

End Users Who Meet Their Own Requirements

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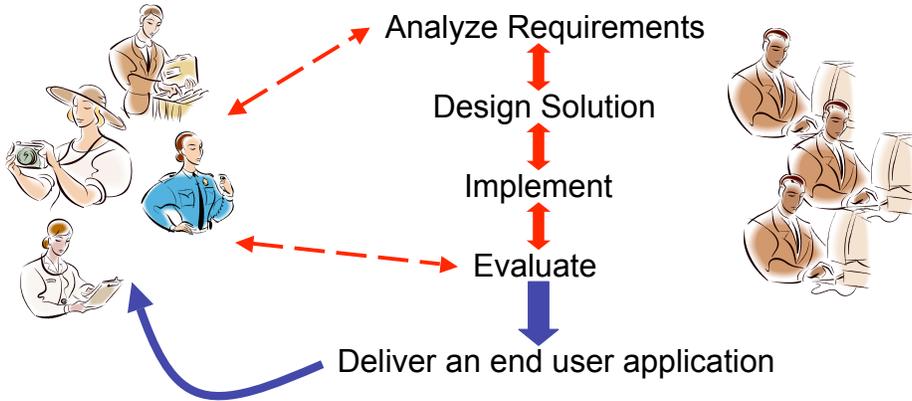


Overview

- Motivation
- Examples
- Challenges and opportunities
 - Usability
 - Universal access
 - Quality
- Final words

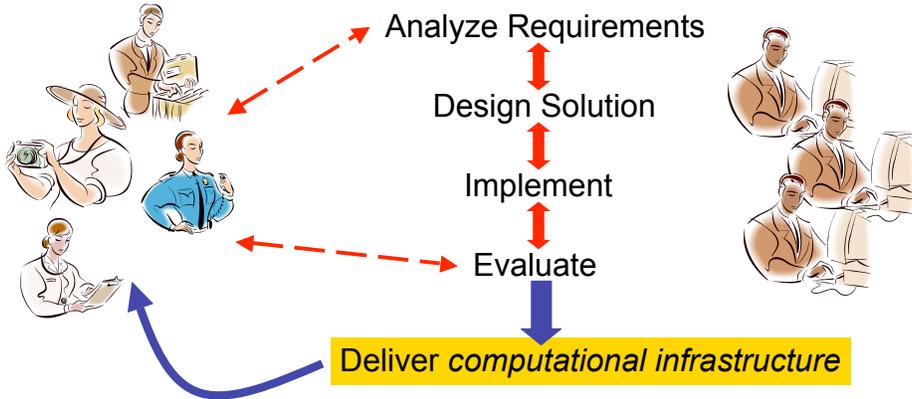
Motivation | Examples | Challenges | Usability | Access | Quality | Final words

