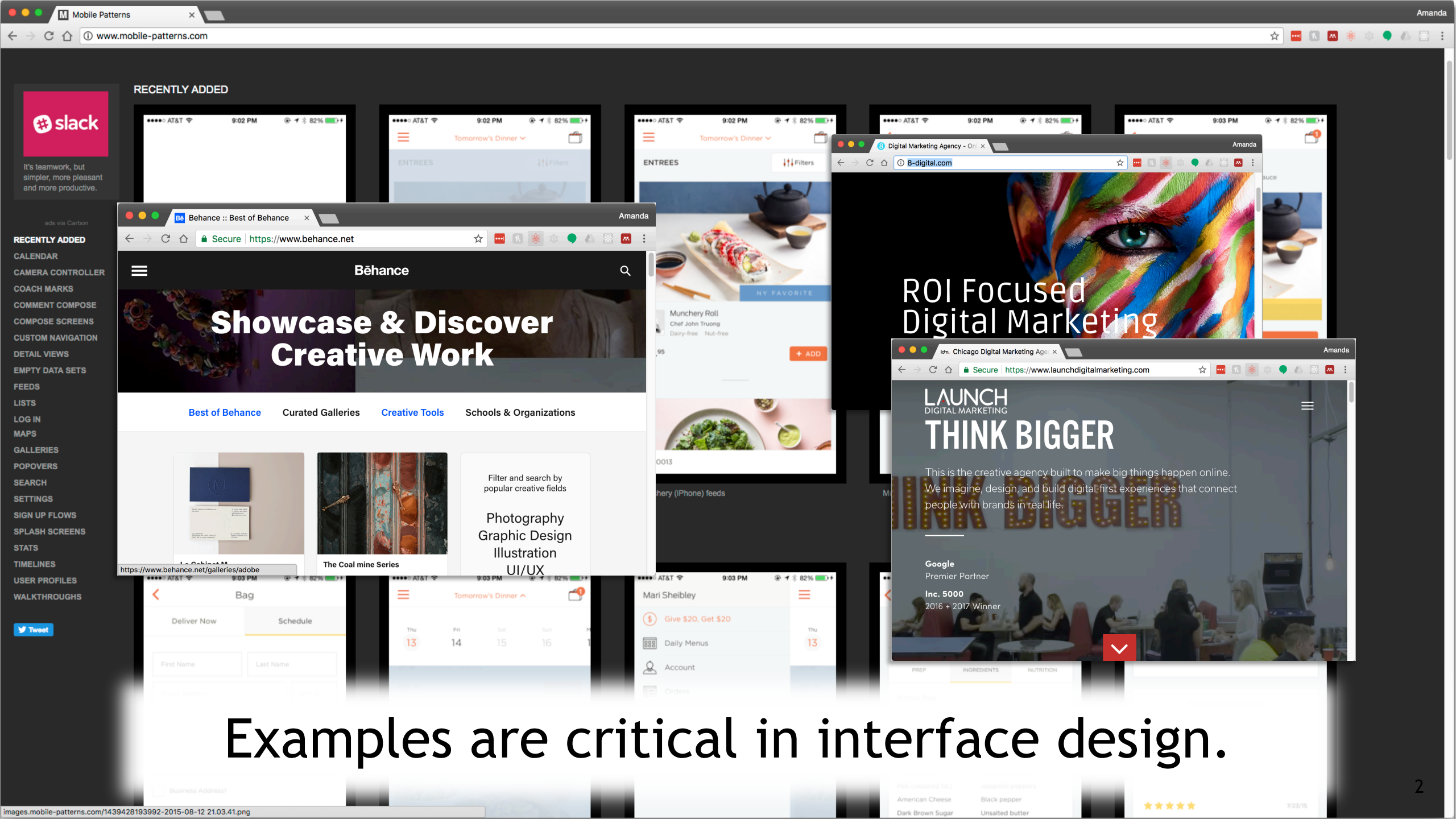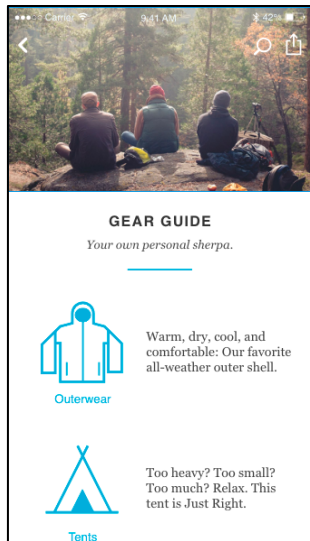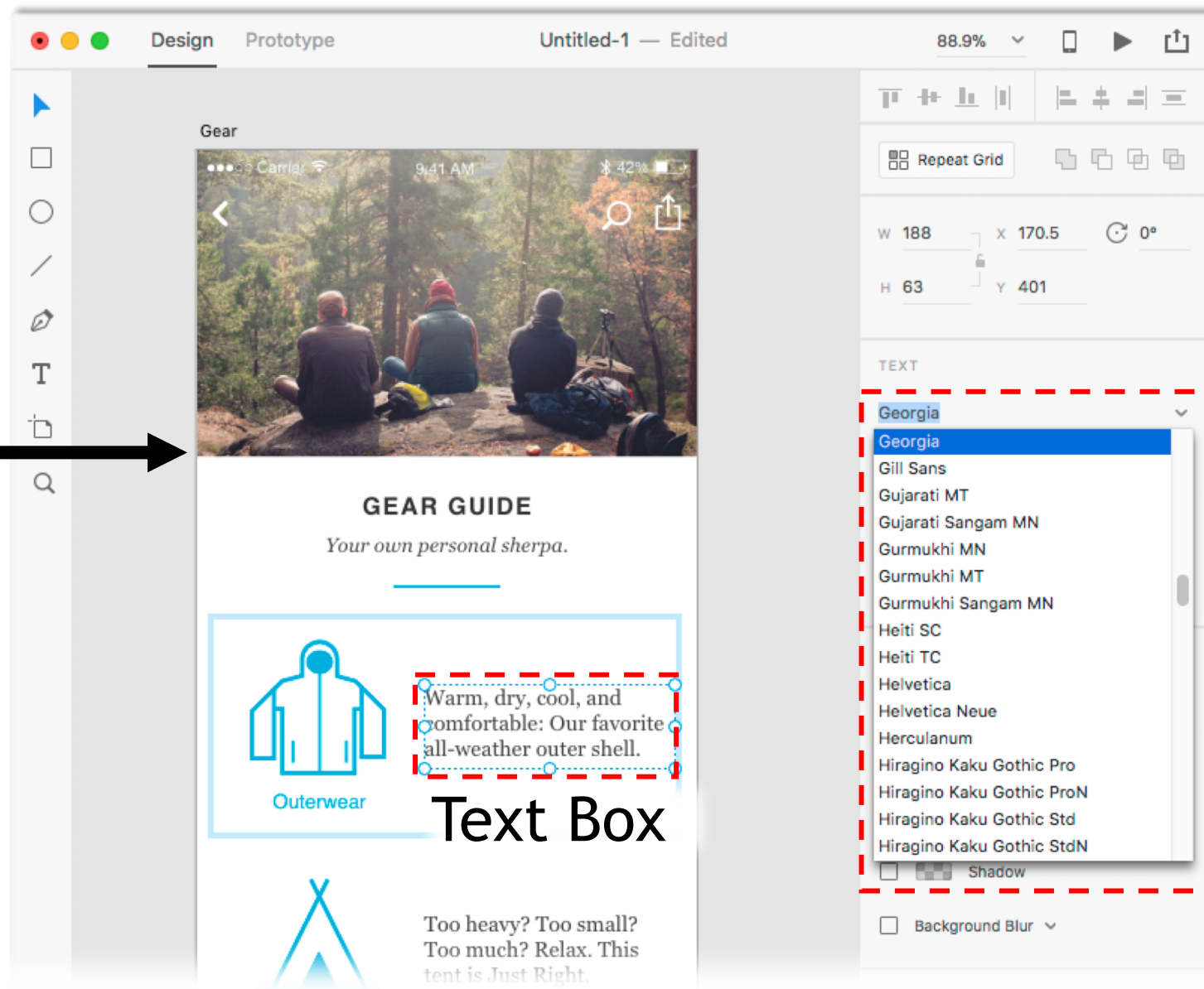# Rewire: Interface Design Assistance from Examples

Amanda Swearngin, Mira Dontcheva, Wilmot Li,
Joel Brandt, Morgan Dixon, Andrew J. Ko

