Chapter 7

Prototyping

" There's a mantra at IDEO: "Never go to a meeting without a prototype." *At whatever stage of development, one week, one month, or 6 months. "*

Perform usability evaluation and obtain feedback as *early* as possible in the design cycle by building and evaluating prototypes.

References

++ Carolyn Snyder; *Paper Prototyping*; Morgan Kaufmann, 2003. ISBN 1558608702 (com, uk) [Snyder 2003]

+   Bill Buxton; *Sketching User Experiences*; Morgan Kaufmann, 2007. ISBN 0123740371 (com, uk) [Buxton 2007]

°   Marc Rettig; *Prototyping for Tiny Fingers*; CACM, 37(4), 1994. [Rettig 1994].

°   Carolyn Snyder; *Using Paper Prototypes to Manage Risk*; Software Design and Publisher Magazine, 1996. https://articles.uie.com/prototyping_risk/

°   Snyder and Lahti; *Paper Prototyping Tricks*; 12 min. videotape. User Interface Engineering, 1995. uie.com

°   Jakob Nielsen; *Paper Prototyping: A How-To Training Video*; 32 min. video (DVD). Nielsen Norman Group, 2003. http://nngroup.com/reports/prototyping/

Online Resources

°   Google; *Rapid Prototyping*; Google for Entrepreneurs; 08 Aug 2016. Three-part short video series; https://youtu.be/JMjozqJS44M

°   Patrick Thornton; *Paper Prototyping: A Primer*; 06 Feb 2019. https://patrickwthornton.com/paper-prototyping-a-primer/

°   Nick Babich; *The Magic of Paper Prototyping*; UX Planet; 01 Sept 2018. https://uxplanet.org/the-magic-of-paper-prototyping-51693eac6bc3

○ Shawn Medero; *Paper Prototyping*; A List Apart; 23 Jan 2007. `https://alistapart.com/article/paperprototyping`

○ Carolyn Snyder; *Streamlining the Design Process with Paper Prototyping: An Interview with Carolyn Snyder*; User Interface Engineering, 30 Jan 2007. `https://articles.uie.com/snyder_interview/`

○ Jared Spool; *Looking Back on 16 Years of Paper Prototyping* ; User Interface Engineering, 27 Jul 2005. `https://articles.uie.com/looking_back_on_paper_prototyping/`

○ Tara Scanlon; *Paper Prototypes: Still Our Favorite*; User Interface Engineering, 01 May 1998. `https://articles.uie.com/paper_prototyping/`

○ Matthew Klee; *Five Paper Prototyping Tips*; User Interface Engineering, 01 Mar 2000. `https://articles.uie.com/prototyping_tips/`

○ Prototypr.io; Prototyping news, stories, tool reviews, etc. `prototypr.io`

The Prototype Becomes The Product

• Historically, best practice was to throw the prototype away and implement the final design (efficiently) from scratch.

• With the advent of agile development and designing in the web browser, that practice is changing.

• It is now quite common to incremetally develop a prototype until it becomes the product.

7.1   Types of Prototype

In increasing order of complexity:

• *Verbal Prototypes*: textual description of choices and results.

• *Paper Prototypes*:
  – *Low-Fidelity*: hand-drawn paper sketches.

  – *High-Fidelity*: more elaborate paper printouts.

• *Interactive Prototypes*: interactive prototypes for testing purposes only.

• *Working Prototypes*: interactive, skeleton implementations in code.

7.2   Verbal Prototypes

• Simple textual description of choices and results.

• Write the user guide first, before anything is implemented. Have it reviewed by someone else.

