The Challenges of Multitasking:
Working Faster, Better, Cheaper?

Gloria Mark
ISR Forum, 2008
Multi-tasking study is in collaboration with…

Victor Gonzalez
Justin Harris
Daniela Hausstein
Ulrik Klocke
Hy Loc
Aimee Strang
Norman Su
Hideto Yuzawa

…….who have fit this in with all their other tasks
Multitasking and IT

Multi-tasking is prevalent for information workers

We’ve got it all wrong with IT design

Information is not organized to support the reality of multi-tasking

We switch projects; information needs to be organized to enable seamless switching among projects, people
For information workers today, time is their most scarce resource.
Invisible Work

Multi-tasking part of a larger phenomenon of *invisible work*

*The extra effort that people must invest to meet demands of their jobs*
Where does multi-tasking stem from?

As scope of work increases

Flattening of hierarchies, expansion of work roles

Link between downsizing, large-scale expansion, increased work activities, higher levels of stress

Adoption and use of technologies in the workplace
Studies conducted

Field study of multi-tasking in three organizations

Field study of switching communication and media

Laboratory study of interruptions, speed, and stress

Diary study of multi-tasking

TIMA prototype
Observation of daily activities
  initial observation
  ~3 days of observation/person
  Each activity timed (to the second) and annotated
  Details of event: what was done, who was present, topics of conversation

Clarifications made at the end of day

Pre and post (long) interviews after observations

36 people observed
Coding events

*Event* = the amount of time that people spent in continuous uninterrupted use of a device or engagement in an interaction with other individuals

Examples:
- telephone call
- typing a Word document
- talking “through the cubicle wall”
Pre- and Post-email Eras
<table>
<thead>
<tr>
<th>Activity</th>
<th>Horne &amp; Lupton 1965&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Minzberg 1970&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Sproull 1984&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Ives &amp; Olson 1981&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Stephens et al. 1992</th>
<th>Hudson et al., 2002&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Mark &amp; Gonzalez 2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desk Work</td>
<td>26%</td>
<td>22%</td>
<td>19%</td>
<td>19%</td>
<td>28%</td>
<td>42%</td>
<td>42.9%</td>
</tr>
<tr>
<td>Phone</td>
<td>9</td>
<td>6</td>
<td>13</td>
<td>9</td>
<td>9</td>
<td>--</td>
<td>7.6</td>
</tr>
<tr>
<td>Scheduled Meetings</td>
<td>10</td>
<td>59</td>
<td>34</td>
<td>48</td>
<td>48</td>
<td>27</td>
<td>14.3</td>
</tr>
<tr>
<td>Un-scheduled Meetings</td>
<td>55</td>
<td>10</td>
<td>34</td>
<td>20</td>
<td>14</td>
<td>19</td>
<td>22.3</td>
</tr>
<tr>
<td>Other</td>
<td>--</td>
<td>3</td>
<td>--</td>
<td>2</td>
<td>2</td>
<td>--</td>
<td>12.9</td>
</tr>
<tr>
<td>Total Time</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>88%</td>
<td>100%</td>
</tr>
</tbody>
</table>
What changed with IT?

People spend more of their day at deskwork

Proportion of desk work nearly doubled in IT-rich environments (42.5%), compared to pre IT-rich environments (23%)

People spend less of their day in F2F formal meetings

pre-IT rich (with exception of Horne & Lupton): 47%
IT-rich environments: 21%
How Fragmented is Work?
## How fragmented is work really?

<table>
<thead>
<tr>
<th>Events</th>
<th>% of day</th>
<th>Avg. Time/event (minutes:seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using PC’s</td>
<td>27.8%</td>
<td>02:30</td>
</tr>
<tr>
<td>Personal</td>
<td>11.2%</td>
<td>33:32</td>
</tr>
<tr>
<td>Formal meetings</td>
<td>14.3%</td>
<td>42:56</td>
</tr>
<tr>
<td>Using email</td>
<td>8.3%</td>
<td>02:04</td>
</tr>
<tr>
<td>Going to other cubicles</td>
<td>12.4%</td>
<td>08:21</td>
</tr>
<tr>
<td>Interaction in cubicle</td>
<td>8.3%</td>
<td>04:29</td>
</tr>
<tr>
<td>Using paper documents/books</td>
<td>6.6%</td>
<td>01:50</td>
</tr>
<tr>
<td>Talking “through the walls”</td>
<td>1.7%</td>
<td>01:06</td>
</tr>
<tr>
<td>Using other tools</td>
<td>0.8%</td>
<td>01:15</td>
</tr>
<tr>
<td>Using phone</td>
<td>7.6%</td>
<td>03:02</td>
</tr>
<tr>
<td>Unknown</td>
<td>1.0</td>
<td>05:09</td>
</tr>
</tbody>
</table>
### How fragmented is work really?

