1. **Specific Objectives –** Key objectives that I intended to complete during the F99 phase of this grant, as outlined in my Activities Planned Under This Award include: 01) developing proficiency with the *nltools* library, 02) developing proficiency with generalized estimating equations (GEEs), 03) creating an open-source library relevant to designing and analyzing video fMRI studies, 04) produce 1 to 2 manuscripts per year, 05) presenting in lab meetings, 06) attending and presenting at conferences relevant to my interests (e.g., SANS, CCN, Flux), 07) mentor students through my lab and my programming organization, the Coding Outreach Group, 08) attending and teaching at a neuroscience summer fellowship program, 09) attending relevant area meetings and speaker series at my institution, 10) completing a developmental neuroscience literature review, 11) continuing regular meetings with my sponsorship team, and 12) identifying and selecting post-doctoral mentor(s).

2. **Major Activities -** I have made significant progress towards all of my goals during this funding period. We successfully completed data collection using the paradigm outlined within my F99 application. I have also completed the primary analyses, comparing brain-behavior synchrony in response to dynamic social and non-social sources of ambiguity, outlined within this application. In this process, I did develop proficiency with tools that I had aimed to learn as outlined in my *Activities Planned Under This Award*, including the *nltools* library (***Specific Objective 01***) and GEEs (***Specific Objective 02***), but also with techniques and tools that I had not anticipated needing, such as dynamic sliding windows and automated stimulus annotation software (*See* Section B.4 Training & Professional Development *and* Section F.2 Challenges & Delays *for more details*). In this process, the various programs that I have written to capture ratings concurrently with video stimuli, clean and reorganize this data, annotate this data, and analyze this data have been processed through a library development pipeline in anticipation of widespread public release for other neuroimaging researchers to use (***Specific Objective 03***). We also conducted analyses to identify differences in neural activity between subjects who viewed the stimulus while rating and not rating their evaluations, as we realized this in itself is currently a gap in the research that our study is well-equipped to resolve and could aid in further validating our novel paradigm. I had completed writing a manuscript to document these results, which I had intended to have available as a preprint prior to this RPPR, but I have fallen just short of that intended timeline (***Specific Objective 04***). Regardless, the results of both of these projects have been presented not only to both Dr. Helion's SAN Lab and Dr. Chein's CAB Lab (***Specific Objective 05***), but disseminated to broader audiences in various invited presentations and posters (*See* **Key Outcomes and Achievements**) (***Specific Objective 06*****).**

This project offered many opportunities for me to mentor other students in skills relevant to how to conduct fMRI experiments generally, but also as it results to naturalistic video fMRI specifically (*See* Section B.4 Training & Professional Development *for more details*) (***Specific Objective 07***). Descriptions of this project were included in my applications to both the Summer Institute for Social and Personality Psychology (SISSP) and Methods in Neuroscience at Dartmouth (MIND) Computational Summer School, which I had attended in 2023 (***Specific Objective 08***). Our department altered area meeting policy since my initial application such that there are no longer developmental-specific presentations and meetings. Instead, we hold monthly inter-area meetings in which social, developmental, and neuroscience faculty present on common themes that stretch across domains. I have attended all of these talks. I also adopted the role of colloquium coordinator and coordinated having outside speakers present at Temple, which I also attended (***Specific Objective 09***). I was not able to complete the developmental neuroscience literature review that I had intended (***Specific Objective 10***), as much of the time that I had dedicated to literature review was rerouted to solving methodological issues that we encountered (*See* Section F.2 Challenges & Delays). Lastly, I was able to maintain my outlined meeting schedule with my sponsorship team (***Specific Objective 11***), all of whom have been incredibly helpful as I have begun the process of identifying my post-doctoral mentor(s) (***Specific Objective 12***).

