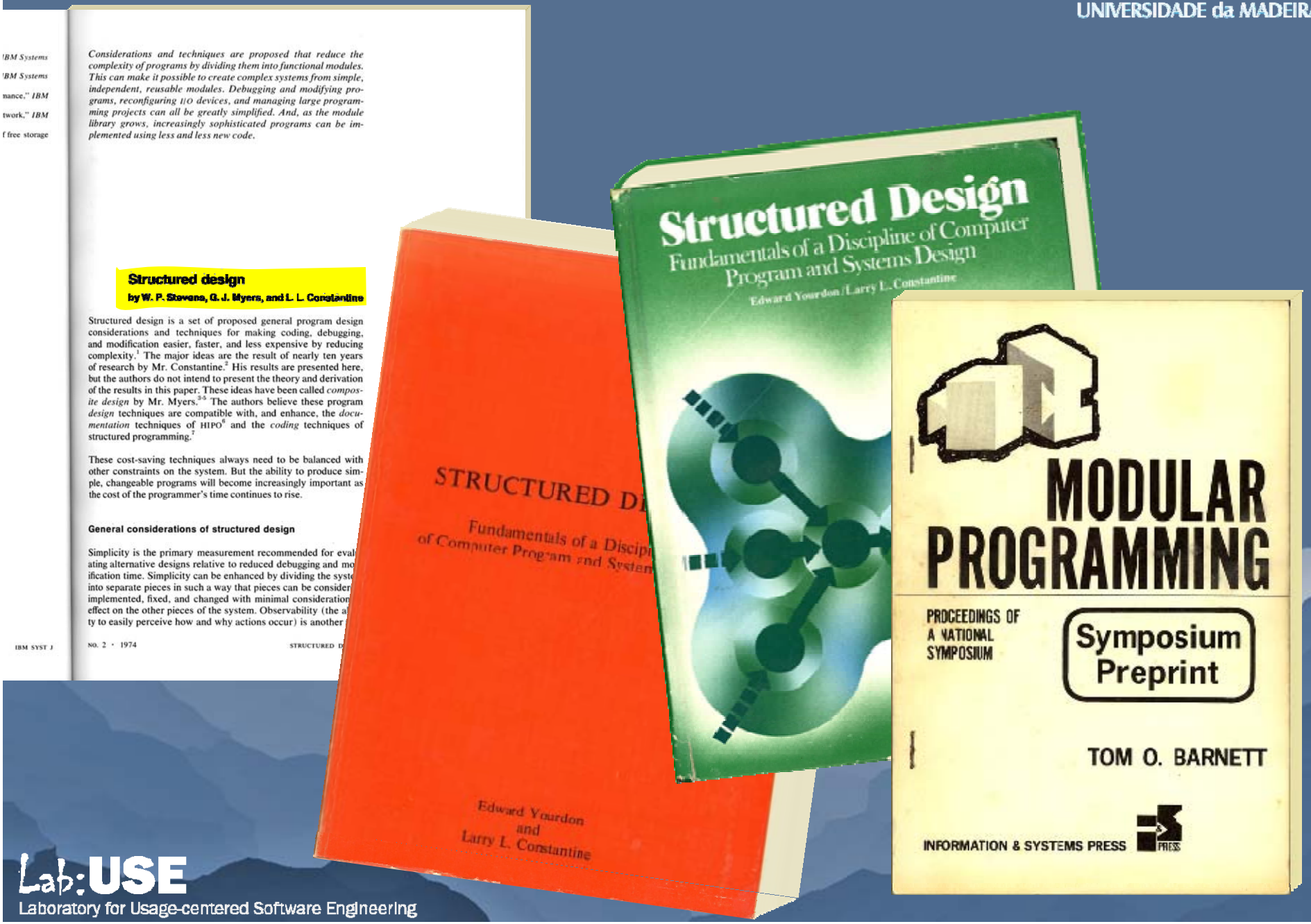
Interaction Design, User Interfaces, and the Future of Model-Driven Design and Development

Prof. Larry Constantine, IDSA, ACM Fellow
Department of Mathematics and Engineering
University of Madeira



Considerations and techniques are proposed that reduce the complexity of programs by dividing them into functional modules. This can make it possible to create complex systems from simple, independent, reusable modules. Debugging and modifying programs, reconfiguring I/O devices, and managing large programming projects can all be greatly simplified. And, as the module library grows, increasingly sophisticated programs can be implemented using less and less new code.

