



Quiz!

30 minutes (1:45-2:15)

Closed note, closed book

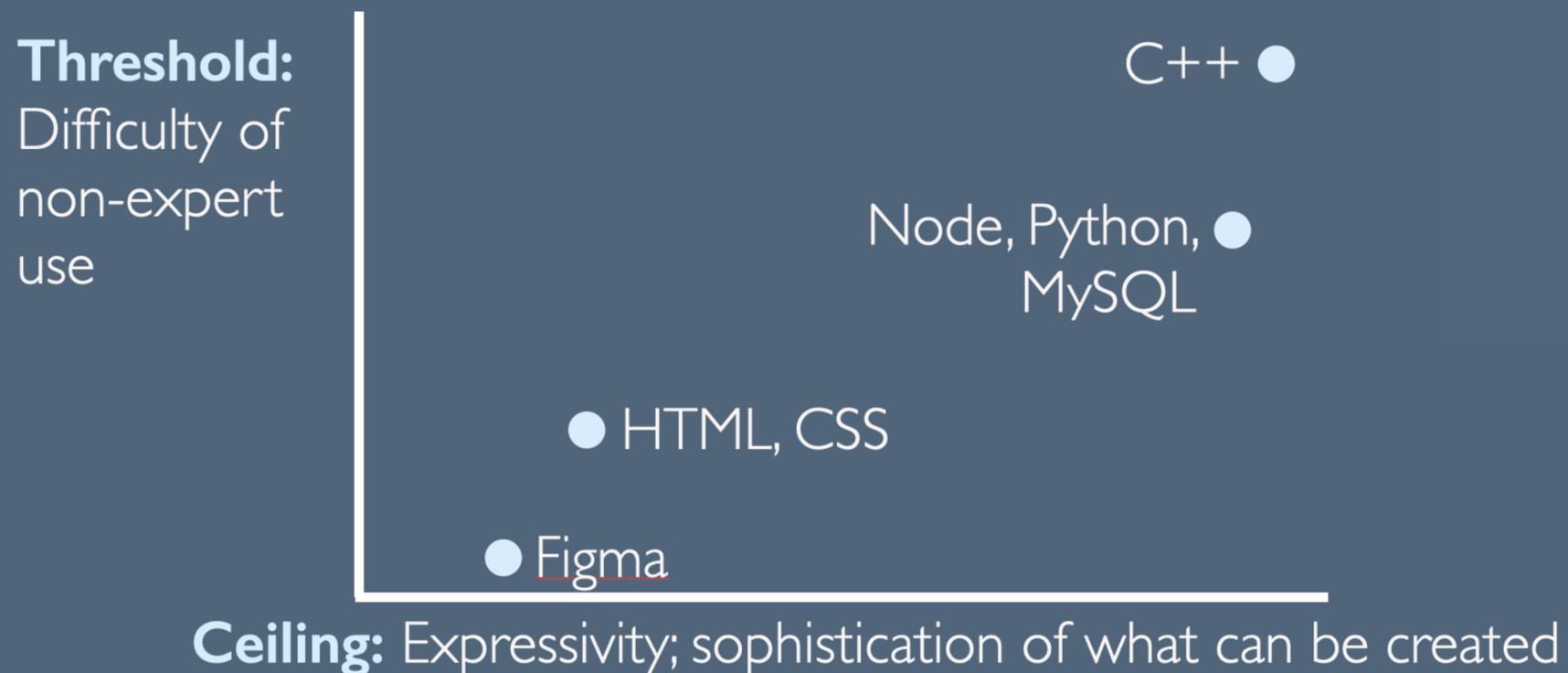
Come up and ask if you have questions.

Content Creation

CS 7000-001

Andrew Head & Danaé Metaxa

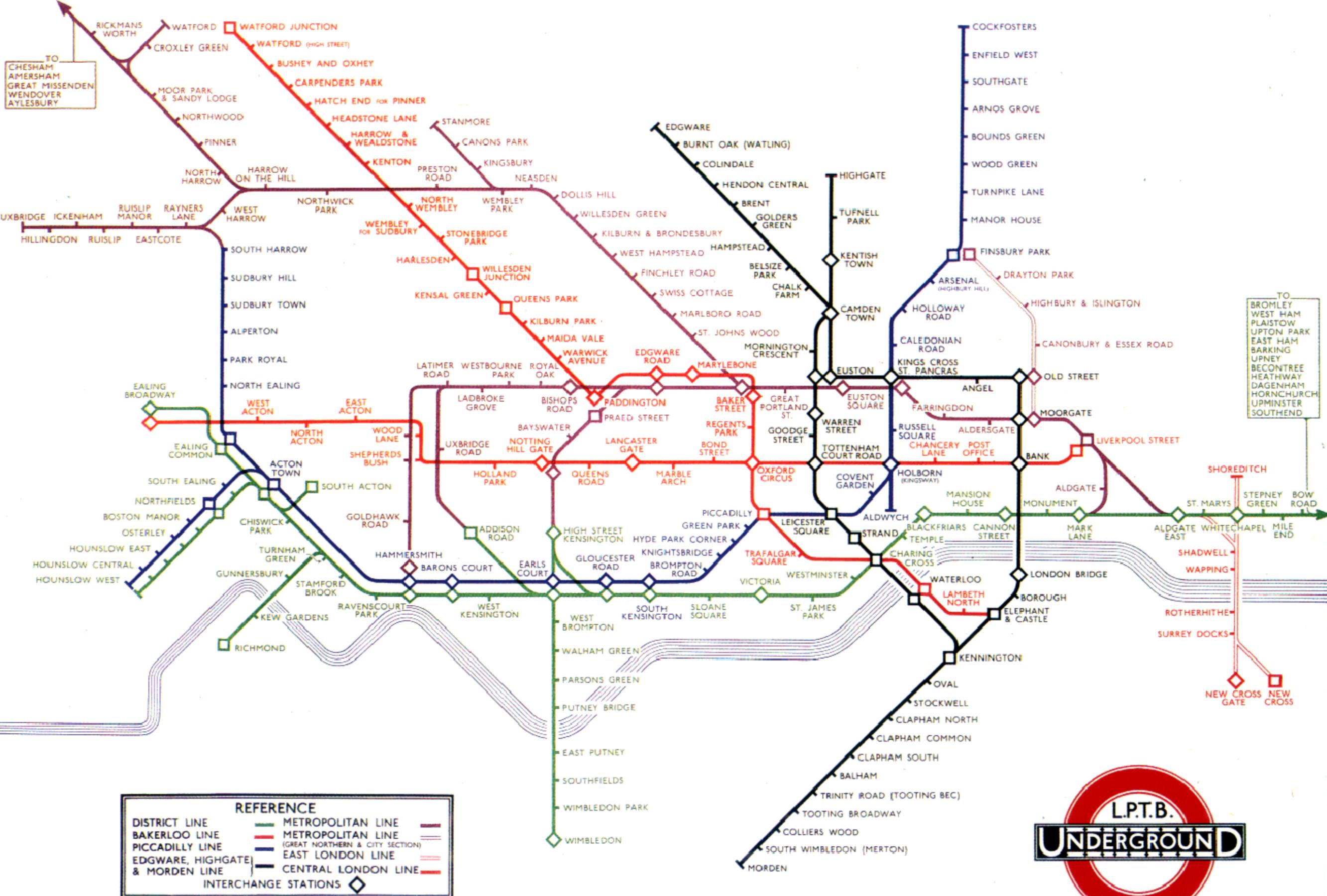
Last time



Programming tools often either aim to **reduce the threshold** or **raise the ceiling** — how depends on which one we're pursuing

Successful programming tools **shift our cognitive problem representations** to make the task more readily solvable

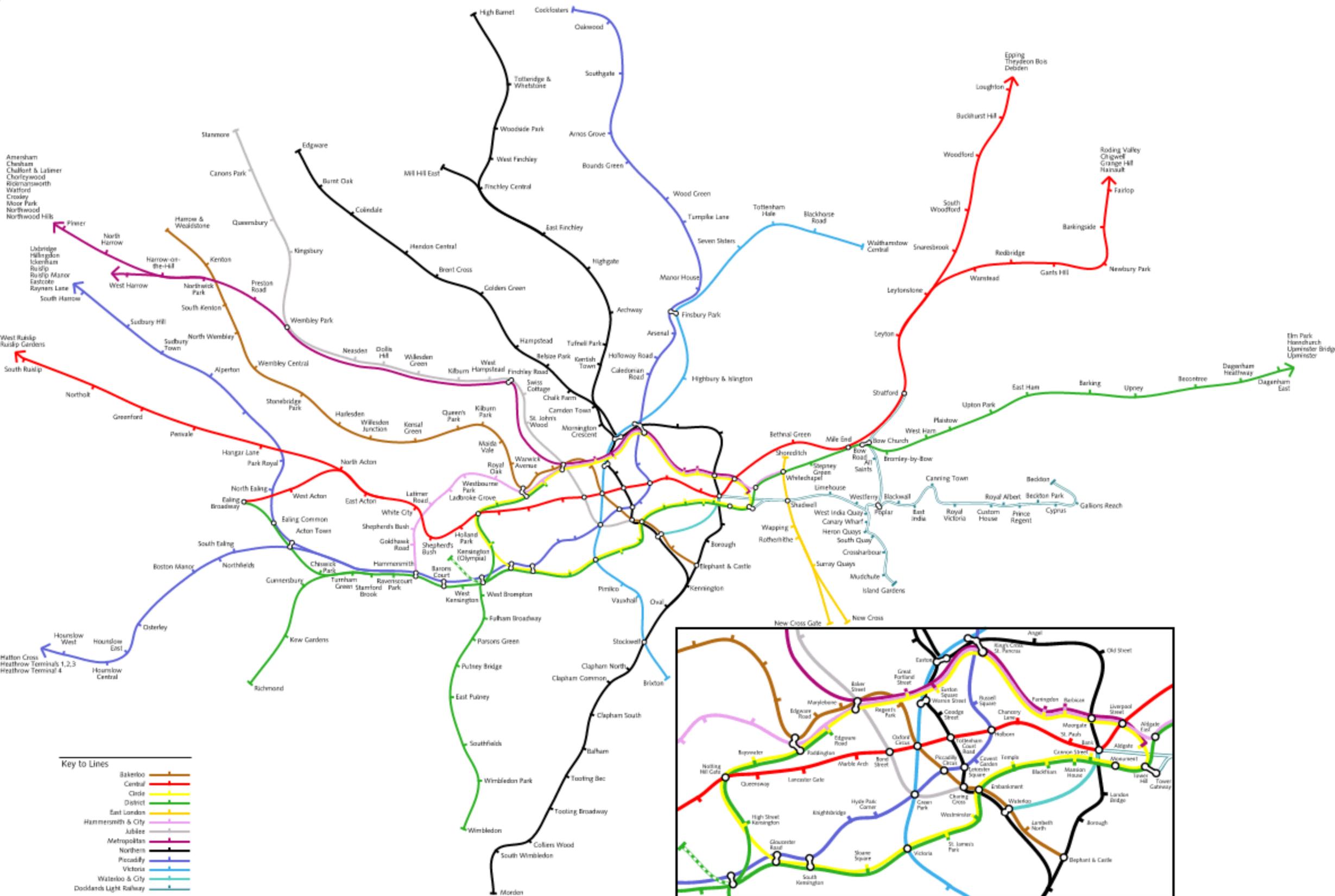
Tools for **learning programming** lower thresholds, aim for high ceilings, teach representations, and facilitate instruction.



ISSUED BY LONDON PASSENGER TRANSPORT BOARD 55, BROADWAY, S.W.1.



London Underground [Beck 33]



Actual
London
Underground
[TfL 2014]

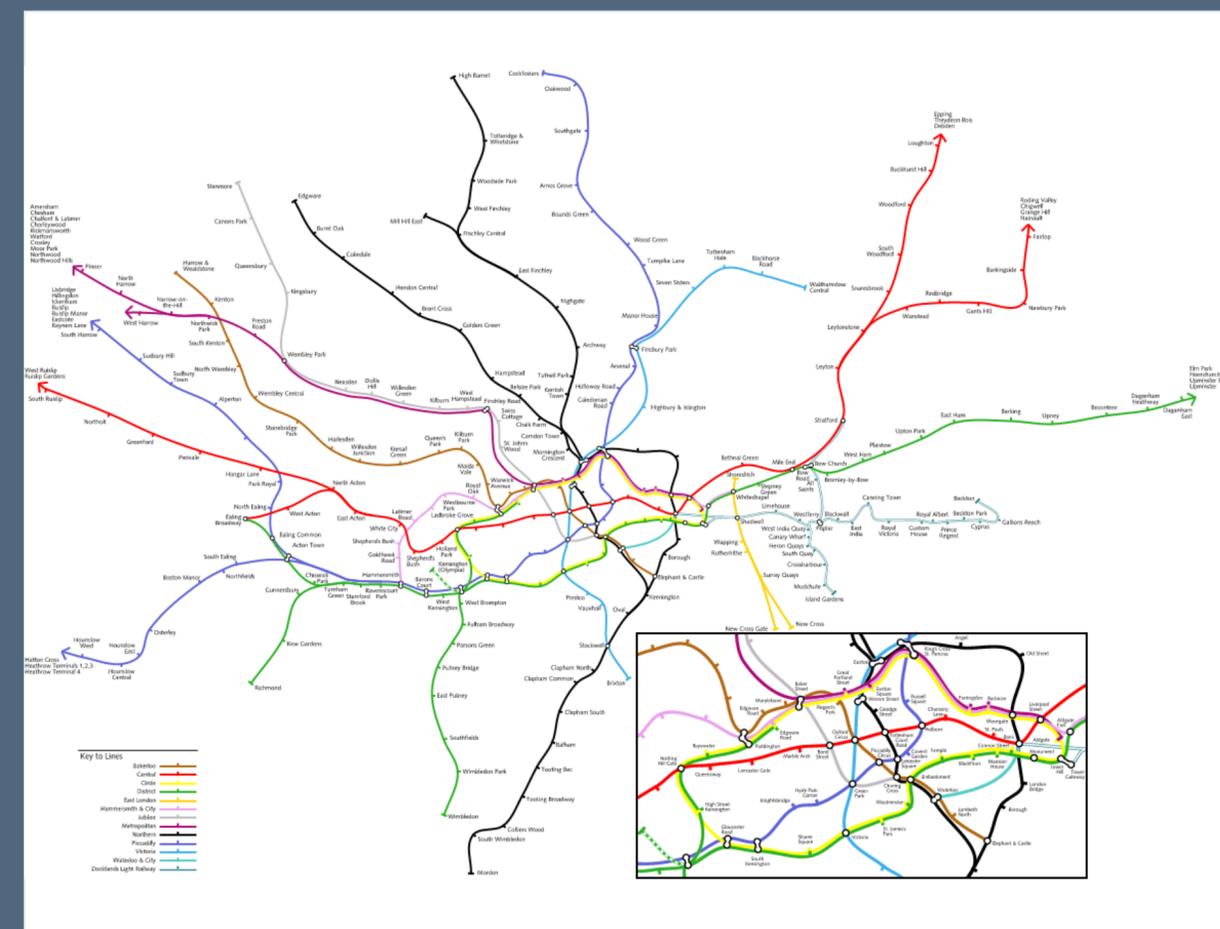
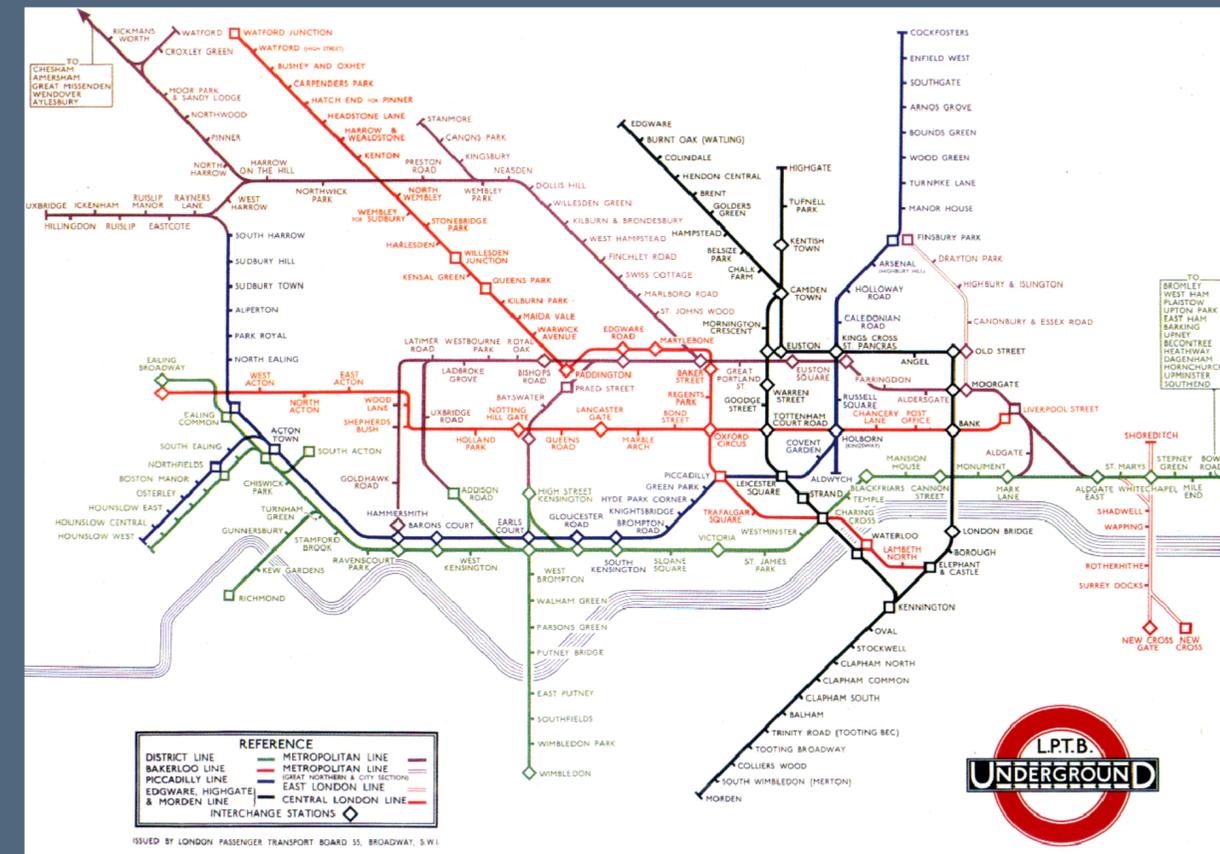
Beck's view vs. geographical view

