CAROLINA RODRIGUEZ PARAS

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EDUCATION

Doctor of Philosophy Industrial Engineering   Expected: 2019
Texas A&M University (TAMU), College Station, TX   GPA: 3.89
Thesis: *"Physiological Measures of Workload in Multitasking Environments as Indicators of the Cognitive Redline"*
Advisors: Dr. Thomas K. Ferris & Dr. Farzan Sasangohar

Masters of Science in Industrial Engineering   August 2015
Texas A&M University (TAMU), College Station, TX   GPA: 3.15
Thesis: *"Exploring Physiological Measures for Prediction and Identification of the Redline of Cognitive Workload"*
Advisor: Dr. Thomas K. Ferris

Bachelor of Science in Systems Engineering, *cum laude, Honors Program Certificate*   May 2013
Texas A&M International University (TAMIU), Laredo, TX   GPA: 3.54
Thesis: *"A Systems Engineering Analysis of Operations in Forwarding Companies"*
Advisor: Dr. Mahmoud Khasawneh
Business Concentration

RESEARCH EXPERIENCE

Department of Industrial and Systems Engineering, Texas A&M University   June 2014 – Present
Research Assistant   September 2015 – Present

Countermeasures to Detect and Combat Inattention While Driving Partially Automated Systems   September 2017 – Present
- Evaluated different displays as countermeasures to prevent driver inattention in partially automated vehicles.
- Collected different physiological measures to compare activation patterns to differentiate between workload, stress, and startle.

Toyota Economic Loss Settlement Safety Research   February 2016 – March 2017
- Investigated driver reaction to different stress conditions, including cognitive, motoric, and emotional.
- Assessed physiological measures (e.g., heart rate, heart rate variability, skin conductance) to differentiate workload states.
- Identified stress mitigation techniques to implement in-vehicle while driving.
- Evaluated heart rate variability as a valid technique to detect sympathetic arousal as a stress reaction.

Evaluation and Redesign of Weather Alerts to Support In-Flight Decision-Making (FAA)   September 2015 – Present
- Analyzed live-coded data to investigate the novel displays for decision-making.
- Studied weather latency effects in general aviation and how to transmit the information in a timely manner.
- Compared different vibrotactile patterns to support
- Explored different types of displays to support in-flight decision making, including vibrotactile.

Human Factors and Cognitive Systems Lab (HF&CS)   June 2014 – Present
Driver Stress and Startle Response   January 2017 – Present
- Contrasted the different physiological patterns for stress and startle responses.
- Developed a model to quantify startle in a driving environment, considering the different stimuli present while driving.
- Examined the startle response in a driving context based on repeated exposure and previous knowledge of events.

Physiological Indicators of the Cognitive Redline of Workload   June 2014 – Present

- Modeled mental workload through the Multi-Attribute Task Battery-II (MATB-II), a software developed by NASA.
- Considered how different physiological measures reflect changes in cognitive workload.
- Analyzed the reliability of the physiological measures as indicators of workload under different conditions.
- Compared different physiological measures, such as heart rate, heart rate variability.

Applied Cognitive Ergonomics Lab (ACE)   January 2016 – Present
Mobile Applications for Post-Traumatic Stress Disorder (PTSD)   January 2016 – Present

- Researched current mobile applications used to detect and treat PTSD, and performed usability testing of the applications to identify opportunities for improvement.
- Appraised different physiological measures as objective methods to detect PTSD, and how the measures can be connected to mobile applications.
- Interviewed clinicians to inquire about their experience with treating PTSD patients, and to gather an understanding of the issues affecting the clinician-patient interaction.
- Developed a healthcare-based model for PTSD treatment based on qualitative data, and revised the model based on iterative interviews.
- Interviewed patients with PTSD to inquire about their PTSD symptoms, and experiences with triggers.
- Established architectural space design guidelines and considerations for patients with PTSD based on the interview data.

