Making Claims: Questioning “Truths” About Computer Science and User Interfaces

D. SCOTT MCCRICKARD, B.S. 1992

ASSOC PROF, DEPARTMENT OF COMPUTER SCIENCE
FELLOW, INSTITUTE FOR CREATIVITY, ARTS, & TECHNOLOGY
MEMBER, CENTER FOR HUMAN-COMPUTER INTERACTION

VIRGINIA TECH
Author Background
UNC Influence

- Fred Brooks
  - mythical man-month
  - design lessons

- James Coggins
  - software design

- Jennifer Welch
  - value of theory
Working together on interaction design

- In creating interactive systems, designers seek to balance innovative ideas with prior result knowledge.
- Design is a collaborative activity that largely builds on prior work and teamwork (not the lone scientist).

Tony Stark, *Iron Man*  
Nathan, *Ex Machina*
Capturing knowledge

- Many domains involve specialized problems with overlap in technological need
  - potential for benefit from shared design knowledge
  - e.g., in-vehicle computing, police and emergency response, mobile health, construction safety, notification systems, cognitive disabilities

- How should knowledge be structured for sharing?
  - visions: Bush’s Memex, Nelson’s Xanadu, Otlet’s Mundaneum
  - realities: papers, cases, scenarios, use cases, patterns, artifacts
  - possibilities: YouTube videos, blog posts, Twitter tweets, Instagram pictures, Google Docs
Henri La Fontaine et Ludwig Quidde lors de la séance d'ouverture du Congrès universel de la paix de Berlin en 1924, dans la salle du Reichstag.
Rittel’s issues

- Rittel’s issues (1970)
  - arguments captured through issue logic
  - IBIS tool/technique
- McCall’s PHIDIAS
  - sharpened issue definition
  - captured knowledge through a tool
- Compendium
  - open source tool available now

McCall’s PHIDIAS (1991)
Issues and Compendium

From http://eight2late.wordpress.com/2011/03/10/capturing-decision-rationale-on-projects/
Alexander and his colleagues presented a collection of linked *patterns* for architecture (1977)
- narrative description supporting a need
- series of rule
- pictoral illustration
- list of related patterns

**Subculture boundary**
- describes problems and opportunities for roads
- includes placement rules
- links to other placement rules
Patterns and software engineering

- What does that have to do with computing?
- “Gang of four” software engineering patterns (1995)
  - name
  - problem (intent and motivation)
  - solution (applicability, structure, participants, collaborations, code)
  - consequences
- Most around 10 pages each

<table>
<thead>
<tr>
<th>NAME</th>
<th>BUILDER (Object Creational)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intent:</td>
<td>Separate the construction of a complex object from its representation so that the same construction process can create different representations</td>
</tr>
<tr>
<td>Motivation:</td>
<td>A reader for the RTF (Rich Text Format) document exchange format should be able to convert RTF to many text formats. ...</td>
</tr>
<tr>
<td>Applicability:</td>
<td>Use the Builder pattern when the algorithm for creating a complex object should be independent of the parts that make up the object and how they’re assembled ...</td>
</tr>
<tr>
<td>Participants:</td>
<td>Builder (TextConverter) specifies an abstract interface for creating parts of a Product object ...</td>
</tr>
<tr>
<td>Collaborations:</td>
<td>The client creates the Director object and ...</td>
</tr>
</tbody>
</table>
Patterns and interface design

Put Headlines and Blurbs into Various Content Modules throughout the Site ●
To bring content to the fore, you must highlight it throughout the site, as headlines and as sidebars. Promote content pages using headlines and blurbs in content modules (D2) on the homepage portal (C1) (see Figure D3.3), and in consistent sidebars of related content (I6) (see Figure D3.4).

If there are only a few headlines and blurbs, just use chronological organization (B6). A chronological structure makes it easier to find what's new, on the basis of the date.

Figure D3.2
A content file or record might show information in this way in a database.

From van Duyne, Landay, and Hong 2006
Harry was born in Bermuda

So, presumably, Harry is a British subject

Since

A man born in Bermuda will generally be a British subject

Unless

Both his parents were aliens/ he has become a naturalised American/ …

On account of

The following statutes and other legal provisions:
Carroll & Kellogg
*Hermeneutics meets theory-based design* (1989)
- include structures of argument
- balances upsides and downsides
- grounded in context with scenarios

**Claim ID:** plan-based error messages claim.
**Author:** Singley, M. K.; Carroll, J. M.
**Artifact:** PROUST Intelligent Tutoring System [Johnson, 1985]
**Description:** system-generated error messages couched in terms of goals and plans.
**Upsides:** brings appropriate planning abstractions to bear when they are needed.
spares the learner the burden of generating explicit goal and plan descriptions
**Downsides:** learners may develop superficial understanding when errors are not under learner control
**Scenario:** the user is learning Pascal by going through exercises. The system spots an error and provides advice in terms of the goals and plans that should solve the problem.
**Effect:** improved learning of programming plans and procedures
**Dependencies:** detection and diagnosis of user errors, plans, and procedures
**Issues:** reactive learning, tutor initiative, contextual advice
**Theory:** indirect theory grounding [Papert, 1980; Lewis & Anderson, 1985]

*From Sutcliffe & Carroll, 1999*
Claims categorization → Claims maps

- Management & Organization of Information
- Personalized Display
- Scalable Display Area - can hide information
- Collapsible Groupings
- Providing Dynamic Information Summaries
- Providing Short Summaries
- Providing RSS Feeds
- Providing Video Feeds
- Display Using Icons
- Automatic Scaling of Icon Size
- Fusion
- Diffusion
- Generalization
- Specification
- Translation
- Mitigation

McCrickard et al., 2003
Wahid & McCrickard, 2006
Representing claims visually

Use of Information Exhibit

Ongoing and future efforts

- Making claims more accessible
  - creating claims for key design areas (mobile, accessibility)
  - using claims sets in classes, design meetings, etc.
  - creating tools for claim creation, management, use, and reuse
  - balancing concerns of design, theory, and software engineering

- Identifying relationship models for claims
  - based on content and community

- Automatic extraction of claims from databases
  - databases can include papers, chat/meeting logs, blogs, case studies, scenario/case libraries

- Applying approaches to other knowledge repositories
Thanks!

- **Shuo Niu**
  - Ph.D. student (expected 2016) at Virginia Tech
- **Shahtab Wahid**
  - Ph.D. at Virginia Tech (2011); now at Bloomberg
- **Christa Chewar**
  - Ph.D. at VT (2005); now at the United States Military Academy
- **other collaborators** Angela Scarpa, Steve Harrison, Troy Abel, John M. Carroll, Mary Beth Rosson, Alistair Sutcliffe, Clayton Lewis, Ray McCall, Janet Burge
- **other students** Stacy Branham,Jason Chong Lee, Jacob Somervell, Jan Willem Streefkerk, Ali Ndiwalana, and others
- **funding from** the NSF (ITR, REU, CRI, EAGER), DoD, Google, Nokia, Microsoft, Meridium, Virginia Tech
Questions/Comments

Scott McCrickard
mccricks@cs.vt.edu