

## The Siren Song of Multitasking

Rapidly evolving technologies deliver more information and provide more opportunity for connection than ever before. Worried they might miss something important, workers are multitasking, even though cognitive research shows that it takes significantly longer to do two tasks at the same time than it does to do them one at a time. In reality, multitasking decreases productivity, increases stress and workplace tension, and affects quality of thought. Researchers are exploring how workers stay focused on one task, as well as the techniques they use to recover quickly from interruptions. While environments that provide quiet spaces for thinking can help, workers themselves have to be willing to shut off technology.

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Personal technology has become so ubiquitous that it seems unnecessary to quote statistics about the growth of cell phone use (every minute another 1,000 users are added to the 2.4 billion existing users<sup>1</sup>), the global growth rate of Internet use (200 percent between 2000 and 2006<sup>2</sup>), or how many e-mail messages and instant messages compete for our attention every day (an estimated 62 billion<sup>3</sup> and 14 billion, respectively<sup>4</sup>). In fact, technology use of this kind is increasing so rapidly that statistics like these are outdated as soon as they are documented.

The popularity of technology is due in part to its tantalizing promise of convenience, a promise that it has delivered on. The crucial report left behind on a business trip can be retrieved via e-mail or remote access; members of the same team who work in different countries can hold meetings electronically; and the stranded motorist with a cell phone is never stranded for very long.

Another promise of technology was that it would result in productivity gains, and productivity in the business sector has been rising by just over three percent a year since 2000.<sup>5</sup> Those who are connected and savvy can find current information on any topic in seconds and distribute it to their managers, coworkers, or customers. In today's competitive marketplace, using a personal digital assistant (PDA) to stay constantly connected—to information, to managers, to customers--can mean the difference between deal and no deal. Or so the manufacturers of those products would have everyone believe.

If technology has been the great panacea, however, it is also Pandora's Box, attractive until it's opened and unexpected problems pop out. There was a time not long ago when the amount of information reasonably available matched human capacity to sort it and make sense of it. Now, rapidly evolving technologies and the speed of computer processors have made *all* existing information available and *all* conceivable connections with others possible 24/7/365. And workers feel compelled to avail themselves of that information and those connections, lest they miss something important. This leads to "frazzing"—frantic, ineffective multitasking, typically with the delusion that you are getting a lot done."<sup>6</sup>

In a superhuman effort to know and do more in less time, they attempt to do several things at once--create a profit-and-loss report, talk on the phone, and carry on a second conversation using IM. In computing, where the term originated, "multitasking" is a method by which multiple tasks share common processing resources, e.g., a computer's central processing unit.<sup>7</sup> But even the CPU actively gives instructions for only one process at a time before it turns its attention to the next task in the queue. It's because the CPU is so efficient at switching tasks and recovering "state" (the point at which it paused the task it is returning to) that it gives the appearance of doing many things at once.

## Cognitive limitations

The brain's "CPU" is the anterior part of the prefrontal cortex, which assesses and prioritizes tasks and assigns mental resources. It's also responsible for marking where a task was abandoned to make it easier to find our place when we go back to it. Since 1935 researchers have believed that (with the exception of rote physical activity, e.g., walking or eating) the brain isn't capable of doing two things at once. That's when psychologist John Ridley Stroop found that participants in his study struggled to say the color of ink a "color word" was printed in. When the word "blue" was printed in red ink, participants would say "blue" automatically, even though they knew their assignment was to name the color of ink, red. The Stroop effect, then, "occur[s] when two tasks get tangled: the brain must suppress one thing that has been learned so well that it has become automatic (reading) to attend to a second that requires concentration (naming the color)."<sup>8</sup>

Instead of doing two tasks at once, the brain actually toggles between whatever tasks are underway. Research conducted by the University of Michigan shows that the toggling requires "goal shifting" (deciding to stop doing one thing and start doing another) and then "rule activation," or "turning off the rules for that and turning on the rules for this."<sup>9</sup> While individuals who multitask may feel they are getting more done, the reality can be quite different. Participants in the University of Michigan study who were asked to write a report and check e-mail at the same time took one and a half times longer to finish than individuals who did the same two tasks sequentially.<sup>10</sup>

