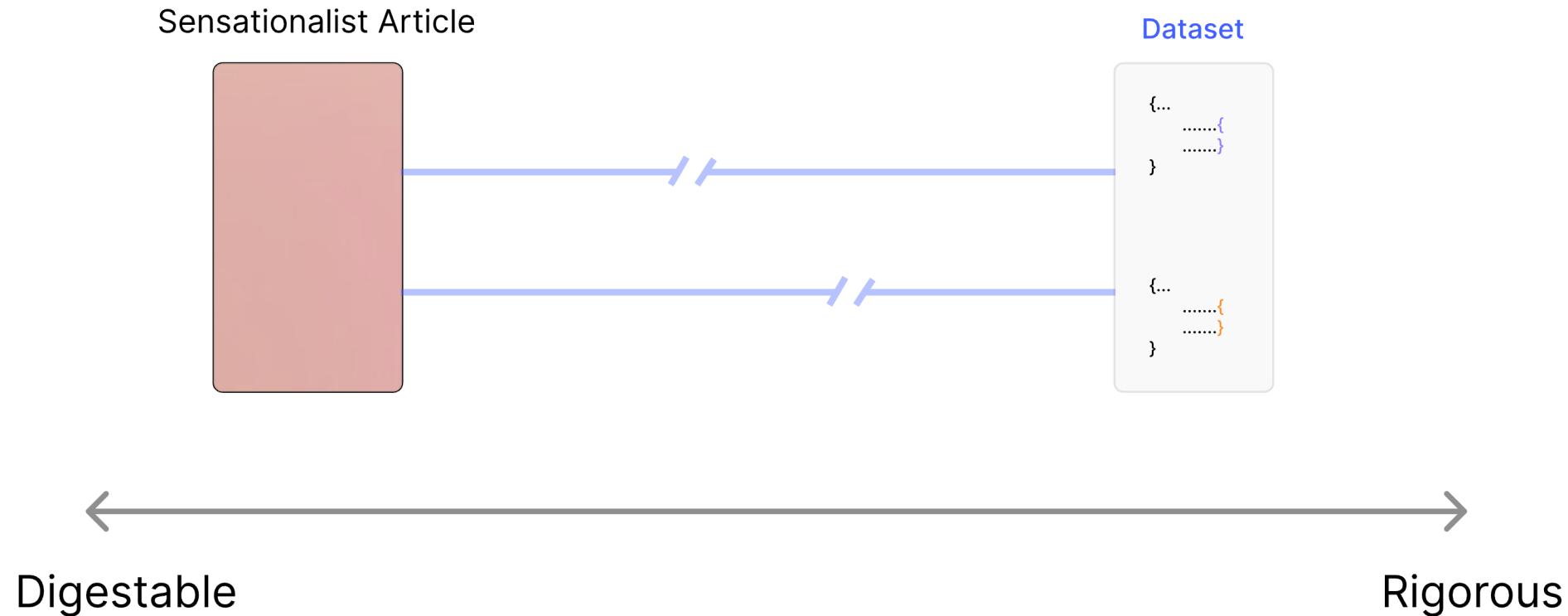
What is a ‘Document’?



