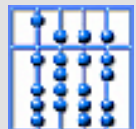


Towards a Development Methodology for Augmented Reality User Interfaces

MIXER 2004

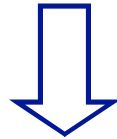
Christian Kulas, Christian Sandor, Gudrun Klinker
Lehrstuhl für Angewandte Softwaretechnik
Institut für Informatik, Technische Universität München
kulas@in.tum.de

January 13, 2004

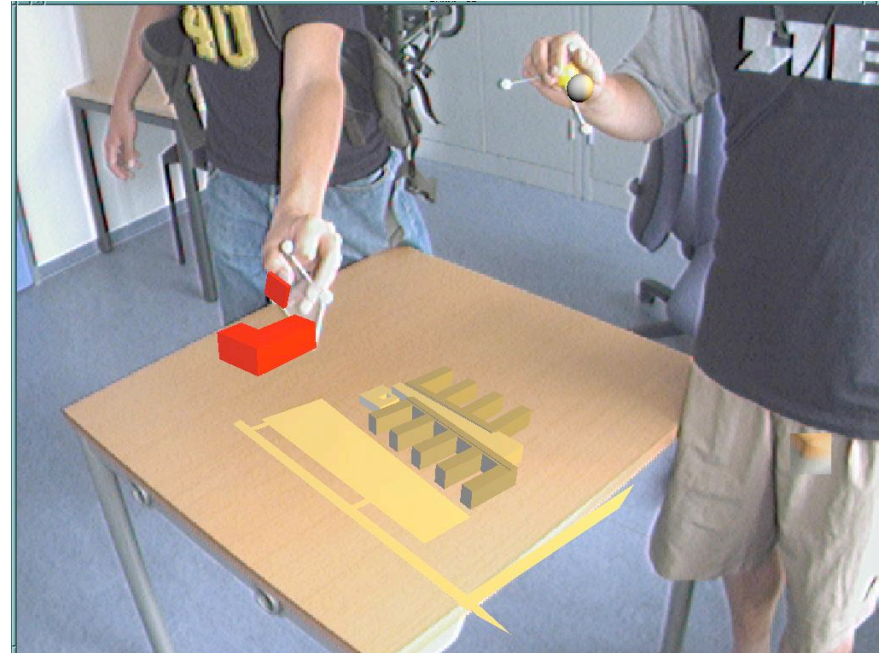


Summary

- ARCHIE (Augmented Reality Collaborative Home Improvement Environment) project



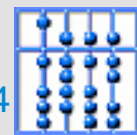
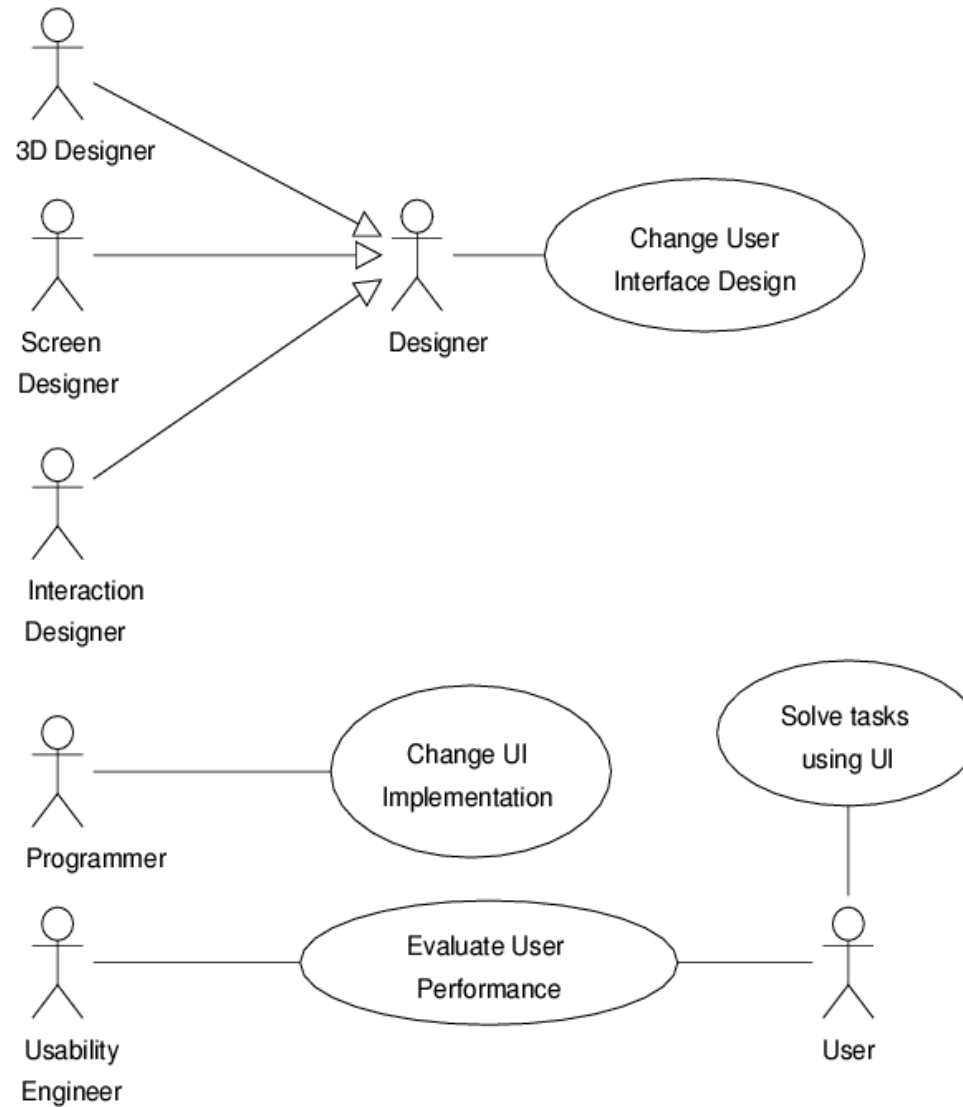
- Traditional tools and processes ill suited for Augmented Reality development
- We propose a new development methodology based on
 - New process
 - New tools



