

Designing Interactive Systems I

Prototyping

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Winter Semester '23/'24

<https://hci.rwth-aachen.de/dis>



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Paper Prototypes

Paper Prototypes

- First prototypes, quick and cheap
- Rough paper & pencil sketches of interface or central UI dialogs
- Hand-drawn, no ruler, no computer!
- Pro: Not detailed, so designer and user focus on important **high-level** UI design
- Con:
 - Dialog sequence hard to convey unless you drive it yourself
 - Drawing many screens is a lot of work
- A storyboard can be your first paper prototype

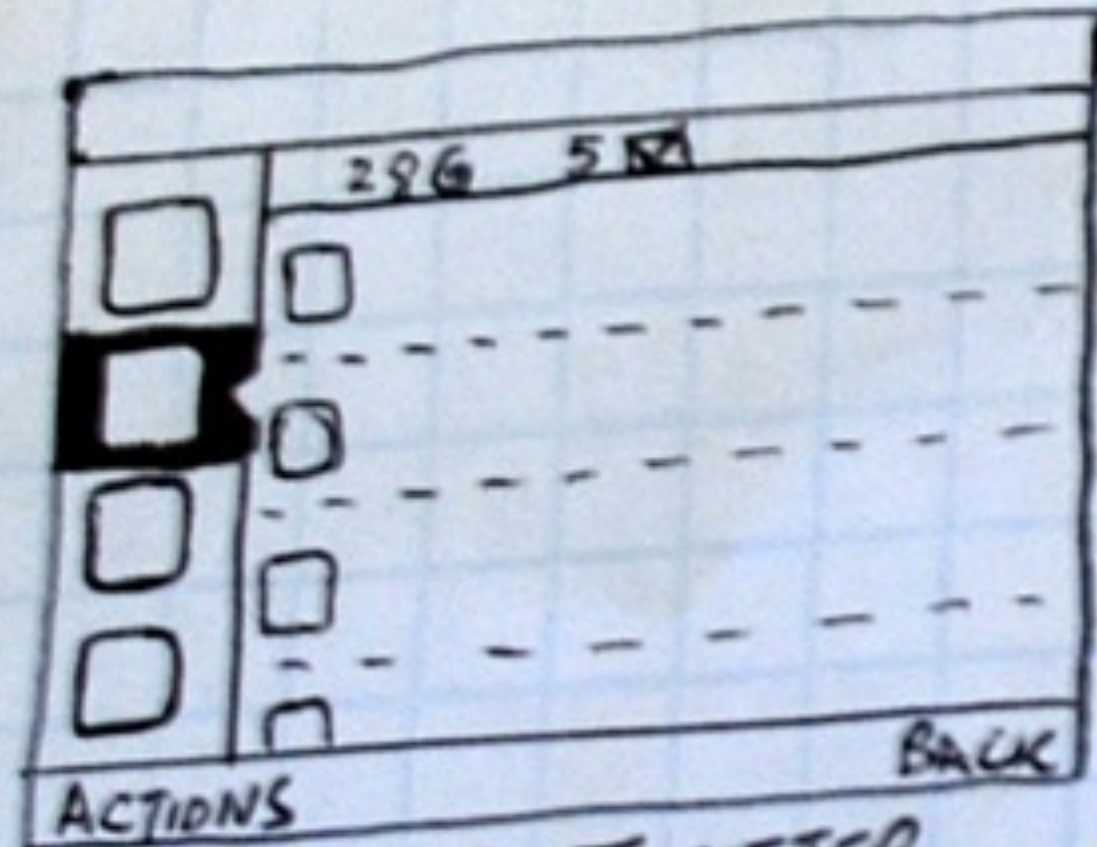


Paper Prototypes

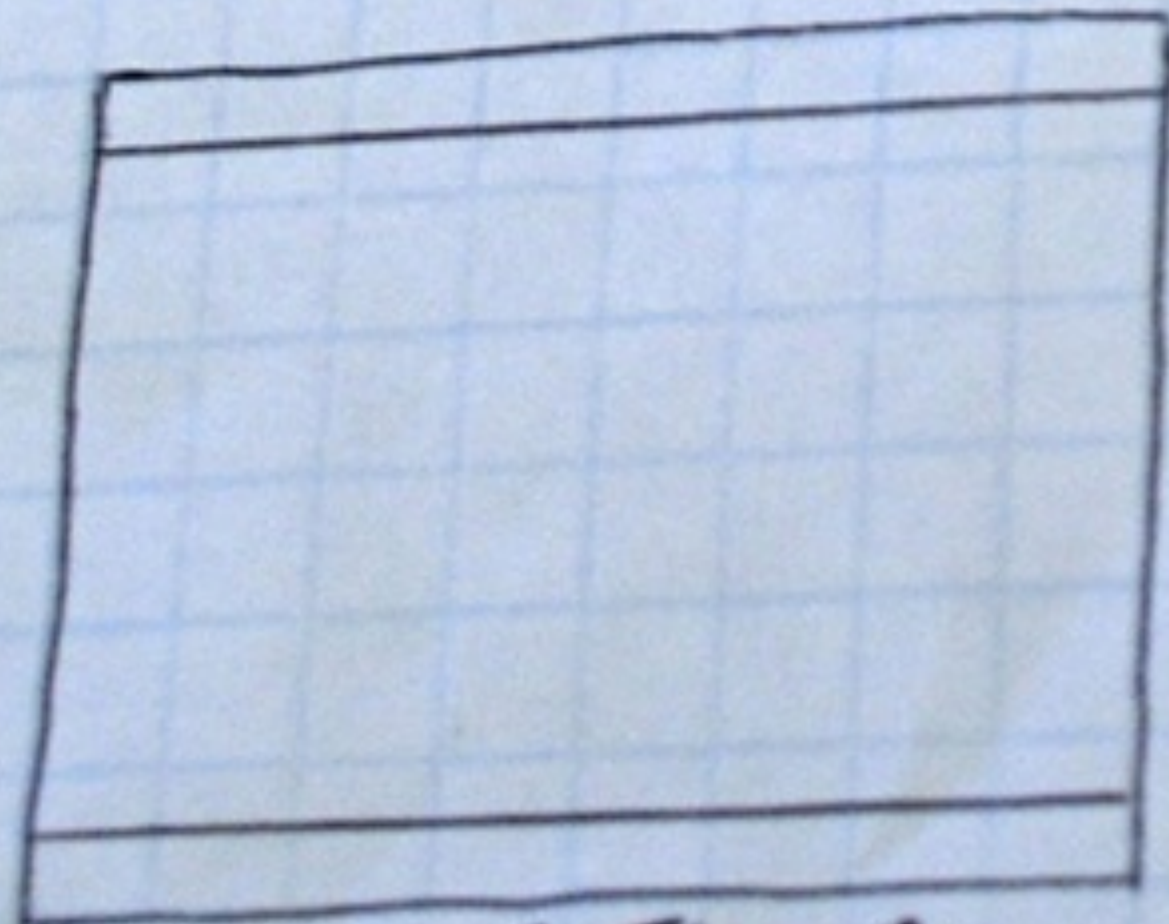
- Type A: Storyboard-like
 - Put several frames with sketched snapshots of the UI on one page
 - Label each frame and each connection
 - Only allows you to show one fixed interaction sequence (scenario)
 - Like a storyboard, but only shows the UI (and maybe the user's hand), not the entire environment of the task
- Type B: Flipbook
 - Sketch each UI snapshot frame on separate page
 - Collect in a loosely bound flipbook that flips over easily
 - Usage: Show start screen page to user—he selects an action—turn to the resulting page from your flipbook, etc.
 - Allows you to simulate the UI for a user