Task: get from Point A to Point B

Important information: sequence of stops or interchanges along the way

Broad “design principle”: emphasize and de-emphasize information to support cognition

Make sequence of stops easy to read off, make interchanges visible, reduce clutter and distraction everywhere that it impedes those goals



Content creation

We are constantly engaging with creative content (illustration, film, animation, photographs, podcasts, screenplays, slides ...)

When a creative task is sufficiently general and valuable, there is significant contribution to be made in **describing its structure and encoding that into tools and workflows.**

How might we develop tools to facilitate creation workflows while ensuring that the user maintains desirable control?

Today

Design principles for visual communication

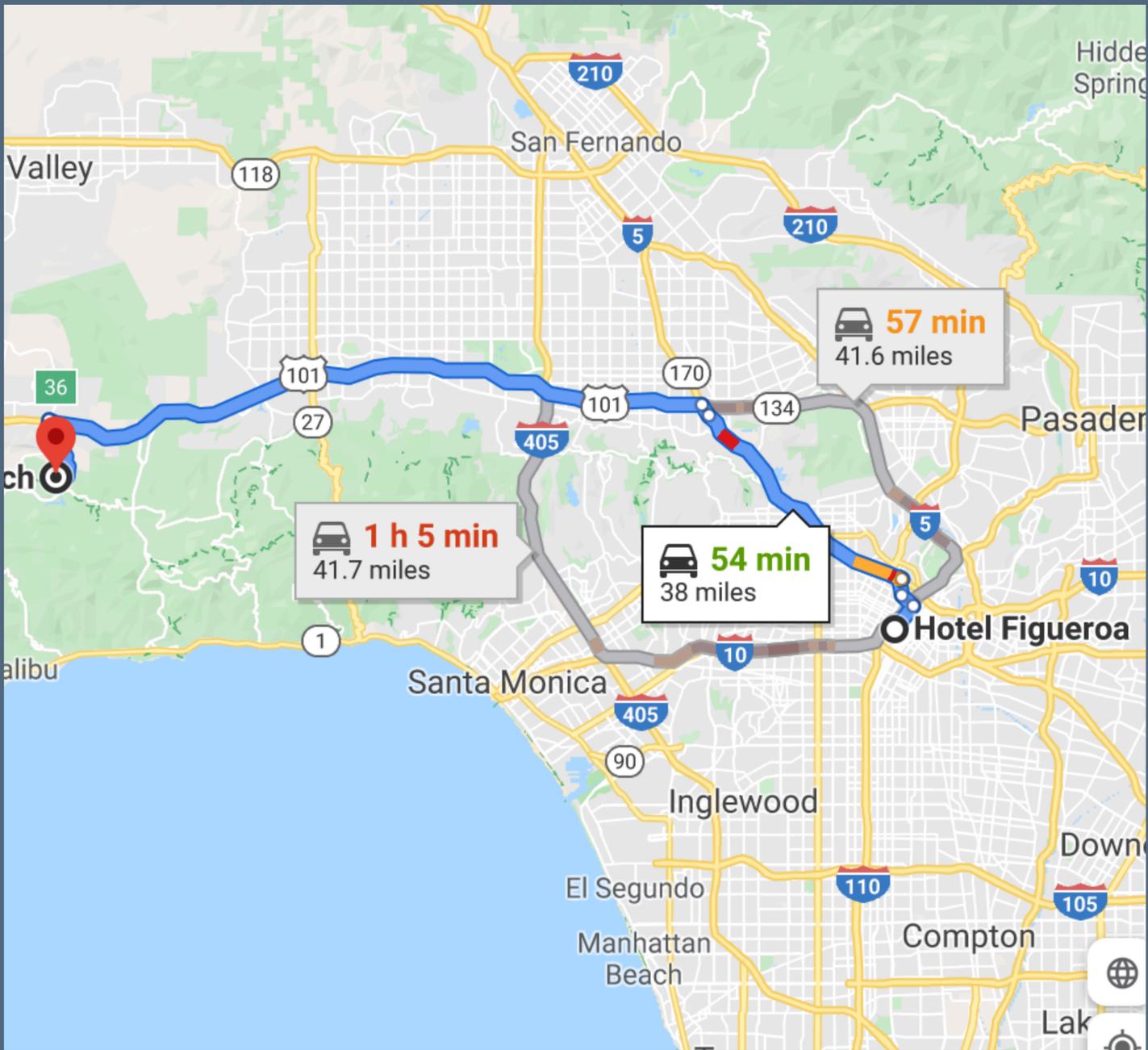
Illustration

Video and Audio

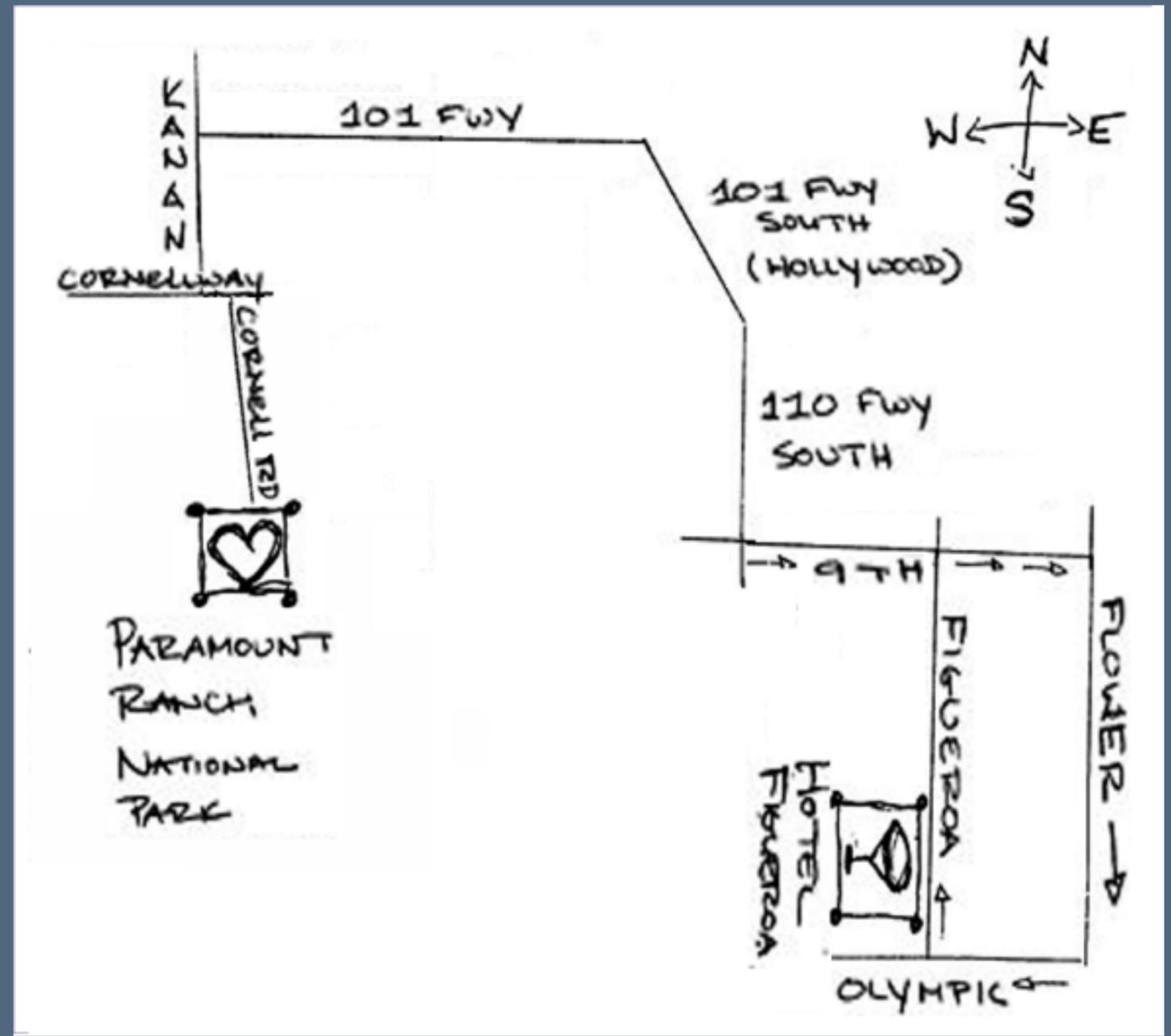
Exploded Views

YOU READ THIS

Design principles for visual communication



Google Maps



Hand-drawn maps

Design principles of effective maps

[Tversky 1992, 1999]

Cognitive guideline: what do people recall?

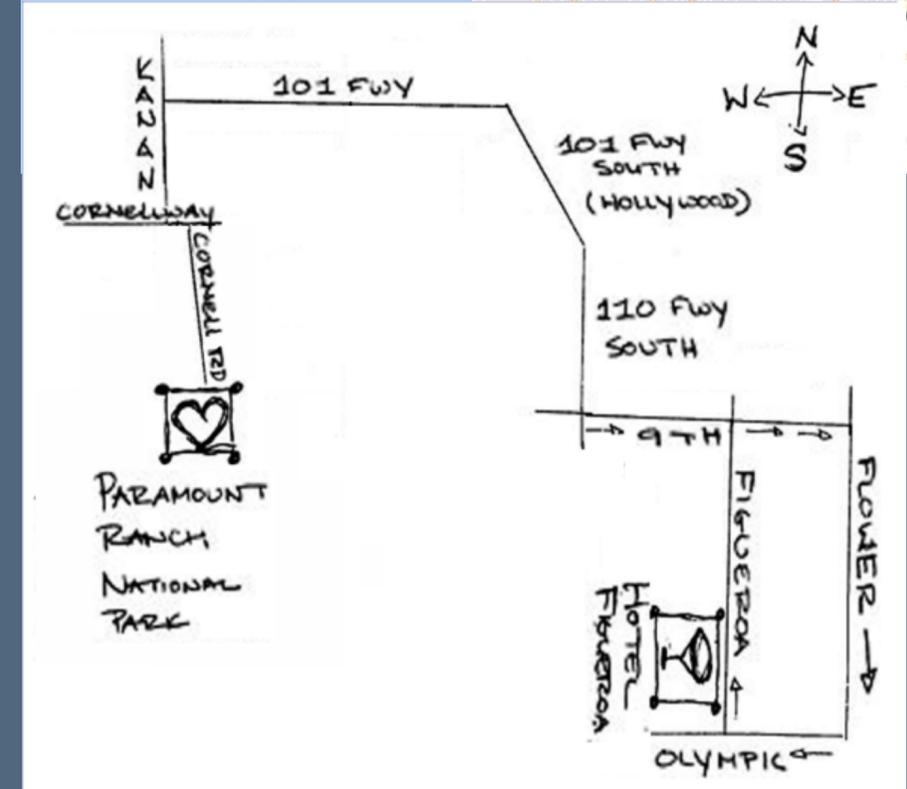
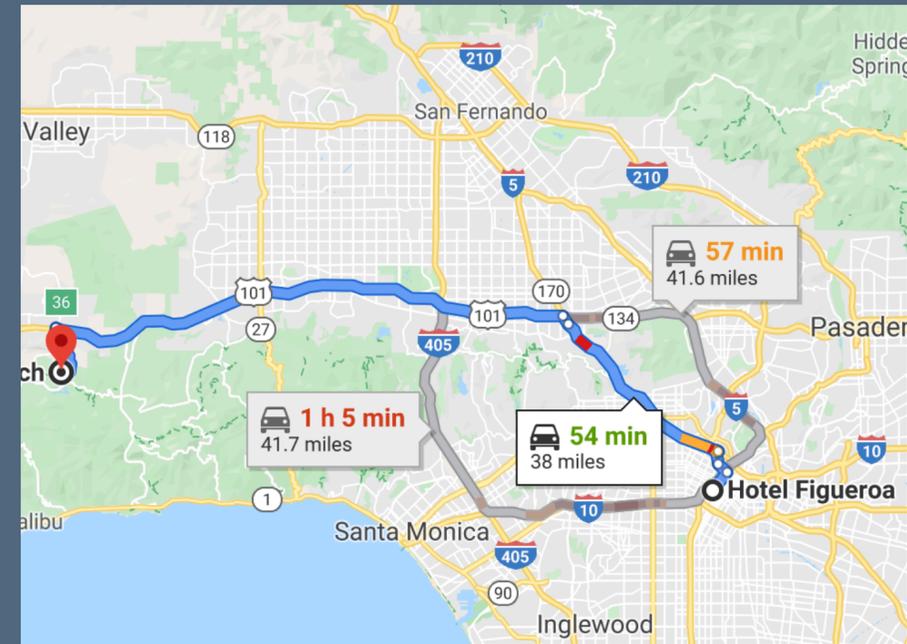
Turning points and route topology are central