Tried and true

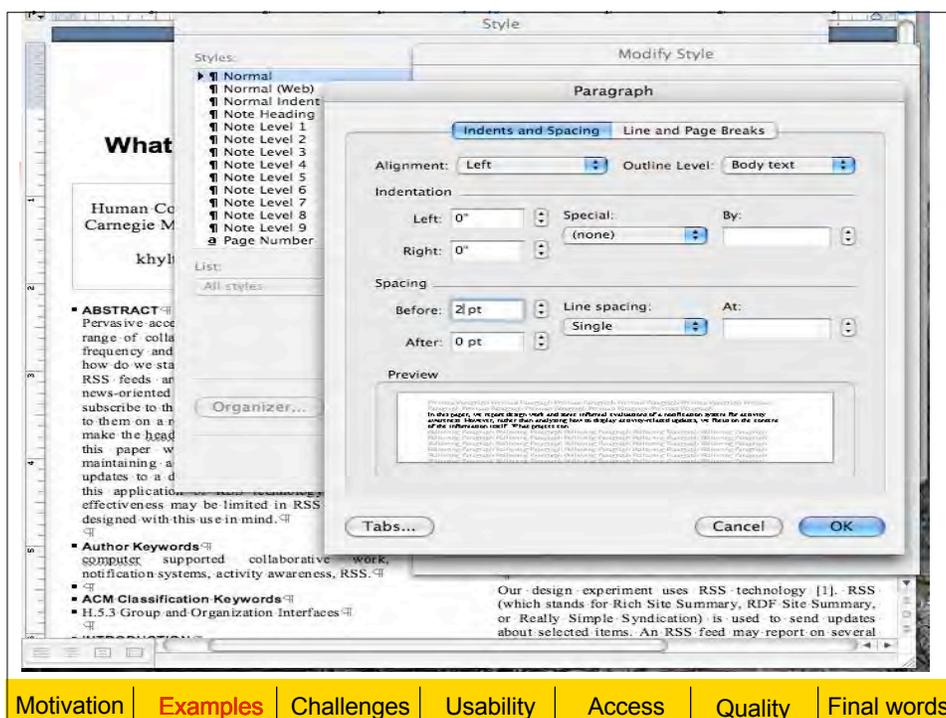
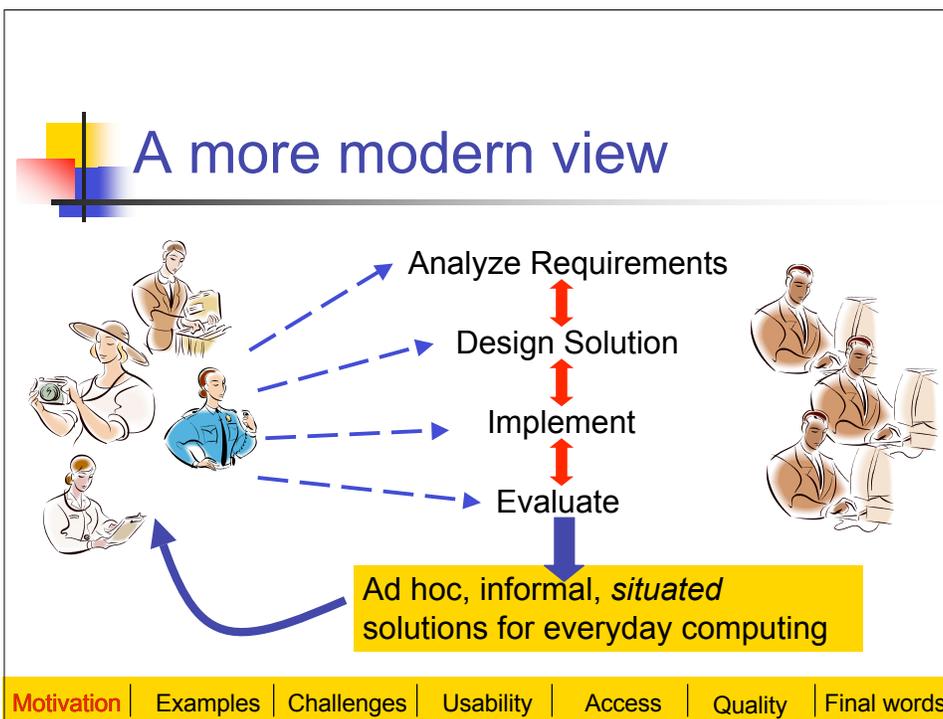


