Content Creation

CS 347
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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).
Today

Design principles for visual communication

Illustration
Audio/video
Diagrams, maps, instructions

Collaborative content creation
Create.
Content creation tools

Design tools were focused on the designer as user.

What if the target user were instead an illustrator, movie editor, or poster designer?

Today's tools include...

- Photoshop
- ProTools
- Max/MSP
- iMovie
- After Effects
- Final Draft (screenplays)
Design principles for visual communication
Why is one more effective?

Task: get from Point A to Point B

Important information: sequence of stops or interchanges along the way

The classic tube map follows design principles:

- Straighten lines and evenly space stops to emphasize sequence
- De-emphasize the geographic shape of subway lines
Google Maps vs. Hand-drawn maps
Why is one more effective?

The exact route geometry is not important: [Tversky 2019]

It’s not drawn accurately when we create maps

And, it’s not even comprehended accurately when we look at maps

Design principles:

- Exaggerate road length
- Regularize turning angles
- Simplify road shape
From principles to algorithms

[Agrawala and Stolte 2001]
From principles to algorithms

[Agrawala and Stolte 2001]

Algorithm includes techniques to:

- Simplify the shapes in the original route map
- Grow short roads to emphasize them

Algorithmic approach: stochastic search

- Exploration space: a set of graphic elements (e.g., roads, labels) and visual attributes (e.g., position, orientation, size)
- Score: 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)
- Connect with prior work in human perception and cognition to determine important information
- Analyze techniques used to emphasize/de-emphasize information
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.
Illustration
Draco: kinetic textures

[Habib et al. 2014]
From principles to design

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

- Particle systems,
- Flocking behavior,
- Stochastic motion

System goal: author these effects without a technical background
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 master/insts
**Sketchpad**  
[Sutherland 1962]

First use of light pen  
First use of GUI windows  

Rubberband lines  
Constraint-based drawing  
Obj. oriented master/insts
Video and Audio
Basic metaphor: clip timeline
Design principle:
For dialogue-heavy video, editors operate on a script, not on video timelines.

Design response:
Empower editors to directly edit scripts, not video, and smooth the cuts automatically.

Algorithm: frame similarity graphs.
Design principle:
For dialogue-heavy video, editors operate on a script, not on video timelines.

Design response:
Empower editors to directly edit scripts, not video, and smooth the cuts automatically.

Algorithm: frame similarity graphs
Abel and Glass 1999

If you’re trying to make something that sounds like that interviews or documentary lectures on The American Life, you have to think the sound. It’s not as easy as you might think. In fact, editing is one of the great pleasures of working in radio. It’s like going to a kind of trance.

You can still sound on real-time tape, using a real microphone to identify cut sentences out of your story.

On good模拟 decks you can do basic editing but nothing too subtle. And then’s a lot of good software that lets you edit directly on a normal home computer (see pages 202-23).

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

That is a section of Philip Glassworth’s interview, reprinted into the editing software we use at The American Life. On the computer, sounds and words are graphically represented as waveforms, and edits are also visible, as virtual lines. Pauses are flat sections of time, and breaths are small waveforms. Notice how the breaths fall often at the ends of sentences, but sometimes in the middle.

Tightly, tightly there were scenes, perhaps more than a hundred...

How many organizations... meaning things like... (let’s say) a World Without Leaders...

What are we going to eat...

There are many..

If you remove a phrase or a sentence, you have to keep the rhythm natural. Usually that means keeping a breath after each sentence, or at the end 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).

Tightly, tightly there were scenes, perhaps more than a hundred...

There were many labor... (let’s say) 

The last Caritas team... or the last labor... (let’s say) the World Vision...

What are we going to eat...

Now are we going to eat...

If you remove a phrase or a sentence, you have to keep the rhythm natural. Usually that means keeping a breath after each sentence, or at the end 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).

Tightly, tightly there were scenes, perhaps more than a hundred...

In this region, the homeless were treated not like the service staff at a hotel, but as occupied people.

They were there to provide... (let’s say)

Philip Glassworth is one of the best interviews possible. He has surprising and moving stories to tell and many urgent and thoughtful things to say about these anecdotes. It took Nancy and I two full days to choose among the many stories and ideas, and to shave them down to zero and then...
Example musical underlay
from This American Life #441: "When Patents Attack!"