When participants from another study tried to listen and rotate two three-dimensional figures at the same time, "they could manage to do both but not as quickly and not as well as doing either by itself. What was striking was how brain activity dropped while the subjects tried to perform the two tasks: it was less than two thirds as much as the total devoted to each task when processed independently. 'The human brain cannot simply double its efforts when there are two problems to solve at the same time,' concluded Marcel Just, leader of the study."<sup>11</sup>

A third study, this one conducted by Massachusetts Institute of Technology (MIT), showed that the faster students were forced to toggle between identifying shapes and either letters or colors, the more they slowed down. Usually that's an indication of greater concentration, but the brain scans done on participants showed that "In between tasks, the part of the brain that prioritizes tasks and engages in higher-order thinking was taking a momentary rest. . . . [T]he students' frontal lobes effectively went blank, waiting for instructions to upload."<sup>12</sup>

Some researchers say it is possible to improve multitasking skills if there is no overlap of resources (perceptual, cognitive, or physical), but only to a certain point and only with those tasks that can become automatic. A good typist, for example, can absorb the content of an unfamiliar text as he's typing it because typing has become automatic. Perhaps the most popular pair of activities—driving and using a cell phone—can fit into this category because after a lot of practice, driving becomes automatic. But driving is not always automatic. Unexpected events like a deer darting into the road are not routine and therefore require "additional attentional and quick decision-making resources," according to Joshua Rubinstein, who helped conduct the University of Michigan research and now works at the Department of Homeland Security. "Because attentional switching takes time, sometimes on the order of one to two seconds," he says, "we do not have the time to engage attention to driving and we will hit the deer."<sup>13</sup>

Mei-Ching Lei, who helped direct a research project at the NASA Ames Research Center, told *Science Daily*, "Practice can help a person reduce the 'cost' of switching tasks, but it apparently cannot eliminate that cost."<sup>14</sup>

## Activity is not the same as productivity

These studies and others like them that have reached similar conclusions are not new, and yet multitasking has not abated: 45 percent of U.S. workers believe they are expected to work on too many things at once<sup>15</sup> (and workers worldwide are likely to come to the same conclusion as other countries embrace technology). If anything, companies are more interested in it than ever. Becky Winkler a consultant at Sperduto & Associates, a firm that does worker psychological assessments, estimates that 75 percent of the firms she screens candidates for are looking for "multitaskers."<sup>16</sup> Why, when the research clearly and unequivocally shows that multitasking is less efficient than focusing on one task at a time? "Organizations haven't realized yet how much this multitasking, constantly connected behavior is hurting them," says Caroline Bell, a professor at the Richard Ivey School of Business at the University of Western Ontario whose thesis is on the effect of multitasking on groups.<sup>17</sup>

Lower productivity ought to be the most obvious effect, but because it runs counter to expectations (everyone *looks* so efficient when they are multitasking), it's difficult for corporations to fully absorb this truth. Benjamin Franklin said, "Never confuse motion with action,"<sup>18</sup> and yet corporations, like the individuals who comprise them, often do. Downsizing,

flattening of hierarchies, and role expansion have resulted in workers having to do more with less, and multiple technologies have made that seem possible.

Yet multiple technologies often translate into multiple interruptions: On average, workers are interrupted once every ten and a half minutes, according to Gloria Mark, a professor at the University of California, Irvine, who studied the cost of worker multitasking.<sup>19</sup> Once interrupted, it takes a worker 23 minutes on average to get back to the task she was working on.<sup>20</sup> Open screens on desktops, files on the desk, and coworkers all distracted workers so that only 55 percent of work was resumed immediately.