Motivation | Examples | Challenges | Usability | Access | Quality | Final words

A more modern view



Motivation | Examples | Challenges | Usability | Access | Quality | Final words



331-001-individual.xls

	J	K	L	M	N	O	P	Q	R	S	T	U
	Hmwrk1	Hmwrk1 %	Hmwrk2	Hmwrk2 %	Hmwrk3	Hmwrk3 %	Hmwrk4	Hmwrk4 %	Hmwrk Avg	Hmwrk - Ind	Part - Ind	Ind. Total
1	10	100.00%	16	100.00%	11	91.67%	12.5	104.17%	98.96%	55.55%	23.81%	86.07%
2	11	110.00%	15	93.75%	0	0.00%	9.8	81.67%	71.35%	40.77%	28.57%	82.66%
3	9	90.00%	14	87.50%	10.5	87.50%	10.5	87.50%	88.13%	50.36%	28.57%	92.07%
4	9	90.00%	13	81.25%	8.8	73.33%		0.00%	61.15%	34.9%	7.94%	42.88%
5	10	100.00%	17	106.25%	13	108.33%	12	100.00%	103.65%	50.23%	28.57%	101.71%
6	6	60.00%	10.5	65.63%	11	91.67%	10.5	87.50%	76.20%	45.54%	20.63%	78.09%
7	9	90.00%	13.5	84.38%	11	91.67%	10	83.33%	87.24%	49.91%	26.98%	90.81%
8	7	70.00%	12	75.00%	10.5	87.50%	11.5	95.83%	82.08%	46.90%	28.57%	89.19%
9	6.5	65.00%	5	31.25%	3.9	32.50%	11	91.67%	55.10%	31.49%	22.22%	62.28%
10	0	0.00%	0	0.00%	9.5	79.17%		0.00%	19.79%	11.31%	20.63%	42.43%
11	8	80.00%	12.5	78.13%	12	100.00%	10.5	87.50%	86.41%	49.38%	26.98%	89.87%
12	0	0.00%	9.5	59.38%	9	75.00%		0.00%	56.1%	32.29%	17.46%	64.04%
13	8	80.00%	13	81.25%	8	66.67%	6.5	54.17%	77.52%	40.30%	25.40%	71.41%
14	9	90.00%	16	100.00%	11	91.67%	11	91.67%	93.33%	53.33%	25.40%	86.73%
15	6	60.00%	0	0.00%	10.5	87.50%	12	100.00%	61.88%	35.36%	28.57%	77.64%
16	8	80.00%	16	100.00%	13	108.33%	12	100.00%	97.08%	55.48%	25.4%	94.59%
17	5	50.00%	12.5	78.13%	11.5	95.83%	11	91.67%	78.91%	45.09%	26.98%	85.79%
18	8	80.00%	14	87.50%	12	100.00%	12	100.00%	91.88%	52.50%	28.57%	93.93%
19	7	70.00%	12	75.00%	11	91.67%	11	91.67%	82.08%	46.90%	23.81%	84.71%
20	7	70.00%	13	81.25%	12	100.00%	10	83.33%	83.65%	47.80%	28.57%	90.08%
21	8	80.00%	11	68.75%	10.5	87.50%	10.5	87.50%	80.94%	48.25%	27.98%	86.38%
22	5	50.00%	14.5	90.63%	10.5	87.50%	11	91.67%	79.95%	45.68%	28.57%	87.97%
23	10	100.00%	13	81.25%	12	100.00%	10	83.33%	91.15%	52.09%	28.57%	94.57%
24	9	90.00%	14	87.50%	11	91.67%	12	100.00%	92.29%	52.74%	26.98%	93.15%
25	10	100.00%	17	106.25%	13	108.33%	12	100.00%	103.65%	50.23%	25.40%	98.34%
26	9	90.00%							88.39%	50.51%	28.57%	91.88%
27	6	60.00%							75.50%	42.35%	22.22%	78.09%
28	6.5	65.00%							78.23%			80.22%
29	6	60.00%	11.5	71.88%	11.5	95.83%	11	91.67%	79.84%	28.99%	23.81%	85.48%
30	9	90.00%	14.5	90.63%	10	83.33%	12	100.00%	90.99%	46.76%	25.40%	85.87%
31	5.5	55.00%	11	68.75%	0	0.00%	9.5	79.17%	50.73%	28.99%	23.81%	65.37%
32	7	70.00%	14.5	90.63%	9	75.00%	11	91.67%	81.82%	46.76%	25.40%	85.87%
33	7	70.00%	14.5	90.63%	12	100.00%	12	100.00%	90.16%	51.52%	19.05%	84.65%
34	7	70.00%	14	87.50%	12	100.00%	10	83.33%	85.21%	49.69%	28.57%	90.12%
35	5	50.00%	0	0.00%	7.4	61.67%	11	91.67%	50.83%	29.05%	22.22%	64.18%
36	9	90.00%	12.5	78.13%	9.3	77.50%	12	100.00%	86.41%	49.38%	25.40%	87.63%
37	10	100.00%	10	62.50%	12	100.00%	12	100.00%	90.63%	51.79%	25.40%	90.70%
38	11	110.00%	13	81.25%	12	100.00%	12	100.00%	97.81%	55.89%	28.57%	97.32%
39	11	110.00%	14	87.50%	12	100.00%	13	108.33%	101.46%	57.99%	26.98%	97.81%
40	6	60.00%	12	75.00%	10	83.33%	12	100.00%	79.58%	45.48%	28.57%	87.56%
41	6	60.00%	16	100.00%	11	91.67%	12	100.00%	86.67%	49.52%	17.46%	81.07%
42	5.5	55.00%										