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]
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]
Visual communication: diagrams, maps, instructions
Assembly instructions

[Agrawala et al. 2003]

Cognitive design principles:

Construct small 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]
Tourist maps [Grabler et al. 2008]

Google Earth

Hand-drawn tourist maps
Tourist maps [Grabler et al. 2008]

Cognitive design principles:

Focus on landmarks, paths, districts, nodes, and edges

De-emphasize and reduce the size of less important areas
Exploded view diagrams

[Li et al. 2008]

Cognitive 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:
Collaborative content creation

A dash of social computing
Scratch: kids remix and create [Resnick et al. 2009]

Social: upload and remix others’ creations

All programming has been done online. This data has led to many papers on understanding notions of authorship and creative remixing.
The cost of collaboration

[Hill and Monroy-Hernández 2013]

Test common wisdom about creative collaboration

Dependent variable: likes on the Scratch web site as a measure of quality

Common wisdom: collaborations produce better results
   Result on Scratch: remixes of prior projects got fewer likes

Common wisdom: collaboration can improve functional items (e.g., code), not art (e.g., images, sounds)
   Result on Scratch: remixes of code-heavy projects got more likes
How might we enable crowds to achieve complex work such as writing short stories?

Unlike most crowdsourcing workflows, creative work requires tight interconnections between different parts of a story, and between the high-level goal and low-level text.
The Hot Air Balloon

A young boy named Malcolm finds himself alone in a runaway hot air balloon and accidentally travels to a city in the sky.

Malcolm found himself fascinated by the balloon. He imagined what it would be like to fly to some exotic location, soaring above the clouds. He closed his eyes and saw himself flying through the clouds. "Hey you!" he heard a voice shout. "What are you doing in my balloon!" The operator yelled as he dropped his snack and ran toward the balloon. Malcolm, startled by the man stumbled. Trying not to fall he reached out and grabbed a rope hanging next to him. As he pulled it, it released the ballast and the balloon leapt into the air. Before he knew it he was rising up too fast for comfort. Horrified he looked down...
relief as he felt the balloon descend a bit. Then suddenly a great gust of wind took the balloon and sent it higher and higher. Fell to the floor, grabbing a lever on the way down that made the balloon rise even faster.

Answer the following questions about the story:

What did you like about the story above?
I like...

What do you wish you could change about the story above?
I wish...

Is the wish you wrote above mostly about the plot, the characters, or the writing? (select one)
Choose...

In one sentence, suggest something for the next revision of the story that could change to address your comments above.
Start your sentence with the words "What if...". Try to write something specific that fits the story.
What if...
The story above! Which change should be the main change for the next revision?

<table>
<thead>
<tr>
<th>Detail and imagine throughout.</th>
<th>Think about what you wish you could change about the story. Which statement below do you agree with most?</th>
<th>Which new idea below do you think should be the main change for a revision of the story above?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I wish there would be a bit more exposition at the beginning of the story. The events all start very quickly and it's easy to not understand what's going on.</td>
<td>What if instead of beginning so abruptly, we learned a little more about Malcolm first?</td>
</tr>
<tr>
<td></td>
<td>The order of the paragraphs. It jumped all over the place.</td>
<td>What if... We wrote a new story about hot air balloons and a mistaken escape?</td>
</tr>
<tr>
<td>hot air balloon</td>
<td>I want to see more exciting things happen to Malcom in Cloud City, and I want to know about his return to the ground.</td>
<td>What if Malcom investigates the Cloud City and then tries to get home, maybe bringing along a friend from Cloud City.</td>
</tr>
</tbody>
</table>
When he woke up, he found himself staring at a glow of big, beautiful crystal-like glass buildings, shimmering in the brilliant sunshine. One was emerald green, another ruby red, still another sparkling like diamonds, others radiating spectacular colors he had never seen. He was a little scared, to be in an unfamiliar place, but he was mostly curious. He could sense that something interesting was going on in this city, and it could be something wonderful. Maybe there were helpful people down below? Perhaps he should take a little gander and see if he can get some help with the balloon.

He suddenly found himself staring at gargantuan glass buildings, their exteriors shimmering under the sun's rays. These buildings were like no others he'd seen before - one was emerald colored, another ruby red, and a third sparkling like a multifaceted diamond. This scenery was frightening, yet, he was curious. Something was going on in this city, and it could be something wonderful. Maybe there were helpful people down below? Perhaps he should take a little gander and see if he can get some help with the balloon.
Summary

Design principles provide strong guides for content creation tools: characterize principles and patterns in expert output, verify them against cognitive and perceptual principles, and systemize them into algorithms to aid content creators.

This approach generalizes across a wide range of categories, ranging from illustration to audio, video, diagrams, maps, and instructions.

Social computing tools offer mechanisms for collaborative creation by forking others’ ideas or engaging in structured collaboration activities to riff on each others’ work.
References


Sutherland, Ivan E. "Sketch pad a man-machine graphical communication system." Proceedings of the SHARE design automation workshop. 1964.
