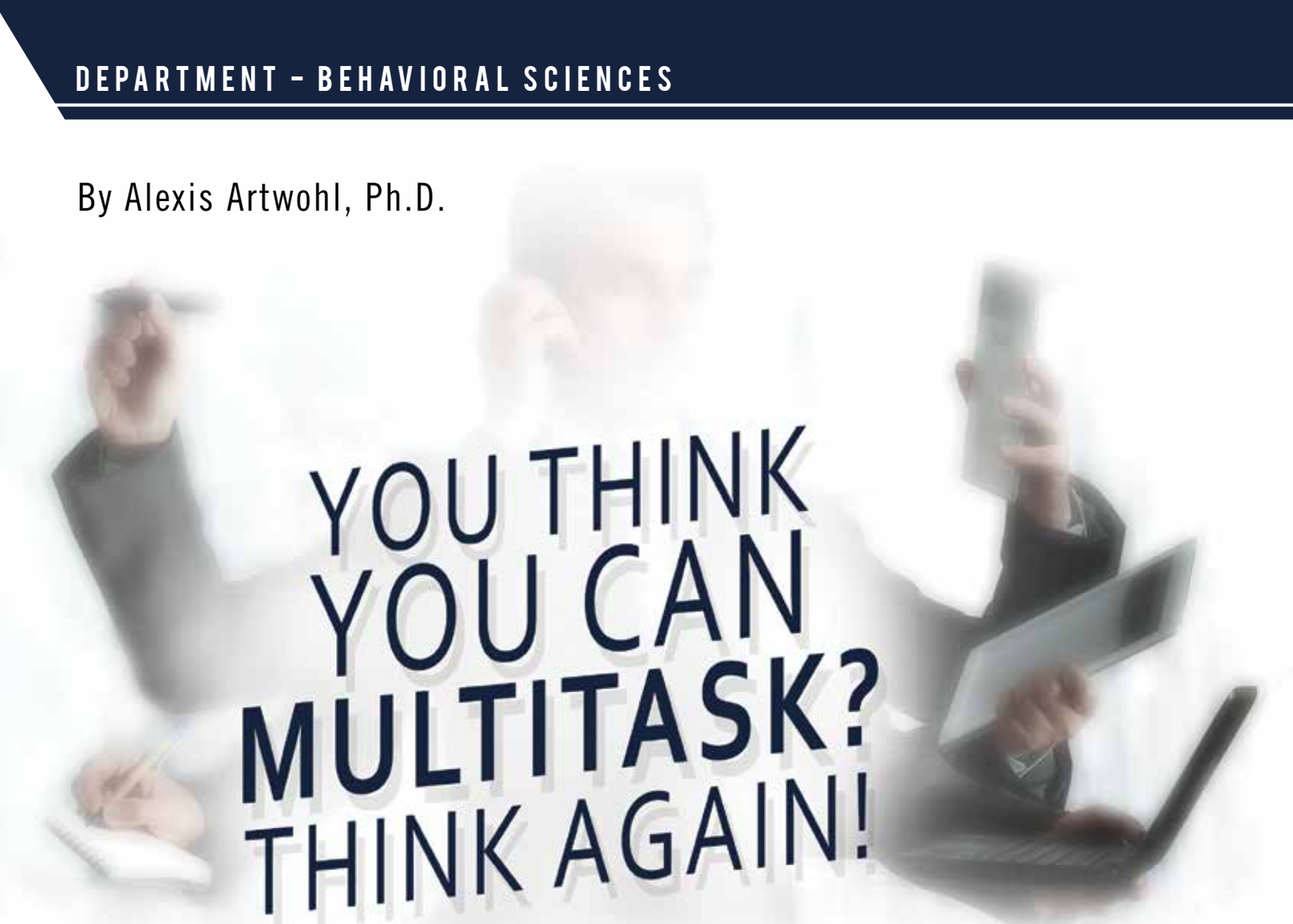By Alexis Artwohl, Ph.D.

YOU THINK YOU CAN MULTITASK? THINK AGAIN!

