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### Investigating the effects of cognitive overload in a simulated manufacturing task

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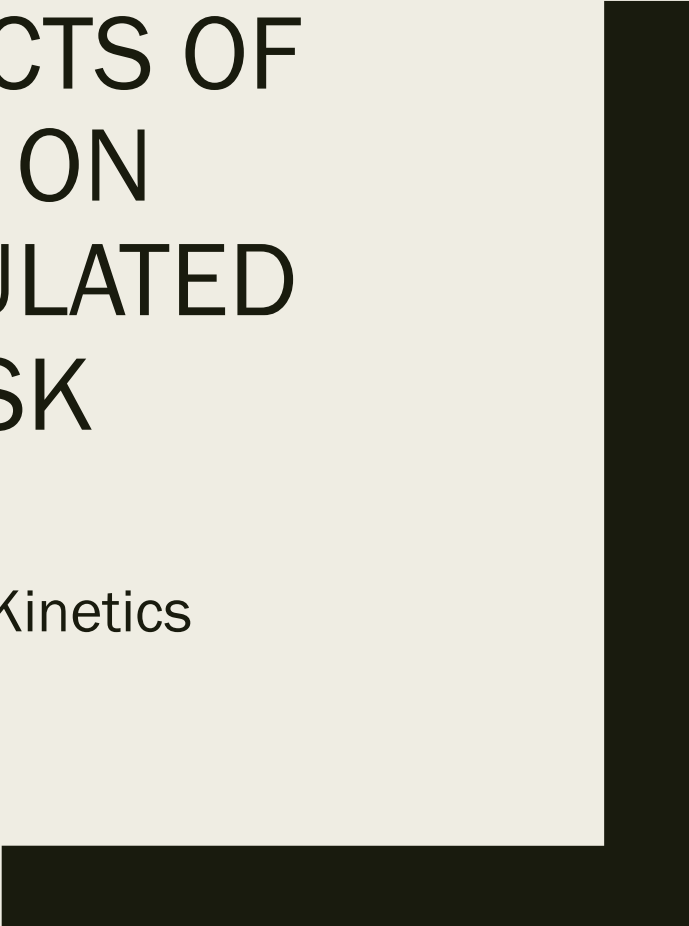

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# INVESTIGATING THE EFFECTS OF COGNITIVE OVERLOAD ON PERFORMANCE IN A SIMULATED MANUFACTURING TASK

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Human Systems Lab

# When you think of ergonomics...

1. Design of products
  2. Workplace safety, reducing injuries
  3. Optimization of jobs
- What do these all have in common?

→ Physical Workload



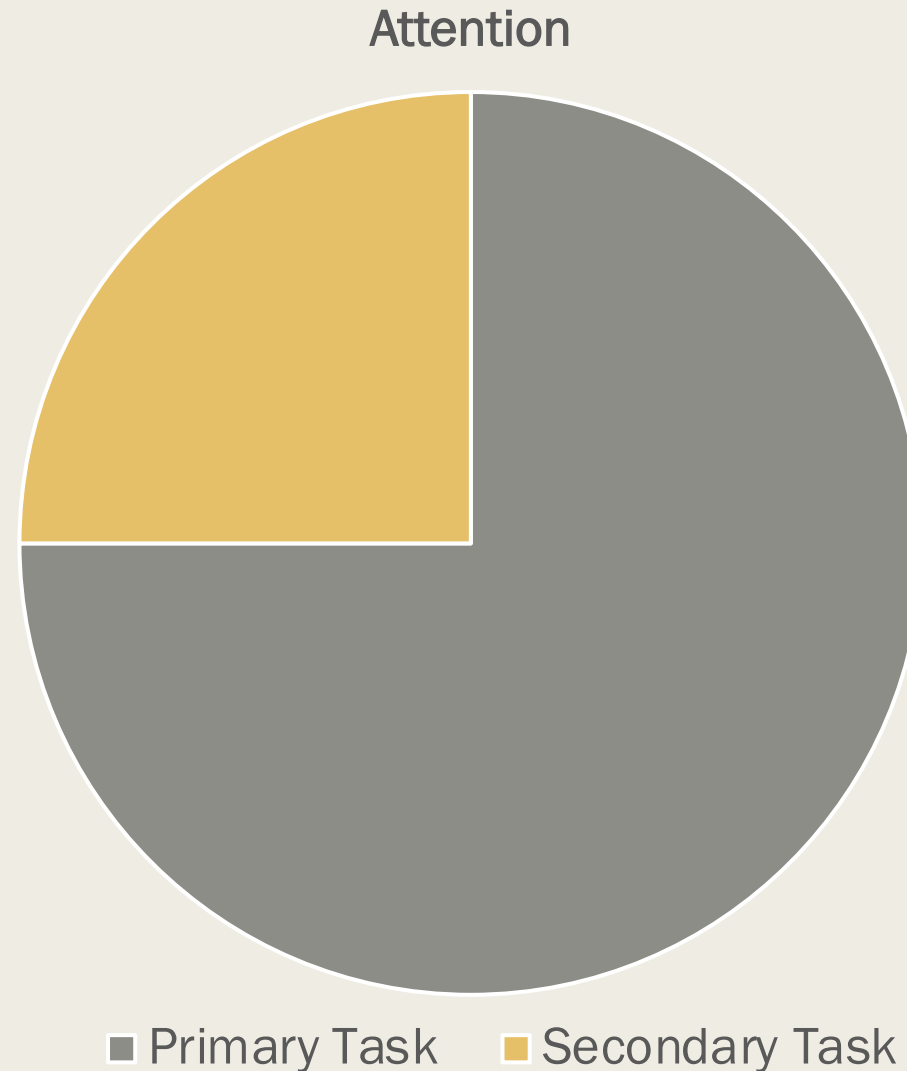
Image: X-Chair (2022)