Landmarks, cross streets, and global shape are important too, but less central

Exact route geometry is less important

We don't draw it accurately when we make a map

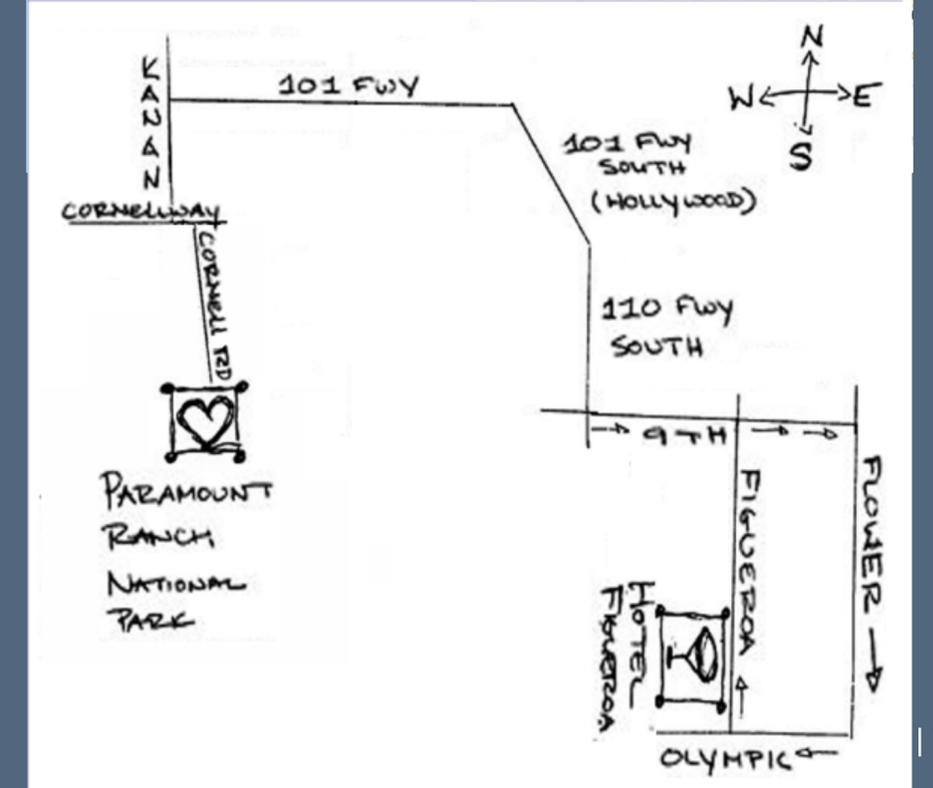
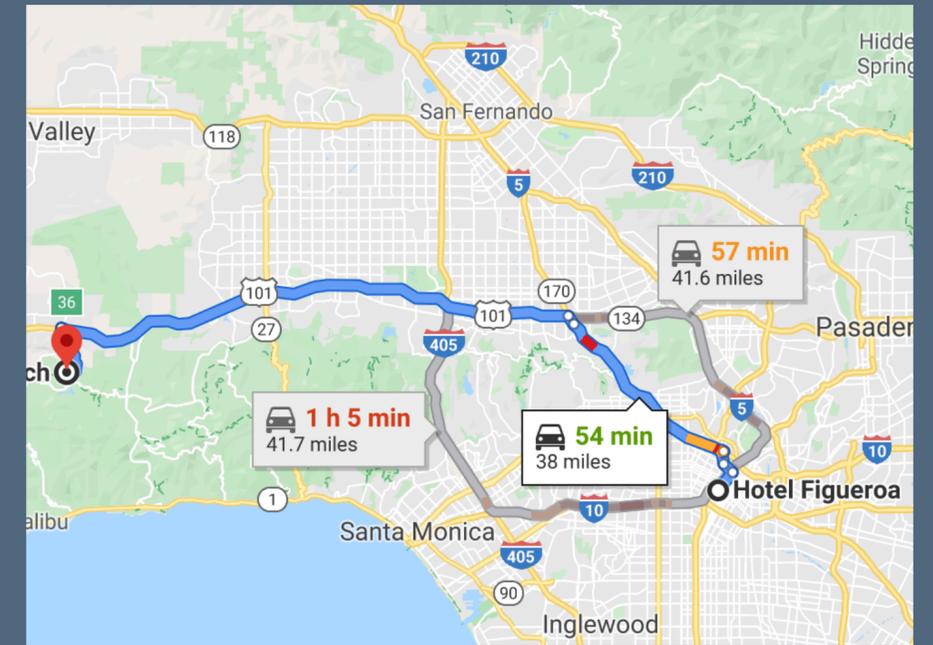
And, we don't comprehend it accurately when we read a map



Design principles of effective maps

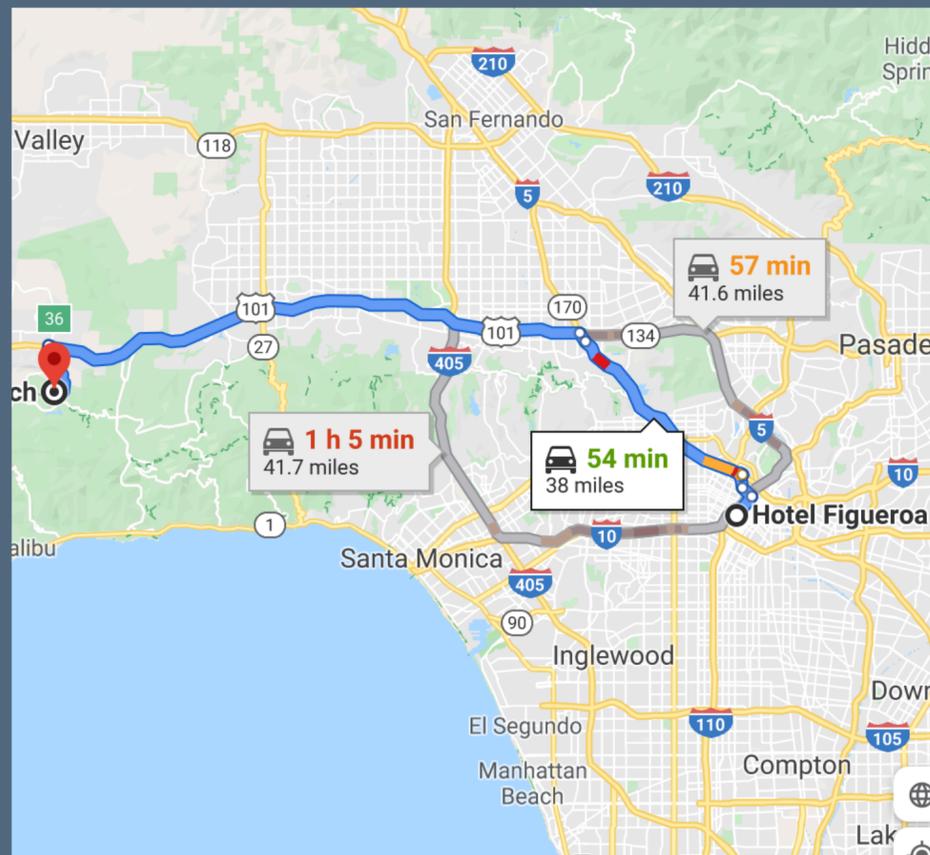
[Tversky 1992, 1999]

1. Exaggerate road length
2. Regularize turning angles
3. Simplify road shape

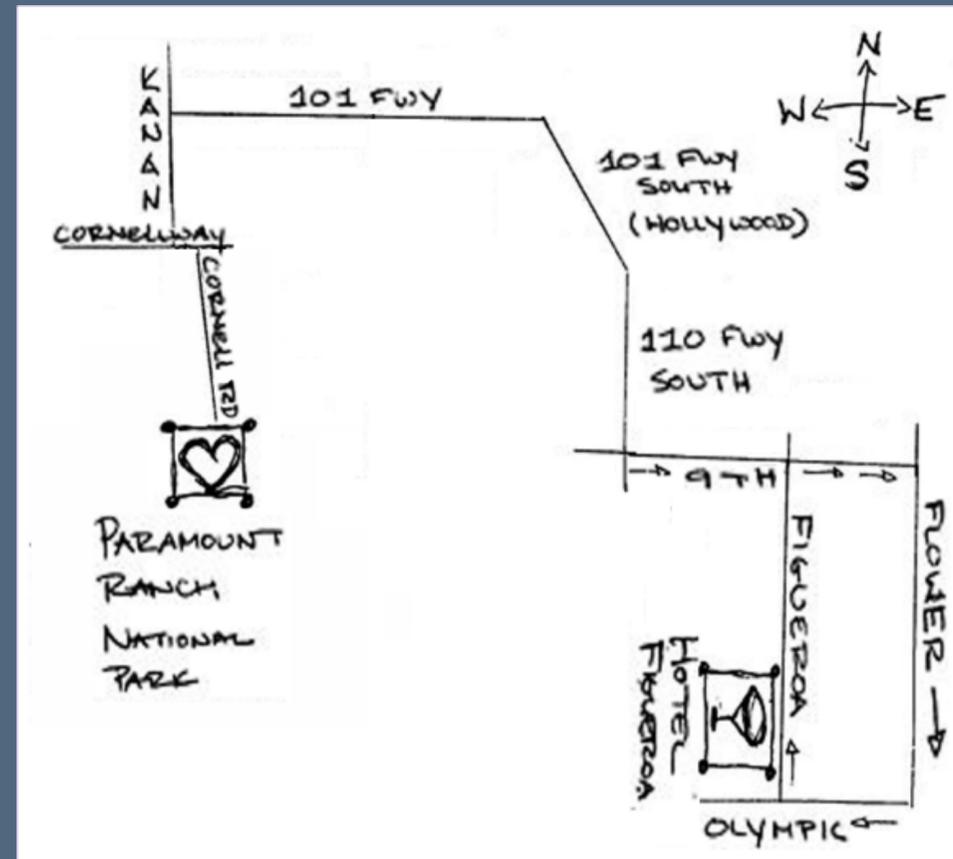


From principles to algorithms

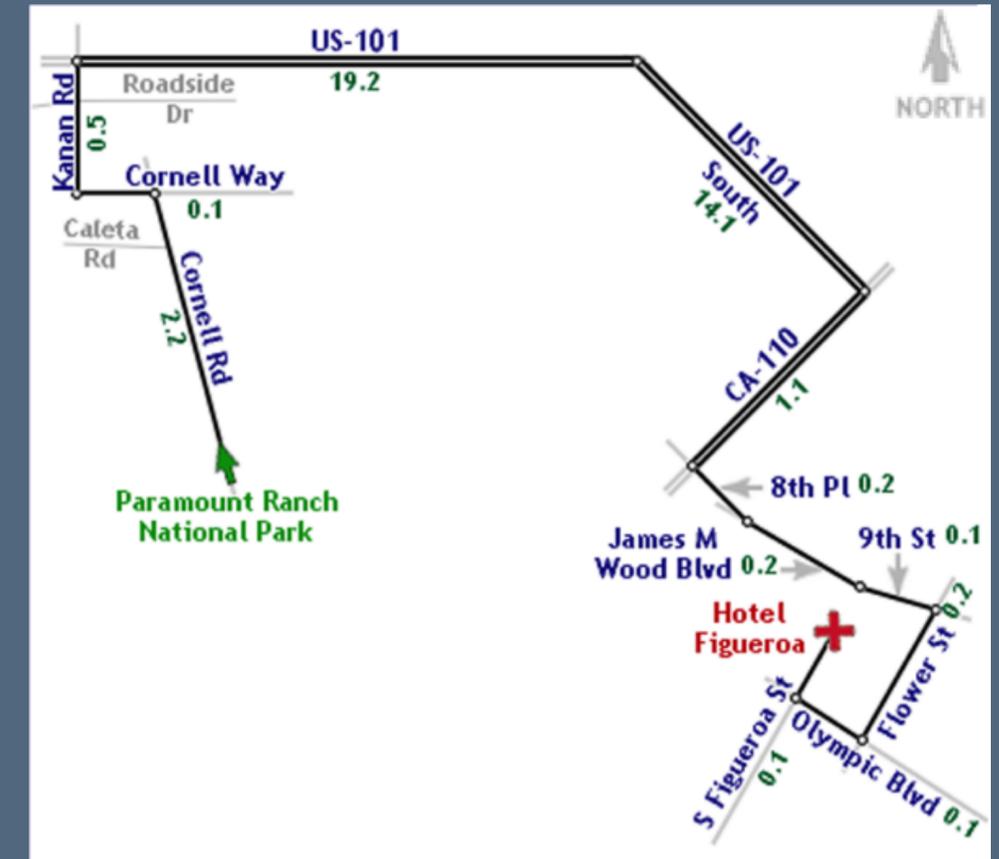
[Agrawala and Stolte 2001]



