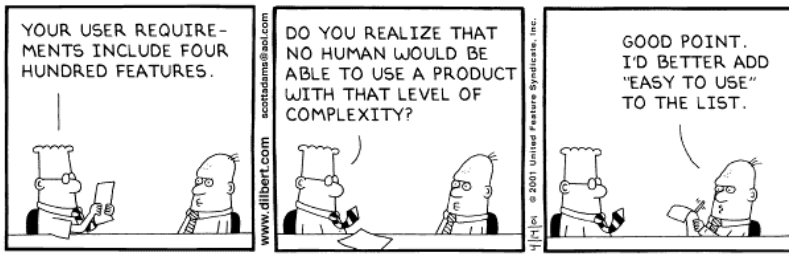
CS 544

The Design and Evaluation of Multiple Interfaces: A Solution for Complex Software

Understanding and Designing for Software Bloat

What you should think about…

- Adaptive vs. adaptable interfaces
- Novel and diverse methodologies
  - Fitting the methodology to the research question
- Iterative design and evaluation
- Cross-disciplinary research
- Scope of research required for a PhD



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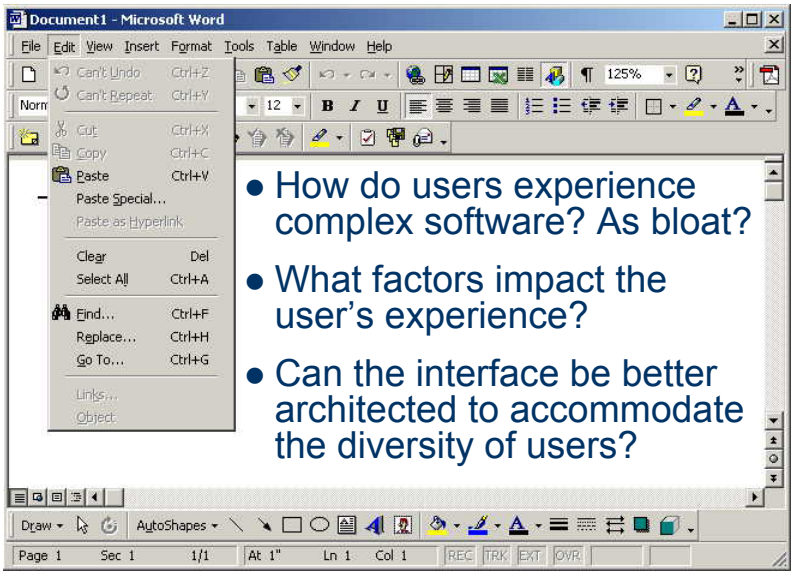

- How do users experience complex software? As bloat?
- What factors impact the user's experience?
- Can the interface be better architected to accommodate the diversity of users?

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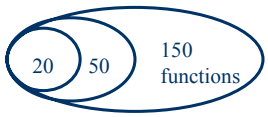
Design Solutions - Background

1. Functionality Blocking / Level-structured approach
2. Adaptive interfaces
3. Adaptable interfaces (customization)

Functionality Blocking

- Block or hide significant amounts of functionality from the user (e.g. Training Wheels Interface)
- Level-structured approach – essentially functionality blocking where the functionality is layered

E.g., 3-level interface



- Commercial Examples Framemaker and Hypercard
- Research Issues (i.e., open questions)
  - How should layers be determined? How many? Which functions?
  - How should users transition between layers?

Functionality Blocking

Training Wheels Interface

- Two different interfaces for an early word processor
  1. Certain functions and error states blocked (TWI)
  2. Complete interface (CI)
- Evaluation (repeated twice)
  - 12 novice users TWI, 12 novice users CI, simple tasks
  - TWI users completed tasks significantly faster with significantly fewer errors

Adaptive User Interfaces (AUIs)

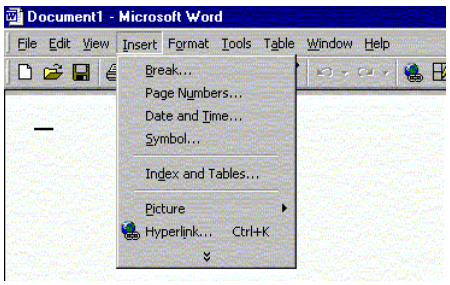
- Dynamically reconfigures the interface to accommodate individual user needs
- Can you think of an adaptive interface???
- System collects information on each user in a *user model* – how?
  - Directly asks user (e.g., survey)
  - Captures user's interactions with system (e.g., logging)
- Interface reconfigured based on content of user model (using AI or other techniques)

Example: Adaptive Telephone Directory

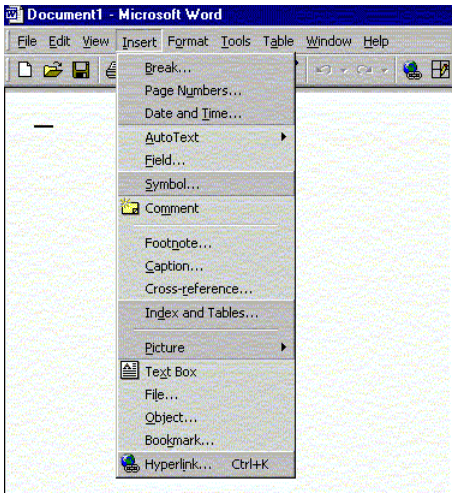
- Menu-driven telephone directory
- 2 different versions of a hierarchichal alphabetical menu
  1. Static
  2. Adaptive – most frequently accessed names near top of menu hierarchy
- Evaluation with 26 users showed the adaptive interface was 35% faster and the error rate was 60% lower
- Constrained example, existence proof that AUIs can work

Example: MSOffice 2000

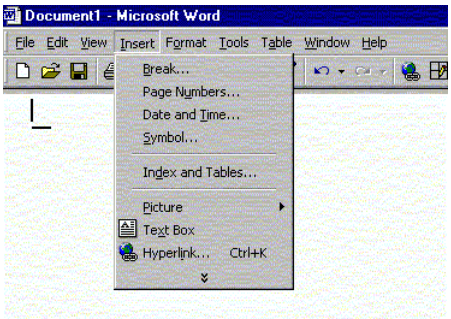
"Short" Insert Menu



“Long” Insert Menu



Updated “Short” Insert Menu



No evaluation of these adaptive menus has been reported.