7.3   Low-Fidelity Paper Prototypes

• Paper prototypes simulate screen and dialogue elements on paper.
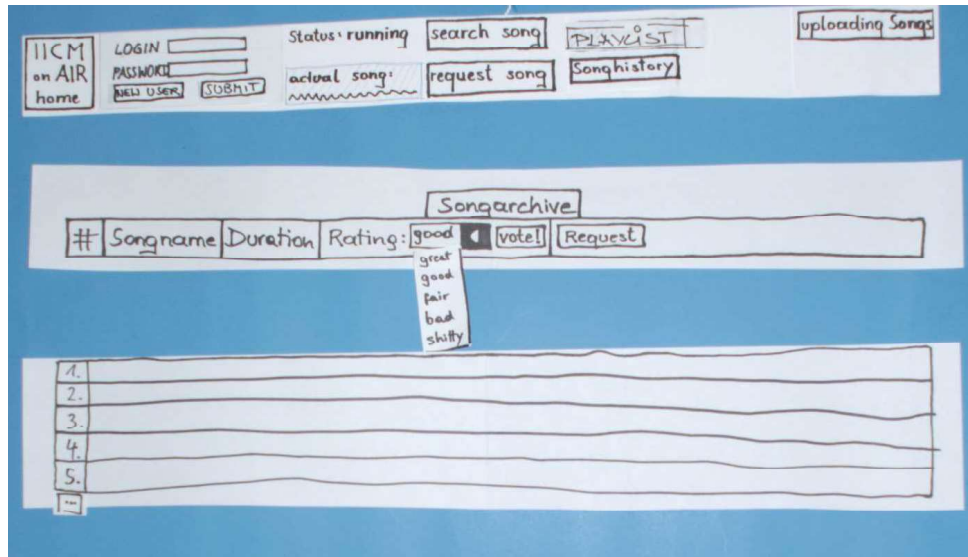
Figure 7.1: Paper prototype of IICM on Air.

- First hand-drawn sketches (lo-fi), later perhaps more elaborate printouts (hi-fi).

- Early usability feedback with throwaway designs: *maximum feedback for minimum effort!*

- Greeking (drawing squiggly lines) is used to represent text which would otherwise be a distraction.

- Figures 7.1 and 7.2 show paper and working prototypes for an online radio station.

- UX Playground have some examples of testing with paper prototypes on YouTube. [Video: `https://youtu.be/Car4IlhY3_0`]

Paper Prototype of Customer Information Terminal

- Design interface for customer information terminal to be placed in branches of the (fictional) Northumberland Bank.

- Specifically prototype the loans section: tasks include information about loans and calculation of loan repayments.

- Figures 7.3, 7.4, and 7.5 show three of the paper prototypes developed.
  [Thanks to Cliff Brown, Northumbria University, for permission to use these images.]

Testing with Low-Fidelity Paper Prototypes

Some examples:

- *Blood Testing Kiosk*; UCID Paper Prototying Project, 2009. [Video: `https://youtu.be/_g4GGtJ8NCY`]

- *T-shirt Vending*; UCID Paper Prototying Project, 2009. [Video: `https://youtu.be/-PZmX1Lt3Ro`]

- Paul Wilshaw; *Low Fidelity Prototype Testing of the YouTube Website*; UX Playground, 2015. [Video: `https://youtu.be/aDqbMOI13o4`]