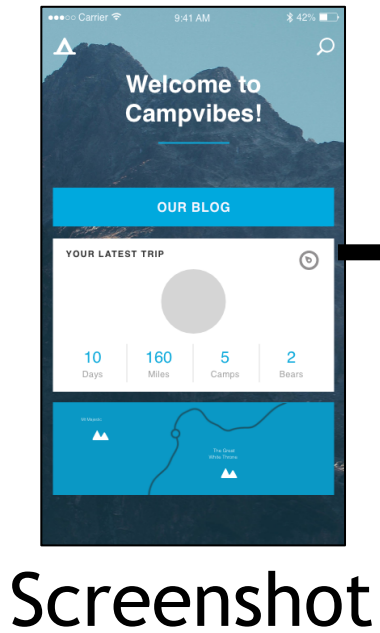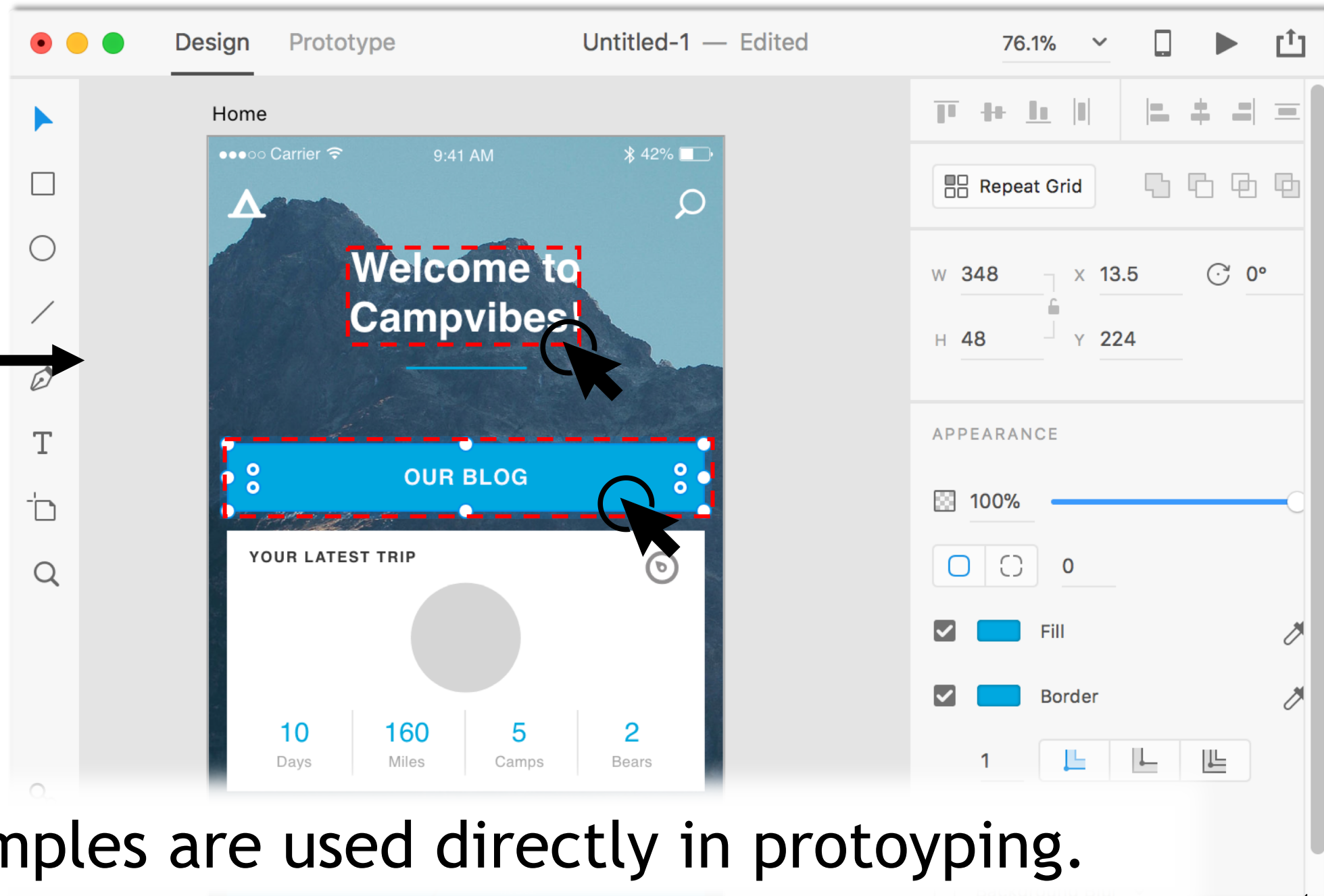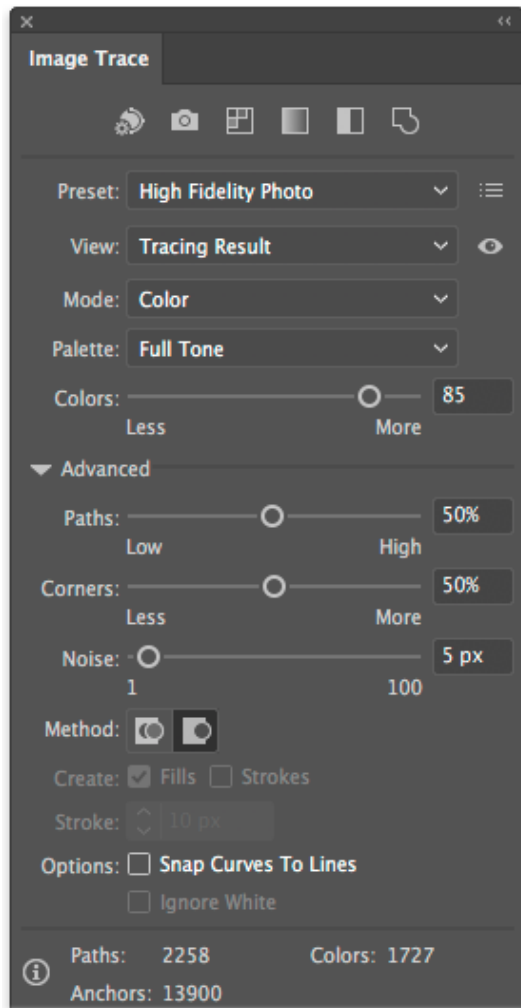Examples are critical in interface design.

Example

Text Box

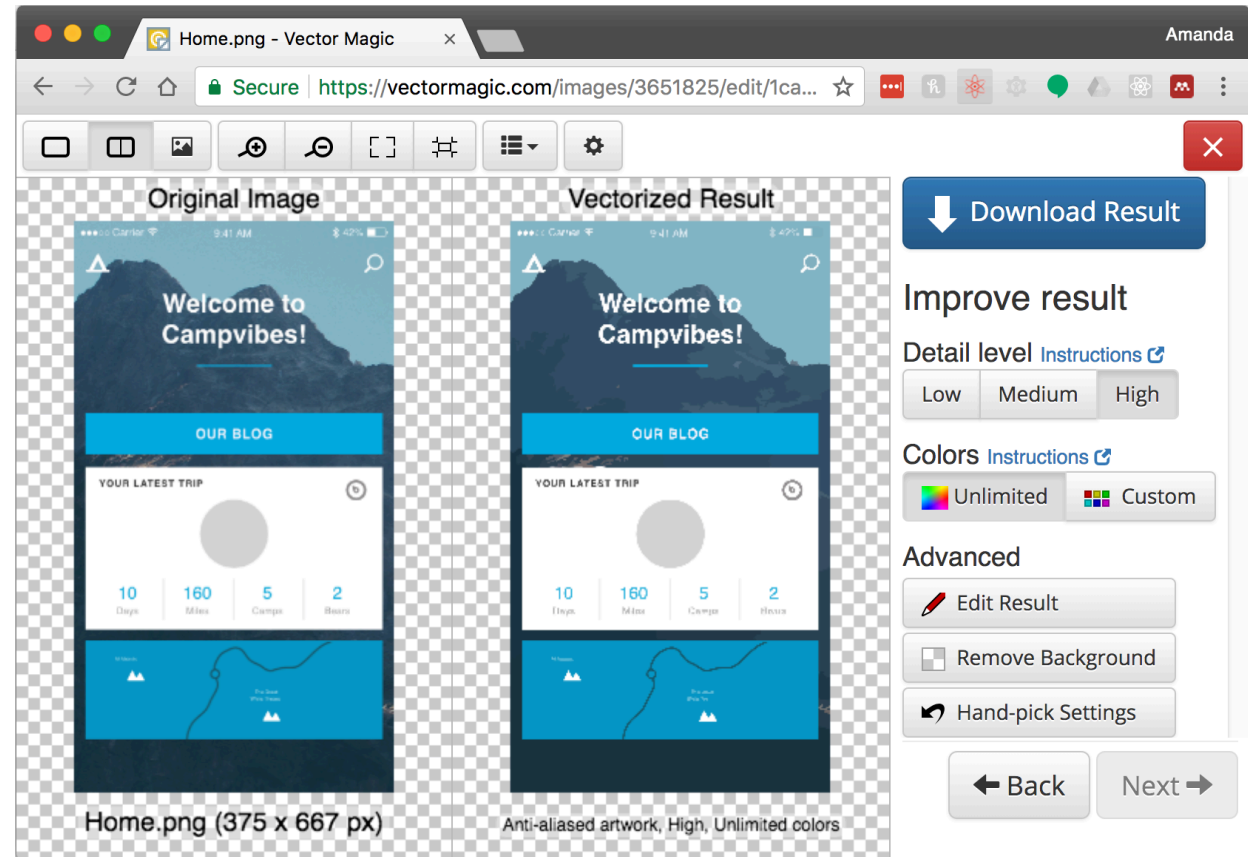Examples are used directly in protoyping.

Screenshot

Examples are used directly in protoyping.

Adobe Illustrator

VectorMagic

There are some commercial tools for vectorization.

Output (Illustrator's Image Trace)

Path-based representation

Text - No ability to change size, font, color

Rectangles – Drag and resize each corner to change radii.

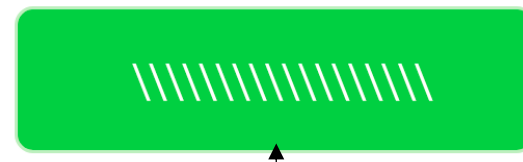Output from commercial tools is difficult to edit.

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.