<table>
<thead>
<tr>
<th>Events</th>
<th>% of day</th>
<th>Avg. Time/event (minutes:seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using PC’s</td>
<td>27.8%</td>
<td>02: 30</td>
</tr>
<tr>
<td>Personal</td>
<td>11.2%</td>
<td>33:32</td>
</tr>
<tr>
<td>Formal meetings</td>
<td>14.3%</td>
<td>42:56</td>
</tr>
<tr>
<td>Using email</td>
<td>8.3%</td>
<td>02:04</td>
</tr>
<tr>
<td>Going to other cubicles</td>
<td>12.4%</td>
<td>08:21</td>
</tr>
<tr>
<td>Interaction in cubicle</td>
<td>8.3%</td>
<td>04:29</td>
</tr>
<tr>
<td>Using paper documents/books</td>
<td>6.6%</td>
<td>01:50</td>
</tr>
<tr>
<td>Talking “through the walls”</td>
<td>1.7%</td>
<td>01:06</td>
</tr>
<tr>
<td>Using other tools</td>
<td>0.8%</td>
<td>01:15</td>
</tr>
<tr>
<td>Using phone</td>
<td>7.6%</td>
<td>03: 02</td>
</tr>
<tr>
<td>Unknown</td>
<td>1.0</td>
<td>05:09</td>
</tr>
<tr>
<td><strong>All actions except Formal meetings, Personal, and Unknown</strong></td>
<td><strong>73.5%</strong></td>
<td><strong>03:05</strong></td>
</tr>
</tbody>
</table>
People spend about 3 minutes on any task before switching or being interrupted
# How often do people switch devices?

**N=24**

<table>
<thead>
<tr>
<th>Device</th>
<th>% of day</th>
<th>Avg. Time/device (minutes:seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC’s (incl. email)</td>
<td>36.1%</td>
<td>02:52</td>
</tr>
<tr>
<td>Desk phone</td>
<td>5.2%</td>
<td>02:17</td>
</tr>
<tr>
<td>Paper documents</td>
<td>5.0%</td>
<td>01:33</td>
</tr>
<tr>
<td>Books, manuals</td>
<td>1.8%</td>
<td>01:57</td>
</tr>
<tr>
<td>Financial terminals</td>
<td>1.6%</td>
<td>01:20</td>
</tr>
<tr>
<td>Cell phone</td>
<td>0.7%</td>
<td>04:13</td>
</tr>
<tr>
<td>Daily planner (paper)</td>
<td>0.2%</td>
<td>00:50</td>
</tr>
<tr>
<td>Address books (paper)</td>
<td>0.07%</td>
<td>01:00</td>
</tr>
<tr>
<td>Hand-held calculator</td>
<td>0.05%</td>
<td>00:48</td>
</tr>
</tbody>
</table>
How often do people switch devices?

N=24

<table>
<thead>
<tr>
<th>Device</th>
<th>% of day</th>
<th>Avg. Time/device (minutes:seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC’s (incl. email)</td>
<td>36.1%</td>
<td>02:52</td>
</tr>
<tr>
<td>Desk phone</td>
<td>5.2%</td>
<td>02:17</td>
</tr>
<tr>
<td>Paper documents</td>
<td>5.0%</td>
<td>01:33</td>
</tr>
<tr>
<td>Books, manuals</td>
<td>1.8%</td>
<td>01:57</td>
</tr>
<tr>
<td>Financial terminals</td>
<td>1.6%</td>
<td>01:20</td>
</tr>
<tr>
<td>Cell phone</td>
<td>0.7%</td>
<td>04:13</td>
</tr>
<tr>
<td>Daily planner (paper)</td>
<td>0.2%</td>
<td>00:50</td>
</tr>
<tr>
<td>Address books (paper)</td>
<td>0.07%</td>
<td>01:00</td>
</tr>
<tr>
<td>Hand-held calculator</td>
<td>0.05%</td>
<td>00:48</td>
</tr>
<tr>
<td><strong>All devices</strong></td>
<td><strong>51.6%</strong></td>
<td><strong>02:11</strong></td>
</tr>
</tbody>
</table>
People spend slightly more than 2 minutes using any digital or physical device before switching or being interrupted.
Projects
Maybe switching isn’t so bad if you’re working on the same project/context?
What becomes difficult is switching between projects.