Structured design

by W. P. Stevens, G. J. Myers, and L. L. Constantine

Structured design is a set of proposed general program design considerations and techniques for making coding, debugging, and modification easier, faster, and less expensive by reducing complexity.[1] The major ideas are the result of nearly ten years of research by Mr. Constantine.[2] His results are presented here, but the authors do not intend to present the theory and derivation of the results in this paper. These ideas have been called *composite design* by Mr. Myers.[3-5] The authors believe these program *design* techniques are compatible with, and enhance, the *documentation* techniques of HIPO[6] and the *coding* techniques of structured programming.[7]

These cost-saving techniques always need to be balanced with other constraints on the system. But the ability to produce simple, changeable programs will become increasingly important as the cost of the programmer's time continues to rise.

General considerations of structured design

Simplicity is the primary measurement recommended for eval
ating alternative designs relative to reduced debugging and mo
ification time. Simplicity can be enhanced by dividing the syst
into separate pieces in such a way that pieces can be consider
implemented, fixed, and changed with minimal consideration
effect on the other pieces of the system. Observability (the a
ty to easily perceive how and why actions occur) is another

NO. 2 · 1974

Structured Design

Fundamentals of a Discipline of Computer Program and Systems Design

Edward Yourdon / Larry L. Constantine

STRUCTURED DE

Fundamentals of a Discipl
of Computer Program and Systen

Edward Yourdon
and
Larry L. Constantine

MODULAR PROGRAMMING

PROCEEDINGS OF A NATIONAL SYMPOSIUM

Symposium Preprint

TOM O. BARNETT

INFORMATION & SYSTEMS PRESS

No Conspiracy, But No Accident

- The place and role of users, usability, and user interfaces in software development.
- The place and role of programmers in software development.

Do Users and the Context of Use Matter?

- Inside the cockpit of the Airbus 320…
- Video games anyone?

"Congratulations to our pilot, newly promoted to Captain!"

