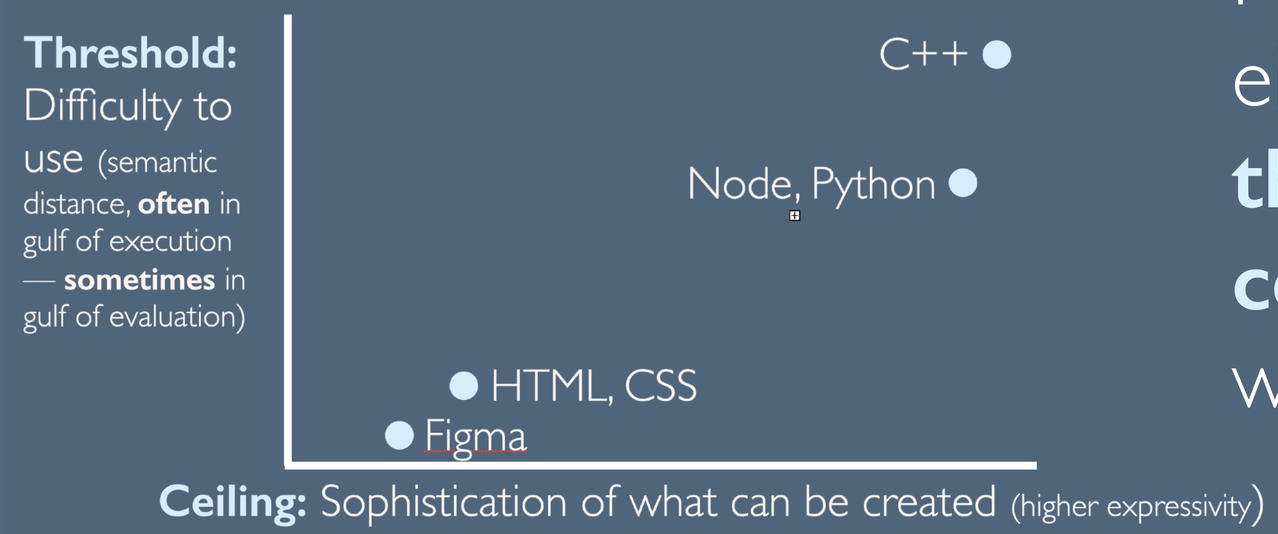
Content Creation

CS 347

Maneesh Agrawala

Last time



Programming tools often either aim to **reduce the threshold** or **increase 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** help externalize our cognition to better understand what code is doing (or ought to be doing)

Creativity Support Tools

Every tool supports creativity

Is there a tool that does not support creativity?

We can use any tool in creative ways

Content creation tools

Content comes in many forms (illustration, film, animation, photographs, podcasts, screenplays, …)

The workflows content creators use differ by content

How might we **develop tools to facilitate creation workflows** while ensuring that the **user feels in control of the creative decisions**

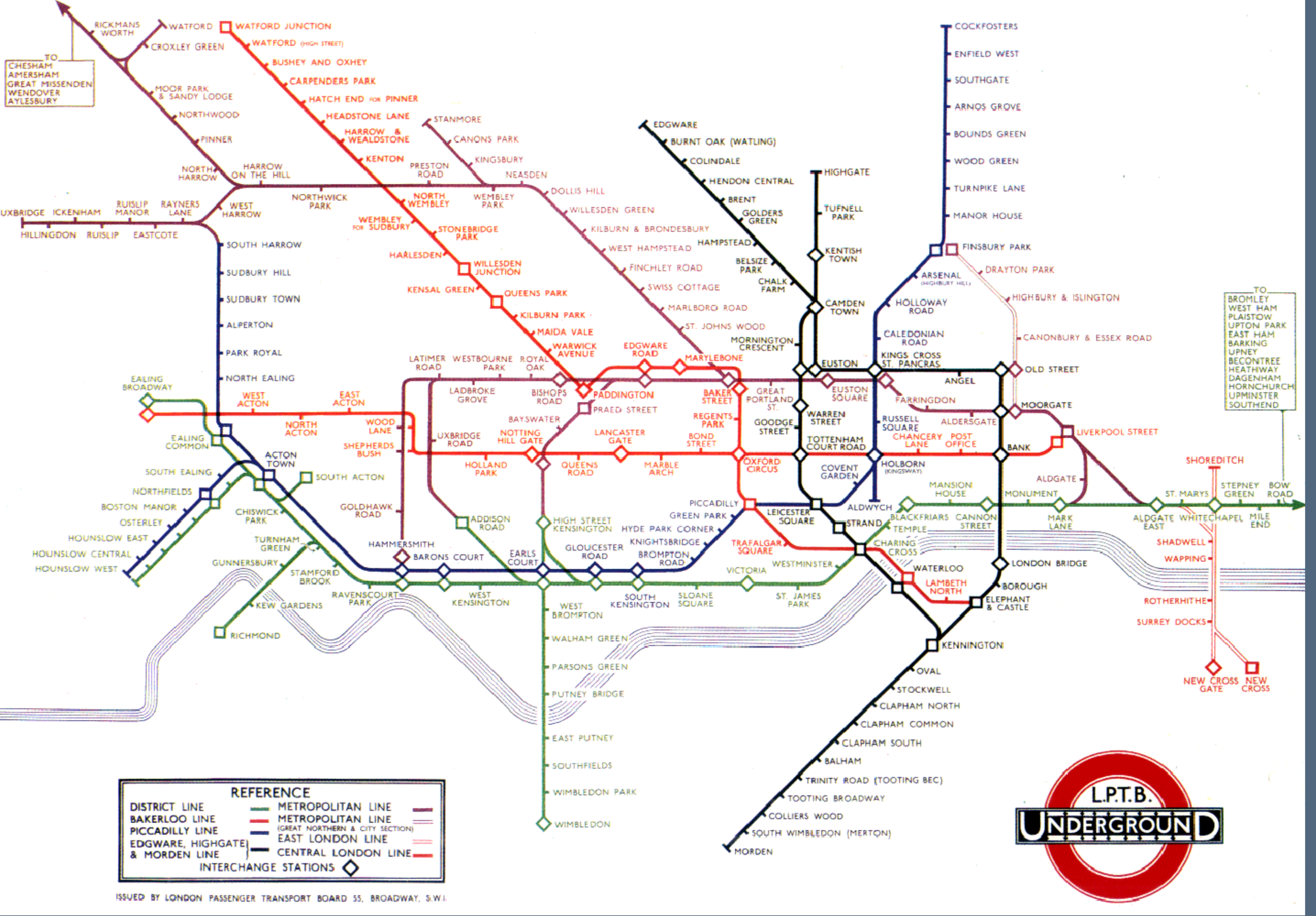
Today

Design principles for visual communication

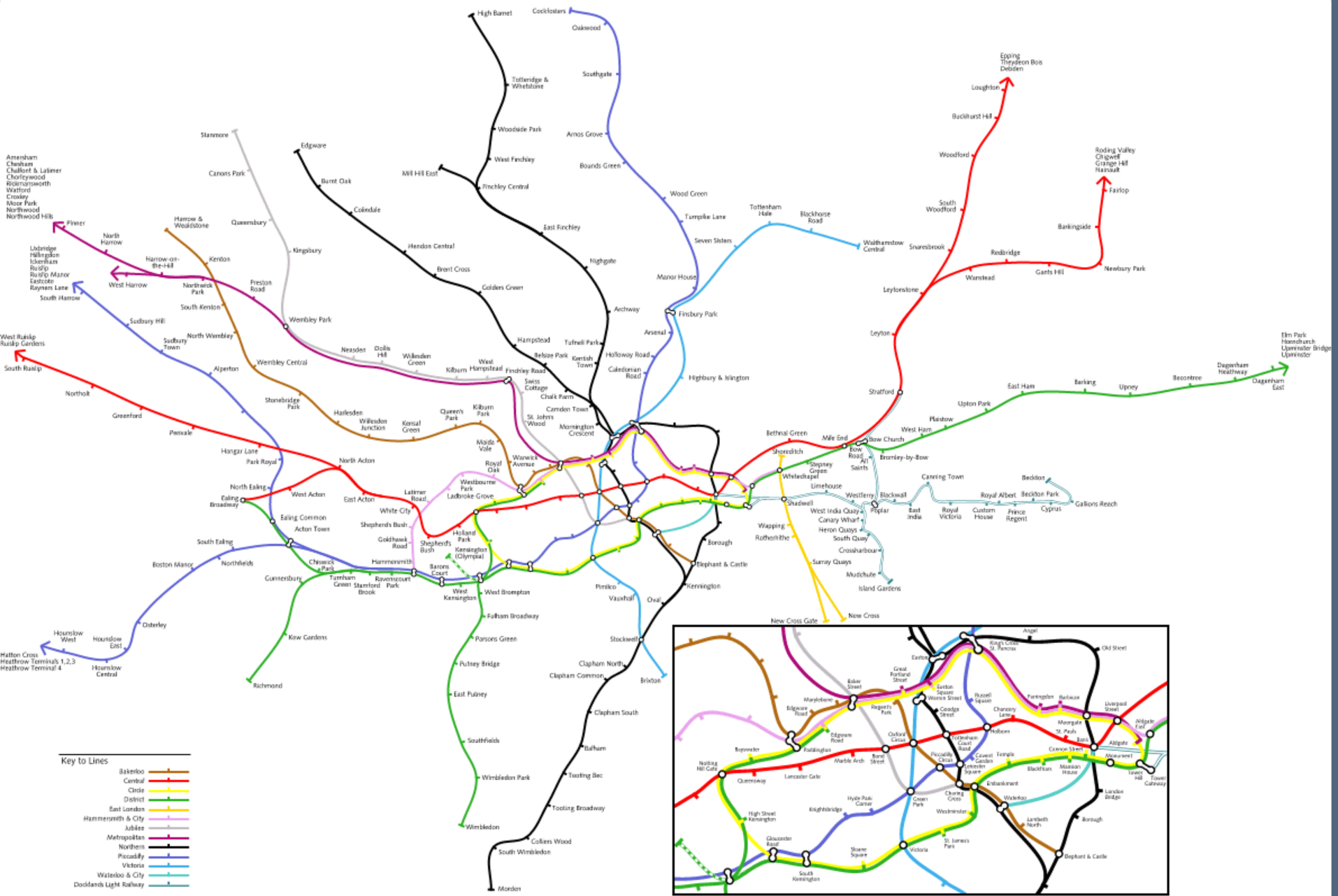
- Digital Illustration
- Video and Audio
- Instructions and Exploded Views

YOU READ THIS

Design principles for visual communication



London Underground [Beck 33]



Actual London Underground [TfL 2014]

Design Principles

Users' task:

Understand how to get from point A to point B

Important information:

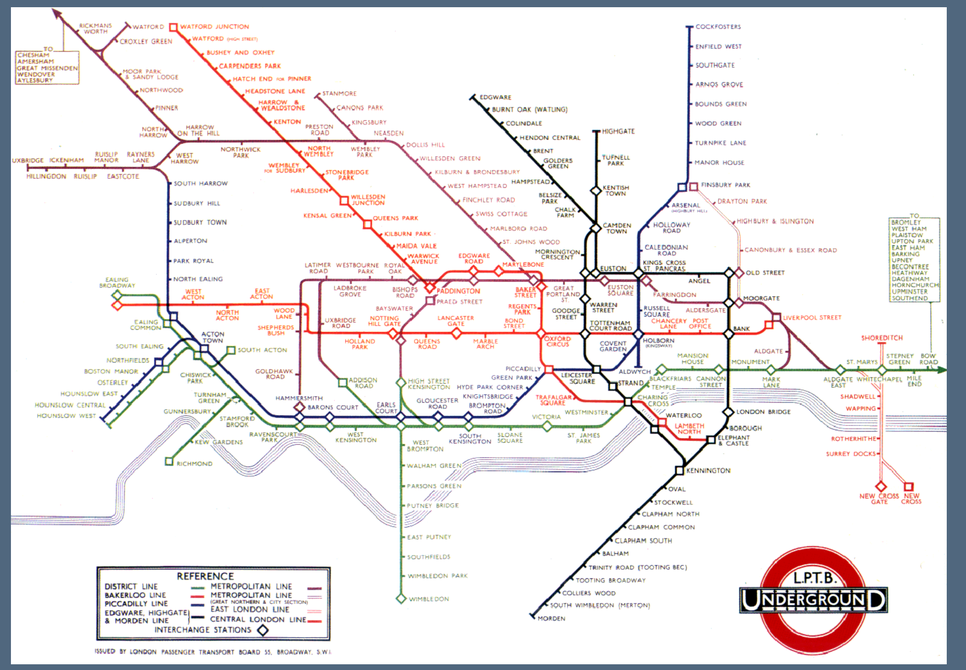
Sequence of stops/interchanges along each line

