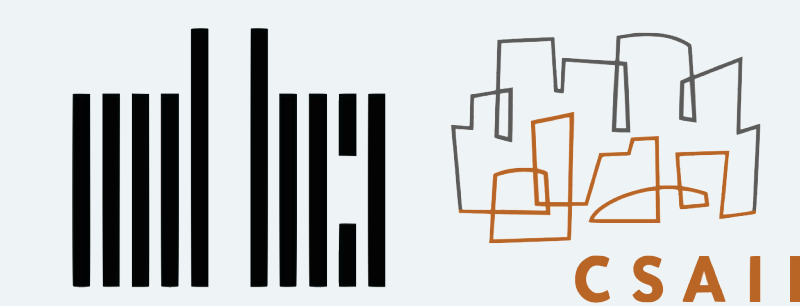


Enhancing How-to Videos with Crowdsourcing and Learnersourcing

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with Rob Miller (MIT CSAIL)



Crowdsourcing Step-by-Step Information Extraction to Enhance Existing How-to Videos
Juho Kim, Phu Nguyen, Sarah Weir, Philip J. Guo, Robert C. Miller, Krzysztof Z. Gajos. *CHI 2014*, to appear.

ToolScape: annotation-aware video player

Crowdsourcing workflow for annotating low-level step information

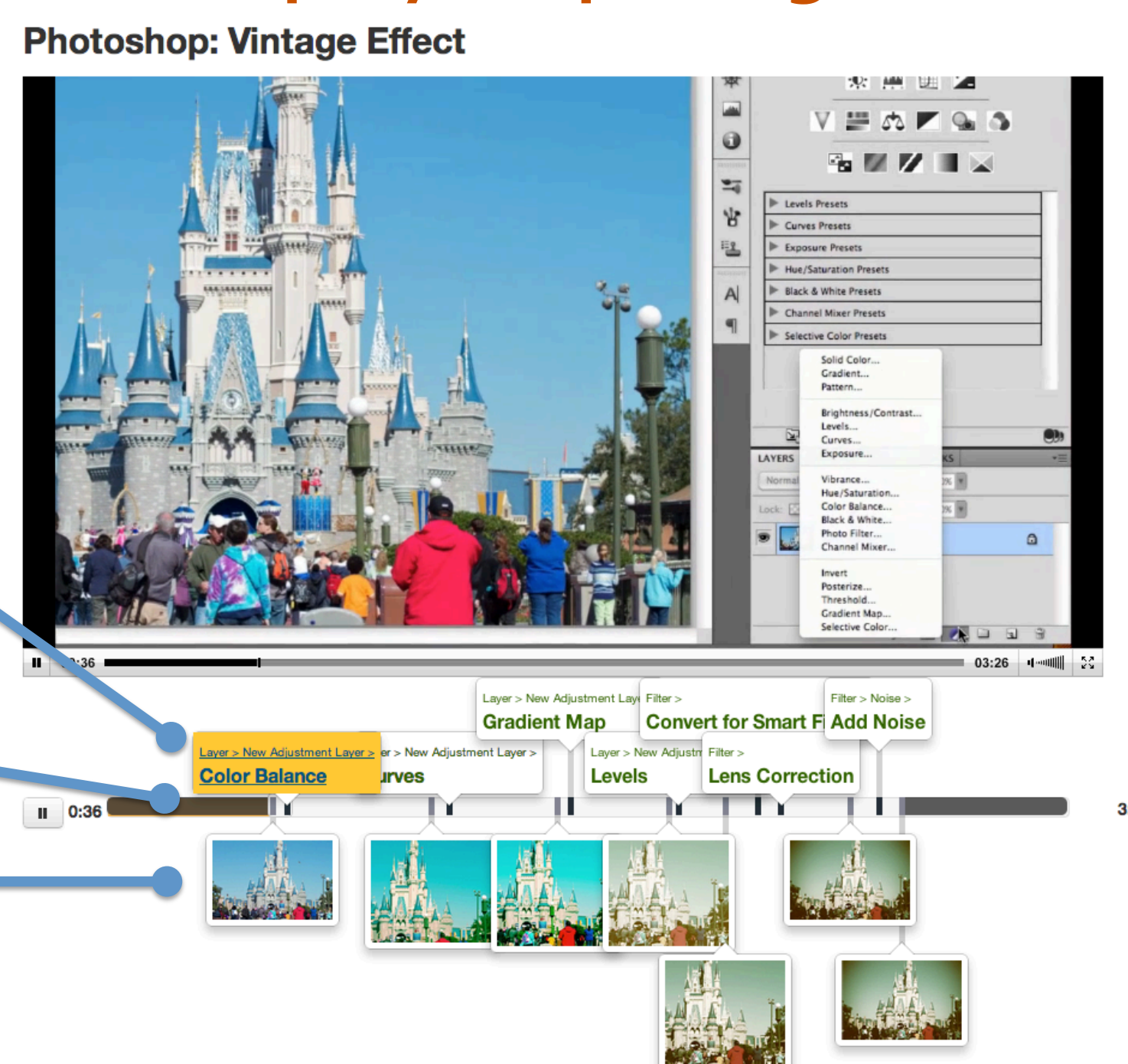
Learnersourcing workflow for annotating high-level goals

