**SPONSOR STATEMENT**

1. **Research Support Available**

I will support the applicant’s research and training expenses via the following grants:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Role** | **Funding Source** | **Project Name** | **Dates** | **Total Costs** |
| co-I | NSF | Distortions in memory for aversive naturalistic events. | 2021 - 2025 | $999,864 |
| co-I | SRNDNA | Deconstructing How Event Memory Shapes Decision-Making in Older Adults | 01/01/2023 – 12/32/2024 | $24,000 |
| PI | NSF | CAREER: Naturalistic Social Network Learning | 2023 - 2025 | *Applied* |
| PI | R03DA058816 | Social Cognition as Self-Regulation: Identifying the Neural and Behavioral Bases of Relationship-Focused Regulatory Strategies | 2023 - 2024 | *Applied* |

If needed, I will support the applicant’s research and training expenses via the primary sponsor (Helion’s) startup fund (totaling over $200,000 across resources and imaging funds), which would provide support for the research/training plan proposed during the F99 period.

### Sponsor's/Co-Sponsor’s Previous Fellows/Trainees

Dr. Helion was an F32 recipient, and is currently the primary mentor for three pre-doctoral trainees, and am a co-mentor for one pre-doctoral trainee. The applicant (William Mitchell) is my (Helion) most senior pre-doctoral trainee. A representative list of current trainees is listed below:

Sponsor’s Predoctoral trainees:

1. William Mitchell, Cognition and Neuroscience area, Temple University
2. Virginia Ulichney, Social area, Temple University
3. Helen Schmidt, Social area, Temple University
4. Joy Ham (co-mentee), Cognition and Neuroscience area, Temple University

### Training Plan, Environment, and Research Facilities

### Primary sponsor: Dr. Helion. This training plan has been designed to allow the candidate, William Mitchell, to develop as an independent scientist. We have developed this plan with the goals of leveraging and extending upon William’s current strengths in programming and multivariate neuroimaging analyses, increasing his competence in computational analytic approaches, and transitioning to focusing his research program on developmental populations. William has strong coding and quantitative skills, but receiving the D-SPAN would allow him to gain additional training to develop more advanced social computational methods and to learn how to apply existing social and cognitive neuroscience models and theory to developmental populations. This will include (1) learning naturalistic neuroimaging analytic methods; (2) building a developmental data collection and analytic pipeline, and (3) professional skills development. This training, and the resulting research products, will make him competitive for postdoctoral and R1 faculty positions.

1. Gaining experience and understanding of naturalistic neuroimaging analytic methods

During his time as a doctoral student, William has focused on researching affective representation and regulation using both naturalistic neuroimaging (i.e., emotion-eliciting videos) and quasi-naturalistic emotional contexts (i.e., a real-world haunted house). Through these research projects, he has learned a variety of methodological and analytic approaches, including representational similarity analysis (RSA), behavioral measurement/self-report question design, and linear mixed modeling. William is currently collecting fMRI data for the uncertainty video paradigm outlined in the F99 section of the proposal in an adult sample. The preliminary results from this project (as outlined in the *Research Strategy*) indicate that the neural circuitry previously implicated in neuroimaging studies examining ambiguous decision-making also tracks ratings of outcome-based certainty. This is notable, as it connects ambiguity (a stimulus-dependent) feature with a metacognitive evaluation of one’s current state (level of uncertainty). This project served as the basis for William’s proposal, and given the previously identified developmental differences in decision-making under risk and uncertainty, he was particularly motivated to design a project where these processes could be explored across development.

However, the type of stimuli that William is interested in working with (naturalistic film stimuli, coupled with free recall) usually necessitates mastering complex methods, including functional hyperalignment (for aligning voxels across participants based on activity patterns), Hidden Markov Modeling (for modeling hidden states present in the stimulus and/or neural signal), and Latent Dirichlet Analysis (LDA) for topic modeling. Notably, given the relative novelty of the usage of this kind of stimuli in neuroimaging research, these methods are at the “cutting edge”, and are being continually extended and updated. The goal of this training program is to prepare William to make novel contributions in this exciting space, and to extend the use of some of these approaches into developmental contexts.