PEER-REVIEWED JOURNAL PUBLICATIONS

1. Zhu, Y., **Rodriguez-Paras, C.**, Rhee, Y., & Mehta, R. (2019 – In review). Methodological approaches and recommendations for functional near-infrared spectroscopy applications in HF/E research. The Journal of the Human Factors and Ergonomics Society.

2. **Rodriguez-Paras, C.**, Tippey, K. G., Brown, E., Sasangohar, F., Creech, S., Kum, H.C., Lawley, M., and Benzer, J. (2017). Investigating post-traumatic stress disorder (PTSD) mobile health (mHealth) applications usage and validation: An app investigation and scoping literature review. Journal of Medical Internet Research (JMIR) mHealth uHealth, 5 (10): e156.

3. Tippey, K.G., Roady, T., **Rodriguez-Paras, C.**, Brown, L.J., and Rantz, W.G., and Ferris, T.K. (2017). General aviation weather alerting: The effectiveness of different visual and tactile display characteristics in supporting weather-related decision-making. International Journal of Aerospace Psychology, 27(3-4), 121-136.

JOURNAL PUBLICATIONS IN PREPARATION

1. **Rodriguez-Paras, C.**, Yang, S., & Ferris, T. K. (In preparation – expected 2019). Assessment of physiological measures as indicators of the cognitive red line of workload.

2. **Rodriguez-Paras, C.**, Rao, A., & Sasangohar, F., & Lawley, M. (In preparation – expected 2019). Investigating architectural and space design considerations for post-traumatic stress disorder (PTSD) patients.

3. **Rodriguez-Paras, C.**, Smith, A., Moon, J., Rao, A., & Sasangohar, F. (In preparation – expected 2019). Qualitative analysis of post-traumatic stress disorder (PTSD) triggers and intervention technologies.

4. Moon, J., **Rodriguez-Paras, C.**, Rao, A., & Sasangohar, F. (In preparation – expected 2019). A descriptive model of the current PTSD care system: identifying opportunities for improvement.

5. Moon, J., **Rodriguez-Paras, C.**, Rao, A., & Sasangohar, F. (In preparation – expected 2019). Designing technologies for veterans with PTSD: An in-depth interview Study.

6. Roady, T., **Rodriguez-Paras, C**., & Ferris, T. K. (In preparation – expected 2019). Identification of vibrotactile patterns for decision making.

PEER-REVIEWED CONFERENCE PROCEEDINGS

1. **Rodriguez-Paras, C.**, Khanade, K., Sadeghi, M., & Sasangohar, F. (2018). Stress detection techniques in different work domains. In Proceedings of Human Factors and Ergonomics Society's 62nd Annual Meeting, Philadelphia, PA, October.

2. Khanade, K., **Rodriguez-Paras, C.**, Sasangohar, F., & Lawley, S. (2018). Investigating architectural and space design considerations for post-traumatic stress disorder (PTSD) patients. In Proceedings of Human Factors and Ergonomics Society's 62nd Annual Meeting, Philadelphia, PA, October.

3. Moon, J., Williams, J., Sasangohar, F., Khanade, K., & **Rodriguez-Paras, C.** Veteran-centered design of a post-traumatic stress disorder (PTSD) tool: Qualitative analysis of interviews with veterans. In Proceedings of Human Factors and Ergonomics Society's 62nd Annual Meeting, Philadelphia, PA, October.

4. **Rodriguez-Paras, C.,** Sasangohar, F. (2017) Usability assessment of a post-traumatic stress disorder (PTSD) mHealth app. In Proceedings of Human Factors and Ergonomics Society's 61st Annual Meeting, Austin, TX, October.

5. **Rodriguez-Paras, C.,** Susindar, S., Lee, S., and Ferris, T.K. (2017). Age effects on drivers' physiological response to workload. Proceedings of the Human Factors and Ergonomics Society 61st Annual Meeting. Austin, TX, October. 1886-1886.