~~Path~~
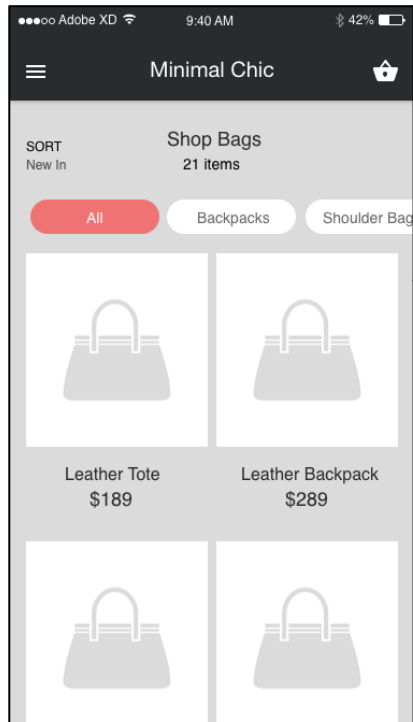
~~Path~~

Text

Rectangle

Overview

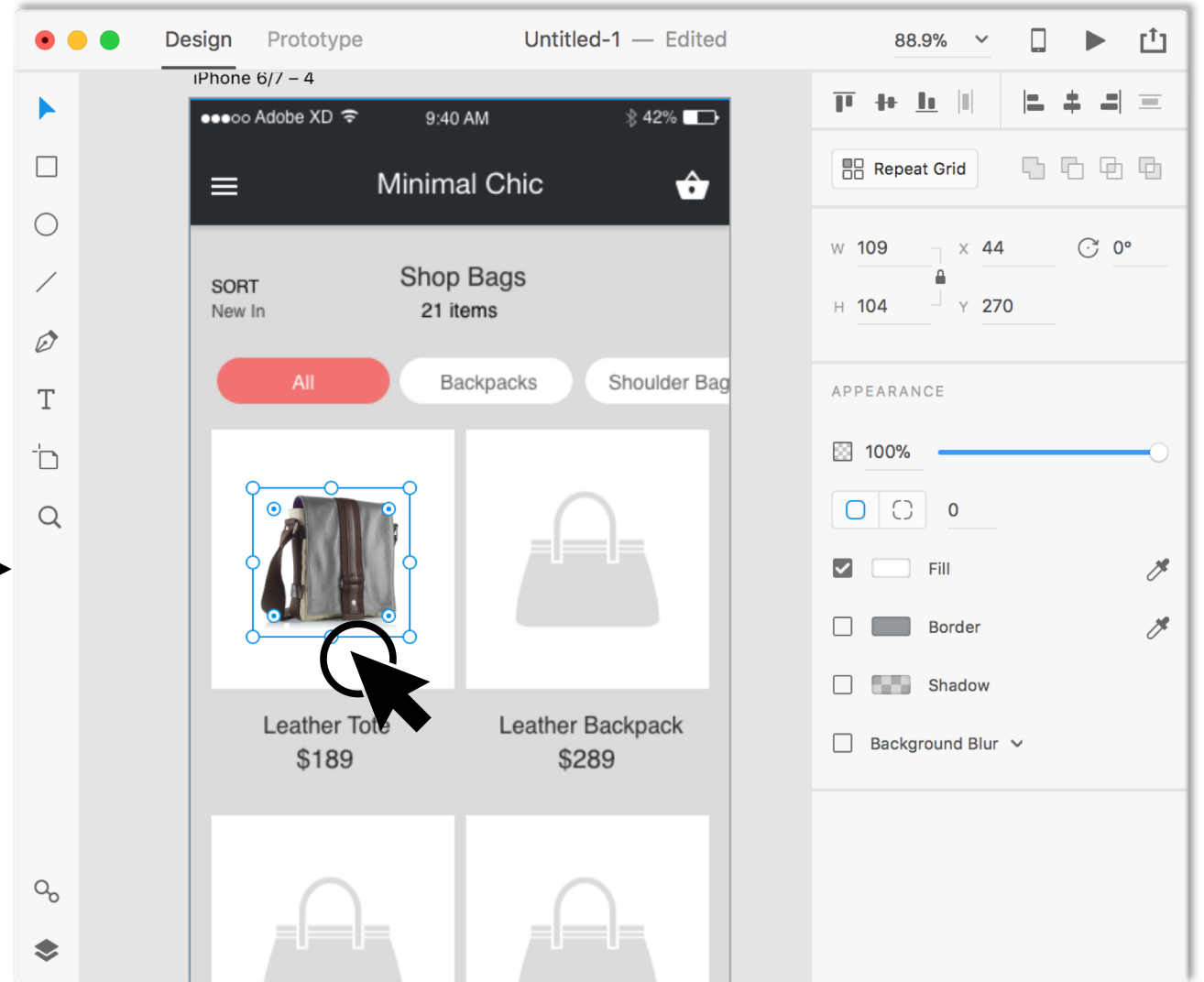Motivation

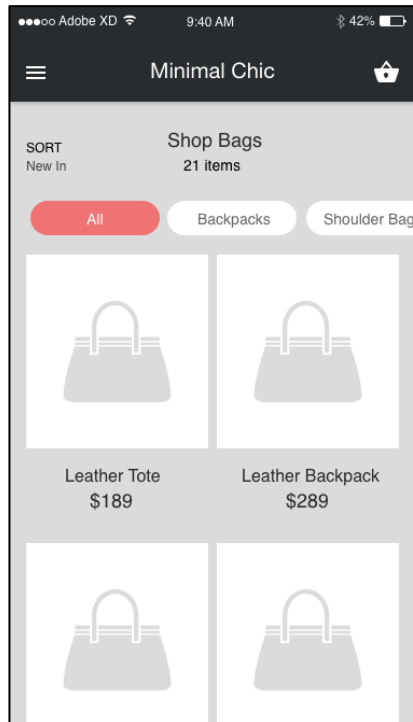**Rewire Intro**

Architecture

Evaluation

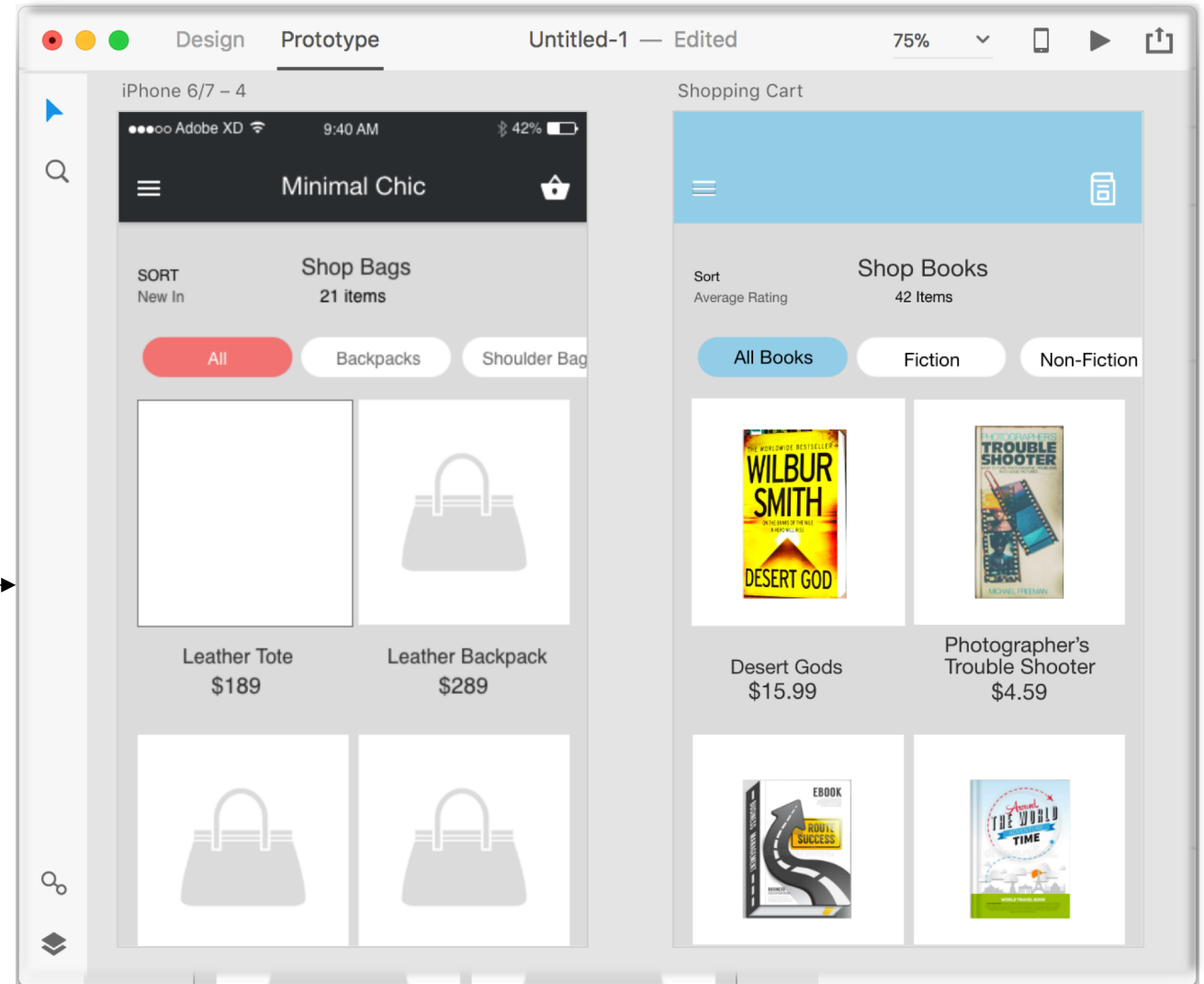# Motivating Scenario – Snapping and Alignment

Maria

Task: Replace bag icons with realistic bag images.