Writes Mark, “This suggests a fairly high cognitive cost to resume work, as people are distracted by multiple other topics, and sometimes even nested interruptions. Our informants report that this can result in redundant work as they reorient.”<sup>21</sup> Mark acknowledges that interruptions are often relevant to the work at hand, but notes that “reorientation” to the task comes at a cognitive cost. A report from Basex quantified the cost of interruptions. It found that the average knowledge worker loses 2.1 hours/day to “unimportant interruptions or distractions.” At \$21 per hour, the cost of interruptions would be \$588 billion a year.<sup>22</sup>

### **More stress—and a lowered ability to deal with it**

Multitasking has other effects beyond lowered productivity. Feeling that they constantly need to be in touch, accessible, and productive is stressful for workers. One international survey of more than 1,300 managers found “one-third of managers suffer from ill-health as a direct consequence of stress associated with information overload.”<sup>23</sup> Enough stress can result in depression and anxiety, and all three put people at risk for diabetes, hyperthyroidism, lung cancer, heart disease, strokes and other diseases, according to former Assistant U.S. Surgeon General Marilyn Gaston.<sup>24</sup>

Multitasking is neurologically taxing, as well, stressing the very area of the brain responsible for multitasking most. “The prefrontal cortex is the part of the human brain that is most damaged as a result of prolonged stress, particularly the kind of stress that makes a person feel out-of-control and helpless,” Dr. Jordan Grafman told the *Los Angeles Times*. “Multitasking, almost by its very nature, creates stress, and long-term stress, in turn, is likely to make us less able to multitask.”<sup>25</sup>

### **Tension in the office: Perceptions of multitaskers**

Researchers are only just beginning to understand the social and cultural implications of multitasking, but what they have found so far isn’t encouraging: Multitasking is a source of tension in the workplace, even among those who are likely to be most enthusiastic about it--young multitaskers themselves.

Workers’ relationship with time can be characterized as monochronic or polychronic. “Monochrons” prefer to focus on one task at a time; “polychrons” are more comfortable with interruptions and activity switches. Researchers expected that polychrons, who are themselves multitaskers, would be supportive of multitasking behavior, but they were not. Instead, all participants, regardless of work style, formed harsh perceptions of multitaskers. “There was statistical significance for the development of negative judgments—impatient, distracted, and disruptive,” says Caroline Bell, who helped direct the research for Richard Ivey School of Business at the University of Western Ontario. “There was no statistical significance for any positive attributes,” such as “efficient, hardworking, or competent.”<sup>26</sup> Regardless of whether people are themselves multitasking, “when they see others doing it, they see it as rude.”<sup>27</sup>

She suspects the reason for the contradiction lies in the multitasker’s perception that whatever he is doing while multitasking is “important”—even if it’s not related to the reason for the meeting. When the multitasker sees someone else doing it, however, he suspects that the other person is doing something irrelevant and therefore unimportant. “In a social setting where we’re supposed to be working together, that’s rude behavior,” at least from the first multitasker’s perspective, says Bell. “When I notice others multitasking, it is likely because I am now paying attention to something that is relevant to me in some way, so now I’m annoyed because others don’t think this bit is important, suggesting somehow that my role/job/task is less important than theirs.”

Office tensions are likely to get worse before they get better. Bell’s university students know they are being rude by multitasking with technology, but have an attitude of, “Everyone does it, so don’t take it personally.”

Those tensions might be mitigated if norms about using the technologies were in place, but the technologies are still too new. While it would be unthinkable to carry on two extended conversations simultaneously in person because of norms

about face-to-face conversation, thanks to IM and PDAs, it happens all the time electronically. Until norms do form, companies may have to be more explicit about how much and where multitasking is acceptable. Some companies hang a shoe organizer outside the meeting room door. Attendees slip cell phones and PDAs, along with their own business card, into a holder, and retrieve them during breaks. One manager allows open laptops in some meetings, but tells attendees they must be willing to subject their computers to spot checks.