Certainly you can multitask, but if you think you can do it effectively, it's time to reconsider. Research has shown that not only are people more prone to error when they attempt to multitask, they overestimate their ability to do it effectively (one example of "egocentric bias"). Loukopoulos et al. points out, "Unfortunately the myth that one can multitask without degrading performance and risking accidents is all too prevalent in modern life... the human ability to process two or more tasks in parallel without detriment is extremely limited." Ophir et al. points out that "human cognition is ill-suited both for attending to multiple input streams and for simultaneously performing multiple tasks."

In their book "The Invisible Gorilla," Chabris and Simons state, "For the human being, attention is essentially a zero-sum game: If we pay more attention to one place, object, or event, we necessarily pay less attention to others. Inattentional blindness is thus a necessary, if unfortunate, byproduct of the normal operation of attention and percep-

tion." (Inattentional blindness is the common phenomenon of looking right at something but not seeing it and therefore having no memory of it. This has been well documented by decades of behavioral science research.)

Chabris and Simons explore the phenomenon of the "illusion of attention," wherein people do not realize that not only are our attentional resources very limited, we are not aware of our limitations. Our inability to pay full attention to multiple things at one time is at the center of our inability to effectively multitask. "The Invisible Gorilla," by the way, opens with the case of a police officer criminally convicted of perjury and obstruction of justice, then fired for supposedly lying when he claimed he did not see an event that was happening nearby. However, after analyzing the case and interviewing the officer, the authors came to the conclusion it was a classic case of the phenomenon known as inattentional blindness. I am happy to report that the officer's convictions were eventually overturned and he got his job back years later.

PRACTICE MAY NOT MAKE PERFECT

There is no doubt that, like all human abilities, some people can generally multitask better than others, for reasons not yet clear. However, practice does not necessarily make perfect. Some people have claimed that young people who have grown up with the media multitasking distractions of TV, smartphones and video games, should be better at multitasking than those of us who matured during an earlier and simpler time. So Ophir, Nass and Wagner did some creative research to test this hypothesis. They divided research subjects into two groups based on a questionnaire regarding their tendency to habitually media multitask: Heavy Media Multitaskers (HMM) and Light Media Multitaskers (LMM). The subjects then participated in a simple but increasingly difficult multitasking filtering challenge in which they had to solve one problem while being forced to try to ignore another distractor that intruded into their attention. The more they were able to focus on the problem-solving task and ignore the irrelevant distractor, the better they performed. The researchers found that the HMMs actually performed significantly worse than the LMMs. They concluded that "media multitasking, a rapidly growing societal trend is associated with a distinct approach to fundamental information processing... HMMs are less effective in suppressing the activation of irrelevant task sets. This last result is particularly surprising given the central role attributed to task-switching in multitasking."

A caution with the results is that the data is correlational, so there is no way to know for sure if the heavy media multitasking caused their inability to be able to focus effectively on one task when the situation called for it, or if they lacked this ability to begin with and perhaps were then drawn to heavy

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media multitasking. But it does belie the belief that HMMs would automatically be better at performing well when presented with competing tasks. Ophir et al. point out that this tendency may represent a difference in orientation that might offer other benefits, rather than being merely a deficit.

AUTOMATED VS. CONSCIOUS BEHAVIORS

Some behaviors are easier to multitask than others. Behaviors which have been practiced to the point where you can do them without thinking — *automated* behaviors — are easier to multitask. One everyday example is driving a car, which is a complex behavior requiring you to do many different things at once: be aware of the speed limit and regulate speed, be aware of traffic and adapt accordingly, notice traffic

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lights and signs, steer the car, remember where you are going and make turns at the right place, not run out of gas, and react to any objects in the environment like road debris and pedestrians. In spite of this complexity, most people, except new drivers, are usually able to simultaneously perform all these tasks competently with minimal conscious thought due to sheer practice.