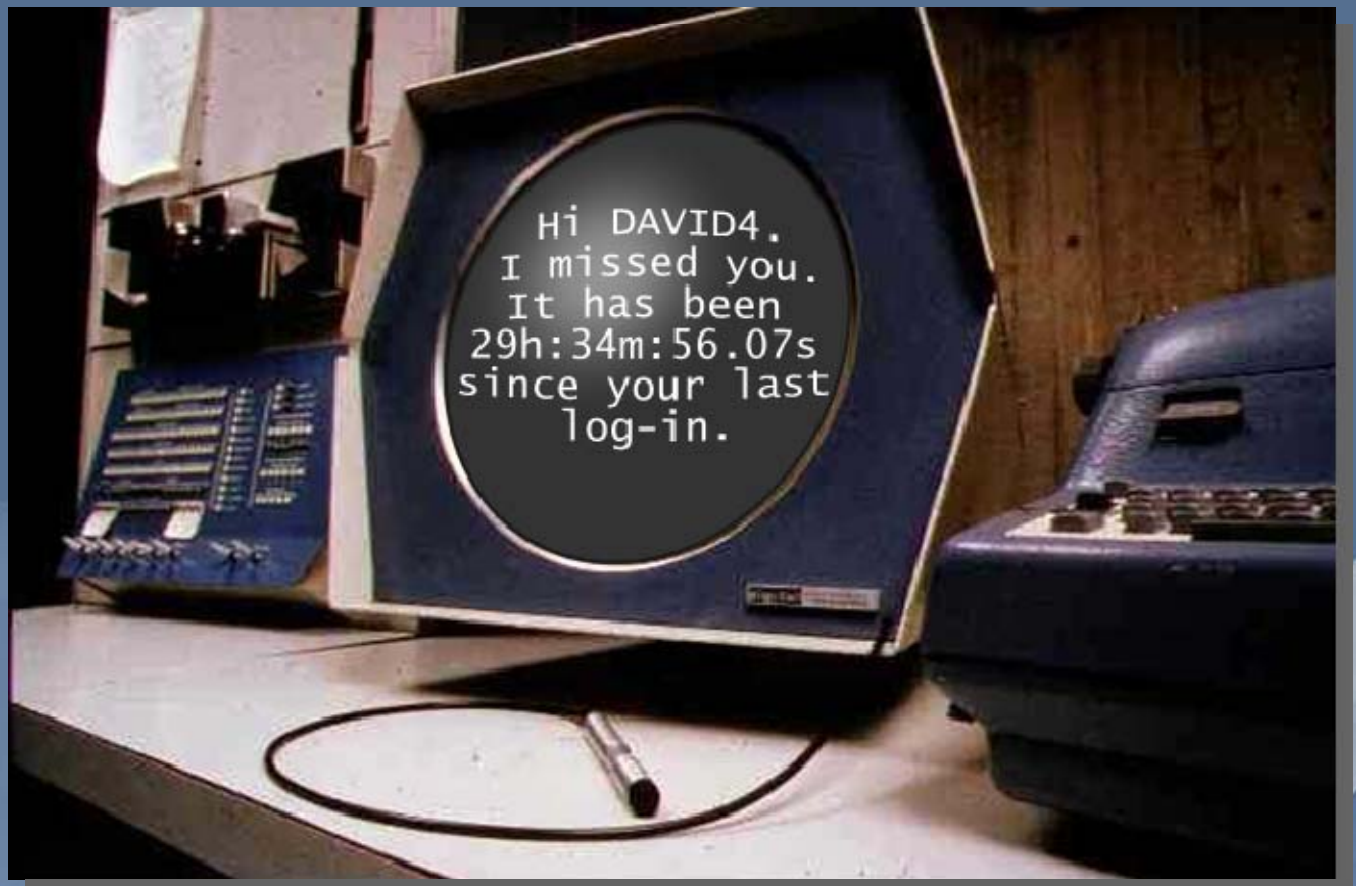
Why Design for Use

- A product can be a success without being useful.
- But usefulness and usability pay.
  - ✓ Simpler documentation, lower support costs.
  - ✓ Faster learning, lower training costs.
  - ✓ Fewer errors, better data integrity.
  - ✓ Improved efficiency, dependability.
  - ✓ Increased customer and end-user satisfaction.

Design for use is an alternative to competing by commodity pricing or through feature bloat.

In the Beginning

Deus ex machina…



Technology at the center. User-friendly design.
UI and usability as after-the-fact decoration.

Advances in Computing

- IBM 1401
- Autocoder
- Progress
  - machine language
  - assembly language
  - high-level languages
  - 3GLs
  - 4GLs
  - application generators
  - executable models

1986. What has Changed, Ed?

- Excelerator (Index Technology)

Same old, same old. But now it's object-oriented programming. And CASE.

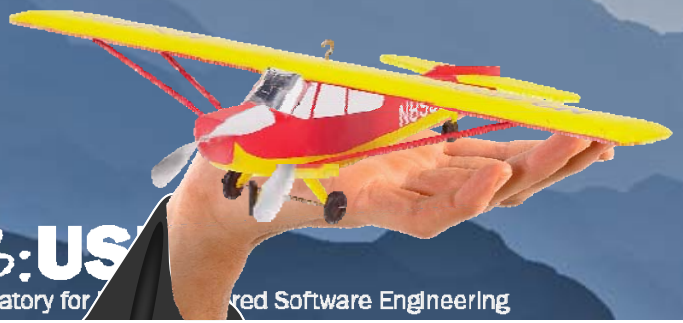
Just pretty pictures. Good marketing. The real stuff is database and code generation!

Why Models?

- Building models is easier than building the real thing.
- Models capture, carry, and organize understanding about a problem or possible solutions.
- Models permit exploration of problem and solution spaces.
- Models can be validated against objective criteria.
- Models can be tested and evaluated.

MODEL-DRIVEN PROCESSES:

- provide an "audit trail" of assumptions, of evolving understanding, and basis of solutions.
- facilitate tracing results back to requirements.
- enable reasoned derivation of successful solutions.



Some Holes in the Story

Ivar Jacobson
Magnus Christerson Patrik Jonsson
Gunnar Övergaard
Object-Oriented Software Engineering
A Use Case Driven Approach
ADDISON-WESLEY
THE UNIFIED MODELING LANGUAGE REFERENCE MANUAL
JAMES RUMBAUGH
IVAR JACOBSON
GRADY BOOCH
The definitive reference to the UML from the original designers
BOOCH
JACOBSON
RUMBAUGH
EXECUTABLE UML
A FOUNDATION FOR MODEL-DRIVEN ARCHITECTURE
STEPHEN J. MELLOR
MARC J. BALCER
Foreword by Ivar Jacobson
UML

Where are the Users?

Even the gurus don't get it!

In 21 classic, respected books –

	INDEX ENTRIES*	TOTAL PAGES	% of PAGES
• UML and the unified process (9 books, © 1997-2003; 3175pp)	12.7	67	(2.1%)
• Use cases (6 books, © 1997-2003; 1913pp)	18.7	47	(2.5%)
• XP and agile development (6 books, © 2000-2002; 1868pp)	2.5	8	(0.4%)

3 books have only 1 mention;
3 have nothing at all to say!

* users, user interfaces, usability, GUI, end users,…

Constantine & Lockwood, Ltd.