$= (J2 + L2 + N2 + P2)/4 * 4/7$

$= H2 + R2 + S2$

Motivation | Examples | Challenges | Usability | Access | Quality | Final words

Compute Variable: If Cases

Include all cases
 Include if case satisfies condition:
 reason=1 | 3 | 5 | 6 | 7

Functions:
 ABS(numexpf)

pathModels.SPS - SPSS Syntax Editor

```

/NOORIGIN
/DEPENDENT expernce testing immedte sysproc colab reuse mediaexp data
/METHOD=STEPWISE careful curious age dforwork
/PARTIALPLOT ALL .

* looking for exogenous and mediating variables on style of help, proble
REGRESSION
/MISSING PAIRWISE
/STATISTICS COEFF OUTS R ANOVA CHANGE
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT consult selfhelp integrate content vdatafac vcommfac
/METHOD=STEPWISE careful curious age dforwork expernce immedte sysproc
/PARTIALPLOT ALL .

USE ALL.
COMPUTE filter_$=(wrkcntxt=1).
VARIABLE LABEL filter_$ 'wrkcntxt=1 (FILTER)'.
VALUE LABELS filter_$ 0 'Not Selected' 1 'Selected'.
FORMAT filter_$ (f1.0).
FILTER BY filter_$ .
EXECUTE .
  
```

SPSS Processor: is ready

Motivation | Examples | Challenges | Usability | Access | Quality | Final words

The screenshot shows the eNormicom Extranet interface. At the top, it says "Logged in as Larry Appleton (Log-out) | Help". The navigation bar includes "Dashboard", "To-Dos", "Milestones", "People", "Templates", and "Settings".

1 Late Milestones
 7 days late: [Awaiting payment so we can release the document](#) [Smithco | Intranet experience review | Matt Linderman]

Due in the next 14 days

Wed	Thu	Fri	Sat	Sun	Mon	Tue
TODAY	Oct 27 Review Personal/Basic	28	29 Kick off meeting	30	31	1

3 Latest activity

5 Martin — Backoffice screens

MESSAGE	NOBODY		by	
		New Order Process: Revised "Find Item"...		Jason Lindy
	22 Oct	New Order Process: Initial Screens		Sam Linderman
	21 Oct	Search/Browser Questions		Matt Ruby
	21 Oct	Order Screen Flow		Sam Linderman
	20 Oct	New CUSTOMER SERVICE order Screens		Lisa Price

Tilted — Snowglobes

MESSAGE	NOBODY		posted by	
		Re: IP allocation		David H.
	Yesterday	Re: Cluster Network Performance Analysis		James K.
	24 Oct	Re: Cluster Network Performance Analysis		James K.
	24 Oct	Re: Cluster Network Performance Analysis		James K.
	24 Oct	Re: IP allocation		James K.

Smithco — Intranet experience review

MESSAGE	NOBODY		assigned to	
	Yesterday	Get sign-off from Marcus		Fischer J.
	Yesterday	Add no...		

4 Your projects
[Create a new project](#)

eNormicom
[Office relocation](#)
[Site redesign](#)

Martin
[Backoffice screens](#)

Smithco
[Intranet experience review](#)

Tilted
[Snowglobes](#)

TravelCenter
[Web Site Redesign](#)

Projects on hold

eNormicom
[Bring portfolio up to date](#)

[Archived projects](#)

Downloaded from BaseCamp website, <http://www.basecampfw.com>

Motivation | **Examples** | Challenges | Usability | Access | Quality | Final words

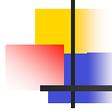
The slide features a large yellow thought bubble with the following text inside:

How do we develop the necessary *socio-technical* infrastructure to help end users meet their own requirements — effectively and safely?

Below the bubble, there are two bullet points:

- Involves, often collaborative, ad hoc problems and task goals;
- Low expectation that computers are *tools* that should support his/her activities.

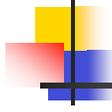
Motivation | **Examples** | Challenges | Usability | Access | Quality | Final words



The opportunities are great

- Personal development
 - Raising the level of computing literacy
- Feelings of control and self-efficacy
 - Computers as flexible tools
 - Ability to *appropriate* IT to actual needs
- Economic benefits
 - Short-circuit software lifecycle
 - Timely production of informal solutions

Motivation | Examples | **Challenges** | Usability | Access | Quality | Final words



But so are the challenges!