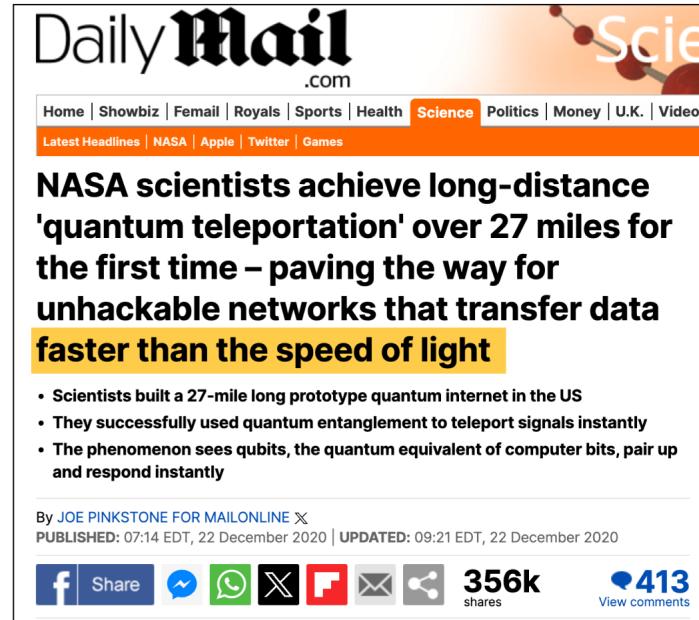
Media



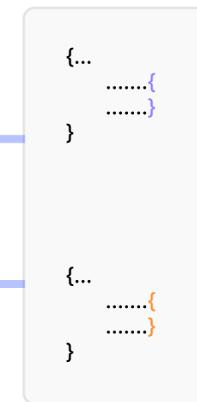
Misleading Media



Misleading Media



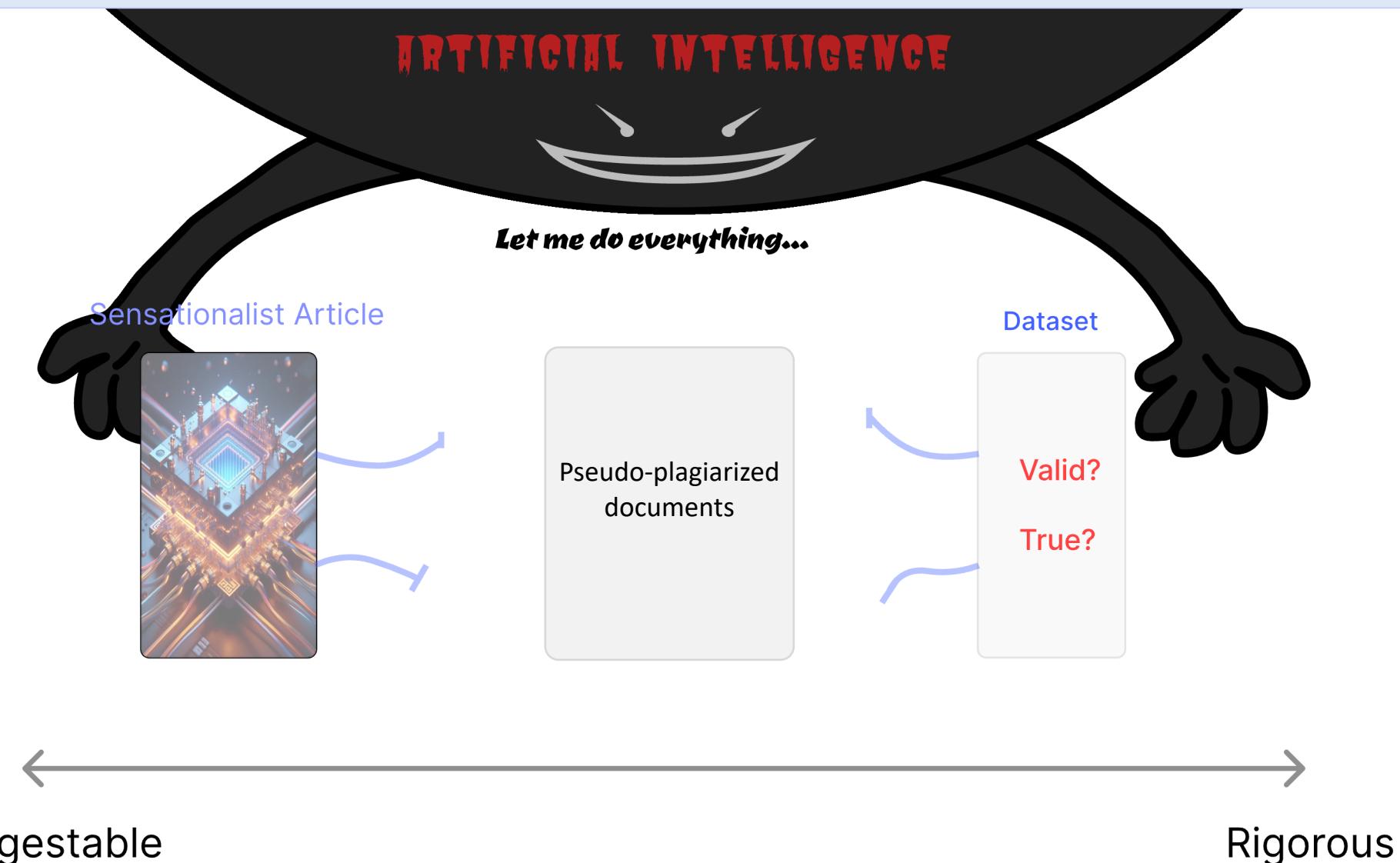
Dataset



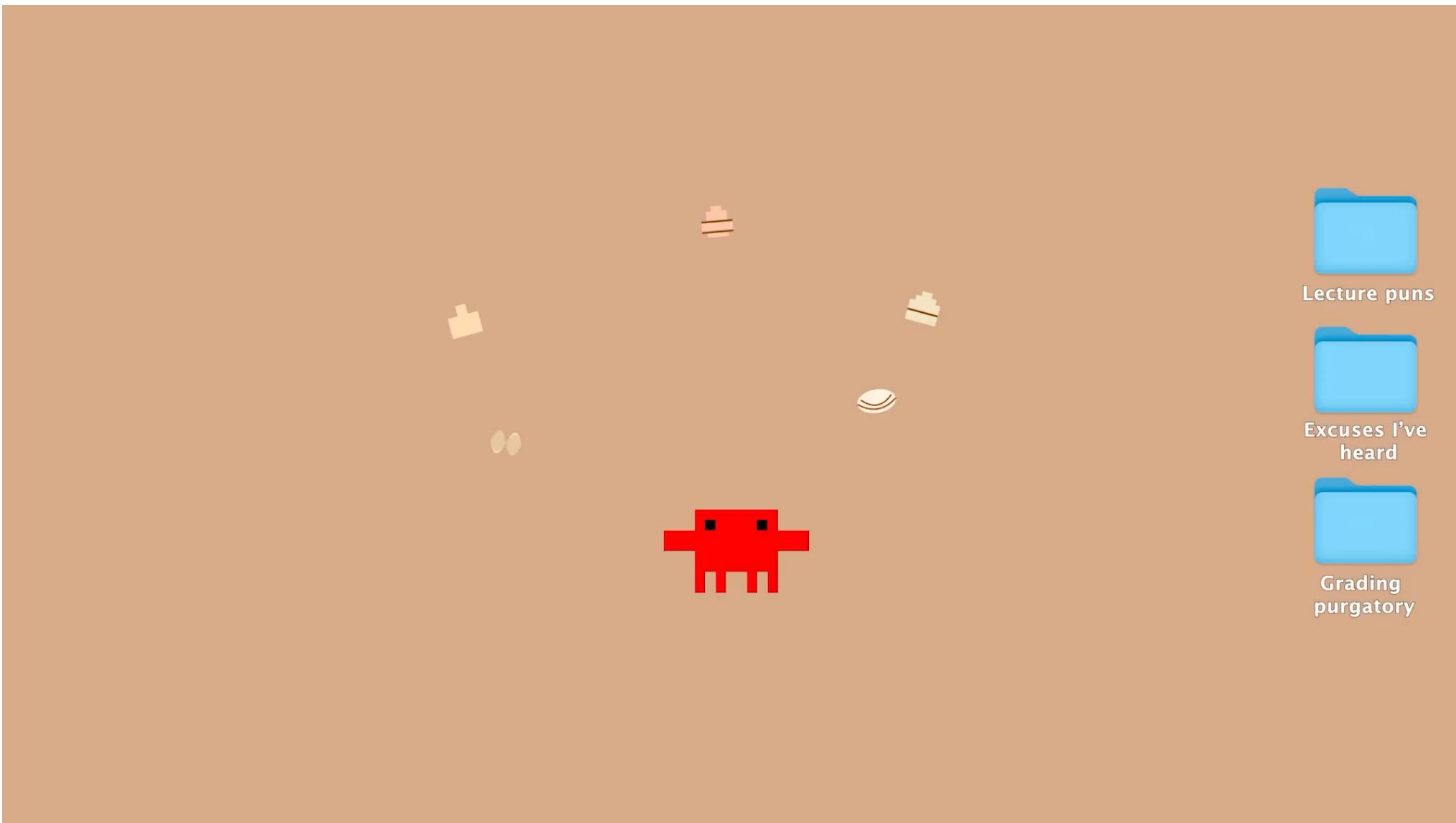
Digestable

