Creating **Visual Metaphors** with Crowds and Machines

**Inputs:** Two Concepts

<table>
<thead>
<tr>
<th>Starbucks</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brainstorm associations</strong></td>
<td><strong>beach, sun, swim</strong></td>
</tr>
<tr>
<td>store, frappuccino</td>
<td></td>
</tr>
<tr>
<td><strong>Find images of objects</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Annotate shapes</strong></td>
<td></td>
</tr>
<tr>
<td>Starbucks, frappuccino</td>
<td></td>
</tr>
<tr>
<td><strong>Annotate coverage</strong></td>
<td></td>
</tr>
<tr>
<td>All of object</td>
<td>Part of object</td>
</tr>
<tr>
<td>Part of object</td>
<td>Part of object</td>
</tr>
<tr>
<td><strong>Synthesize blends</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Evaluate</strong></td>
<td></td>
</tr>
<tr>
<td>Objects are integrated</td>
<td>Both objects are identifiable</td>
</tr>
</tbody>
</table>

**Output:** A visual blend
My background **Crowdsourcing:**
Decompose a problem and let people do the tasks a computer can’t
Microtask Crowdsourcing
Pay people to do microtasks on Amazon’s Mechanical Turk
Problems too hard for one person

You (misspelled) (several) (words). Please spellcheck your work next time. I also notice a few grammatical mistakes. Overall your writing style is a bit too phoney. You do make some good (points), but they get lost amidst the (writing). (signature)
Iteratively Improve the Transcription: Allow people to build on the clues from the last person.

You (misspelled) (several) (words).

You (?) (?) (?) (work).

You (?) (?) (?) (work).

(?) (?) (?) (?).
Many iterations of TurKit

version 1:
You (?) (?) (?) work). (?) (?) (?) work (not) (time). I (?) (?) a few grammatical mistakes. Overall your writing style is a bit too (phoney). You do (?) have good (points), but they got lost amidst the (writing). (signature)

version 2:
You (?) (?) (saved) (work). (?) (?) (?) work (not) (time). I (?) (?) a few grammatical mistakes. Overall your writing style is a bit too (phoney). You do (?) have good (points), but they got lost amidst the (writing). (signature)

version 4:
You (misspelled) (several) (words). (?) (?) (?) work next (time). I also notice a few grammatical mistakes.

version 5:
You (misspelled) (several) (words). (Plan?) (spell-check) (your) work next time. I also notice a few grammatical mistakes. Overall your writing style is a bit too phoney. You do make some good (points), but they got lost amidst the (writing). (signature)

version 6:
You (misspelled) (several) (words). Please spell-check your work next time. I also notice a few grammatical...
Can you decompose something “creative”? 
Outline

• Define Visual Metaphors
  • Can viewers infer the message from a visual metaphor?
• Creating Visual Metaphors (with crowds and machines)
• Refining Visual Metaphors
Brazil + Takes Off
Brazil + Takes Off

Tabasco + Hot
Definition of Visual Metaphors

1. Two concepts:
   1. a concrete noun
   2. an abstract property.
2. Two objects: one representing each concept
3. Two objects are integrated into one object
4. Both objects are individually recognizable.

Concrete: Starbucks
Abstract: “summery”

Objects: Starbucks logo + sun

Not a visual blend. Objects not integrated

Not a visual blend
Objects not integrated into one object

A visual blend
Two objects integrated, both objects recognizable
Connection to Literary Metaphors:  Apply abstract properties to a concrete noun

“"The classroom was a zoo.""

Zoo properties:
• Has wild animals
• Animals are in cages
• People can view them

Message: The classroom was wild.

The reader must infer:
* what property of zoo applies to classroom.

Tabasco + fire extinguisher.

Fire extinguisher properties:
• For dangerous hot situations
• Puts out fires

Message: Tabasco is dangerously hot.

The viewer must infer:
• the direction of the metaphor and
• what property to apply.

Why not “Fire Extinguishers taste spicy”?
Outline

• Define Visual Metaphors
• Can viewers infer the message from a visual metaphor?
• Creating Visual Blends (with crowds and machines)
• Refining Visual Blends
Most visual Metaphors have supporting text. Do viewers need the supporting text to understand the metaphor?
Study: Can people infer the message from Visual Metaphors without the text?

Mturk study.
• 24 professional VMs
• 10 workers each
• Give them 4 examples of VMs
• Ask them:
  • What are the two objects?
  • What is the message?

People infer the two objects **85% of the time**.

People infer the message (without text) **49% of the time**.
Open question: Why do people infer some messages and not others?