Models Matter

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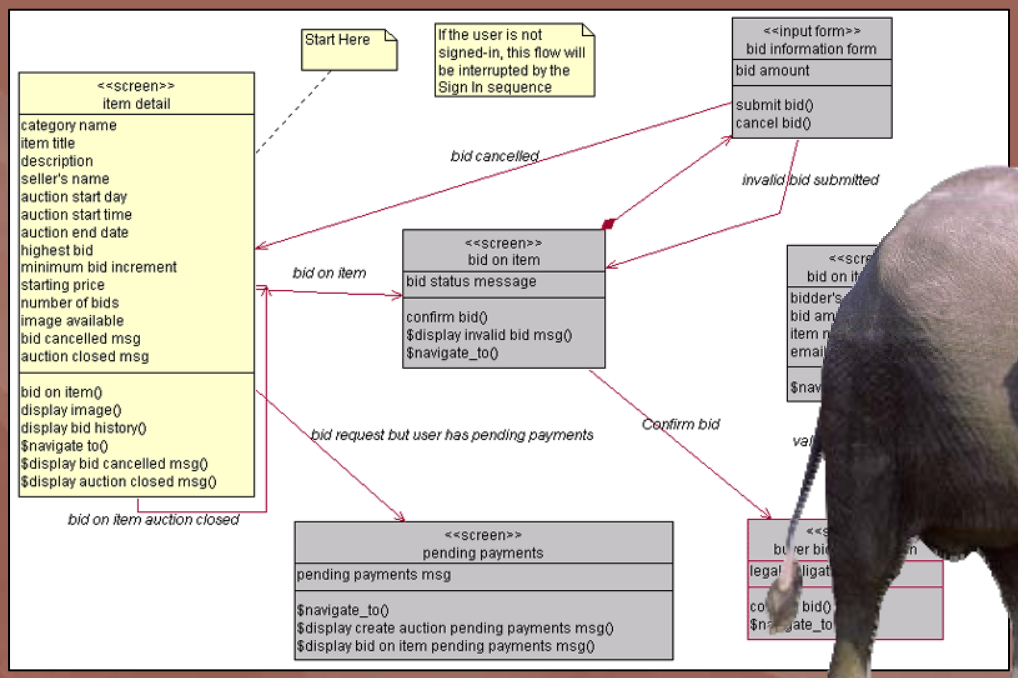
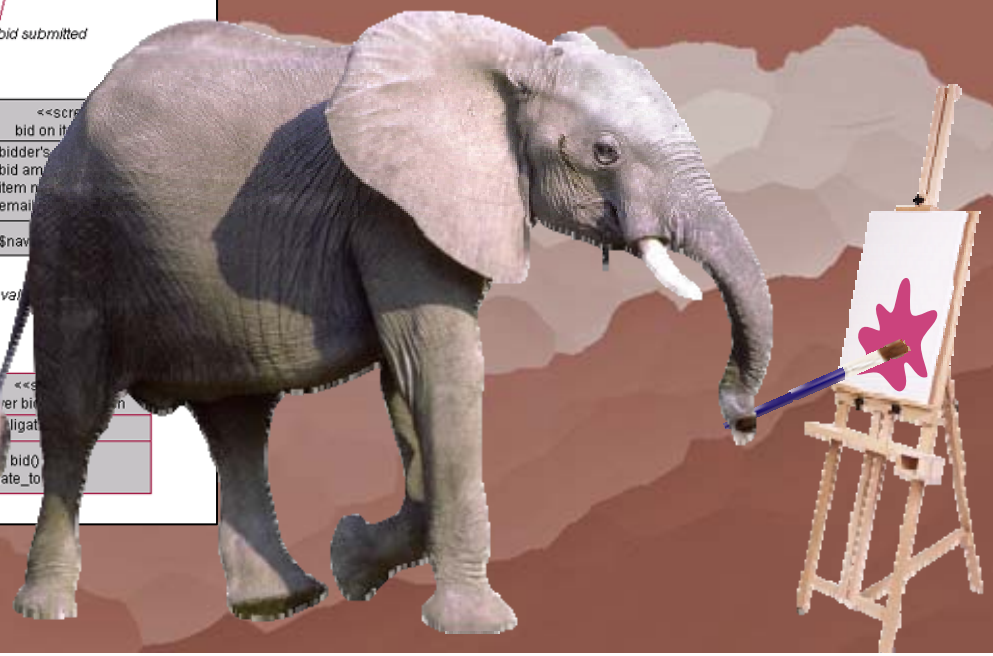
- Models should be suited to the design task.
- UML can be used to model user interface design and interface architecture, but…
- Some design modeling is better than none at all.
- But big, clumsy, complicated models tend to lead to…