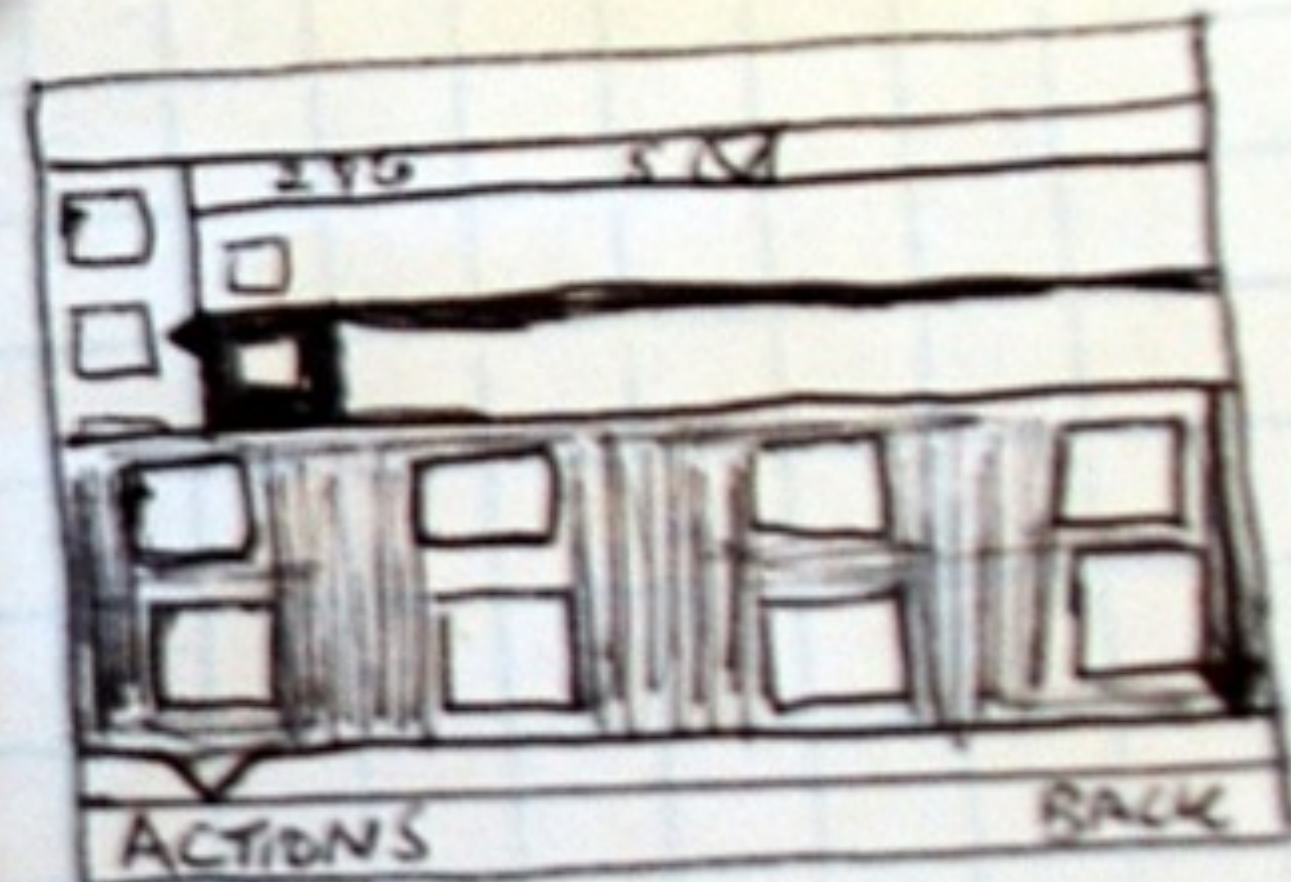
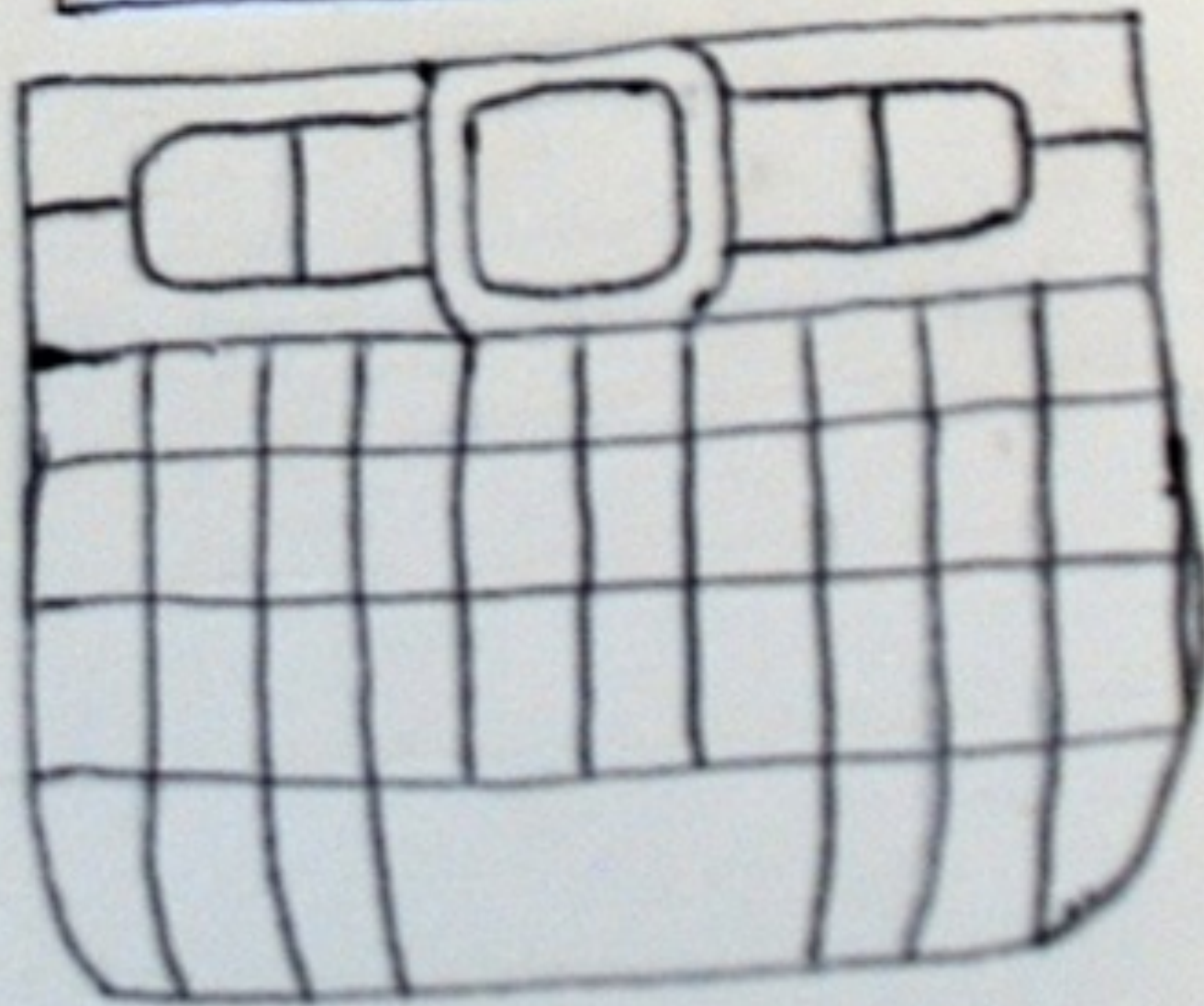
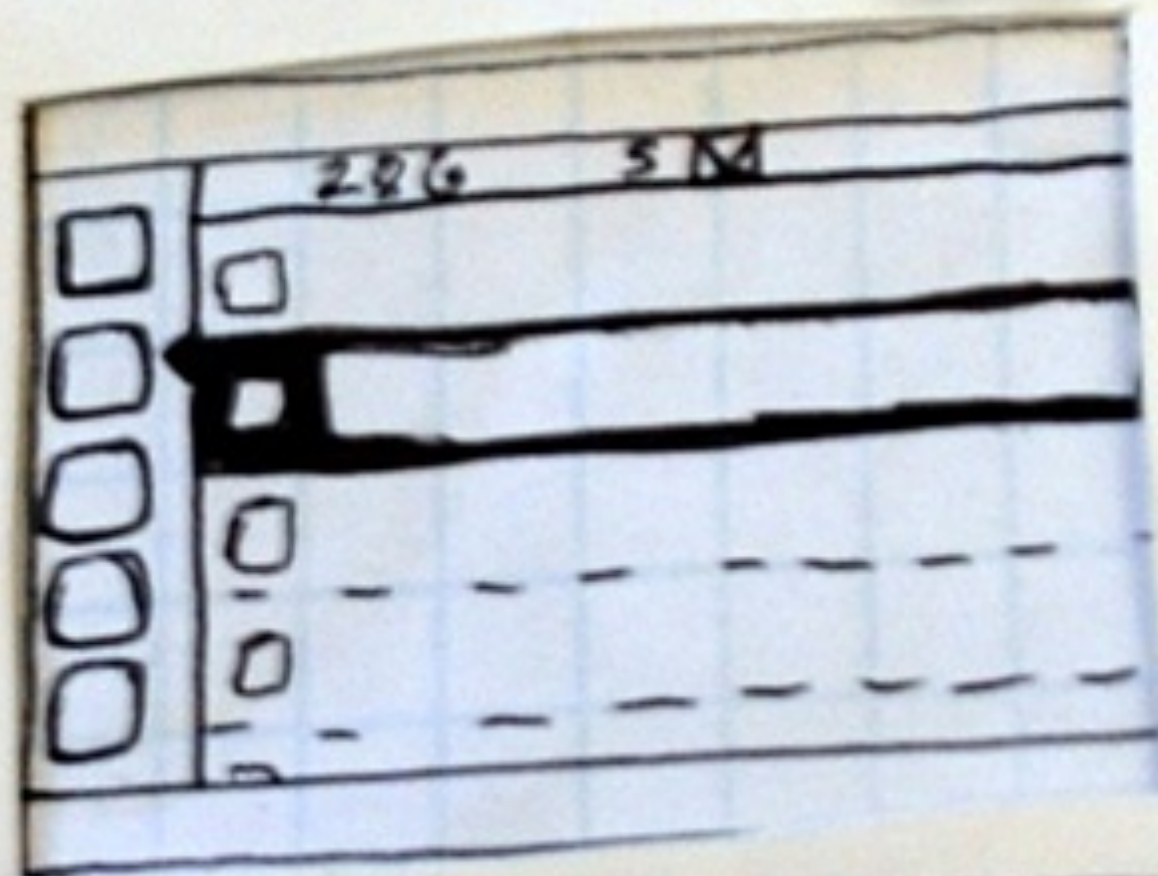
Storyboard-like Prototypes