Overview

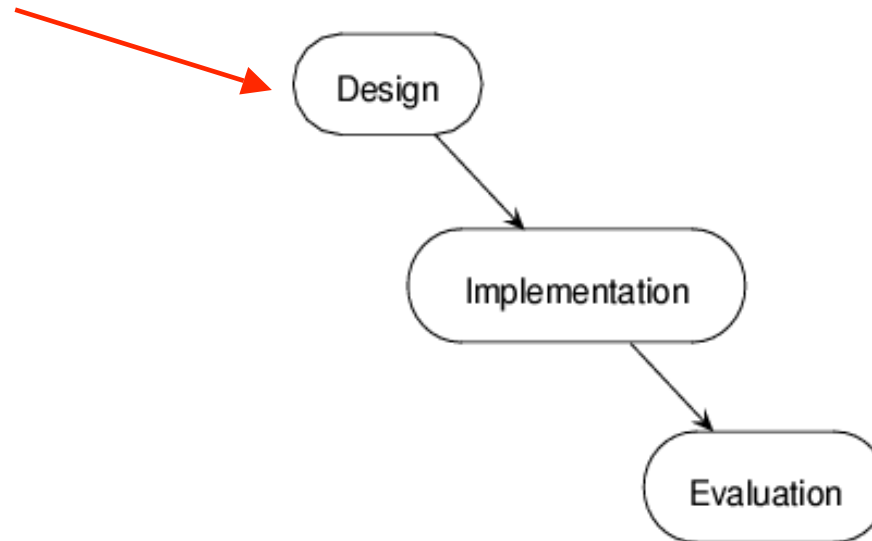
- Participating groups
- The problem
- Research challenges
- Our approach
- Future work

Participating groups

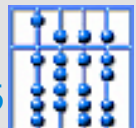


The problem

- Process issues: Waterfall [1]
- Missing tools
 - *Authoring Tools*
 - *Frameworks*
 - *Automatic Evaluation*
- Bad integration of tools
- Unclear design space
- Unclear non-functional requirements



[1] D.J. MAYHEW, *The Usability Engineering Lifecycle*, Morgan Kaufmann Publishers, 1991.

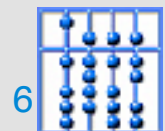


Research Challenges

- Tool Challenges:
 - Which tools?
 - Tool integration?
 - Tool mapping?
 - Tool automation?
- Methodology
 - Limits?
 - Validation?
- Process Challenges:
 - Limit to parallelism?
 - Formal process (XP[2], Design Patterns [3]) ?
 - Persistence of UI experiments?

[2] K.BECK, *eXtreme Programming Explained: Embrace Change*, Addison-Wesley, 1999.

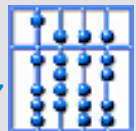
[3] A. GRANDLUND AND D. LAF, *A pattern-supported approach to the user interface design process*, 1999.



Tool combination design space

Tool	Designer	Programmer	Usability Engineer
2D Paint tool	+	-	-
3D Modeller	+	-	-
IDE or Authoring	+	+	+
Performance logging & visualization	-	O	+
Wizard of Oz [4]	+	+	+
Automatic testing	+	+	+
Monitoring tool	-	+	+
Interaction graph	+	+	+

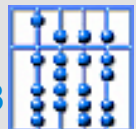
[4] T.REICHER AND T.KOSCH, Software Design Issues for Experimentation in Ubiquitous Computing, The Second Workshop on Artificial Intelligence in Mobile Systems (AIMS 2001), Seattle, USA, 2001.



Tool combination design space

Tool	Designer	Programmer	Usability Engineer
2D Paint tool	+	-	-
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[4] T.REICHER AND T.KOSCH, Software Design Issues for Experimentation in Ubiquitous Computing, The Second Workshop on Artificial Intelligence in Mobile Systems (AIMS 2001), Seattle, USA, 2001.