# How can we account for mental components?

- We know attentional resources affect safety → *distracted driving*
  - Large impact on safety
- **Cognitive ergonomics**
  - Growing field of research
  - Encompasses many different human factors
  - Focus on cognitive workload

# What is cognitive workload?

- A user's perceived level of mental effort
- Multitasking
- One task with multiple components



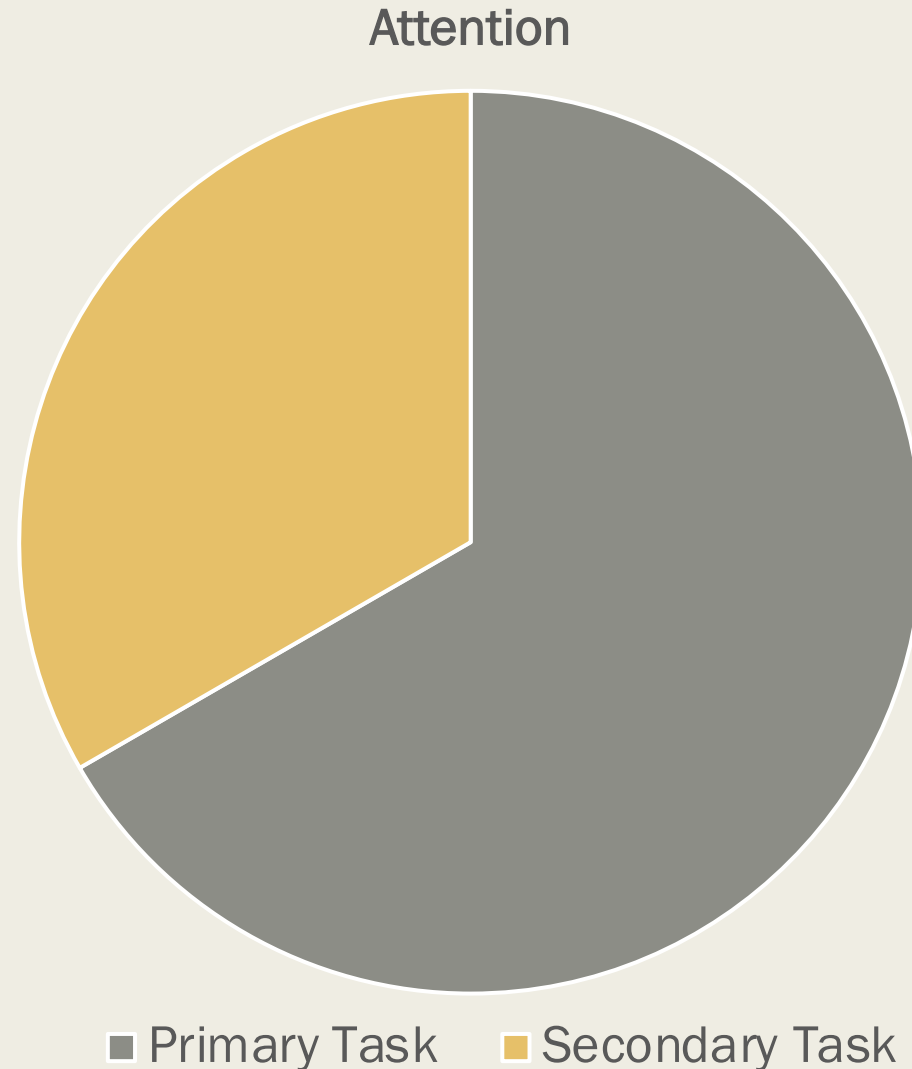
# What is cognitive overload?