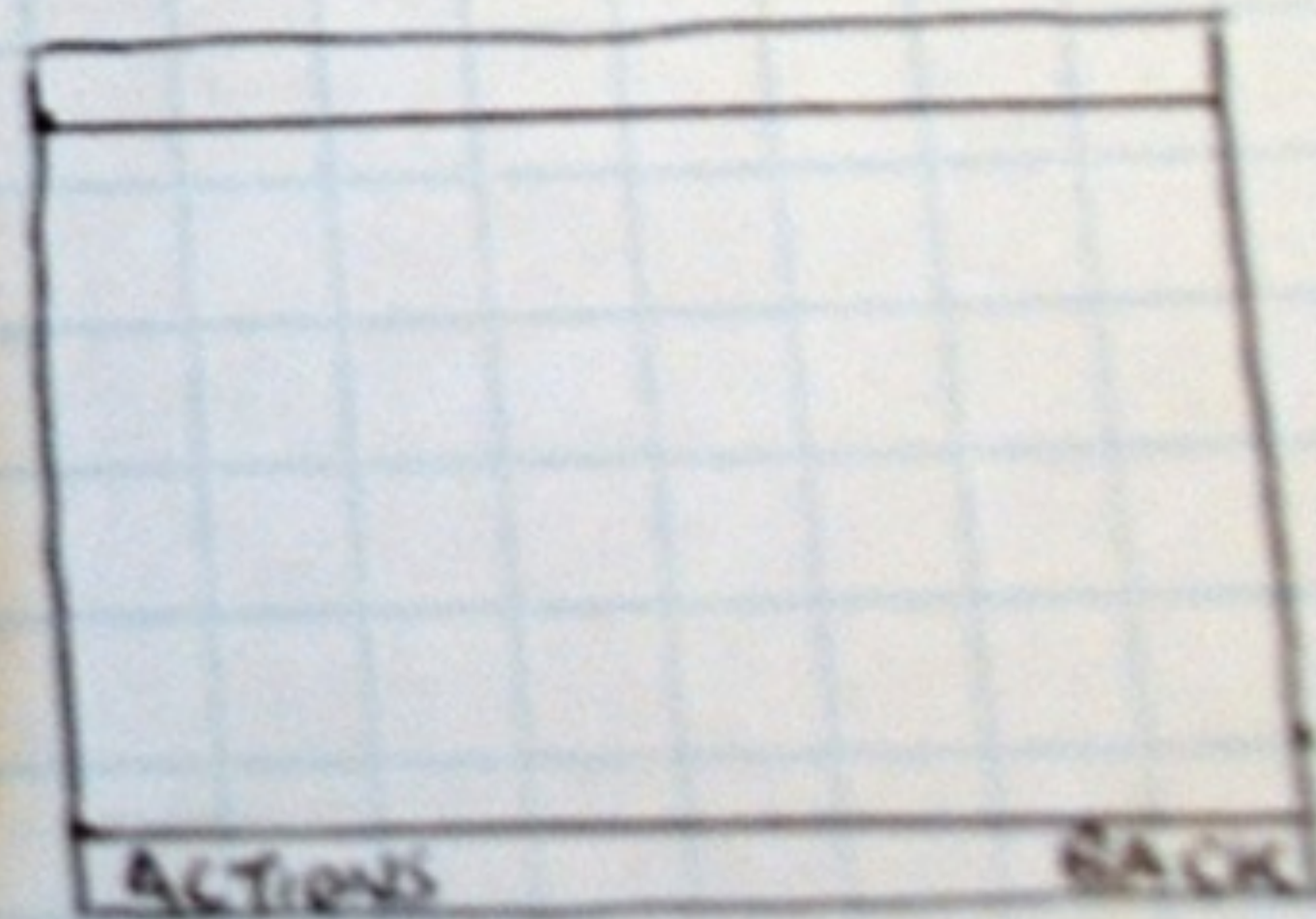
SELECT TWITTER



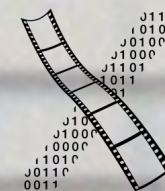
SELECT FLICKR



ACTIONS ON A TWEET

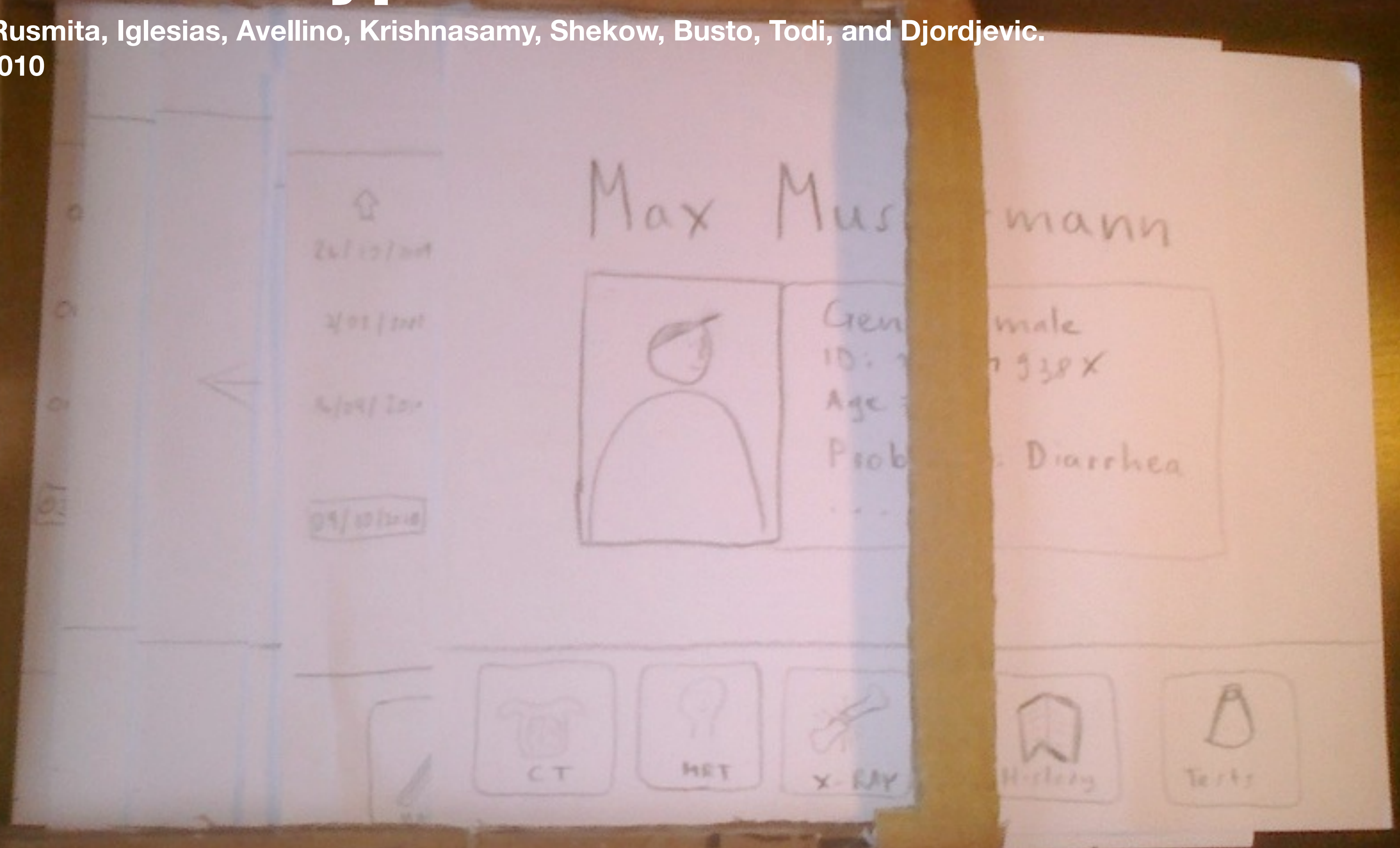


ACTIONS ON A FILTER




Flipbook Prototypes

Franzen, Ahmad, Rusmita, Iglesias, Avellino, Krishnasamy, Shekow, Busto, Todi, and Djordjevic.
DIS1 students in 2010



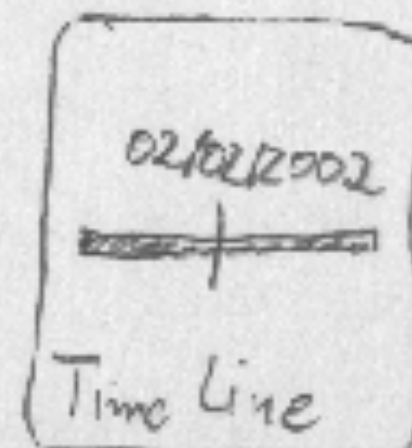
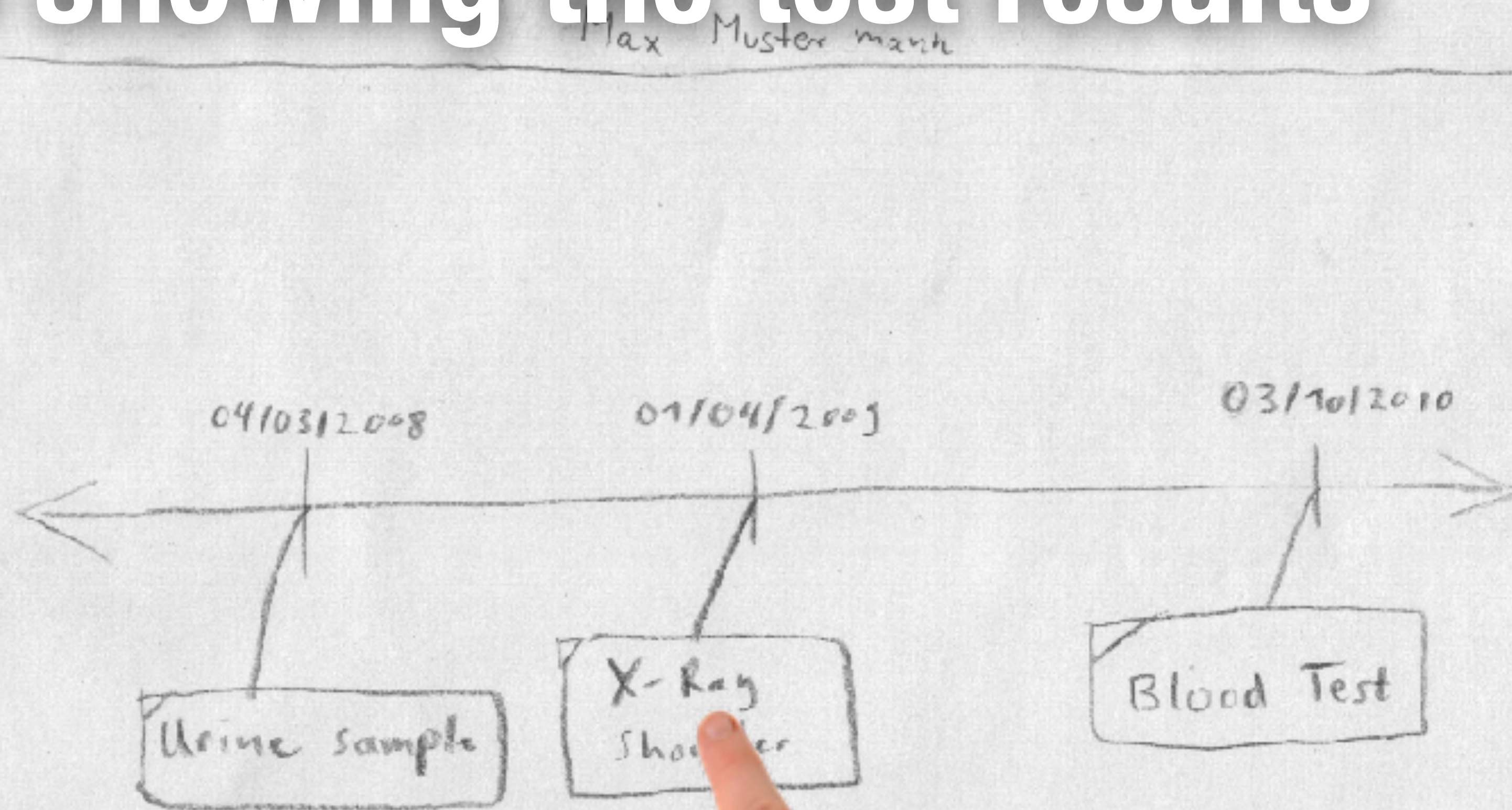
Patient overview

Max Mustermann

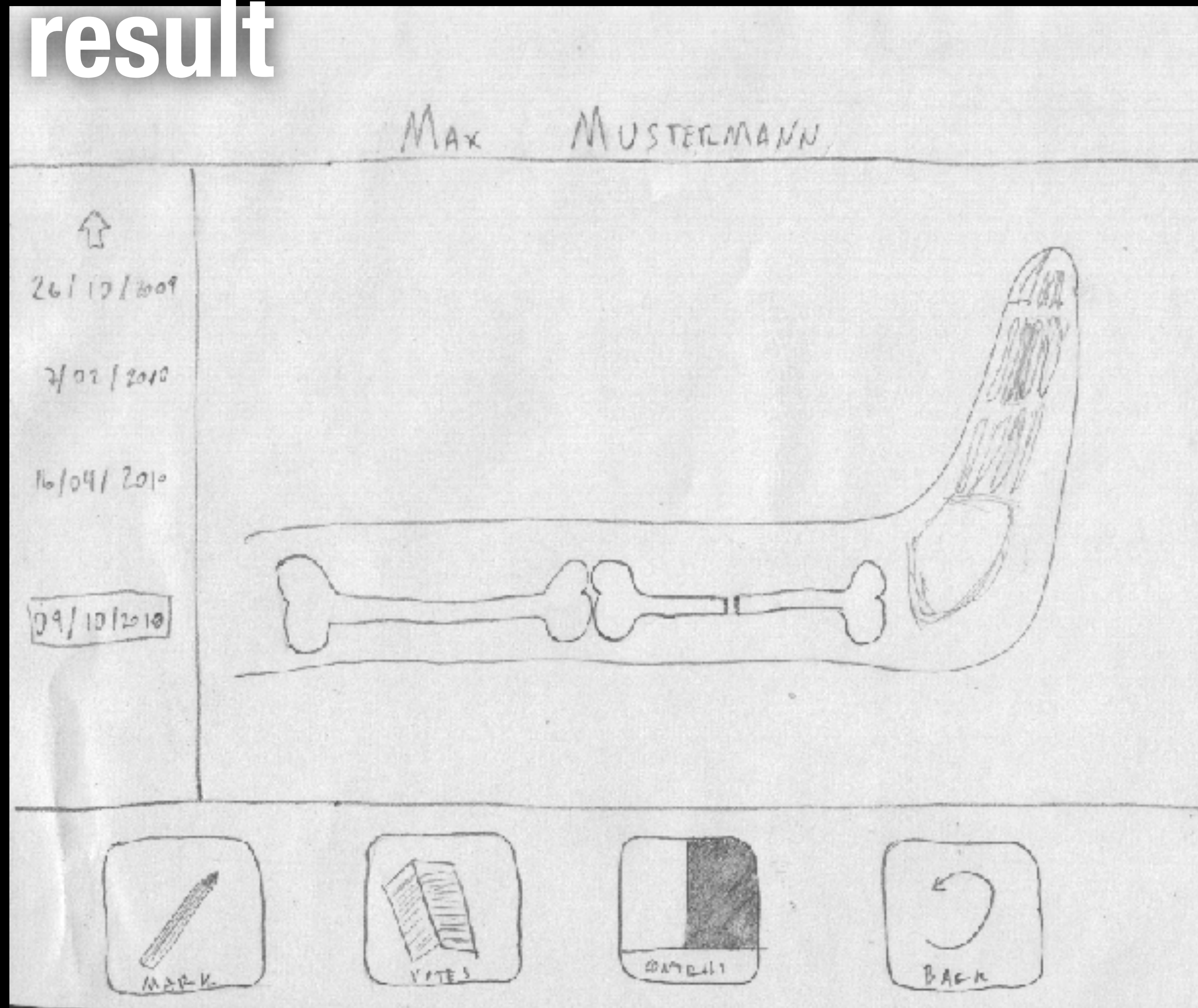
	Gender: male ID: 13527938X Age: 35 Problems: Diarrhea
---	---