3. Major Findings, Developments, and Conclusions – There are several notable findings to report. After many discussions with other researchers at SANS and in response to my presentations, it became apparent that a common concern to our approach was that interoception would fundamentally alter the social or emotional response relative to non-rating. However, the limited extant behavioral research examining this question only provides evidence to the contrary and just a single neuroimaging study exists, which found differences only in attention and sensation between rating and completely passive viewing, which unfortunately confounds interoception and instructions to focus on a specific thing. Our study,

maintaining consistent instructions for raters and non-raters, was well equipped to determine how rating alters neural activity. We used both univariate and multivariate dynamic statistical techniques and Kong 2022 17-network schema to characterize which networks differentially activated in each condition. We did find greater activation of control, attention and salience networks while rating, suggesting greater error monitoring via top-down, voluntary attention for sustained periods of time. We also found greater activation of sensory and default mode networks while not rating, which may suggest broader, less-focused engagement and sensory processing. Importantly, in line with the previous study, we did not find evidence to suggest substantive differences in emotion or social evaluations with this data. We believe this may be valuable to dispel concerns around using continuous online ratings and outline circumstances in which they may be most useful within the manuscript.

Our primary analysis characterized neural responses to dynamic social and non-social ambiguity using a dynamic sliding window ISC approach. This revealed domain-specific neural activity. For social foci, synchronized ratings were predicted by synchrony in the dorsal anterior cingulate and anterior insulae, which likely indicates similarities in theory error detection (i.e, "Is Jonathan Guilty?") and social tracking processes, respectively. We found a negative association between precuneus synchrony and decision synchrony, suggesting heterogeneity in mentalizing. Only the inferior parietal lobe and motor regions were consistently activated across domains. Non-social uncertainty engaged a broader range of sensory and attention processing regions compared to social uncertainty. Interestingly, dorsolateral prefrontal cortex synchrony, often a hallmark of uncertainty processing, predicted synchronous non-social, but not social, evaluations, which may reflect a domain-specific role in processing uncertainty not reported in other studies, though more controlled analyses are needed to determine this, which we are in the process of conducting.

a. **Key Outcomes or Achievements** – There are many achievements to report within this period. As previously noted, I was awarded fellowships to both the SISSP and MIND summer programs, which allowed me allowed me to receive feedback on this project from like-minded individuals and expand my professional network. It is due to attending these events that I was invited to present my research to David March's lab at Florida State in October 2023, Ajay Satpute's lab at Northeastern University in December 2023, and Emily Finn's lab at Dartmouth College in February 2024. My research was further disseminated through poster presentations at the 2024 SPSP and SANS conferences, and a symposium at the 2024 APS conference, though the former and latter were regarding my naturalistic emotion regulation research and not this project specifically. However, my dissertation won a national decision research competition sponsored by the market research company *Ipsos,* which required presenting neuroscience to a primarily business audience and was a great exercise in effective science communication.

4. **Discussion of Stated Goals Not Met -** Despite substantial progress, there are goals yet to be achieved. I am currently awaiting approval from my co-authors for the manuscript comparing rating and non-rating video fMRI, after which I will publish the document on *PsyArXiv* and submit it to *Social Cognitive and Affective Neuroscience* for consideration. Following this, I will continue writing the manuscript summarizing our social and non-social contrast and we anticipate that this will be completed and submitted for review to a high-impact journal before the end of the year 2024 (***Specific Objective 04***). I also anticipate releasing the first public-ready version of my library before the next RPPR as well (***Specific Objective 03***). During the review of my F99 application, Reviewers 1 and 2 expressed concerns regarding the lack of a non-ambiguous social control within the initial paradigm. In our response to reviewers, we agreed to correct this in a follow-up study. We have just launched this study in July 2024. We plan to collect and analyze data from sixty (60) new subjects before the next RPPR. However, to maximize efficiency, the planned analytic pipeline has already been programmed and tested using what I have learned completing the first project. Though I have attended a neuroscience fellowship program, and I have mentored at one and was unable to do so this summer due to time conflicts. I plan to do so at MIND or Neurohackademy next year (***Specific Objective 08***). In conjunction with selecting my post-doctoral mentor(s) (***Specific Objective 12***), I will complete the intended developmental neuroscience literature review to better inform my lab selection (***Specific Objective 10***). In summary, this period has been highly productive, yielding significant findings and developments that contribute valuable insights to the scientific community. As we continue to address remaining objectives, we anticipate further impactful results that will advance our understanding of neural and behavioral responses to social and non-social ambiguity.