■ Secondary task over 25%?

➤ Errors

➤ Safety concerns

➤ Inefficient



# Cognitive Workload

## Why is this relevant?

- Increasing...
  - *Reliance on technology*
  - *Cell phone use (companies competing for our attention)*
- Concerns...
  - *Safety*
  - *Productivity*



# What we know

- When cognitive demands increase:
  - Performance decreases (driving & aviation control) Strayer et al., 2015
  - Increased muscle activation (small scale assembly) Biondi et al., 2020
  - Pupil diameter and blink rate (generic computer task) Biondi et al., 2021

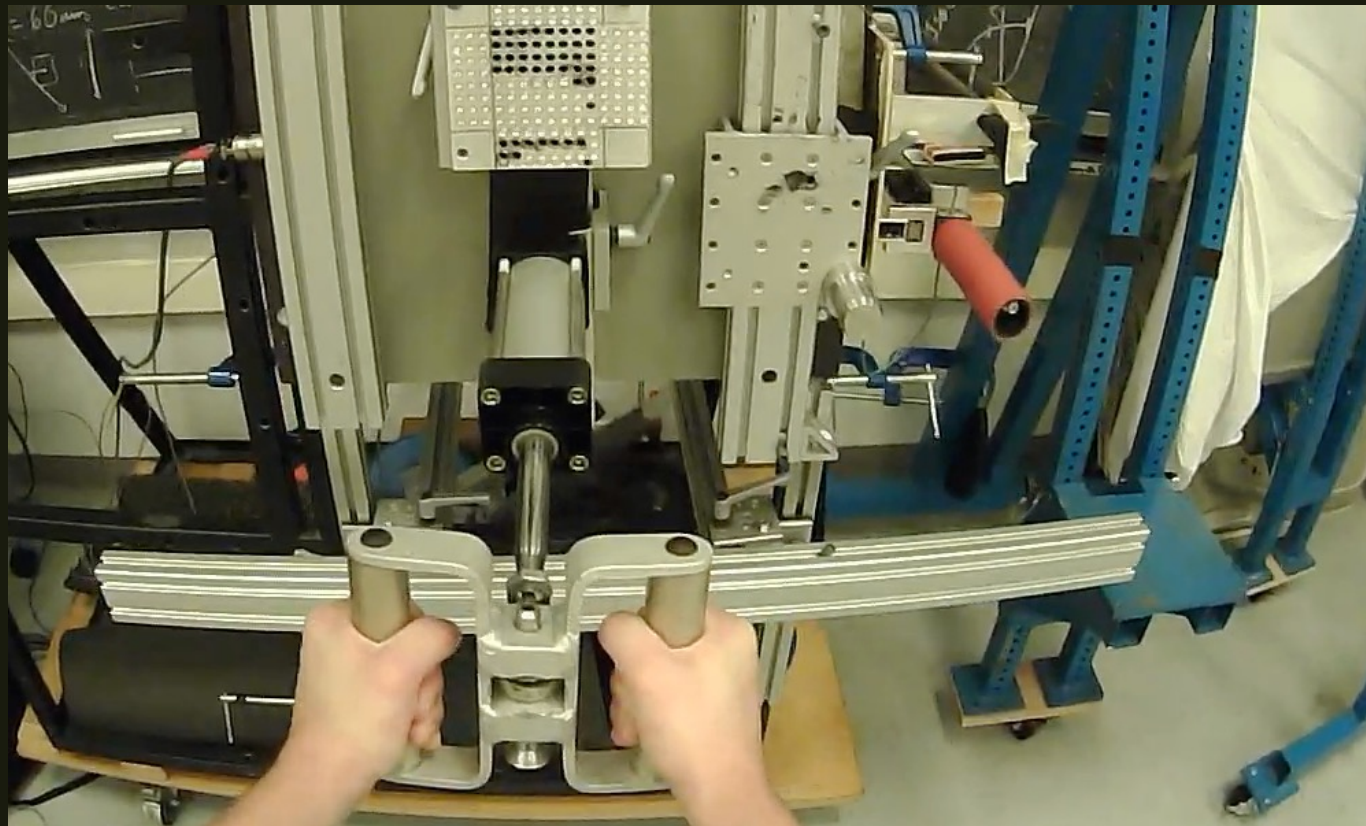
***Does this hold true for simulated manufacturing tasks?***