Timeline showing the test results



Detailed result



Post-It Prototypes

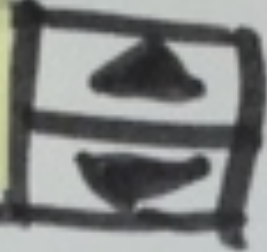
- More interactive paper prototype
- Dialogs, menus, windows on post-it notes in multiple layers
- Allows simulating opening dialogs, etc., by manipulating notes
- Quick to change by making new notes
- Tip: Create empty templates for dialog objects, then fill in
- Tip: Videotape user session for later analysis



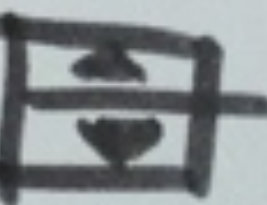
Radio Buttons/Checkboxes

Range Name

Row:

Height: 

Fit largest font

Column:
 width: 

Default width: 9

Hide row

Break page
at row

Hide column

Break
page at
column

Range Name

PrototypeRange

Row:

Height: 5

Fit largest font

Column:

width:

Default width: 9

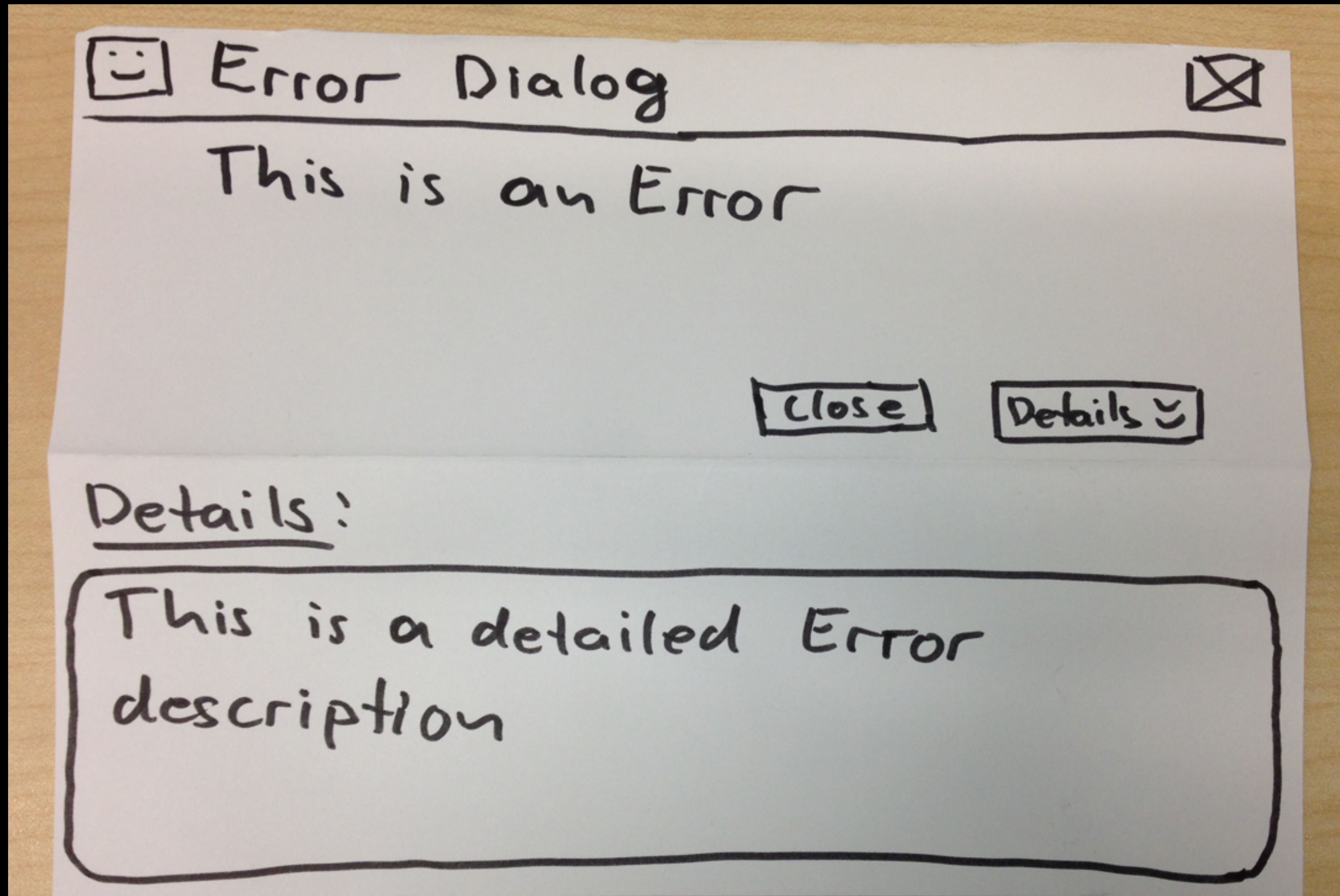
Hide row

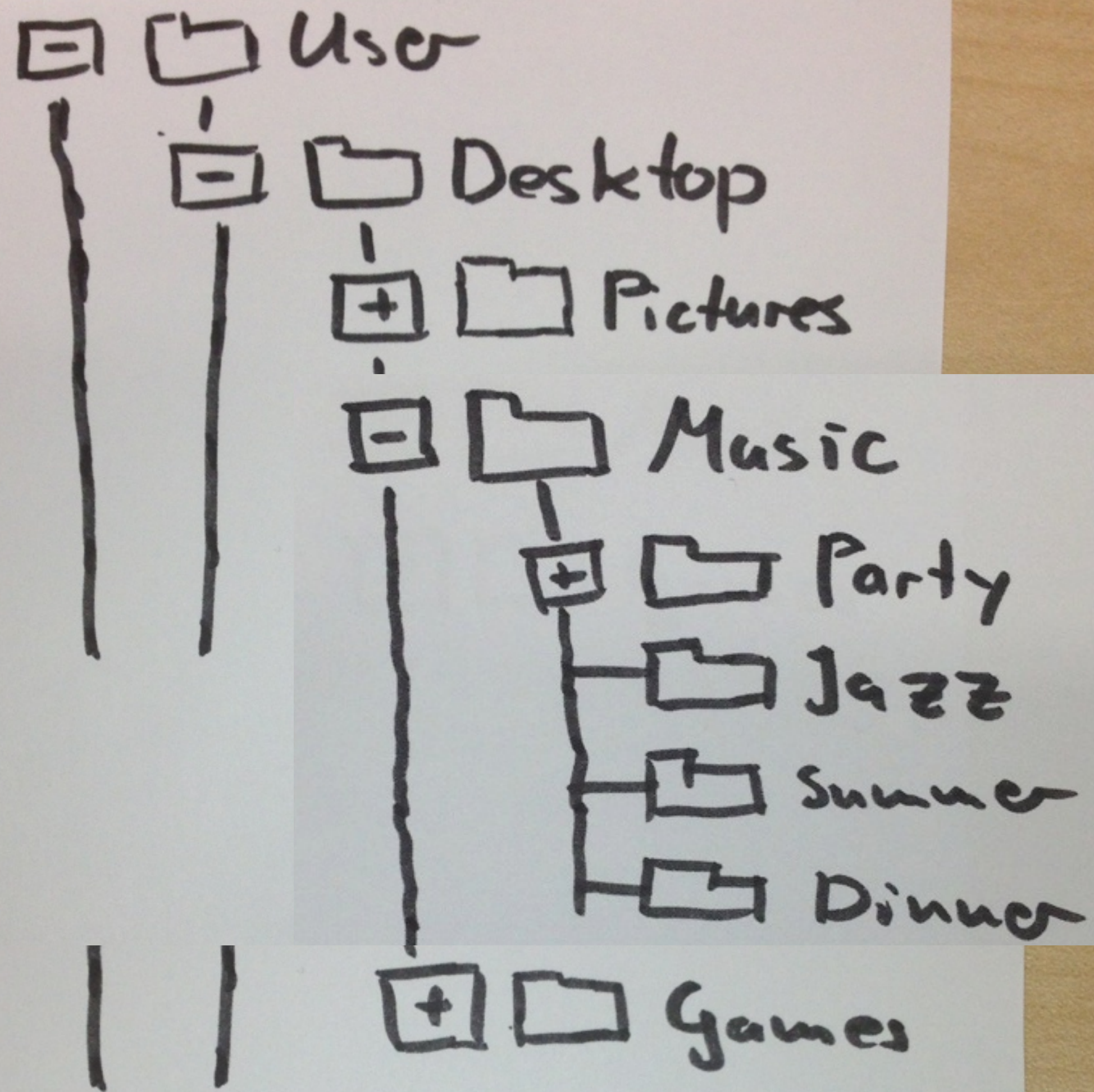
Break page
at row

Hide column

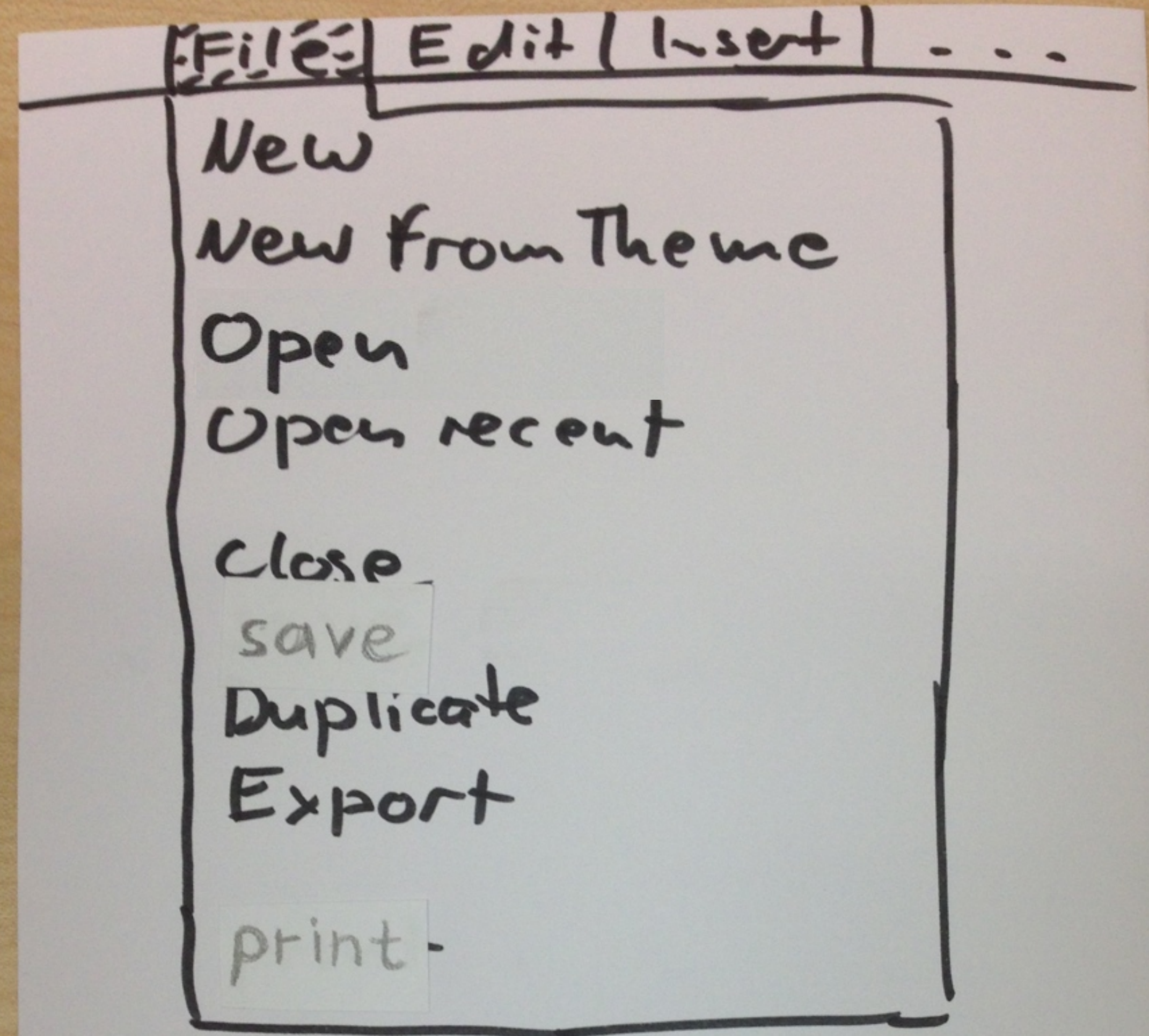
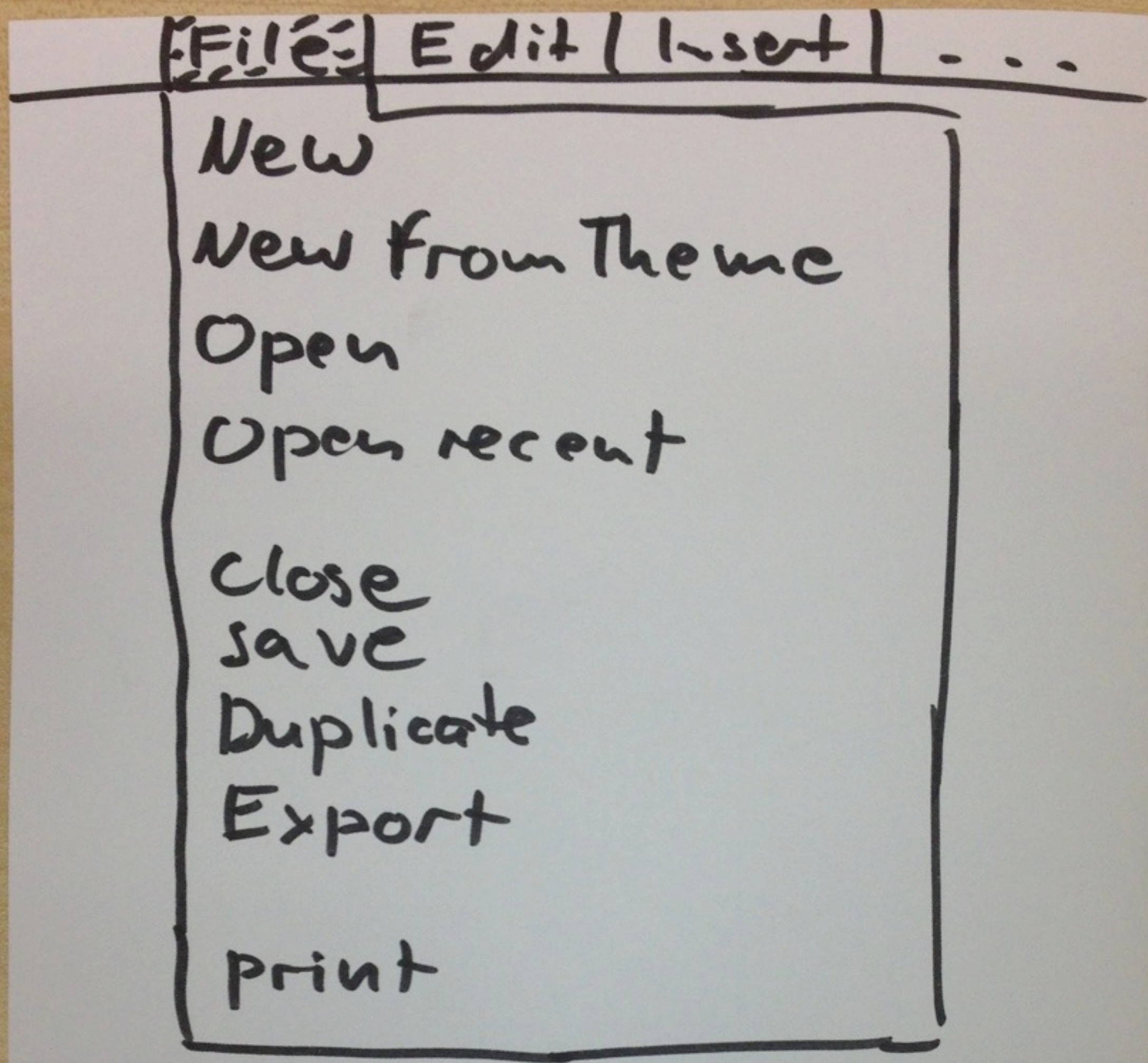
Break
page at
column

Expandable Dialog Boxes





Expandable Lists



Disabled (“grayed-out”) Controls

You are logged
in as

JOE

Username: ----- ●

Password: ----- ●

ENTER

I am a Rightie Leftie



Simulating Touchscreen UI with Paper Prototype

Kaiser, Dieckert. DIS1 students in 2010

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Veranstaltungen

Aktuelles

Digital Prototypes

Video

Veranstaltung 2

Veranstaltung 3

mehr...

Aktuelles 1

Aktuelles 2

Aktuelles 3

mehr...

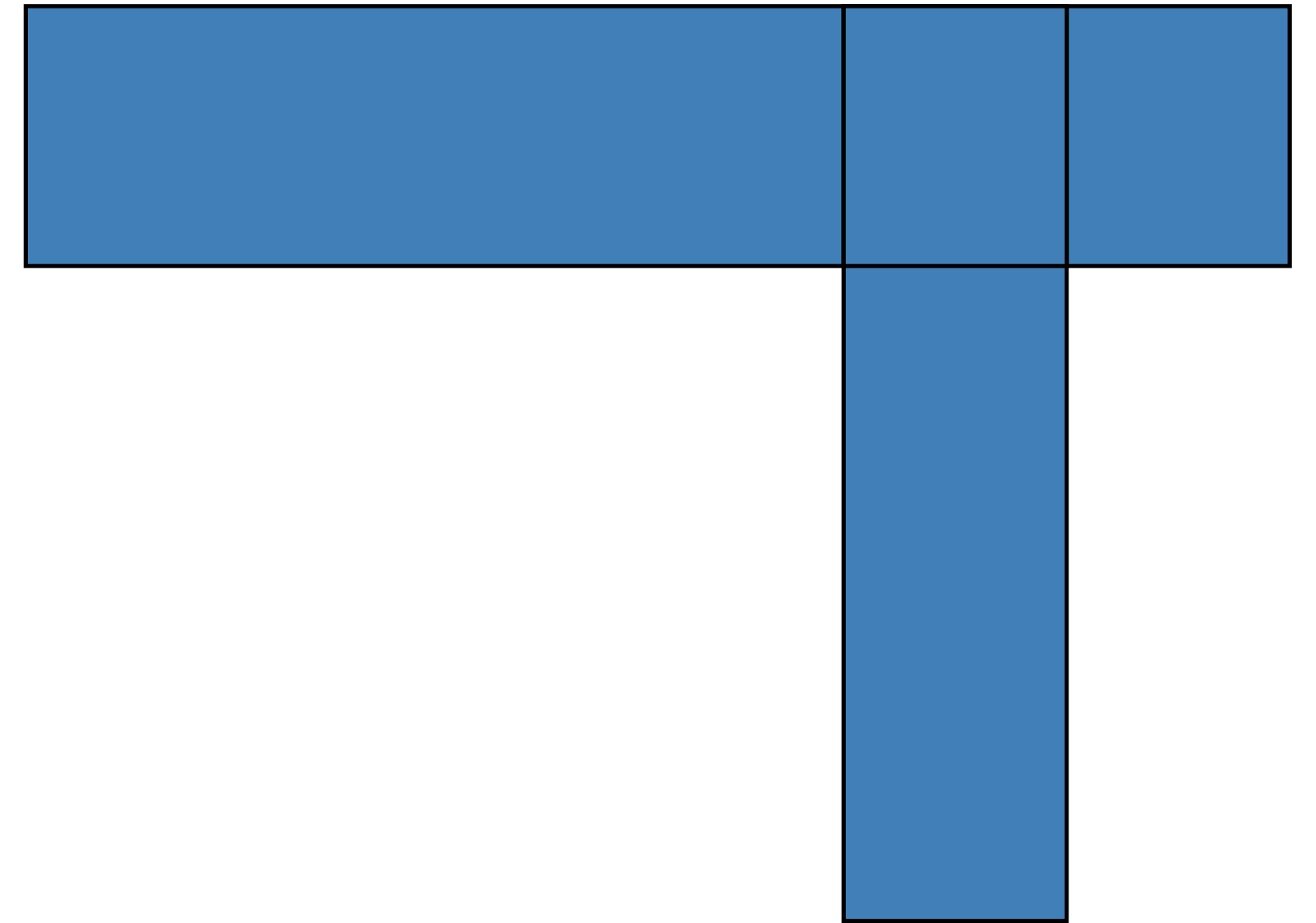
