



LODGE VEGAS # 32

Multitasking

Since the 1990s, experimental psychologists have started experiments on the nature and limits of human multitasking. It has been shown multitasking is not as workable as concentrated times. In general, these studies have disclosed that people show severe interference when even very simple tasks are performed at the same time, if both tasks require selecting and producing action (e.g., ([Gladstones, Regan & Lee 1989](#)) ([Pashler 1994](#))). Many researchers believe that action planning represents a "bottleneck", which the human brain can only perform one task at a time. Psychiatrist [Edward M. Hallowell^{\[5\]}](#) has gone so far as to describe multitasking as a "mythical activity in which people believe they can perform two or more tasks simultaneously as effectively as one."

Others have researched multitasking in specific domains, such as learning. Mayer and Moreno have studied the phenomenon of cognitive load in multimedia learning extensively and have concluded that it is difficult, and possibly impossible to learn new information while engaging in multitasking. Junco and Cotten examined how multitasking affects academic success and found that students who engaged in more multitasking reported more problems with their academic work. A more recent study on the effects of multitasking on academic performance found that using Facebook and text messaging while studying were negatively related to student grades, while online searching and emailing were not.

The brain's role

Because the brain cannot fully focus when multitasking, people take longer to complete tasks and are predisposed to error. When people attempt to complete many tasks at one time, "or [alternate] rapidly between them, errors go way up and it takes far longer—often double the time or more—to get the jobs done than if they were done sequentially," states Meyer. This is largely because "the brain is compelled to restart and refocus". A study by Meyer and David Kieras found that in the interim between each exchange, the brain makes no progress whatsoever. Therefore, multitasking people not only perform each task less suitably, but lose time in the process.

When presented with much information, the brain is forced to pause and refocus continuously as one switches between tasks. Realistically, this is "a rapid toggling among tasks rather than simultaneous processing." According to a study done by Jordan Grafman, chief of the cognitive neuroscience section at the National Institute of Neurological Disorders and Stroke, "the most anterior part [of the brain] allows [a person] to leave something when it's incomplete and return to the same place and continue from there," while Brodman's Area 10, a part of the brain's frontal lobes, is important for establishing and attaining long term goals. Focusing on multiple dissimilar tasks at once forces the brain to process all activity in its anterior. Though the brain is complex and can perform a myriad of tasks, it cannot multitask well.

Another study by René Marois, a psychologist of Vanderbilt University, discovered that the brain exhibits a "response selection bottleneck" when asked to perform several tasks at once. The brain must then decide

which activity is most important, thereby taking more time. Psychologist David Meyer of the University of Michigan claims that, instead of a “bottleneck,” the brain experiences “adaptive executive control” which places priorities on each activity. These viewpoints differ in that, while bottlenecking attempts to force many thoughts through the brain at once, adaptive executive control prioritizes tasks to maintain a semblance of order. The brain better understands this order and, as psychologists such as Dr. Meyer believe, can therefore be trained to multitask. It is not known exactly how the brain processes input and reacts to overstimulation.

Some research suggests that the human brain can be trained to multitask. A study published in *Child Development* by Monica Luciana, associate professor of psychology at the University of Minnesota, discovered that the brain’s capability of categorizing competing information continues to develop until ages *sixteen and seventeen*. A study by Vanderbilt University found that multitasking is largely limited by “the speed with which our prefrontal cortex processes information.” Paul E. Dux, co-author of the study, believes that this process can become faster through proper training. The study trained seven people to perform two simple tasks, either separately or together, and conducted brain scans of the participants. The individuals multitasked poorly at first but, with training, were able to adeptly perform the tasks simultaneously. Brain scans of the participants indicate that the prefrontal cortex quickened its ability to process the information, enabling the individuals to multitask more efficiently. However, the study also suggests that the brain is incapable of performing multiple tasks at one time, even after extensive training. This study further indicates that, while the brain can become adept at processing and responding to certain information, *it cannot truly multitask*.

People have a limited ability to retain information, which worsens when the amount of information increases. For this reason people alter information to make it more memorable, such as separating a ten-digit phone number into three smaller groups or dividing the alphabet into sets of three to five letters. George Miller, former psychologist at Harvard University, believes the limits to the human brain’s capacity centers around “the number seven, plus or minus two.” An illustrative example of this is a test in which a person must repeat numbers read aloud. While two or three numbers are easily repeated, shown in the beginning straight line, fifteen numbers becomes more difficult, as the line curves. The person would, on average, repeat seven correctly. Brains are only capable of storing a limited amount of information in their short term memories.