6. Johnson, I., Whitehurst, G., Risukhin, V.N., Brown, L.J., Rantz, W., Ferris, T.K., Roady, T., **Rodriguez Paras, C**., Tippey, K., and Futrell, M.J. (2017). PEGASAS: Weather technology in the cockpit. Proceedings of the 19th International Symposium on Aviation Psychology. Dayton, OH, May.

7. **Rodriguez-Paras, C**., Sasangohar, F. (2017). Usability testing of PTSD Coach: A mobile health app for post-traumatic stress disorder. Proceedings of the Human Factors and Ergonomics Society Healthcare Symposium. New Orleans, LA. March.

8. **Rodriguez-Paras, C**., Yang, S.Y., and Ferris, T.K. (2016). Using pupillometry to indicate the cognitive redline. Proceedings of the Human Factors and Ergonomics Society 60th Annual Meeting. Washington, DC, September.

9. **Rodriguez Paras, C**., Yang, S.Y., Tippey, K., and Ferris, T.K. (2015). Physiological indicators of the cognitive redline. Proceedings of the Human Factors and Ergonomics Society 59th Annual Meeting. Los Angeles, CA. October.

PRESENTATIONS

1. **Rodriguez-Paras, C.,** & Thomas K. Ferris. (2019 – Accepted). Countermeasures to combat driver inattentiveness in partially automated vehicles. Accepted at the Industrial & Systems Engineering (IISE) Conference. Orlando, FL. May.

2. **Rodriguez-Paras, C.,** & Thomas K. Ferris. (2019). Analysis of physiological measures as indicators of autonomic activation. Presented at Presented at the Texas A&M Student Research Week. College Station, TX. March.

3. **Rodriguez-Paras, C.,** & Thomas K. Ferris. (2018). Using physiological indicators to predict performance in high workload scenarios. Presented at the Industrial & Systems Engineering (IISE) Conference. Orlando, FL. May.

4. **Rodriguez-Paras, C.,** Mack, S., Rodriguez-Paras, P., & Thomas K. Ferris. Physiological indicators of startle and stress in a driving environment. Presented at the Industrial & Systems Engineering (IISE) Conference. Orlando, FL. May.

5. Roady, T., McKenzie, J. T., Choterungruengkorn, P., **Rodriguez-Paras, C.,** Susindar, S., & Ferris, T. K. (2018). Design recommendations for wrist-based vibrotactile cueing for general aviation pilots. Presented at the Industrial & Systems Engineering (IISE) Conference. Orlando, FL. May.

6. Susindar, S., **Rodriguez-Paras, C.,** McKenzie, J.T., Choterungruenkorn, P., Allred, B., Rodriguez-Paras, P. E., & Ferris, T.K. (2018). Head-worn displays in general aviation: a human factors review. Presented at the Industrial & Systems Engineering (IISE) Conference. Orlando, FL. May.

7. Moon, J., **Rodriguez-Paras, C.,** Sasangohar, F., Benzer, J.K., & Kum, H-C. (2018). Modeling patient-centered pathways of the current PTSD care system. Presented at the HSPIC'18: The Healthcare Systems Process Improvement Conference. Atlanta, GA. February.

8. **Rodriguez-Paras, C.,** Khanade, K., Sadeghi, M., & Sasangohar, F. (2018). Stress detection techniques in nursing and other work domains. Presented at the HSPIC'18: The Healthcare Systems Process Improvement Conference. Atlanta, GA. February.

9. Tippey, K., **Rodriguez-Paras, C.,** Roady, T., Ferris, T., Rantz, W., and Brown, L. (2017). General aviation weather alerting: effectiveness of display characteristics in supporting weather related decision making. Presented at the 19th International Symposium on Aviation Psychology, May 10, 2017, Dayton, OH.

10. Ardoin, W.V., **Rodriguez Paras, C.,** Ferris, T.K., and Hallbeck, S (2016). Investigating nonvisual displays in overview monitoring: Designing to support monitoring operator efficiency and patient care. Presented at the Industrial & Systems Engineering Research Conference (ISERC). Anaheim, CA. May

11. Tippey, K. G., **Rodriquez Paras, C.,** & Ferris, T. K. (2016 May). General aviation weather alerting: evaluating display complexity and tactile alerts to support weather-related decision making. Presented at the Industrial and Systems Engineering Research Conference. Anaheim, CA. May

12. **Rodriguez-Paras, C.,** & Ferris, T.K. (2015). Using physiological measures to determine the cognitive redline. Presented at the Texas A&M Student Research Week. College Station, TX. March.