Motivation: How to design a video interface that is optimized for the **step-by-step structure** of how-to videos (e.g., cooking, makeup, Photoshop)?

Motivation: How to extract step-by-step information from thousands of existing how-to videos from various domains?

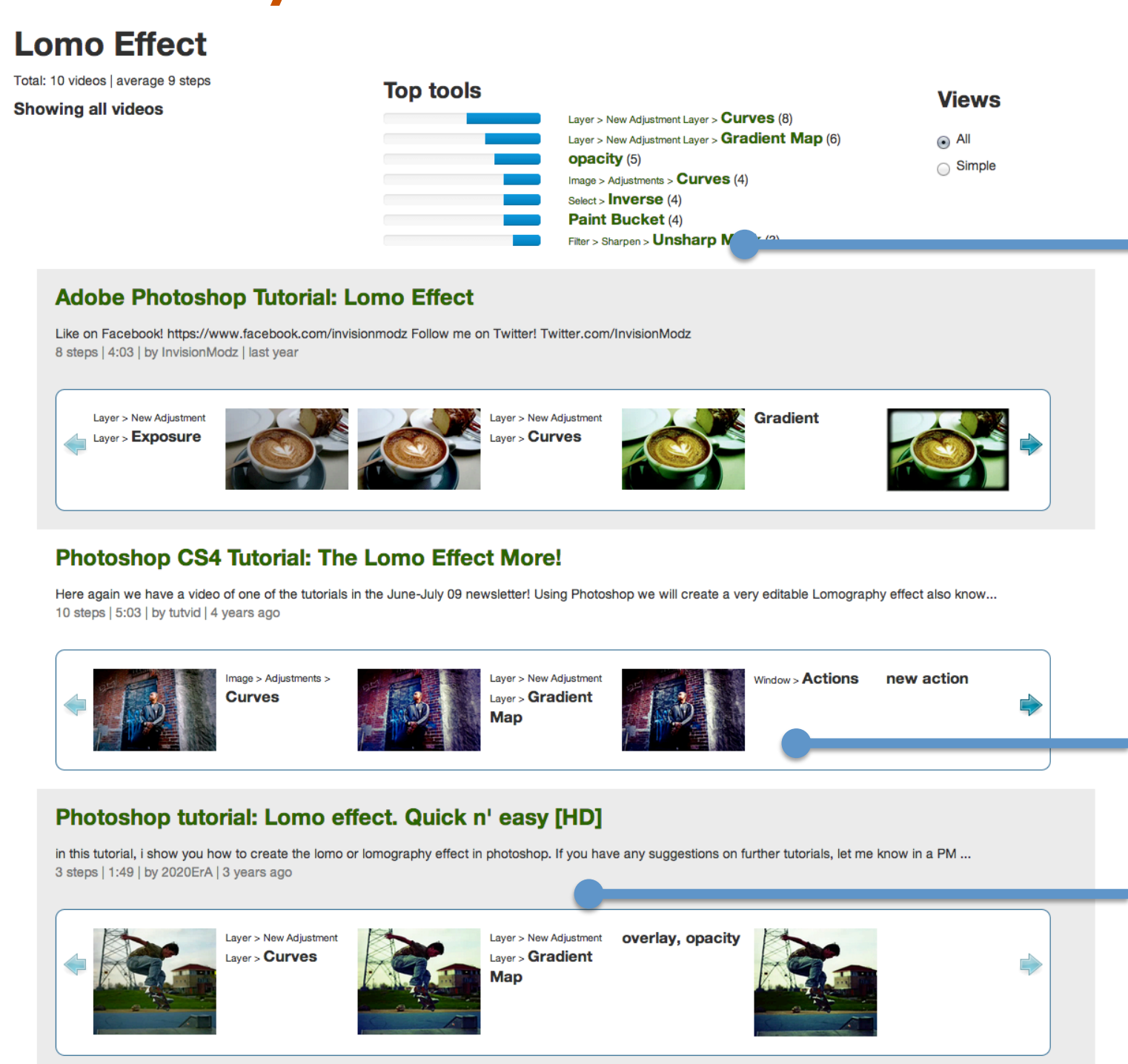
Motivation: Subgoal labels (high-level goals identified by grouping low-level steps) improve learning, but crowd workers often fail and experts are scarce. How to extract subgoal labels from thousands of existing how-to videos?