- Chakib Labidi; *Paper-Based Prototype Testing (National Rail Enquiries App and snozoneuk.com)*; UX Playground, 2015. [Video: `https://youtu.be/Car4IlhY3_0`]
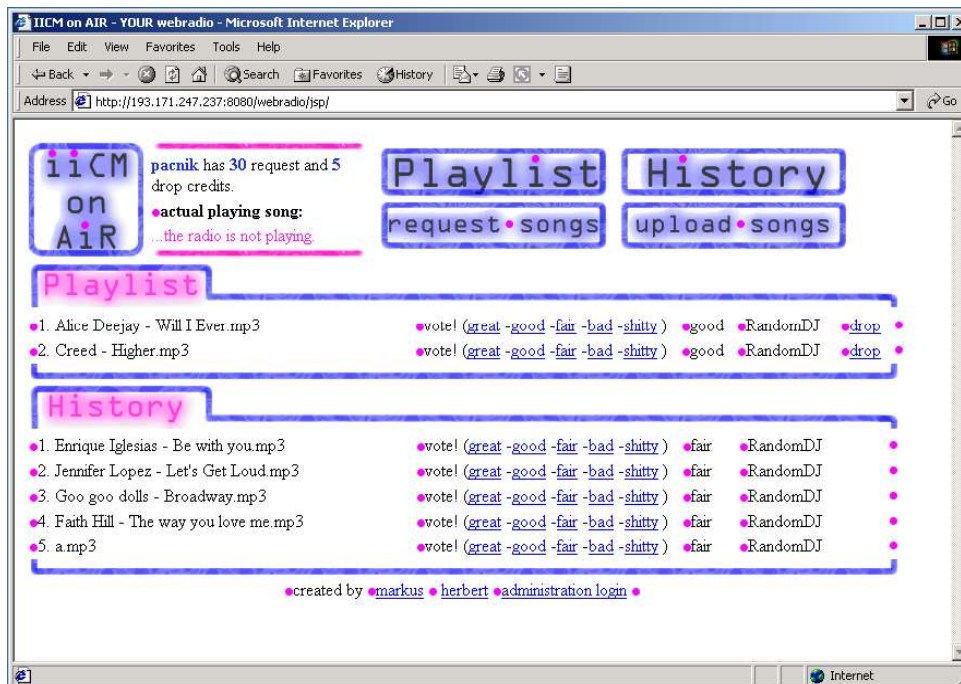
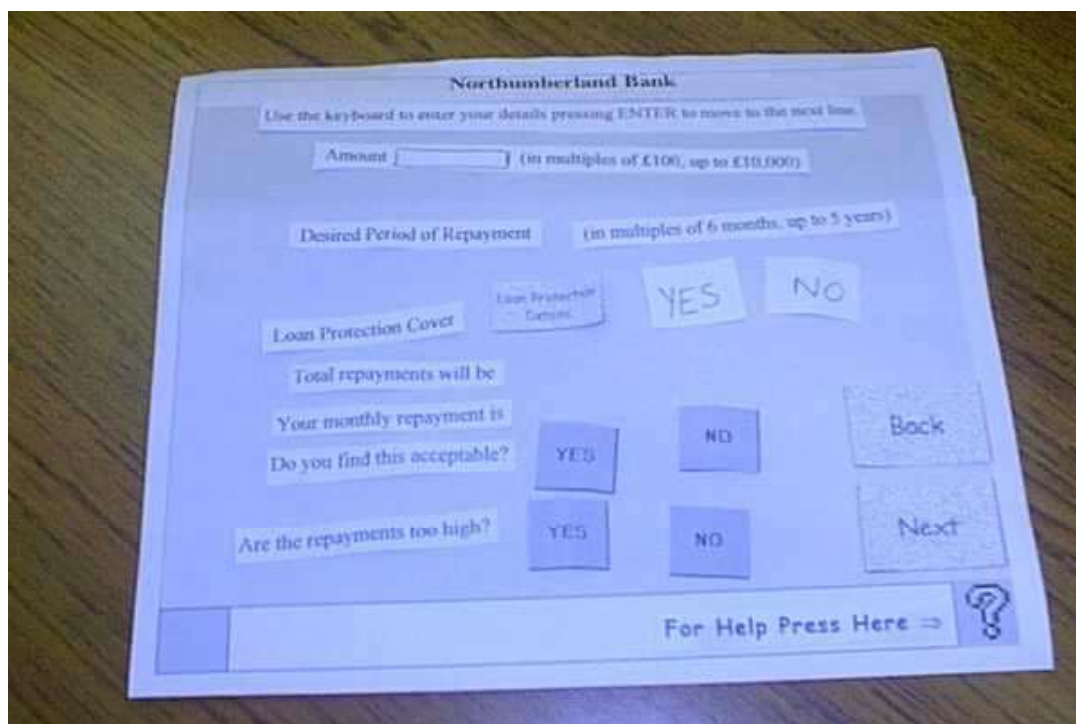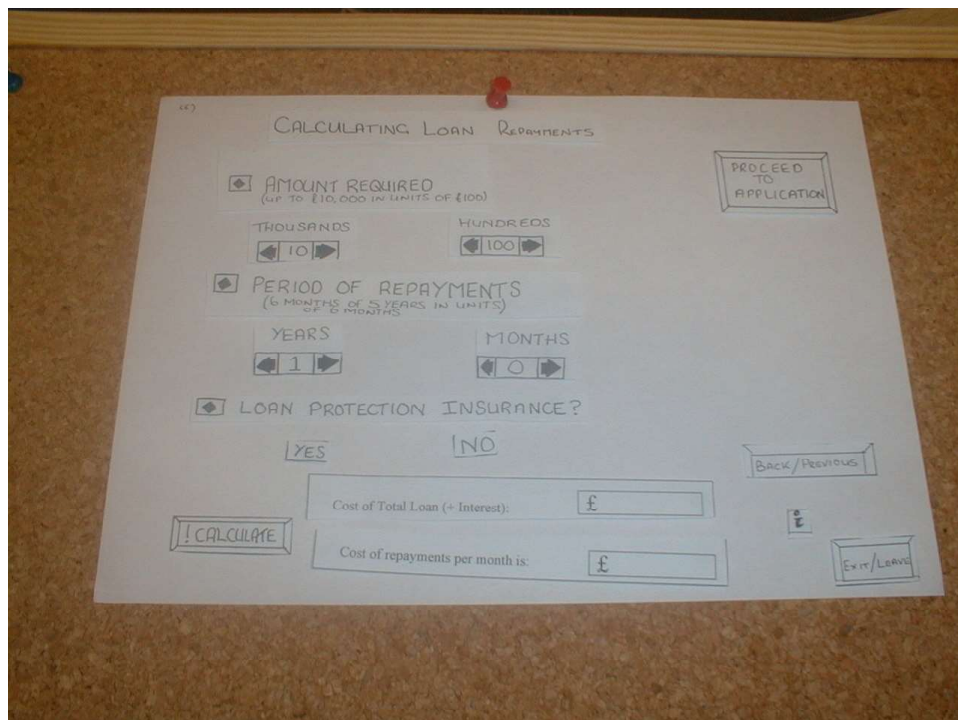**Figure 7.2:** Working prototype of IICM on Air.