13. **Rodriguez-Paras, C.** (2013). Analyzing customer trends in a forwarding company. Presented at the Great Plains Honors Conference. West Texas A&M University. Amarillo, TX. March.

14. **Rodriguez-Paras, C.**, de la Cruz, A. (2013). Warehousing. Presented at the Texas A&M International University - Lamar Bruni Vergara/Guillermo Benavides Z. Student Conference. Laredo, TX. March.

15. **Rodriguez-Paras, C.**, (2012). Refrigeration and heat-pump systems. Presented at the Texas A&M International University - Lamar Bruni Vergara/Guillermo Benavides Z. Student Conference. Laredo, TX. April.

16. **Rodriguez-Paras, C.**, de la Fuente, A., & Pena, J. (2011). A Two-Mass/Spring/Damper System in our Everyday life. Presented at the Texas A&M International University – Department of Mathematics, Physics, and Engineering Fall Conference. Laredo, TX. November. **2nd place for undergraduate group presentation.**

17. **Rodriguez-Paras, C.** (2011). Depreciation methods in the automobile market. Presented at the Texas A&M International University – Department of Mathematics, Physics, and Engineering Fall Conference. Laredo, TX. November. **3rd place for undergraduate presentation.**

POSTERS

1. **Rodriguez-Paras, C.**, & Ferris, T. K. (2019 – Accepted). Application of active learning methodologies in interdisciplinary research groups. Transformational Teaching and Learning Conference (TTLC). College Station, TX.

2. Rao., A. H., Larsen, E., **Rodriguez-Paras, C.**, & Sasangohar, F. (2019 - Accepted). Designing for Veterans: A User-Centered Approach to Designing Continuous Monitoring Tools for Post-Traumatic Stress Disorder (PTSD). Proceedings of the Human Factors and Ergonomics Society Healthcare Symposium. Chicago, IL. March.

3. Moon, J., Williams, J., Sasangohar, F., Khanade, K., & **Rodriguez-Paras, C.** Veteran-centered design of a post-traumatic stress disorder (PTSD) tool: Qualitative analysis of interviews with veterans. Houston Human Factors and Ergonomics Society 15th Annual Symposium. April 2018.

4. **Rodriguez-Paras, C.**, Sasangohar, S. Assessing usability of a mobile health (mHealth) app for post-traumatic stress disorder (PTSD). (2017) International Society for Traumatic Stress Studies 33rd Annual Meeting. Chicago, IL. November.

5. **Rodriguez-Paras, C.**, Sasangohar, F. Utilizing heart rate variability as an indicator of post-traumatic stress disorder (ptsd). Houston Human Factors and Ergonomics Society 13th Annual Symposium. June 2016.

6. **Rodriguez-Paras, C.**, Sasangohar, F., Benzer, J., and Kum, H.C. (2017). Utilizing heart rate variability as an indicator of post-traumatic stress disorder (PTSD). Proceedings of the Human Factors and Ergonomics Society Healthcare Symposium. New Orleans, LA. March.

7. **Rodriguez-Paras, C.**, & Mehta, R. Functional near infrared spectroscopy (fNIRS) applications in human factors. (2016). Houston Human Factors and Ergonomics Society 12th Annual Symposium. May 2016

8. **Rodriguez-Paras, C.**, Benzer, J., Creech, S., Kum, H.C., and Sasangohar, F. (2016). Collaborative management of PTSD treatment through smartphone apps validated through patient-centered design. International Society for Traumatic Stress Studies 32nd Annual Meeting. Dallas, TX. November.