Digital Prototypes

- Medium fidelity prototype
 - More detailed, more precise, interactive
 - Create only after initial, simpler (paper) prototypes!
- Mock-up (model, illusion) of some (but not all) aspects of the final UI
- Example: Powerpoint prototype
- Important: UI, not functionality, is key!
- Pro: More engaging for user to try, user can play with it without designer around



How to Limit Prototypes

- Horizontal prototype
 - Entire UI visible, but no functionality
 - Simulate each interaction step (nothing “works”)
- Vertical prototype
 - Few functions, but those implemented in detail
 - Allows testing general design ideas by example
- Scenario
 - Combination of horizontal and vertical prototype
 - Script simulates only fixed interaction paths



Digital Prototyping: Screenshots

- Photoshop, PowerPoint, etc.
- Draw screens / UI storyboards
- Thin horizontal prototype
- Easier to change than hand drawings
- Allows for visual detail and quality
- Designs can become part of actual UI
 - Useful for non-standard GUIs
- Easy to distribute electronically





What to do

Find the item you want in the catalog and scan the bar code next to it.



What you selected

Item

Style

Cost

tax:

Total: \$ 0.00

All done?

Place your order

Print this list

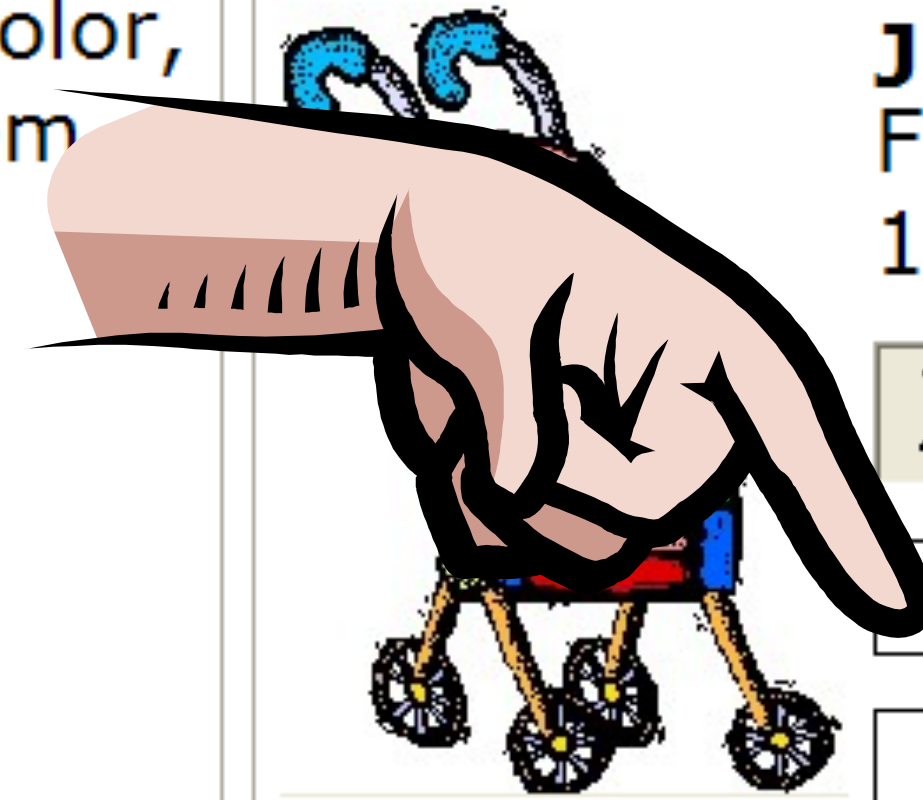
Throw this list away

What to do

Touch a different color,
or scan another item



What you selected



JPG Stroller

For children between
1-3 years old ...\$98.