As with everything, managers need to lead by example. Consultants at Sperduto and Associates say this is difficult for managers, who themselves feel pressured to stay connected and “in the loop.” But the “negative nonverbals” executives send by multitasking in a meeting make a big impression. “We often have to coach senior executives to put down the Blackberry in meetings. If they don’t, it sends the message, intentional or not, that they don’t care about the meeting—even if they are sending an email related to the meeting. You need to be present and accomplish the objectives of the meeting,” says Winkler. “Leaders don’t realize that they are the ones who started the whole issue.”<sup>28</sup>

### “Quality of thought” at risk

Multitasking also affects the quality of thought. A constantly toggling brain cannot do best that which it was intended to do—think. And while all the busy-ness and activity may distract companies from this fact, sooner or later, it will become evident. Shrinking technology devices and the compulsion to use them results in “people tuning in and out of meetings, based on when they think the discussion is relevant to them. When they don’t think it is, they interact with their technology,” says Bell. “Employees are missing critical information and they don’t even know they missed it.”<sup>29</sup> This is perhaps the ultimate irony: In staying electronically connected lest they miss anything important, workers are missing things in the meeting that are important.

Long-term implications include a higher number of errors, duplication of work, and completion of the wrong work, all of which, Bell believes, means that employees will have to be more closely managed. That has implications for the number of managers organizations will need and the speed with which decisions will or will not get made.

Edward Hallowell, the psychologist and author who coined the term “frazzing,” thinks creativity and innovation suffer when people have “attention deficit trait.” How can workers know if they have it? When they are working harder but producing less and of lower quality; “when they start answering questions in ways that are more superficial...when their reservoir of new ideas starts to run dry.”<sup>30</sup> Workers may be managing to get their work done, “but they’re not as creative, flexible, humorous, or innovative as they might be.”<sup>31</sup>

This is a particular area of concern for some experts, given that the generation now entering the workforce has never known life without technology. Sherry Turkle, an MIT professor, tells *The New Scientist* magazine, “We insist that our world is increasingly complex, yet we have created a communications culture that has decreased the time available to sit and think, uninterrupted.”<sup>32</sup> Turkle worries about a culture in which young people constantly check in with friends about what they think before forming opinions of their own.

Duke history professor Claudia Koonz believes students today are less tolerant of ambiguity than past students. According to *Time* magazine, she thinks “this aversion to complexity is directly related to multitasking: ‘It’s as if they have too many windows open on their hard drive. In order to have a taste for sifting through different layers of truth, you have to stay with a topic and pursue it deeply, rather than go across the surface with your toolbar.’”<sup>33</sup>

David Kirsh, chair of the Department of Cognitive Science at the University of California, San Diego, seems less worried. “People have been considering whether there won’t be a shift between these two styles of work--thinking hard about a small number of articles, focusing, and processing deeply versus having a topic or question and looking at lots of things in a shallow way but from multiple perspectives. We’ve always tended to bias the deep, but both have value and both have biases.”<sup>34</sup>

Like some others in his field, Marcel Just, the psychologist at Carnegie Mellon University who has studied the multitasking brain, believes it is possible to become better at multitasking through routinization. After an interview with him, the *Los Angeles Times* wrote, “A lot more of the tasks on which we now expend thought (or foresight or empathy or creativity) would have to be put on automatic pilot. We might be able to do more, but we’d forfeit a lot of the subtlety and richness that comes with thought.”<sup>35</sup>

## Implications for the office

While some experts believe that multitasking behavior needs to be eliminated completely, that's an unlikely scenario. It's more likely that norms about it will develop and people will, through time and experience, learn when it is likely to work and when it is not. "Multitasking is not good or bad," says Rubinstein. "You just have to make good decisions [about when to do it]. Calculate the odds of making an error and the impact of the error. It's risk analysis."<sup>36</sup>

Researchers are trying to understand what might help multitasking workers stay on task and recover from interruptions more quickly. Gloria Mark, professor of infomatics at University of California, Irvine, offers "working spheres" as a framework of understanding.<sup>37</sup> A working sphere has a unique time frame, involves other people, and is oriented toward a specific purpose. The information workers she studied engaged in about 12 working spheres every day for an average time of 10.5 minutes.

