Clipping Lists & Change Borders: Improving Multitasking Efficiency with Peripheral Information Design

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Peripheral Info can Help Multitaskers
- Information workers balance many tasks and interruptions and need help to
  - maintain task flow
  - know when to resume tasks
  - more easily reacquire tasks
- We explore peripheral information design to support these needs

Study: compare abstraction techniques
- Change detection
  - signals when a change has occurred
- Relevant task information
  - pulling out and showing the most relevant content
- Scaling
  - shrunken version of all the content
- Which will most improve multitasking efficiency?

Results: most relevant task info...
+ benefits task flow, resumption timing, and reacquisition
+ improves multitasking performance more than either change detection or scaling
- Clipping Lists performed best:
  - like WinCuts, cuts out a relevant portion of each task window
  - like Scalable Fabric, arranges clippings in the periphery
Outline

- System design
  - Scalable Fabric, Clipping Lists, & Change Borders
- User study
- Results
- Design implications & future work

Our Designs: Video

Study Design

<table>
<thead>
<tr>
<th></th>
<th>no Clippings</th>
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</tr>
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<tbody>
<tr>
<td>no Change Borders</td>
<td><img src="no-border-no-clippings.png" alt="Image" /></td>
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Comparing Tradeoffs

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<td>no Change Borders</td>
<td>+ spatial layout – no legible content</td>
<td>+ most relevant task info – detailed visuals / text</td>
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**User Study: Participants**
- 26 users from the Seattle area (10 female)
  - moderate to high experience using computers and Microsoft Office-style applications

**User Study: Tasks**
- Four tasks designed to mimic real world tasks
  - **Quiz** - wait for modules to load
  - **Uploads** - wait for documents to upload
  - **Email** - wait for quiz answers and upload task documents to arrive
  - **Puzzle** - high-attention task done while waiting

**Quiz**

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Uploads

![Uploads window](image)
User Study: Tasks

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User Study Setup

Metrics & Key Results

- Metrics
  - Overall performance
  - Ability to maintain task flow
  - Knowing when to resume a task
  - Ease of reacquiring tasks
  - User satisfaction
- Key results
  - Clipping Lists perform significantly better for all metrics
  - Change Borders further improved performance for most metrics, on average

Results: overall performance

Clipping Lists → faster performance
Change Borders → no significant improvement
Results: overall performance

Clipping Lists → faster performance
Change Borders → no significant improvement
Clipping Lists → better task flow  
Change Borders → worse task flow for SF
Results: knowing when to resume

Clipping Lists → trend toward resuming the Quiz task at more opportune times

Results: ease of reacquiring tasks

Clipping Lists → easier to reacquire tasks
Change Borders → no significant improvement
Results: ease of reacquiring tasks

- Clipping Lists → easier to reacquire tasks
- Change Borders → no significant improvement

Results: user satisfaction

- Clipping List UIs → rated better than those without
- Change Border UIs → rated better than those without

Preferred UI
- 17 → Clipping Lists + Change Borders
- 4 → Scalable Fabric + Change Borders
- 2 → Clipping Lists
- 2 → Scalable Fabric
**Results: user satisfaction**

- Clipping List UIs ➔ rated better than those without
- Change Border UIs ➔ rated better than those without
- Preferred UI
  - 17: Clipping Lists + Change Borders
  - 4: Scalable Fabric + Change Borders
  - 2: Clipping Lists
  - 2: Scalable Fabric

**Results Summary**

- Clipping Lists were most effective for all metrics
  - Overall performance
  - Ability to maintain task flow
  - Knowing when to resume a task
  - Ease of reacquiring tasks
  - User satisfaction
- Improvements are cumulative, adding up to a sizeable impact on daily multitasking productivity
  - Clipping Lists ➔ 29 seconds faster on average
  - Clipping Lists + Change Borders ➔ 44 seconds faster on average

**Peripheral Design Implications**

- Why were Clipping Lists more effective?
  - Provided most relevant task info
- Why is this surprising?
  - Clippings are higher in detail than Change Borders – require more attention
- Why were Change Borders relatively less effective?
  - Change detection didn’t provide enough task info
- Change Borders + Clipping Lists were most effective together

- Show enough relevant task information
- Even if this means more detailed visuals
- Combining relevant task info with simple visuals is best
Future Work

- Glanceable peripheral interfaces
  - Relevant task info does not require excessive details
  - Easy to perceive & interpret visuals should perform better
  - Presumably, simpler visuals will be easier to perceive
  - What is the sweet spot between simple design and conveying relevant info?

- Automatic selection of content relevant to user’s tasks

Summary

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+ most relevant task info  
+ simple visual cue for change  
+ spatial layout  
+ limited info
Summary

Results:
- showing relevant task info via Clippings best enabled users to
  - maintain task flow
  - know when to resume tasks
  - more easily reacquire tasks

Peripheral design implications:
- providing *enough relevant* task info may be more important
  than very simplistic designs
- together, relevant task info and simplistic visuals improve
  performance even more

Questions?

Contact Tara Matthews
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Download Scalable Fabric
http://research.microsoft.com/research/downloads/
Scalable Fabric

- Study compares Scalable Fabric and two variations of it
- Clipping Lists & Change Borders
- We use SF since tasks span multiple applications and SF keeps track of tasks across applications

Scaling: baseline condition

- Previous study:
  - Scalable Fabric performed as well as Windows & was qualitatively preferred
- Scaling benefits:
  - Convey window’s spatial layout, major color schemes, & graphics
  - May enable easy recognition of windows for reacquiring tasks
  - Large updates are visible
  - …but virtually none of the content is legible…

Clipping Lists: semantic content extraction

- SF scaled windows are replaced by clippings
- Clippings: live window cuts, manually created by user
- Task: list of clippings
- Benefits:
  - Shows most relevant portion of window
  - More readable than scaled window
- Disadvantages:
  - May provide too much info, increasing cognitive overhead
  - Removes spatial window layout

Change Borders: change detection

- Red Change Border
- Green Change Border
- Red = change in progress
- Green = change is complete
Change Borders: change detection

- **Benefits:**
  - Cognitive overhead is low
  - Knowing about changes can help users know when to resume a paused task, *e.g.*, when waiting for
    - Important email
    - Documents to upload
    - Files to be checked in to a version control system
    - A compiler build to complete
    - A large file or Web page to load
- **Disadvantages:**
  - Change doesn’t always require a task switch, *e.g.*
    - Moving Web page ads
    - Spam email