- Green
- Blue
- Red (out of stock)

Item

Style

Cost

JPG Stroller

Green

98.00

Delete

tax: 6.98

Total: \$104.98

All done?

Place your order

Print this list

Throw this list away

What to do

Touch a different color,
or scan another item.



What you selected



JPG Stroller
For children between
1-3 years old ...**\$98.**

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- Blue
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Cost

JPG Stroller

Green

98.00

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Item

Style

Cost

JPG Stroller

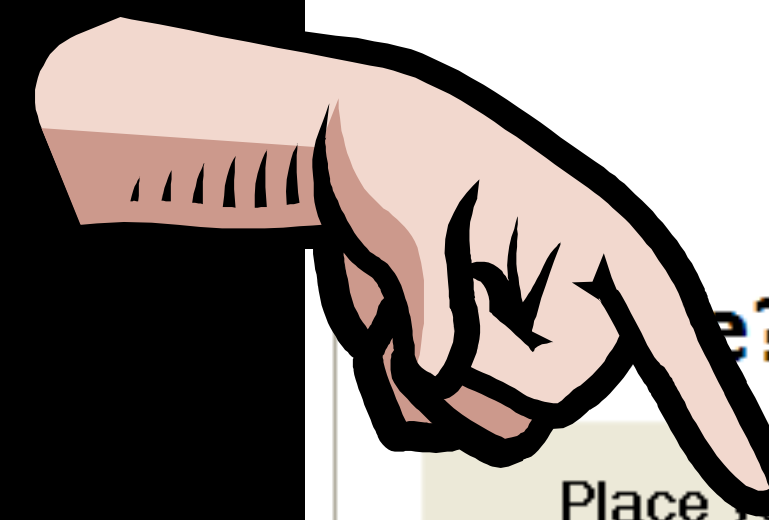
Green

98.00

Delete

tax: 6.98

Total: \$104.98



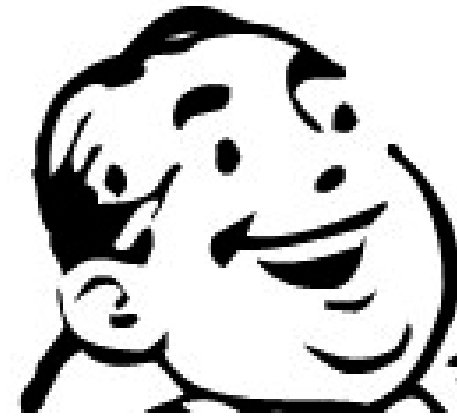
Place your order

Print this list

Throw this list away

What to do

To get your items,
bring your printout to
the front counter.



What you selected

Item

Style

Cost

JPG Stroller

Green

98.00

tax: 6.98

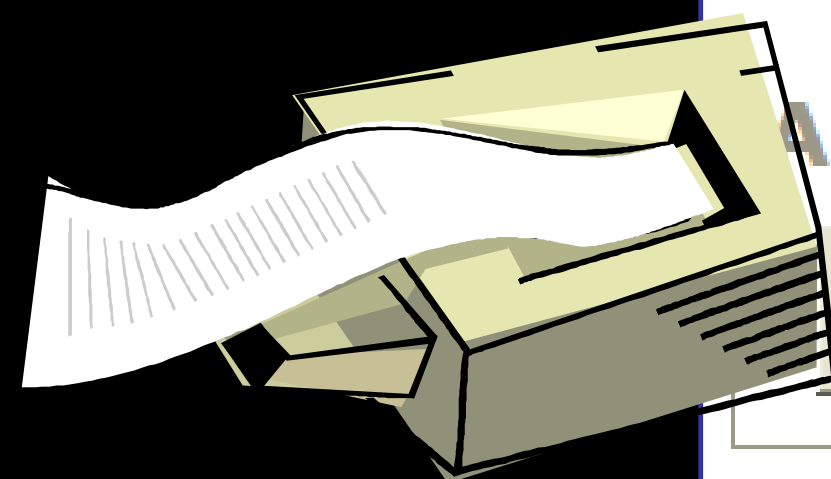
Total: \$104.98

All done?

Place your order

Print this list

Throw this list away



Screenshot Prototypes: Problems

- No interaction, does not capture any dynamic behavior or “feel” of the UI
- Danger of looking too polished, limits feedback, suggests the interface is “done”
- Missing physical aspects of devices

Screenshot Prototypes: Adding Effects

- Scripted simulations
- Using media tools such as PowerPoint or Photoshop layers
- More potential for interactivity:
 - Scene transition by simple input, timing, animation
- Prototype with slightly more vertical depth
- Use as click-through prototype for pitching
- Pro: looks real, good for non-standard UIs, no programming
- Con: still linear—simulation fails when script is not followed

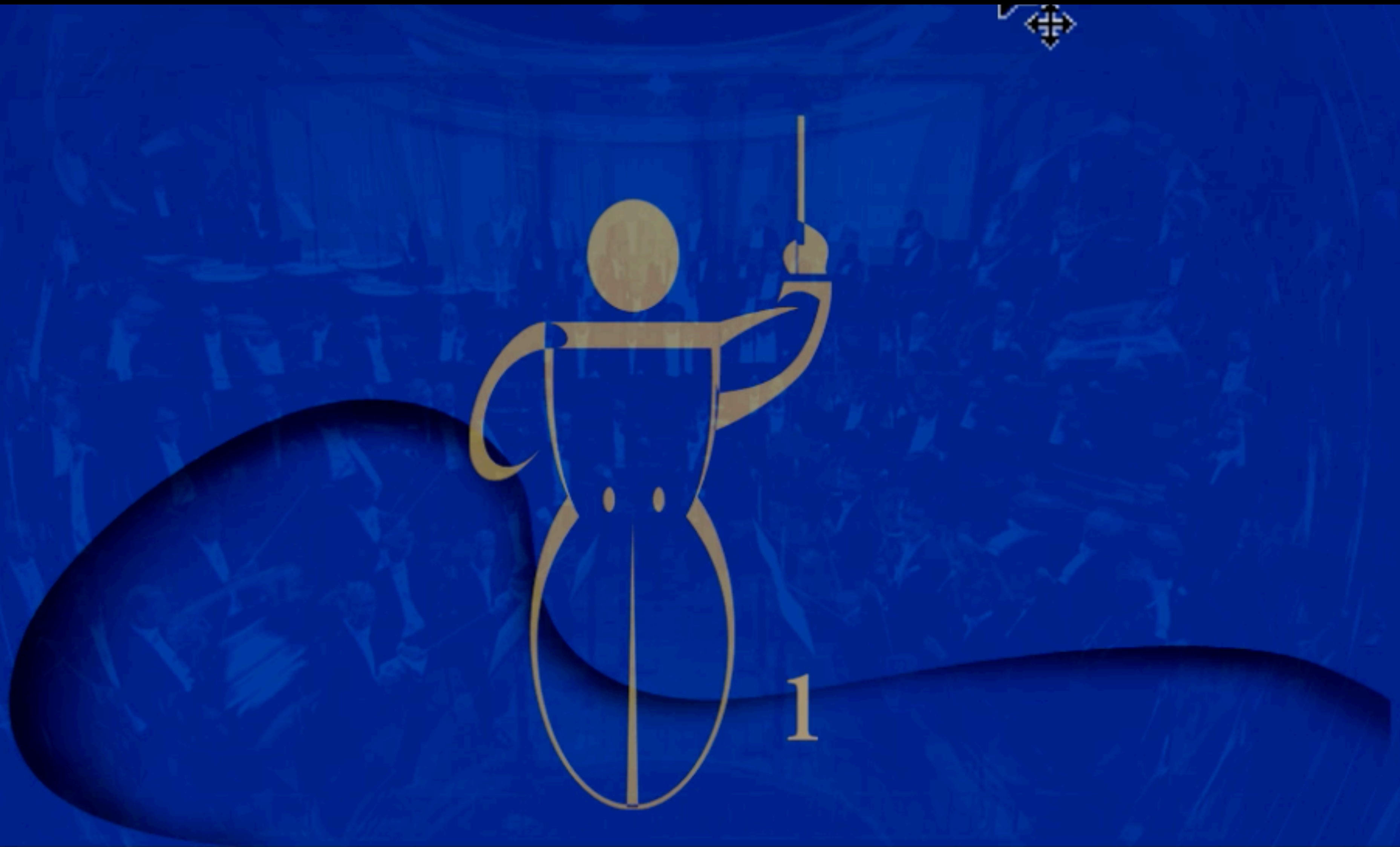


Demonstration: Personal Orchestra Prototype

- Alternative to sequential interaction scripts
- Using Photoshop layers to simulate
 - Highlighting menu options
 - Moving to different screens
- Photoshop layers can do some magic
- Normally your Screenshot Prototype will look less polished
 - This example turned out to also become our final graphical layout