Analysis of the research showed that participants manage multitasking three ways. First, they constantly renew and update overviews of their working spheres, using tools like whiteboards, day planners, e-mails, and sticky notes. Second, they keep a flexible window of focus over external events. This means they focus on one sphere while keeping an ear cocked or an eye open for things that might have an impact on their other spheres. Finally, they do what they can to manage the transitions between spheres. Often this takes the form of asking an interrupter to wait until the worker gets to a natural breaking point on the working sphere she's in, so it's easier to resume the task later. In the case of abrupt (e.g., urgent) interruptions, workers use sticky notes to help them remember where they were. Alternatively, they use files, open documents, or open applications on their computer screens to find their way back to where they were on a project—probably accounting for the 23 minutes it takes, on average, for a person to get back to the original task.

Other researchers are honing in on that very thing—how to help workers resume a task following an interruption. Kirsh is looking for design principals for achieving "persistent state," which he defines as "information represented explicitly in figures, words, lists, or encoded more subtly in the arrangement of things which serves as a cue or external memory for people and helps them re-situate in a task they left off—to pick up that earlier task and everything they had to know about it to recover their earlier mindset."<sup>38</sup> This might include a few words jotted on a white board (calling them "notes" would be an exaggeration, Kirsh says) or a set of papers laid out in such a way that it would help recover the mindset the worker was in when she began the project.

Back in the 1960s, designer Robert Propst was also considering the relationship between display and recall. In his classic piece *The Office: A Facility Based on Change*, he writes: "An office with no relevant visual display deprives the human performer of a spectacular recall tool: the human eye as a receptor for the mind."<sup>39</sup> He felt offices were so neat and controlled that they didn't offer workers any clues about their work. In his design of the Action Office, he allocated space specifically for display, thereby remedying what he referred to as "...one of the most serious deficiencies in our present office culture...The suppression of relevant display."<sup>40</sup>

Whereas 50 years ago *display* was the key part of that phrase, the key in today's trigger-rich environments is *relevancy*. Theoretically, "you want the information that's connected to the goal [the project that's underway] to float up [physically or electronically]. But how do you do that without making the environment too dynamic?" Kirsh asks. "When you change the appearance of things a lot, people lose their bearings."<sup>41</sup> He believes RFIDs (through automatic "tagging" related to the activity involved in the creation of the document) and context-aware devices ("devices that have information about the circumstances under which they operate and can react accordingly"<sup>42</sup>) will make it easier to quickly retrieve information related to a project, regardless of how the information is stored.

An environment should be conducive to the kind of work that will transform the retrieved information into knowledge and even wisdom: "Place can energize the creation of wisdom—with time, connection, and experience. Beyond simply receiving information, people need time and space to think about it, to compare it to other things we know, to talk to others about it, to work with it in various physical ways."<sup>43</sup> Quite simply, people need the mental and physical space to think. In fact, the number one predictor of job performance and satisfaction is the ability to concentrate in one's own workplace.<sup>44</sup> While work environments that include places for quiet, uninterrupted work as well as collaborative work can help a worker fight the urge to multitask, a worker's ability to concentrate comes in part from being determined to concentrate. That's especially true now that workers can no longer physically separate themselves from distractions and interruptions. Worker hideouts like coffee shops and libraries now have wi-fi, and electronic interruptions are the hardest to resist. Any worker who needs to do focused work these days must rely on something decidedly low-tech: self discipline and resolve.

Workers will likely appreciate any help they can get from good workplace design and/or technologies, as long as those solutions don't inadvertently make the multitasking problem even worse. Until then, they might do well to shut off technology (yes, even the Blackberry) and prominently display their "heads down" working hours during which they intend to focus and think. Otherwise, at some point in the future, thinking at all may constitute thinking outside the box.

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## End Notes

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