Google Maps



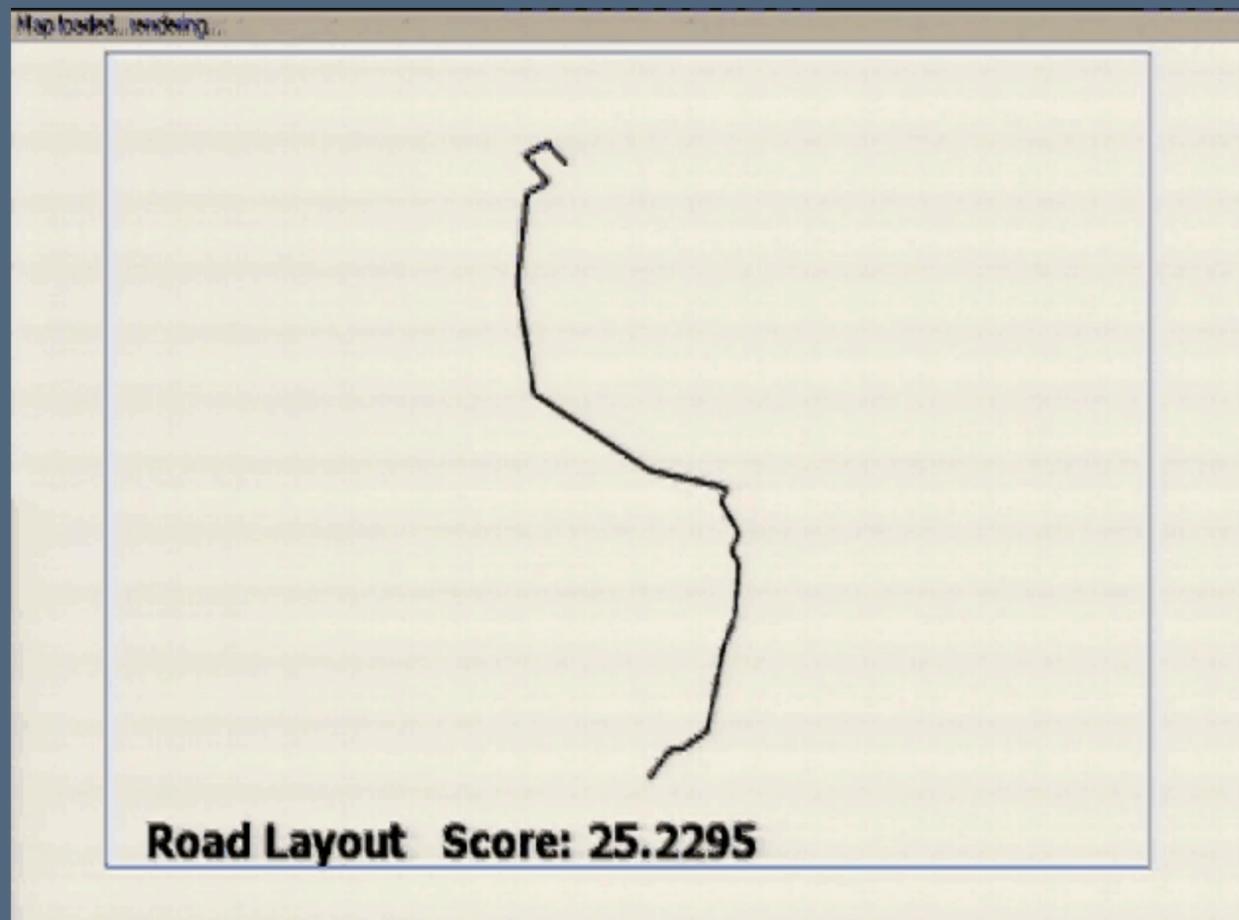
Hand-drawn maps



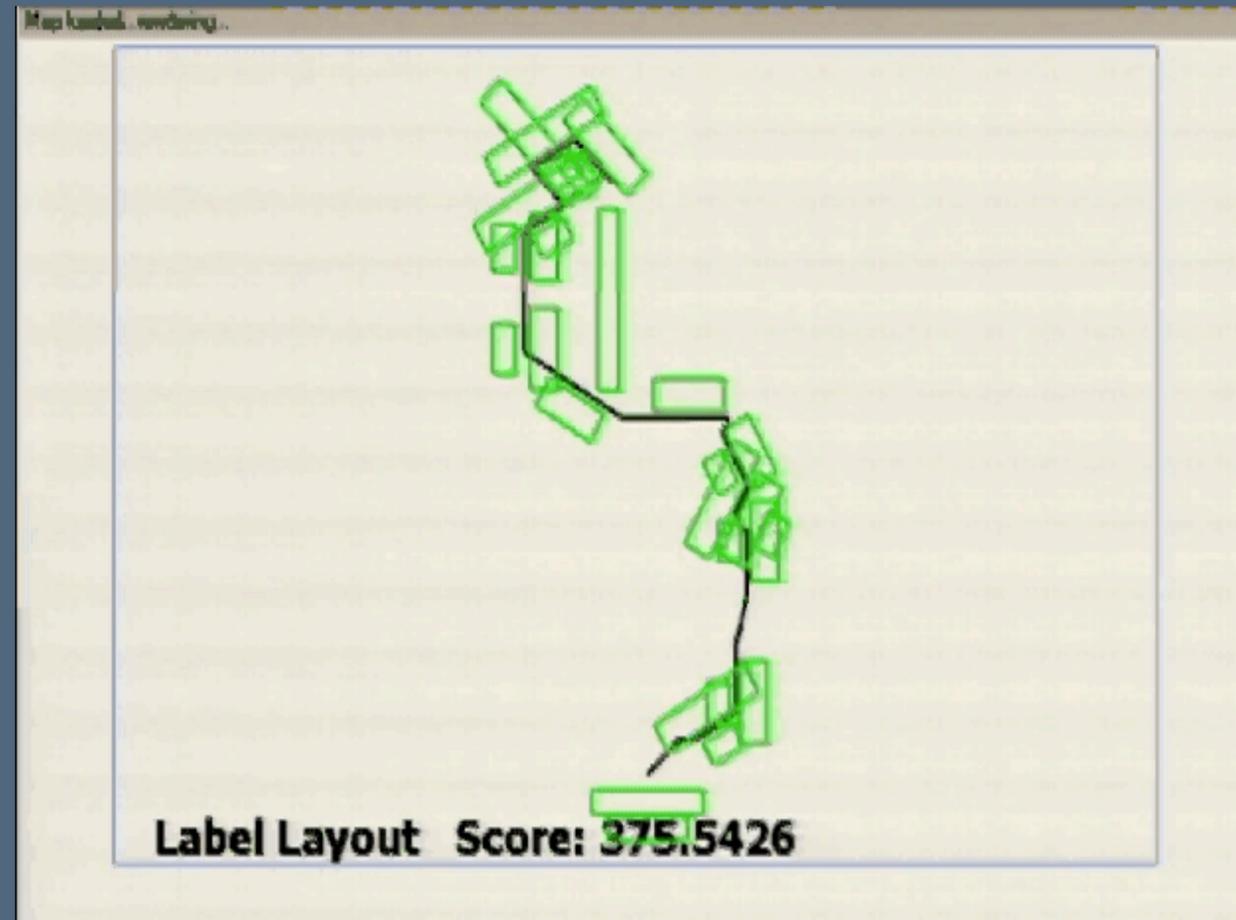
LineDrive

From principles to algorithms

[Agrawala and Stolte 2001]



Road layout



Labels

From principles to algorithms

[Agrawala and Stolte 2001]

Techniques to:

- Simplify the shapes in the original route map

- Grow short roads to emphasize them

- Layout graphic elements (e.g., roads, labels) by stochastically searching over possible visual attributes (e.g., position, orientation, size)

 - Evaluate/score layout based on alignment with design principles

 - Algorithm: simulated annealing — a “try, score, and perturb” loop

Design principles for visual communication

[Agrawala, Li, and Berthouzoz 2011]

Step 1: Identify design principles

Analyze most effective visualizations within domain (consider user's task) and look for **techniques they frequently use to emphasize/de-emphasize** information

Examine prior work in cognitive psychology that has considered how people understand a domain to determine information that is important/unimportant to task

Perform new experiments in perception or cognition to determine information that is important/unimportant to task.

Design principles for visual communication

[Agrawala, Li, and Berthouzoz 2011]

Step 2: Instantiate design principles

Encode design principles into algorithms and interfaces

Add controls that help users (authors/consumers) attain their goals

Step 3: Evaluate/validate design principles

Measure improvements in task performance, quality of results, etc.

What design principles are not

We do not literally replicate **the exact process by which** the expert achieves those design principles

Instead, we bake into tools **the design principles** that the expert exemplify in their work

This might require changes to the tools and techniques used

Sketchpad

[Sutherland 1962]

You'll see:

- One of the first uses of light pen
- Support for engineering sketching

You won't see, but also developed:

- Object-oriented manipulation
- early GUI windows



Sketchpad

[Sutherland 1962]

You'll see:

- One of the first uses of light pen
- Support for engineering sketching

You won't see, but also developed:

- Object-oriented manipulation
- early GUI windows





Draco: kinetic textures

[Habib et al. 2014]

From principles to design

Via an inductive study of animations on YouTube and interviews with animators, found that common approaches:

Particle systems, flocking behavior, and stochastic motion

System goal: author these effects without a technical background



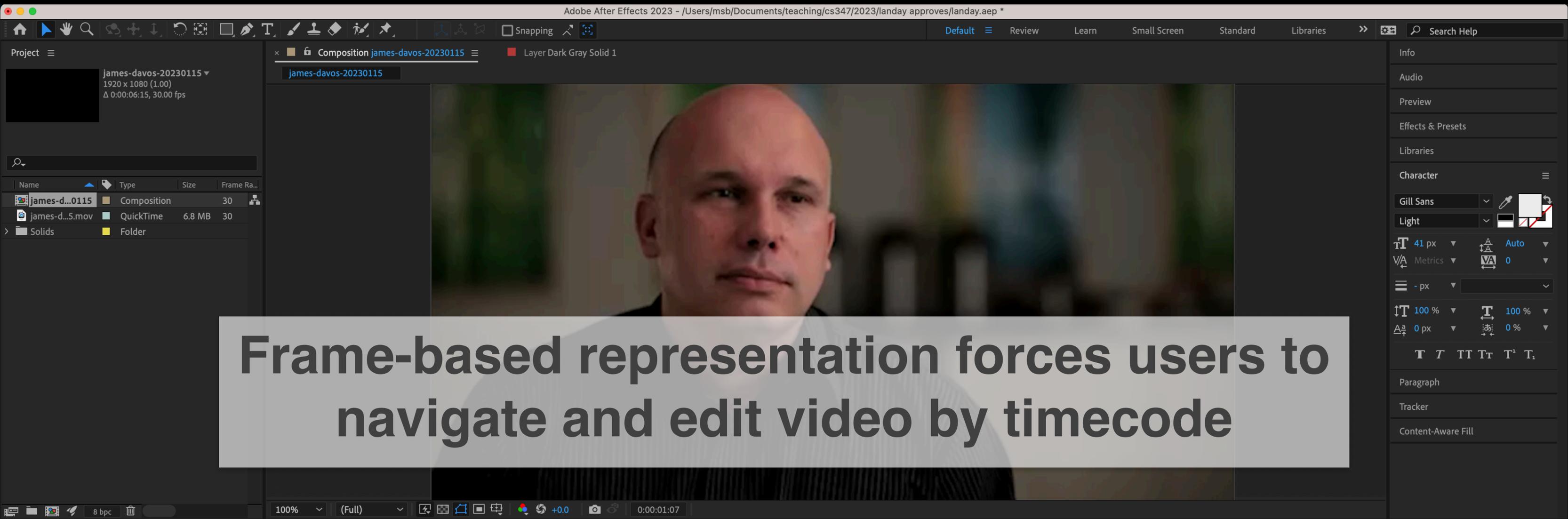


Tovi Grossman
@ToviGrossman

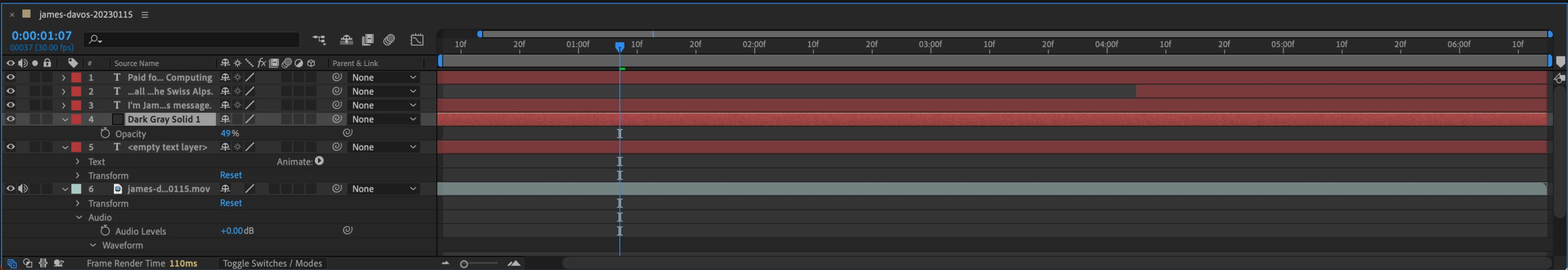
Wow! [@autodesk](#) Sketchbook Motion (AKA [@rubaiat](#) et al, Draco, CHI 2014), was chosen by Apple as iPad App of the Year. sketchbook.com/motion



Video and Audio



Frame-based representation forces users to navigate and edit video by timecode



Design principle:

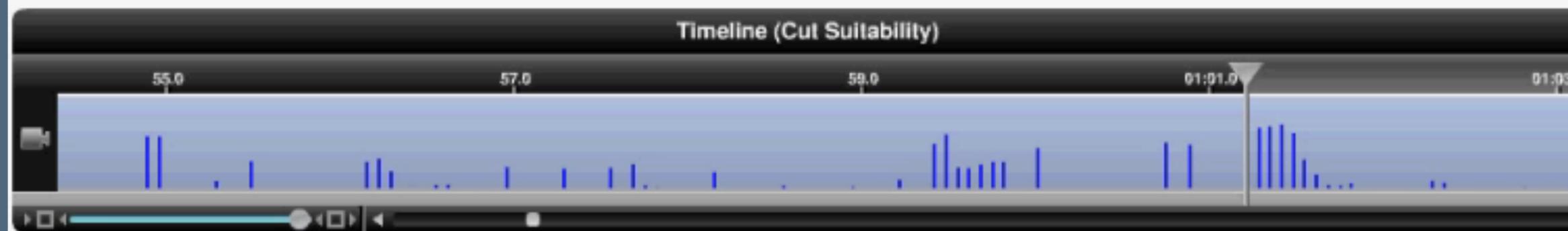
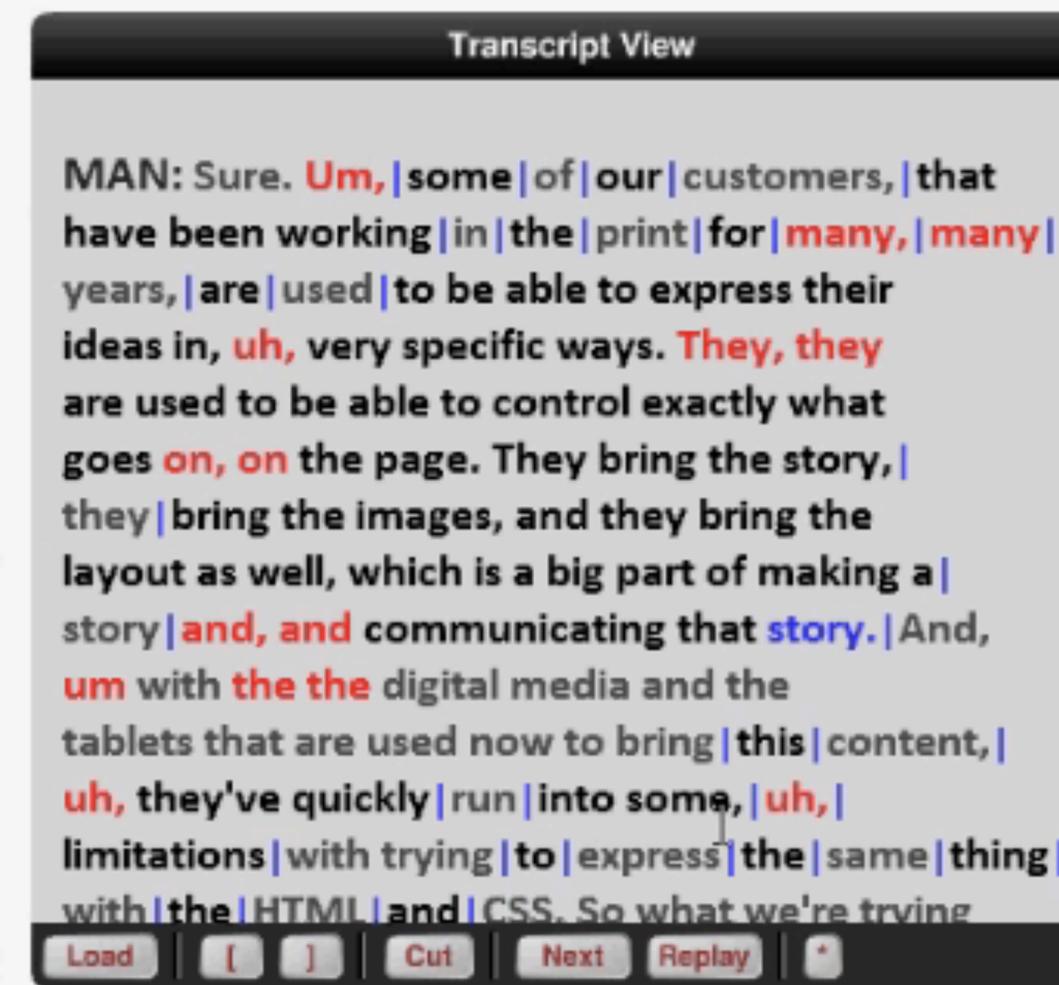
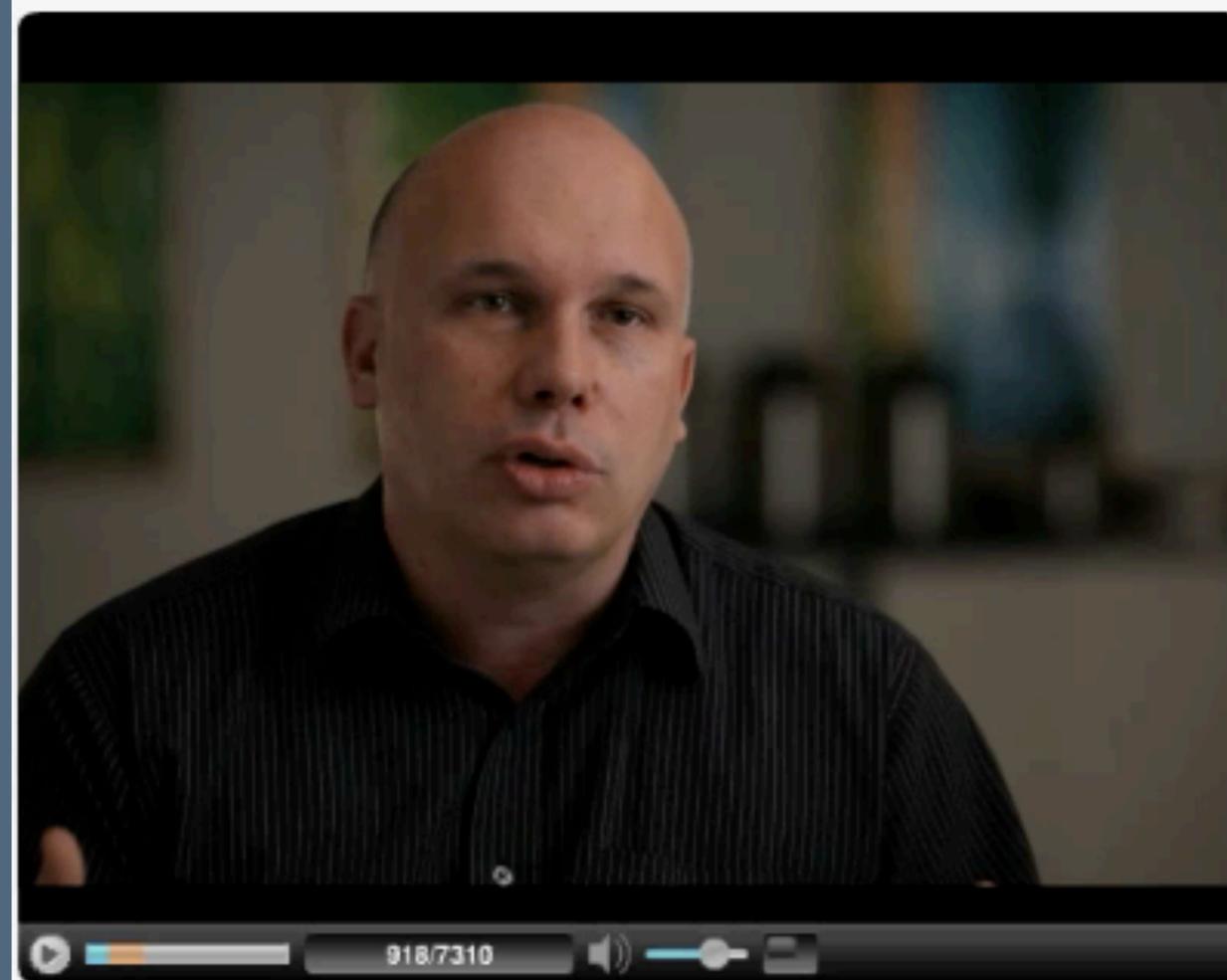
Remove disfluencies, accentuate important information, make “cuts” look smooth

