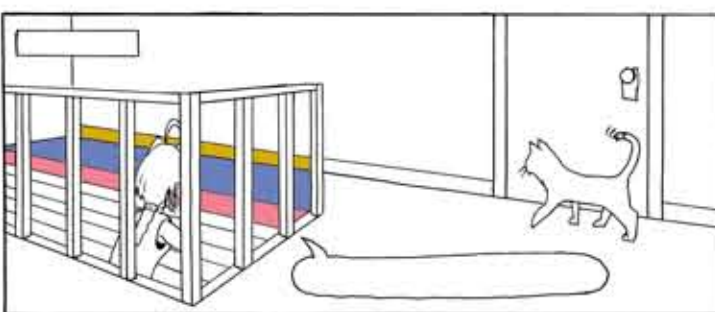


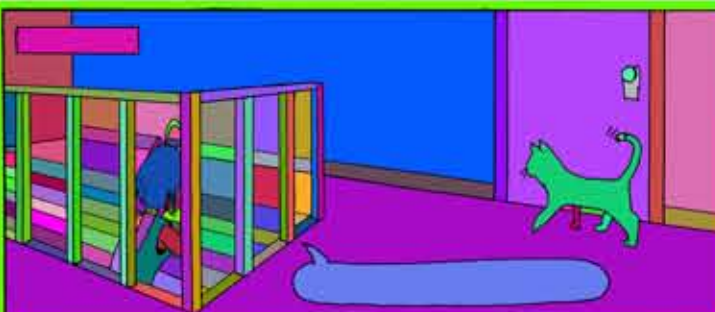
OCCLUSION AWARE DIGITAL COLOURING FOR COMICS

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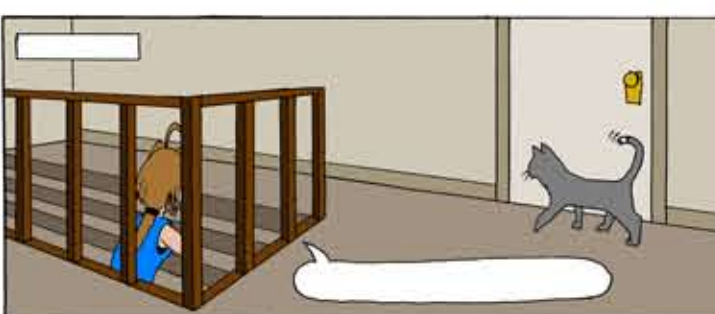
INTRODUCTION



Partially flattened image. Regions are outlined by hand and assigned a colour.



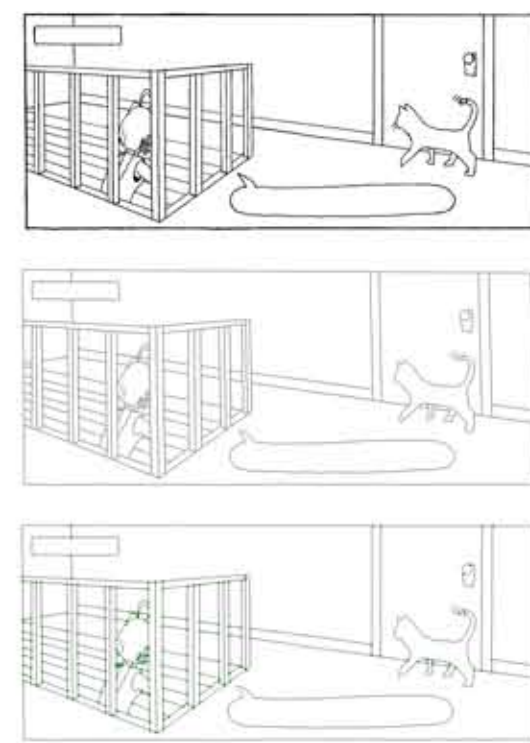
Output of a flattening plug-in: each image region has been assigned a colour. Parts of occluded objects, such as the stairs and baseboard, are all assigned different colours.



Final coloured image.