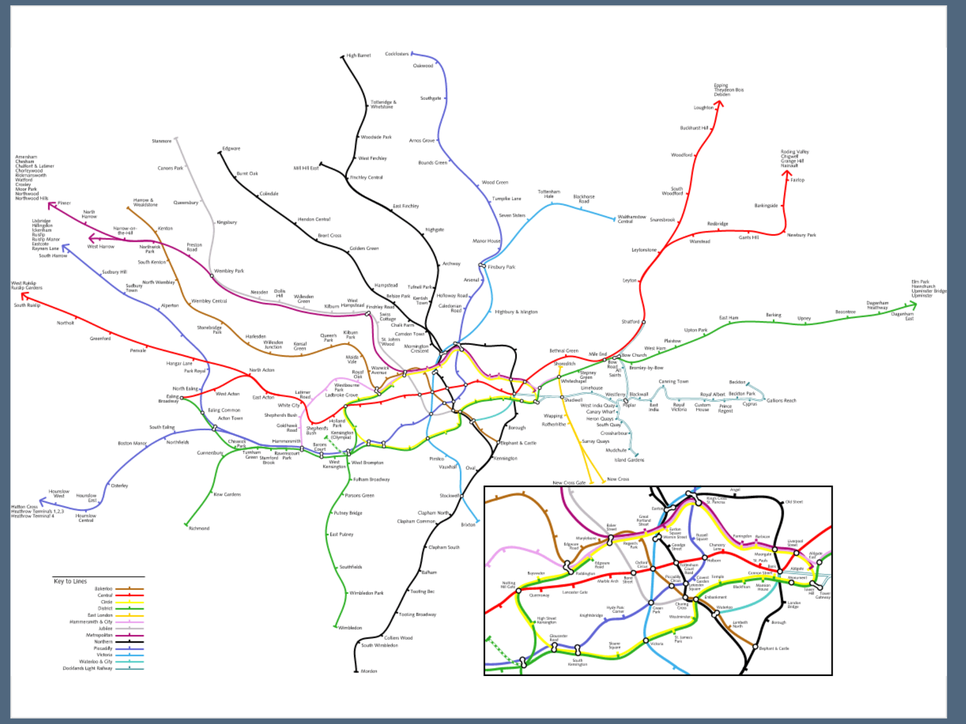
Design principles:

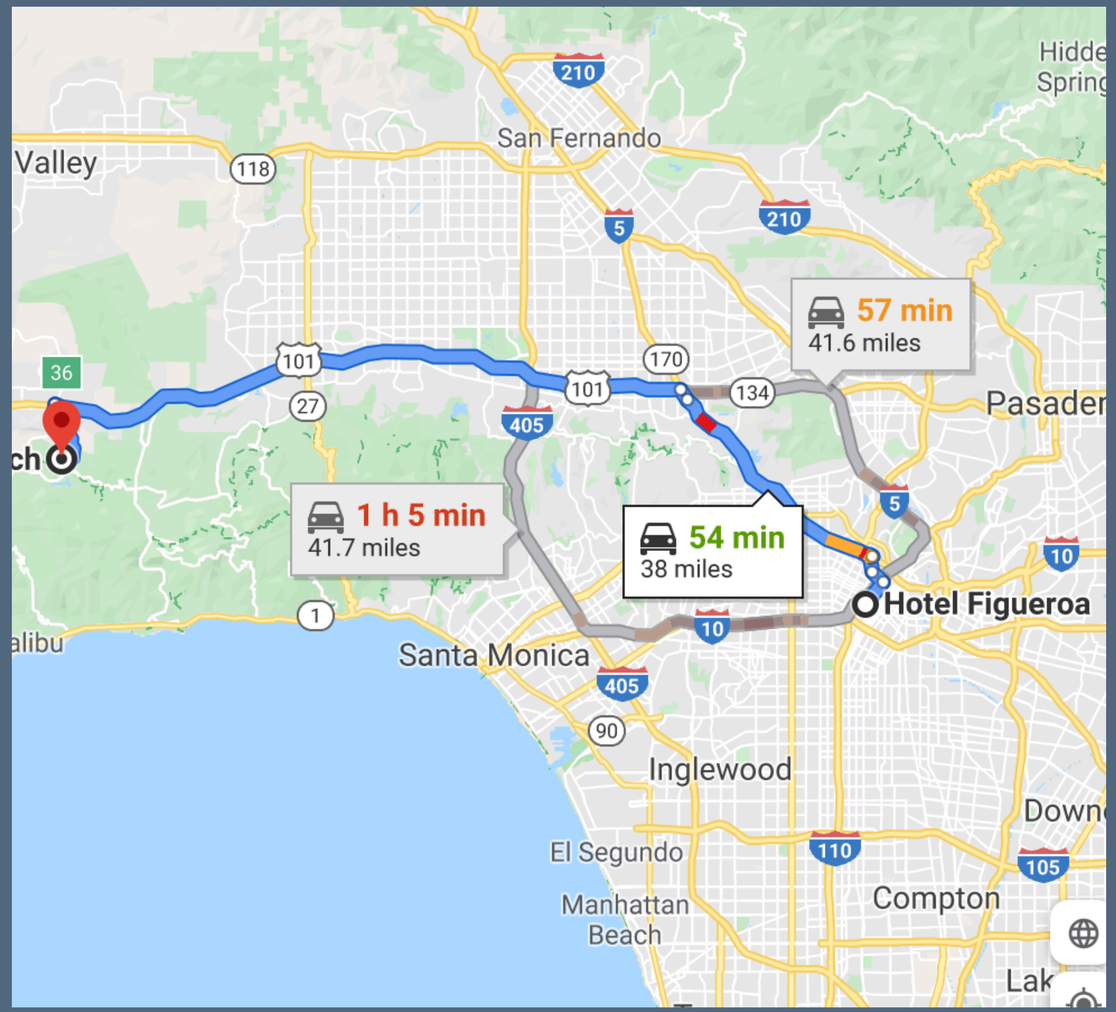
Straighten lines & evenly space stops to emphasize sequence

De-emphasize geographic shape of subway lines

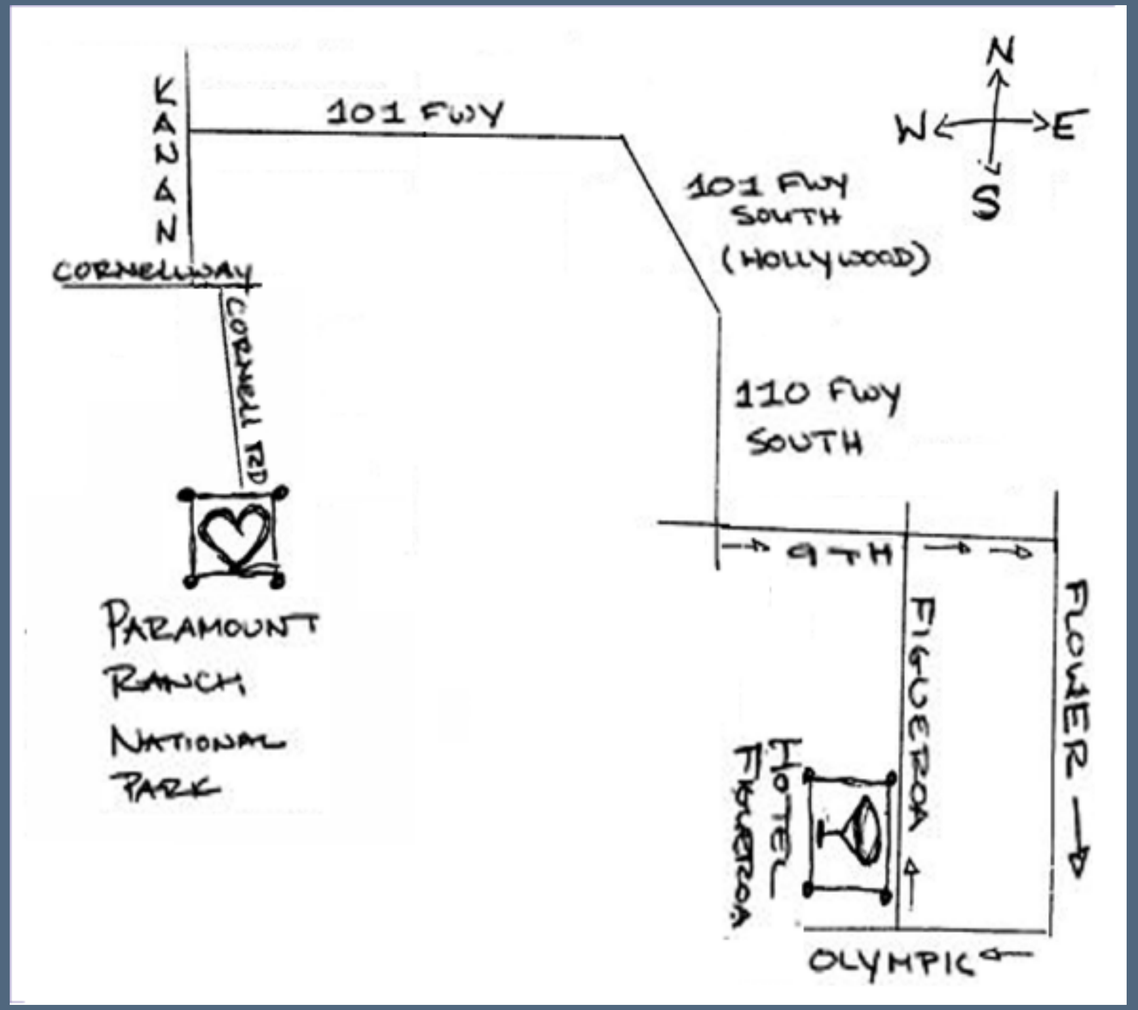
Techniques used to emphasize/de-emphasize information







Google Maps



Hand-drawn maps

Cognition of Route Maps

[Tversky 1992, 1999]

Essential information

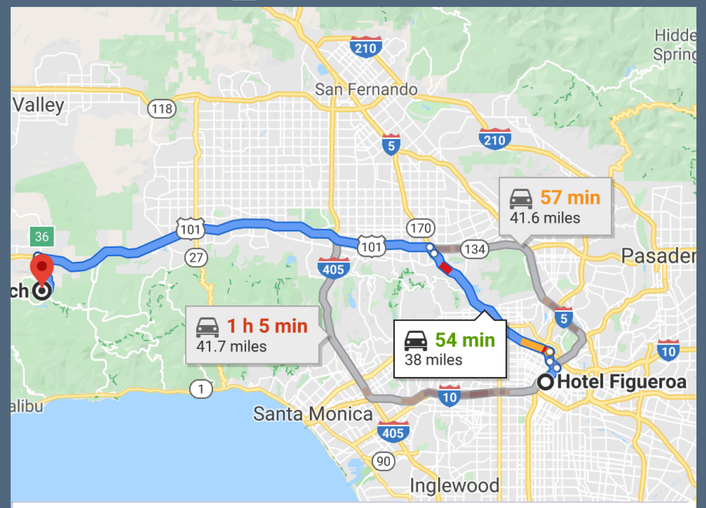
Turning points
Route topology

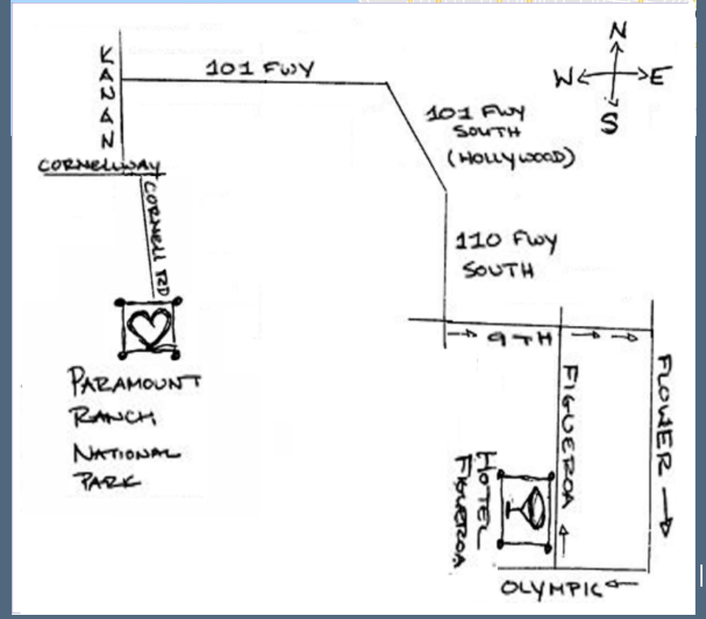
Secondary context information

Local landmarks, cross streets, etc.
Overview area landmarks, global shape

Exact geometry less important

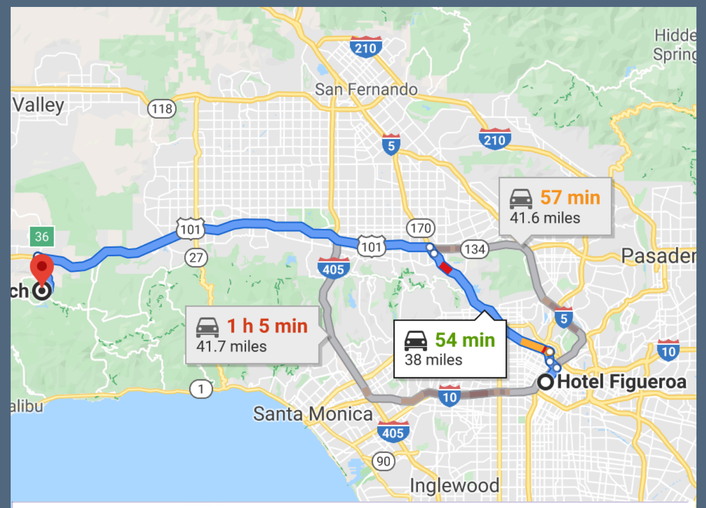
Not apprehended accurately
Not drawn accurately