# Hypotheses

1. Cognitive load increases lead to poor performance & increased muscle activation
2. Ocular metrics are effective in measuring cognitive workload in dynamic tasks (*theoretical/technological*)

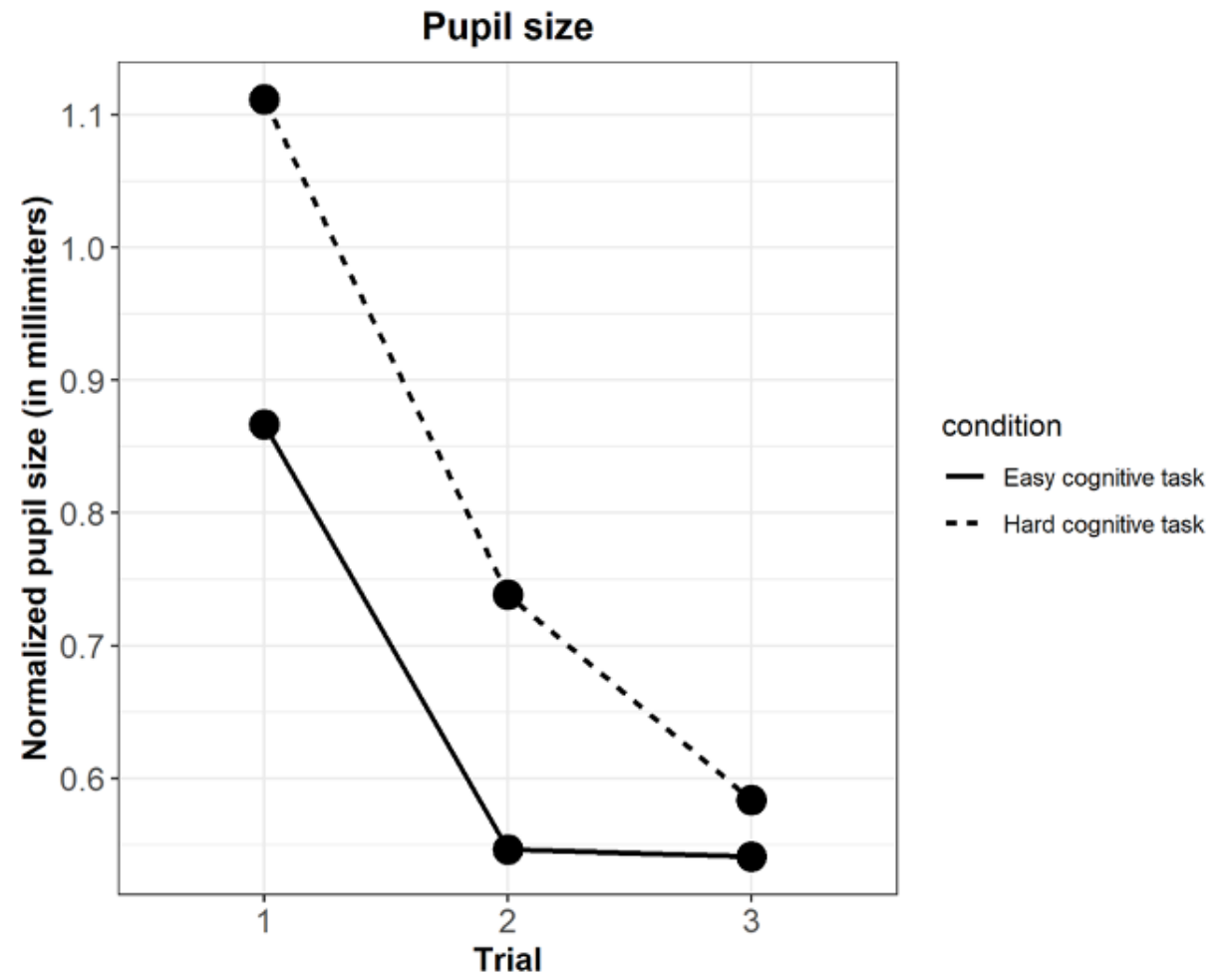


# Methods

- Simulated manufacturing task
- Simultaneously completing short term memory task
- Measuring
  - *Force*
  - *Muscle activity*
  - *Ocular metrics*
  - *Performance*