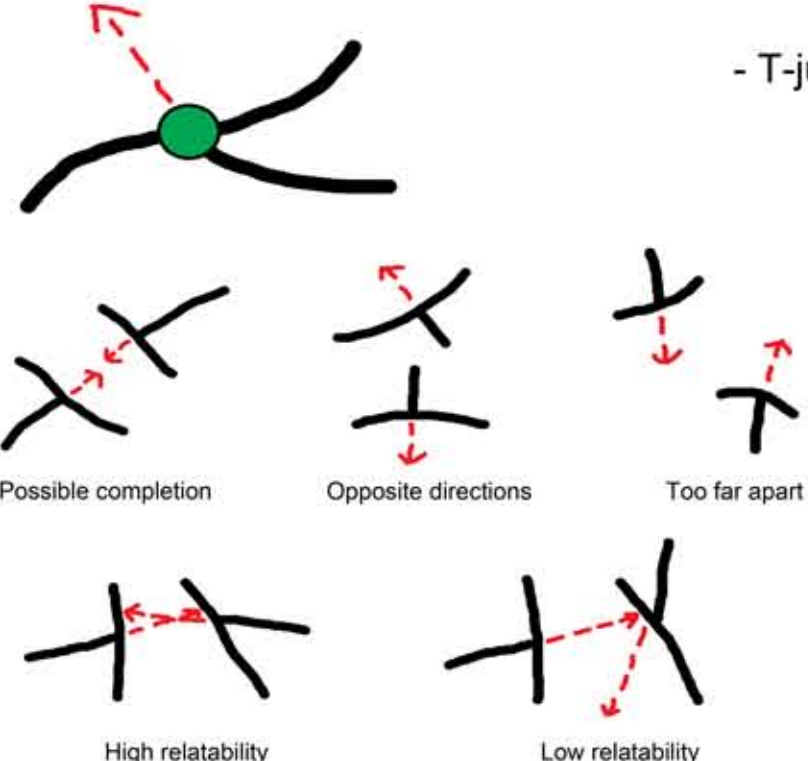
- "Flattening" is a standard process for digitally colouring comics
- Image regions are outlined by hand and assigned a colour
- Manual, labour intensive process
- Each image region must be coloured individually
- Occlusion may split objects into multiple regions
- We would like to colour multiple parts of an occluded object in a single interaction
- Low-level relationships in line drawings can reveal information about occlusions
- We present a framework that infers occlusion relationships in line drawings, inspired by perceptual cues
- We apply this framework to the problem of flattening in comics

PRE-PROCESSING



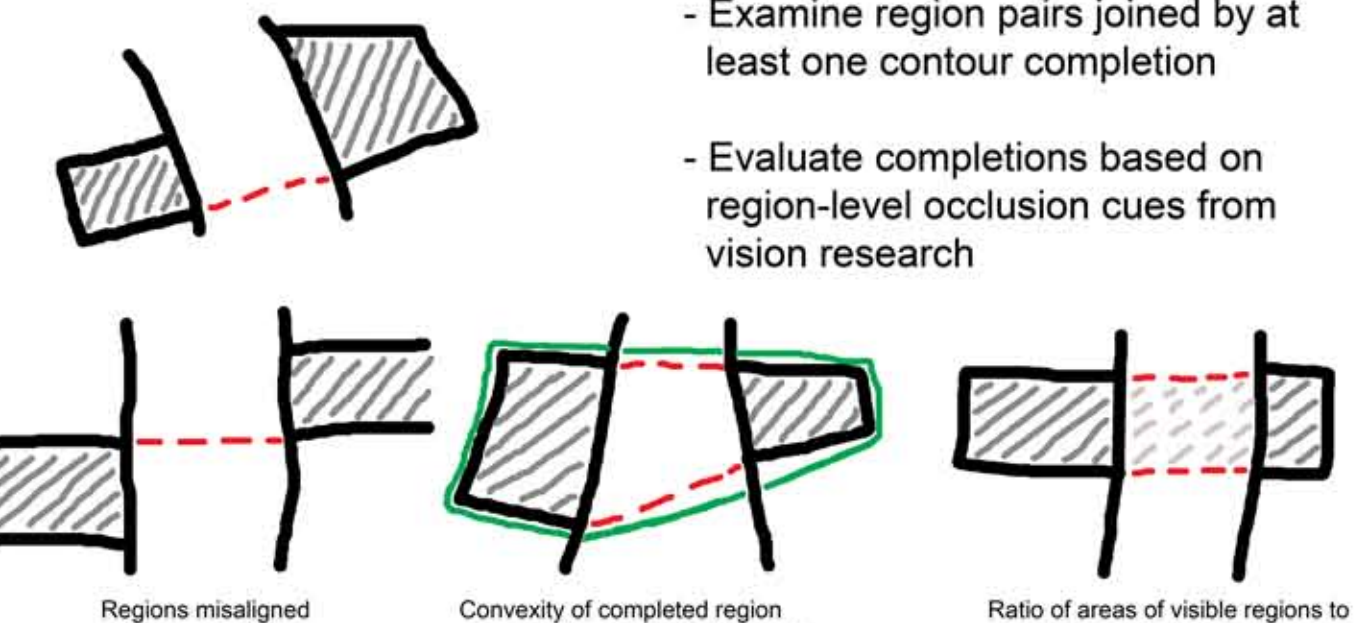
- Scan black and white line art
- Apply morphological line thinning
- Extract t-junctions