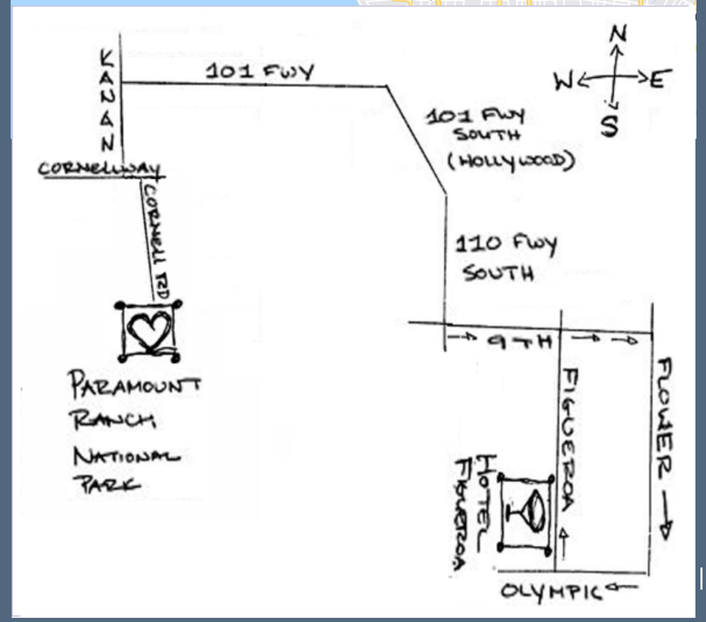




Design Principles

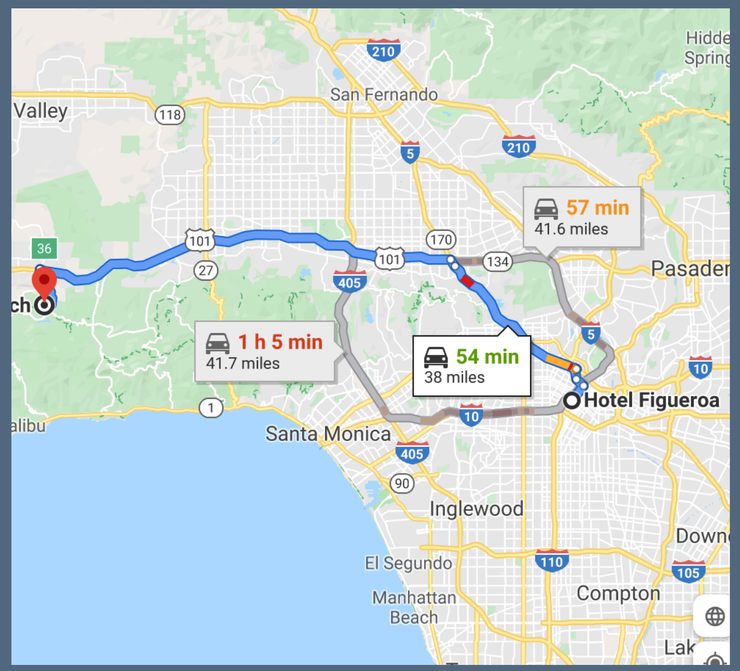
1. Exaggerate road length
2. Regularize turning angles
3. Simplify road shape



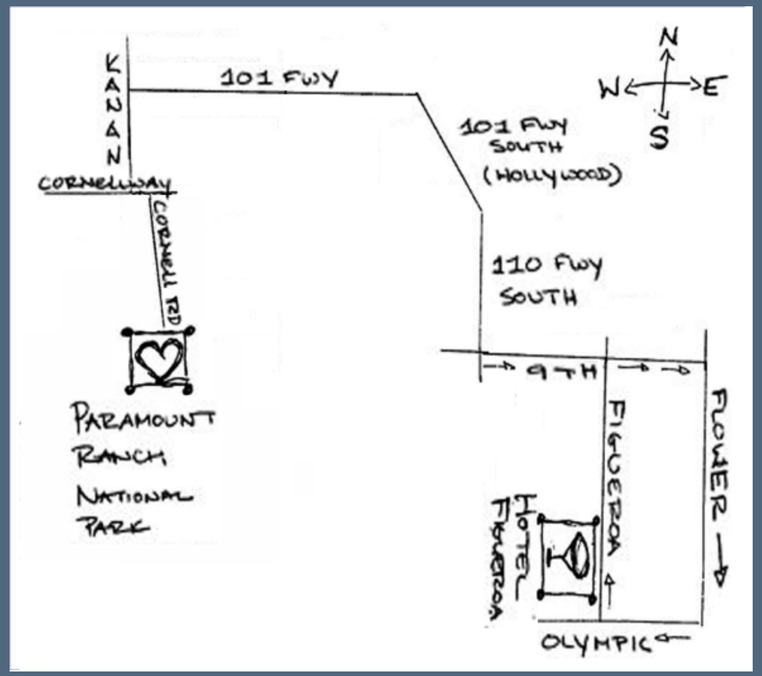


From principles to algorithms

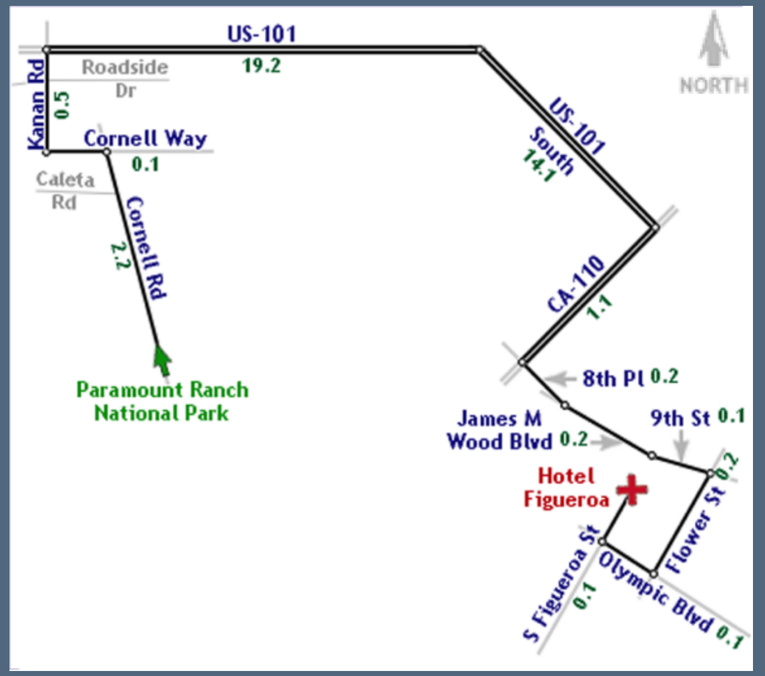
[Agrawala and Stolte 2001]



Google Maps



Hand-drawn maps



LineDrive

From principles to algorithms

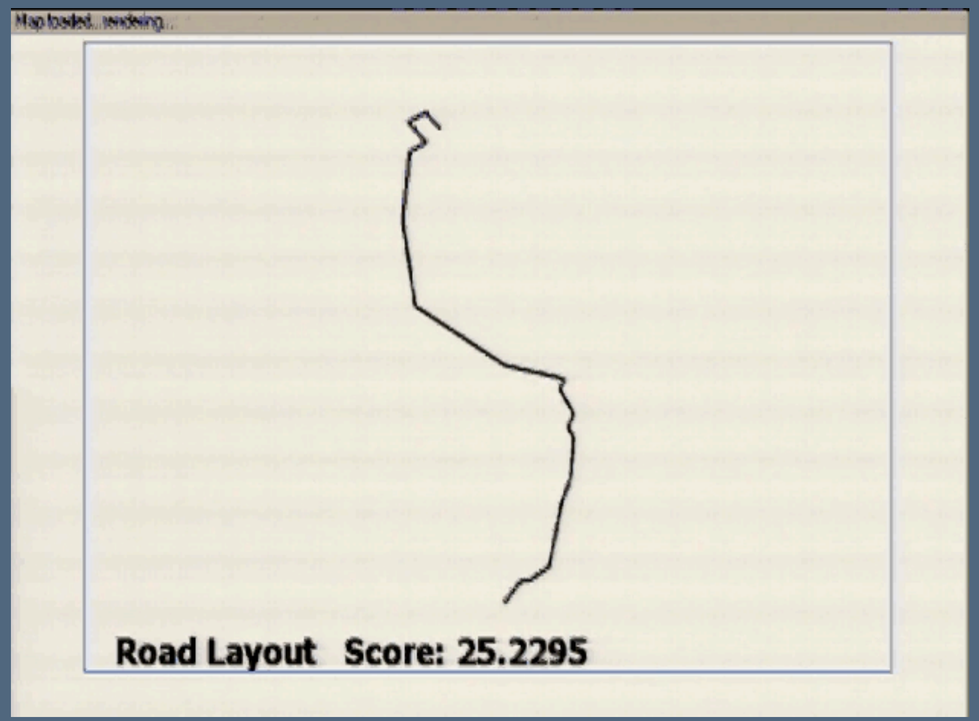
[Agrawala and Stolte 2001]

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

From principles to algorithms

[Agrawala and Stolte 2001]

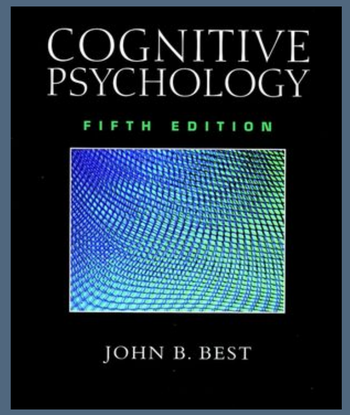


Road layout

Labels

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

Constrained optimization, controls that match the user's mental models

Step 3: Evaluate/validate design principles

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

Digital Illustration

Draco: kinetic textures

[Habib et al. 2014]

From principles to design

YOU READ THIS

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

Visual blends

[Chilton, Petridis, and Agrawala 2019]

Combinations of visual concepts, suggested by algorithm

Design principles:

Two concepts, two objects, integrated into one object

Retain the most salient visual signals (semiotics) of each object

Sketchpad
[Sutherland 1962]

First use of light pen
First use of GUI windows

Rubberband lines
Constraint-based drawing
Obj. oriented

Sketchpad
[Sutherland 1962]