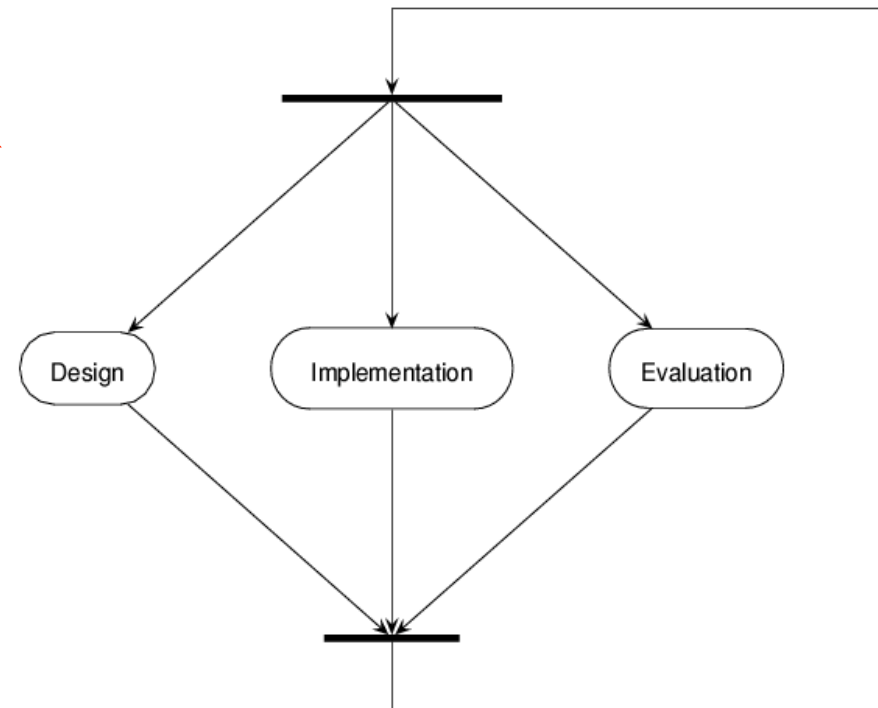
Tool combination design space

Tool	Designer	Programmer	Usability Engineer
2D Paint tool	+	-	-
3D Modeller	+	-	-
IDE or Authoring	+	+	+
Performance logging & visualization	-	O	+
Wizard of Oz [4]	+	+	+
Automatic testing	+	+	+
Monitoring tool	-	+	+
Interaction graph	+	+	+

[4] T.REICHER AND T.KOSCH, Software Design Issues for Experimentation in Ubiquitous Computing, The Second Workshop on Artificial Intelligence in Mobile Systems (AIMS 2001), Seattle, USA, 2001.

Our approach

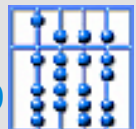
- Parallel development process
 - Jam sessions [5]
 - *Crowded group* working
- New tools
 - Interaction graph
 - Monitoring tool
 - Usability evaluation tools [6] based on DWARF [7]



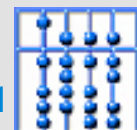
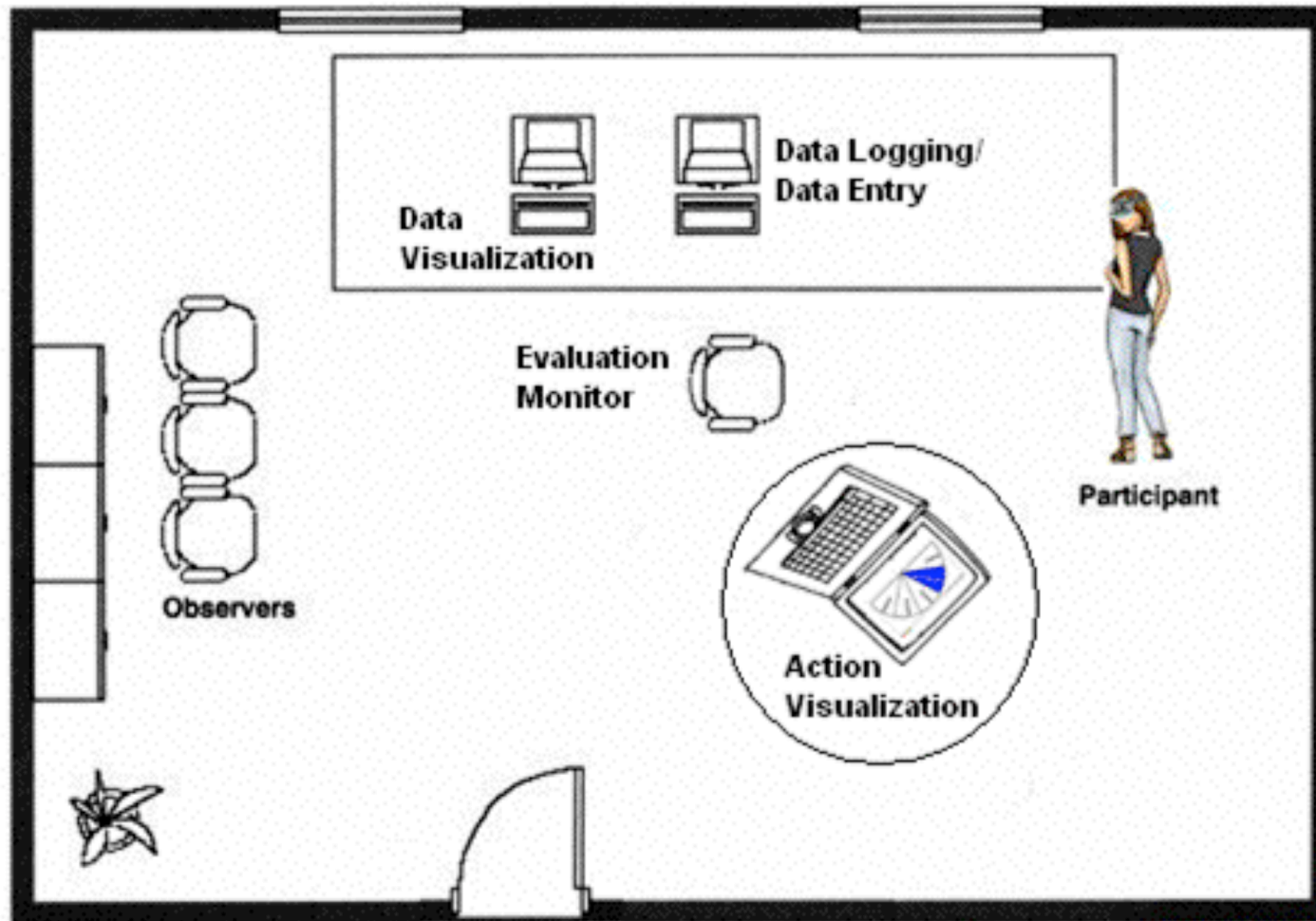
[5] A. MACWILLIAMS, C. SANDOR, M. WAGNER, M. BAUER, G. KLINKER, AND B. BRÜGGE, *Herding Sheep: Live System Development for Distributed Augmented Reality*, in Proceedings of ISMAR 2003.