Adaptive User Interfaces

- Mostly prototype systems and very little evaluation conducted (have shown you 2 counter examples to this)
- Most of the research has been done by people in the AI community – searching for just the right adaptive algorithm
- Goal is to help the user, but has been largely technology driven rather than user driven
- Main problem – lack of user control

Adaptable (customizable) interfaces

- User adapts his/her own interface
- Can you think of an adaptable interface???
- Not specifically a solution to complex software – but one could remove unwanted functions
- Very little research on how users customize, two examples given:

1. Majority of My Yahoo! users do not customize, why?
   - Default page good enough
   - Customization tools too difficult
   - No need for complex personalization

Adaptable (customizable) interfaces

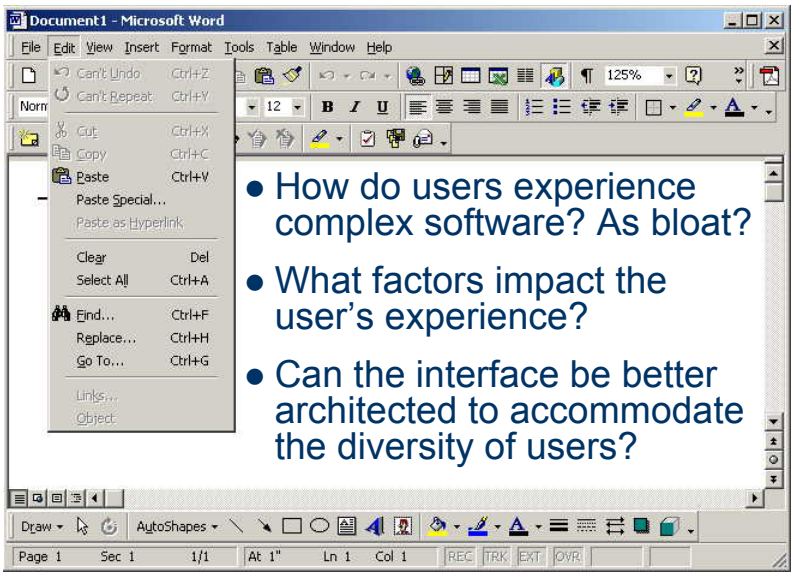
2. Customization in UNIX
   - 51 users followed over a 4 month period
   - Only a small number of highly skilled users found customization useful
   - Less skilled users less interested in customization (and less capable of doing it)
   - Most senior technical users no longer interested in "playing" with systems

Adaptive vs. Adaptable

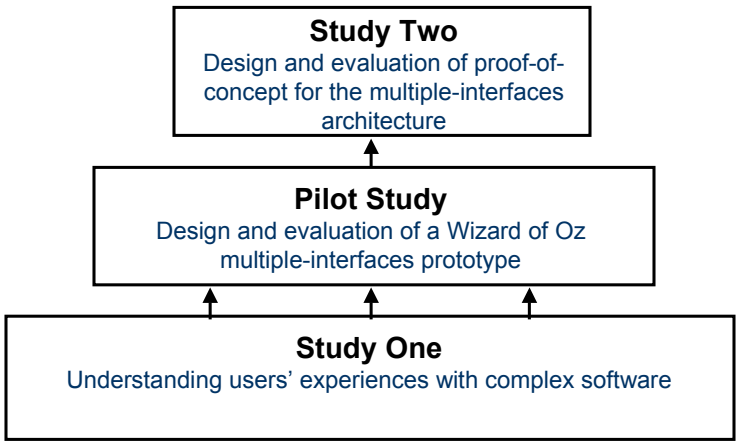
- Low user control
- User focuses on task only
- If it is done right, should save the user time
- Can be frustrating if user doesn't understand how the interface is adapting
- Can be a problem if someone else uses the system
- Very little evaluation (user testing)

- Total user control
- User has to focus on interface *and* task
- Might be time consuming
- Customization facilities are often very complex – only good for experienced users
- Can be a problem if someone else uses the system
- Very little research

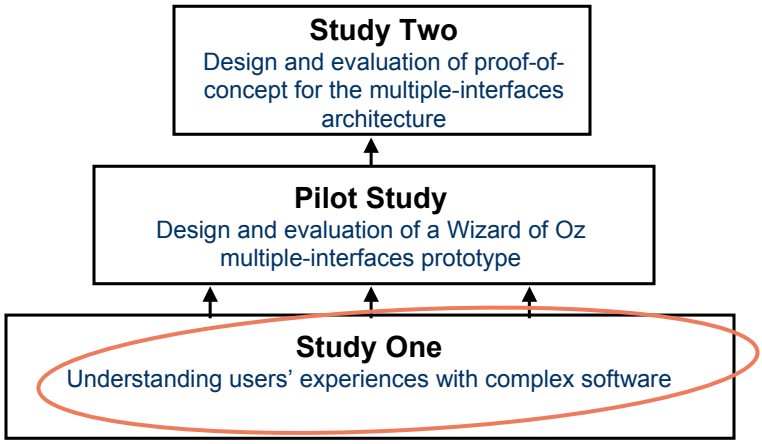
Back to my research...



Research Overview



Research Overview



Study One – Design

Goal: exploratory study, uncover the problems of complex software

- Collaborative effort with a Sociologist
- Judgmental sample: 53 participants representative of the general working population
- Methods
  - self-completion questionnaire (3 kinds of expertise, perception of complex software, history of word processing, demographics)
  - on-site interviews
    - identification instrument: functions used/familiar
    - open-ended follow-up interview

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1. **Did you know this function was here?**

   AND

   Do you know what the function does? (Do not attempt to guess.)