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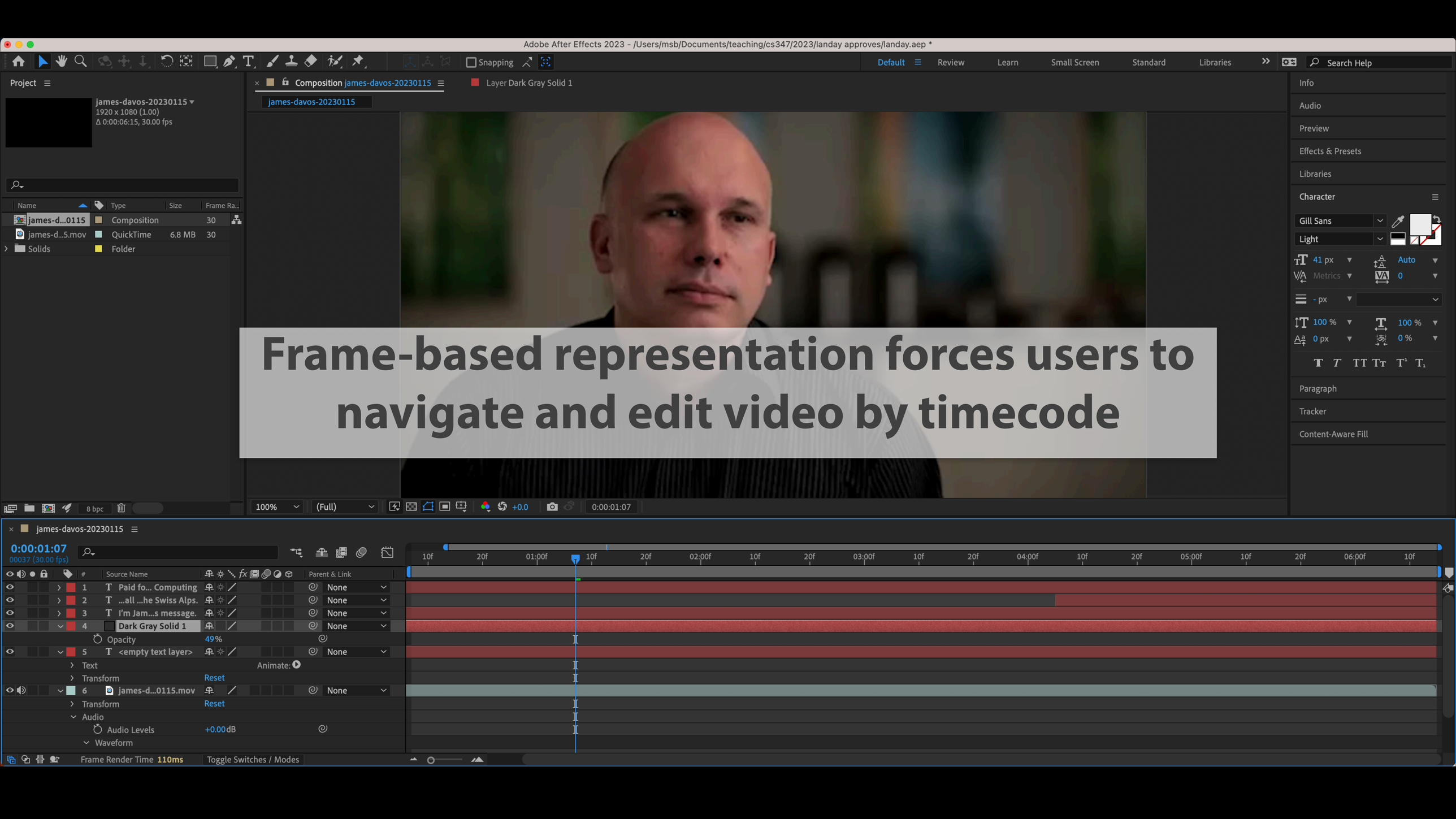
Video and Audio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Layer Dark Gray Solid 1
Frame-based representation forces users to navigate and edit video by timecode
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Audio
Preview
Effects & Presets
Libraries
Character
Gill Sans
Light
Paragraph
Tracker
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Source Name
Parent & Link
1 Paid fo... Computing
2 ...all ...he Swiss Alps.
3 I'm Jam...s message.
4 Dark Gray Solid 1
Opacity 49%
5 <empty text layer>
Text
Transform
6 james-d...0115.mov
Audio
Audio Levels +0.00 dB
Waveform
Frame Render Time 110ms
Toggle Switches / Modes

Design principle:

For dialogue-heavy video, editors think in terms of the words being spoken (the transcript)

Interface should:

Empower editors to directly edit scripts, not video, and smooth the cuts automatically

Algorithm:

frame similarity graphs

[Berthouzoz, Li, Agrawala 2012]

Design principle:

For dialogue-heavy video, editors think in terms of the words being spoken (the transcript)

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Algorithm:

frame similarity graphs

Jump cuts (in red)

[Berthouzoz, Li, Agrawala 2012]

Design principle:

For dialogue-heavy video, editors think in terms of the words being spoken (the transcript)

Interface should:

Empower editors to directly edit scripts, not video, and smooth the cuts automatically

Algorithm:

frame similarity graphs

Our result

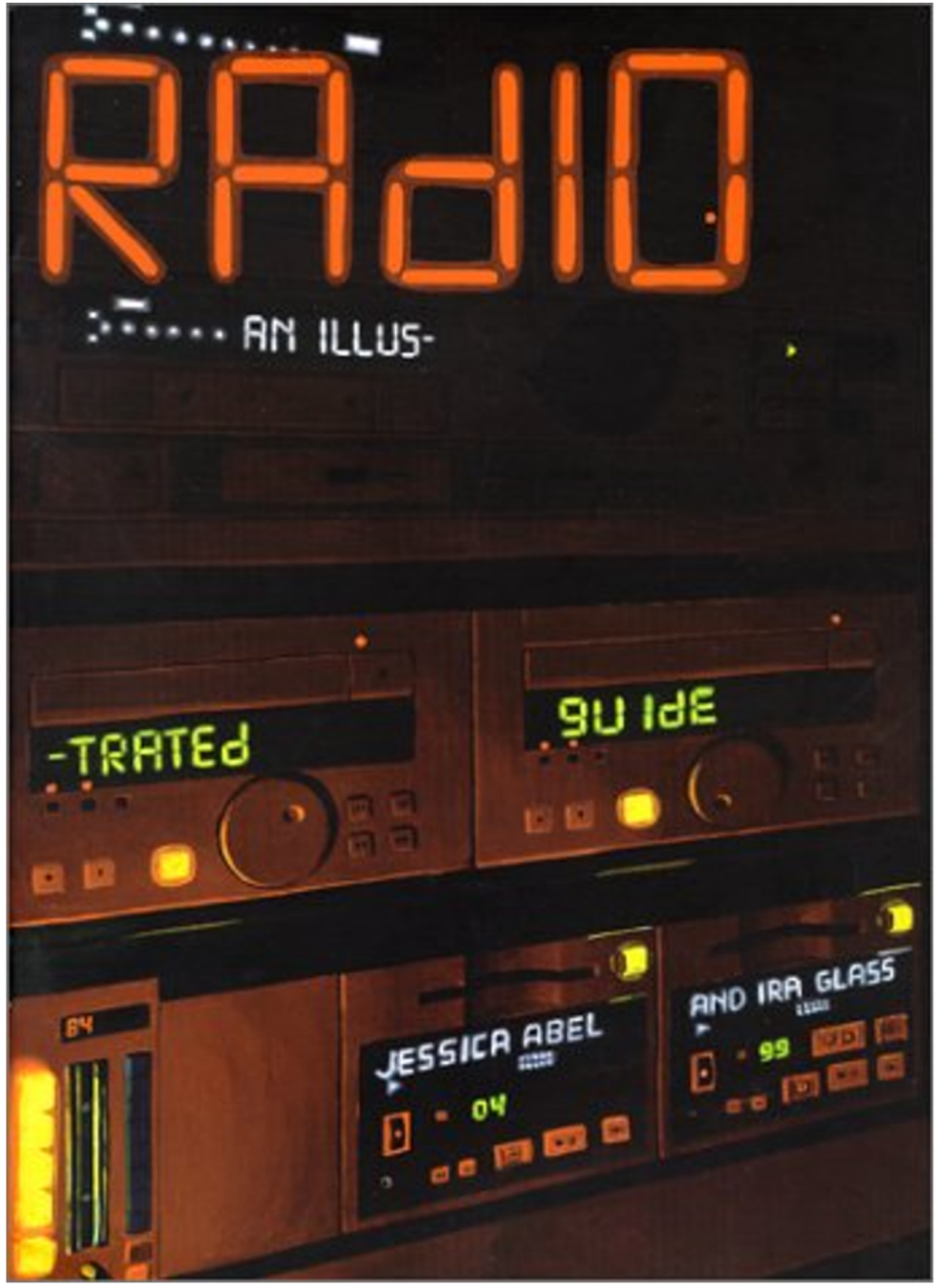
hidden transitions in blue
pauses in green

Comp. time:

clusters	22m
hidden	5s
pauses	9s

[Berthouzoz, Li, Agrawala 2012]

STUDIO 360
WNYC



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.

"Literally, literally, there were scores, perhaps more than a hundred..." "private organizations..." "uhh..." "everything from..." [breath] "private organizations, meaning things like Doctors Without Borders..." [breath] "Doctors of the World..." "ahh..." "American Refugee Committee, International Rescue Committee..." "um..." [pause] [breath] What we're going to cut. [breath] "There were many smaller..."

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).

"Literally, literally, there were scores, perhaps more than a hundred..." "private organizations..." "um..." [breath] "There were many smaller private organizations and church-based organizations..." [breath] "You had Caritas from 6 or 7 different countries, you had World Vision..." "They all came in with their flags..." [pause] [pause] The edit we just made. Previous edits. [pause] "it was...it was..."

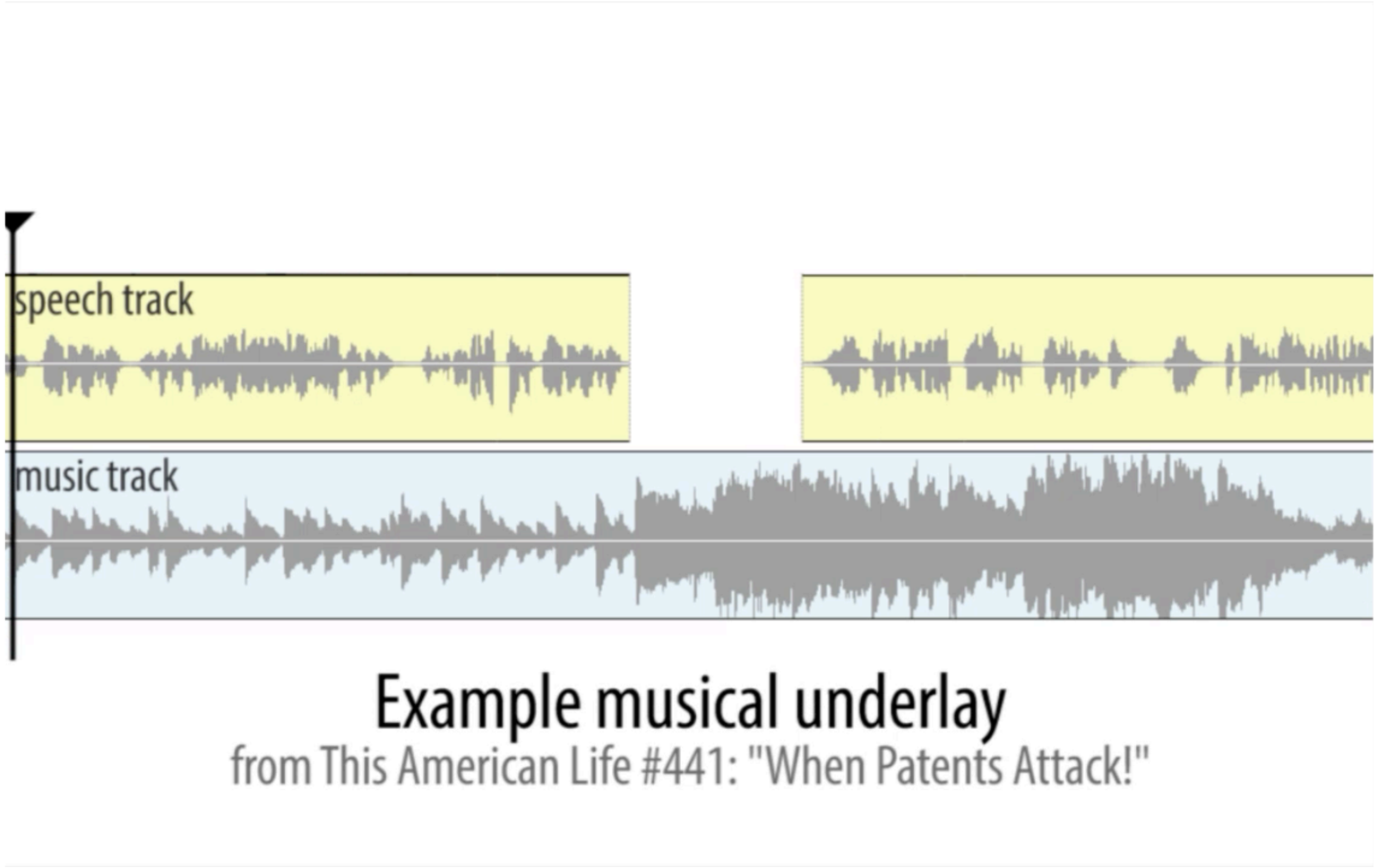
Second, there's a difference between a pause and a breath. Sometimes an interviewee will finish an important point, take a quick breath, but then rush on to the next idea. If you insert a pause—just the sound of the room—**before** the breath—or **replace** the breath with a pause, then their big idea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

"In this regime, the humanitarians were treated rather like the service staff at a seedy, Mafia-occupied hotel." [pause] "They were there to provide: food, medicine, housewares..."

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.