Interactive timeline: step-by-step navigation



- Navigate step-by-step
- Skip parts with no progress
- Track changes visually

Storyboard summarization: enhanced search



Steps sorted by frequency + faceted navigation

Storyboard summarization

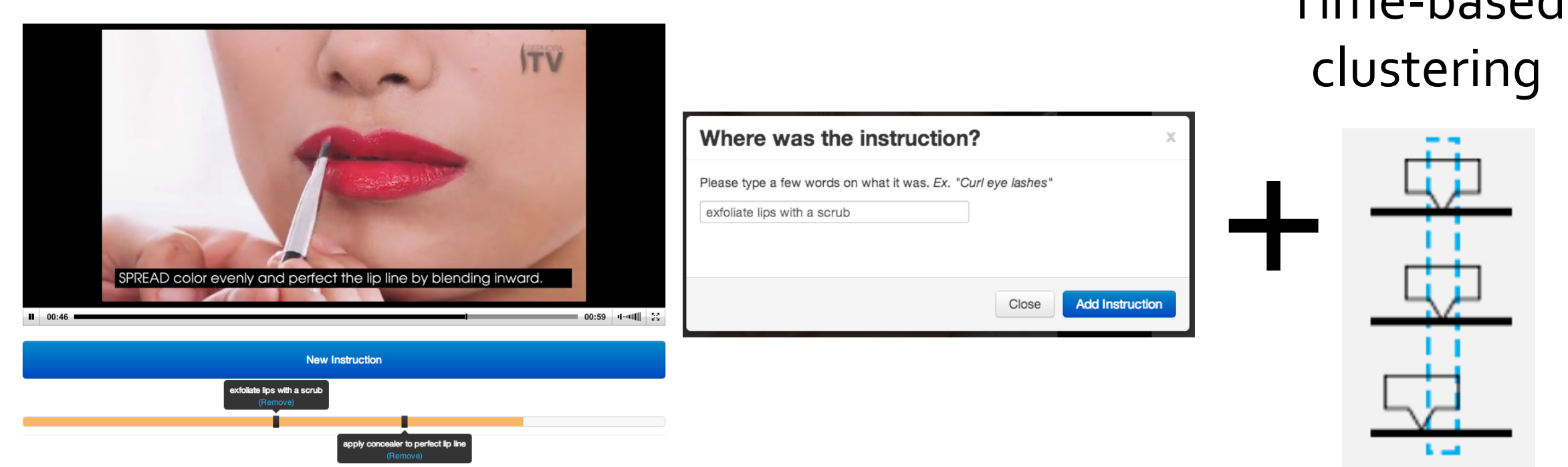
The number of steps

User study: image manipulation tasks

- Learners with ToolScape (vs ordinary video player)
- Frequently used interactive navigation (9 times per task)
 - Gained more self-efficacy in their skills
 - Rated their own work higher
 - Produced designs rated higher by external judges