9. **Rodriguez-Paras, C.**, Yang, S., & Ferris, T. K. (2015). Using physiological measures to determine the cognitive redline. Houston Human Factors and Ergonomics Society 11th Annual Symposium. May.

TEACHING EXPERIENCE

Department of Engineering, Texas A&M International University   June 2018
Guest lecture
SENG 3320 – Engineering Modeling & Design   June 2018
Topic: "Human Factors Design Considerations"

Department of Industrial and Systems Engineering, Texas A&M University   September 2015 – Present
Guest lecture
ISEN 635 – Human Information Processing Systems   February 2019
Topic: "Gestalt Principles and Design Applications"

ISEN 434 – Human Error and Resilient System Design   February 2019
Topic: "Workload and Stress"

ISEN 330 – Human Systems Interaction   November 2018
Topic: "Thermal Stress"

ISEN 434 – Human Error and System Failure   September 2018
Topic: "Workload and Stress"

ISEN 330 – Human Systems Interaction   March 2018
Topic: "Workload and Stress"

ISEN 330 – Human Systems Interaction   March 2017
Topic: "Workload and Physical Work Capacity, Work-Rest Cycles"

ISEN 630 – Human Operator in Complex Systems   September 2017
Topic: "Necessary Requirements to Submit an IRB Application"

Graduate Teaching Assistant   September 2015 – Present
ISEN 434 – Human Error and Resilient System Design   January 2019 – May 2019
ISEN 330 – Human Systems Interactions   August 2018 – December 2018
ISEN 434 – Human Error and System Failure   August 2018 – December 2018
ISEN 631 – Cognitive Systems Engineering   January 2017 – May 2017
ISEN 489 – Occupational Biomechanics   January 2017 – May 2017
ISEN 630 – Human Operations in Complex Systems   September 2015 – December 2015

Department of Physics and Mathematics, Texas A&M International University September 2012 – May 2013
Undergraduate Lab Assistant   September 2012 – May 2013
PHYS 1102 – General Physics Lab II   January 2013 – May 2013
PHYS 1101 – General Physics Lab I   September 2012 – December 2012
ASTR 1110 – Principles of Astronomy Lab   September 2012 – May 2013

MENTORSHIP EXPERIENCE

Department of Industrial and Systems Engineering, Texas A&M University   August 2013 – Present
Human Factors and Cognitive Systems Lab (HF&CS)   September 2015 – Present
Lab Manager   August 2016 – Present
- Coordinated demo events for visitors and prospective undergrad and graduate students.
- Organize teams of undergraduate and junior graduate students to motivate and guide in their research projects.

Texas A&M University   August 2017 – Present
Aggie Leadership Research Program (ARLP)   May 2018 – Present
Graduate Mentor   May 2018 – Present
- Coach a team of interdisciplinary undergraduate students and guide them on their first research project.
- Encourage independent learning and the development of research skills.
- Provide professional development tools and techniques.

LEADERSHIP EXPERIENCE – PROFESSIONAL ORGANIZATIONS

Institute of Industrial and Systems Engineering (IISE) member   March 2016 – Present

Human Factors and Ergonomics Society (HFES)   October 2015 – Present
HFES Student Career Day Co-Chair   October 2017
- Prepared a round-table session between professionals and students.
- Moderated the event by introducing the professional speakers and guiding the event.

Society of Hispanic Professional Engineers (SHPE)   March 2011 – Present
Region V Graduate Representative (AL, AR, LA, MS, OK, TN, TX)   July 2013 – May 2014
- Supervised the graduate structure, and developed a strategic plan to increase communication and graduate student participation.
- Participated in regional conferences and leadership development conferences to increase interest in grad school.
- Supervised bi-monthly calls with prospective students to provide mentorship and guidance.

Region V Student Representative (AL, AR, LA, MS, OK, TN, TX)   July 2012 – June 2013
- Established and implemented a strategic plan for the region, developed and executed effective means of communication among the chapters, monitored their progress, and identified any areas that needed to be strengthened.
- Achieved regional goals, increased membership by 21% to over 1,100 student members.
- Planned and organized a Regional Leadership Retreat (LRL), Sub-Regional Outings (SRO), and Regional Leadership Development Conference (RLDC).
- Hosted monthly meetings with chapter leaders to oversee progress, and provided support in accomplishing their goals.