Rigorous

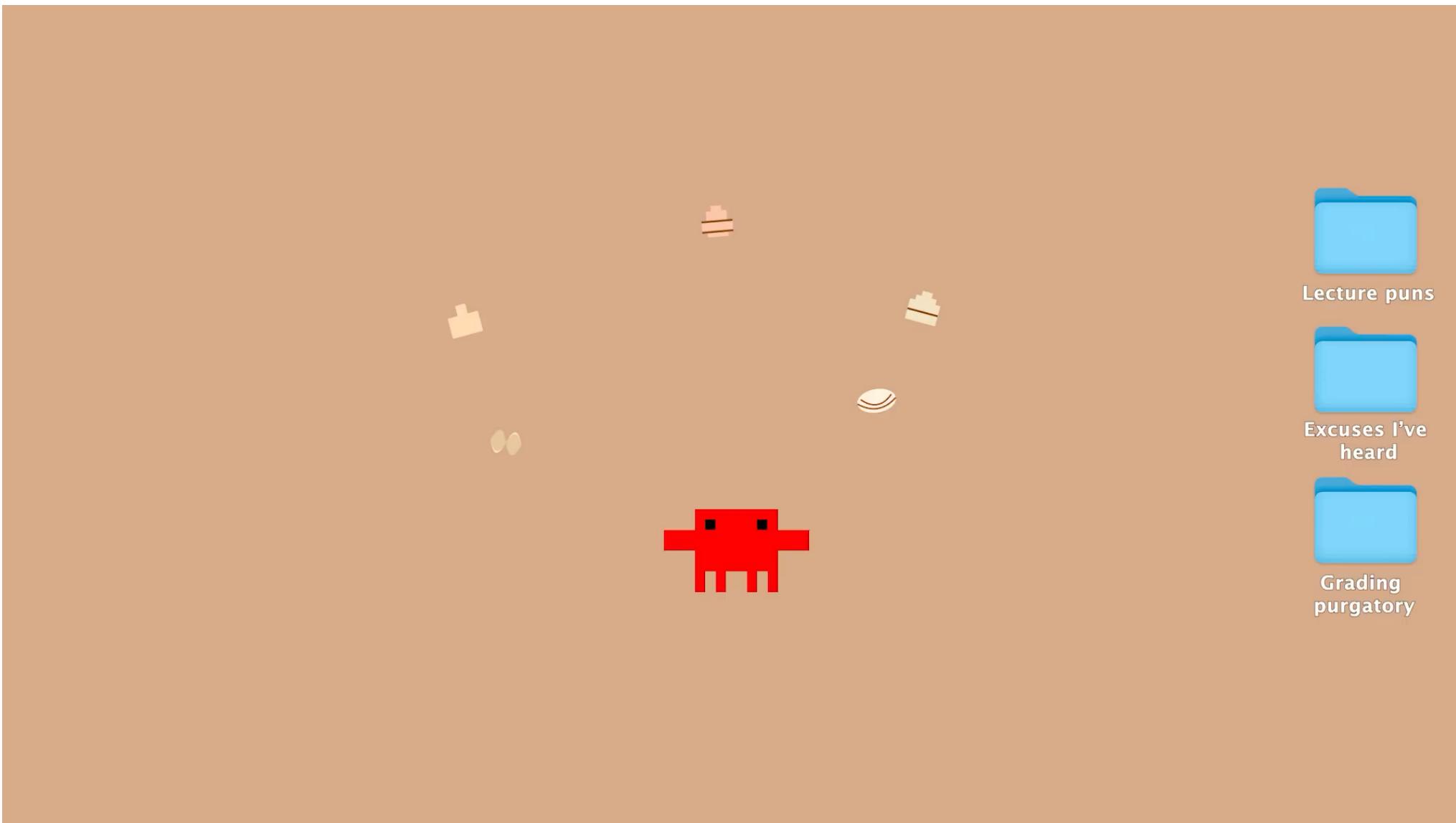
Misleading Media



AI-generated content

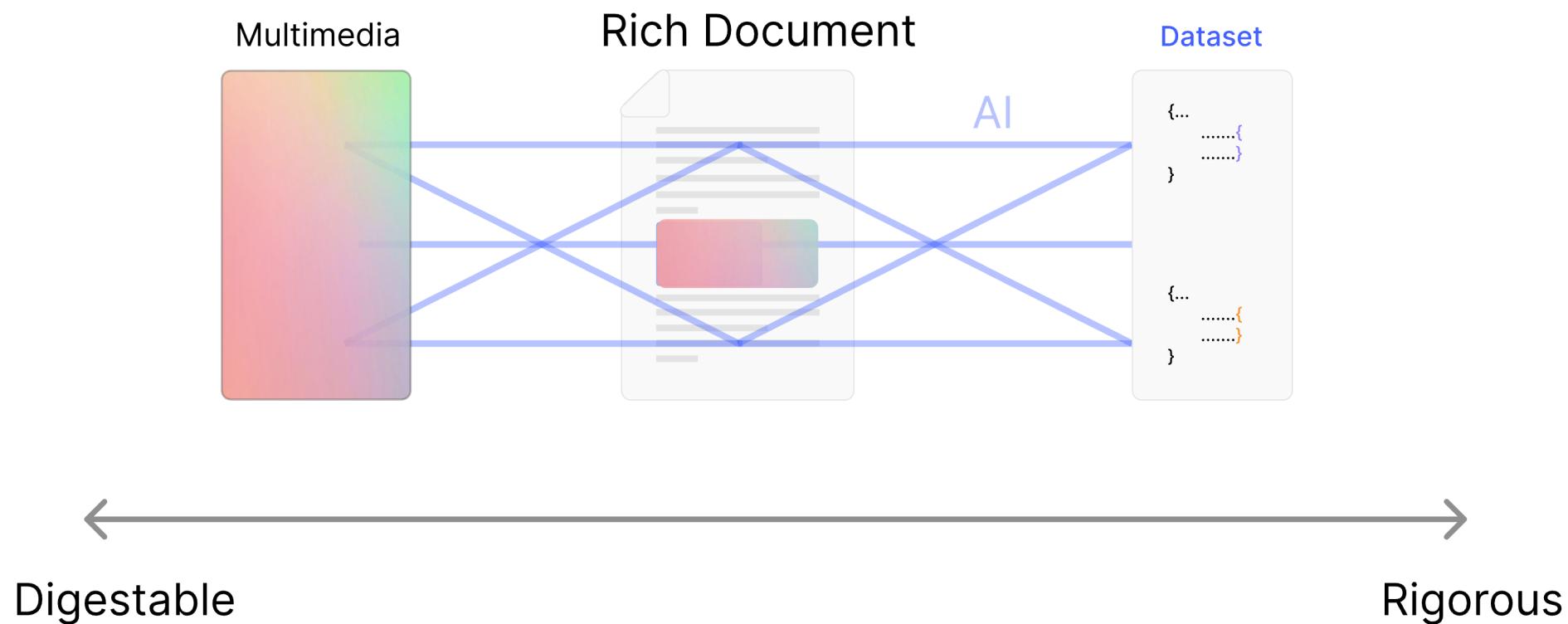


AI-generated content



What would be better?

AI-assisted transformations



Tightly link text to diagrams and animations

Yohei Nakajima

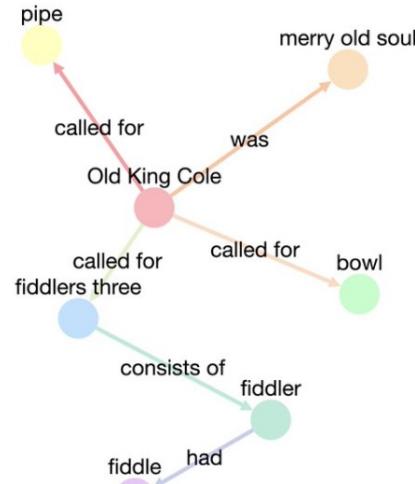


Yohei ✅

@yoheinakajima

look at this pretty little text-to-knowledge graph ui

Old King Cole was a merry old soul,
And a merry old soul was he;
He called for his pipe, and he called for his
bowl,
And he called for his fiddlers three.
Every fiddler he had a fiddle,
And a very fine fiddle had he;
Oh, there's none so rare, as can compare,
With King Cole and his fiddlers three.