CONTOURS AND RELATABILITY



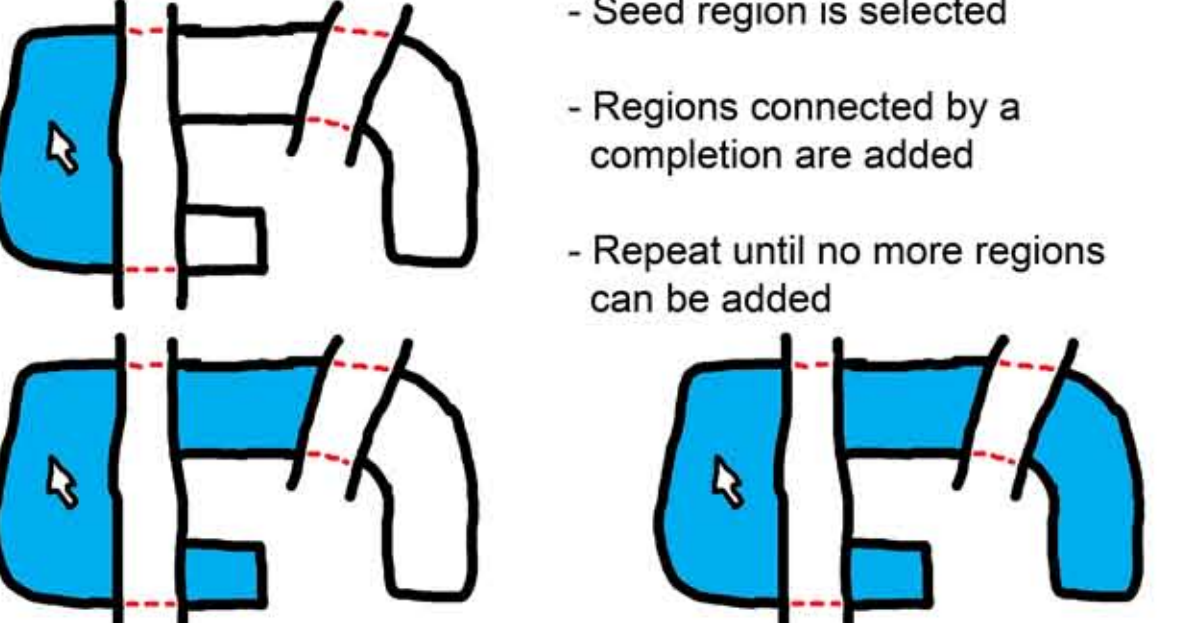
- T-junctions indicate possible occlusions
- Compare junction pairs
- Exclude pairs unlikely to form "completions" (perceived as single unit)
- Evaluate completions based on contour-level occlusion cues from vision research (such as relatability)