   No, unfamiliar **Yes**, familiar

2. **Do you use the function?**

   Never **Irregularly** (at least a few times) **Regularly** (weekly or monthly)

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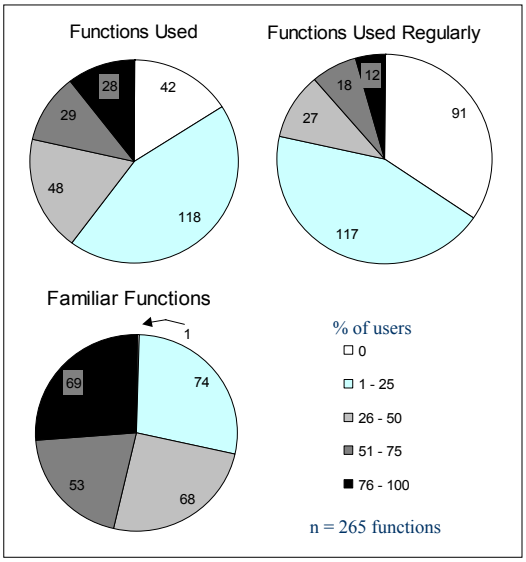
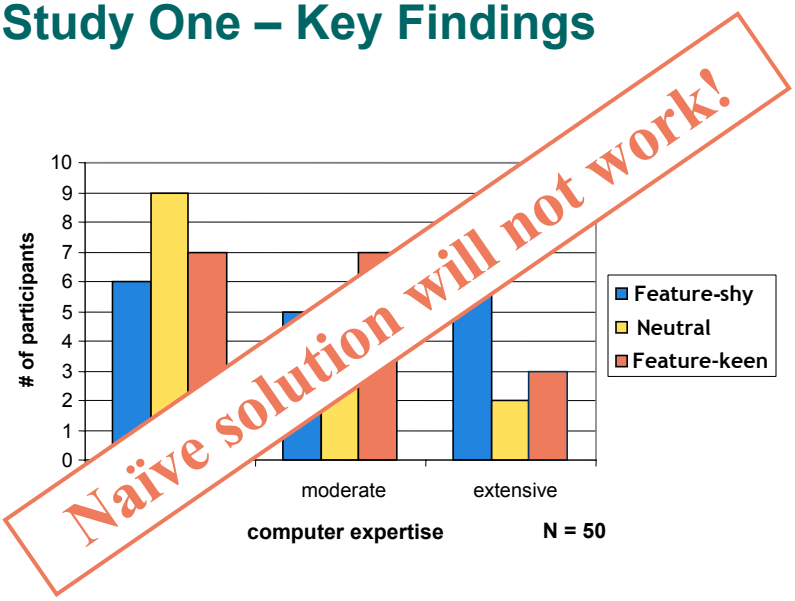
Study One
Key Findings



Study One – Key Findings



A senior technical expert:

"I want something much simpler… I'd like to be able to customize it to the point that I can eliminate a significant number of things. And I find that very difficult to do. Like I'd like to throw away the 99% of the things I don't use that appear in these toolbars. And I find that you just can't there's a minimum set of toolbars that you're just stuck with. And I think that's a bad thing. I really believe that you can't simplify Word enough to do it."

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A junior consultant:

"I like the idea of knowing that in case I needed to do something, that that stuff is there. And again, I think it goes back to the personality thing I was talking about where, you know, there's [sic] people that are options people…. I love to know that options are there, even if I never use them. I really like knowing that it does all that stuff."

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Study One – Redefining Bloat

Objective bloat – functions not used by any users

Subjective bloat – the set of unwanted functions that varies from user to user

Study One – Summary

- A significant number (~50%) of users would like to have unused functionality tucked away but not removed entirely
- Users do not use the same functions and have different tolerance levels for unused functions

Directions for Design

From: enabling the customization of "one-size-fits-all" interfaces

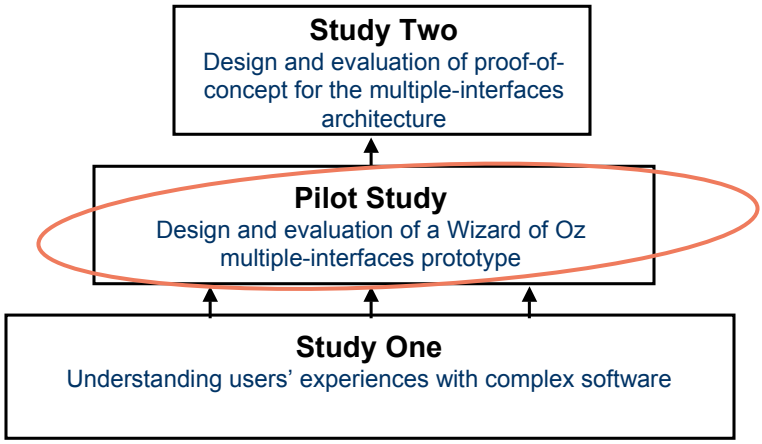
To: supporting the creation of personal interfaces, multiple interfaces

Research Questions

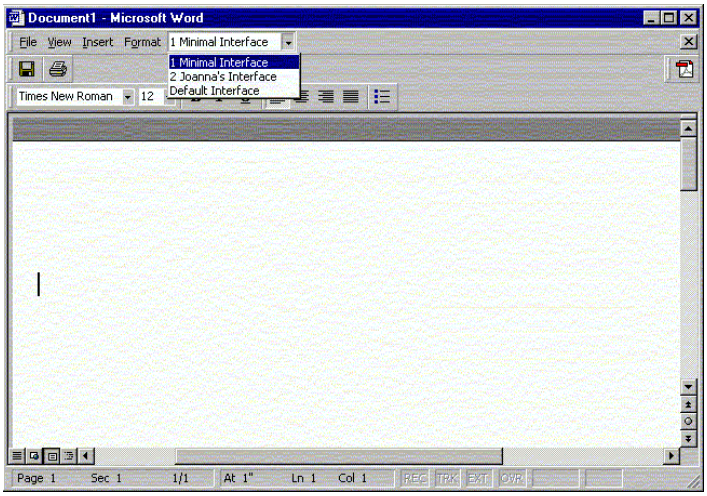
- Will users grasp the concept of multiple interfaces?