1:26 AM · May 1, 2024 · 368.3K Views

67

218

3.4K

1.6K



Tightly link text to diagrams and animations

Yohei Nakajima

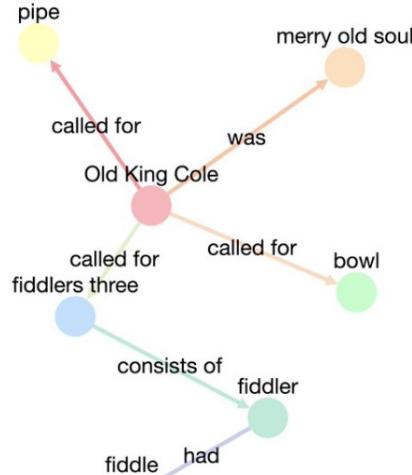


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67

218

3.4K

1.6K



output json that represents a knowledge graph of this sentence. "Mary had a little lamb, it's fleece was white as snow"



json

```
{  
  "entities": [  
    {  
      "id": "Mary",  
      "type": "Person"  
    },  
    {  
      "id": "Lamb",  
      "type": "Animal"  
    },  
    {  
      "id": "Fleece",  
      "type": "Object"  
    }  
],  
  "relationships": [  
    {  
      "source": "Mary",  
      "target": "Lamb",  