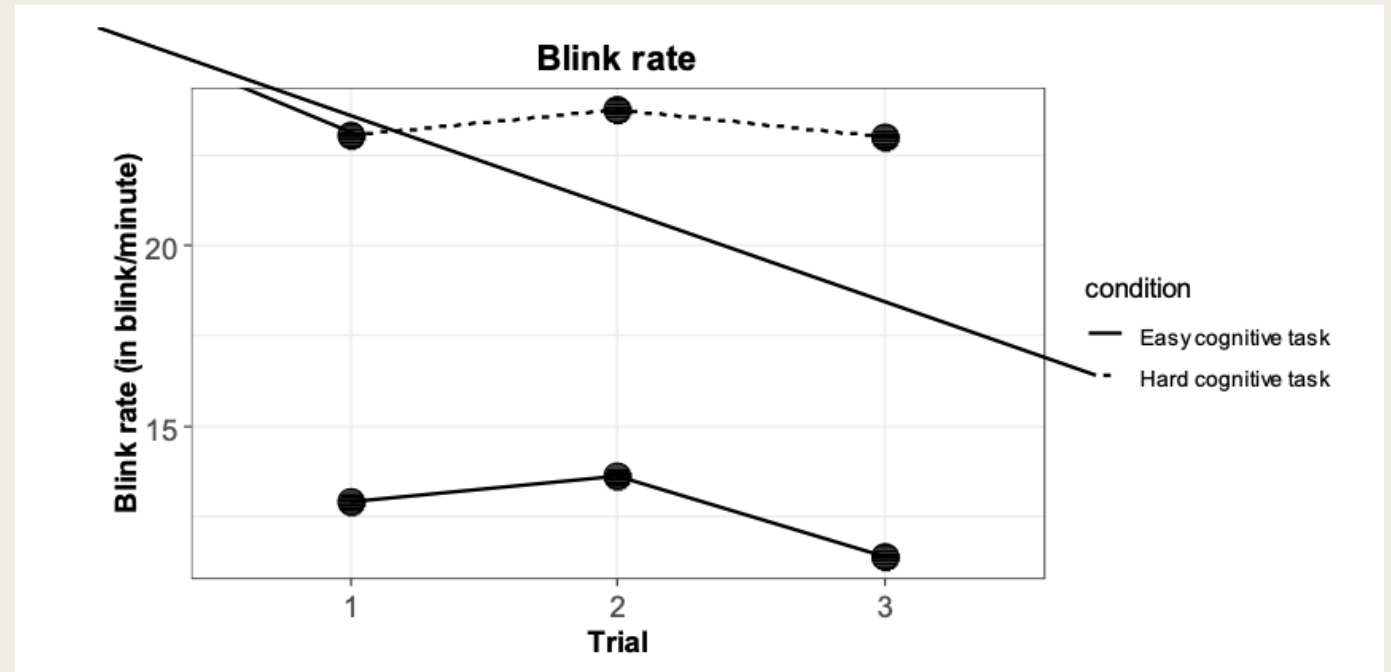
# Preliminary Results

- Pupil size is higher in conditions with hard cognitive task



# Preliminary Results

- Blink rate is higher in conditions with hard cognitive task



# What is the significance of this?

- Company assessments using eye tracker
- Design jobs to fit mental ability
- Further optimize performance & safety



Image: Pupil Labs (2021)

# References

- Biondi, F. N., Balasingam, B., & Ayare, P. (2021). On the Cost of Detection Response Task Performance on Cognitive Load. *Human Factors*, 63(5), 804–812.  
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- Biondi, F. N., Cacanindin, A., Douglas, C., & Cort, J. (2020). Overloaded and at Work: Investigating the Effect of Cognitive Workload on Assembly Task Performance. *Human Factors*, 2004. <https://doi.org/10.1177/0018720820929928>
- Strayer, D. L., Turrill, J., Cooper, J. M., Coleman, J. R., Medeiros-Ward, N., & Biondi, F. (2015). Assessing cognitive distraction in the automobile. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 57(8), 1300–1324.  
<https://doi.org/10.1177/0018720815575149>

The image features two large, thick, black L-shaped corner brackets. One is positioned in the top-left corner, and the other is in the bottom-right corner. They are oriented towards each other, framing the central text.

**THANK YOU!**