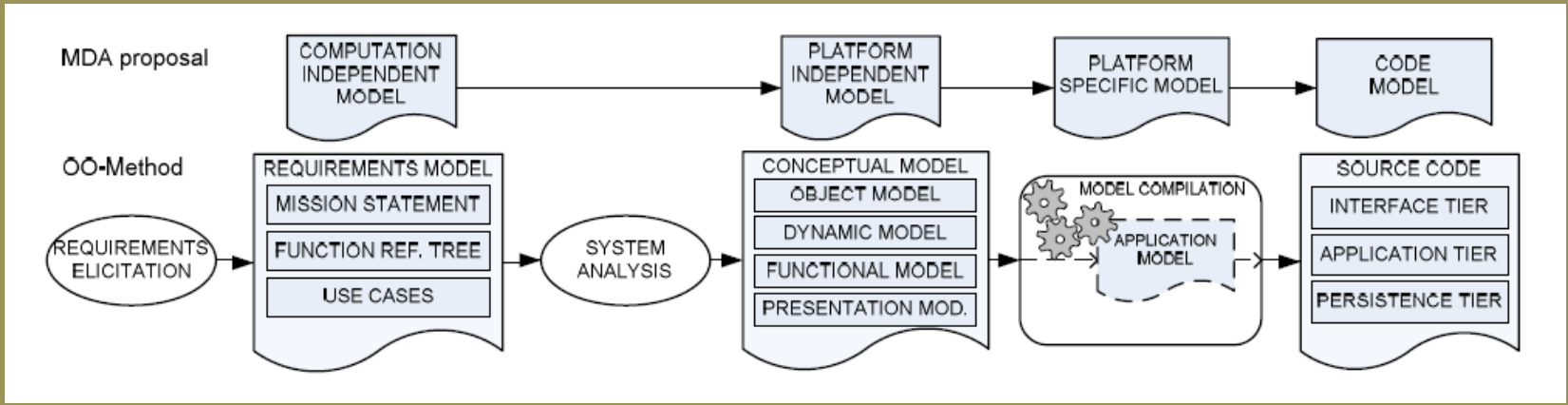




Model-Driven Everything

- model-driven user interfaces?
- model-driven engineering
- executable models
- model-driven architecture
- model-driven development
- model-driven design
- models in analysis and design