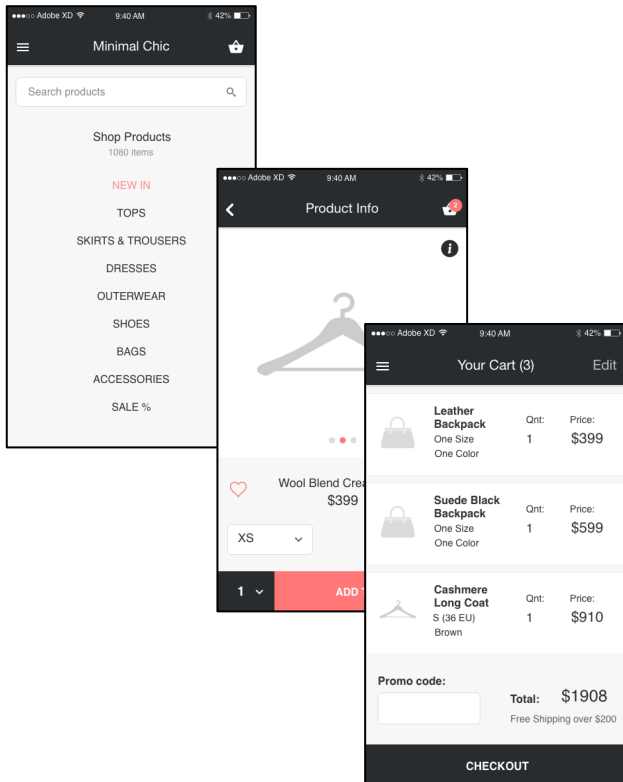# Motivating Scenario – Creating Design Variations

Maria

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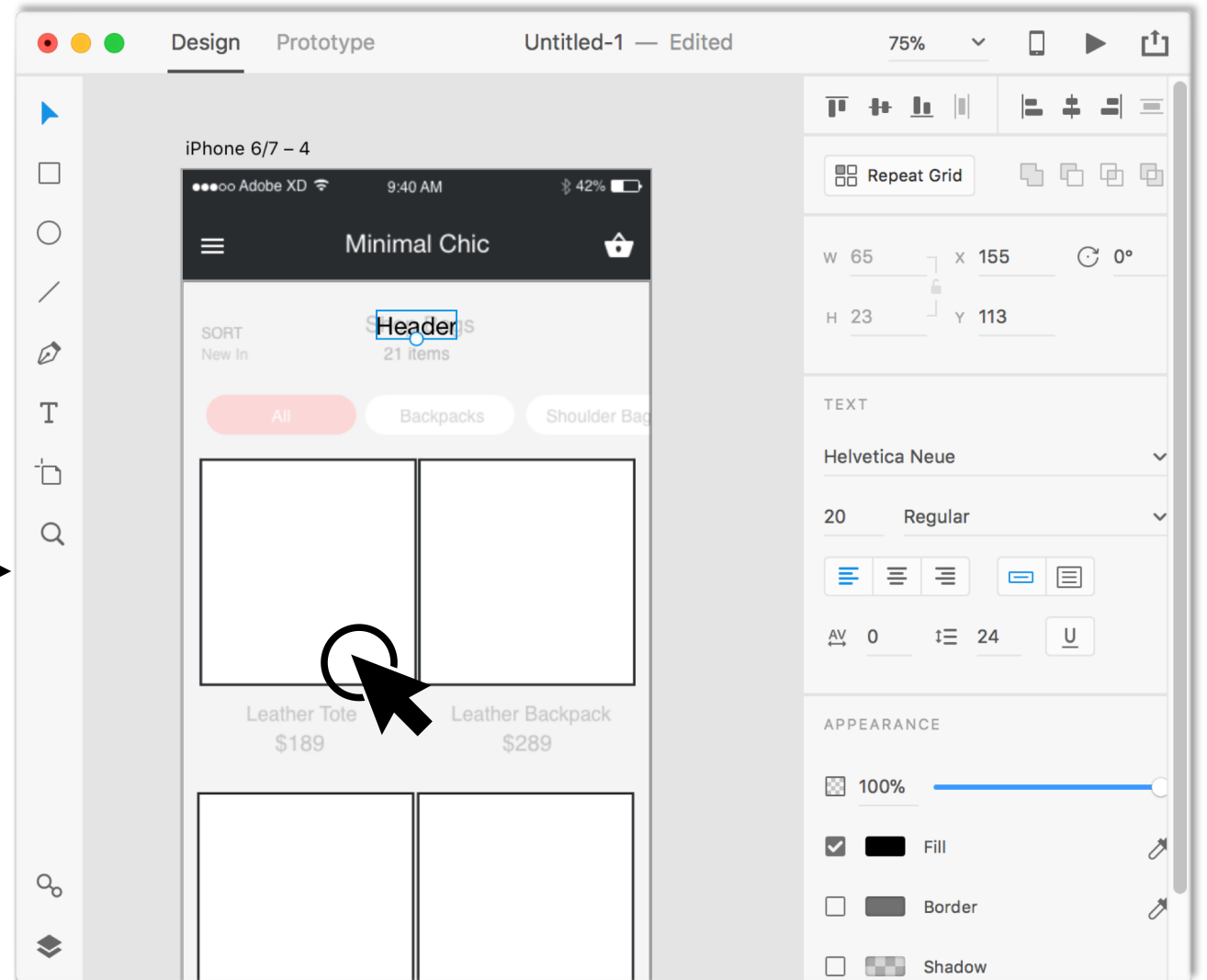
Motivating Scenario – Wireframing

Maria

Task: Show client high level overview.

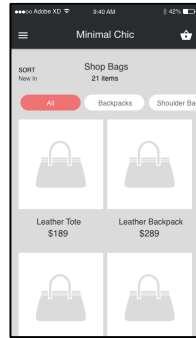# Overview

Motivation

Rewire Intro

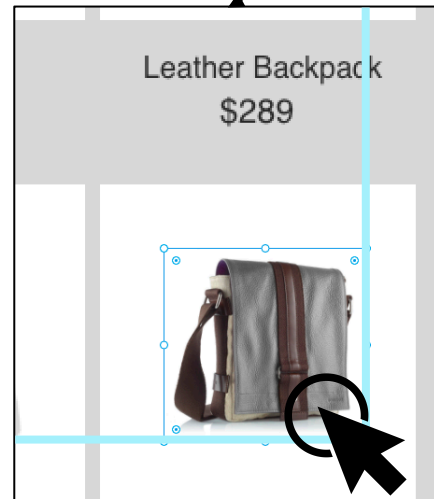Architecture

Evaluation

Rewire – 3 forms of design assistance

Screenshot

Rewire

Smart-Snap
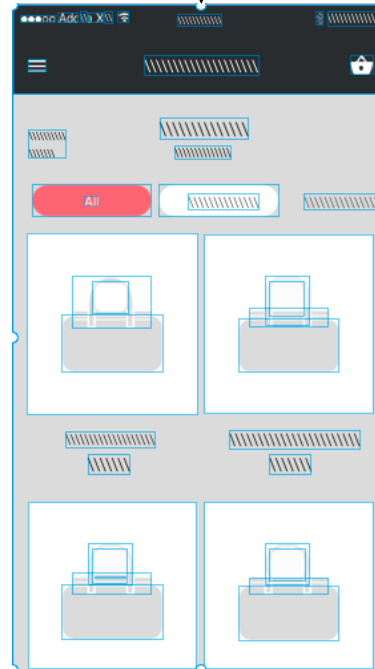
Full Vector
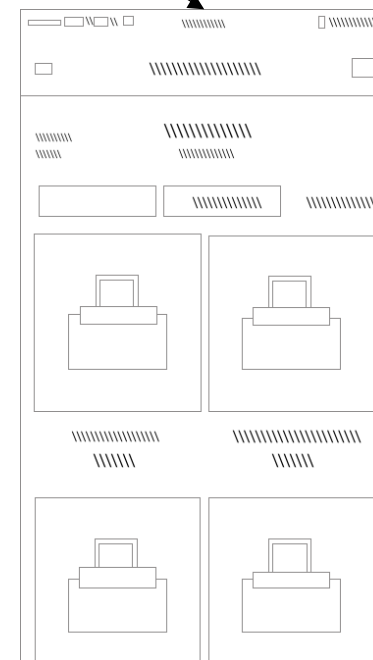
Wireframe

Motivating Scenario – With Rewire

Maria

Smart-Snap Mode

Task: Replace bag icons with realistic bag images.