Figure 7.3: Paper prototype 1 for a customer information terminal. [Image used with kind permission of Cliff Brown, Northumbria University.]

Figure 7.4: Paper prototype 2 for a customer information terminal. [Image used with kind permission of Cliff Brown, Northumbria University.]

Figure 7.5: Paper prototype 3 for a customer information terminal. [Image used with kind permission of Cliff Brown, Northumbria University.]

7.4   High-Fidelity Paper Prototypes

- Elaborate screen designs created with drawing editors such as Adobe Illustrator or Corel Draw.

- Printed out in colour.

- The often look too much like a finished design, and not enough like a prototype.

- Users tend to comment on the choice of fonts and colours, rather than the flow through the application.

7.5   Interactive Prototypes

Building an interactive prototype for testing:

- Hand-drawn sketches, scanned, and linked together for interactive use.

- Electronic sketching interfaces.

- Prototyping tools (some of which can switch between a hand-drawn and a clean look).

The prototype is then thrown away, and the system is implemented in code.

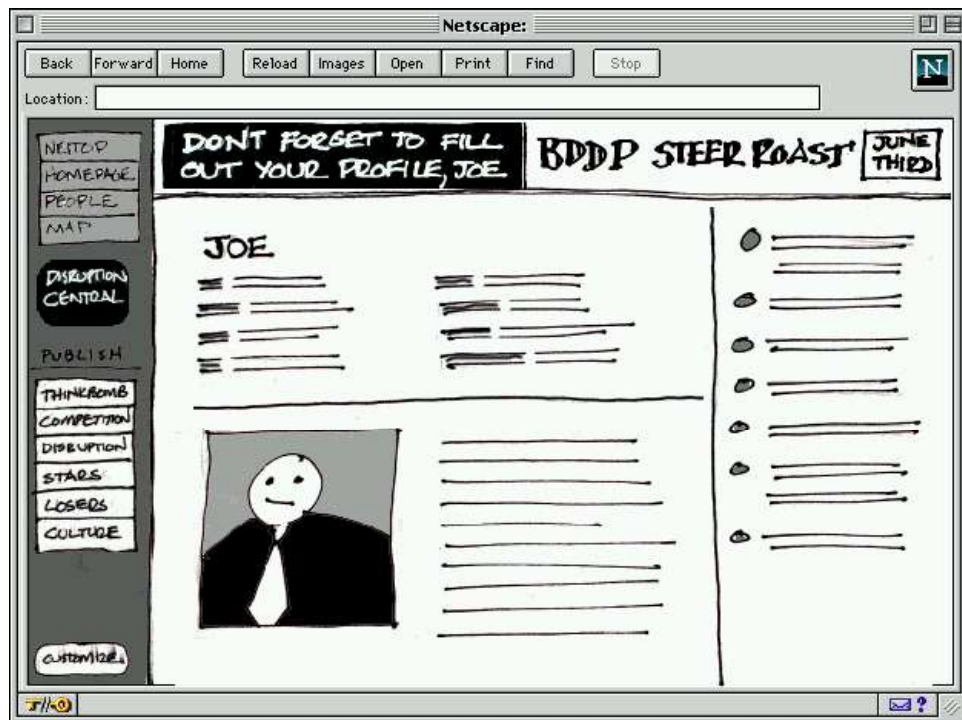### Hand-Drawn Interactive Sketches

- Scan in hand-drawn interface sketches.

- Assemble interactive prototype with clickable elements (say as web pages with image maps linking between them).

- Retains throwaway, casual look to encourage criticism and discussion, as shown in Figure 7.6.

- For example, Chris Edwards' Sketchy Thing [Edwards 1999] and Marc Rettig's Interactive Sketch [Rettig 1999].

- And more recently, the Marvel App (formerly called the PoP App) `https://marvelapp.com/apps`. [Video: `https://youtu.be/JCEhCSDcj_I`].

### Electronic Sketching Interfaces

- DENIM; James Lin, tablet-based research prototype [Lin et al. 2002a; Lin et al. 2000a] See Figures 7.7 and 7.8. Videos at CHI 2002 [Lin et al. 2002b] and CHI 2000 [Lin et al. 2000b]. [Video: `https://youtu.be/0ZA0TgmCMgI`]

Prototyping Tools

- Balsamiq Mockups; `balsamiq.com`. Can switch between hand-drawn and clean look. See Figure 7.9. [Video: `https://youtu.be/70hfU7_95Gw`]

- Pidoco; `pidoco.com`. Can switch between hand-drawn and clean look.

- Adobe XD; `https://adobe.com/products/xd.html`.