Region V Vice-Regional Student Representative (AL, MS & TN)   September 2011 – July 2012
- Supported the Pre-College track at the Regional Development Leadership Conference.
- Led bi-monthly conference calls with regional leaders to provide updates and assistance on chapter goals.

LEADERSHIP EXPERIENCE – STUDENT ORGANIZATIONS

Aggie Polo Club member   January 2019 - Present

Human Factors and Ergonomics Society (HFES) Student Chapter   October 2015 – Present
HFES TAMU President   June 2017 – August 2018
- Developed a strategic plan for the chapter, acknowledging areas of improvements and growth opportunities.
- Oversaw the accomplishment of chapter goals, as stated in the strategic plan by using measurable outcomes.
- Facilitated the establishment of new chapter activities, including a Lunch and Learn series, and Aggie Dinner at the national HFES conference.

HFES TAMU Finance Officer   October 2015 – May 2017
- Administered and managed the chapter's budget, and disbursement of funds for events.
- Budgeted the chapter's yearly allowance in accordance with the chapter's goals and objectives.

Society of Hispanic Professional Engineers (SHPE)   March 2011 – Present
TAMU SHPE Chapter Graduate Representative/Graduate Interest Chair   October 2013 – May 2014
- Promoted graduate school awareness in undergraduate students by providing news and information about on-campus events.
- Networked with other graduate students to plan how to increase awareness of research opportunities for undergrads.

TAMIU SHPE Chapter Secretary   May 2011 – May 2013
- Created and distributed meeting agendas, prepared necessary files and forms to keep the organization active.
- Notified members of upcoming meetings and events, maintaining records of chapter activities.
- Volunteered to build FTC Robotics Competitions fields with the chapter, visiting participating high schools to provide information about college and engineering degrees.

LEADERSHIP EXPERIENCE – ELECTED POSITIONS IN ACADEMIC ORGANIZATIONS

TAMIU Honor Council Student Co-Chair   August 2012 – May 2013
- Elected to serve as the co-chair for the University Honor Council alongside a faculty member.
- Listened to appeals due to alleged academic violations of students, discussed and solved the cases along faculty and student representatives.

TAMIU Honor Council Student Representative   May 2011 – May 2012
- Nominated and selected to serve as a hearing student member of the University Honor Council.
- Mediated in appeals due to alleged academic violations as pertains to the Student Code of Conduct in the Student Handbook.

Leadership TAMIU   August 2010 – May 2012
- Actively contributed to the program to develop leadership, public speaking, and communication skills.
- Provided guidance to juniors and seniors on how to take active roles and initiative in their student organizations

AWARDS, HONORS, AND CERTIFICATIONS

- Aggie Research Program Leader Certificate   December 2018
- Mentoring Undergraduate Researchers: A Workshop for Graduate Students   September 2018
- Texas A&M University Academy for Future Faculty (AFF) Certification   April 2018
- Institute of Industrial and Systems Engineering Graduate Research Award, 2nd place   May 2017
- HFES Council of Technical Groups Student Author Presentation Support Award ($500)   September 2016
- Medical Device Human Factors Introductory Workshop, Dr. Anthony Andre   May 2016

- Lamar Bruni Vergara Graduate Scholarship ($3,750)   May 2016 – Present
- Student Author Presentation Award by Council of Technical Groups (HFES 2015) ($500)   October 2015
- Houston-HFES Chapter Travel Award ($200)   October 2015
- Institute of Industrial Engineers Lean Manufacturing Green Belt Certification   March 2014
- Lamar Bruni Vergara Graduate Scholarship   ($2,000)   May 2013 – May 2014
- Johnson&Johnson Corporate Readiness Program   November 2012
- TAMIU Honors Program/Scholarship Recipient ($2,000)   August 2011 – May 2013
- TAMIU Pre-Engineering Scholarship ($2,000)   August 2011 – May 2013
- SHPE National Institute for Leadership Advancement, *Certified Chapter Leader*   August 2011
- TAMIU Dean's list   May 2009
- Texas A&M International University Scholarship Recipient ($8,000)   August 2008 – May 2012