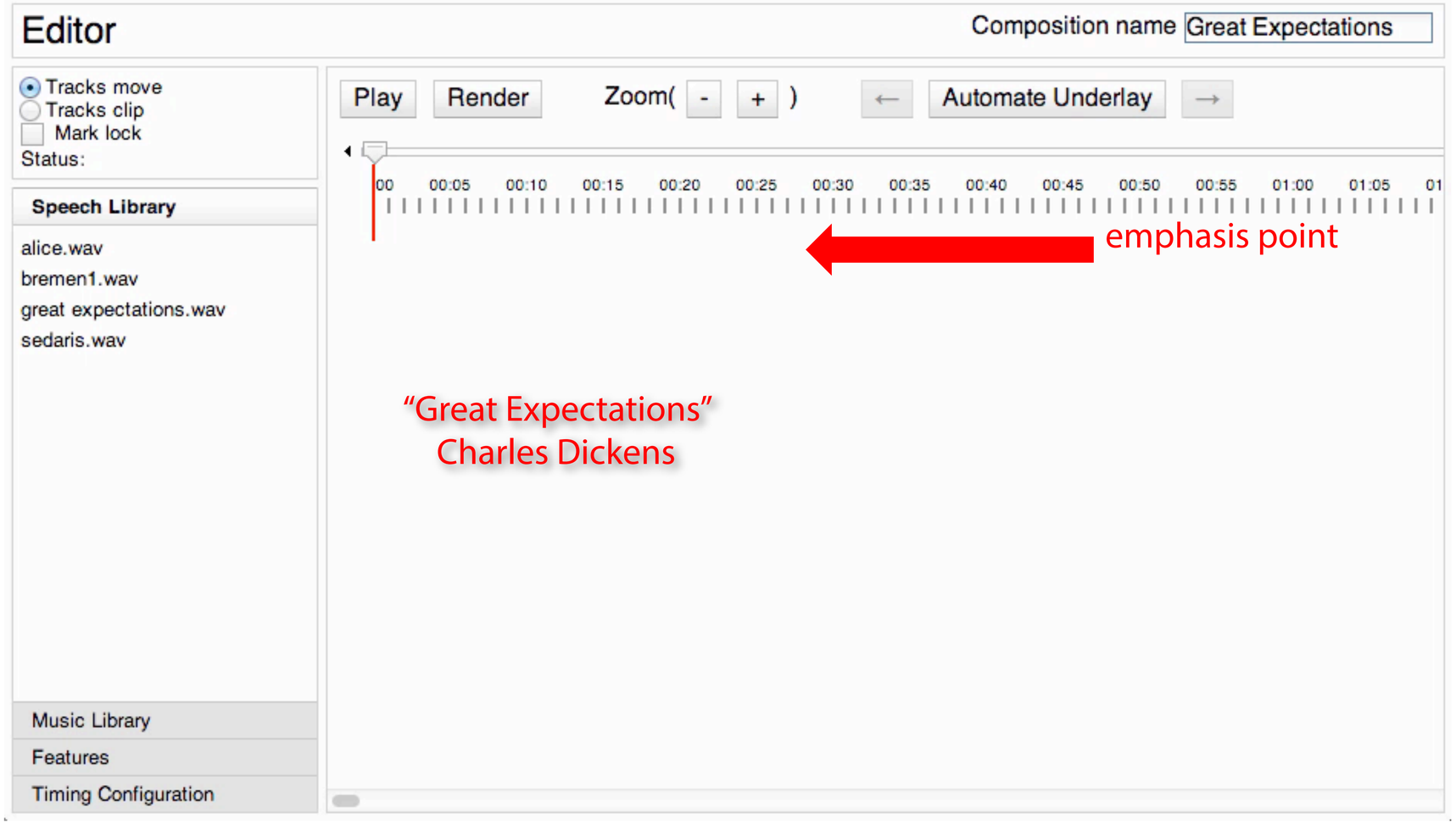
18

[Abel and Glass 1999]



Underscore

[Rubin et al., CHI 2014]



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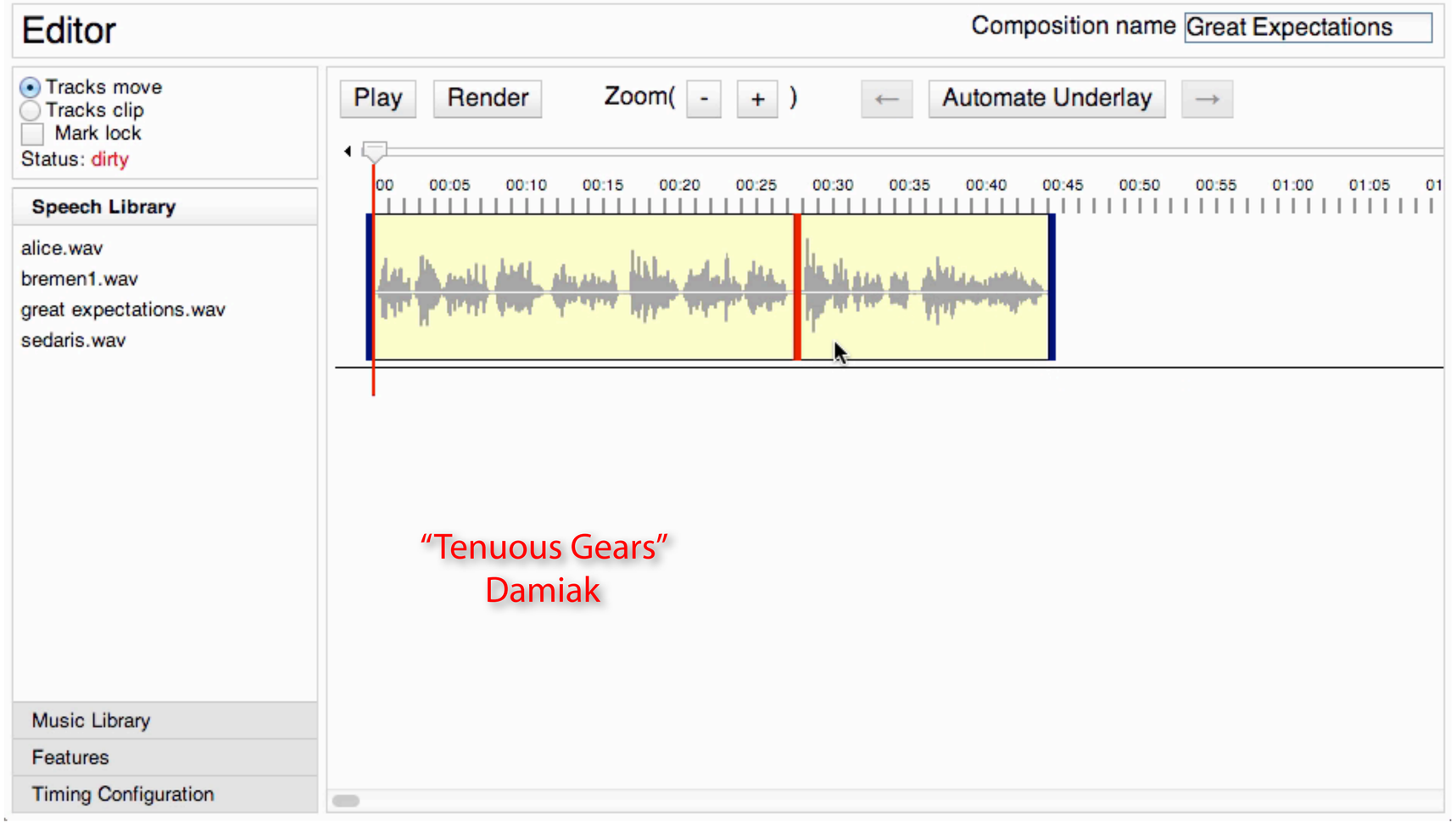

Underscore

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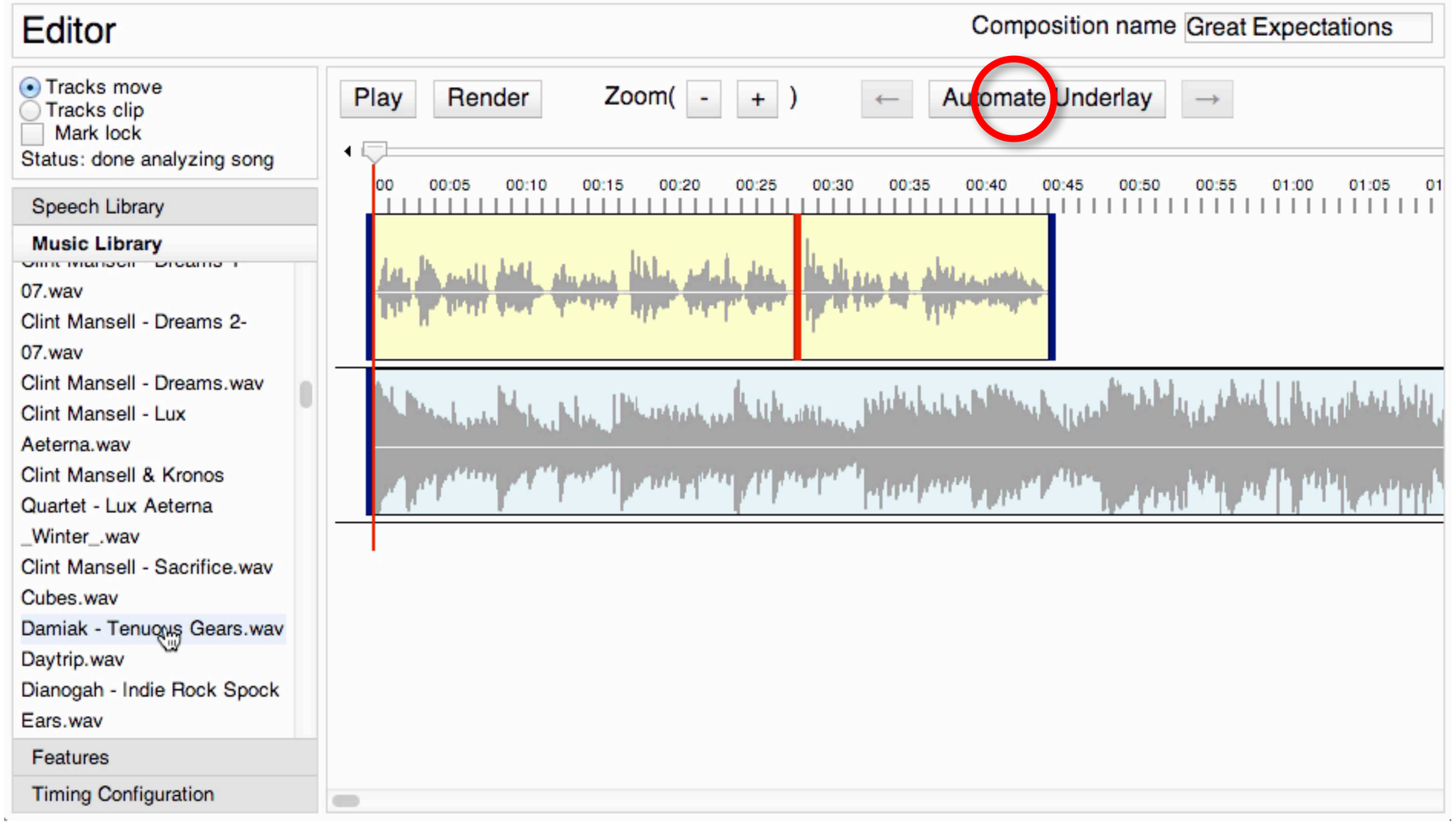