[6] C. KULAS, *Usability Engineering for Ubiquitous Computing*, Master's thesis, Technische Universität München, 2003.

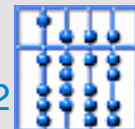
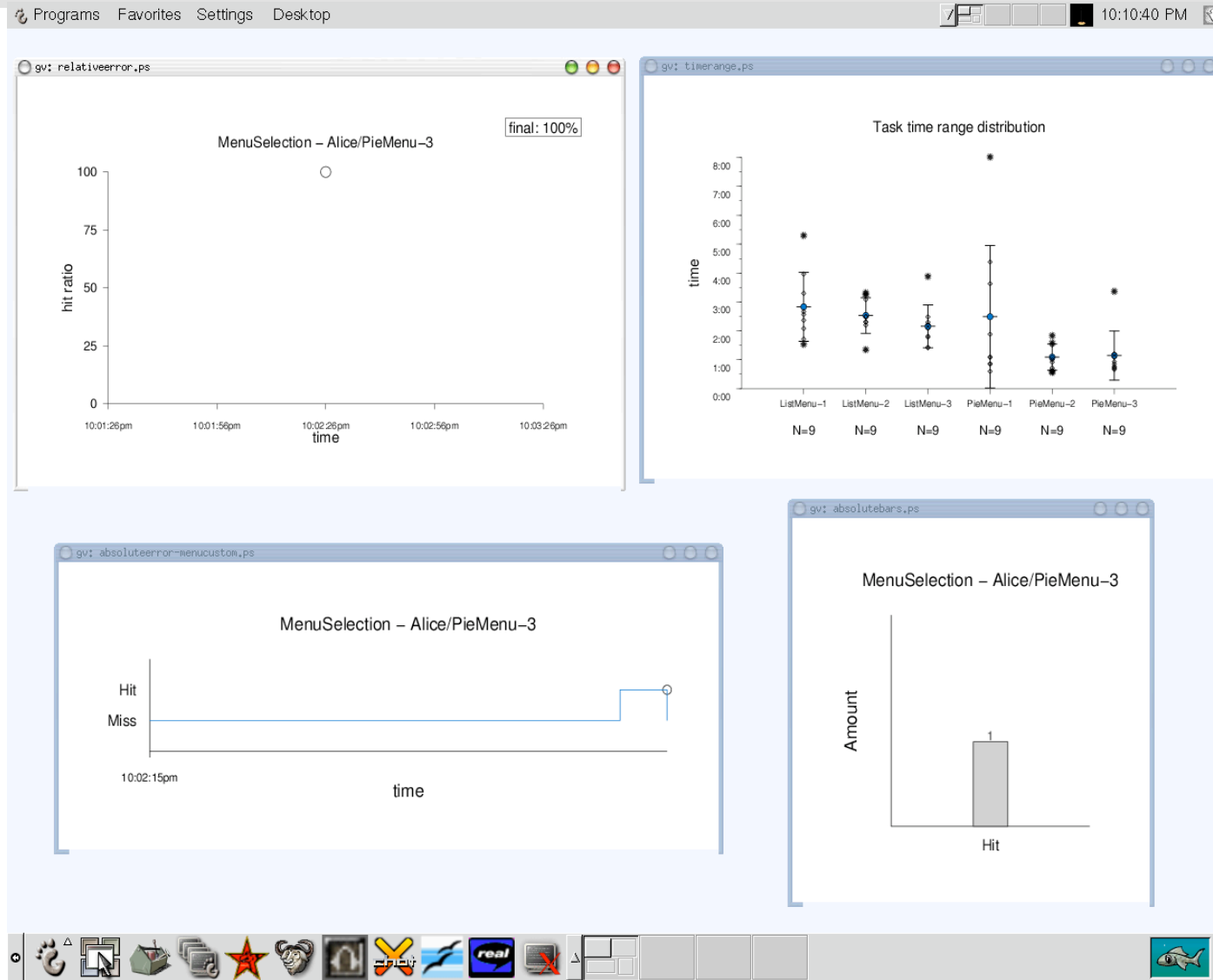
[7] M. BAUER, B. BRUEGGE, G. KLINKER, A. MACWILLIAMS, T. REICHER, S. RISS, C. SANDOR, AND M. WAGNER, *Design of a Component-Based Augmented Reality Framework*, in Proceedings of the 2nd International Symposium on Augmented Reality (ISAR 2001), New York, USA.