REGION COMPLETION



- Examine region pairs joined by at least one contour completion
- Evaluate completions based on region-level occlusion cues from vision research

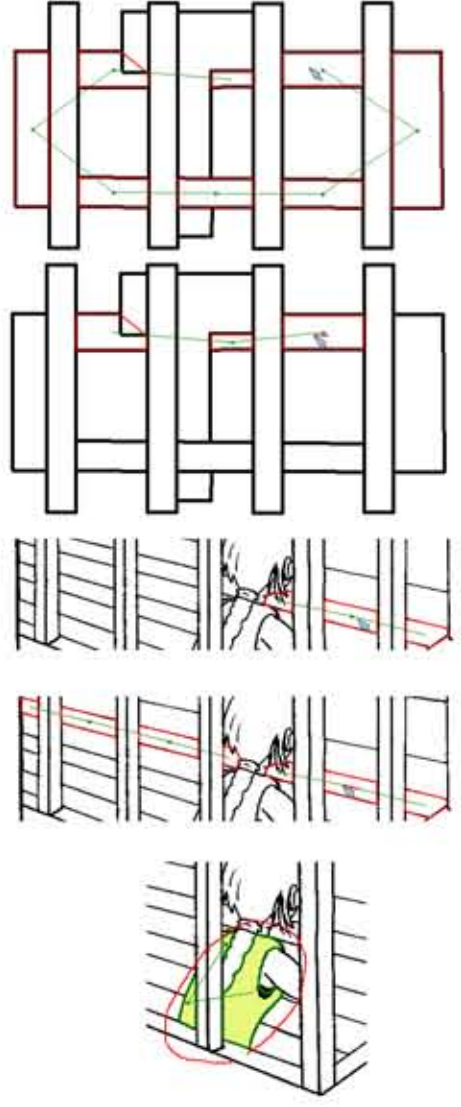
OBJECT CONSTRUCTION



- Seed region is selected
- Regions connected by a completion are added
- Repeat until no more regions can be added