Motivating Scenario – With Rewire

Maria

Full Vector Mode

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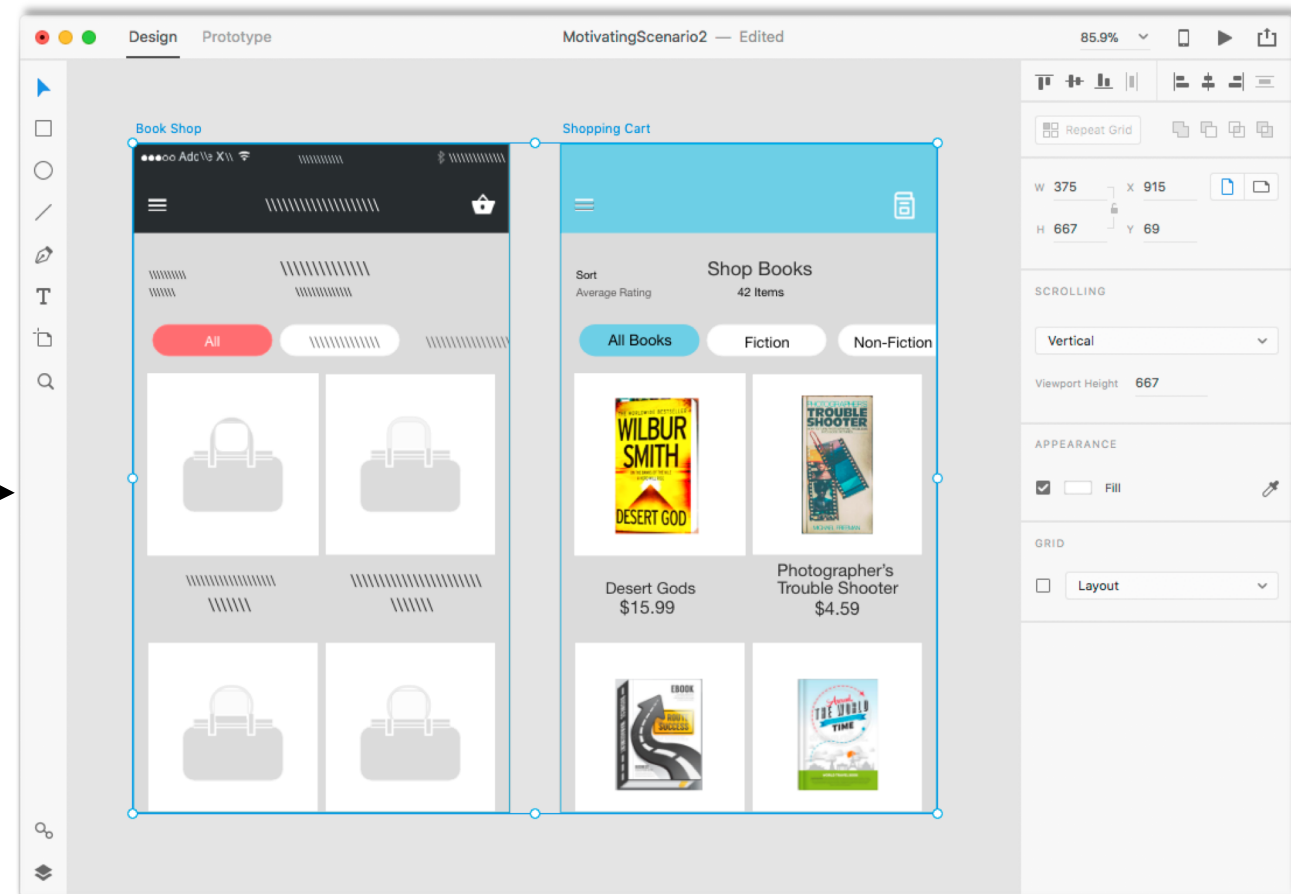
Motivating Scenario – With Rewire

Maria
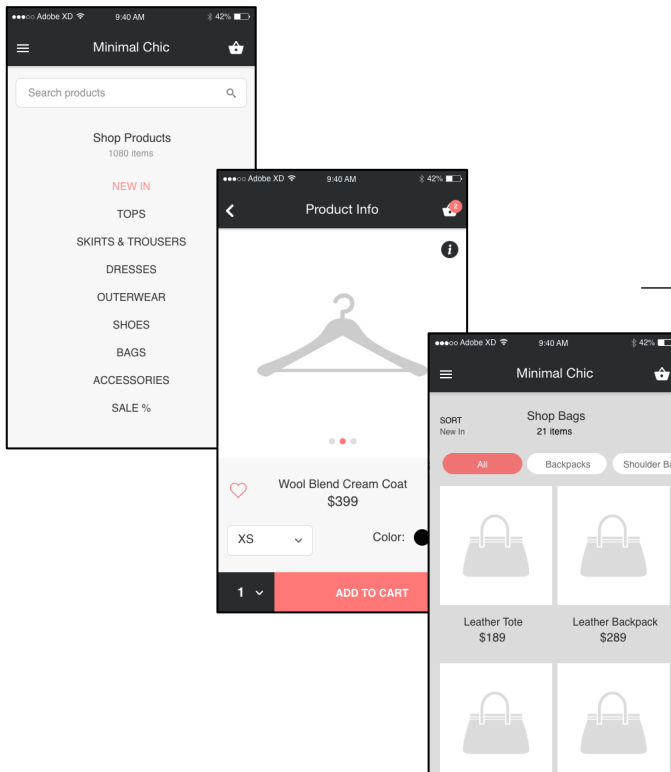
Wireframe Mode

Task: Show client high level overview.

Overview

Motivation

Rewire Intro

Architecture

Evaluation

Rewire Architecture – 3 Phases

Input:
Pixel-Based
Screenshot

① Segmentation

② Vectorization

③ Beautification

Color: #FE4F55
Corner Radius: 5px

Output:
Editable Artboard
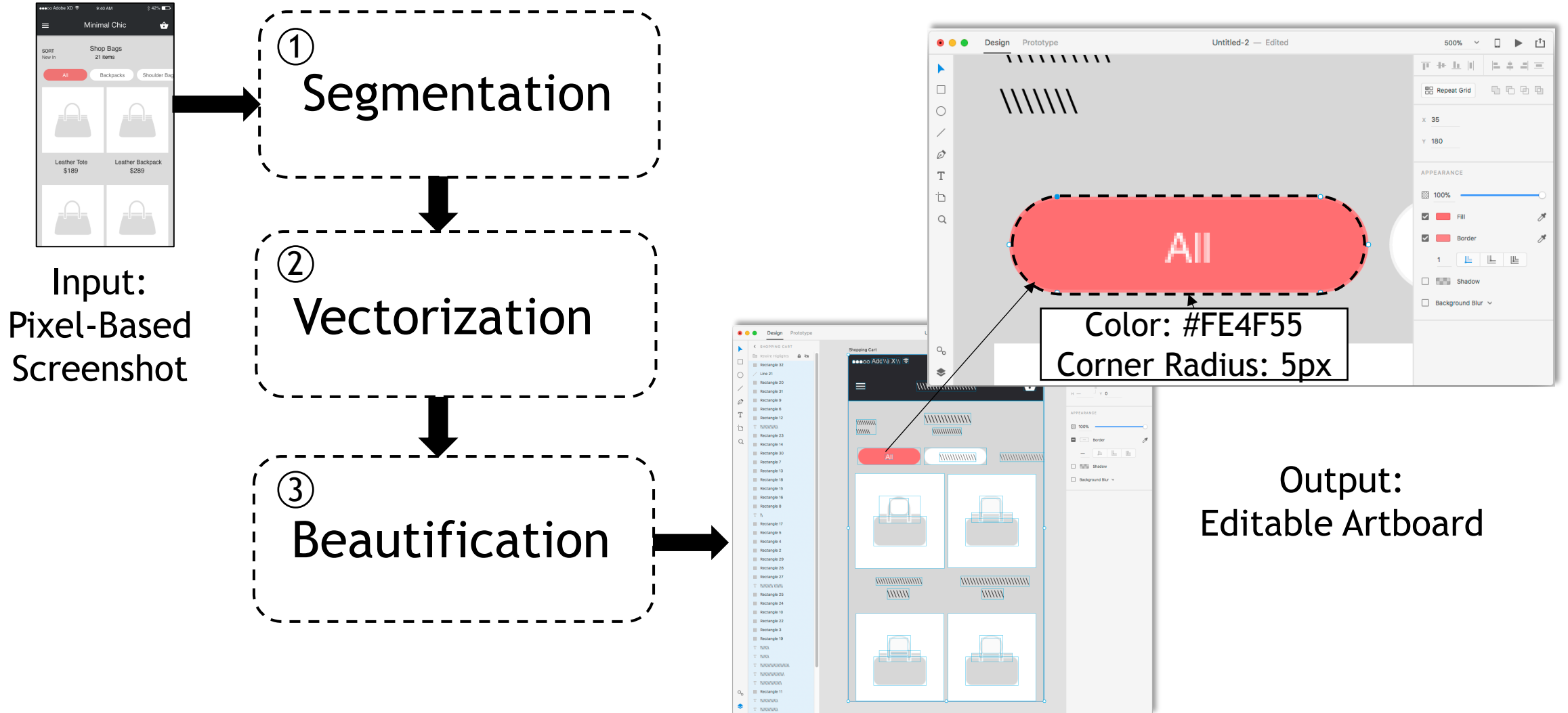
Segmentation

Discover, *segment*, and *classify* UI elements

Segmentation

Text

Minimal Chic

Shop Bags

Rectangle

All

Vectorization

Beautification
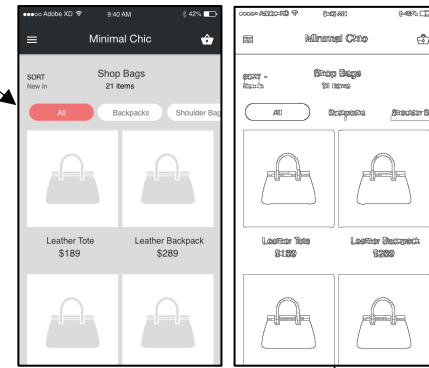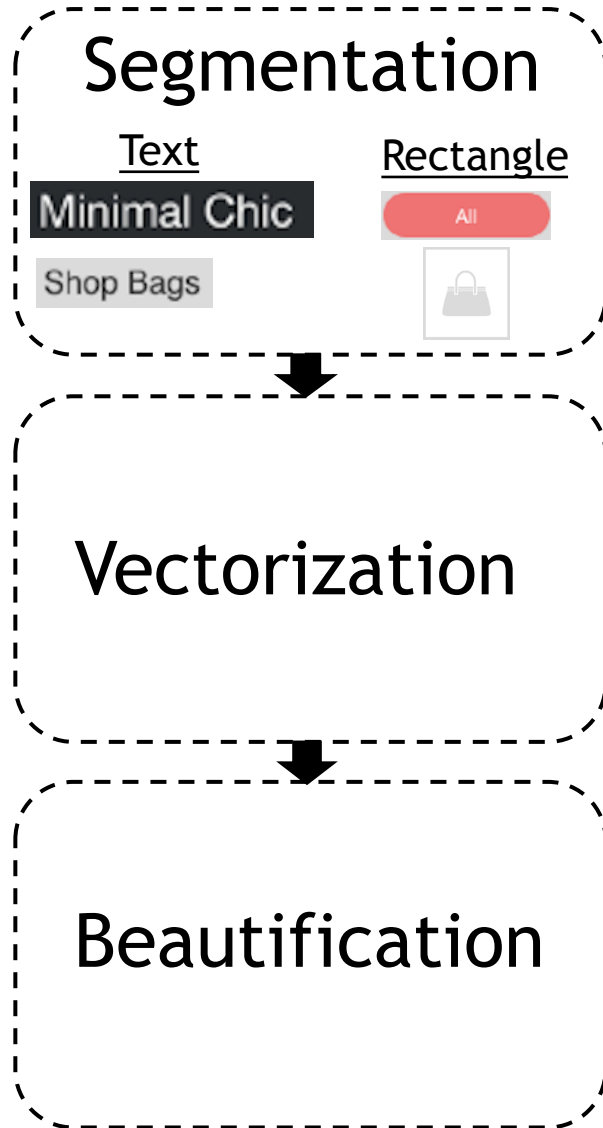
Shape Detectors