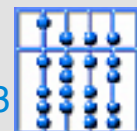
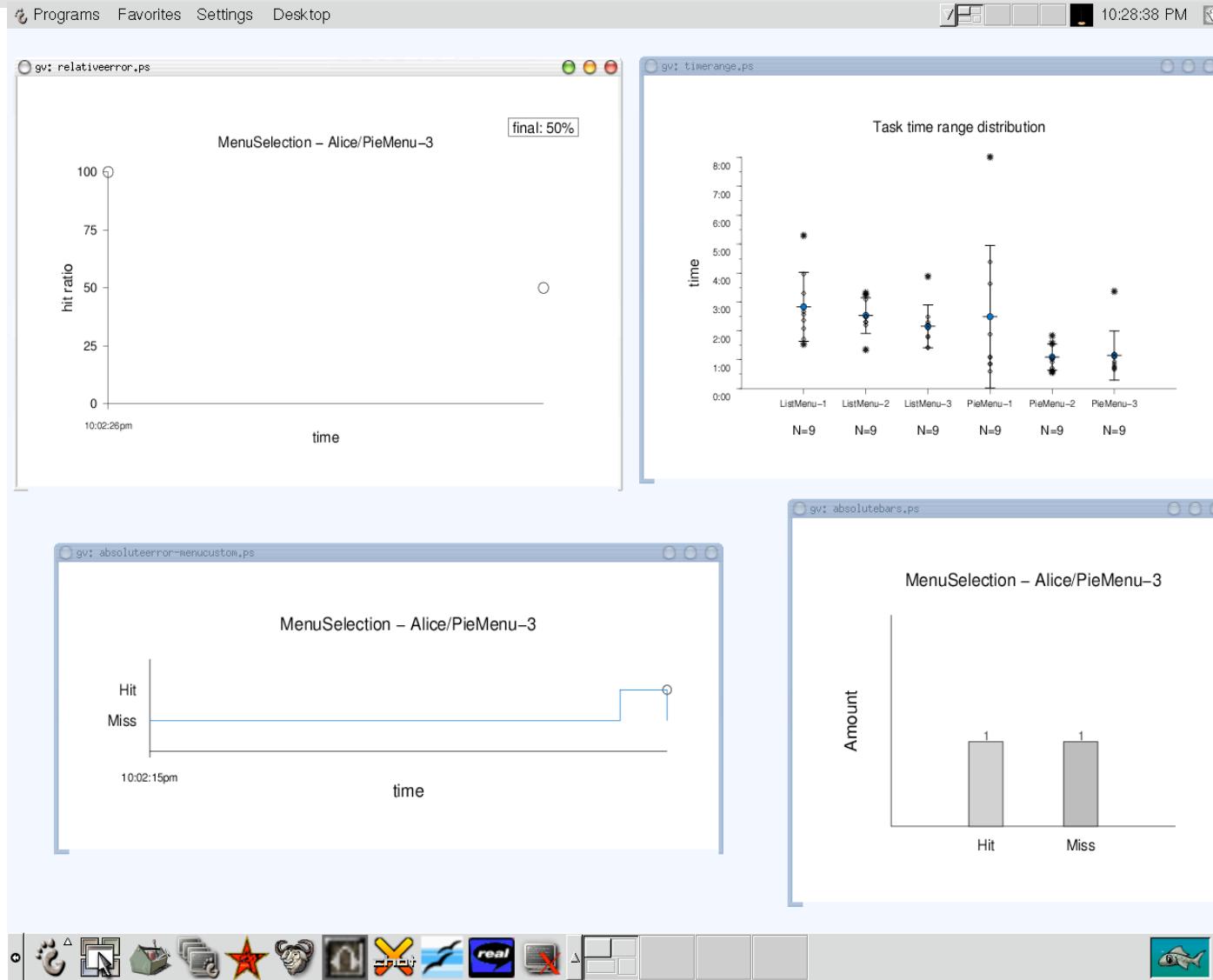
Usability evaluation setup