A *Working Sphere* is a set of interrelated events which:
- share a common goal
- involve communication with a particular set of people
- use unique resources
- have their own time framework

Examples:
- “The TGX project”, “Clear Quest app” project, task force
People work in an average of 12.2 different working spheres per day

People worked an average of about 10 1/2 minutes in a working sphere before switching or being interrupted
Even when removing “non-significant” interruptions (2 minutes or less), average working sphere segment was 12 minutes, 18 seconds
Types of Intermittents
Maybe not all interruptions are the same?
<table>
<thead>
<tr>
<th>Type of Interruption</th>
<th>% of All Types</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal 43.6%</strong></td>
<td></td>
</tr>
<tr>
<td>Leaving cubicle</td>
<td>14.7%</td>
</tr>
<tr>
<td>Checking/Using computer</td>
<td>12.3%</td>
</tr>
<tr>
<td>Email use</td>
<td>5.8%</td>
</tr>
<tr>
<td>Phone call</td>
<td>5.8%</td>
</tr>
<tr>
<td>Talking “through the wall”</td>
<td>3.5%</td>
</tr>
<tr>
<td>Using paper documents</td>
<td>1.5%</td>
</tr>
<tr>
<td><strong>External 56.4%</strong></td>
<td></td>
</tr>
<tr>
<td>Person comes into cubicle</td>
<td>25.8%</td>
</tr>
<tr>
<td>Email notification</td>
<td>14.5%</td>
</tr>
<tr>
<td>Phone ringing</td>
<td>10.3%</td>
</tr>
<tr>
<td>Others call “through the wall”</td>
<td>4.1%</td>
</tr>
<tr>
<td>Status on financial terminals</td>
<td>0.7%</td>
</tr>
<tr>
<td>Reminder notification</td>
<td>0.7%</td>
</tr>
<tr>
<td>Voice message light</td>
<td>0.4%</td>
</tr>
</tbody>
</table>
Resumption of Work
Resumption of Interrupted work

We consider only work interrupted and resumed on the same day, for uniform comparison.

We do not consider the last hour of work.
Resumption of Interrupted work

Good news:
81.9% of interrupted work was resumed on the same day

Bad news:
Interrupted work resumed on the average in 23 min. 15 sec.

But… our informants worked in an avg. of 1.92 (sd=1.79) WS before resuming work

Informants reported: a high cost in reorienting to work
Gender
Gender Effects!

6 females, 29 males

Females worked in significantly more central and peripheral working spheres than males

Females experienced fewer interruptions

Females were less likely to interrupt themselves

Females more likely to resume interrupted work (87.3%) than males (80.8%)

*all results significant to $p<.05$
The paradox in IT support

IT currently supports individual tasks, and is not designed to support the integration of information into larger themes, associated with projects.

*The burden falls on the users to integrate their work that is fragmented over time and space!*

Information should be organized according to working spheres.

Interruptions need to match users’ current working spheres.
Chains of Interaction

People often communicate in *chains* of interactions (median 3 links)

People switch media and organizational contexts within chains

H: Chains of interaction are a way of aligning work with others
Characteristics of Chains

All significant results at p<.05:

Email-initiated chains have the longest links

External interruptions lead to significantly more links

Organizational context switching is correlated with media switching

Organizational context switching is also correlated with job strain
What about interruptions and stress?
Email Experiment

Email done with and without interruptions

Total time to perform task:
  [total time to perform task – time spent on interruptions]

Errors: factual errors, typos

Politeness metric-assigned points for standard greeting/closing phrases and polite words

Stress: NASA Task Load Index: stress, workload, time pressure, effort, and frustration
People took longer to perform the task when not interrupted, but they wrote more.

People measured significantly higher in stress, mental workload, frustration, time pressure, effort.
Interrupted work is done faster, but at a price

When interrupted, people develop a mode of working faster (and writing less) to compensate for the time they know they will lose by being interrupted.