Text

Rectangles/Lines

Circles

Shop Bags

Minimal Chic

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

All

Hough Transforms & Thresholds

Vectorization

Segmentation

Text
Minimal Chic
Shop Bags

Rectangle
All

Vectorization

Background: #FE4F55
All
Corner Radius: 5px
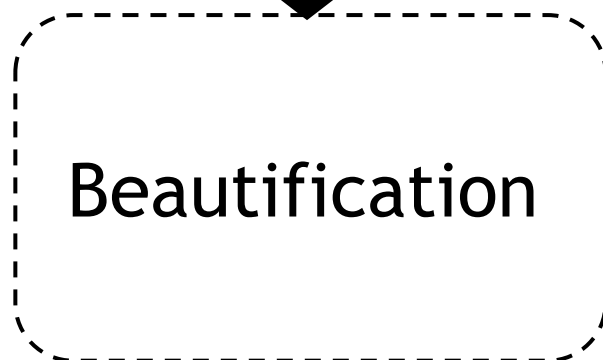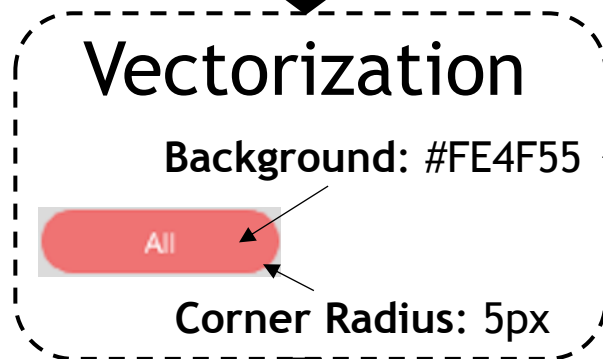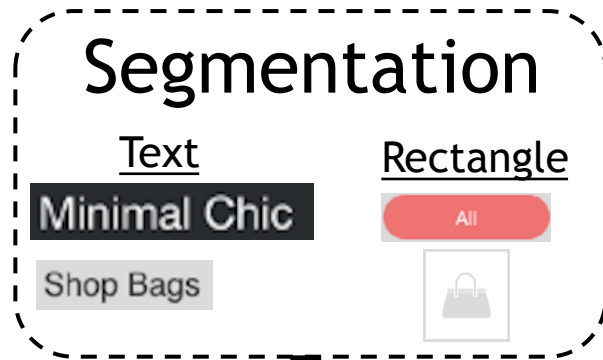
Beautification
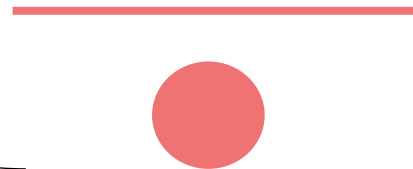
Minimal Chic

Font Color, Size, Baseline

All

Background color, Border, Corner Radii

Corners

Border
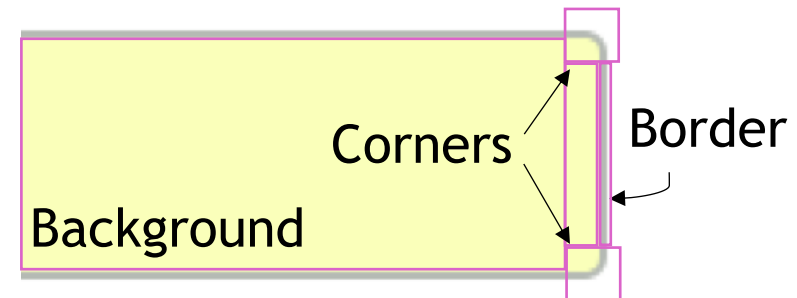
Background

Prefab
(Dixon, et. al., CHI '10)

Beautification

Segmentation

Text

Minimal Chic

Shop Bags

Rectangle

All

Vectorization

Background: #FE4F55

All

Corner Radius: 5px

Beautification

SORT
New In
Shop Bags
21 items
All   Backpacks

z3

Constraint Solver

Y: 24px   Y: 25px

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

All

Corner Radius: 5px

Beautification

SORT
New In

Shop Bags
21 items

All   Backpacks
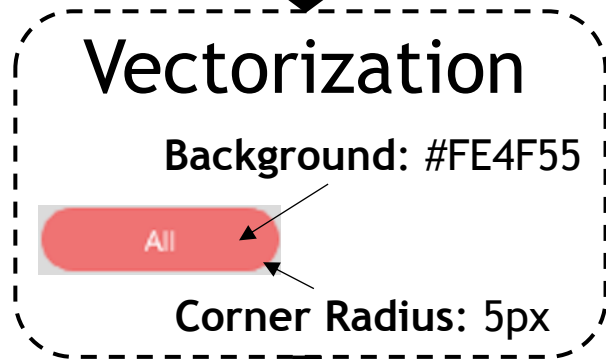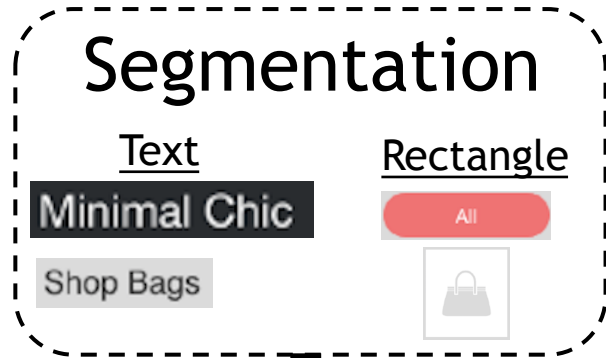
Vector Shapes, Properties

Full Vector

Wireframe

Smart-Snap

Leather Backpack
$289

Xd Prototyping Tool
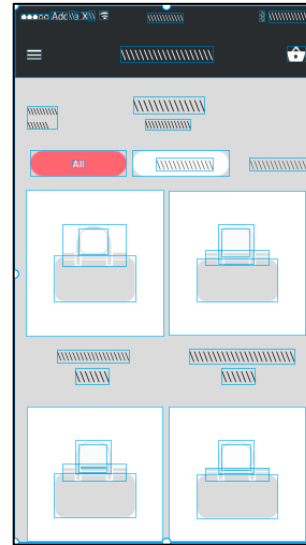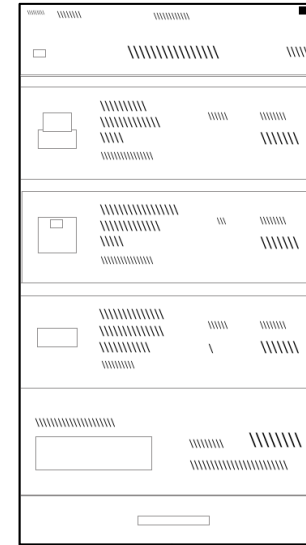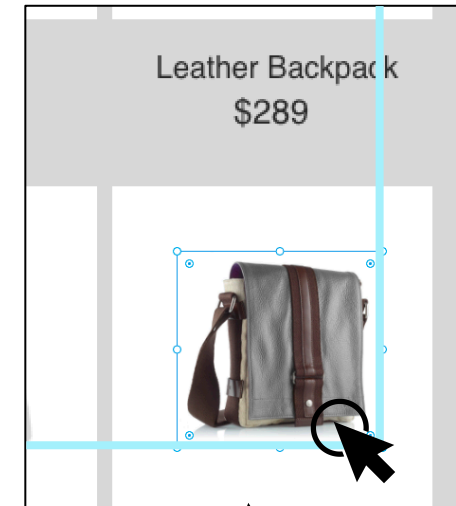
Overview

Motivation
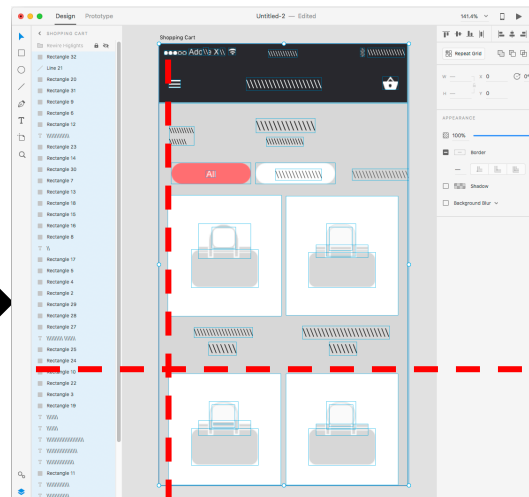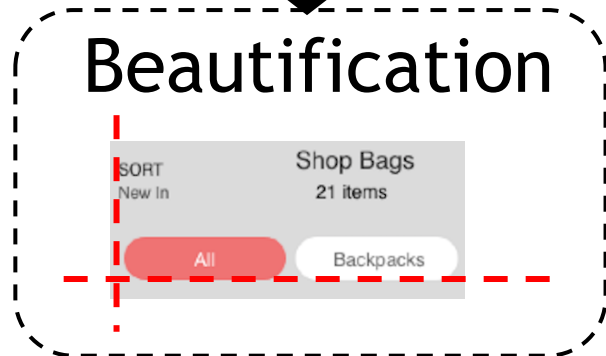
Rewire Intro