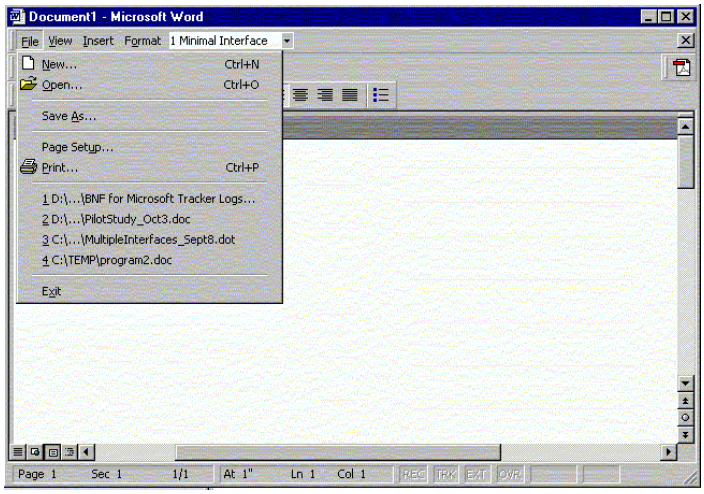
- BIG questions about personalization:
  (1) Is there value to a personalized interface?
  (2) If so, how can the construction of the personalized interface be facilitated?