Interface should:

Let editors to directly edit through script manipulation (easier to skim for the main message), smooth out the footage and audio

Algorithm:

frame similarity graphs



Design principle:

Remove disfluencies, accentuate important information, make “cuts” look smooth

Interface should:

Let editors to directly edit through script manipulation (easier to skim for the main message), smooth out the footage and audio

Algorithm:

frame similarity graphs

Jump cuts (in red)



Design principle:

Remove disfluencies, accentuate important information, make “cuts” look smooth

Interface should:

Let editors to directly edit through script manipulation (easier to skim for the main message), smooth out the footage and audio

Algorithm:

frame similarity graphs

Our result

hidden transitions in blue
pauses in green

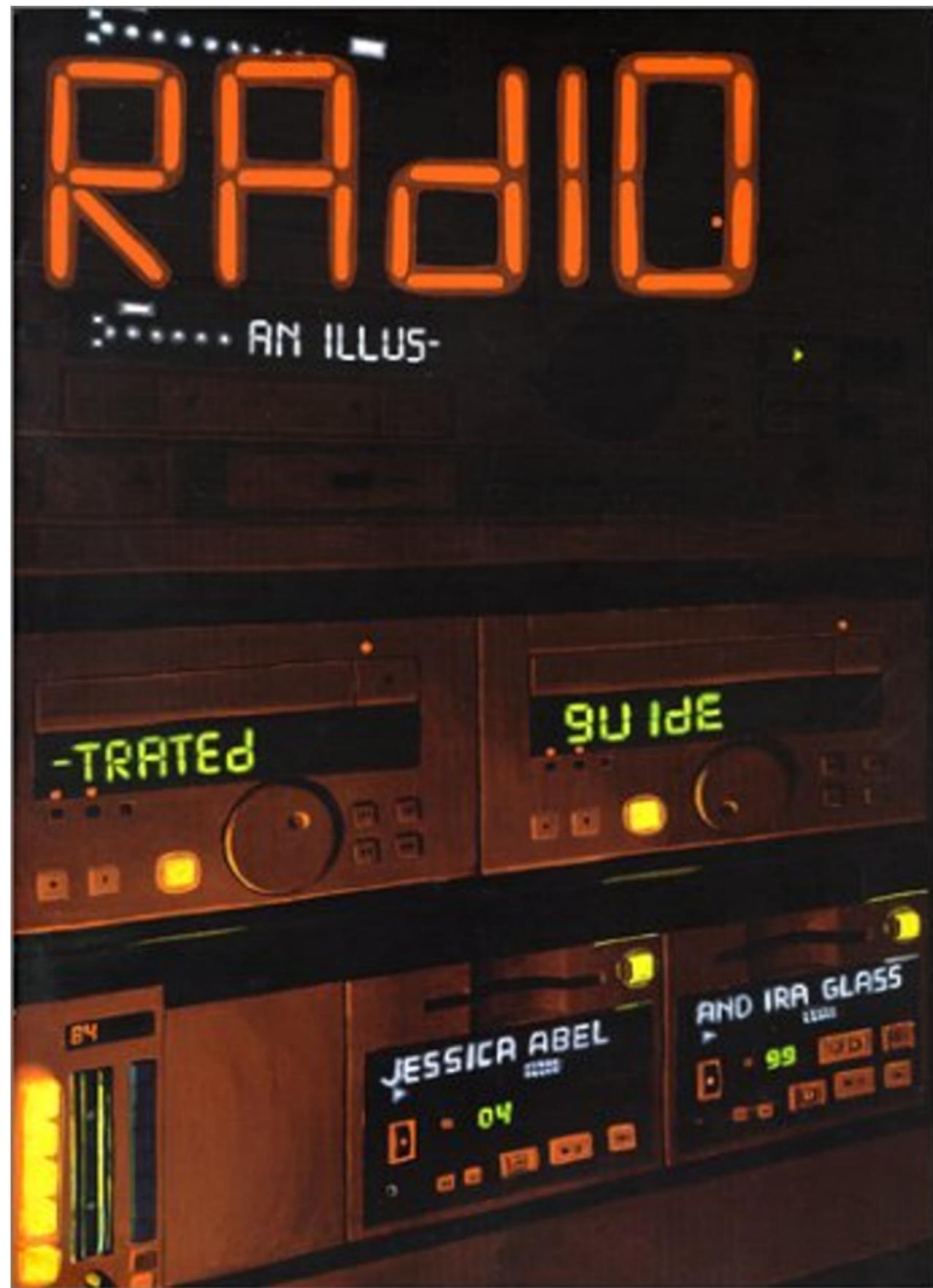


Comp. time:

clusters	22m
hidden	5s
pauses	9s







EDITING: THE INVISIBLE ART

If you're trying to make something that sounds like the interviews or documentary stories on *This American Life*, you have to edit the sound. It's not as hard as you might think. In fact, editing is one of the great pleasures of working in radio. It's easy to go into a kind of trance.



Young Ira cutting tape at NPR.

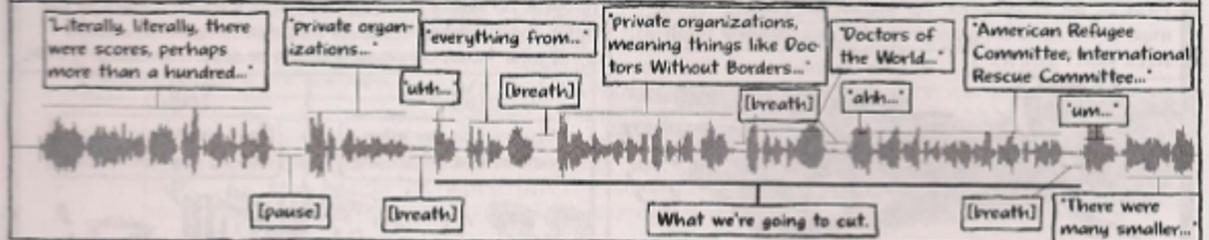
You can edit sound on reel-to-reel tape, using a razor blade to literally cut sentences out of your story.

On good minidisc decks you can do basic editing but nothing too subtle. And there's lots of good software that lets you edit cheaply on a normal home computer (see pages 20-21).

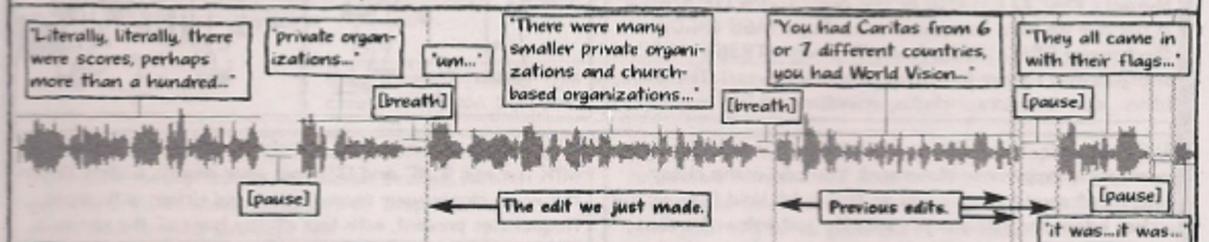


But whichever system you use, when you're editing people talking, there are certain basic rules. First, you have to preserve the rhythm of normal speech. When we speak, we normally say a sentence, and then we breathe, and then we say another sentence. Then we breathe again.

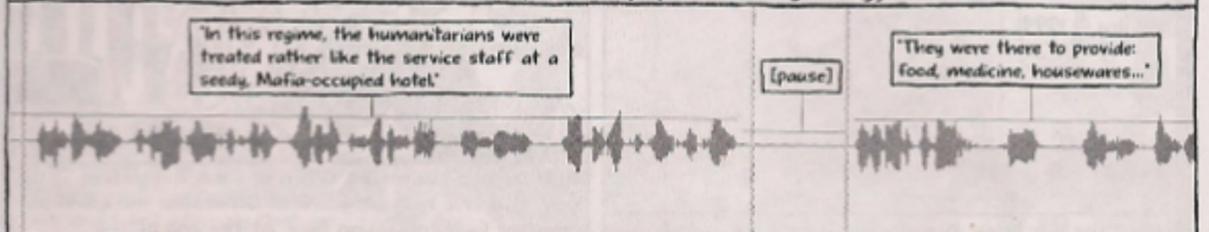
This is a section of Philip Gourevitch's interview, loaded into the editing software we use at *This American Life*. On the computer, sounds and words are graphically represented as waveforms, and edits are also visible, as vertical lines. Pauses are flat sections of line, and breaths are small waveforms. Notice where the breaths fall: often at the ends of sentences, but sometimes in the middle.



If you remove a phrase or a sentence, you have to keep the rhythm natural. Usually that means keeping a breath after each sentence, at the edit points. Sometimes you have to try different breaths, to see which one sounds more natural. Your edit points are almost always at the very beginning of a word (after a pause or breath) or at the very end of a word (before a pause or breath).

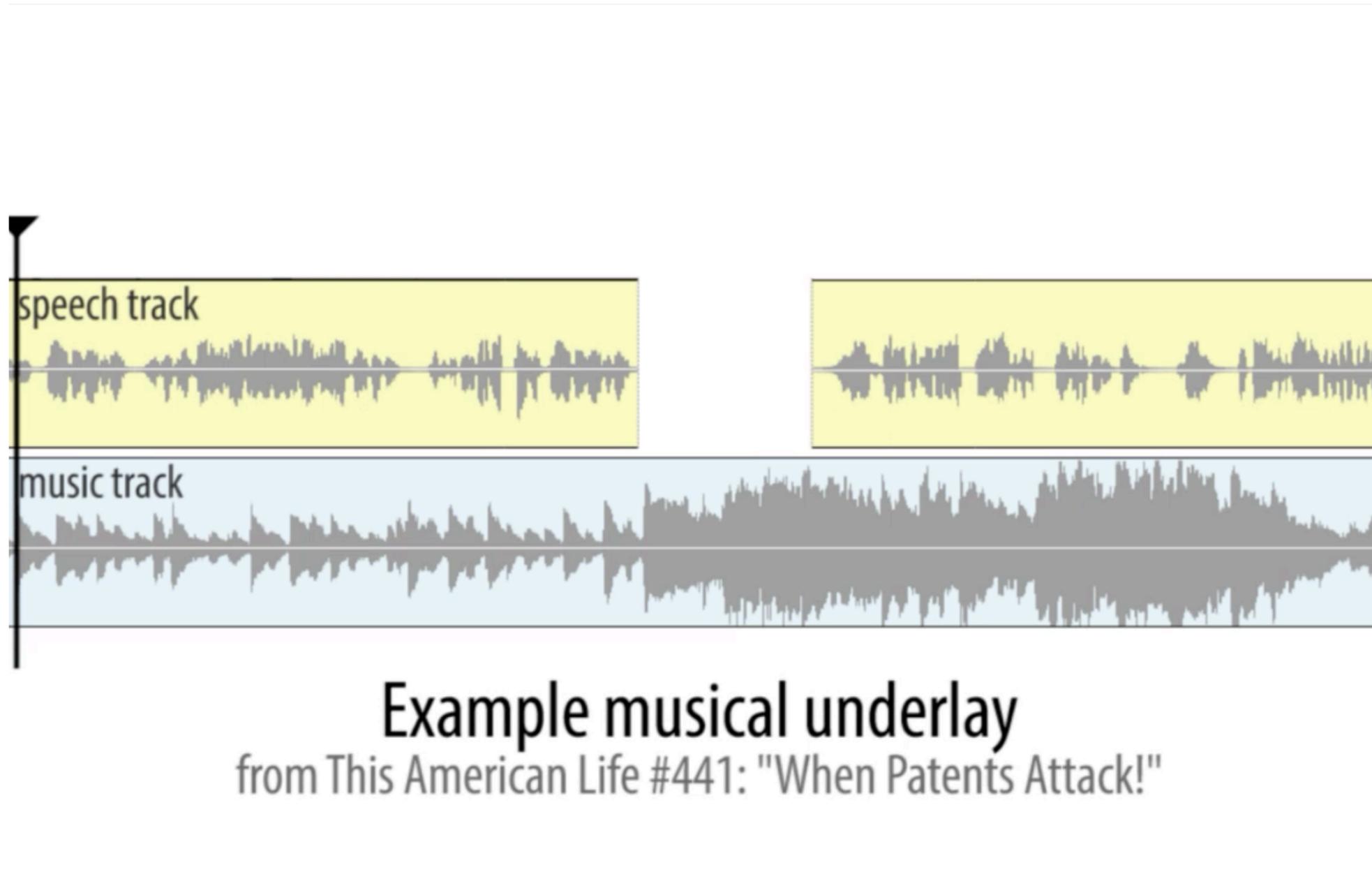


Second, there's a difference between a pause and a breath. Sometimes an interviewee will finish an important point, take a quick breath, but then rush on to the next idea. If you insert a pause—just the sound of the room—before the breath—or replace the breath with a pause, then their big idea will register more clearly with the listener. Here we inserted a pause to emphasize a particularly apt and chilling analogy.



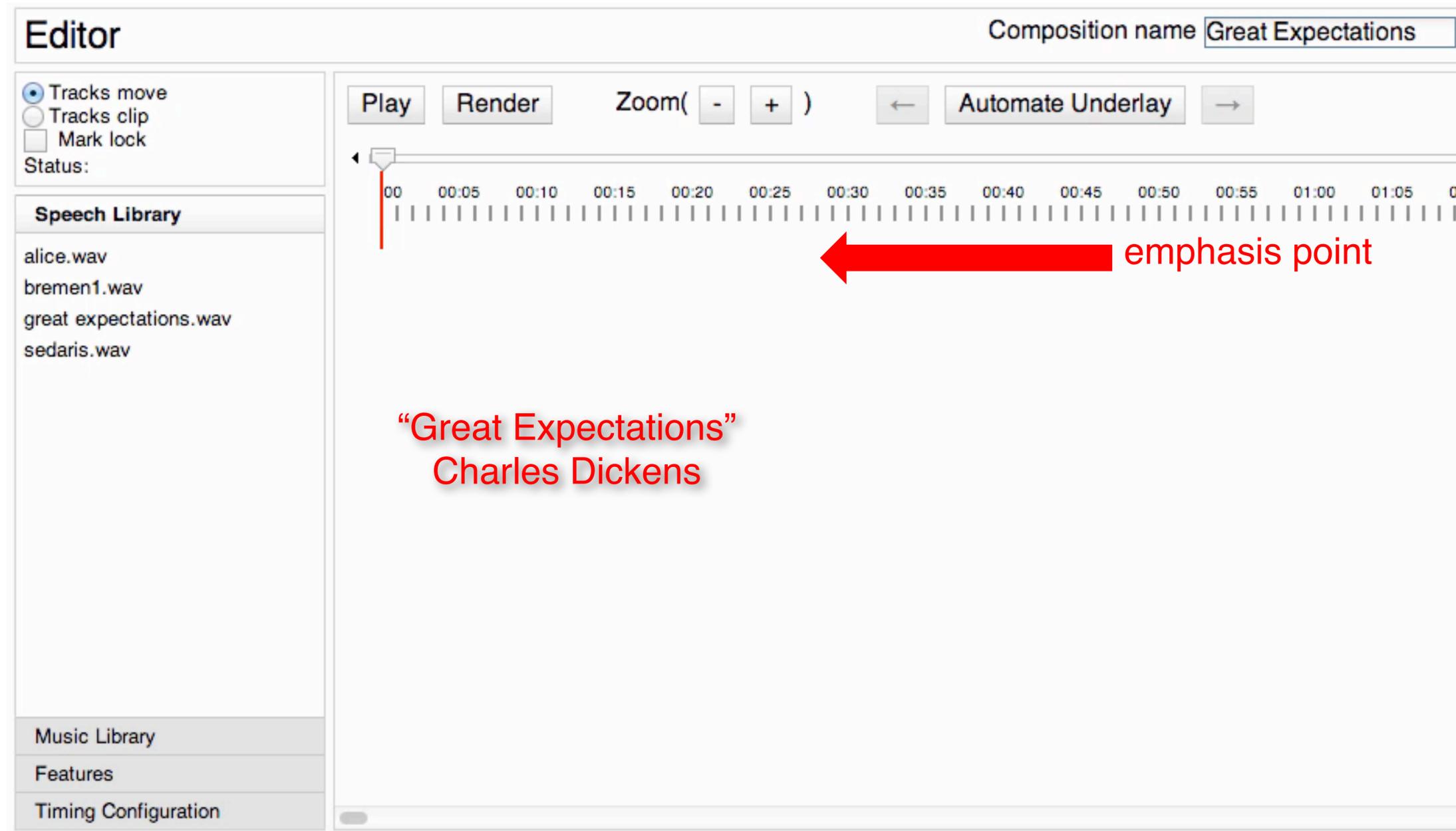
Philip Gourevitch is one of the best interviewees possible. He has surprising and moving stories to tell, and many urgent and thoughtful things to say about those anecdotes. It took Nancy and Jorge two full days to choose among the many stories and ideas, and to shorten anecdotes here and there.