<table>
<thead>
<tr>
<th>Message</th>
<th>Objects</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Brazil is taking off&quot;</td>
<td>6 / 10</td>
<td>0 / 10</td>
</tr>
<tr>
<td>&quot;McDonald’s has WiFi&quot;</td>
<td>4 / 10</td>
<td>2 / 10</td>
</tr>
<tr>
<td>&quot;Nike makes you healthy&quot;</td>
<td>10 / 10</td>
<td>6 / 10</td>
</tr>
<tr>
<td>&quot;Coffee turns you on&quot;</td>
<td>9 / 10</td>
<td>8 / 10</td>
</tr>
</tbody>
</table>
Hypothesis: People are more likely to get the message if the message is already familiar.

Familiar Messages:
- “Tabasco is hot”
- “Global warming”
- “Nike is healthy”
- “Cigarettes kill”
- “Coffee turns you on”
- “The classroom was wild”

Unfamiliar Messages:
- “Brazil is taking off”
- “McDonalds has Wifi”
There are **valid alternate** interpretations

**Objects:**
- Christ statue
- Rocket

**Meaning:**
- “The ascension of Christ”
- “Christianity is taking off”
- “Jesus is a blast!”
When interpreting symbols, first associations are better than logic.

Objects:
• Tabasco bottle
• Fire extinguisher

Association:
• Dangerous / Hot

“But doesn’t a fire extinguisher put out heat. So the meaning should really be that Tabasco is not hot.”
Outline

• Define Visual Metaphors
• Can viewers infer the message from a visual metaphor?
• Creating Visual Blends with crowds and machines
• Refining Visual Blends
Challenge: Blending Objects

1. Two concepts:
   1. a concrete noun
   2. an abstract property.
2. Two objects: one representing each concept
3. **Two objects are integrated into one object**
4. Both objects are individually recognizable.

Concrete: Starbucks
Abstract: “summery”

Objects: Starbucks logo + sun

Not a visual blend.
Objects not integrated

Not a visual blend
Objects not integrated into one object

A visual blend
Two objects integrated, both objects recognizable
Superficially, these images have nothing in common.

Brazil + Takes Off

Tabasco + Hot

Earth + Melt
Design Pattern: Single Shape Mapping

1. Two objects are integrated into one object
2. Both objects are individually identifiable
Removed Video
Removed Video
Creating Visual Blends can be seen as a constraint based search problem.

For a pair of concepts, search for pairs that follow the single shape matching pattern.
Starbucks + Summer
**Inputs:** Two Concepts

- Starbucks
- Summer
<table>
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<th><strong>Brainstorm associations</strong></th>
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<th><strong>Summer</strong></th>
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<tbody>
<tr>
<td></td>
<td>store, frappuccino</td>
<td></td>
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<tr>
<td>Brainstorm associations</td>
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</tr>
<tr>
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<td>-------------------------</td>
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<td>--------</td>
</tr>
<tr>
<td>Find images of objects</td>
<td><img src="image" alt="Starbucks Store" /></td>
<td><img src="image" alt="Starbucks Frappuccino" /></td>
</tr>
<tr>
<td>Annotate shapes</td>
<td><img src="image" alt="Starbucks Store" /></td>
<td><img src="image" alt="Starbucks Frappuccino" /></td>
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**Inputs:** Two Concepts

- Starbucks: store, frappuccino
- Summer: 

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<td>associations</td>
<td>store, frappuccino</td>
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</tr>
<tr>
<td><strong>Find</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>images of objects</td>
<td><img src="image" alt="Starbucks logo" /> <img src="image" alt="Frappuccino" /></td>
<td><img src="image" alt="Starbucks logo" /> <img src="image" alt="Frappuccino" /></td>
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<td><strong>Annotate</strong></td>
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</tr>
<tr>
<td>shapes</td>
<td><img src="image" alt="Starbucks logo" /> <img src="image" alt="Frappuccino" /></td>
<td><img src="image" alt="Starbucks logo" /> <img src="image" alt="Frappuccino" /></td>
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<tr>
<td><strong>Annotate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>coverage</td>
<td><em>All of object</em></td>
<td><em>Part of object</em></td>
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<td><strong>Find images of objects</strong></td>
<td></td>
<td><img src="image1.png" alt="Image" /> <img src="image2.png" alt="Image" /></td>
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<tr>
<td><strong>Annotate shapes</strong></td>
<td><img src="image3.png" alt="Image" /> <img src="image4.png" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td><strong>Annotate coverage</strong></td>
<td>Part of object</td>
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<th>Find images of objects</th>
<th><img src="image1.png" alt="Starbucks" /></th>
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<tr>
<th>Annotate shapes</th>
<th><img src="image3.png" alt="Starbucks" /></th>
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<td></td>
</tr>
<tr>
<td><strong>Find</strong> images</td>
<td>![Starbucks logo]</td>
<td>![Popsicle] ![Sun]</td>
</tr>
<tr>
<td>of objects</td>
<td>![Image of frappuccino]</td>
<td>![Image of beach, sun, swim]</td>
</tr>
<tr>
<td><strong>Annotate</strong></td>
<td>![Starbucks logo]</td>
<td>![Image of popsicle]</td>
</tr>
<tr>
<td>shapes</td>
<td>![Image of frappuccino]</td>
<td>![Image of sun]</td>
</tr>
<tr>
<td><strong>Annotate</strong></td>
<td><strong>All of</strong> object</td>
<td><strong>Part of</strong> object</td>
</tr>
<tr>
<td>coverage</td>
<td>![Image of frappuccino]</td>
<td>![Image of sun]</td>
</tr>
<tr>
<td></td>
<td><strong>Part of</strong> object</td>
<td></td>
</tr>
<tr>
<td></td>
<td>![Image of frappuccino]</td>
<td>![Image of sun]</td>
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<td></td>
<td>beach, sun, swim</td>
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</table>