Research Overview



Pilot Study – Prototype

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File View Insert Format 1 Minimal Interface
New... Ctrl+N
Open... Ctrl+O
Save As...
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Print... Ctrl+P
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2 D:\...\PilotStudy_Oct3.doc
3 C:\...\MultipleInterfaces_Sept8.dot
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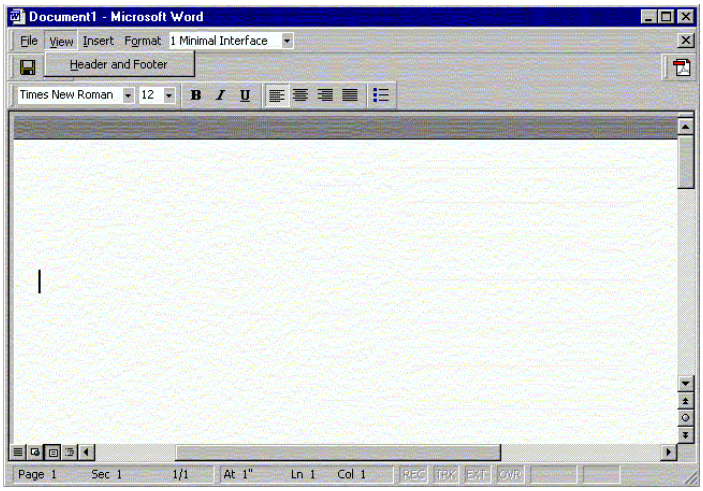
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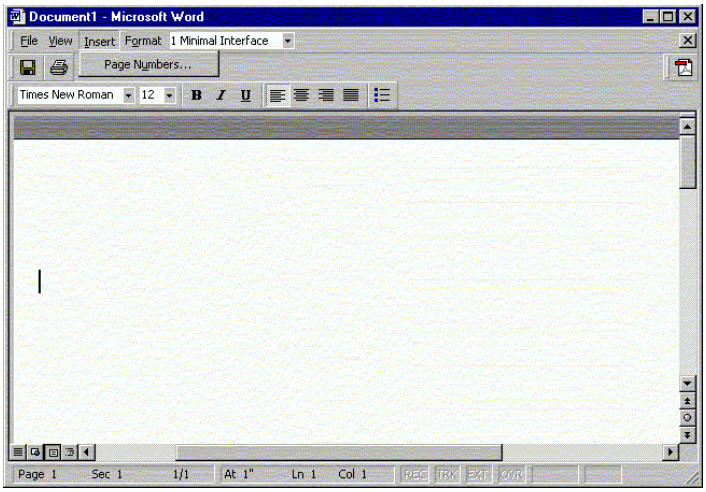
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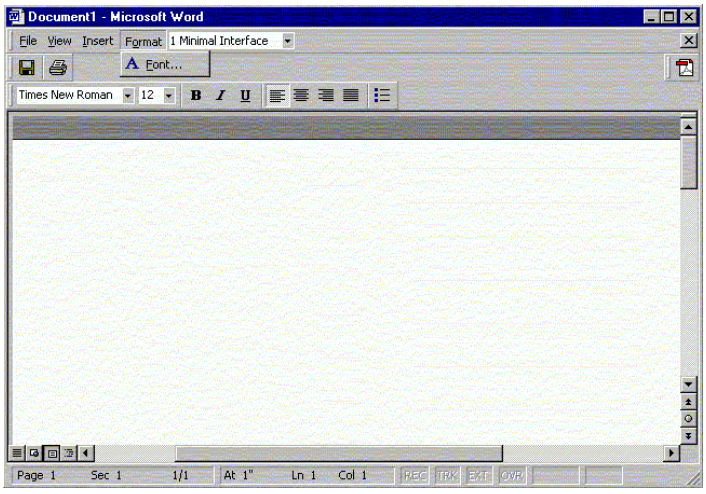
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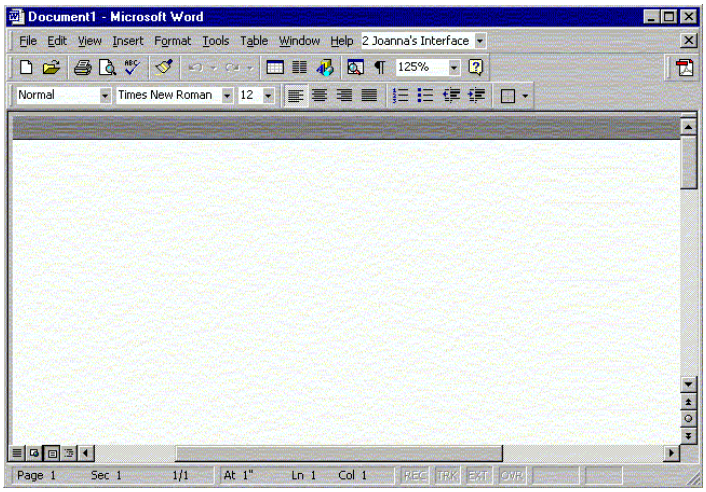
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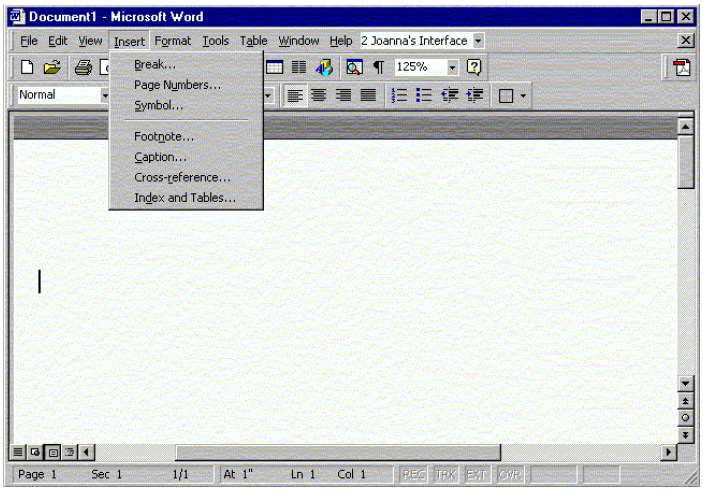
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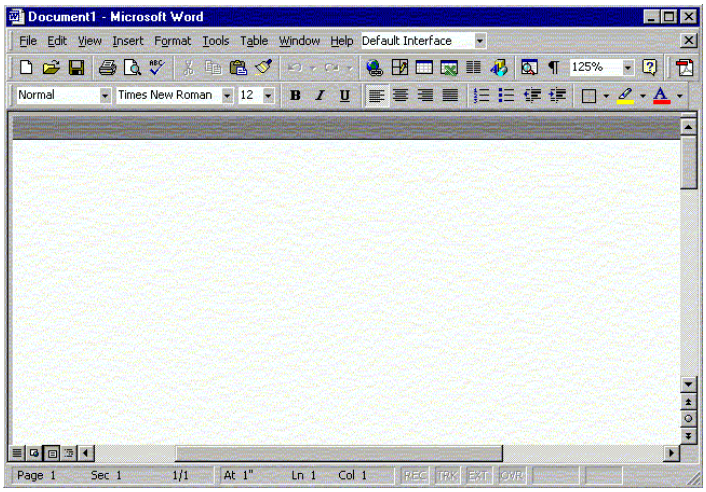
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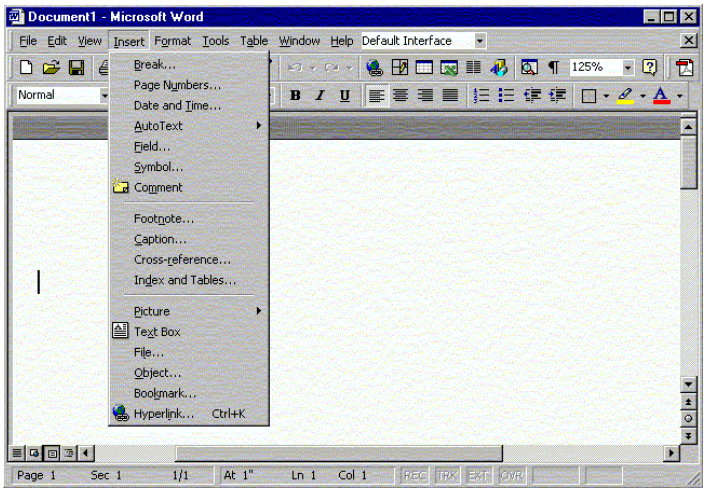
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Implementation Details

- Macro programming APIs in Word 2000
- Document templates
- 700 lines of Visual Basic code
  (second prototype: 5000 lines)
- Designed to accommodate previous customizations

Pilot Study – Protocol

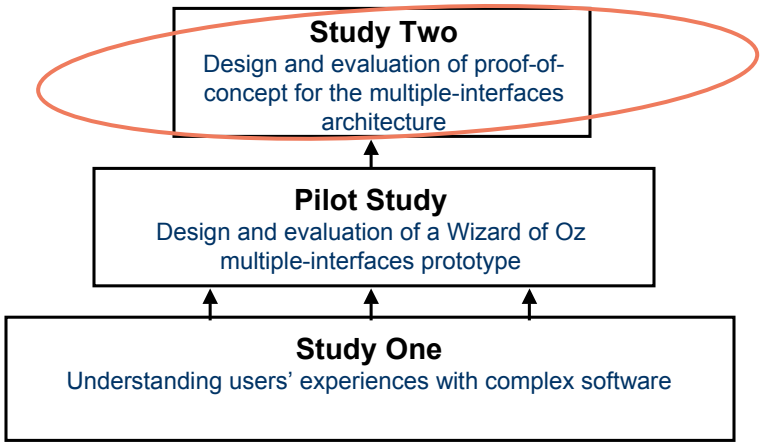
Goal: get early feedback, do something quick and dirty