Architecture

Evaluation

Evaluation

Technical
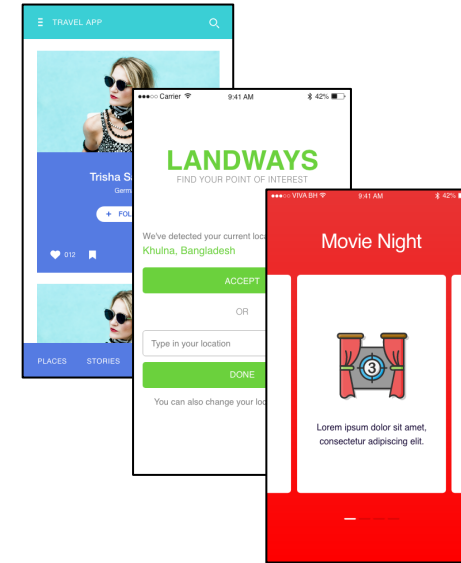
User Study

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)
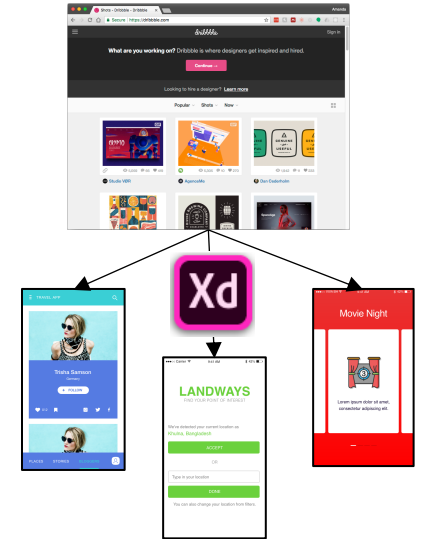
User Study – Research Questions

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.

Lighthouse

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Sign up   Sign In
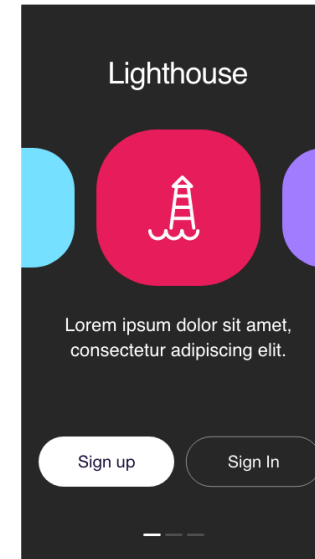
Rewire Modes

1. Smart-Snap
2. Full Vector

Baseline Modes

3. Screenshot Only
4. Ideal Vector

User Study – Artifacts

Original

Variations

Design Spec
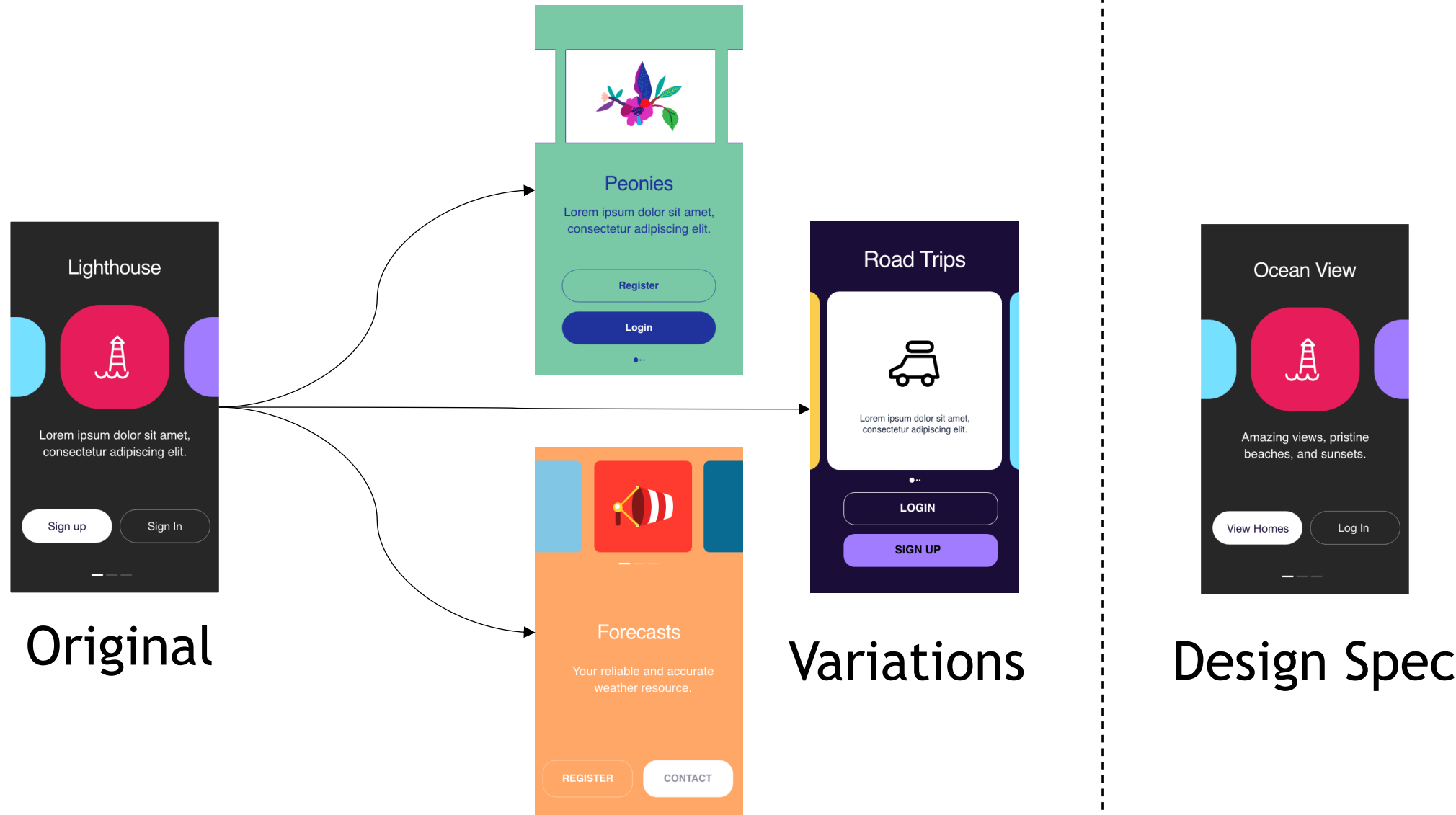
Quantitative Results - Speed
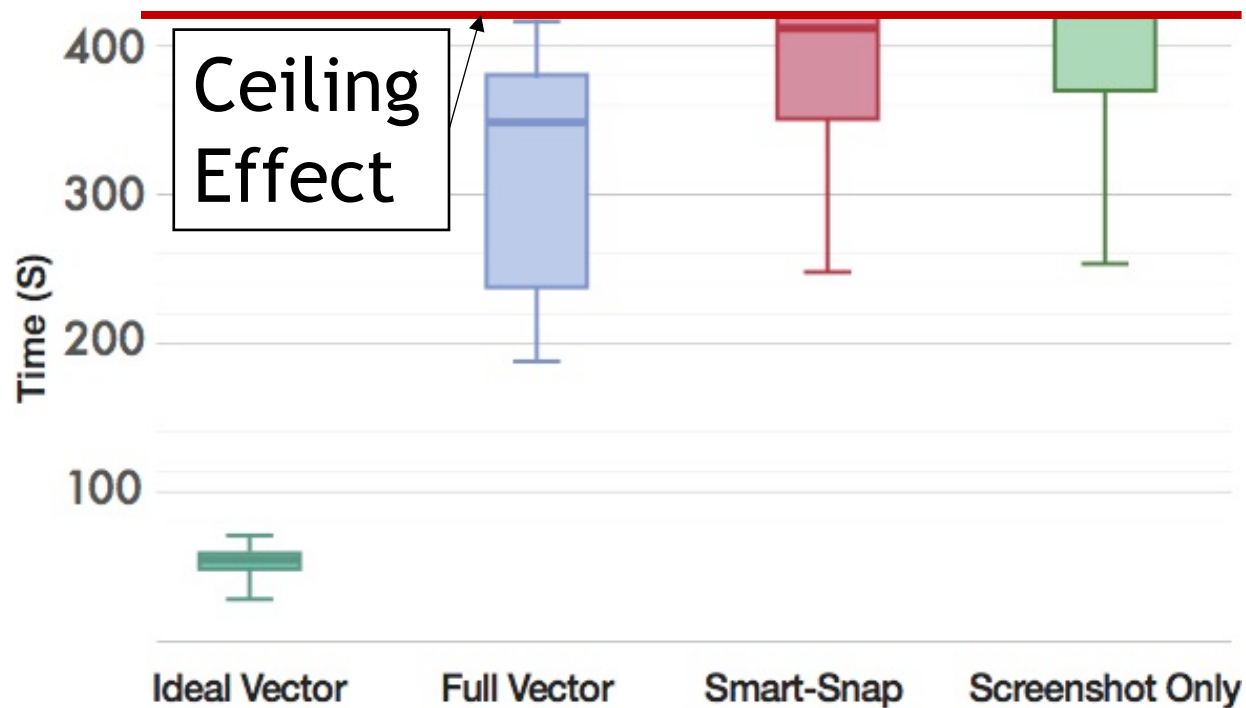
- *Full vector* significantly faster than *Smart-Snap* and *Screenshot Only*