So why do accidents still happen? Leaving aside the obvious, such as drivers who are operating under the influence and doing other unintelligent and negligent things like texting while driving, even conscientious drivers make glaring errors, sometimes with fatal consequences. These operator errors are all too common and are the result of the brain's limited ability to pay attention to more than one task or object at a time, especially if the operator environment demands even minor deviations in how or when the automated behaviors need to be performed. Therefore, even automated behaviors need some degree of attentive supervision because the real world is rarely without deviations, and most activities, even well-practiced ones, are a combination of automatic and conscious activities. For instance, if you are driving and you very briefly divert your attention to check the fuel gauge or look for a street sign, or you start thinking about an unrelated problem or make a call on your cell phone, you will invariably have fewer attentional resources to notice and react quickly to any unexpected stimuli, such as the car in front of you suddenly slowing down.

WHAT WE CAN LEARN FROM THE AVIATION INDUSTRY

An excellent book on this subject is "The Multitasking Myth: Handling Complexity in Real World Operations" (Loukopoulos, Dismukes and Barshi). This book addresses reducing operator errors (focusing mostly on pilots) in commercial aviation. However, that should not dissuade you from reading it, as it is full of concrete suggestions on how individuals and organizations can reduce human error and save lives. Focusing on human performance factors has worked well for the aviation industry: in spite of its many inherent dangers, it is now the safest way you can travel. Although some of the information is aviation-specific, the authors discuss general research literature on multitask-

> **Multitasking permeates almost every aspect of modern personal and professional life.**

ing and the implications for operator error in all types of occupations. They point out, "All operators are vulnerable in similar ways. Inadvertent errors of omission are generally not careless oversights, nor are they evidence of lack of competence or of conscientiousness. The reality is that cognitive constraints on attentional resources, on the abil-

ity to manage concurrent tasks and on prospective memory are shared by all people everywhere, in all endeavors. Multitasking permeates almost every aspect of modern personal and professional life." This certainly applies to police officers who are frequently required to multitask in potentially dangerous situations such as driving, interacting with suspects and conducting safe reality-based training. It is also relevant in our daily lives where attempts to multitask can have disastrous consequences, such as fatal traffic accidents, or merely annoying ones, like having no idea where we put our car keys.

THOSE PESKY PERTURBATIONS

In their study of cockpit operations, the authors of "The Multitasking Myth"

discovered four categories of perturbations in the environment that made pilots more vulnerable to error: interruptions and distractions; tasks that cannot be executed in the normal, practiced sequence of procedures; unanticipated new tasks; and multiple tasks that must be interleaved (performed simultaneously, forcing the brain to rapidly switch attention from one to the other, thus slowing down each one and making them more prone toward error). All of these can become worse when the operator is under time pressure to get things done, is fatigued or is experiencing other stressors.

These perturbations challenged the pilots in a variety of cognitive tasks, including:

• **Prospective memory**. This means that if you are interrupted and forced to suspend a task, or become aware of a new task that must be performed at a later time, you have to remember to do that task later at the right time and place. Good luck! This is not easy for people to do.

• **Habitual responding.** As long as frequently practiced habitual (automated) behaviors can be performed in the same sequence, errors are less likely. However, habitual responding will not work well if any of the following conditions are present: the task is novel; the task is perceived as dangerous, critical or difficult; the chain of a habitual task is broken, forcing you to respond in an atypical manner; or you are forced to choose among competing activities or goals. Therefore, your well-practiced behaviors can only get you so far and may even become a liability at some point.

• **Switching attention**. This means you are doing what is typically thought of as "multitasking," trying to do two things at once. Your brain is forced to rapidly switch back and forth from one task to another until both are done. If you frequently do the same two behaviors together, you may become relatively proficient at switching between them because one will often serve as a cue for the other from sheer practice. However, being interrupted or being forced to do a behavior out of sequence can throw you off, forcing you to try and compensate, and errors are more likely to occur.

REAL WORLD SOLUTIONS

In addition to a detailed discussion of the task demands people face when dealing with real world complexity, "The Multitasking Myth" discuss solutions

and examples of how these have been applied in the aviation industry. Some of these include:

Checklists: The aviation industry is big on checklists, for good reason. These help ensure that the essential components of a task are not missed. While checklists are a powerful tool, the authors outline multiple ways that checklists can also be a hindrance and how to avoid falling prey to those common pratfalls.