Model-Generated User Interfaces

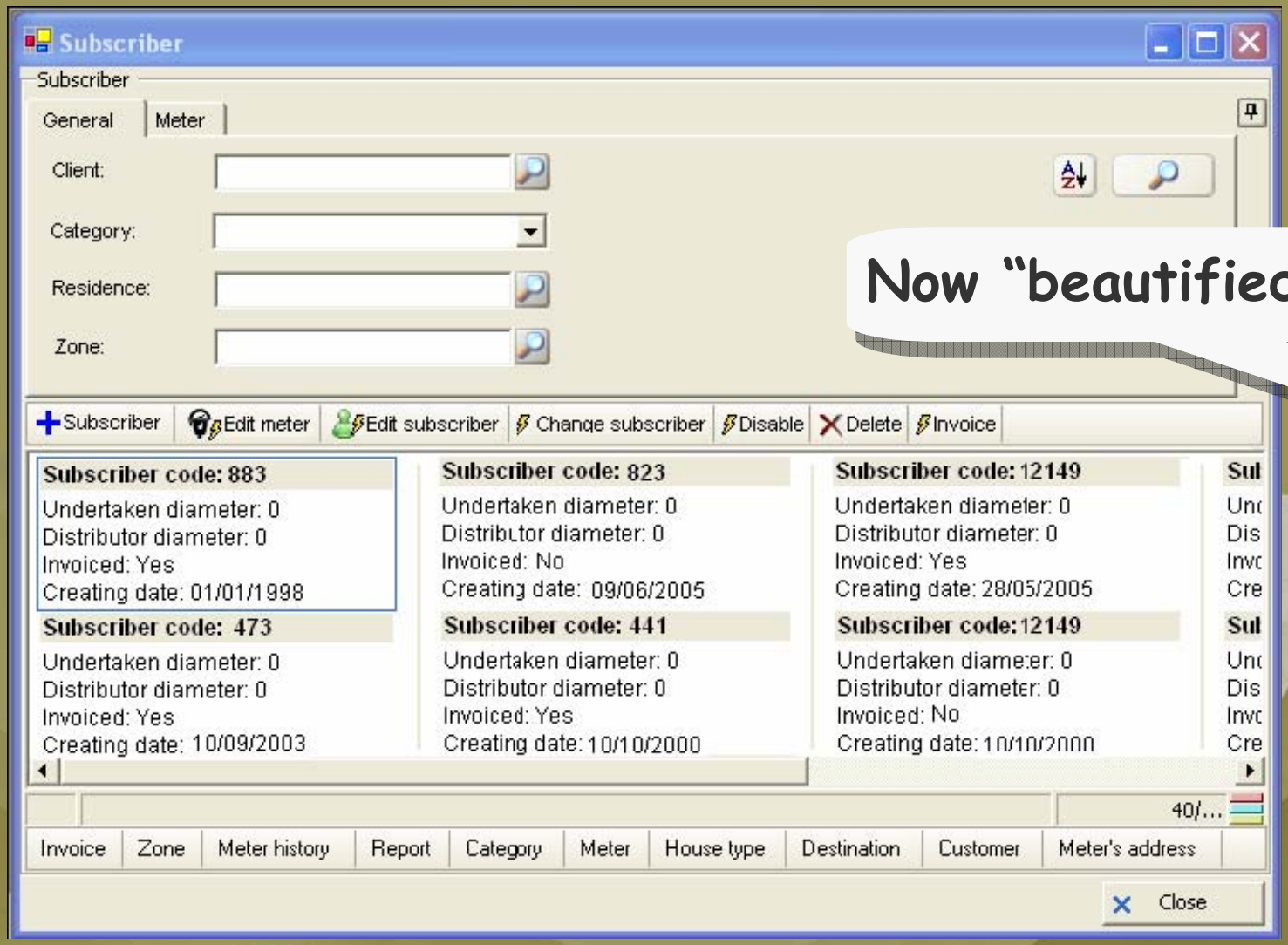


- Some processes can target alternate deployment: Web, desktop, smartphone,…
- Some even attempt integrated "beautification."

Pederiva et al., "The Beautification Process in Model-Driven Engineering of User Interfaces" *Interact 2007*

And the results?

- Real-world app generated by OlivaNova



Pederiva et al., "The Beautification Process in Model-Driven Engineering of User Interfaces" *Interact 2007*

Getting Better, Getting Worse

- To avoid "analysis paralysis," agile development rejects thoughtful, thorough design. No BDUF! *Big Design Up Front*
- Users can be shortchanged in "customer-centric" focus on features, delivered value, customer satisfaction.

"GUI-intensive projects are problematical for XP (and probably for many [agile] approaches)."

—Ron Jeffries

"[Usability] is not a 'weak point' [of the agile methods], it is an absence."

—Alistair Cockburn

- But, things may be getting better -
  - Jeff Patton, agile-usability@yahoogroups.com
  - Scott Ambler, Agile Modeling
  - Cutter Agile Management "The Usability Challenge"

Still, . . .

- User-centered design is no guarantee either.
- User experience design is often misguided because user performance is what is truly important.
- Industrial design does no better than software engineering.

"It probably won a prize!"
—Donald Norman

"Focus upon humans detracts from support for the activities themselves."
—Donald Norman

If Only Things Were Simple

Management fantasy

- The new programmer –
- The new designer –

Everyone's fantasy

- The new user –

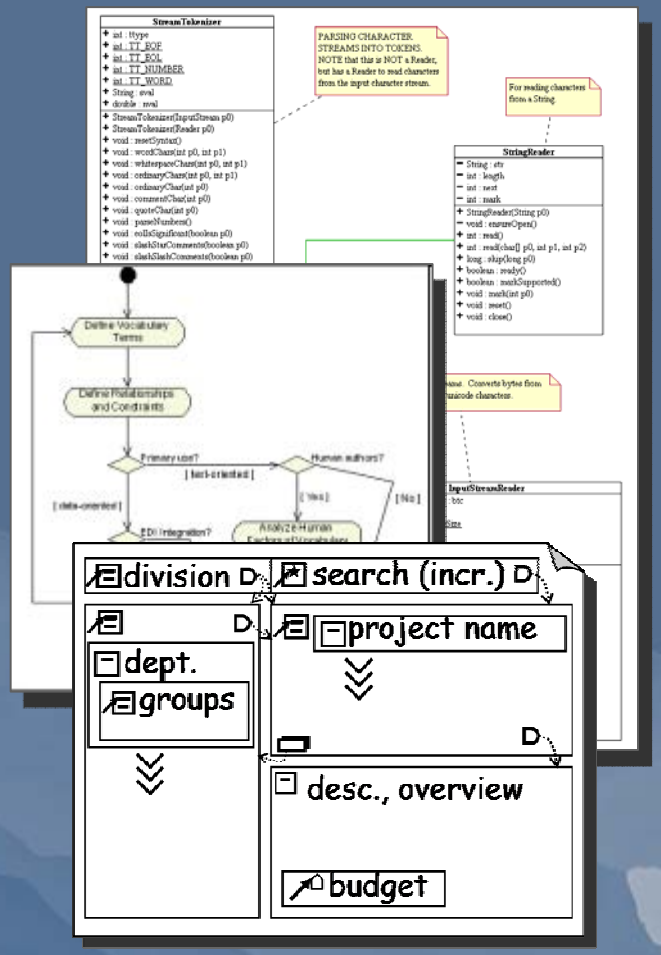
Points of Departure

- Study process and UI problems (1991-1992).
- Use cases promising but early results disappointing.