[Abel and Glass | 1999]



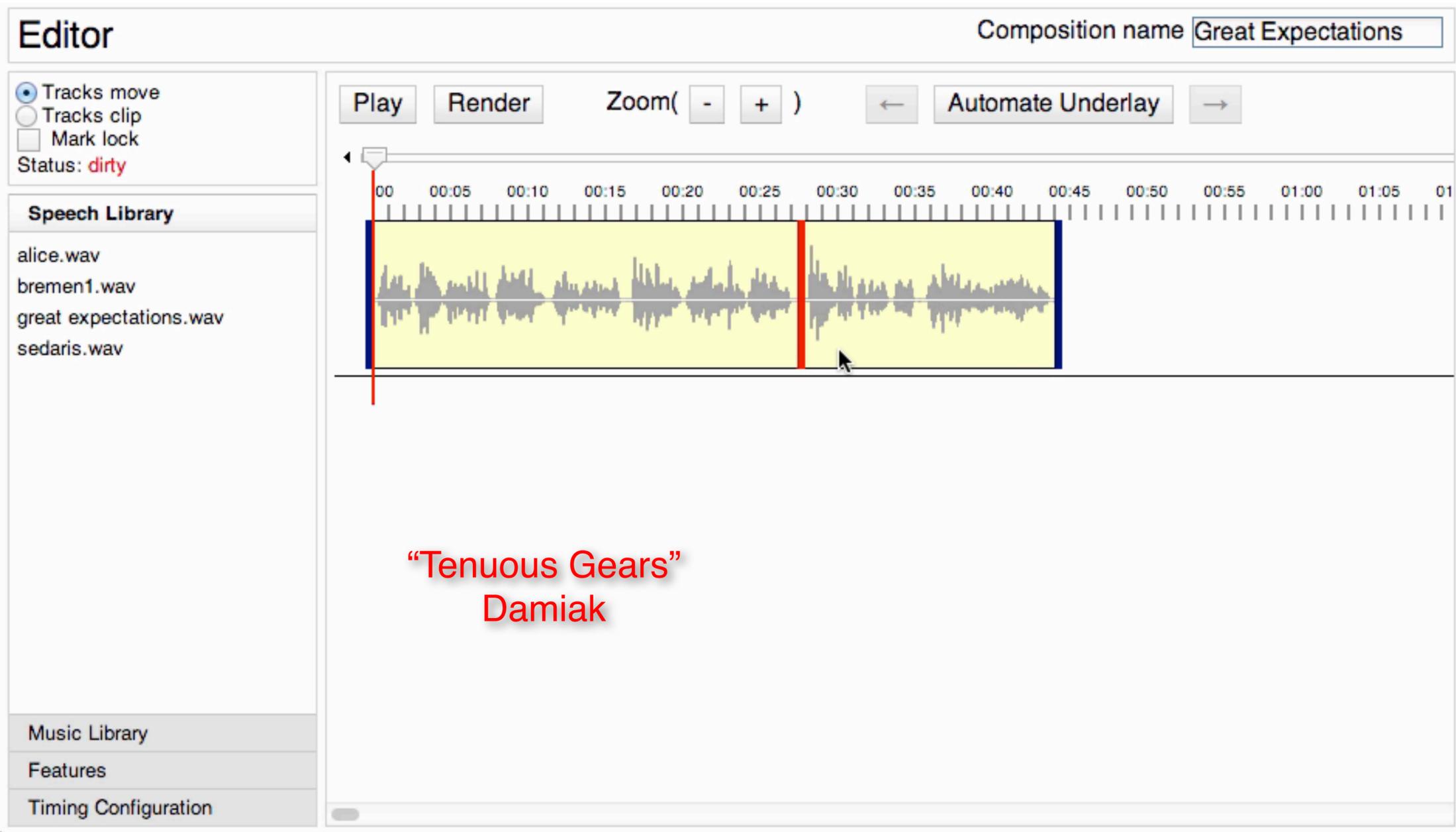
Underscore

[Rubin et al., CHI 2014]



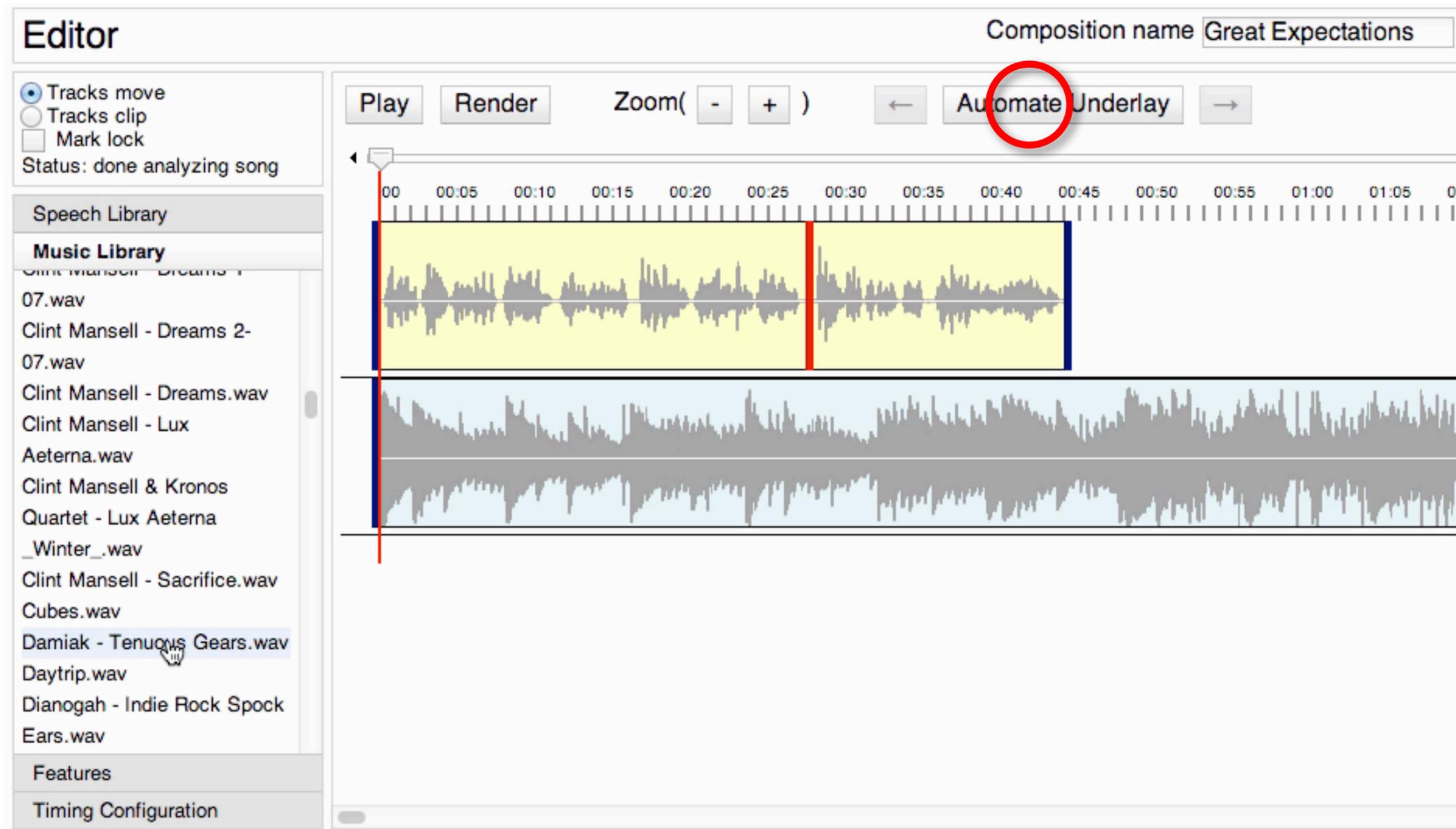
Underscore

[Rubin et al., CHI 2014]



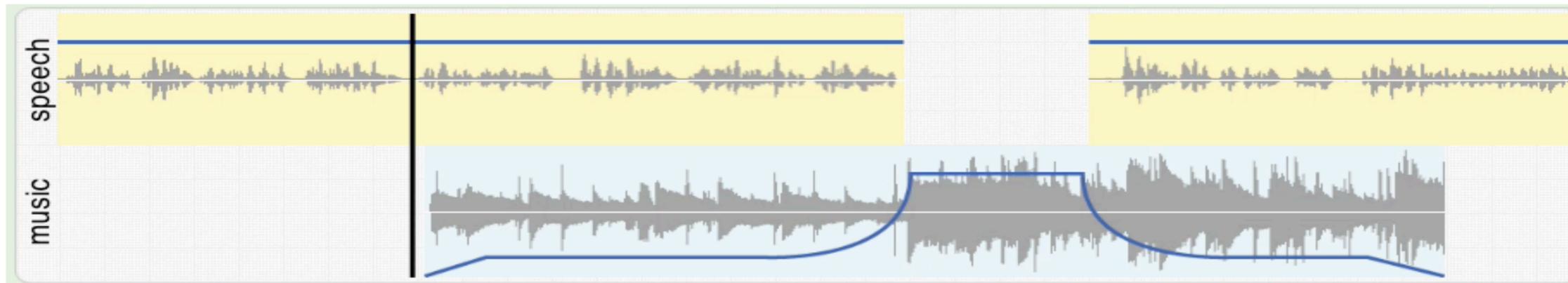
Underscore

[Rubin et al., CHI 2014]



Underscore

[Rubin et al., CHI 2014]



Story: Charles Dickens – “Great Expectations”
Read by Mark F. Smith [librivox.org]
Music: Damiak – “Tenuous Gears”