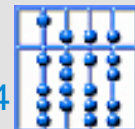
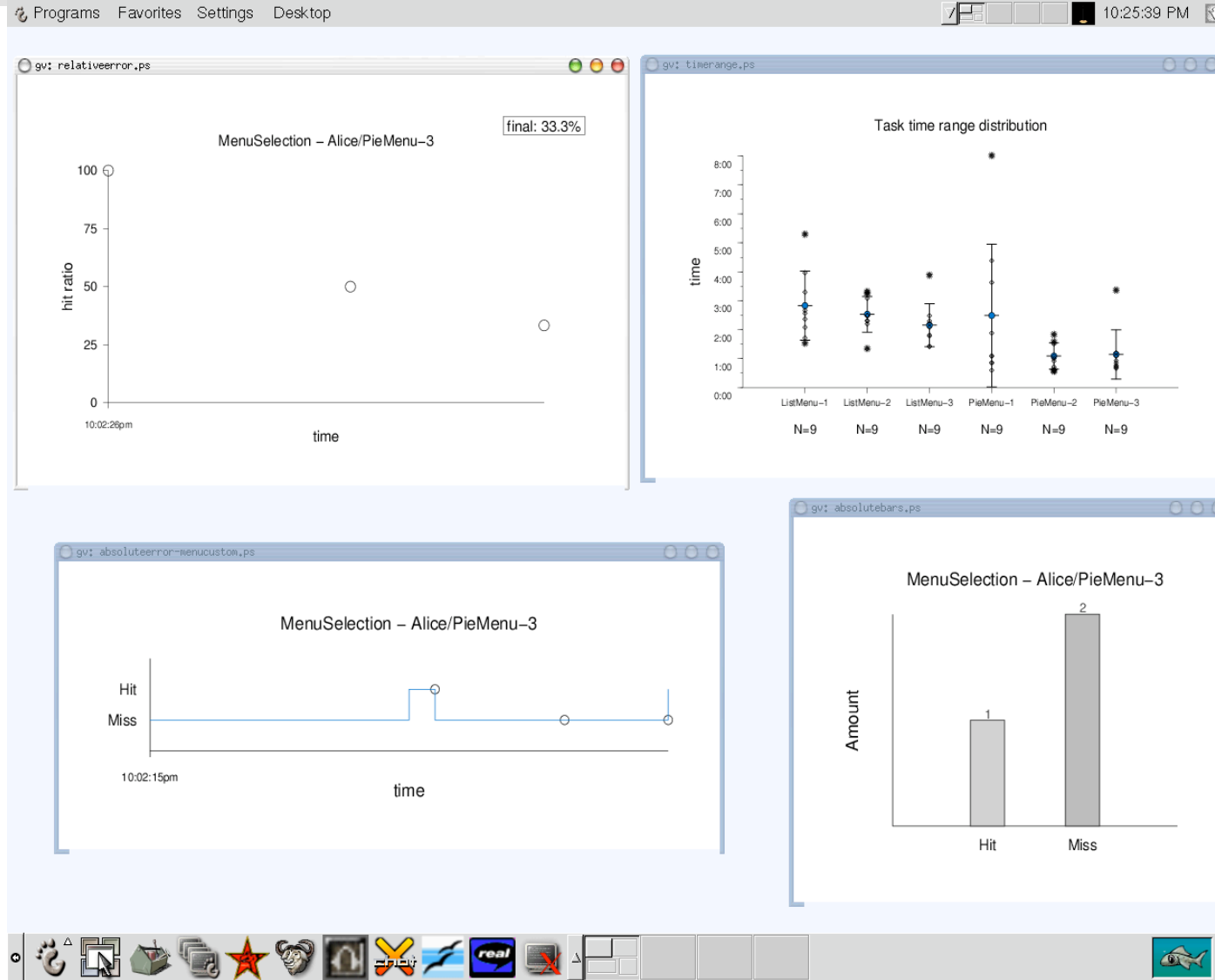
Performance visualization



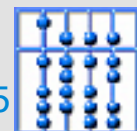
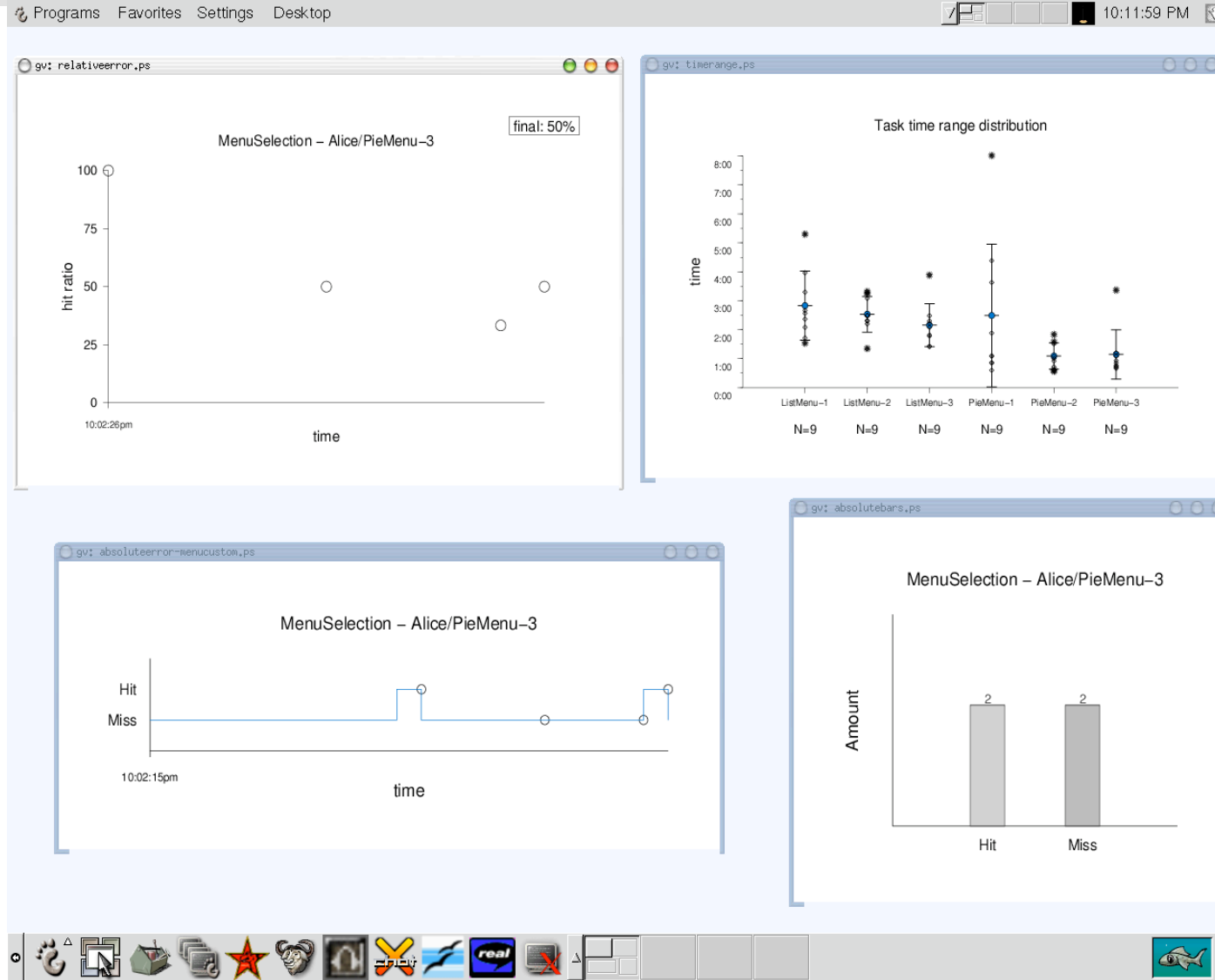
Performance visualization