```

Copy code

Tightly link text to diagrams and animations

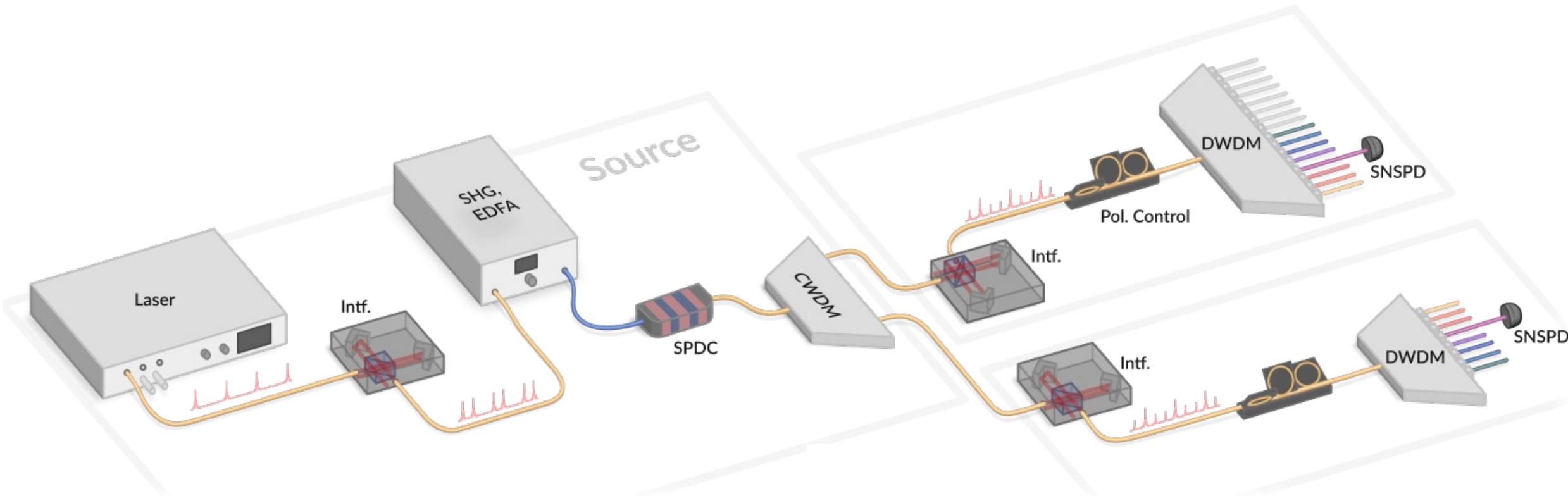


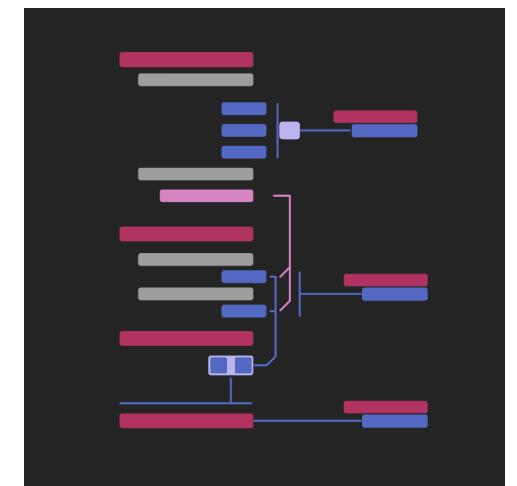
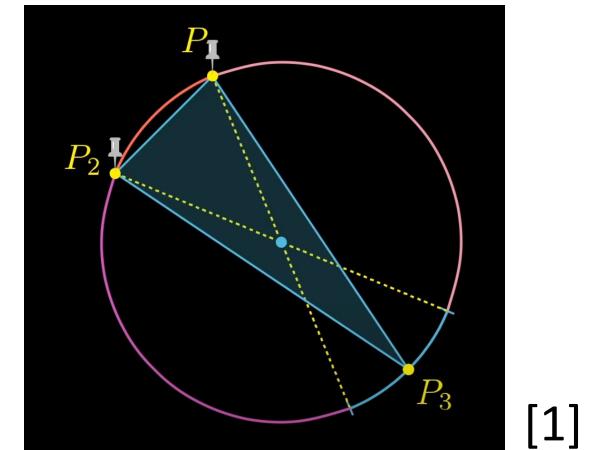
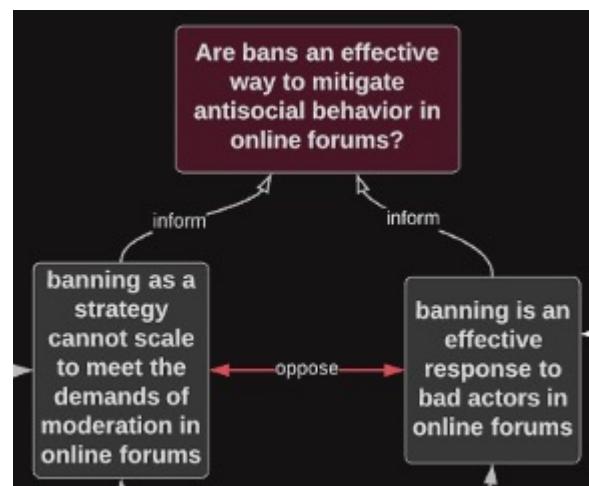
Figure 1 shows the experimental setup. Pulses from the 4.09-GHz mode-locked laser, with a center wavelength at 1539.47 nm, are sent through an 80-ps delay-line interferometer (Optoplex DPSK Phase Demodulator). Following the interferometer, pairs of pulses are upconverted by a second harmonic generation (SHG) module (Pritel) and downconverted into entangled photon pairs by a type-0 spontaneous parametric downconversion (SPDC) crystal (Covesion). The photon pairs are separated by a coarse wavelength division multiplexer (CWDM) which serves to split the SPDC spectrum into two wide-bandwidth halves. For a system using more than 16

Demo

Knowledge graphs

KGs can represent:

- Visual Constraints
- Relationships
- Data flow
- Discourse Graphs



[1] The hardest problem on the hardest test <https://www.youtube.com/watch?v=OkmNXy7er84v>

[2] Discourse Graphs <https://oasis-lab.gitbook.io/roamresearch-discourse-graph-extension/fundamentals/what-is-a-discourse-graph>

To be useful...

- Make *expressive* diagrams and animations *easily*
- Editable *not just* with language (**todo**), but tightly linked with language
- Based on *reusable, sharable, and web-accessible* components.

Built with



Motion Canvas

Similar to [Manim](#), the tool used by 3Blue1Brown



Svelte

Frontend framework

Instructor

AI data extraction library, python

Thank you!