Figure 7.6: An interactive sketch made in Shockwave. Screen designs sketches are scanned and assembled into an interactive prototype with Macromedia Director. Screenshot taken from Chris Edwards' Sketchy Thing [Edwards 1999].
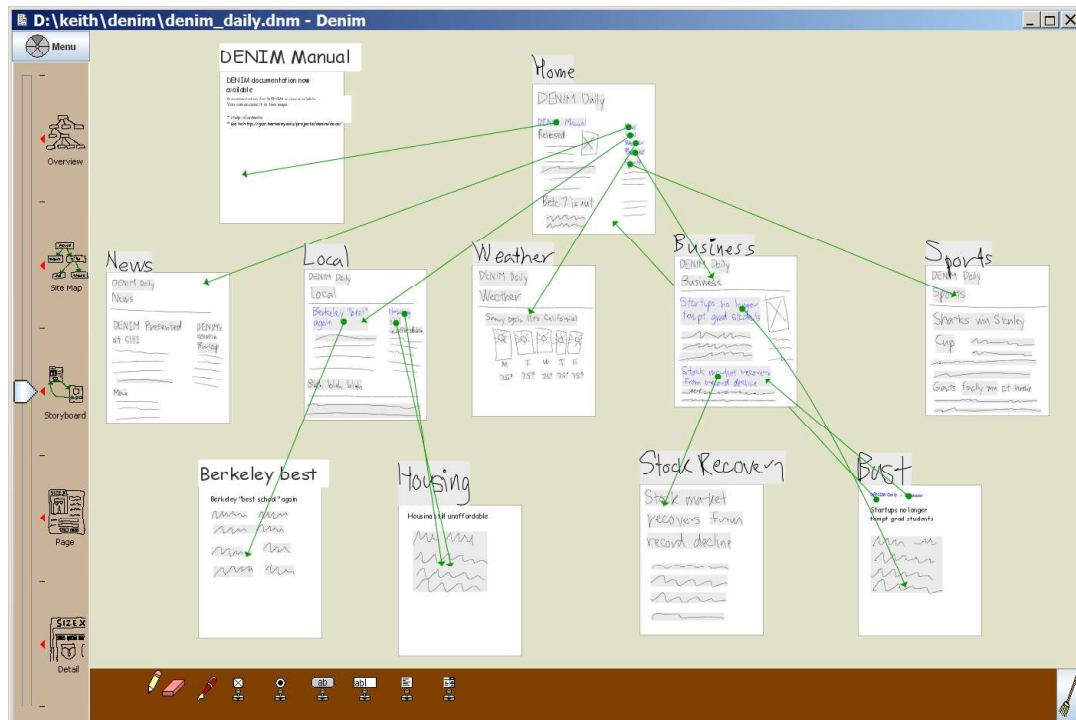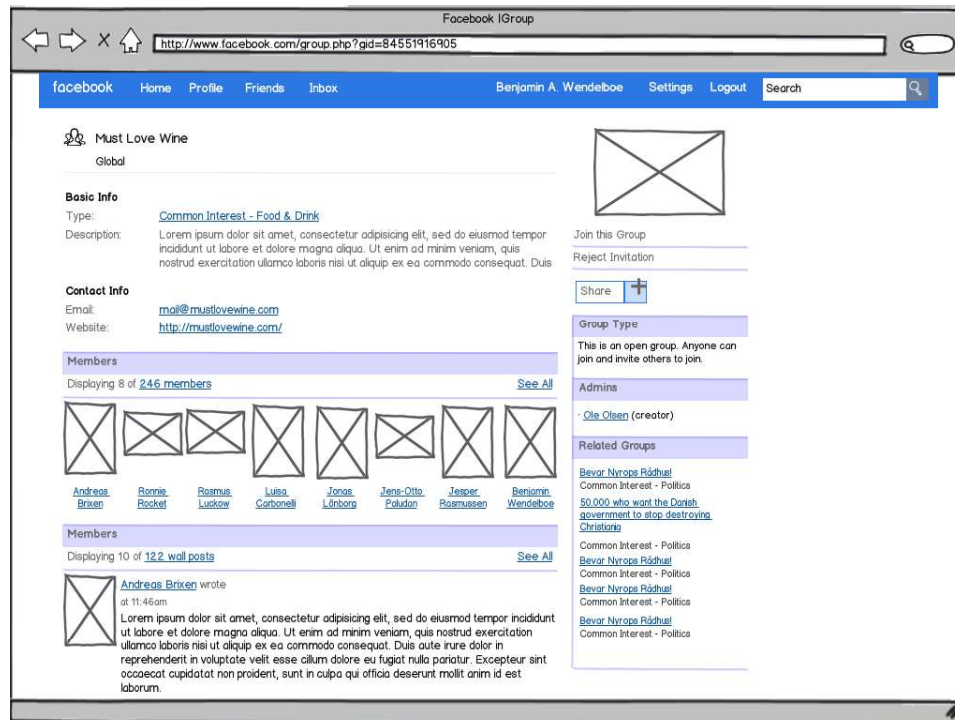
Figure 7.7: A storyboard of individual page wireframes modeled using DENIM.
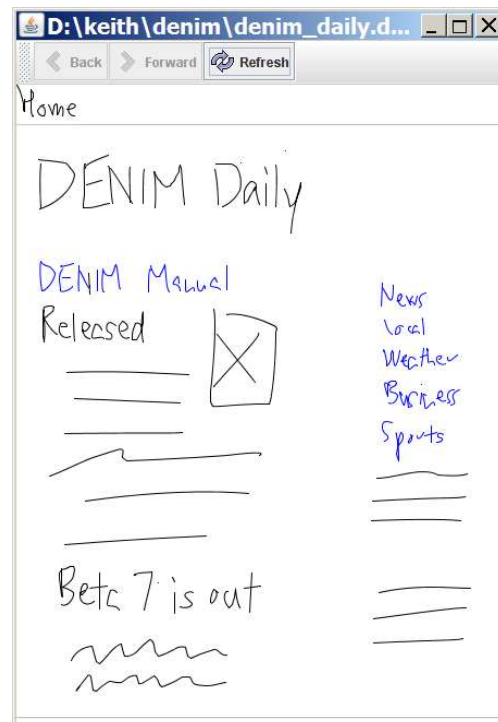
Figure 7.8: Running through a DENIM prototype.