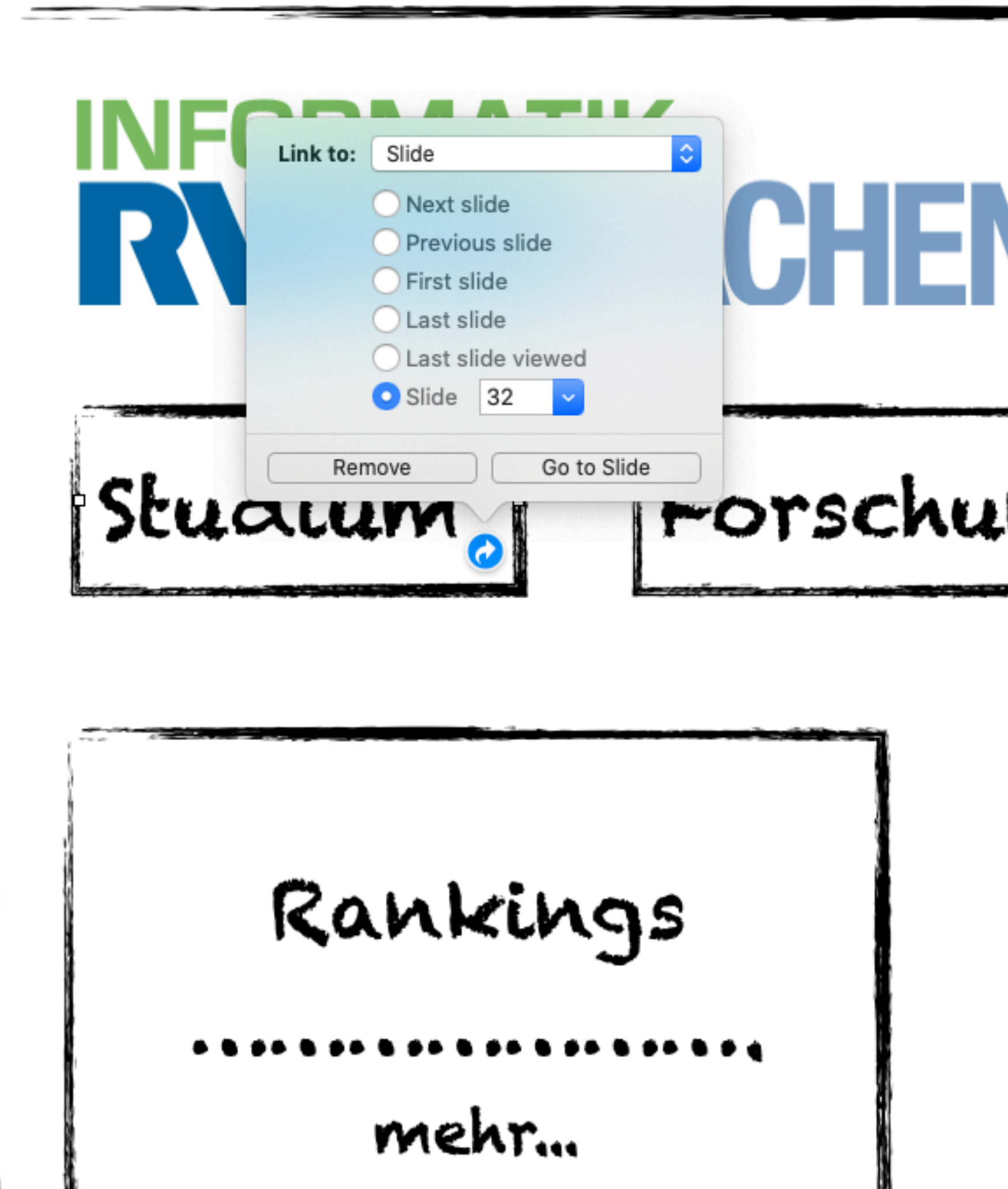


Using Layer Comps for Prototyping



Non-Linear Digital Prototypes

- Connect UI elements to a specific screenshot
- Prototypes with more horizontal and vertical depth
- No predefined sequence of actions
 - Users can decide what to do next and **do it themselves**



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mehr...

Video

.....

mehr...

Veranstaltungen

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Veranstaltung 1

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Veranstaltung 2

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Veranstaltung 3

.....

mehr...

Aktuelles

.....

Aktuelles 1

.....

Aktuelles 2

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Aktuelles 3

.....

mehr...

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[nn.nn.2011 Abend der Offenen Tür](#)

[nn.nn.2011 Girls' Day](#)

[nn.nn.2011 Tag Der Informatik](#)

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Warum Informatik an der RWTH?

Girls' Day 2011

Schülerinformationstag 2011

Helle Köpfe 2011 für Grundschüler

5 vor 12: Die Wissenschaftsnacht 2011

Fit für Informatik? Mach' den Test!

Vorkurs Informatik

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Aktuelles Studieren bei uns? Studiengänge Ansprechpartner Service Absolventen

- Bachelor Informatik
- Master Informatik
- Master of Science in Software Systems Engineering
- Master of Science in Media Informatics
- Promotionsstudium Informatik
- Diplomstudiengang Informatik
- Lehramtsstudiengang Informatik - Gymnasium und Gesamtschule
- Schwerpunkt Informatik im Studiengang Technik-Kommunikation

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Fachschaft Mathematik/Physik/Informatik

Studienberatung Bachelor Informatik

Studienberatung Master Informatik

Studienberatung Master Software Systems Engineering

Studienberatung Master Media Informatics

Studienberatung Lehramt Informatik

Studienberatung Technik-Kommunikation

Auslandsstudienberatung

Prüfungsausschüsse...

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Rechnerbetrieb Informatik (RBI)

RWTH-Rechenzentrum

Alle Lehrveranstaltungen in CAMPUS

Das RWTH-Lernportal L2P

Vorlesungen auf iTunes U

Prüfungsordnungen

Formulare

Semestertermine

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- Master
- Promotion
- Berufseinstieg
- Career Center
- Alumni Office

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Aktuelles ...	Personen ...	Gruppen ...	Projekte ...	Publikationen Presse...	Auszeichnungen ...	Forschen an der RWTH Stellenangebote ...
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Aktuelles

Die Informatik als Partner Angebote Recruiting Sponsoring & Fundraising

...

...

Weiterbildung... ...

...

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Aktuelles

Über die Fachgruppe Fachgruppen-Sprecher Kooperationen

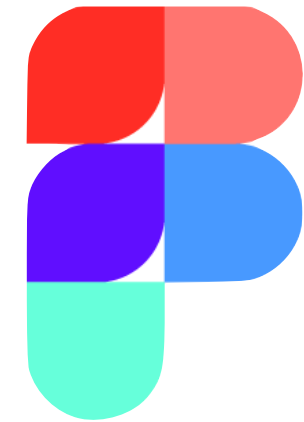
Struktur
Jahresberichte
Geschichte

Mitgliedschaften

Digital Prototyping Software



**Apple
Keynote**



Figma



miro



**Microsoft
PowerPoint**



**Adobe
Xd**



**Meta
Origami**

More examples:

- DIS 2
- <https://www.interaction-design.org>

balsamiq®

Prototyping Tools: Animation Apps

- Timeline metaphor
- Good for intricate animations
- Powerful when extended with scripts
 - But: Scripting languages are clumsy by CS standards
- May allow for integration of non-standard hardware and other OS features
- E.g., Adobe Animate
- Can even become final product
- But: Large designs become hard to manage



Image adopted from tutorial video: <https://creativecommons.adobe.com/cc/discover/learn/animate/beginner/graphic-design/animate-basics/vector-pattern-brush-animation>

Prototyping Tools: Web

- HTML + JavaScript, etc.
- Natural choice for web interface design
 - Can become final product
- Ubiquitous
 - Many tools (Electron, Cappuccino, ...)
 - Cleartext format
 - Viewable in any browser (in theory...), over the net
 - But: No precise look & feel (nature of the web)



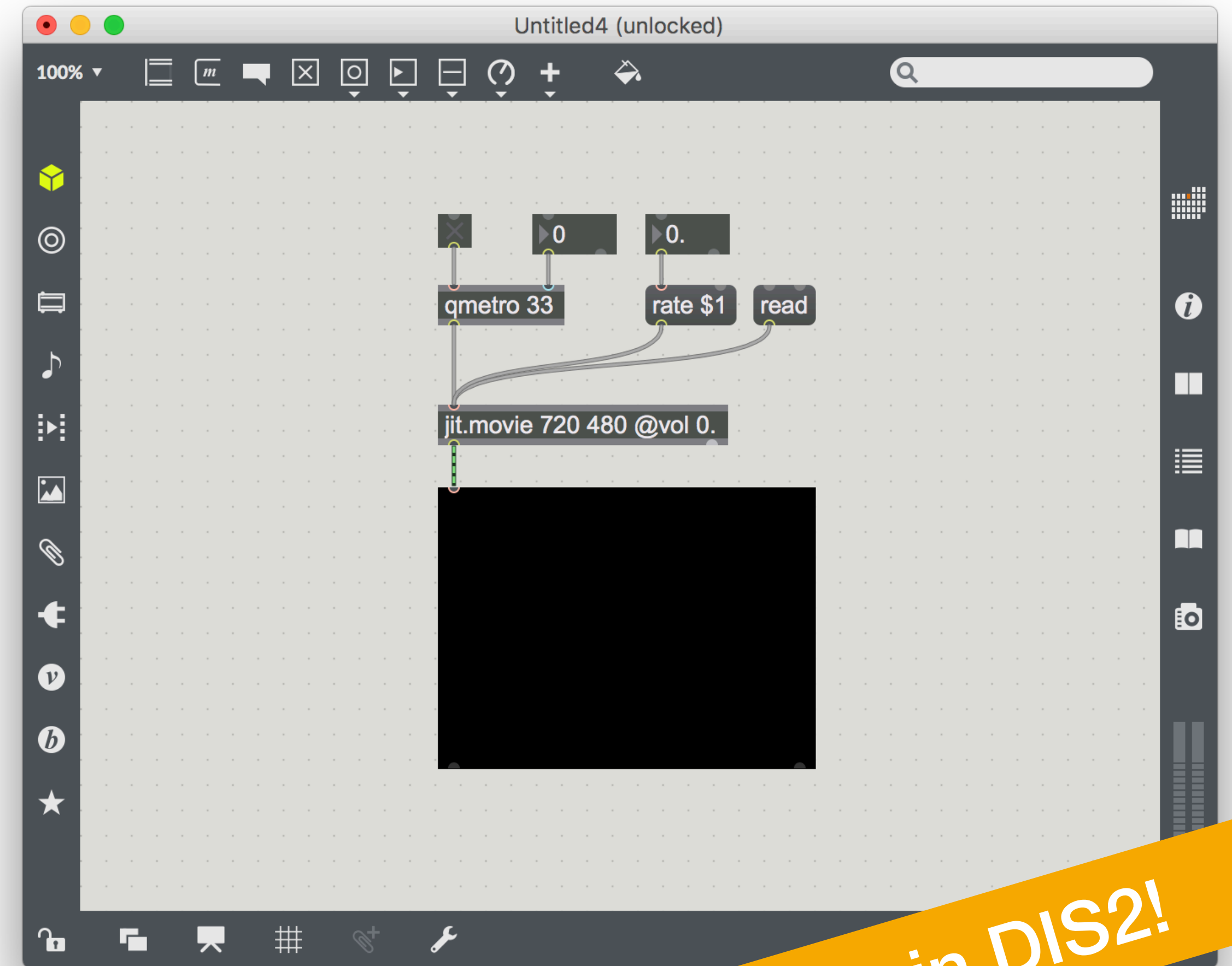
Prototyping Tools: Rapid Development Environments

- Visual Basic .NET, Tcl/Tk, etc.
- Good for standard GUIs (create standard look & feel)
- Often become final product
- Partly interpreted
 - Quick development cycle, but potential performance issues
- Distribution: OK
 - Not always cross-platform
 - May require specific runtime environment



Prototyping Tools: Special-Purpose

- Example: MAX/MSP
 - Multimedia development environment
 - Originally for MIDI applications
 - Extended to handle graphics, audio, and video
 - Build applications by connecting “patches” that process incoming data
 - Very helpful for specific type of applications
 - MIDI/audio/video processing, interactive music systems
 - Can be used for end products (WorldBeat)
 - Distribution: Mac and Windows, free player
 - pd for Linux



More in DIS2!

User Interface Builders

- Graphical/textual tools to define UI of real software application
- Usually part of integrated development environment (IDE)
- Pro:
 - Finished design can be used for final implementation
 - Real look & feel
 - Vertical functionality can be added easily
- Con:
 - Limited to 1 window system and its toolkit (windows, buttons, ...)



The image shows the Xcode IDE with a storyboard and a Swift file open. The storyboard, titled "Main.storyboard", displays a "TemperatureConverter" application window with a menu bar (File, Edit, Format, View, Window, Help) and a "Convert" button. A "View Controller" is connected to the storyboard via a relationship arrow. The Swift file, "ViewController.swift", contains the following code:

```
1 //
2 //
3 //
4 //
5 //
6 //
7
8 import Cocoa
9
10 class ViewController: NSViewController {
11
12     @IBOutlet weak var fahrenheitField: NSTextField!
13     @IBOutlet weak var celsiusField: NSTextField!
14
15     override func viewDidLoad() { ... }
16
17
18     @IBAction func convert(_ sender: NSButton) { ... }
19
20 }
21
22
23
24 }
25
26
```

A blue arrow points from the `convert` method in the Swift code to the "Convert" button in the storyboard. A "Connect Action" button is visible next to the `convert` method signature.

More in DIS2!