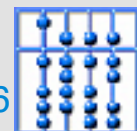
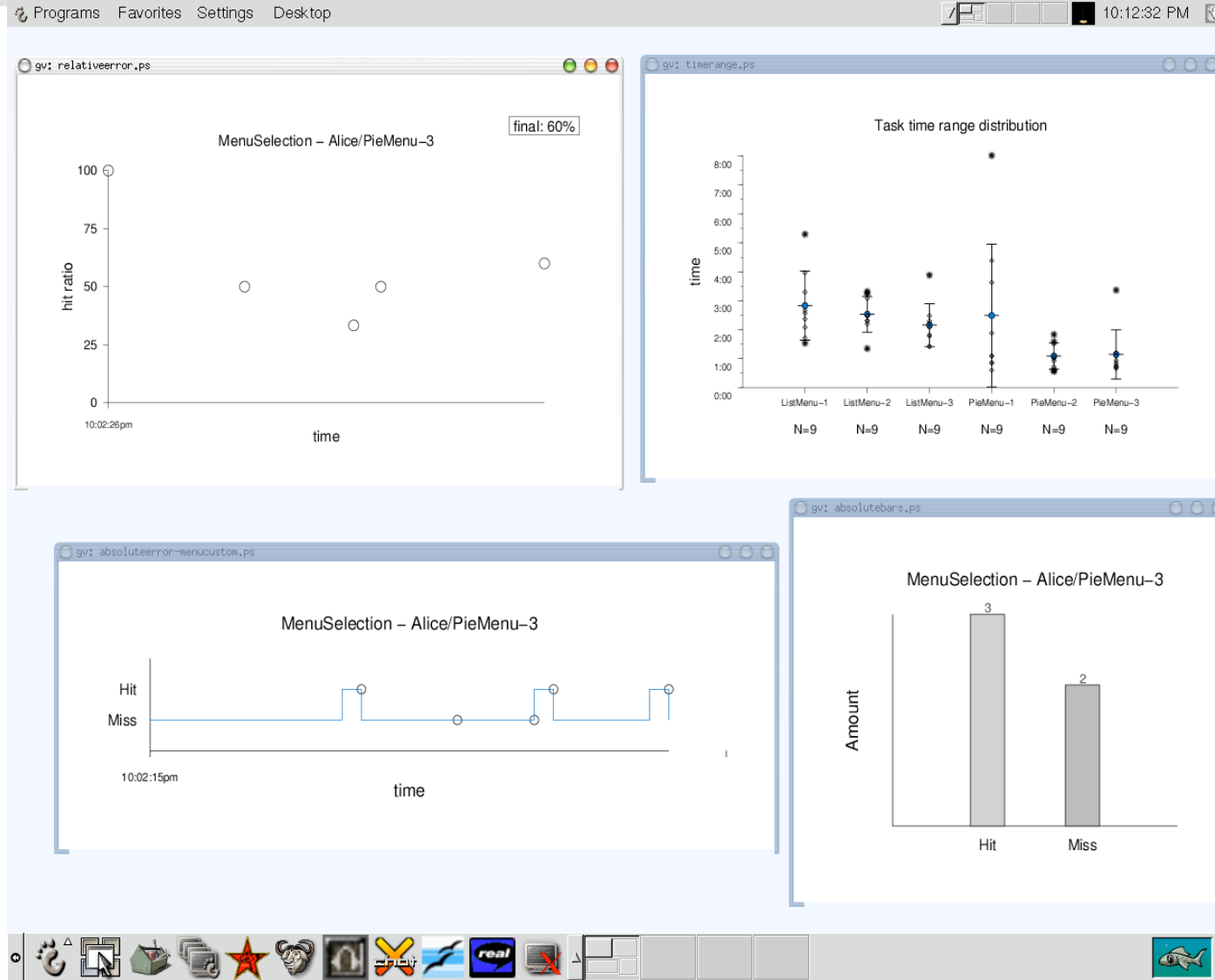
Performance visualization