  Smart-Snap
    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

  t(11) = 2.20, p'< 0.025, d=0.36

Quantitative results - Accuracy
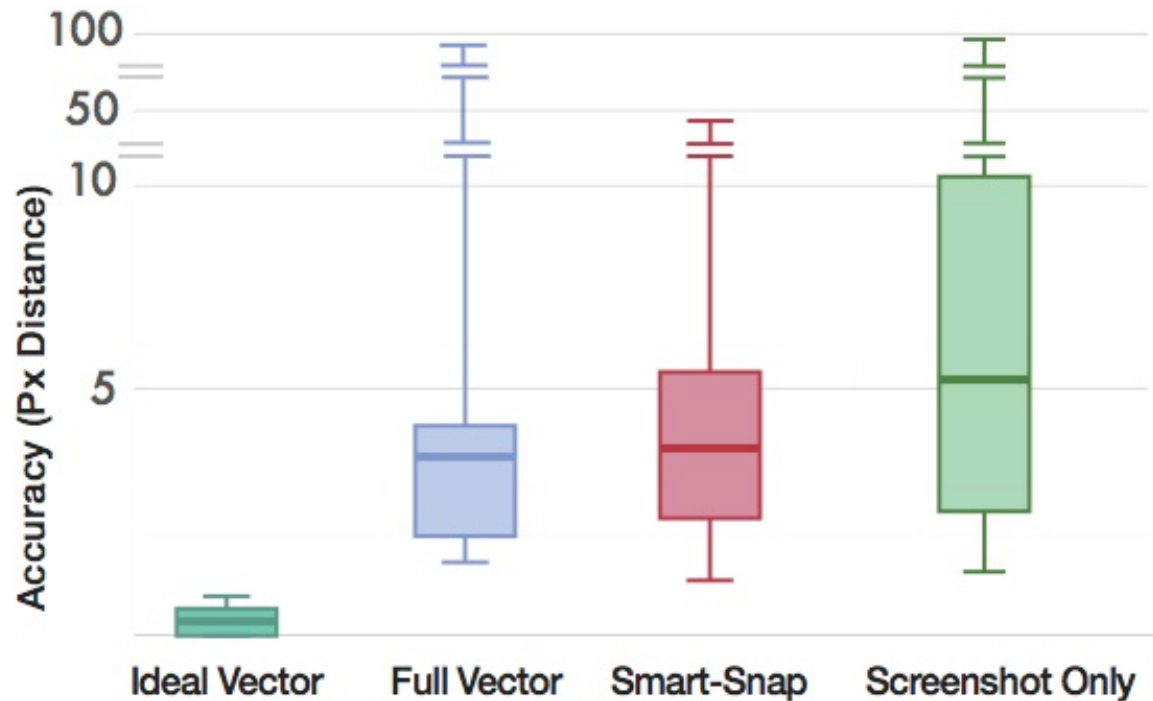
- Measured by average pixel distance

- No significant differences between pairs of conditions

- Rewire modes helped designers complete the tasks quicker with no accuracy tradeoffs

Designers rankings of modes
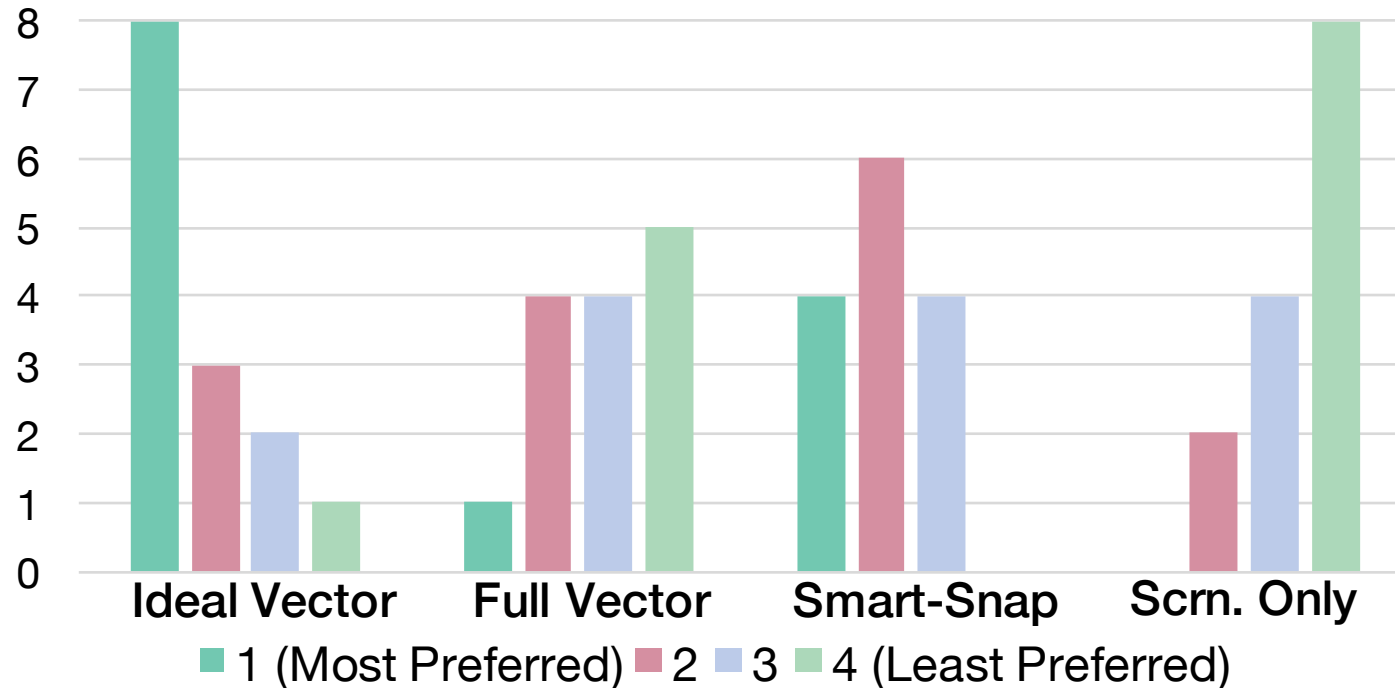
- Ideal vector was the most preferred, and both Rewire modes preferred over screenshot only

- 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
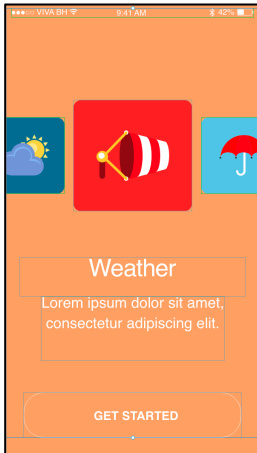
P11: *"It was way easier. Now I can spend my time working on actual design."*

Screenshot Only
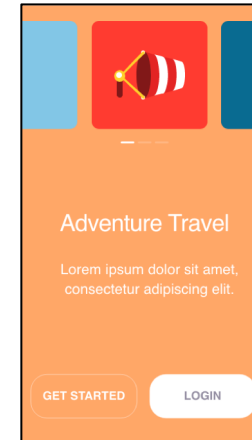
More difficult, more tedious, less accurate

Designers' Feedback

Smart-Snap

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

Easier to get the 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

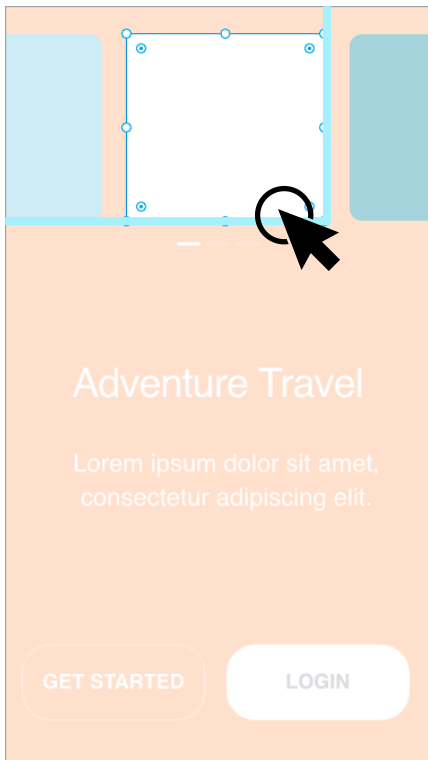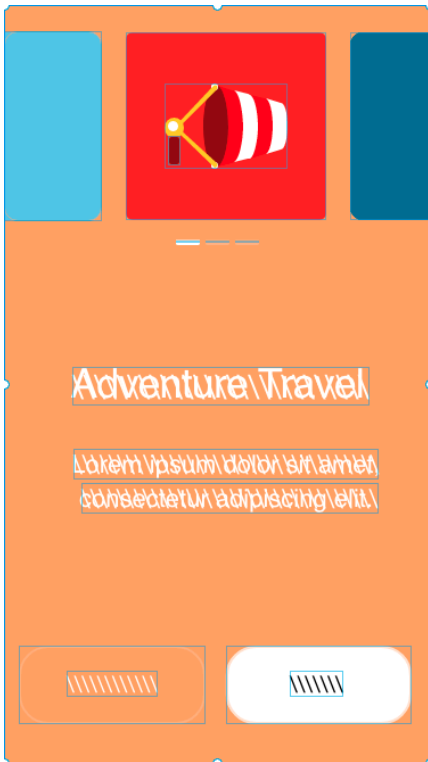Designers **liked auto-generated shapes** and text (9 designers), and required **less effort** than Screenshot Only mode (4 designers)

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.

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