| **Find images of objects** | ![Starbucks](image1.png) | ![Frappuccino](image2.png) | ![Beach](image3.png) | ![Sun](image4.png) |

| **Annotate shapes** | ![Starbucks](image1.png) | ![Frappuccino](image2.png) | ![Popsicle](image5.png) | ![Sun](image4.png) |

| **Annotate coverage** | All of object | Part of object | Part of object | Part of object |

| **Prototype blend** | ![Starbucks](image1.png) | ![Sun](image4.png) |
Inputs: Two Concepts

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<td>Annotate shapes</td>
<td>![Starbucks icon]</td>
<td>![Summer icon]</td>
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<tr>
<td>Annotate coverage</td>
<td>All of object</td>
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<td></td>
<td>Part of object</td>
<td>Part of object</td>
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</table>

Prototype blend

Evaluate prototype

Two objects are integrated into one object
Both objects are identifiable
Two objects are integrated into one object
Both objects are identifiable
Inputs: Two Concepts

Brainstorm associations
Find images of objects
Annotate shapes
Annotate coverage
Prototype blend
Evaluate prototype

Starbucks
- store, frappuccino

Summer
- beach, sun, swim

Two objects are integrated into one object
Both objects are identifiable
Complications with finding images

There are many restrictions on what images we pick.
Could you just use Google image search?
Complications with annotating shapes

Is the object “flat” or “deep”?
Complications with annotating shapes

Are the parts outside the object important enough to identify it.
Two studies

• Can people independently do these tasks and find blends for random concept pairs?
  • How many iterations does it take?
• Can people create visual metaphors for their own messages?
Study 1: Independent Microtasks

First iteration: 11 of 16 blends
Study 1: Independent Microtasks

First iteration: 11 of 16 blends
Second iteration: 16 of 16 blends
Study 2: Blends for Messages

Public Service Announcement
“Wash your hands. It’s the smart move.”

Concept Pair:
Hand-washing + Smart
Study 2: Blends for Messages

Advertisement
“Joe’s Coffee: Open Late”

Concept Pair:
Joe’s Coffee + Night
Study 2: Blends for Messages

Advertisement
“Panel Discussion: Women in Computer Science”

Concept Pair:
Women + Computer Science
Study 2: Blends for Messages

Advertisement
“Join the Philosophy Dept’s Holiday Celebration”

Concept Pair:
Philosophy + Christmas
Study 2: Blends for Messages

News

“Football linked to lasting brain damage.”

Concept Pair:
Football + Dangerous
What goes wrong in the process? (And how we iterate to fix it.)
Lego + Valentine’s Day
Lego

Brainstorm associations

Find Images of objects

Annotate shapes

Annotate shape coverage

Shape covers All of object

Valentine’s Day

Blend

Shape covers Part of object

Evaluate

Are both objects identifiable?

Are two objects integrated into one object?
<table>
<thead>
<tr>
<th><strong>Brainstorm associations</strong></th>
<th>Lego</th>
<th>Valentine’s Day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><img src="image1" alt="Lego" /></td>
<td><img src="image2" alt="Valentine's Day" /></td>
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</table>

<table>
<thead>
<tr>
<th><strong>Find Images of objects</strong></th>
<th></th>
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<tr>
<td></td>
<td><img src="image3" alt="Find Images" /></td>
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<table>
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<tr>
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<tr>
<td></td>
<td><img src="image5" alt="Annotate" /></td>
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<tr>
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<th>Valentine’s Day</th>
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<tbody>
<tr>
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<tr>
<th><strong>Blend</strong></th>
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<tr>
<th><strong>Evaluate</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Are both objects identifiable?</td>
<td>✅</td>
</tr>
<tr>
<td>Are two objects integrated into one object?</td>
<td>✅</td>
</tr>
</tbody>
</table>
Football + Dangerous
Brainstorm associations

Find Images of objects

Annotate shapes

Annotate shape coverage

Blend

Evaluate

Are both objects identifiable?