This ineffectiveness of the human brain for multitasking has been demonstrated in different studies. Laboratory based studies of multi-tasking indicate that one motivation for switching between tasks is to increase the time spent on the task that produces the most reward (Payne, Duggan & Neth, 2007). This reward could be progress towards an overall task goal or it could simply be the opportunity to pursue a more interesting or fun activity. Payne, Duggan and Neth (2007) found that decisions to switch task reflected either the reward provided by the current task or the availability of a suitable opportunity to switch (i.e. the completion of a subgoal). A French [fMRI](#) study published in 2010 indicated preliminary support for the hypothesis that the brain can pursue at most two goals simultaneously, one for each frontal lobe (which has a goal-oriented area).

Continuous partial attention

Author [Steven Berlin Johnson](#) describes one kind of multitasking: “It usually involves skimming the surface of the incoming data, picking out the relevant details, and moving on to the next stream. You’re paying attention, but only partially. That lets you cast a wider net, but it also runs the risk of keeping you from really studying the fish.” Multimedia pioneer [Linda Stone](#) coined the phrase “[continuous partial attention](#)” for this kind of processing. Continuous partial attention is multitasking where things do not get studied in depth.

Rapidly increasing technology fosters multitasking because it promotes multiple sources of input at a given time. Instead of exchanging old equipment like TV, print, and music, for new equipment such as computers, the Internet, and video games, children and teens combine forms of media and continually increase sources of input. According to studies by the Kaiser Family Foundation, in 1999 only 16 percent of time spent using media such as internet, television, video games, telephones, text-messaging, or e-mail

was combined. In 2005, 26 percent of the time this [media was used together](#). This increase in simultaneous media usage decreases the amount of attention paid to each device. In 2005 it was found that 82 percent of American youth use the Internet by the seventh grade. A 2005 survey by the Kaiser Family Foundation found that, while their usage of media continued at a constant 6.5 hours per day, Americans ages 8 to 18 were crowding roughly 8.5 hours' worth of media into their days due to multitasking. The survey showed that one quarter to one third of the participants have more than one input "most of the time" while watching television, listening to music, or reading. The 2007 Harvard Business Review featured Linda Stone's idea of "continuous partial attention," or, "constantly scanning for opportunities and staying on top of contacts, events, and activities in an effort to miss nothing" As technology provides more distractions, attention is spread among tasks more thinly.

A prevalent example of this inattention to detail due to multitasking is apparent when people talk on cell phones while driving. One study found that having an accident is four times more likely when using a cell phone while driving. Another study compared reaction times for experienced drivers during a number of tasks, and found that the subjects reacted more slowly to brake lights and stop signs during phone conversations than during other simultaneous tasks. A 2006 study published in the Human Factors journal showed that drivers talking on cell phones were more involved in rear-end collisions and sped up slower than drivers intoxicated over the .08% legal limit.¹ When talking, people must withdraw their attention from the road in order to formulate responses. Because the brain cannot focus on two sources of input at one time, driving and listening or talking, constantly changing input provided by cell phones distracts the brain and increases the likelihood of accidents.

Popular commentary on practical multitasking

Multitasking has been criticized as a hindrance to completing tasks or feeling happiness. [Barry Schwartz](#) has noted that, given the media-rich landscape of the Internet era, it is tempting to get into a habit of dwelling in a constant sea of information with too many choices, which has been noted to have a negative effect on human happiness.

The idea that women are better multitaskers than men has been popular in the media. Recently, a study by British psychologist Professor Keith Laws at the [University of Hertfordshire](#) was widely reported in the press to have provided the first evidence of female multitasking superiority. A formal research paper has yet to be published.

In another study, females were found to perform better at coordinating a primary test with a secondary test ($p=0.007$), supporting this notion that females are better at multi-tasking. However, the authors concluded their tests may not reflect real life multi-tasking and that further research was required.

Observers of youth in modern society often comment upon the apparently advanced multitasking capabilities of the youngest generations of humans ([Generation Y](#) and [Generation Z](#)). While it is true that contemporary researchers find that youths in today's world exhibit high levels of multitasking, most experts believe that members of the Net Generation are not any better at multitasking than members of older generations. However, recent studies by Bardhi, Rohm, and Sultan argue that Generation Y is becoming better at media multitasking. This is evidenced by the fact that they are gaining control over deciding which messages they pay attention to or not. Furthermore, while there is a great deal of evidence showing the negative effects of multitasking on cognitive tasks, *there is no evidence showing that multitasking has a positive or neutral effect on these tasks.*