- 4 participants (2 unbiased)
- Field study
- 2 - 3 months
- Wizard of Oz construction of PI
- Informal weekly interviews
- Software logging

Pilot Study– Key Findings

- Concept of multiple interfaces easily grasped
- Very little modification to PI
- Users want functions based on future use, not recency of use
- Biggest complaint – starting and stopping the logger
- One crash
- Minimal Interface did not add any value for 3 users
- If given the option, 3 users would keep multiple interfaces, 1 was ambivalent

Research Overview



Study Two – Prototype

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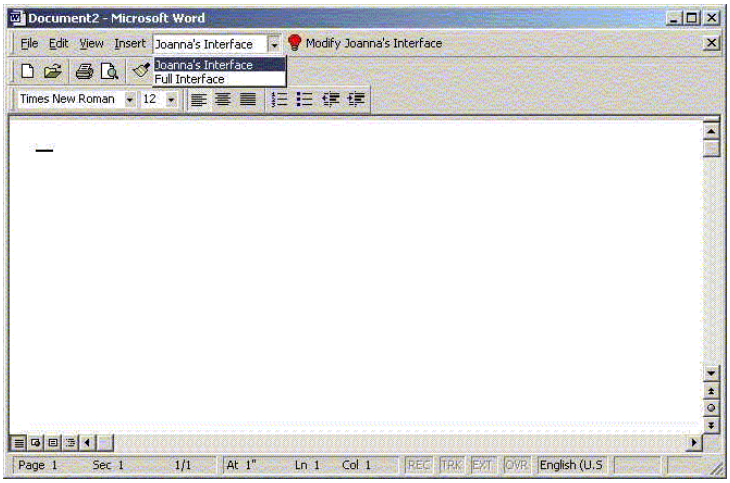

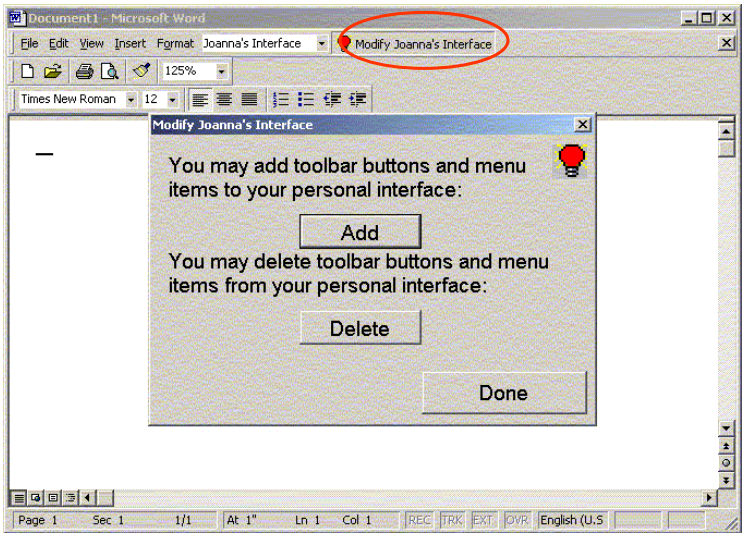

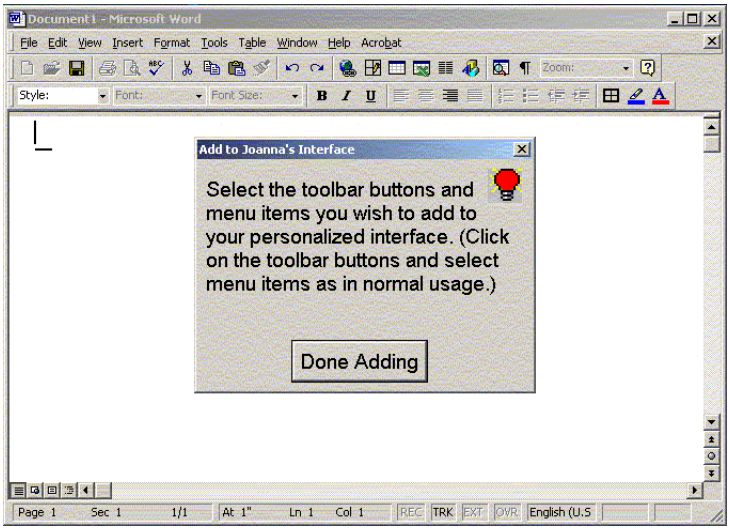
Document1 - Microsoft Word
File Edit View Insert Format Tools Table Window Help Acrobat
Add to Joanna's Interface
Select the toolbar buttons and menu items you wish to add to your personalized interface. (Click on the toolbar buttons and select menu items as in normal usage.)
Done Adding

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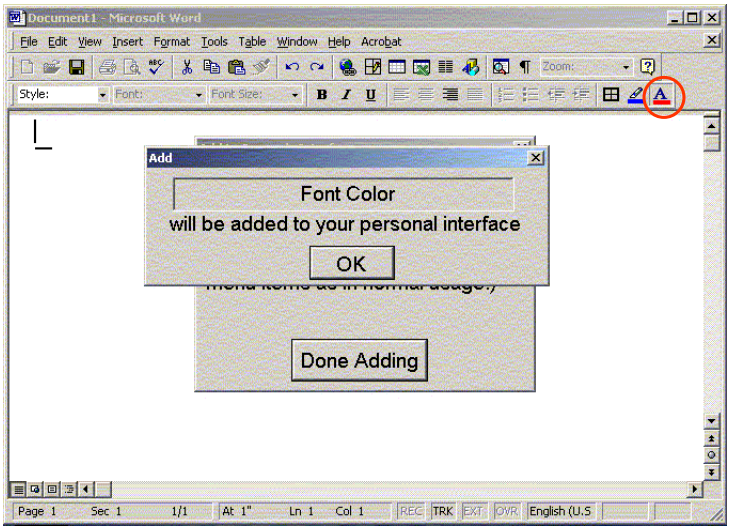
Document1 - Microsoft Word
File Edit View Insert Format Tools Table Window Help Acrobat
Add
Font Color
will be added to your personal interface
OK
Done Adding