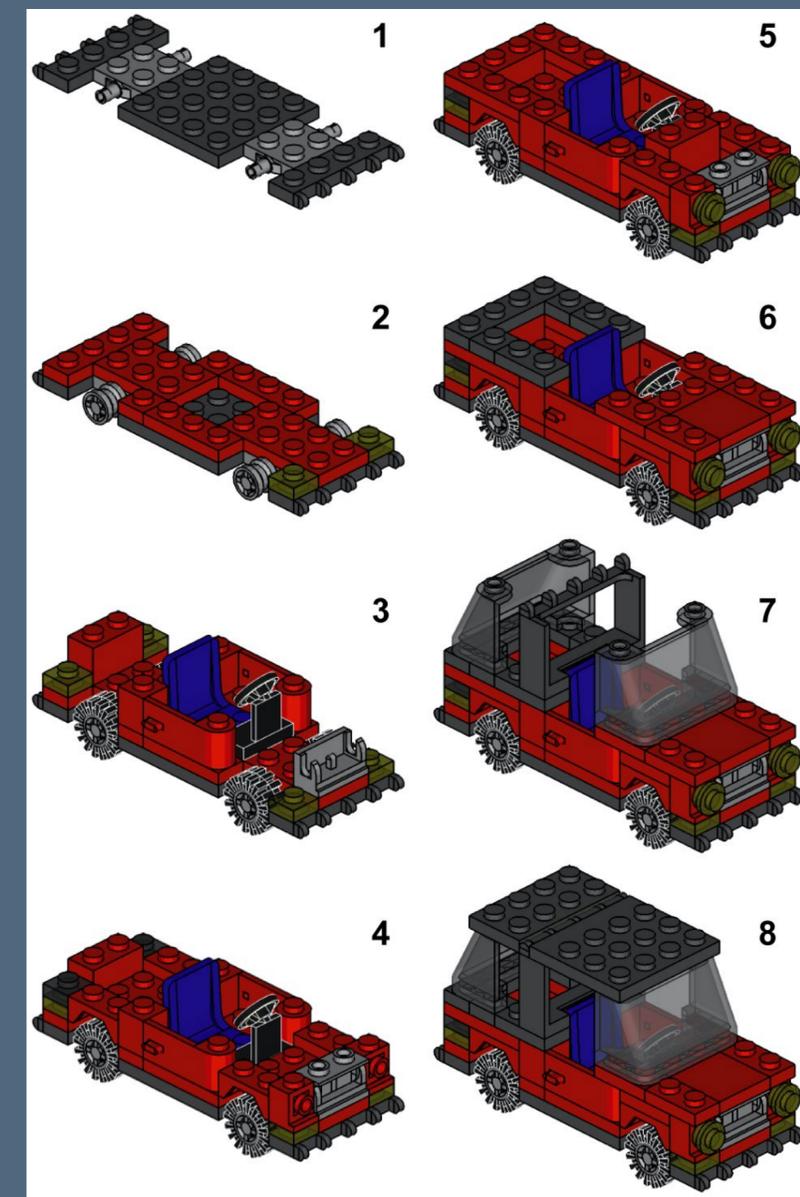
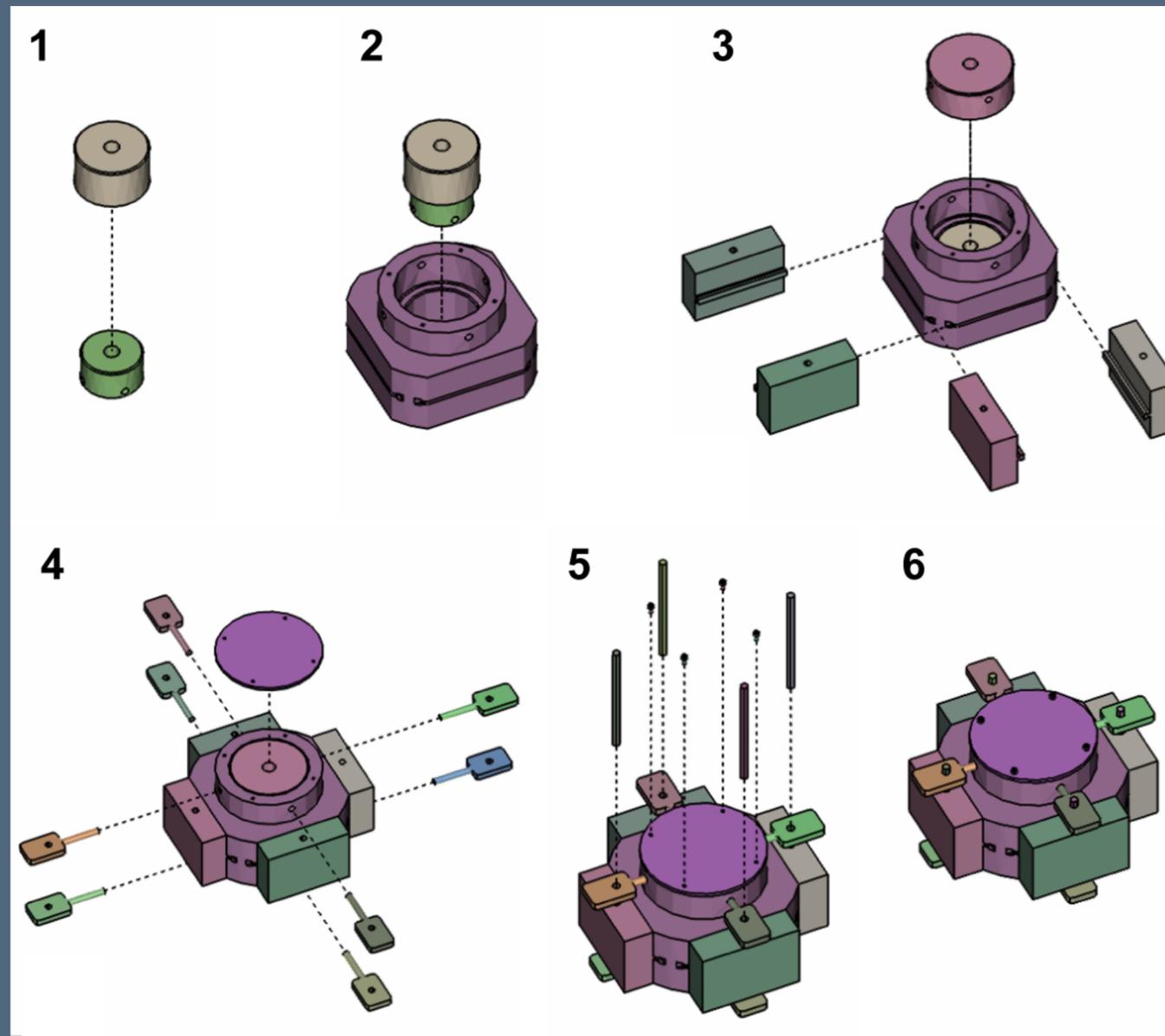
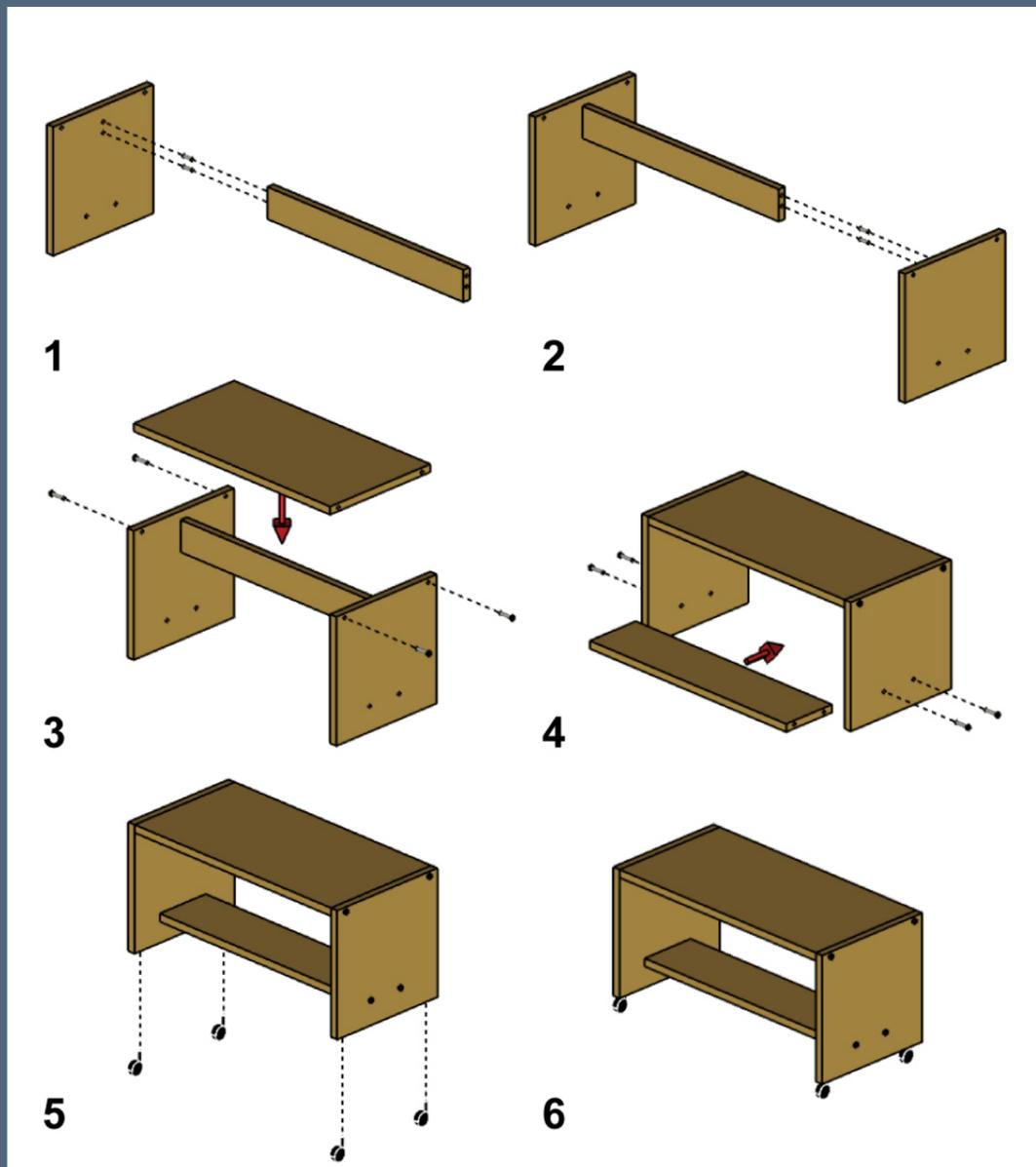
Underscore

[Rubin et al., CHI 2014]

Exploded Views

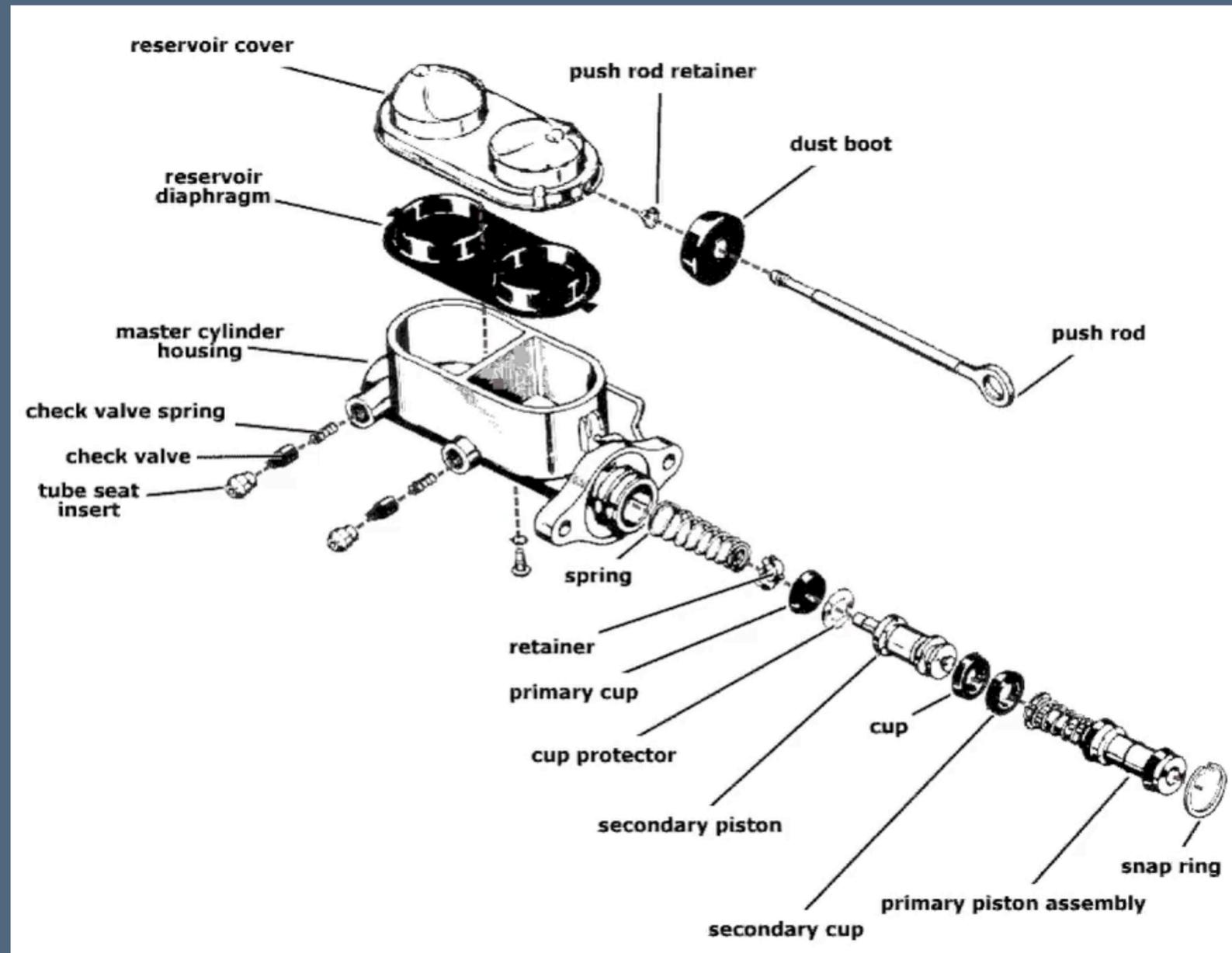
Assembly instructions

[Agrawala et al. 2003]

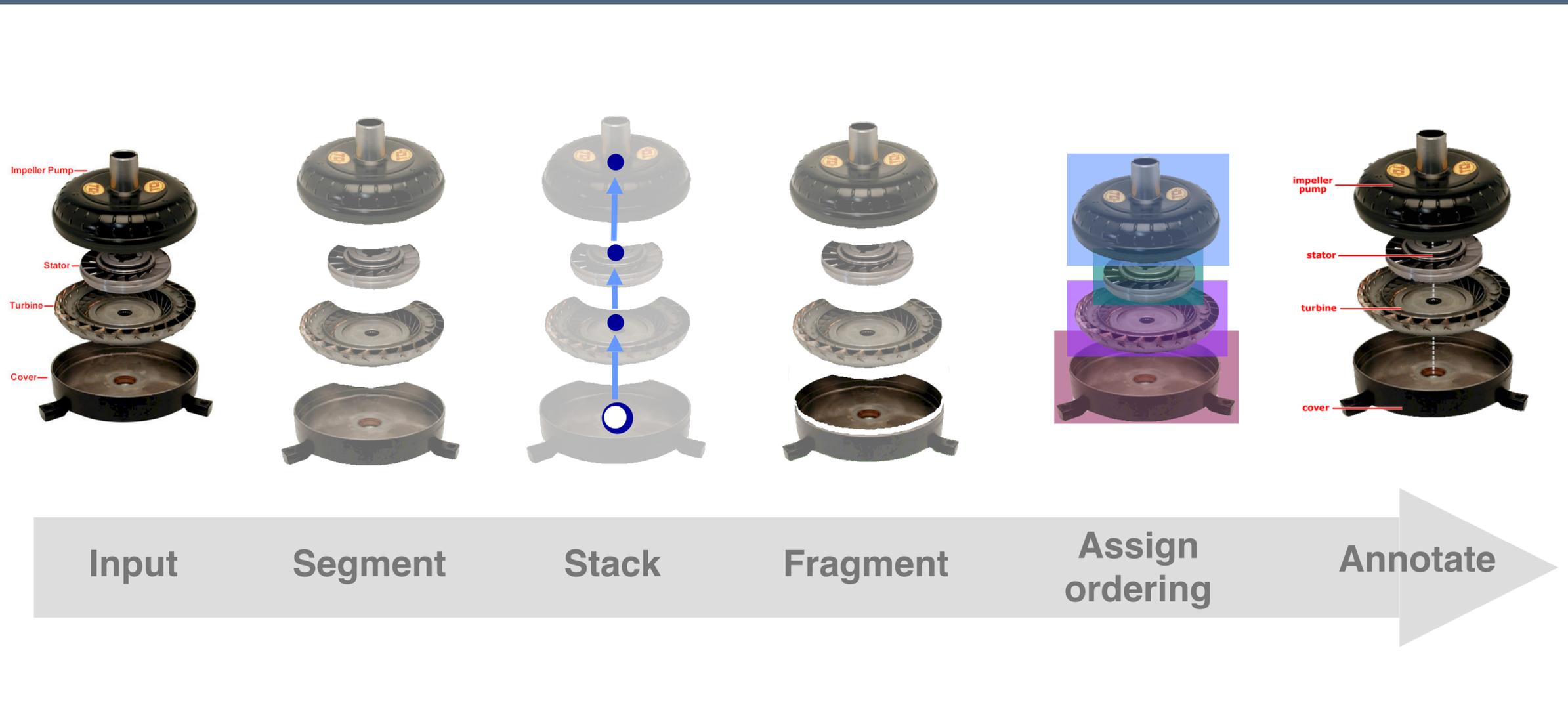


Interactive Exploded Views

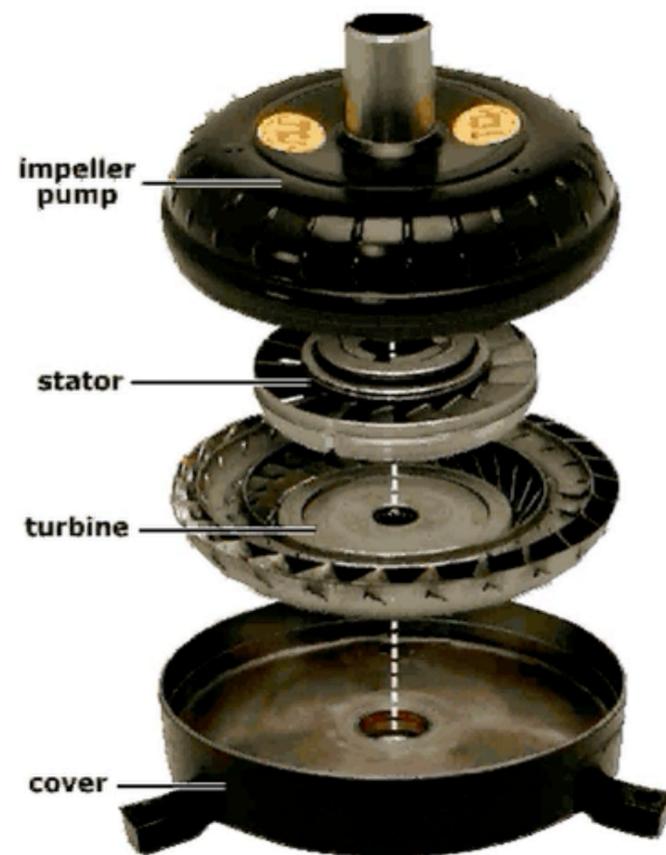
[Li et al. 2004]