- Usability of the tools and techniques
 - Design and programming are hard!
- Universal accessibility
 - Familiar set of IT diversity concerns
 - Plus, an aging population of end users
- Quality of the end-user-created solutions
 - Even when created to meet informal needs, “bad” software is still bad

Motivation | Examples | **Challenges** | Usability | Access | Quality | Final words

Building usable tools

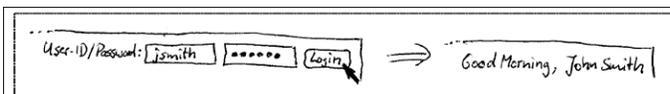
- Majority of usability practice focused on traditional application design
- Psychology of programming, end user programming (EUP) are open topics
 - Studying design, problem solving is hard!
 - Inherent tradeoff: ease of use vs. power
- Example: Natural programming tools

Motivation | Examples | Challenges | Usability | Access | Quality | Final words

CLICK:

Click, a Lightweight Internet Construction Kit

- Base tools on nonprogrammers' natural mental models when they think about computation



1) After logging in with your user-ID the web site always shows your full name and a logout button in the upper right corner.

a) What do you think the web site must do to keep track of the fact that you are logged in even though you go from page to page?

b) What do you think the web site must do to show your full name, although you only entered a short user-ID? Take the user-ID "jsmith" as an example and show step-by-step how the web site determines the name "John Smith".

c) Note that the library home page only displays your name when you are logged in. If you are not logged in, it shows a login box instead. How do you think this feature works behind the scene?

*PhD work of
Jochen Rode
(VT, 2005)*

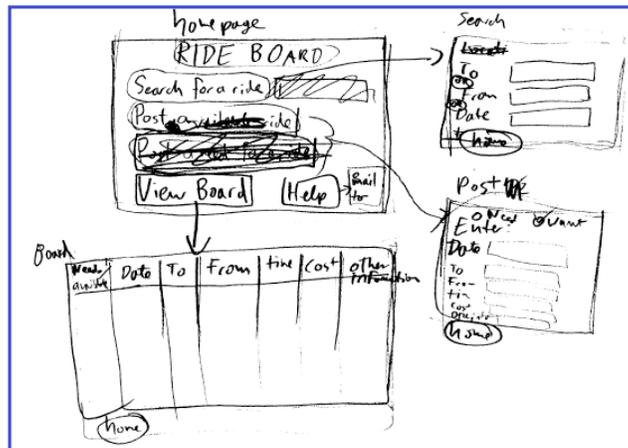
Motivation | Examples | Challenges | Usability | Access | Quality | Final words

Motivation | Examples | Challenges | Usability | Access | Quality | Final words

id	timestamp [date/time]	lastmodifiedbyuserid	dateout [text]	datein [text]	location [text]	details [text]	contactname [text]
1							
2	2006-06-07 14:47:46		07/14/06	07/15/06	York, PA	one suitcase only	Joe
3	2006-06-07 14:59:38		7/22/06	7/23/06	New York		Jen
4	2006-06-07 15:00:31		08/22/06	08/24/06	OBX	only girls please!	Steph

Motivation | Examples | Challenges | Usability | Access | Quality | Final words

Up-front design in CLICK?



Motivation | Examples | Challenges | Usability | Access | Quality | Final words

Ensuring accessibility

- Computing pervades all aspects of the world, not just the “technical” users
 - Participation from full range of user population essential for diverse needs
- CS training, expertise increasingly rare in some significant segments
 - Women, minorities, the elderly
 - Same concerns apply to EUP

Motivation | Examples | Challenges | Usability | Access | Quality | Final words

Storykit Alice 3D: Reaching out to girls (Kelleher, 2006)

- Girls “turned off” by math & science starting in middle school
 - What can we do to mitigate?
- Start with what girls like to do - what are their age- & gender-specific “requirements”?
 - Girls this age like to tell stories, especially ones with romance or other social relations
 - So: give them cool tools that let them “program” their own stories

Motivation | Examples | Challenges | Usability | Access | Quality | Final words

Katelin Kelleher's Ph.D. dissertation (CMU)