Underscore

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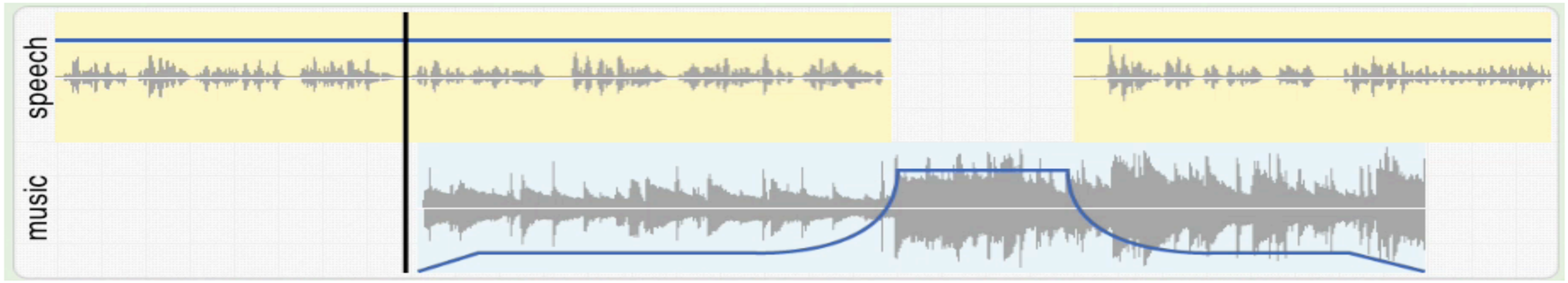
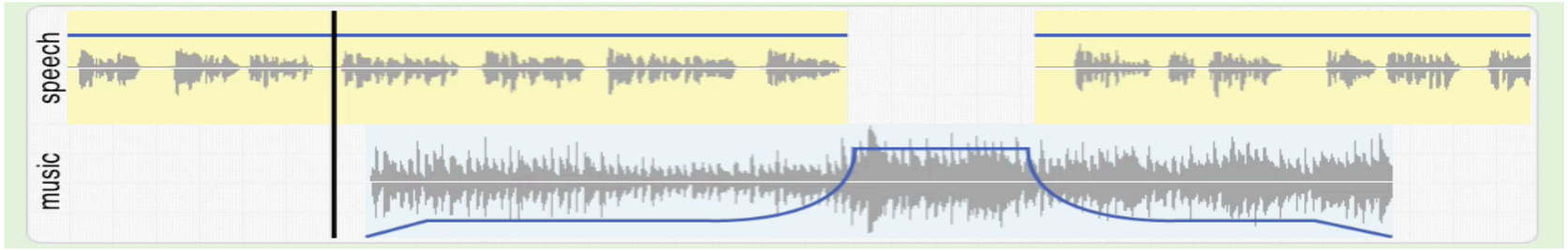


Story: Charles Dickens – “Great Expectations”
Read by Mark F. Smith [librivox.org]
Music: Damiak – “Tenuous Gears”

Underscore

[Rubin et al., CHI 2014]



Story: David Sedaris – “Go Carolina”
Read by David Sedaris [Hachette Audio, 2001]
Music: El Chicano – “Viva Tirado Pt. 1”

Underscore

[Rubin et al., CHI 2014]

Instructions and Exploded Views

Assembly instructions

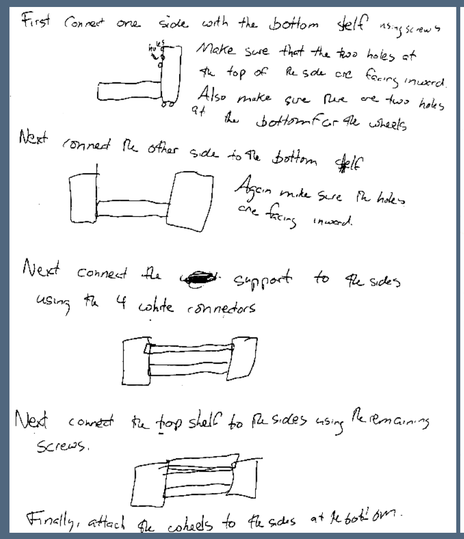
[Agrawala et al. 2003] [Heiser et al. 2004]

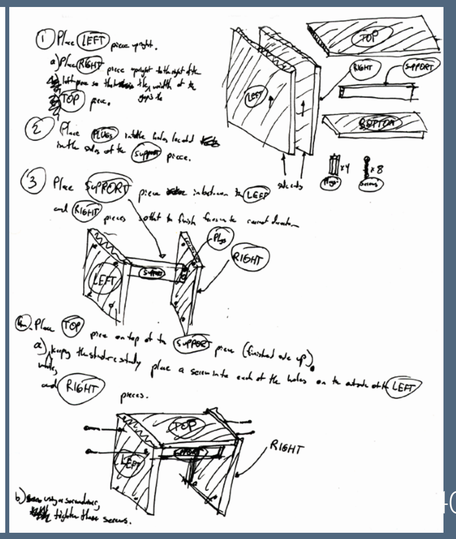
Design principles:

Depict subassemblies first, then combine those subassemblies together

Annotations and step-by-step diagrams highlight changes

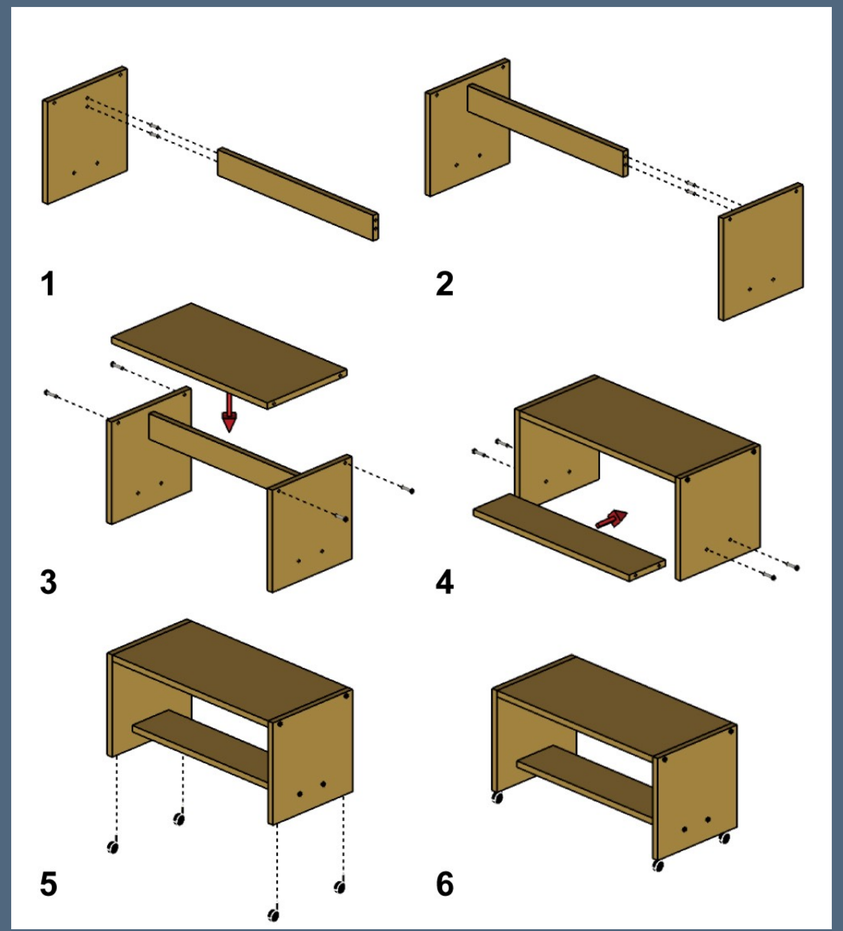
All changes in a given step must be in plain view, while keeping the viewpoint static when possible

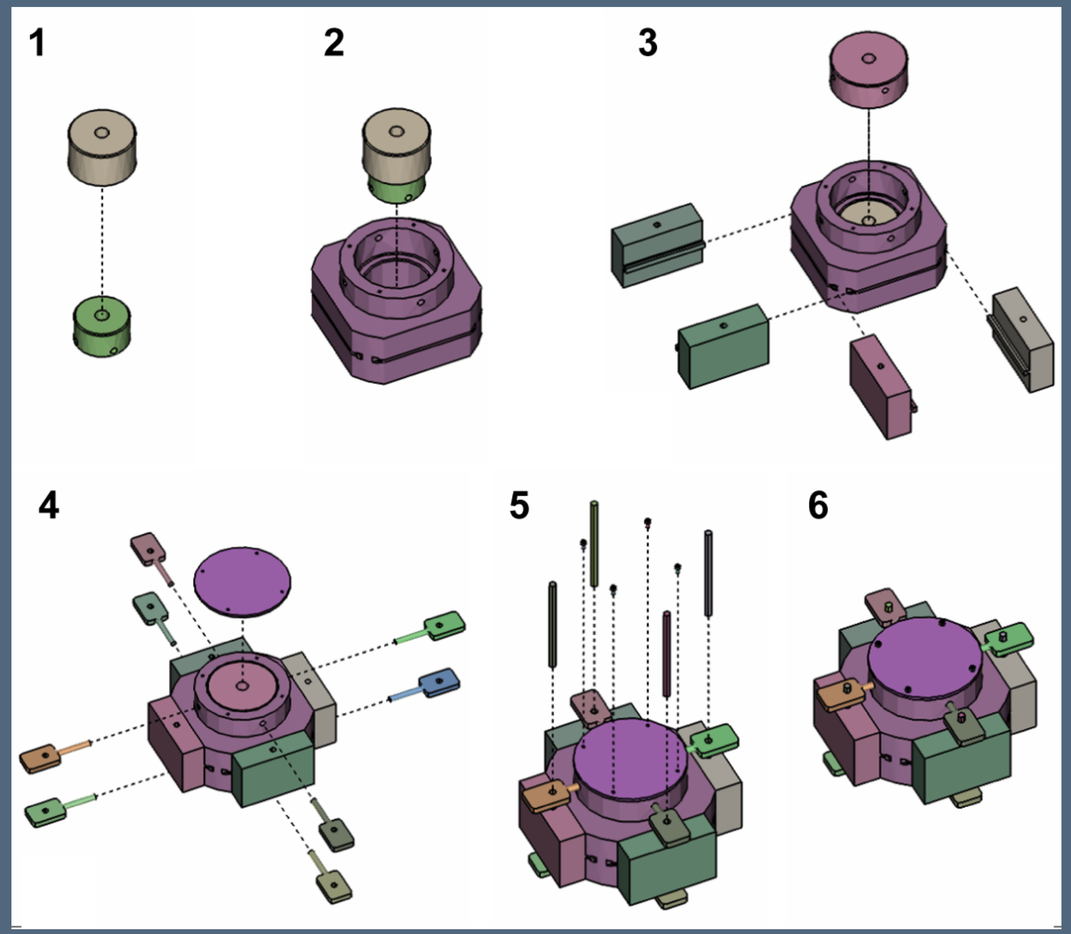


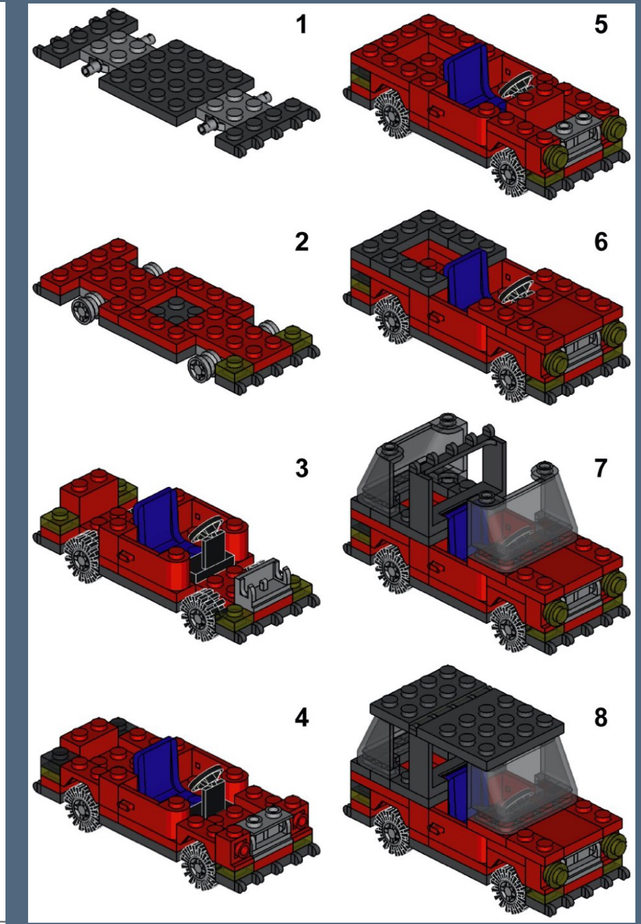


Assembly instructions

[Agrawala et al. 2003]