- Figma; `figma.com`

- Axure; `axure.com`.

- UXPin; `uxpin.com`.

- HotGloo; `hotgloo.com`.

- Framer; `framer.com`.

Figure 7.9: A wireframe of a Facebook Group page, modeled using Balsamiq Mockups. [Mockup contributed to `mockupstogo.net` by Benjamin A. Wendelboe. Image created by Keith Andrews.]

7.6 Working Prototypes

Implemented in code, but cut down to a bare minimum:

- *Simple algorithms*: ignore special cases.

- *Fake data*: similar data, images instead of video, etc.

- *Wizard of Oz*: human expert operating behind the scenes to simulate interface responses.

  [For example, Minister Busek's visit to Graz in 1990 and the Hotact demo. [Video: `https://much.isds.tugraz.at/social_events/films/_data/098.mpg`]]

Dimensions of Working Prototypes

Working prototypes cut down on either the number of interface features, or the depth of functionality of features:

- *Vertical Prototype*: in-depth functionality for a few selected interface features.

- *Horizontal Prototype*: full interface features, but no underlying functionality.

- *Scenario Prototype*: only interface features and functionality along the specific scenarios or paths through the interface which are to be evaluated.

These varieties of prototype are illustrated in Figure 7.10.
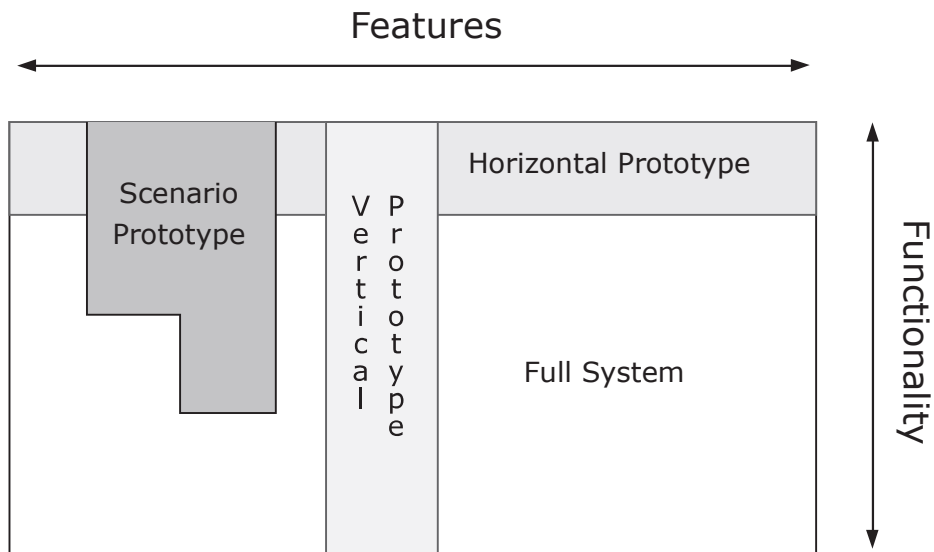
Figure 7.10: Working prototypes vary according to the breadth or depth of features and functionality implemented. Adapted from Figure 9 of Nielsen [1993b, page 94].

7.7 Implementation

Implement final design.

Competitive analysis of software components:

- Use existing interface framework as far as possible (Motif, MS-Windows, Java Swing) – saves a *lot* of work.

- Use existing components and applications rather than re-inventing the wheel.