  Keys ✓ simplification not elaboration
  ✓ abstraction not realism
  ✓ intentions not interaction

- Essential use cases and basic process (1993).
- Widely used and practiced: Siemens, McKesson, Nortel, Navy, Lockheed, Gartner, DaimlerChrysler, IBM,…
- Full spectrum of problems: e-commerce, automation, healthcare, finance, banking, insurance, education, embedded systems, CAD/CAM, office products, …
- Integrated with varied processes: OOSE (Ahlqvist, 1996), RUP/USDP, XP, agile modeling,…

Unified Modeling?



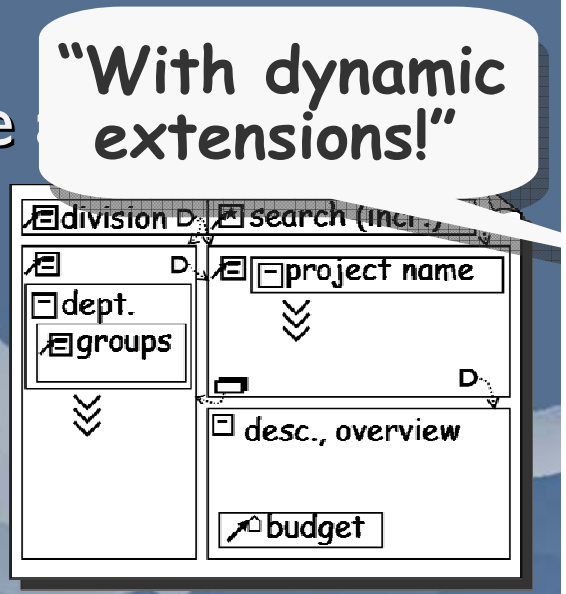
- For data modeling you want appropriate models by skilled data modelers.
- For process modeling you want appropriate models by skilled process modelers.
- For interaction modeling you want appropriate models by skilled interaction designers.

- Different models and different skills are needed for different parts of the modeling process!

* A. Chanda, E. Allen, Rice University

Much is Asked

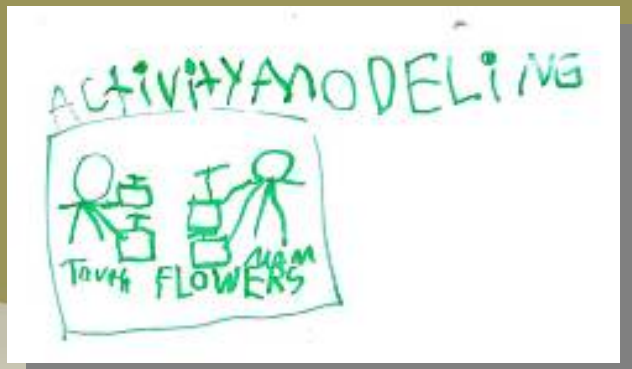
- Focus shifted from users and user experience to human activity and user performance.
- Model-driven inquiry grounded in systematic models of human activity. **Human Activity Modeling**
- Model-based process for user interface interaction design. **Usage-centered Design**
- Models tailored to the needs of interaction design and designers.
- Models based in powerful abstractions and separation of concerns.
- Tools supporting flexible, seamless problem solving with all models interconnected.



Canonical Abstract Prototypes

Human Activity Modeling

- Based in activity theory, models human activity:
  "loosely ordered collection of flexibly adaptive actions having distinct but disparate goals contributing to a shared or common purpose."
- Simple notation, small number of concepts systematizing activity theory, linked with UML.
- Captures and organizes aspects of activity context most salient and relevant to interaction design in support of real user requirements.