Authoring Pipeline



Interactive Viewing



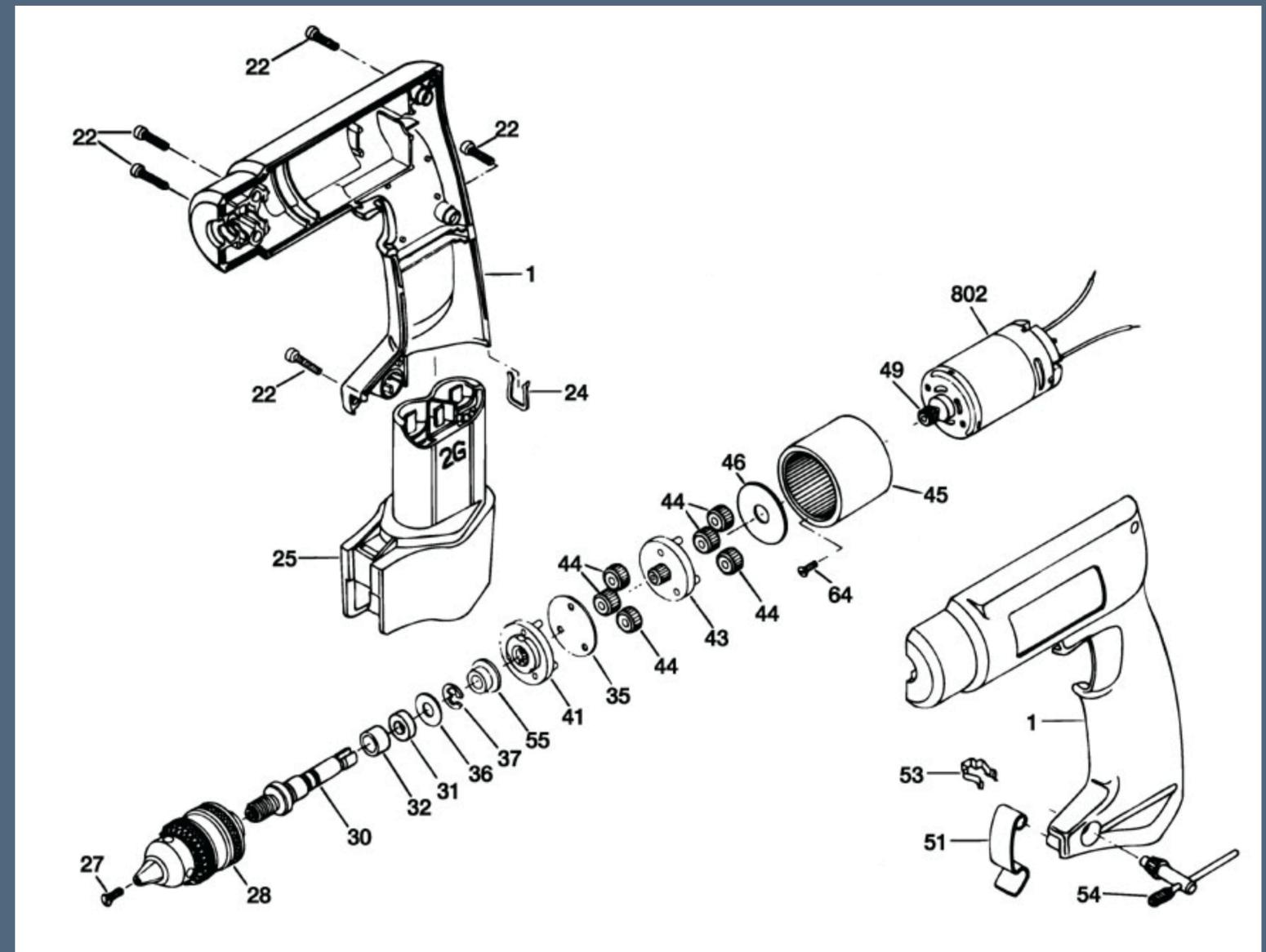
Exploded view diagrams

[Li et al. 2008]

Design principles:

Explode parts in directions that do not occlude (block) other parts, while minimizing distance from their original position

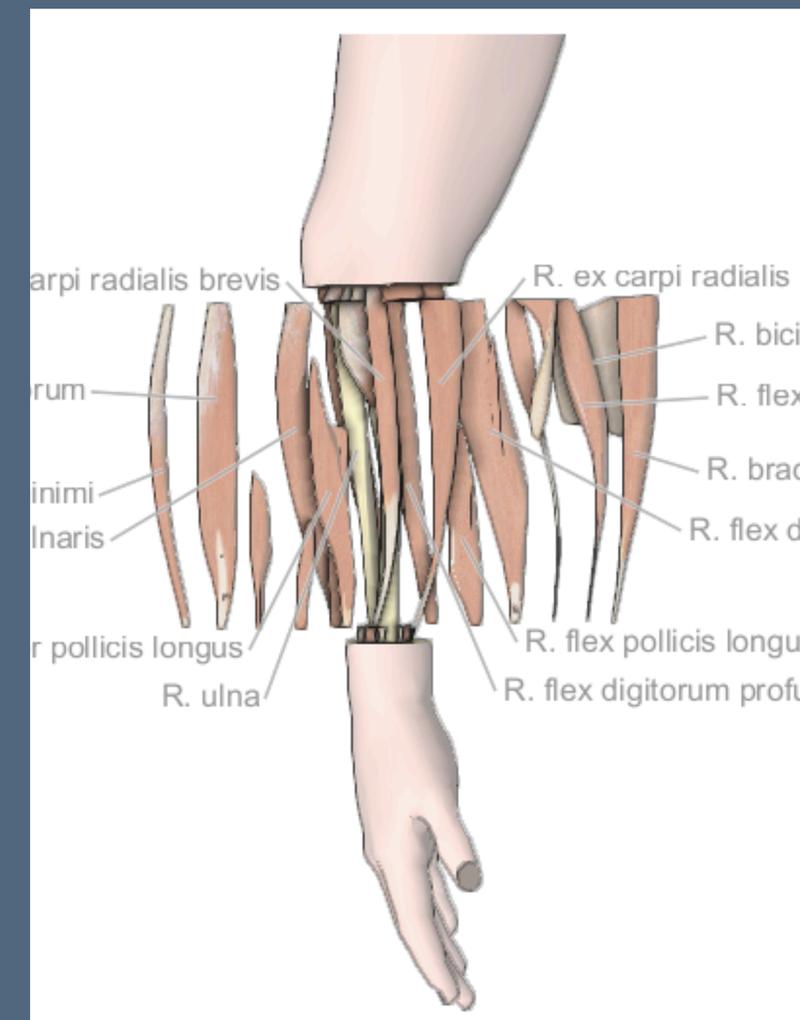
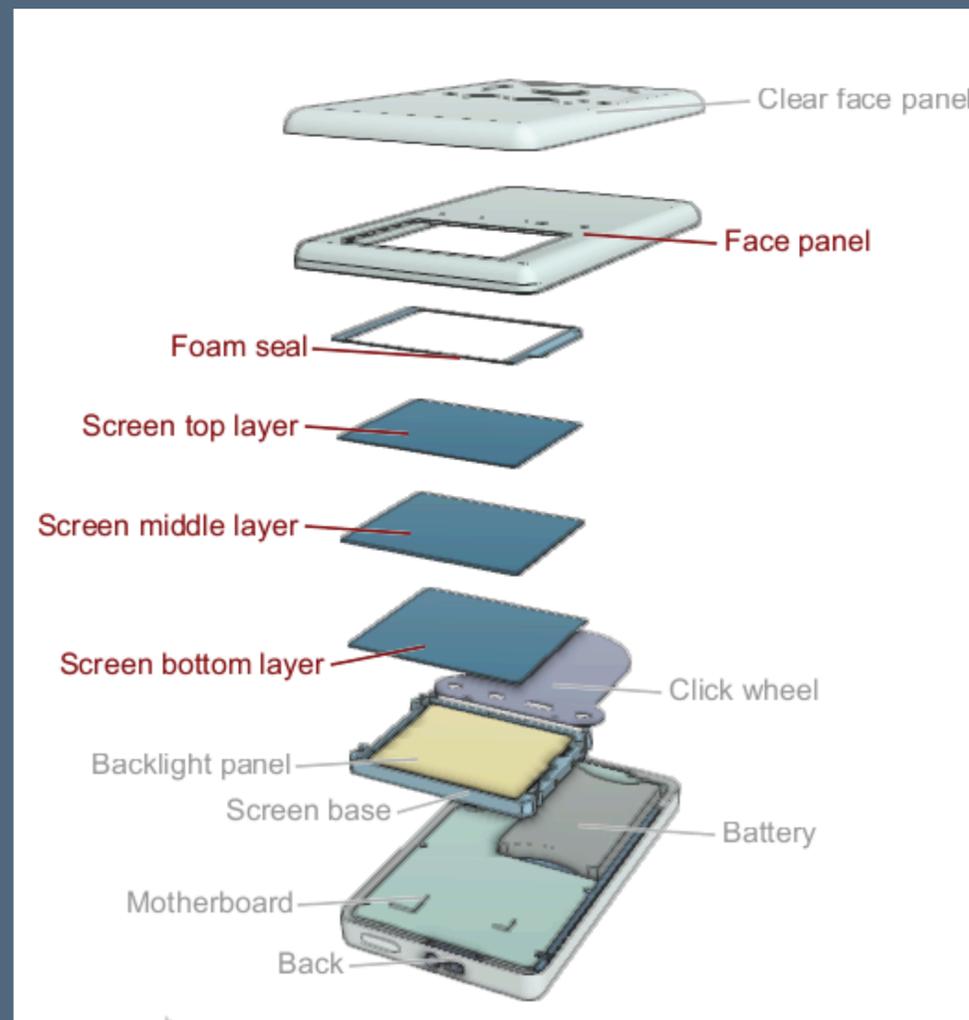
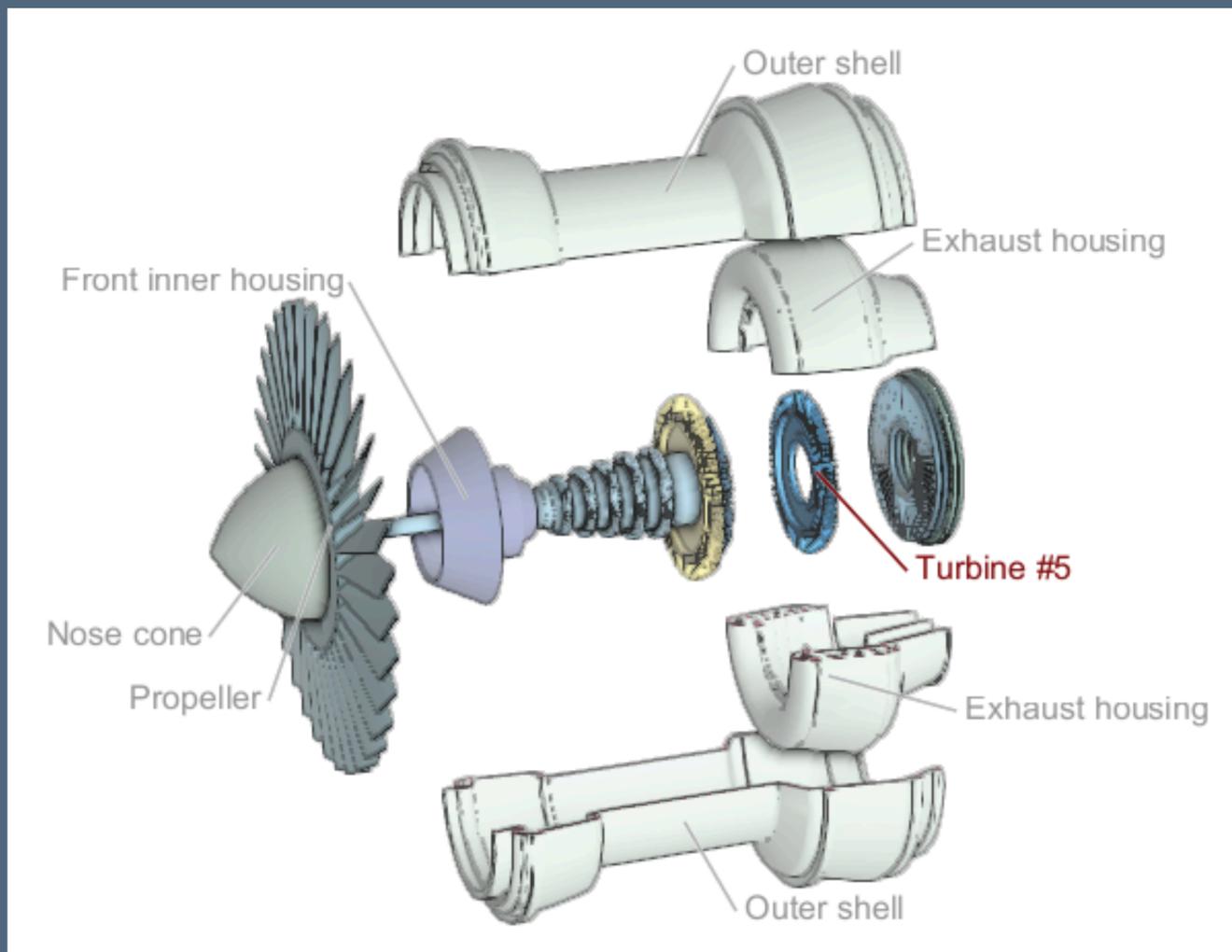
When parts are nested inside a container, explode out from the center of the container



Exploded view diagrams

[Li et al. 2008]

Algorithmically generated diagrams:



YOU READ THIS

Design principles for visual communication

Limitations in capturing richness

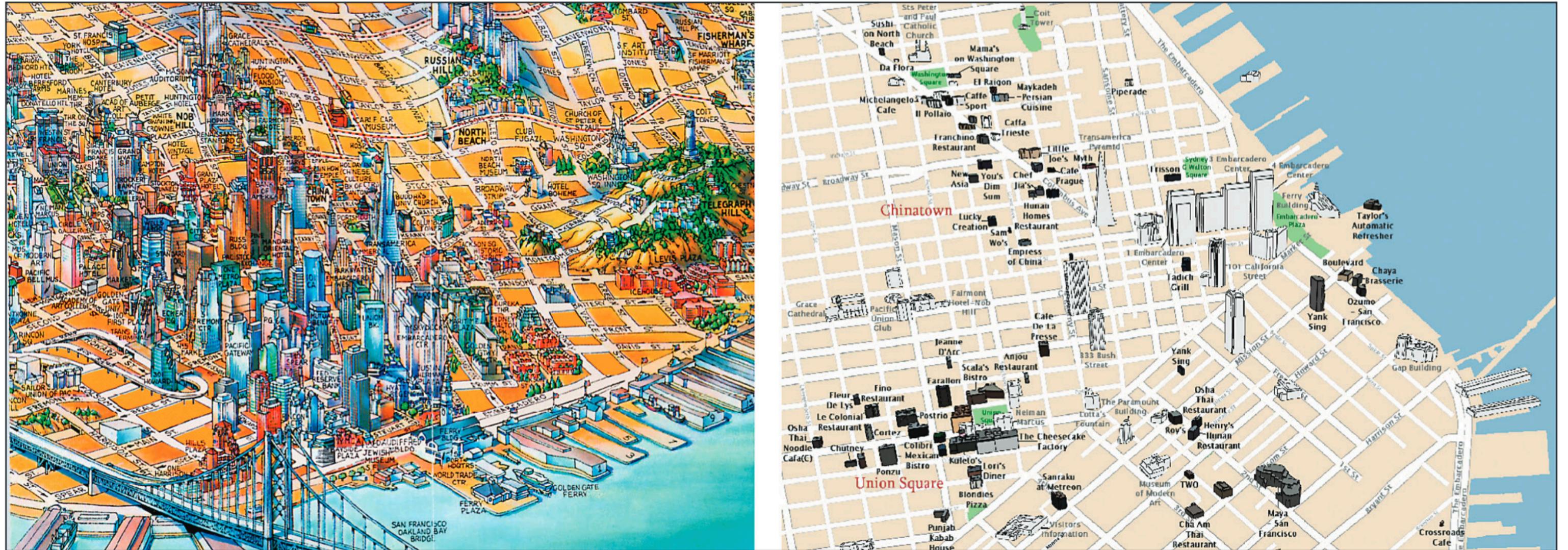


Figure 7. A hand-designed tourist map of San Francisco emphasizes semantically, visually, and structurally important landmarks, paths, districts, nodes, and edges, using multi-perspective rendering to ensure the facades of buildings are visible (left). Our tourist-map design system is based on these principles and similarly emphasizes the information most important for tourists in this map of San Francisco (right).

Summary

When a creative task is sufficiently general and valuable, there is significant contribution to be made in **describing its structure and encoding that into tools and workflows.**

Design principles provide guides for content creation tools: (1) **identify design principles** in expert output, (2) **instantiate them into algorithms** to aid content creators, and (3) **evaluate principles** through user studies

This approach can be used in a wide range of applications; we showed digital illustration, audio/video, and exploded views

Guest: Christina Ma

Ph.D. student
CMU HCII

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