Finding Our Minds: An APS Award Address by David Meyer

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In his seminal 1890 masterwork, *Principles of Psychology*, William James wrote: "The faculty of voluntarily bringing back a wandering attention, over and over again, is the very root of judgment, character, and will. … An education which should improve this faculty would be *the* education *par excellence*."

It is fitting, then, that in part for his efforts at investigating the faculties of human multitasking, APS Fellow David E. Meyer received this year's APS William James Fellow Award. During his award address at the APS 20th Annual Convention, Meyer argued that to further understand how people try to do so much at once, psychological science itself will need to multitask — blending theory and data from cognitive science, computer science, and neuroscience with basic behavioral research.

"Over the past 10 years or so, multitasking has become a pervasive cultural phenomenon," explained Meyer, the Clyde H. Coombs and J. E. Keith Smith Professor of Cognitive and Mathematical Psychology at the University of Michigan, Ann Arbor. "The people who really need psychology right now are those who have become overwhelmed by multitasking."

Perhaps contrary to popular belief, there are actually several distinct types of multitasking, said Meyer. The first, which he called *sequential multitasking*, entails switching back and forth between tasks without working on more than one of them at a time. In contrast, the second type — *simultaneous multitasking* — entails varying degrees of temporal overlap in performing multiple tasks.

To illustrate sequential multitasking, Meyer asked the audience to say the letters A through J out loud as quickly as possible, and next to say the digits 1 through 10. Each of these tasks was performed with great speed and ease. However, when the audience had to switch back and forth between them—saying "A-1, B-2, C-3" and so on—the considerable difficulty of even this basic sequential multitasking became apparent in the din that ensued.

According to Meyer, both sequential and simultaneous multitasking could conceivably involve two distinct types of task combinations: For example, *disjoint tasks*, such as walking and chewing gum, require different mental and physical operations; *conjugate tasks*, such as talking on the phone while driving, require some shared resources.

At this point in his address, Meyer's cell phone rang loudly and unexpectedly. He answered it disconcertedly and mumbled, "Uh, sorry, I'm in the middle of giving a talk, so I'll have to call you back later."

Whether the phone call was a planned stunt or serendipitous coincidence, Meyer did a convincing job of linking it to the confusions sometimes caused by sequential and simultaneous multitasking. He stumbled — naturally, it seemed — while resuming his presentation, eventually taking several seconds to collect

himself. “See what these distracting interruptions do to us?” he groaned.

Researchers have debated whether fully simultaneous multitasking is possible, especially for seemingly disjoint tasks, Meyer mentioned. Some believe that people can perceive various stimuli at the same time, but that certain basic cognitive stages of one task must always wait until after those of another have been completed during multitasking. Despite his disruptive cell-phone interlude, though, Meyer disagreed with this intuitive notion, known as the *cognitive-bottleneck hypothesis*, and turned to some of his previous research for support of his claims.

In one study, for example, participants viewed geometric shapes and used various fingers to press buttons depending on where the shapes appeared. Meyer and his collaborators measured the participants’ reaction times to do this basic task. They then added a further twist to create a situation involving simultaneous multitasking with disjoint tasks. Participants performed the location-based button-pressing task while also doing another task for which particular digits had to be said in response to the pitches of various auditory tones. After some practice, neither of these two tasks interfered much, if any, with the other; participants’ reaction times were similar to those obtained when only one task had to be performed. This would be expected if there are no “hardwired” cognitive bottlenecks.

Nevertheless, a study of sequential multitasking with conjugate tasks produced large increases of reaction times when participants had to switch back and forth between two different tasks that each required pressing buttons in response to colored shapes. Yet this result, Meyer noted, does not fit the cognitive-bottleneck hypothesis either. Instead it gives evidence for a kind of “mental warm-up,” involving multiple brain sites, that people complete in order to prepare for each successive task of a sequence. Additional practice can decrease the amount of time taken to finish the goal-shifting, attention-refocusing, and rule-activation stages of executive cognitive control constituting this warm-up, Meyer reported.

Furthermore, cultural differences might impact a person’s natural multitasking skills. In an on-going study, Meyer and his collaborators have found that Japanese participants are inclined toward simultaneous multitasking, whereas American participants tend more toward sequential multitasking.

To advance our present understanding of multitasking, Meyer suggested that psychological scientists will have to do two things at once — merge the mind and the brain. As regions of the brain activated by various tasks become evident through neuroimaging, behavioral studies will have to characterize the mental processes used for performing them. Combining these approaches, he forecast, will provide deeper insights into the nature of multitasking.

“You gotta have psychological science,” he concluded, “not just brain mapping.”

Further scientific articles and news media coverage regarding Meyer’s research on multitasking can be found at the website of his Brain, Cognition, and Action Laboratory: www.umich.edu/~bcalab. ?