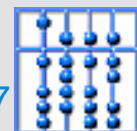
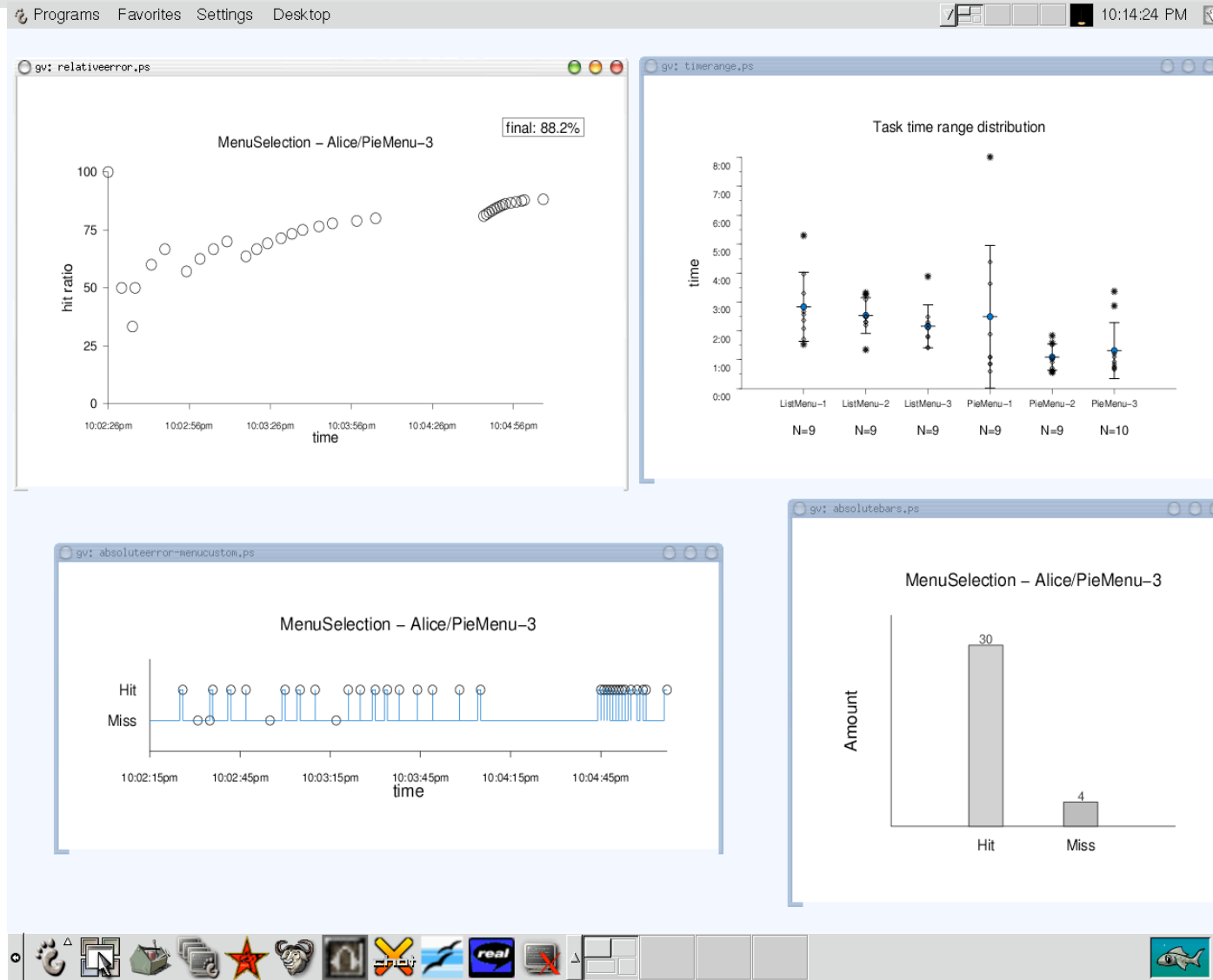
Performance visualization



Performance visualization

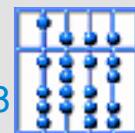
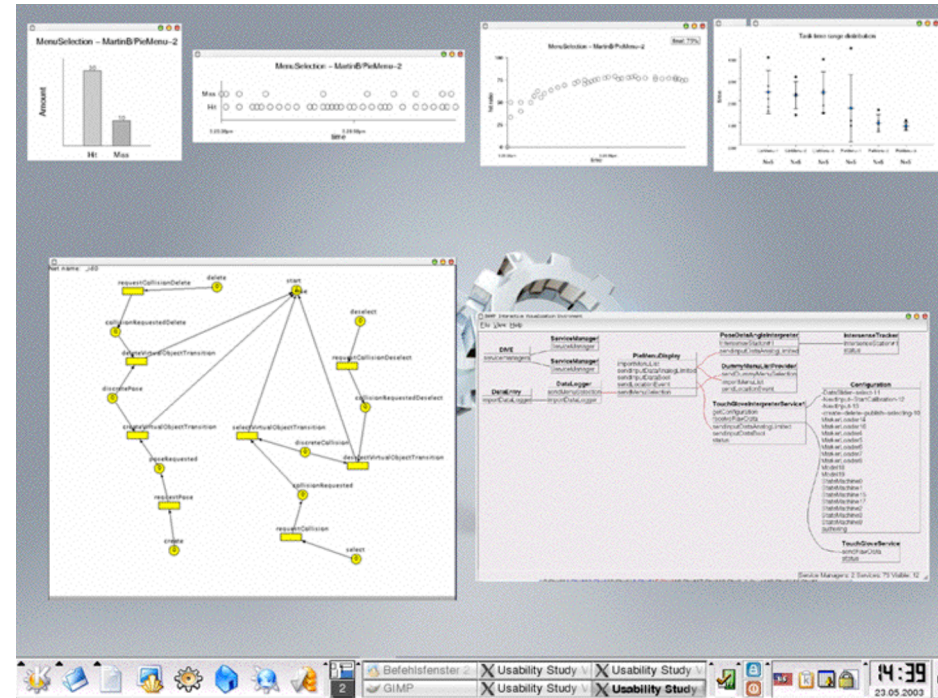


Performance visualization



Future Work

- Implement missing tools
- Better tool integration
 - Wizard of Oz / Interaction graph
 - Monitoring / Performance visualizations
 - Authoring tool for Interaction designer (vision: boot strapping)
- Proactive UIs
- Process refinement



Any Questions?

Thank You