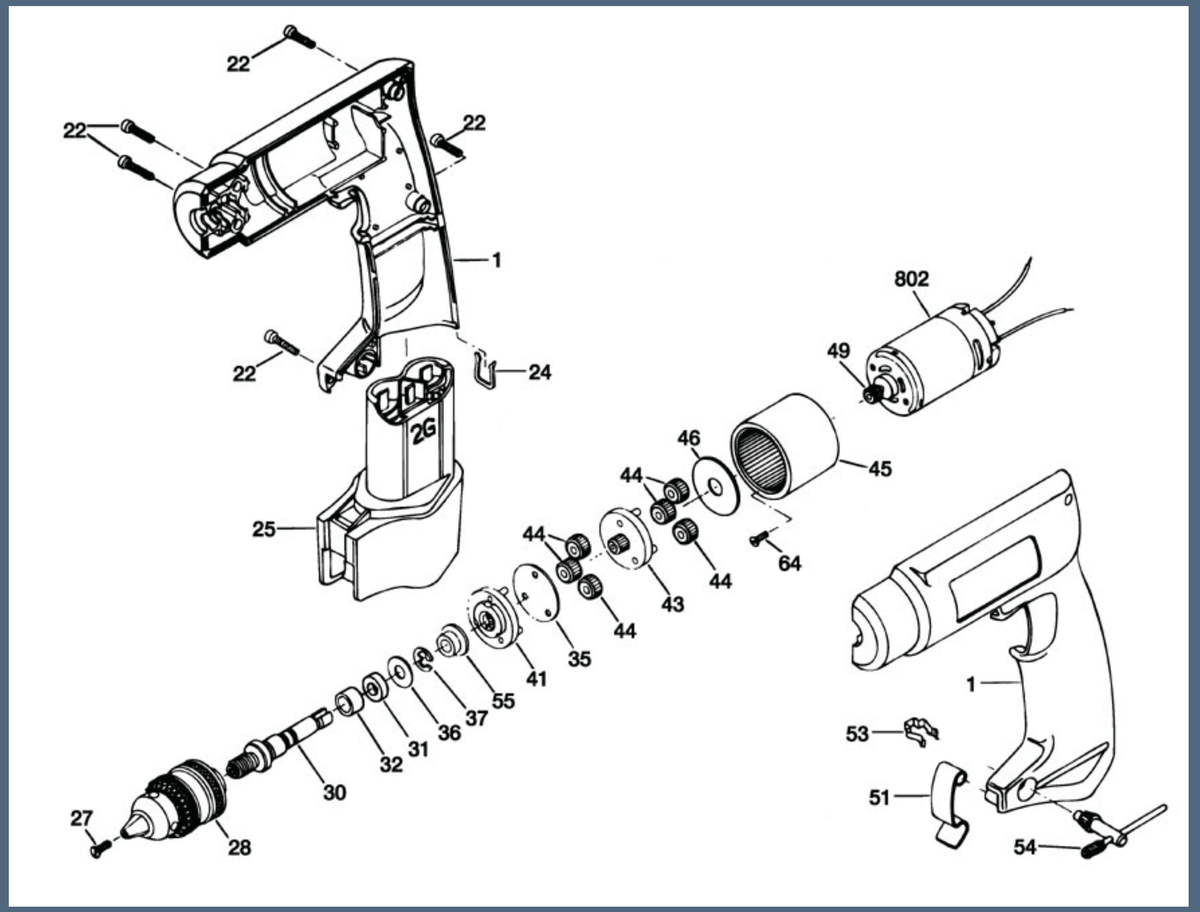
Exploded view diagrams

[Li et al. 2008]

Design principles:

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

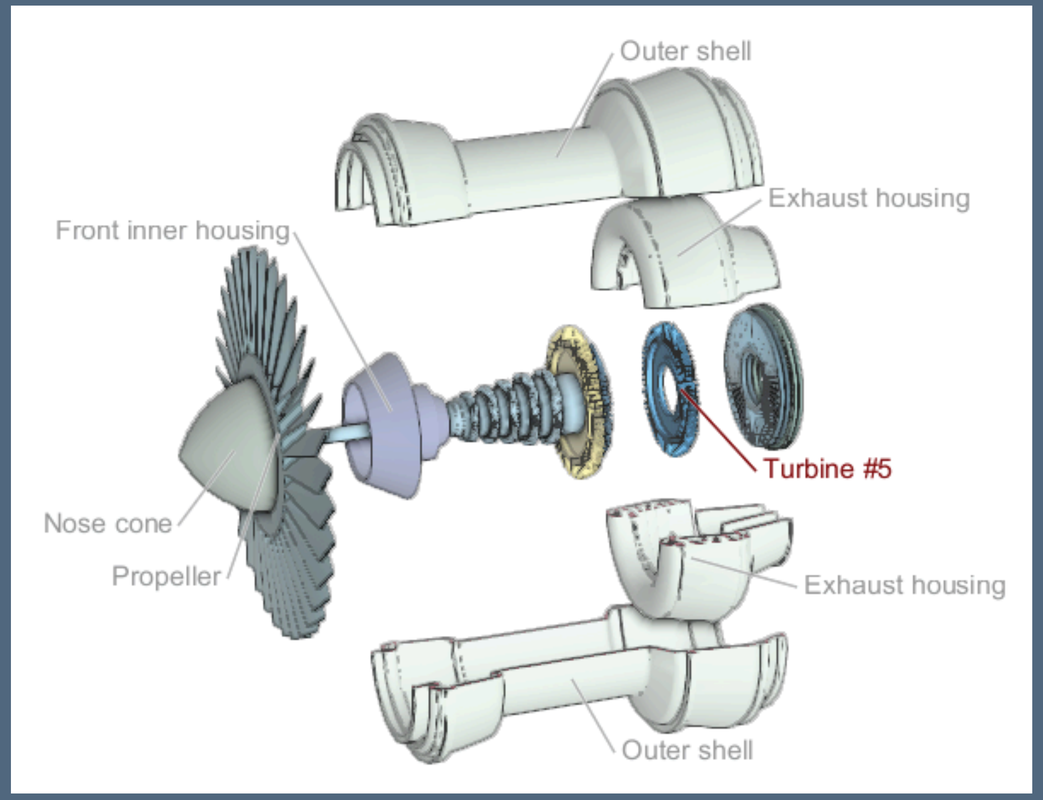
When parts are nested inside a container, explode out from the center of the container

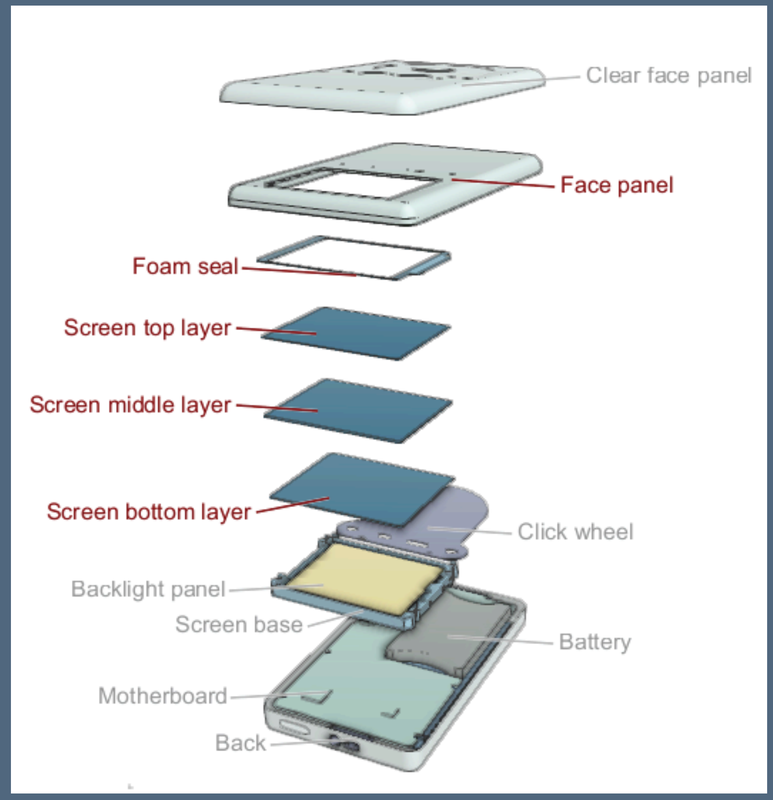


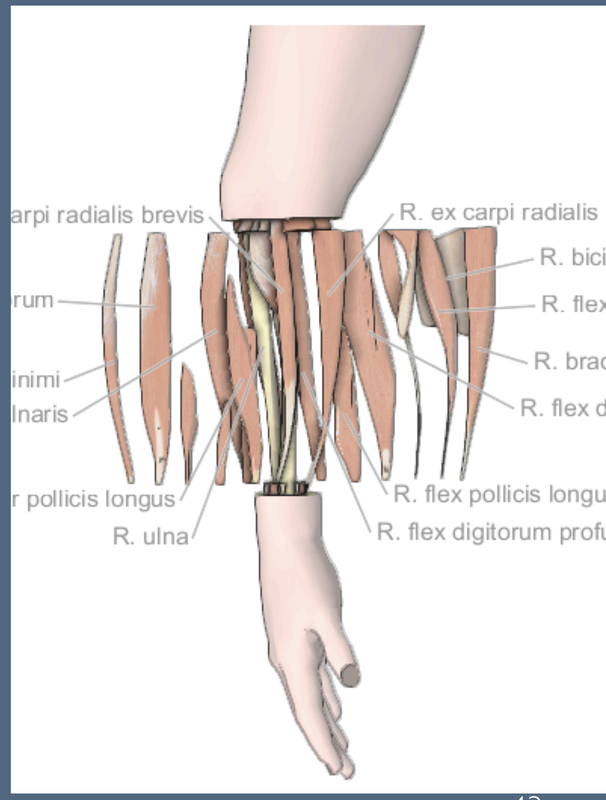
Exploded view diagrams

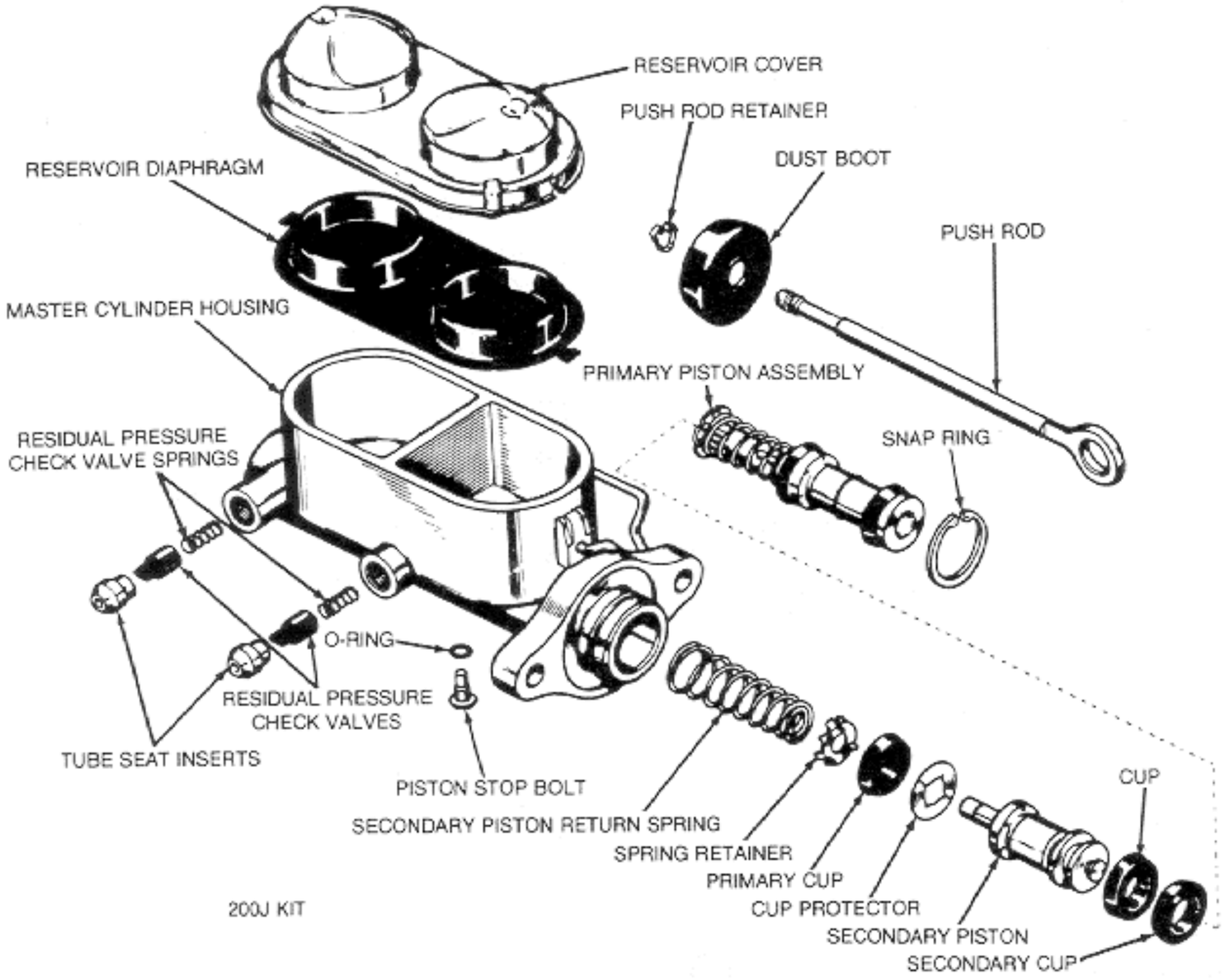
[Li et al. 2008]

Algorithmically generated diagrams:

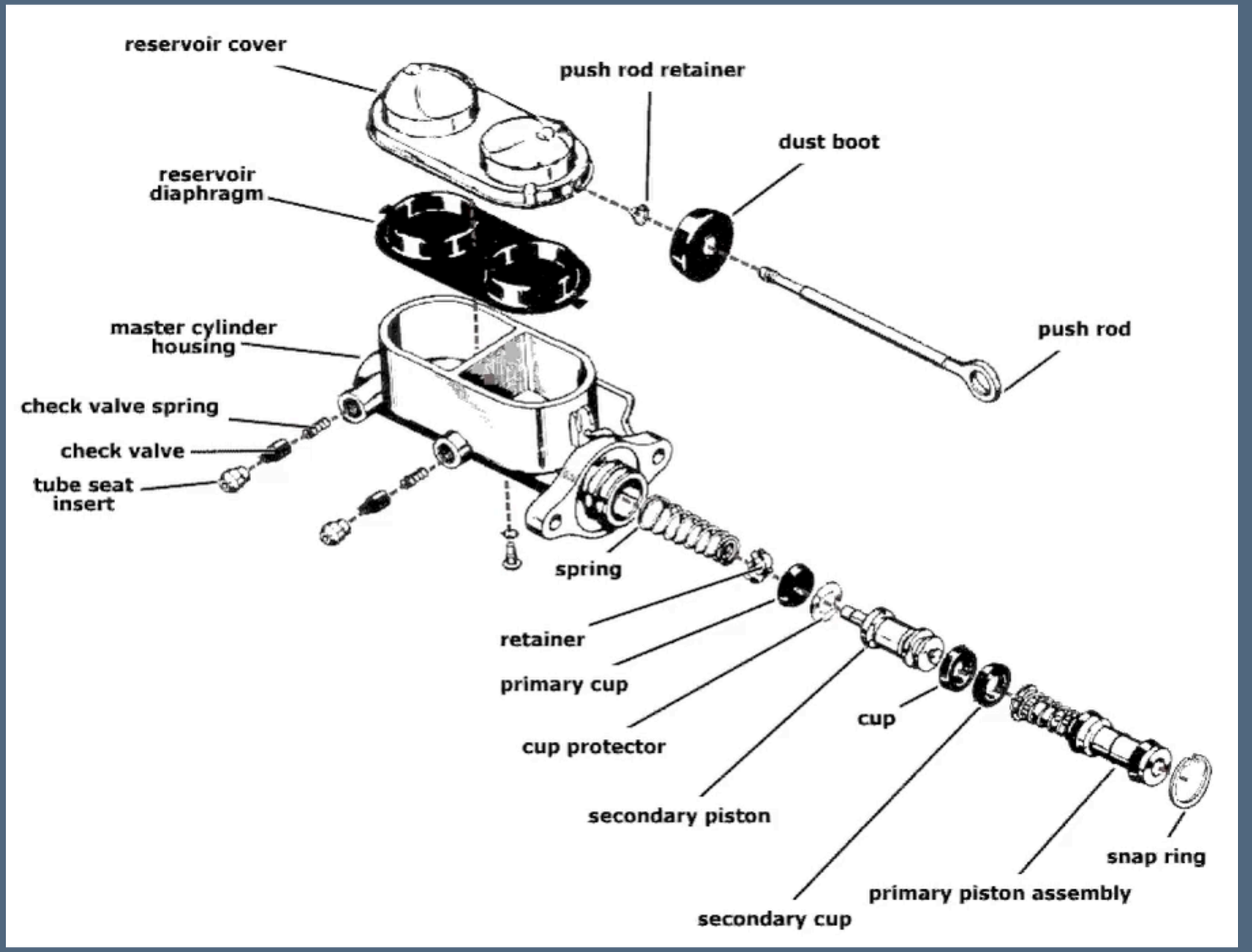








Exploded view of the master cylinder


reservoir cover
push rod retainer
dust boot
reservoir diaphragm
push rod
master cylinder housing
check valve spring
check valve
tube seat insert
spring
retainer
primary cup
cup protector
cup
secondary piston
snap ring
primary piston assembly
secondary cup

Interactive Exploded Views

[Li et al. 2004]

Design Principles:

Clarify spatial relationships

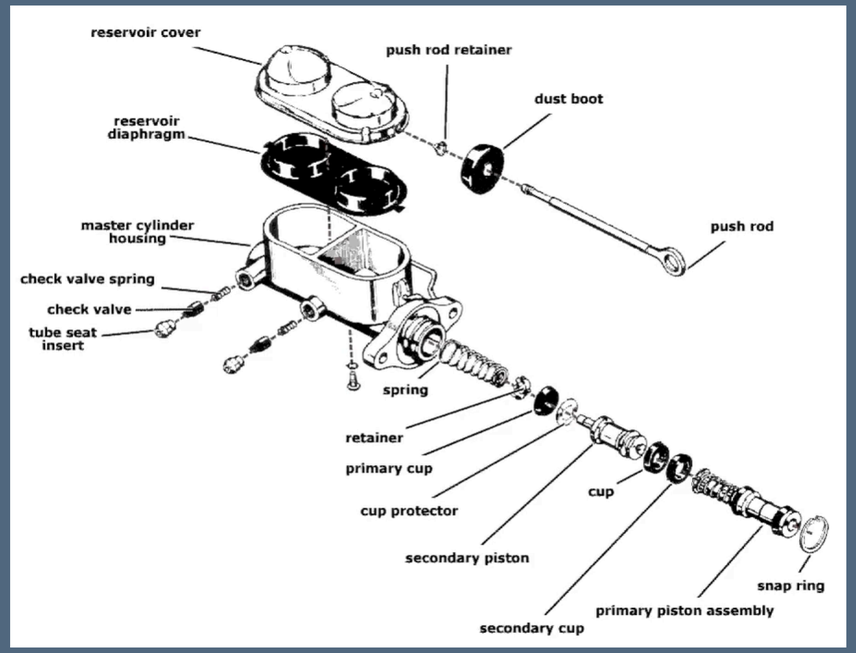
Direct manipulation [Shneiderman 83]

Animated transitions [Woods 84] [Robertson 91] [Grossman 01]

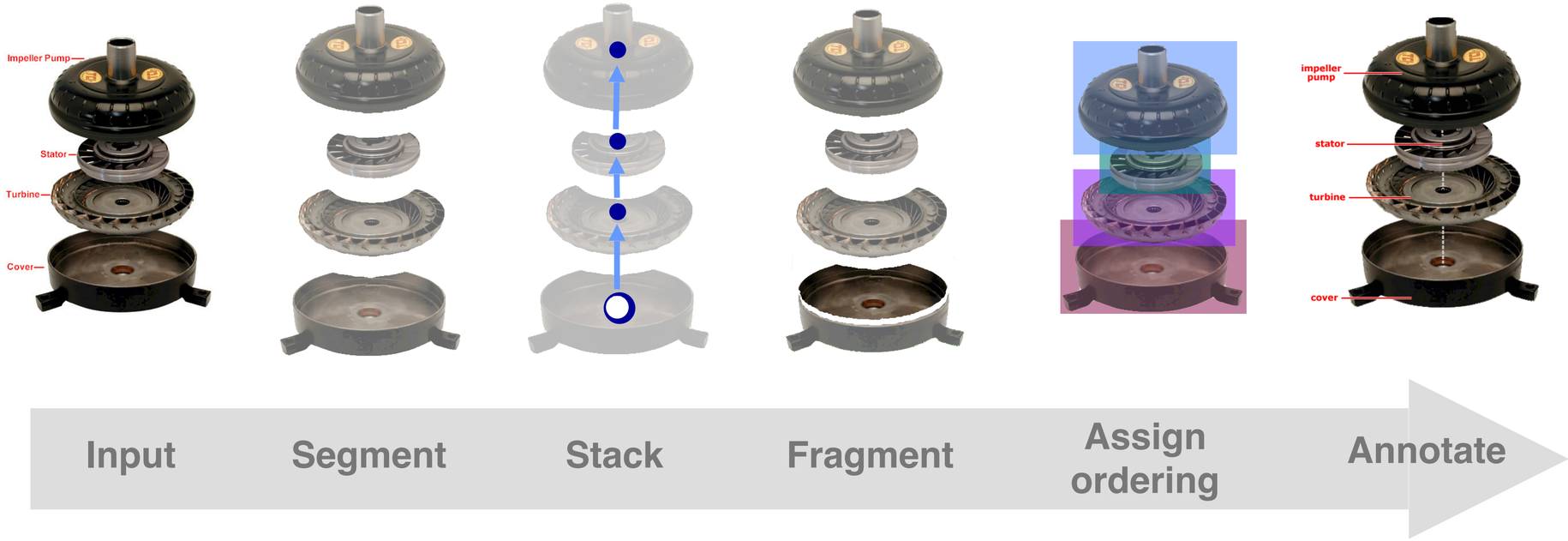
Reduce visual clutter

Interactive filtering [Shneiderman 96] [MacEachren 97]

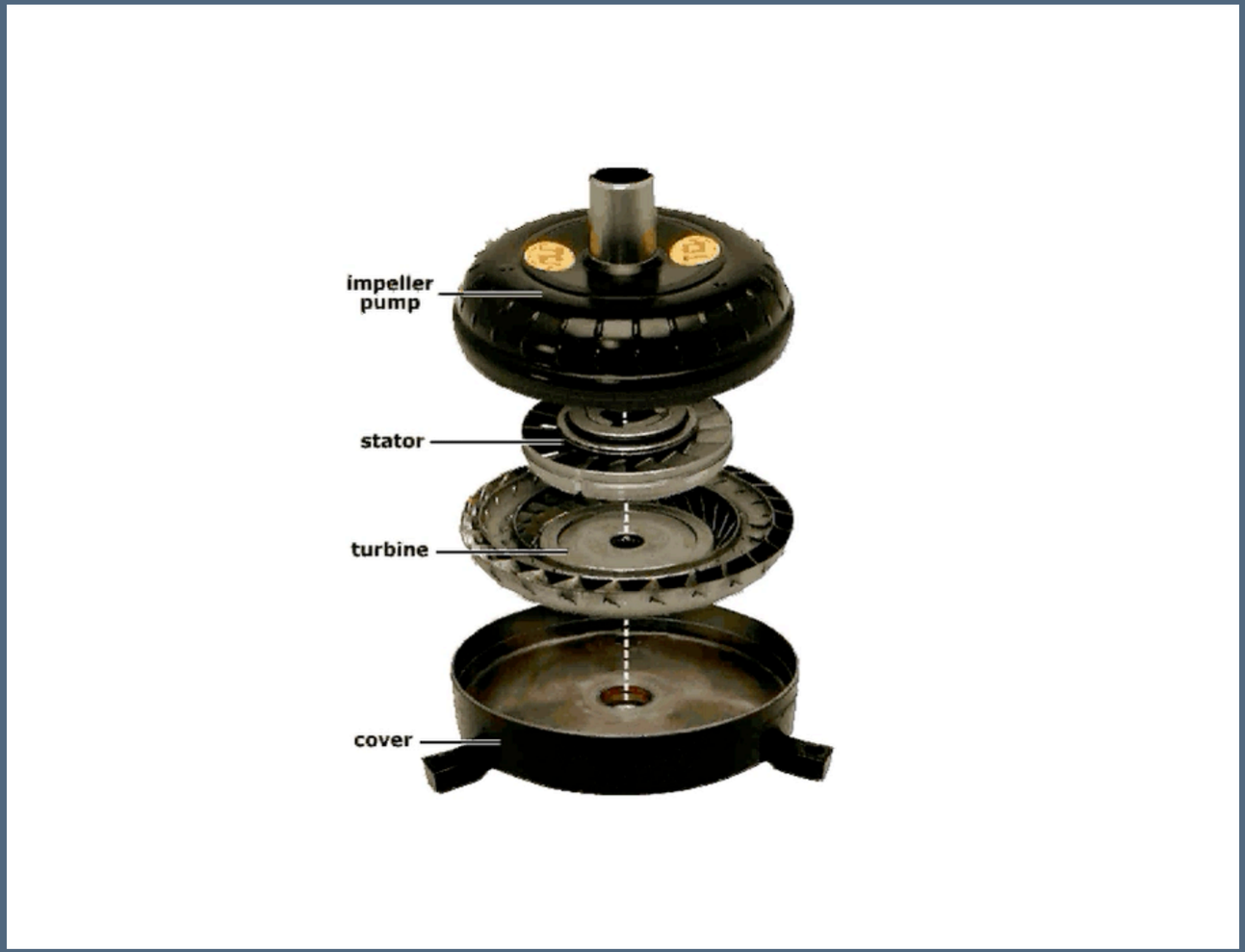
Highlight most important information [Tufte 83] [MacEachren 97]



Authoring Pipeline



Interactive Viewing



Summary

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

Approach generalizes across a wide range of categories, ranging from digital illustration to audio, video, instructions and exploded views

References

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