Digital Prototypes: Dangers

- Users focus on design details and overlook larger problems
- Users afraid to criticize or suggest changes to “nice” UI design
 - Looks like it was so much work...
- Management may think it’s real 😊
 - Looks like the software is almost done
 - Reason: Users think the interface is the system! (“Conceptual models”)

Hardware Prototypes

Hardware Prototypes

- For systems that are hard to imagine by software alone
 - Example: Palm's wooden blocks
- Physical interaction is important
 - E.g., new 3-D mouse
- Design in wood, foam core, plastics, styrofoam, cardboard, ...
- Problem: high effort to build and change

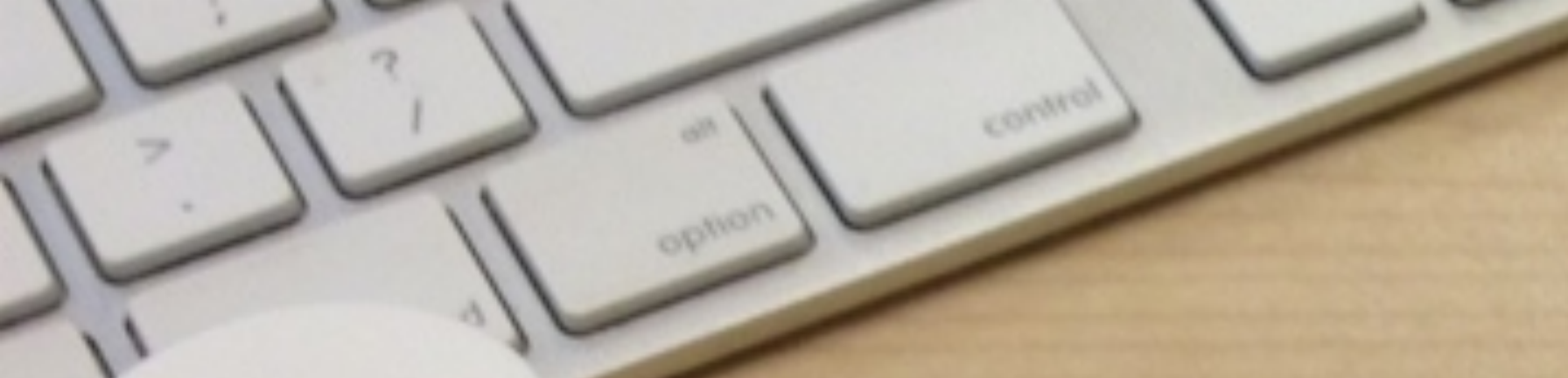


Prototypes of Microsoft Touch Mouse, Cut From Foam



3D Printed Prototype of Pebble Watch





1 2 3
 4 5 6
 7 8 9
 -- 0 AV
 - CHANNEL +

HELLO!
 Please
 Select
 Device :)

ZOOM



EXIT

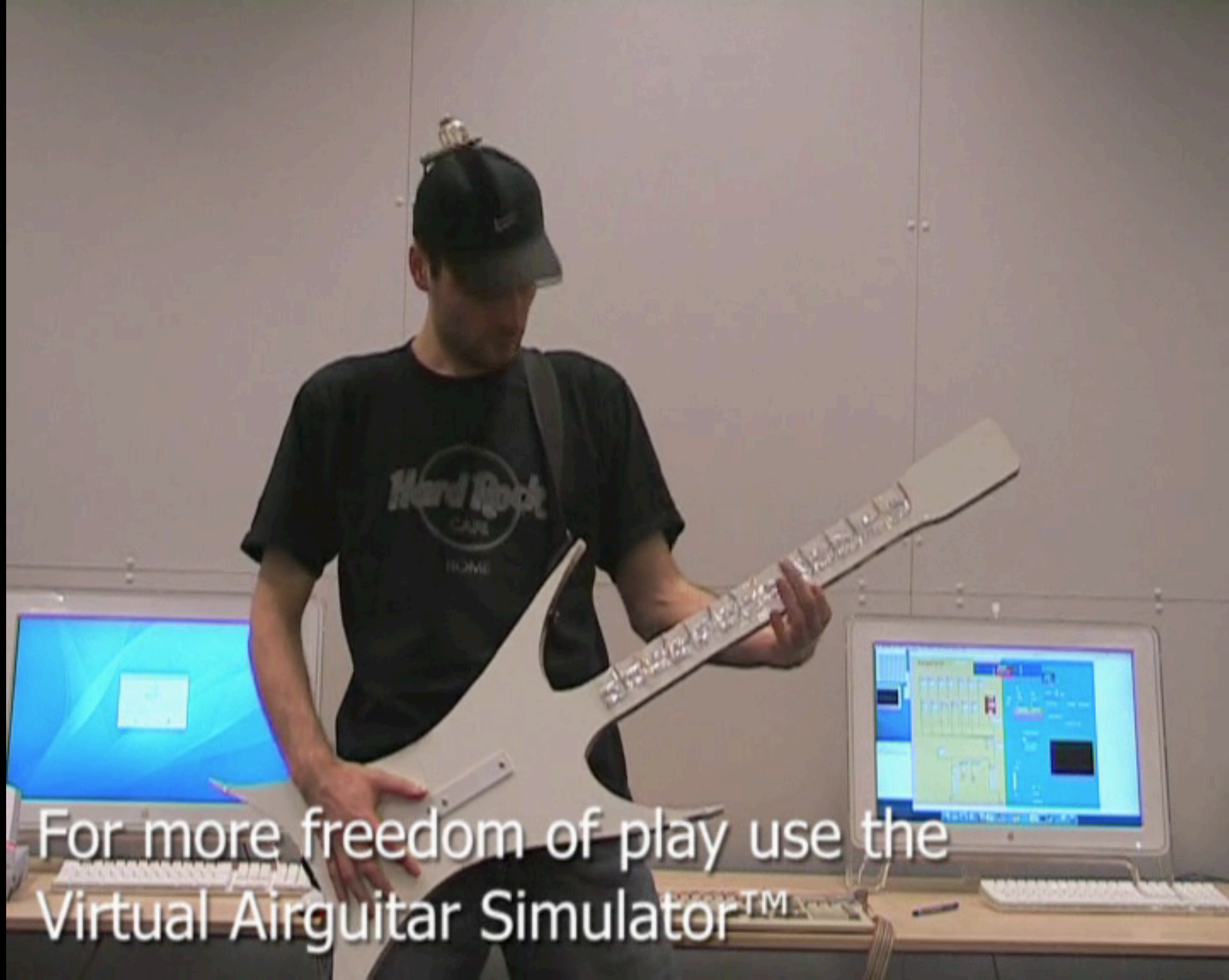
MENU



TV

DVD

RADIO



For more freedom of play use the
Virtual Airguitar Simulator™

Wizard of Oz

- Human ‘wizard’ simulates system response
 - Interprets user input according to an algorithm
 - Controls computer to simulate appropriate output
 - Uses real or mock interface
 - Wizard sometimes visible, sometimes hidden
 - “Pay no attention to the man behind the curtain!”
- Good for:
 - Adding simulated and complex vertical functionality
 - Testing futuristic ideas
 - Example: 1984 IBM voice recognition editor

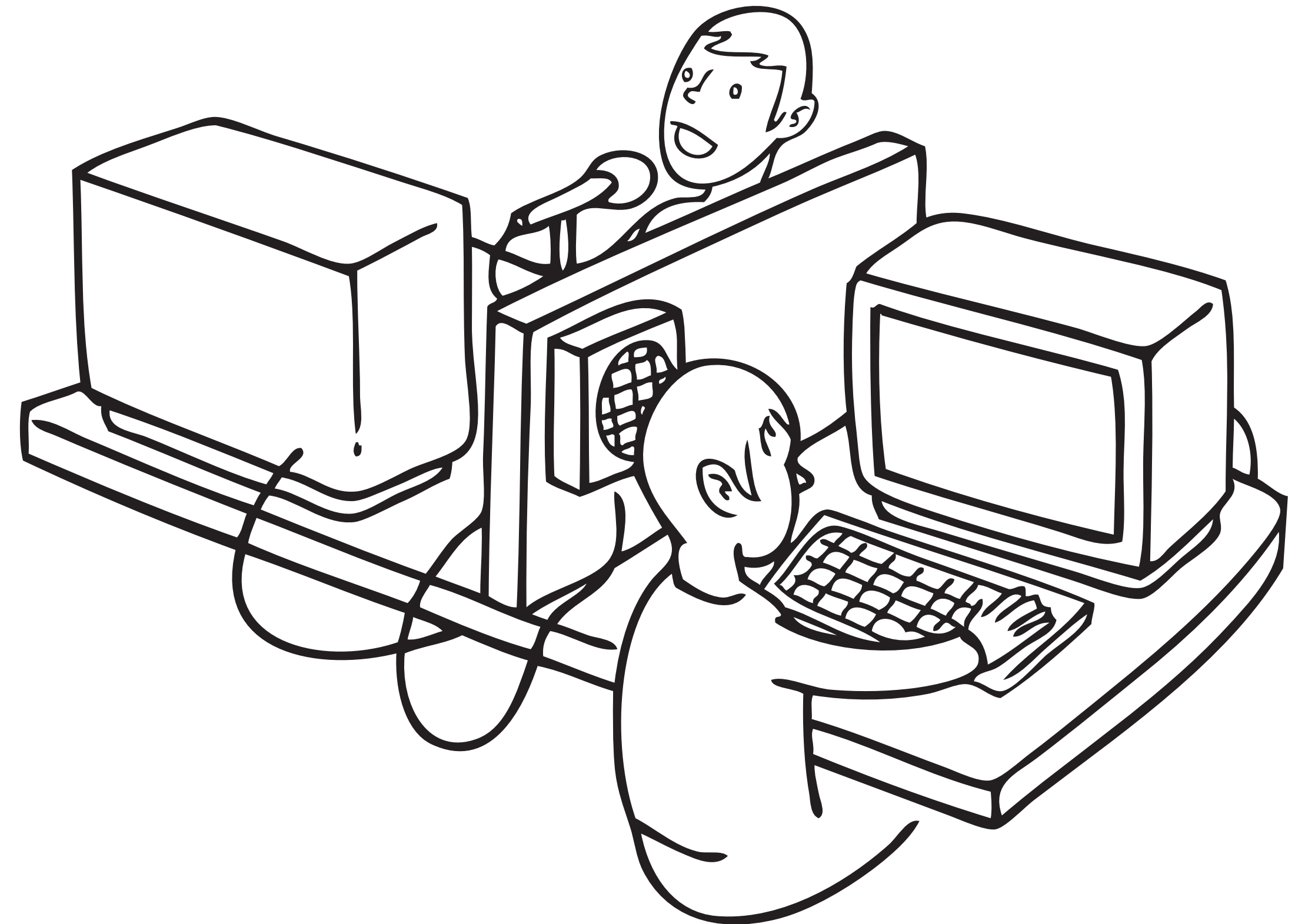


Image: Buxton 2007, *Sketching User Interfaces*

What to Do with a Prototype?

- Throw away
 - If creation was quick and cheap
- Continue to develop
 - Prototype improved incrementally
 - Becomes final product
 - Problem: Has to use production-strength technology



Summary

- Many iterations of prototypes necessary
 - Paper prototypes for high-level, rough UI design
 - Types: Storyboard-like & Flipbook
 - Post-it prototypes to create first interactive versions
 - Digital prototypes for more detailed, interactive walkthrough
 - Can be vertical and/or horizontal
 - Types: Screenshot, Non-Linear
 - Tools: Wireframing Apps, Animation Apps, Web, Interface Builders
 - Hardware prototypes if physical interaction is important
- Wizard of Oz technique to add simulated and complex vertical functionality
- Throw it away or keep it?