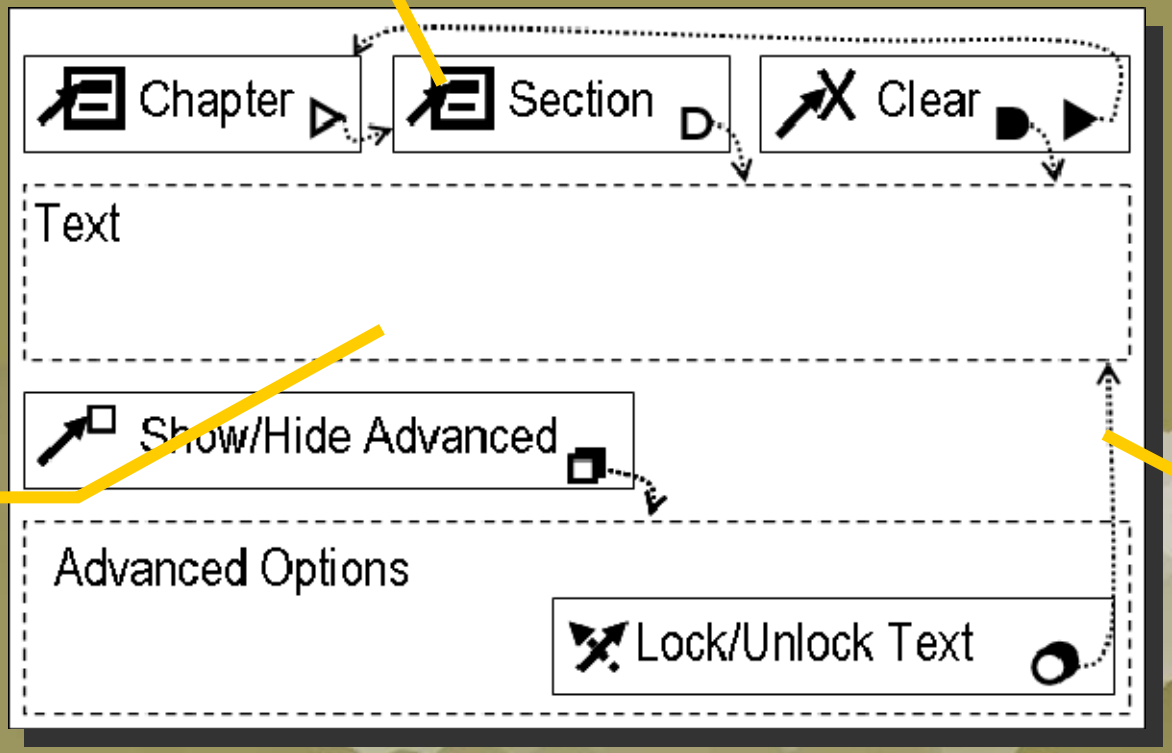


"Business process modeling done right!"
- Nuno Nunes

Anatomy of an Abstraction

abstract UI components with standardized user-centered semantics

CAPs and dCAPs: formalized abstract wireframe schematics.



content, function, layout and organization

Supports separation of concerns.

And they are "executable"!*

dynamic relationships among UI components

* Nóbrega, University of Madeira

Constantine & Lockwood, Ltd.

Prescription for Progress

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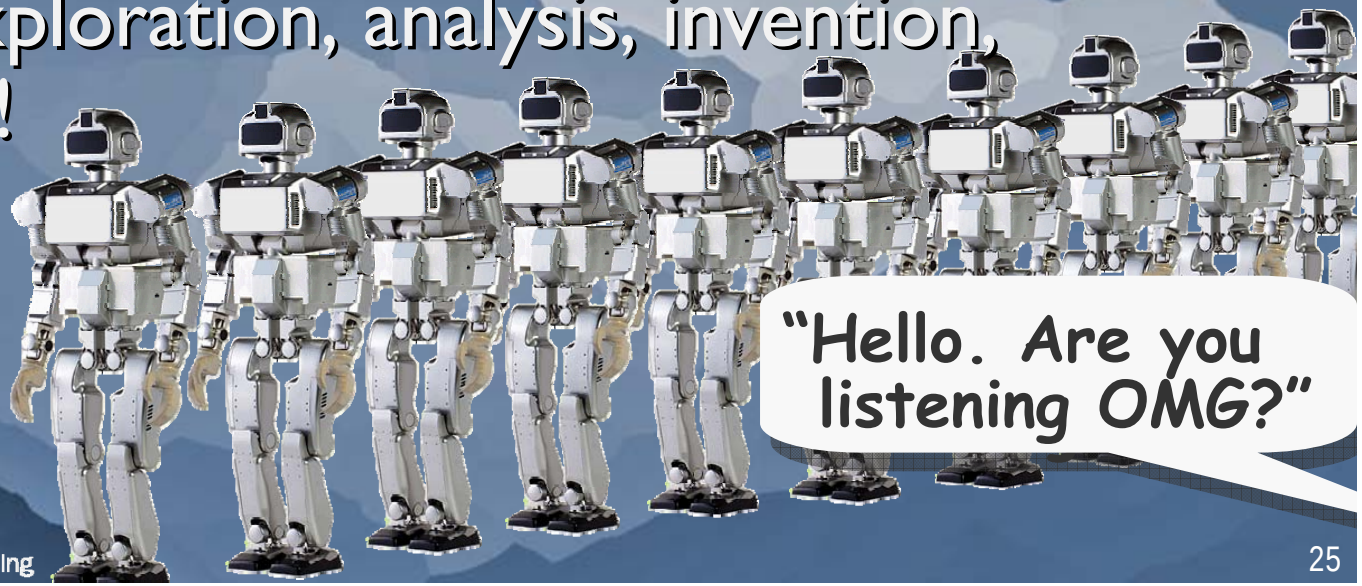
- Models to capture, hold, and organize understanding of problems and solutions.
- Focus on user performance, human activity.
- Tools to support, not take over human activity.
- Fix and finish UML (notations suited for human activity and user interaction modeling).
- Use people for what people are best at: creative exploration, analysis, invention, and design!

OR…



Thank you.
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