Rewire: Interface Design Assistance from Examples

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Examples are critical in interface design.
Examples are used directly in protoyping.
Examples are used directly in prototyping.
There are some commercial tools for vectorization.
Path-based representation

Text - No ability to change size, font, color

Rectangles - Drag and resize each corner to change radii.

Output from commercial tools is difficult to edit.
Key Insight

Instead of focusing on visual fidelity, focus on semantic fidelity.

Represent UI components using higher-level semantic objects.

Apply Computer Vision & Pixel-Based Reverse Engineering to discover, and detect properties of interface shapes in a pixel-based image.
Overview

Motivation

Rewire Intro

Architecture

Evaluation
Motivating Scenario - Snapping and Alignment

Task: Replace bag icons with realistic bag images.
Motivating Scenario - Creating Design Variations

Maria

Task: Modify Shopping Cart page to mock up a book results page, and create a few design variations.
Motivating Scenario - Wireframing

Maria

Task: Show client high level overview.
Overview

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Evaluation
Rewire - 3 forms of design assistance

- Screenshot
- Smart-Snap
- Full Vector
- Wireframe
Motivating Scenario - With Rewire

Smart-Snap Mode

Task: Replace bag icons with realistic bag images.
Motivating Scenario - With Rewire

Task: Modify Shopping Cart page to mock up a book results page, and create a few design variations.

Full Vector Mode
Motivating Scenario - With Rewire

Maria

Task: Show client high level overview.
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Rewire Architecture - 3 Phases

1. Segmentation

2. Vectorization

3. Beautification

Input:
Pixel-Based Screenshot

Output:
Editable Artboard

Color: #FE4F55
Corner Radius: 5px
Segmentation

Discover, segment, and classify UI elements

Segmentation

- Text
  - Minimal Chic
  - Shop Bags
- Rectangle

Vectorization

- Shape Detectors
  - Text
  - Rectangles/Lines
  - Circles

Beautification

Tesseract OCR (https://github.com/tesseract-ocr/)
Vectorization

Segmentation

Text

Minimal Chic
Shop Bags

Rectangle

All

Cornet Radius: 5px

Vectorization

Background: #FE4F55

All

Font Color, Size, Baseline

Minimal Chic

Background color, Border, Corner Radii

Beautification

Corner Radius: 5px

Border

Corners

Prefab

(Dixon, et. al., CHI ‘10)
Beautification

Segmentation
- **Text**
  - Minimal Chic
  - Shop Bags

- **Rectangle**

Vectorization
- **Background**: #FE4F55
- **Corner Radius**: 5px

Beautification

Rewire beautifies:
- Shape Properties (e.g. alignment, distribution)
- Text Properties (e.g. baseline, font size)
Output - Design Assistance Modes

Segmentation
- Text
  - Minimal Chic
  - Shop Bags
- Rectangle
  - All

Vectorization
- Background: #FE4F55
- Corner Radius: 5px

Beautification
- Vector Shapes, Properties

Full Vector

Wireframe

Smart-Snap
- Leather Backpack
  - $289

Prototyping Tool: Xd
Overview

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Evaluation
Evaluation

Technical

User Study
Technical Evaluation Results

• Good accuracy for text detection, text properties, and geometric shape properties

• Geometric shape identification not as accurate due to:
  • Natural Images
  • Small shapes
  • Variety of representations for shapes (e.g. path for circle)
User Study - Research Questions

Do Rewire’s modes of design assistance improve the *accuracy* and *efficiency* of designers?

What aspects of each design assistance mode do designers like and dislike?
User Study - Participants & Tasks

16 UX Designers

Task
Produce a vector representation of all of the UI shapes and properties in the screenshot.

Rewire Modes
1. Smart-Snap
2. Full Vector

Baseline Modes
3. Screenshot Only
4. Ideal Vector
User Study - Artifacts

Original

Variations

Design Spec
Quantitative Results - Speed

- **Full vector** significantly faster than **Smart-Snap** and **Screenshot Only**

  \[t(11) = 3.26, \ p' < 0.008, \ d=0.91\]

- **Smart-Snap** significantly faster than **Screenshot Only**

  \[t(11) = 4.32, \ p' < 0.002, \ d=1.07\]

- **Screenshot Only** significantly faster than **Ideal Vector**

  \[t(11) = 2.20, \ p' < 0.025, \ d=0.36\]
Quantitative results - Accuracy

- Measured by average pixel distance
- No significant differences between pairs of conditions
- Rewire modes helped designers complete the tasks quicker with no accuracy tradeoffs
Designers rankings of modes

- Ideal vector was the most preferred, and both Rewire modes preferred over screenshot only.
- Most important factors in rankings were perceived effort and time.
- Full Vector required more fixes, so designers felt it was more work.
Designers’ Feedback - Non Rewire Modes

Ideal Vector

P11: “It was way easier. Now I can spend my time working on actual design.”

Screenshot Only

More difficult, more tedious, less accurate
Designers’ Feedback

Smart-Snap

Easier and quicker to achieve a more accurate alignment (8 designers)

Easier to get the correct size and shape (5 designers)

P5: “The snapping guidelines are helpful and make for most accurate tracing of shapes - much better than doing them by hand.”
Designers’ Feedback

Full Vector

Designers liked auto-generated shapes and text (9 designers), and required less effort than Screenshot Only mode (4 designers)

Designers did not like manually fixing issues in output (6 designers)

P11: “It requires more brain computing to determine how much more needs to be done. I would prefer to have it draw only the objects it is most confident about.”
Summary & Future Work

• Designers preferred Rewire modes to only a screenshot.

• Most important factors were accuracy and time.

• Future work
  • Designer in the loop repair
  • Partial vectorization
  • Accuracy improvements
Rewire

Key Takeaways

• Examples are valuable in design but are difficult to use and adapt in designs.

• We can extract semantic representations and manifest them in different modes to benefit designers.