Multi-stage crowdsourcing workflow

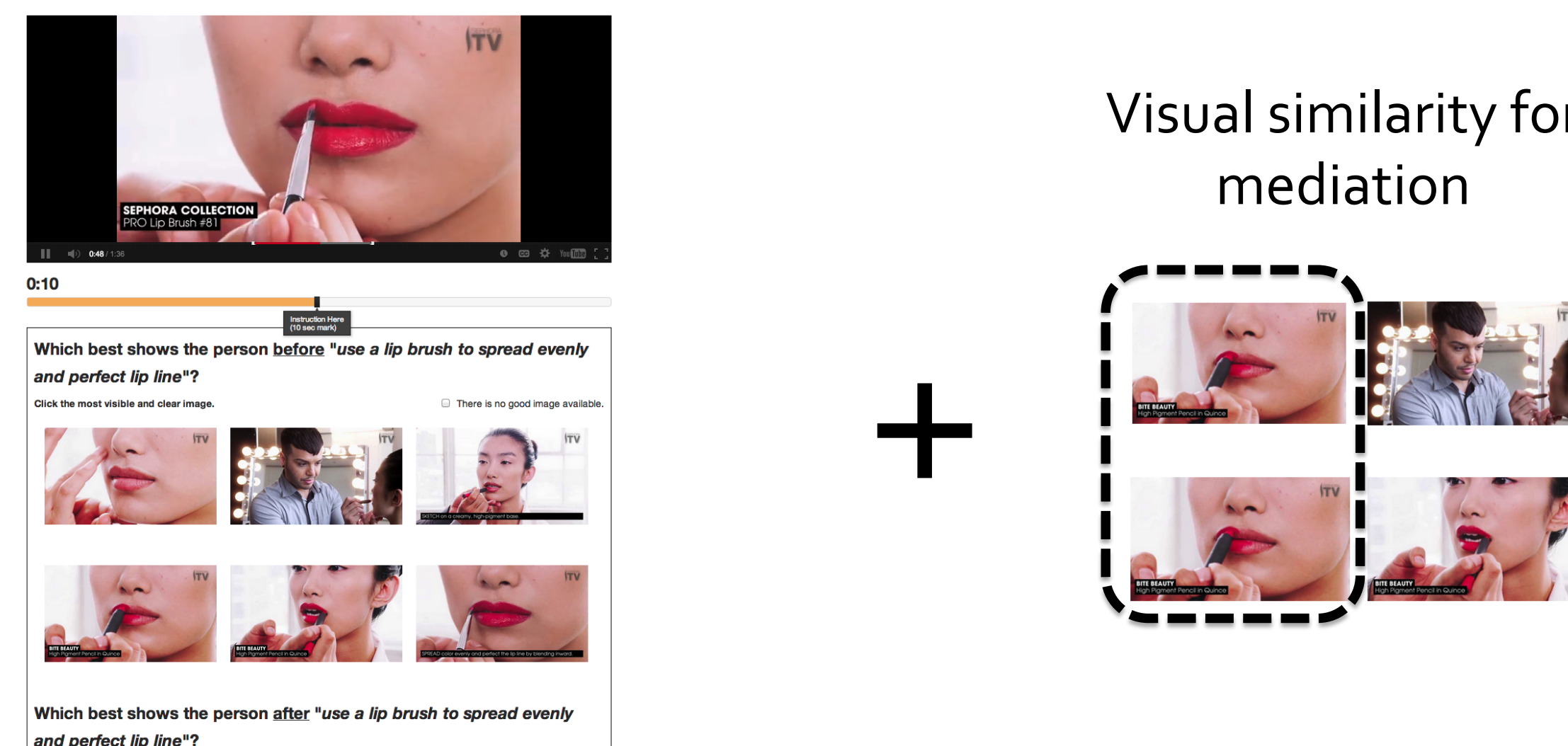
Stage 1: FIND candidate steps



Stage 2: VERIFY steps by voting or improving



Stage 3: EXPAND steps with before/after images



Learnersourcing: learners as a motivated and qualified crowd with pedagogically useful tasks

Stage 1: FIND candidate subgoals

What was the overall goal of the video section you just watched?

e.g. Mix the dry ingredients

Stage 2: VERIFY subgoals by voting or improving

Which of the following best describes the video section you just watched?

Choose the best answer or add your own.

- Materials you'll need to decorate your house with lights
- Collect necessary tools
- Preparation
- None apply

Stage 3: BALANCE subgoal scope & language

How to put Christmas lights on a house



Does this subheading accurately summarize the below steps?

Feel free to add your own or decide that none apply. Subheadings for the wiki outline should be consistent!

The subheading should be actionable, i.e. "Mix the dry ingredients" instead of "Dry ingredients".

- Subhead: Materials you'll need to decorate your house with lights
- Gather materials: tools, extension cord, lights, ladder
- This subhead applies
 - Replace subhead:
 - There should be no subheading here

Wiki Video Outline

Materials you'll need to decorate your house with lights

1. Gather materials: tools, extension cord, lights, ladder

Useful accessories

2. Use plenty of extension cords

3. Use a weather protected outlet strip

Notes before starting

4. Use a lighting timer if you'll be away from home

5. Make sure ladder is locked in place, secure, and stable

6. Use cord wraps and color-coded containers to store materials

Decide on method to fasten lights to your fascia

7. Optionally, use screws or staples to secure lights

Gutter hooks as alternative

8. Clip gutter hooks onto gutter

9. Snap in the wiring to the gutter hooks

Evaluation: 75 videos (cooking, makeup, Photoshop)

- Precision: 77%, Recall: 81% relative to trained annotators
- Timing error for extracted steps: 2.7 seconds on average
- 60% of before/after images rated to accurately represent steps
- Results consistent across all domains

Acknowledgements

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