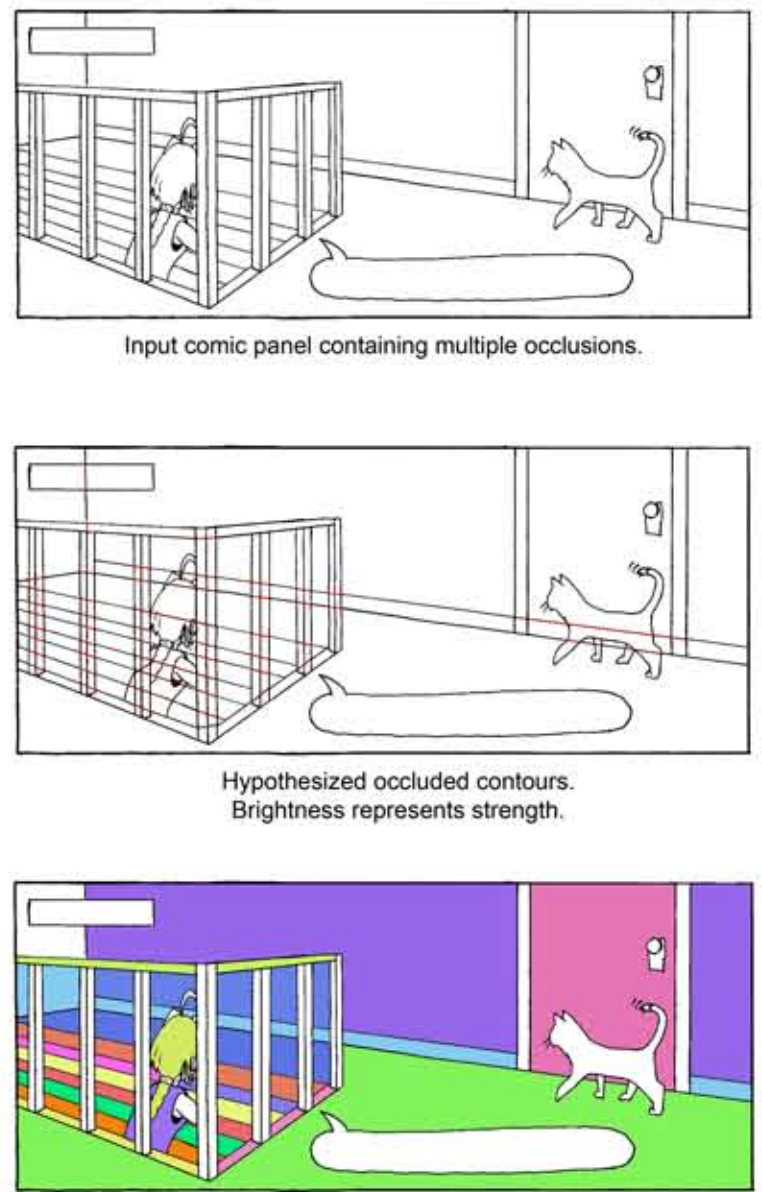
USER INPUT

- Gesture-based input is used to fix ambiguous or missed occlusion relationships

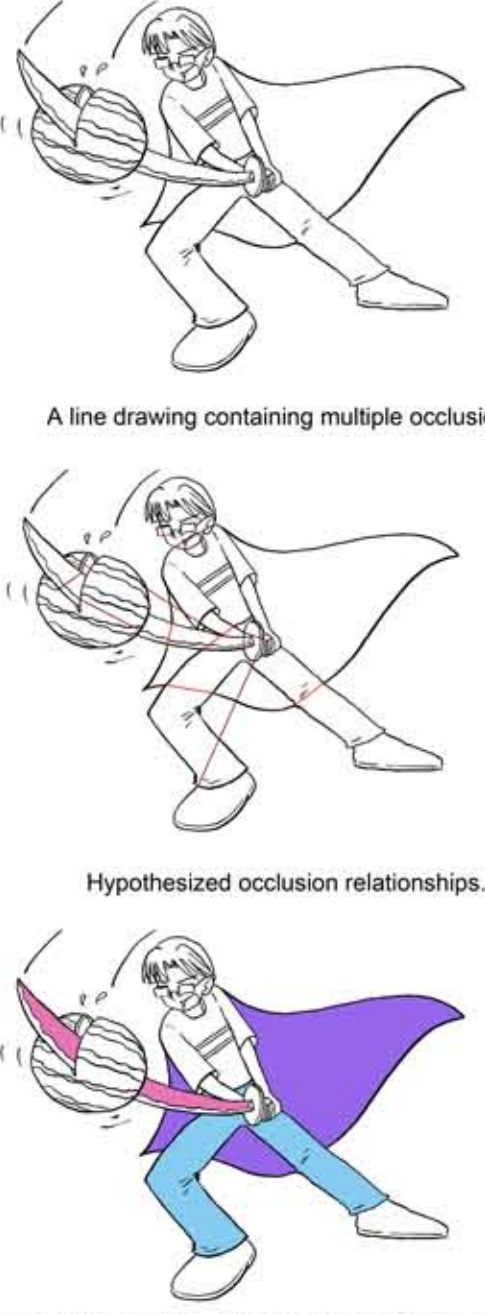


- Default object selection
- A short stroke limits selected regions based on stroke direction
- Weak occlusion cues cause some regions to be missed
- A long stroke extends the completion in the stroke direction
- A lasso-style curve adds a shape constraint to object construction

RESULTS



- Input comic panel containing multiple occlusions.
- Hypothesized occluded contours. Brightness represents strength.
- Coloured image. Occluded objects have been assigned temporary colours via a combination of single clicks, swipe and lasso gestures.



- A line drawing containing multiple occlusions.
- Hypothesized occlusion relationships.
- Abstract colours assigned to occluded objects. The cape and pants required a single click, the blade requires a "long swipe" gesture.

FUTURE WORK

- Improve handling of looser, more imprecise drawing styles (these are more sensitive to misalignments)
- Exploration of additional interactive techniques for refining results (e.g., multitouch)

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