

APA citation of journal article: Wechsler, K., Drescher, U., Janouch, C., Haeger, M., Voelcker-Rehage, C., & Bock, O. (2018). Multitasking During Simulated Car Driving: A Comparison of Young and Older Persons. *Frontiers in Psychology*, 9. <https://doi.org/10.3389/fpsyg.2018.00910>

The Basics:

1. What was the broad question being asked by this research project? What was the specific question being asked by this research project?
 - a. Summarize the background information on the research topic in three sentences.
 - b. What is the gap in the literature identified by the researchers? What question(s) are they trying to answer? What is their hypothesis and what should happen if the author's hypothesis is true?
 - c. What are alternative hypotheses?

General: What is the nature of age-related deficits in realistic human multitasking (e.g., driving with a variety of cognitive demands)? Specific: Relative to younger adults, do older adults show large deficits in multitasking while driving if the secondary task is very challenging?

Background: everyday life involves a lot of human multitasking, and it's been studied with task-switching and dual-tasking experiments typically. Multitasking ability declines with age, but that has typically been studied in the laboratory and has only used 2 tasks. Several studies have implemented virtual reality, car driving, etc. The gap from the researchers: participants are performing an ever-changing sequence of loading tasks with a variety of demands, not just one task, extending previous work with driving simulators. And what's the nature of the age-related deficits in realistic multitasking? The study also wants to look at that.

Hypothesis: Both young and older adults will show multitasking deficits when driving. Deficits will be more pronounced with greater load (visual processing and structural interference).

Magnitude of deficits will be only moderately higher in older vs. younger adults.

Alternate: Perhaps older adults will have much larger deficits in multitasking relative to younger adults. It seems unlikely that they wouldn't find deficits, but that perhaps the deficits could go in a direction not specified by this hypothesis (which could also be "post-hoc" – i.e., after the experiment was already run).

2. What experiments were done to test the hypothesis or investigate the research question?
 - a. Explain the task design – what are participants instructed to do and what is being measured? Think about the independent and dependent variables.

Made sure the adults were still cognitively fit to perform the task and that they didn't have experience with similar research and they had some history of driving recently. In a driving simulator (Figures 1, 2), participants followed a lead car at 70 km/h. Sometimes the car approached a construction site or speed-restricted zone, leading to slow-downs and subsequent speeding back up ('braking task'). A battery of loading tasks was presented at different times and varied (typing (operating); reasoning (like talking with a passenger), Fig 3; memory (gas station prices, traffic announcement), Fig 4) Sometimes the tasks were presented visually, sometimes auditorily. 4 experimental sessions: screening tests, simulator practice and loading tasks practice; in one session: drove behind car with no additional tasks; in another: concurrently responding to loading tasks; in another session: car drove in autopilot mode, so people responded to loading tasks. They analyzed the driving data within road segments of interest (i.e., started with loading task, ended right before task). Their DVs: mean velocity, SD velocity, mean lateral position, SD lateral position; RT and correctness for the typing and memory task.

3. What evidence supports each of the conclusions?
 - a. Before you read the discussion, summarize the main findings and link each one back to the research question(s). How does each result inform the hypothesis?

Participants drove more slowly in the multitask vs. single task condition (Fig 5). Slowing was most evident in the reasoning task and the difference less evident for memory task. Older participants drove slower. Participants drove slower when doing the reasoning vs. memory/typing tasks, and they were slower when the task was presented visually than auditorily.

Speed was more variable during multitasking (Fig 6). Again, it increased most during visual reasoning, and variability was higher for older folks.

Participants veered more when multitasking; veering was more pronounced when the memory task was visual, reasoning and typing auditorily presented, and more in older adults (Fig 7).

Variability in their lateral position was higher during multitasking; scores were higher in older adults and with auditory tasks (Fig 8).

People were slower to respond on the typing task – specifically older adults, and younger adults were slower during auditory than visual presentation, and both were slower during multitasking (Fig 9, Table 5).

Differences in typing accuracy were shown for older adults (lower; Fig 10, Table 6). Did not analyze the memory accuracy.

4. What are the major conclusions?
 - a. What do the results add to the field? How do the researchers interpret their findings? Summarize any limitations identified by the researchers.

Both young and older adults show deficits in multitasking for all six DVs analyzed. The structural interference (same modality) – visual vs. auditory? They sometimes found visual > auditory, sometimes the opposite. Multitasking deficits in older adults may not be “much” larger in older vs. younger adults – they said they only found one time when older adults veered more than younger adults during the typing task. So, they have some age-related deficits in multitasking for some tasks but not others.

Page 5: “Differences between tasks are therefore confounded by differences between road conditions. By the same token, differences between modalities are confounded by differences between road conditions. Scattering of loading tasks along therefore added to the realism of our paradigm, but hinders comparisons between tasks and modalities.”

Variability in typing – older adults didn’t grow up in the age of computers, so there’s going to be a difference in the automaticity of the behavior relative to young adults, and that’s not so much a function of cognitive aging as it is a cultural shift.

The third hypothesis on older adults not being much different from younger adults on the basis of experience? They don’t analyze by age. What “experience” are they referring to here? If it’s

driving years, why isn't that a part of the analysis? They just say "experience" is basically the difference between old and young adults, which is confounding age deficits and learned experience. You don't really have a sense of the mechanism here.

They talked about dual-tasking and task-switching in the introduction and come back to it in the discussion as a comparison, but there's nothing meant to directly compare the two.

The Critique:

1. Is the paper well written? How do you know? For week 2 & later, use this space to practice headlines & summaries of the articles via tweets.

It has so many DVs, it's sometimes hard to keep track of what's what. Plus, while the acronyms save word-count, I sometimes had to go back between the pages to remind myself of what's what. They also reported their ANOVAs weirdly. But having all the data shown is nice.

2. Do the conclusions seem logical given the data processed? Why or why not? Another way of thinking about this: do the results adequately support the conclusions that are drawn? Are there alternative explanations for the findings? What inferences about the hypotheses and questions can be made based on these results?

See comments on the limitations above—which the authors did not comment on.

The conclusions make sense given the number of differences they found for multitasking related deficits, but their actual comparisons are more confusing.

3. Are the conclusions important? How do you think this relates to everyday behavior?

I think it's important to study realistic multitasking in different populations. I think some of their loading tasks do actually simulate real-world behavior, although I did wonder why not actually trying out real-world behavior? Like holding a conversation for 1 minute as a loading task.

4. What were the best aspects of the research presented, and how could the research be improved? Name at least one way to improve the experiment.

See comments above on limitations, #3 on this realistic multitasking. Their research also seems a bit incremental – only different with a few loading tasks and aging population comparison.

5. How would you follow-up this experiment or study?

I'd like to make the driving simulator more realistic with other people nearby or a cell phone or other types of demands. I did like the memory demand. It'd have been nice for more of those.

Additional Resources: What are the basic concepts that you need to know to understand the science presented in your paper? What other information or resources would help you better understand the paper? This is helpful to consider for your science communication pieces.

Task-switching, dual-tasking, not much though because they're not crucial

Further Questions:

Write at least five comments or questions about the article to discuss with the class.

1. Does this research seem realistic and fit with our notions of multitasking?
2. If we were to apply the Seli paper here, what would strategic versions of multitasking or mind-wandering look like in this experiment?
3. Most GPS these days won't let you type unless you're parked, so maybe a cell phone version of that would've been more realistic?
4. How much does driving experience matter?
5. How much do previous accidents or media multitasking habits play a role?