Are two objects integrated into one object?
Brainstorm associations

Find Images of objects

Annotate shapes

Annotate shape coverage

Blend

Evaluate
  ✓ Are both objects identifiable?
  ✓ Are two objects integrated into one object?
NYC + Healthy
Brainstorm associations

Find Images of objects

Annotate shapes

Annotate shape coverage

Blend

Evaluate

No shape matches
Brainstorm associations
Find Images of objects
Annotate shapes
Annotate shape coverage
Blend
Evaluate
Are both objects identifiable?
Are two objects integrated into one object?
Orange + Healthy
Brainstorm associations
Find Images of objects
Annotate shapes
Annotate shape coverage
Blend
Evaluate
Are both objects identifiable?
Are two objects integrated into one object?
Shape covers Part of object
Shape covers All of object
Brainstorm associations

Find Images of objects

Annotate shapes

Annotate shape coverage

Blend

Evaluate

Orange

Shape covers All of object

Healthy

Shape covers Part of object

Exercise equipment
Orange

Brainstorm associations

Find Images of objects

Annotate shapes

Annotate shape coverage

Healthy

Shape covers All of object

Shape covers Part of object

Exercise equipment

Blend

Evaluate

Are both objects identifiable?

Are two objects integrated into one object?
When do we need to iterate?

**Improve object fit**

- Within same search space, meet other constraints.
  - Find versions of an object with different color, style, aspect ratio

**No matches**

- Focus on meeting a specific constraint:
  - Find symbols with a different shape

**Objects are not identifiable**

- Search in a new subspace
  - Find symbols with a different shape
Outline

• Define Visual Metaphors
• Can viewers infer the message from a visual metaphor?
• Creating Visual Blends with crowds and machines
• Refining Visual Blends
Could you just use **deep learning**?
Could you just use deep learning?

Fast Style Transfer
Fast Style Transfer: Lego + Popsicle
Fast Style Transfer: Apple + Burger
Fast Style Transfer: Apple + Burger *Parts*
We can’t just blend objects by applying the “style” of one to the other.

Instead, we can transfer visual properties individually:
* Color
* Internal details
* Shape mask
* Luminosity
Why is this blend better when the Starbucks logo is yellow?

Yellow is a highly identifying visual feature of the sun.

Although green is highly identifying of Starbucks, the internal details of the logo are identifying “enough” in any color.
Some blends don’t need refinement

iPhone + Turn off

Orange + Summer

Football + Dangerous
Apply **color** of one object to the other.
Apply internal details of one object to the other
Apply **shape mask** of one object to the other.
Apply *multiple visual features* of one object to another.
Use **Internal details** of Snowman
Use **shape mask** of snowman
Use **luminosity** channel of snowman
The Evolution of *Orange + Snowman*

Original: Shape replacement

Use **internal details** of snowman

Use **shape mask** of snowman

Use **luminosity** of snowman
Summary
Visual Metaphors blend two symbols into one object

1. Two concepts:
   1. a concrete noun
   2. an abstract property.
2. Two objects: one representing each concept
3. Two objects are integrated into one object
4. Both objects are individually recognizable.

Starbucks is “summer-y”

Single Shape matching
one design pattern for creating visual blends
People infer the message from Visual Metaphors **49% of the time**.

People infer the two objects **85% of the time**.

People infer the message without text **49% of the time**.
Creating Visual Metaphors can be seen as a constraint-based search problem.

(currently we need people to help with the search)
To refine blends, transfer visual features from one object to another individually.

- Original: Shape replacement
- Use **internal details** of snowman
- Use **shape mask** of snowman
- Use **luminosity** of snowman
Creating **VisualMetaphors** with Crowds and Machines

**Design Pattern**

- **Object A**
  - Shape: Sphere
  - Coverage: All

- **Object B**
  - Shape: Sphere
  - Coverage: Part

- **Visual Blend**

**Interactive Pipeline**

- **Inputs:** Two Concepts
  - Starbucks
  - Summer

  - Brainstorm associations
  - Find images of objects
  - Annotate shapes
  - Annotate coverage
  - Synthesize blends
  - Evaluate: Objects are integrated, both objects are identifiable

- **Output:** A visual blend

**Blends for Messages**

- Joe's Coffee
  - Wash your hands. It's the smart move.
  - Open late

- Football linked to lasting brain damage

**Tool for refining blends**

- Original: Shape replacement
- Use internal details of snowman
- Use shape mask of snowman
- Use luminosity of snowman