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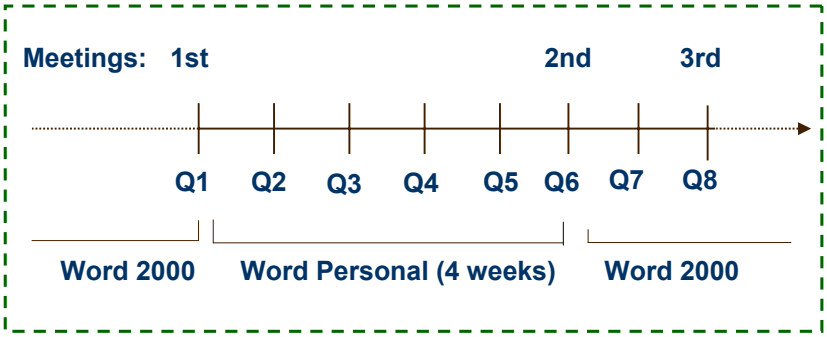
Study Two – Protocol

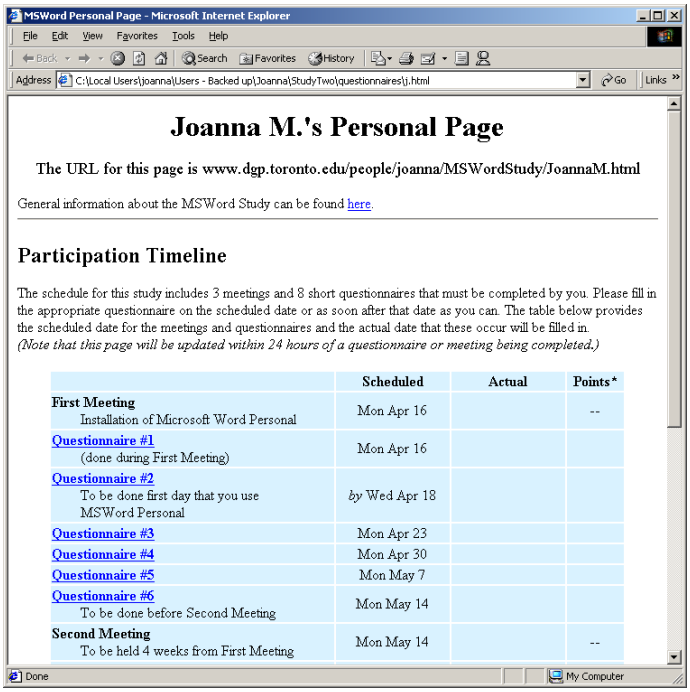
Goal: formal evaluation, capture the users' experience of our interface AND compare our interface to adaptive UI

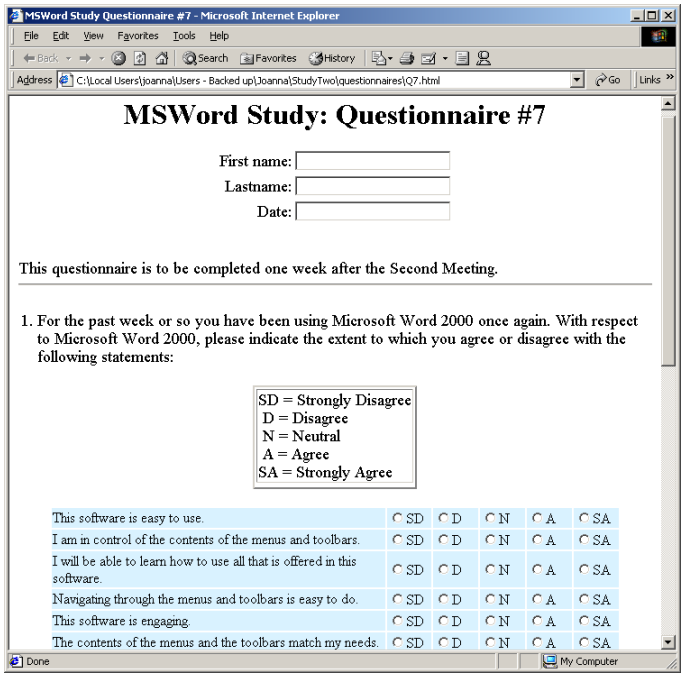
Participants: 10 Feature-keen
10 Feature-shy



Study Two - Protocol Details

- Call for Participation
- On-line preliminary screening questionnaire
  - Base criteria, e.g., use MSWord 3 hours per week
  - Feature keen, neutral, or shy
- Phone many of the people
- Personal web page (shared schedule)
- Email reminders of questionnaires/meetings
- Software logger with batch script to upload logs to UofT server