Motivation | Examples | Challenges | Usability | Access | Quality | Final words

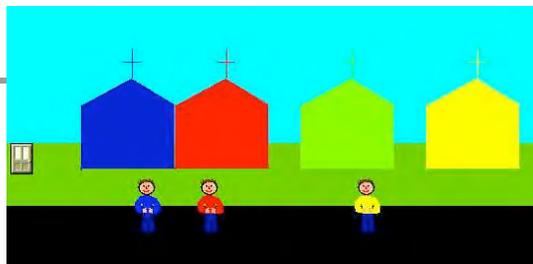
Community Sims:

Exploring cross-generation collaboration

- Different segments of the population have distinct interests, skills
 - E.g., kids are eager, experimental while the elderly tend to be wise, cautious
- Can an EUP project serve as a focus for collaborative learning?
 - Kids learn to think about problems, the elderly learn to use a novel tool

Motivation | Examples | Challenges | Usability | **Access** | Quality | Final words

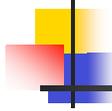
Programming in pairs *across generations*



Predefined roles created a smooth design and implementation collaboration

Elders were the simulation **designers**, kids did the **building**

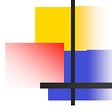
Motivation | Examples | Challenges | Usability | **Access** | Quality | Final words



Ensuring quality outcomes

- End users are active, focused on goals
 - Production paradox: Users want to produce, not stop to *learn* something
- They are not software engineers!
 - No overarching process
 - No analysis, design, testing skills
- How much of a problem is this?

Motivation | Examples | Challenges | Usability | Access | **Quality** | Final words

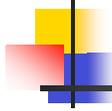


Skeptical SW professionals

“... we now have systems on the Web that dilettantes built in their spare time while holding down a job in marketing, accounting, hardware repair, or even medicine. They’ve given little if any thought to systematic testing, maintainability, design, and yes, security. These systems are available to the entire Internet community—geography and international borders no longer buffer our data from programming mistakes.”

—Warren Harrison, Editor of *IEEE Software*,
July/August 2004

Motivation | Examples | Challenges | Usability | Access | **Quality** | Final words



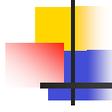
But also real world costs

“In adopting a new and complex accounting standard in a short period of time, Fannie Mae had to put in place a system and process to capture all open commitments and mark them to market ... To implement this standard, Fannie Mae utilized information from its internal automated systems in conjunction with spreadsheets that made additional calculations necessary under the new rule.”

One of the spreadsheets contained a \$1.2 Billion error.

— *New York Times*, October 30th, 2003

Motivation | Examples | Challenges | Usability | Access | **Quality** | Final words



Who is responsible?

- Software professionals: Smarter tools
 - Need to provide just the right support at just the right time
- End users: Learn new skills, values
 - Embed quality values in learning process
 - Rely on community-based processes to reinforce and develop quality culture

Motivation | Examples | Challenges | Usability | Access | **Quality** | Final words

WYSIWYT:

A smarter tool (Burnett et al., OSU)

0% Tested

90	100	90	88	100	82
Quiz1	Quiz2	Min_Quiz1_Quiz2	Quiz3	Quiz4	Quiz5
45	90	90	90	88	90
Midterm1	Midterm1_Perc	Midterm2	Min_Midterm1_Midterm2	Midterm3	Curved_Midterm3
120	82.1918		92.5	90	57.3973
Final	Final_Percentage		Quiz_Avg	Midterm_Avg	Exam_Avg

Forms/3 spreadsheet, red borders indicate the cells have not been "tested", i.e checked off as correct or incorrect

Motivation | Examples | Challenges | Usability | Access | Quality | Final words

WYSIWYT, cont'd

30% Tested

90	100	90	88	100	82
Quiz1	Quiz2	Min_Quiz1_Quiz2	Quiz3	Quiz4	Quiz5
45	90	90	90	88	90
Midterm1	Midterm1_Perc	Midterm2	Min_Midterm1_Midterm2	Midterm3	Curved_Midterm3
120	82.1918		92.5	90	57.3973
Final	Final_Percentage		Quiz_Avg	Midterm_Avg	Exam_Avg

Border color changes and a 'testedness bar' provide feedback and immediate reward for testing behaviors