Monitoring. Besides conscious self-monitoring, which requires self-discipline, another tool is asking others to monitor you as well. A good example is an entity many of us see as an annoyance: the dreaded backseat driver. However, many of us have been saved from error by an alert passenger who called out a warning, thus spurring us to take evasive action that avoided an accident. Research by Strayer et al. on inattentional blindness while driving showed that when drivers in a driving simulator had a passenger they were asked to interact with, the passenger helped compensate for being a potential distractee by monitoring the driver's behavior and pointing out when the driver was getting ready to make an error. Two brains paying attention to a task are often better than one.

Good procedures. Established procedures are obviously important for complex tasks. However, many procedures have been around for a long time, are often taken for granted and rarely carefully reviewed. Thus they can become outdated, irrelevant and inefficient. Loukopoulos et al. state, "Designing good procedures is neither trivial, nor obvious. Simply understanding the relevant equipment and how it is to be used is not enough. Operating equipment safely and efficiently also requires a thorough understanding of the operator, of the environment in which the operations will take place, and the operations themselves... procedures should minimize the need for concurrent task management and for prospective memory tasks." They also encourage regularly critically evaluating procedures and tweaking them with input from operators, trainers and others with knowledge of the task demands.

Facilitating team coordination. Tasks often involve teams of people who can either facilitate optimal behavior from each other, or get in each other's way. Whoever on the team has the most task demands at any given moment is the most prone toward error and therefore should be able to call the shots and set the pace until he is done. Not interrupting each other at critical moments, monitoring and evenly distributing the workload can also help teams operate more efficiently.

Training and personal coping strategies. The authors recommend that, "Operators should be explicitly trained to recognize the circumstances that are conducive to error and how to avoid and/or manage them." How many of you have benefitted from formal training specifically about the research on multitasking and how to avoid errors? Probably very few.

I become annoyed when I think about all the totally useless information I was forced to learn in school and all the vital information that was never even mentioned, like how to cope with

multitasking and avoid errors, how to manage personal finances, coping with a bad boss, and so many more "life lessons." We are left to figure out a lot of the really important stuff on our own and that's what Loukopoulos et al. found with the pilots. They had developed many personal strategies on their own through trial and error. For instance, if they were interrupted when performing a checklist, this would force them to have to perform not one, but two difficult prospective memory tasks: 1) remembering to complete the items on the checklist, and 2) remember that they had not completed the checklist in the first place. Realizing how easy it is to forget these vital tasks, they would remind themselves by putting the checklist down in an atypical spot so they would be forced to interact with it later on before stowing it away in its usual location. This was a reminder they had been interrupted and still needed to complete the checklist. Many of us have also figured out on our own how helpful it is to use notes, timers, objects and such to keep track of all the tasks we interweave throughout our busy lives.

Recognize signs of task overload. Even the calmest and most competent operator can reach his or her limit in terms of time pressure, task demands, fatigue and other stressors. They should be trained to recognize the signs of task overload in themselves and others, such as feeling rushed, confused, anxious or falling behind the task. When those signs appear, corrective strategies can be deployed, such as consciously slowing down if possible, asking for or offering help and deliberately focusing on being consciously aware of what you are doing. Loukopoulos et al. point out that "rushing a checklist saves at best a trivial amount

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of time but enormously increases the vulnerability to error."

Training and practice dealing with emergencies and perturbations. Procedures and checklists are effective in helping keep order in our complex world and in helping operators get the job done efficiently. However, Murphy's Law will inevitably rear its ugly head and operators need to be prepared to rapidly switch gears and respond dynamically to sudden, unexpected task demands. The content of the emergency training will obviously vary depending on the occupation, but it should instill a sense of confidence in the operators that they can think and respond under pressure and give them many different emergency scenarios to draw upon. (The book "Sources of Power" by Gary Klein describes this type of emergency decision-making and how to enhance it.)

BE AWARE AND STAY SAFE

I have only skimmed the highlights of some of the research. It is a very important and complex topic with life-saving implications. Still, most organizations and individuals are not aware of the limitations they are operating under and the risk this represents to

themselves, their employees and the public. I hope this will whet your appetite to explore the topic further and start tweaking your own organization and your own efforts to avoid potentially tragic errors. Stay safe! ■

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