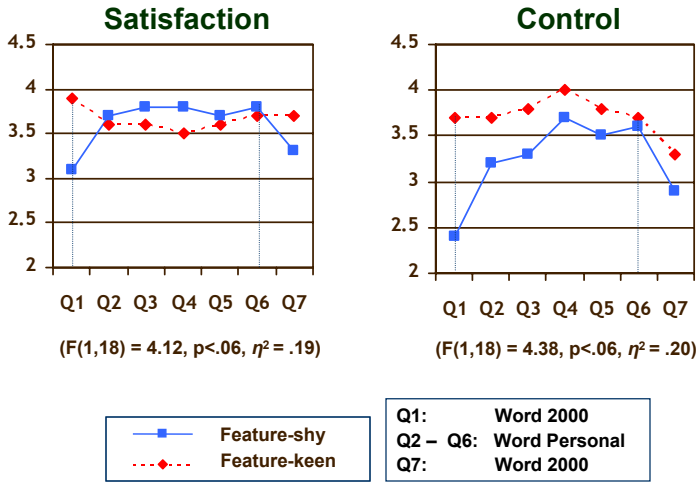

MSWord Personal Page - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address C:\Local Users\joanna\Users - Backed up\Joanna\StudyTwo\questionnaires\j.html
Joanna M.'s Personal Page
The URL for this page is www.dgp.toronto.edu/people/joanna/MSWordStudy/JoannaM.html
General information about the MSWord Study can be found here.
Participation Timeline
The schedule for this study includes 3 meetings and 8 short questionnaires that must be completed by you. Please fill in the appropriate questionnaire on the scheduled date or as soon after that date as you can. The table below provides the scheduled date for the meetings and questionnaires and the actual date that these occur will be filled in.
(Note that this page will be updated within 24 hours of a questionnaire or meeting being completed.)
Scheduled
Actual
Points*
First Meeting
Installation of Microsoft Word Personal
Mon Apr 16
--
Questionnaire #1
(done during First Meeting)
Mon Apr 16
Questionnaire #2
To be done first day that you use MSWord Personal
by Wed Apr 18
Questionnaire #3
Mon Apr 23
Questionnaire #4
Mon Apr 30
Questionnaire #5
Mon May 7
Questionnaire #6
To be done before Second Meeting
Mon May 14
Second Meeting
To be held 4 weeks from First Meeting
Mon May 14
--
Done
My Computer


MSWord Study Questionnaire #7 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address C:\Local Users\joanna\Users - Backed up\Joanna\StudyTwo\questionnaires\Q7.html
MSWord Study: Questionnaire #7
First name:
Lastname:
Date:
This questionnaire is to be completed one week after the Second Meeting.
1. For the past week or so you have been using Microsoft Word 2000 once again. With respect to Microsoft Word 2000, please indicate the extent to which you agree or disagree with the following statements:
SD = Strongly Disagree
D = Disagree
N = Neutral
A = Agree
SA = Strongly Agree
This software is easy to use.
I am in control of the contents of the menus and toolbars.
I will be able to learn how to use all that is offered in this software.
Navigating through the menus and toolbars is easy to do.
This software is engaging.
The contents of the menus and the toolbars match my needs.
SD D N A SA
Done
My Computer

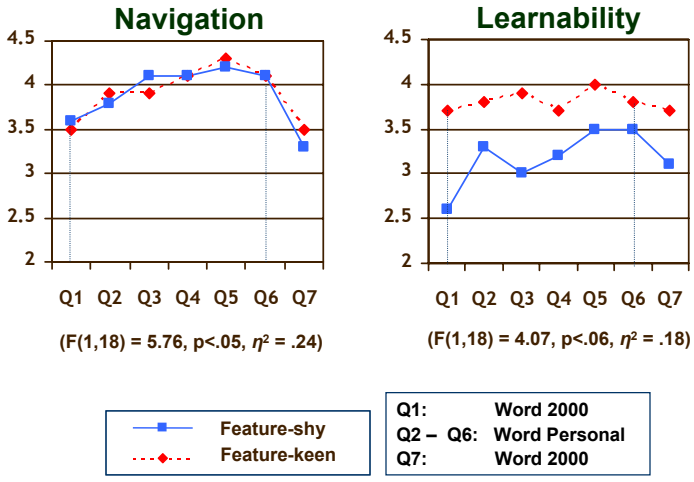
Study Two – Key Findings

- Majority of participants had positive experience
- 14/19 spent ≥ 50% time in PI
- 90%+ of the functions used ≥ 25% of the time were added to PI
- No dominant approach to personalization, 7 “gave up”
- Triggers for modification: 77% initial bulk-add, 9% immediate need
- No substantial differences between feature-keen and feature-shy

Study Two – Key Findings



Study Two – Key Findings



Study Two - Summary

- Study execution – extremely smooth
- Encourage further exploration of multiple interfaces
- 13 participants preferred it to alternatives
- Personalizing mechanism “clunky”
- Differences between feature-keen and feature-shy

Research Contributions

1. Bloat – objective and subjective dimensions
2. Feature Profile Scale – the Feature-keen, Feature-neutral, and Feature-shy
3. Multiple-interfaces design
4. Personalization – adaptable vs. adaptive
5. Novel methodology
6. Cross-disciplinary research approach
7. Software logging in practice

What you should have learned…

- Adaptive vs. adaptable interfaces
  - Generally what are the pros and cons of each
  - In our research we compared one particular adaptable interface to one particular adaptive interface, results favoured adaptable
- Novel and diverse methodologies
  - Fitting the methodology to the research question
  - Study One: exploratory, understanding the problem
  - Pilot Study: get preliminary feedback, Wizard of Oz prototype
  - Study Two: formal evaluation, full prototype, quasi-experimental design

What you should have learned…

- Iterative design and evaluation
  - Importance of evaluating early in design cycle, changing design based on evaluation results
- Cross-disciplinary research
  - Sociology: plays an important role in setting the problem and helping to understand and reveal the experiences and practices of those using technology in a variety of social contexts
  - Computer Science: provides and understanding of the technical possibilities, the scope for possible solutions, and the realization of those solutions
  - Psychology: provides the methods and tools for doing formal evaluation
- Scope of research required for a PhD – think about doing one!

Your turn ...

Selected References

Carroll, J., & Carrithers, C. (1984). Blocking learner error states in a training-wheels system. *Human Factors, 26(4),* 377 - 389.

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Mackay, W. E. (1991). Triggers and barriers to customizing software. *Proceedings of ACM CHI'91*, 153 - 160.

Manber, U., Patel, A., & Robison, J. (2000). Experience with personalization on Yahoo! *Communications of the ACM, 43(8),* 35 - 39.

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