ENGINEERING SKILLS

Statistics	IBM SPSS Statistics, Minitab, R Statistics, SAS
Qualitative Data Analysis	MaxQDA
Programming	R, Python, MATLAB, C++, SQL, VBA
Design/Graphics	AutoCAD, Adobe Photoshop, Illustrator, Corel Painter
Simulation	Simio, Arena
Databases	Microsoft Access, SQL Server 2008 R2
Relevant coursework	Cognitive psychology, cognitive systems engineering, design of experiments, engineering modeling and design, experimental psychology, management of engineering systems, systems thinking and analysis, design and analysis of industrial experiments, industrial case analysis, organizational psychology, human error and systems failure, human information processing, human factors engineering for aerospace environments

WORK EXPERIENCE

Exl Inc. Forwarding   June 2012 – August 2012
System Analyst and Database Intern

- Evaluated server options to expand the databases, and monitored the adequate functioning of the system using SQL Server.
- Forecasted clients' schedules and implemented mathematical models to improve company effectiveness.
- Forecasted the traffic throughput in order to determine the seasonality effects in customer demand.

LANGUAGES

- Proficient in reading, writing and speaking English and Spanish, intermediate proficiency in French.

"Physiological Measures of Workload in Multitasking Environments as Indicators of the Cognitive Redline"

In multitasking environments, several tasks vie for the limited attentional resources of the human operator. The threshold at which task demands exceed the available mental capacity, eliminating residual resources, and possibly resulting in a performance decrement is known as the cognitive redline of workload. While the redline is different for every person, understanding how to detect the threshold can aid in developing strategies for mental resource allocation. *There is a need to objectively identify patterns in cognitive workload to prevent the human from reaching their cognitive redline and incurring performance decrements.*

Methods to detect cognitive workload consist of either subjective or objective measures. Subjective measures provide insight into the human's perceived mental workload level. Data collection can occur concurrently with the task, or once the task is completed. If the data are collected simultaneously with the task, the task can be interrupted by the collection, costing additional mental resources. Subjective measures collected when the task is completed may lose accuracy due to memory decay, a process where short term memories fade. Performance-based measures are categorized as objective measures of workload. Performance usually degrades when the person experiences increasing cognitive workload, as more attentional resources are demanded. However, performance decrements can also be related to periods of low workload. Physiological measures are non-intrusive and respond to changes in workload, which can be used in estimating workload changes.

Physiological measures, such as heart rate, heart rate variability, and skin conductance reflect changes occurring in both branches of the autonomic nervous system, the sympathetic and parasympathetic nervous system. Changes in cognitive workload will be reflected as an increased sympathetic activity. However, other factors, such as stress, can also influence the sympathetic nervous system. These other factors tend to be present in heavy workload multitasking environments. While the cognitive redline has been researched using subjective and performance measures, it has been theorized that physiological measures may offer a more accurate estimate of the redline.

The current research aims to gather a better understanding of how high levels cognitive workload is reflected through changes in physiological measures, and to compare these changes with performance and subjective measures. The main research contributions include 1) explore how different physiological measures relate to different changes in workload levels related to the redline, 2) investigate the role of stress and startle as possible factors influencing high cognitive workload, 3) analyze physiological patterns to detect changes in workload, and 4) propose potential solutions as the subject of future work to capture the limited attentional resources to the main task to prevent performance decrements. Work has been started on addressing questions 1 and 2, with future work projected to investigate the role of physiological patterns.

The ability to detect periods of high sympathetic activity through patterns in physiological measures can provide new insight into the detection of the cognitive redline. Understanding how increased workload levels in multitasking environments could prevent performance decrements.