A Review of Milestones in the History of GUI Prototyping Tools

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User-Centered Design Process

(ISO 9241-210)

But which kind of solution?
Transition to another tool
Evolution using the same tool
Existing solutions: iterative process and prototypes

1. Initial needs and requirements
2. Needs and requirements analysis
   - Few knowledge of the domain
     - Low degree of fidelity
     - Solutions not fitting to the problem
   - Lot of knowledge of the domain
     - High degree of fidelity
     - Solutions fitting to the problem
3. Prototyping
   - Concepts of the prototype
   - Paper Prototype
   - Low fidelity prototype
   - High fidelity prototype
4. Tests and evaluations
   - Results of assessment of concepts and ideas
   - Results of evaluation of concepts and interactions
   - Results of User experience evaluations
5. Final product
   - Implementation
   - Prototype meeting the requirements
Questions we want to understand

• Which tools support exist for prototype?
• What features are available?
• What are the opportunities improving tools?
• There is any conceptual gaps in tools?
• There is any trend in the development of tools?
Survey of academic papers and commercial tools

• Review of academic full papers in conferences:
  – ACM CHI (1982-2014)
  – ACM UIST (1988-2014)
  – ACM DIS (1995-2014)
  – ACM EICS (2009-2014)
  – IFIP INTERACT (1984-2013)
  – Keywords: prototype, prototyping tool, prototyping interface, wireframe, wireframing, sketch, sketching, draws and drawing.
  – Total: 7,243 publications matched keyword(s)
  – Excluded: model-based prototyping, multimodal user interfaces

• Review of commercial tools
  – 113 selected tools in a first round
  – 23 discarded because they are not proper interactive software tools...
Diversity in existing prototyping tools

Prototype papier
Mockup Plus
MockupScreens
Axure
Proto.io
Java
Tools in numbers along the years

- Academic tools
- Commercial tools

First period:
- Non-Programming Skills, Preview Mode, Behavior Specification
- Widgets, Reuse Mechanism

Second period:
- Annotations, Support for Code Generation, Support for the Entire Design Lifecycle, Version Control, Pen-based Interaction
- Scenario Management
- Support for Usability Testing

Third period:
- Collaborative Working
Identified milestones

- Non-Programming Skills
- Pen-Based Interaction
- Widgets / ontological model
- Specification of prototype behavior
- Collaborative Working
- Scenario Management
- Preview Mode
- Support for Usability Testing
- Support for Code Generation
- Version Control
- Annotations
- Support for UCD interactive development
## Summary of milestones

<table>
<thead>
<tr>
<th>Year</th>
<th>Tool</th>
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<tbody>
<tr>
<td>1987</td>
<td>Adobe Illustrator</td>
<td>2010</td>
<td>Appery.io</td>
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<td>1988</td>
<td>Adobe Photoshop</td>
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<td>1992</td>
<td>Microsoft Visio</td>
<td>2011</td>
<td>Sketch</td>
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<td>1994</td>
<td>SmartDraw</td>
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<td>105Screens</td>
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<td>1997</td>
<td>Adobe Fireworks</td>
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<td>AppCroker</td>
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<td>1999</td>
<td>Adobe InDesign</td>
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<td>FieldTest</td>
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<td>2000</td>
<td>ScreenArchitect</td>
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<td>Lumzy</td>
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<td>2003</td>
<td>Axure</td>
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<td>Mockups.me</td>
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<td>2004</td>
<td>CogTool</td>
<td>2012</td>
<td>AppMockupTools</td>
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<td>2005</td>
<td>SketchiXML</td>
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<td>AppSketcher</td>
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<td>2006</td>
<td>GUI Design Studio</td>
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<td>FluidUI</td>
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<td>2007</td>
<td>JustinMind</td>
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<td>POP</td>
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<td>2008</td>
<td>Balsamiq</td>
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<td>ActiveStory Enhancer</td>
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<td>MockingBird</td>
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<td>Framer</td>
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<td>Pencil Project</td>
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<td>InVision</td>
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<td>Pidoco</td>
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<td>Marvel</td>
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<td>ProtoShare</td>
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<td>NinjaMock</td>
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<td>PickFu</td>
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<td>Notism</td>
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<td>Wireframe Sket</td>
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<td>WWD Wireframes</td>
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<td>2009</td>
<td>ActiveStory Enhancer</td>
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<td>AppGyer Prot.</td>
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<td>Cacao</td>
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<td>Crank Storyboard</td>
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<td>Mockup Plus</td>
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<td>SnapUp</td>
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### Skills Percentage

<table>
<thead>
<tr>
<th>Skill</th>
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<tbody>
<tr>
<td>Non-Programming Skills</td>
<td>67.69%</td>
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<tr>
<td>Pen-Based Interaction</td>
<td>5.38%</td>
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<tr>
<td>Widgets</td>
<td>60.77%</td>
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<tr>
<td>Behavior Specification</td>
<td>56.15%</td>
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<tr>
<td>Collaborative Working</td>
<td>21.54%</td>
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<tr>
<td>Reuse Mechanism</td>
<td>63.08%</td>
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<tr>
<td>Scenario Management</td>
<td>8.46%</td>
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<tr>
<td>Preview Mode</td>
<td>52.31%</td>
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<tr>
<td>Support for Usability Testing</td>
<td>5.38%</td>
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<tr>
<td>Support for Code Generation</td>
<td>21.54%</td>
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<tr>
<td>Version Control</td>
<td>19.23%</td>
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<tr>
<td>Annotations</td>
<td>41.54%</td>
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<td>Support for UCD interactive</td>
<td>6.92%</td>
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As for non-programming skills

**Type of tools**
- For drawing
- For modeling
- For prototyping

**Main features**
- Building the prototype
- Executing prototypes
- Annotations
- Versioning

User interface and interactions

Tools:
- Balsamiq
- Marvel
- Denim
As for annotations

### Definition
[Sanderson R. et al. 2013]
- Context
- Target
- Body

### Types of annotations
[Renear et al. 1999]
- Textual
- Symbols
- Dessin
- Sessions
- Modification

### Integration of annotations
[Chang et al. 2000]
- Directly on the support
- On the site
- External links

[Image of handwritten notes]
As for annotations: ways to annotate prototypes

Analyses on annotations (113 tools)
- only 43 tools support annotations
- 3 methods
  - Annotation is a widget
  - Revision mode
  - Record values used in test
As for versioning

Analysis of versioning (113 tools)
  – Only 11 tools support that feature

Gestionnaire de version (Alouka)
Intriguing questions in the findings & future work

• Large spectrum of features covered over time
• Many commercial tools launched after 2008 (ex. Balsamiq)
  – Does it mean a significant change of development practice encourage the development of tools?
• Little support of the tools to annotation activities in a requirements process.
  – Why is that?
• How to move prototypes from low-fidelity to interactive prototypes and final products?
• What is the impact of idiosyncrasies of application domains and technology (such as mobile, web, post-wimp) affect the development of prototyping tools?
• How features in tools affect usability and UX of final products?
• How tools affect creativity in the development process?
Future work

• Complete the survey
  – With review of journal papers
  – Assessing impact, adoption etc. of tools in the market

• Analyzing prototyping activities with tools

• Try to understand what kind of features tools can provide to prototype aspects that can create realism and enforce UX (ex. animations, sound feedback, continuous feedback...)

• Investigate mechanisms for tracing the evolution and decision making between iterative life cycles of prototyping

• Develop a prototyping environment called PANDA: Prototyping using ANnotation and Decision Analysis
Thanks for your attention

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