Motivation | Examples | Challenges | Usability | Access | Quality | Final words

Learning by debugging: Teaching kids to test and fix their code

- Attract attention, curiosity by presenting a “broken” example
 - E.g., a story in Alice 3D where characters fall over, fail to launch a ball, etc.
- Invite learners to find and fix errors
 - Commentary that guides, explains
 - Learn from example, but also the skills and confidence for testing and debugging

Motivation | Examples | Challenges | Usability | Access | Quality | Final words

The screenshot displays the Alice 3D software interface. At the top, there is a menu bar (File, Edit, Tools, Help) and a toolbar with buttons for Play, Undo, Speed: 1x, Pause, Resume, Restart, Stop, and Take Picture. The main window shows a 3D scene with a wolf character in a grassy field with trees. A speech bubble above the wolf says "The den is under attack!". On the left, there is a scene tree listing objects: World, Camera, Light, ground, Pine_tree, Wolf, cloudy sky, Pine_tree2, Pine_tree3, and Pine_tree4. Below the scene tree is a panel for "Wolf's details" with tabs for properties, methods, and functions. The methods list includes: pick_up_and_throw, approach_Rabbits, warn_the_pups, request_help, run_to_woods, get_help_from_Wise_Rabbit, follow_Wise_Rabbit, and get_across_lake. At the bottom, there is a list of actions for the wolf and camera, such as "Wolf.body-front - turn forward 0.2 revolutions" and "Camera - move amount = 7 meters away from target = Wolf".

Motivation | Examples | Challenges | Usability | Access | Quality | Final words

Teacher Bridge: Building and sharing in a community

- Teachers (and other communities) contain individual with diverse profiles
 - Expertise, motivation, needs, etc.
 - Infrastructure needs multiple entry points
- Online tools enable learning community
 - Advanced, motivated users lead the way
 - Reputation and reuse promote culture of mentoring and collaboration

Motivation | Examples | Challenges | Usability | Access | **Quality** | Final words

The screenshot shows the PandapasPond.org website. The browser address bar displays the URL: <http://www.pandapaspond.org/public/projects/pandapaspond.org/index.html>. The page title is "PandapasPond.org".

On the left side, there is a welcome message: "Welcome to www.pandapaspond.org! This site is a collection of information about Pandapas Pond, along with resources for use by educators and others visiting the pond." Below this, it states "The site is organized as follows:" and lists several bullet points describing the site's content, including reference materials, activities, data repositories, and journals.

In the center, there is a photograph of a small brown animal, possibly a chipmunk, sitting on a gravelly surface.

On the right side, there is a navigation menu with links: Home, General Background, Reference, Activities, Data, Journals, Forum, and Contributors. Below the menu is a calendar for "September 06". The calendar shows the days of the week (S, M, T, W, T, F, S) and the dates from 1 to 30. The 9th is highlighted.

Below the calendar, there is a section for "Online:" with the text "guest (web)" and "carroll". There is also a "Search:" field with a search button.

At the bottom of the page, there is a footer that reads: "This web site is part of the TeacherBridge project (<http://teacherbridge.cs.vt.edu>) and is designed to support authoring and contribution by users. If you would like more information, please [drop us a note](#)." Below this, there are links for "Login", "Web Editor", and "Full Editor".

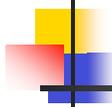
Motivation | Examples | Challenges | Usability | Access | **Quality** | Final words

Motivation | Examples | Challenges | Usability | Access | Quality | Final words

model reuse

A bit like open source with **already-known community**—established practices for mentoring, modeling, reputation-building, and sharing

Motivation | Examples | Challenges | Usability | Access | Quality | Final words



Final words

- End users are already meeting their own software requirements
 - With whatever resources they can find
- We must maximize the upsides of this trend, while minimizing downsides
 - Usability of end user development tools
 - Universal accessibility the infrastructure
 - Tools, training, culture to promote quality

Motivation | Examples | Challenges | Usability | Access | Quality | **Final words**



Thank you!

Many collaborators, including John Carroll, Jochen Rode, Philip Isenhour, Jayne Litzinger, Julie Ballin, Cheryl Seals, Tracy Lewis, Craig Ganoë, Dan Dunlap

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Motivation | Examples | Challenges | Usability | Access | Quality | **Final words**