His theoretical training is summarized in *Table 1*:

|  |  |  |
| --- | --- | --- |
| Lab meetings and Journal Clubs | | |
| The SAN lab meeting | Weekly | Dr. Chelsea Helion |
| The CAB lab meeting | Weekly | Dr. Jason Chein |
| Social Psychology Seminar | Bi-weekly | Run by Social area faculty |
| National conferences | | |
| Social Affective Neuroscience Society | 1x / year | Social neuroscience national meeting |
| Conference on Cognitive Computational Neuroscience | 1x / year | Computational methods in neuroscience conference |
| FLUX Congress | 1x / year | Developmental neuroscience international meeting |
| Computational Workshops |  |  |
| Neuromatch Academy | On-demand | Virtual International |
| Summer Training Course in fMRI | August 2023 | University of Michigan |
| Methods in Neuroscience at Dartmouth | July 2023 | Dartmouth |
| The Kavli Summer Institute in Cognitive Neuroscience | July 2024 | UC Santa Barbara |

William will learn about the social, developmental, and computational aspects of his proposal through a combination of formal and informal training mechanisms. This will adequately fortify William’s theoretical and methodological foundations before he advances to his postdoctoral training.

2. Building a developmental data and analytic pipeline

William’s primary sponsor, Dr. Helion is an expert in social and affective neuroscience, and received extensive postdoctoral training in developmental neuroscience. Dr. Helion has published multiple papers that bridge social psychological and developmental theory with neuroscience methods, and in particular, has focused on studying these constructs using more naturalistic (i.e., field studies, quasi-naturalistic staged settings, videos/film) study designs. Her mentorship on this proposal will be critical for study design, participant recruitment, and also for providing guidance in post collection quantitative analyses. William’sco-sponsor, Dr. Chein, is an expert in developmental neuroscience, and the director of Temple’s TUBRIC Imaging facility. Dr. Chein has published multiple papers on executive control and decision-making in adolescent populations.

Building a developmental neuroscience research program is not easy. It involves establishing recruitment pipelines for children and families, stringent RCR and human subjects protection considerations, and specific study design and analytic considerations (e.g., “The Task B” problem (Church et al., 2010), vasculature differences, increased movement in developmental populations, spatial normalization considerations). Recruiting developmental participants requires both flexibility and creativity -- this can include setting up recruitment tables at events like recruiting at local street fairs, science museums, etc. Dr. Helion has experience in developmental data recruiting, and will help William build the infrastructure to complete his planned work. A critical part of developmental work is also making families feel involved in the data collection process and that they are part of a larger research community. William will receive training on how to best achieve this (e.g., through sending annual newsletters to participant families that summarize the research in a way that can be easily understood for all family members) – this type of engagement and community building is very important to keep children and families engaged in the work, and will prepare him to continue the same practices in his postdoctoral lab. Guidance from both his primary and co-sponsor will also be critical for building a developmental analytical research pipeline. Working with participants that are different ages can be challenging when it comes to optimizing/equating task performance, and also in keeping younger participants engaged while also minimizing head motion. Both Dr. Chein and Dr. Helion have experience collecting and analyzing developmental neuroimaging data, and will help William with these aspects of task design and data collection, to ensure that his data is collected efficiently, and is also the highest-possible quality.

3. Professional skills development

We propose a three-pronged approach for increasing William’s professional skills development. The first focuses on the development of research-related products (e.g., manuscripts, grants, analytic tool development). The second focuses on building a successful research team. The third focuses on collaboration development and networking.

Development of research-related products.

*Manuscripts.* William is already building a solid publication record given his early career stage. This includes a first-author developmental RSA paper, published in *SCAN* last year. This paper is a perfect example of William’s unique combination of interests (emotional experience in developmental) and methodological approach (multivariate neuroimaging analyses). William also has a first-author paper under review at *Emotion*, examining emotion regulation strategy usage in quasi-naturalistic contexts, and a meta-analysis of cognitive reappraisal methods that is currently in preparation. His planned dissertation research (the F99 portion of his proposal) builds on this program of research, and will be both novel (given the combination of a developmental population and naturalistic methods) and of high interest for both basic scientists and clinical practitioners given its multidisciplinary approach and its ramifications for better understanding the basis of anxiety-related symptomatology. The combination of cross-disciplinary theory and social computational methods will make him very competitive on the postdoctoral job market.

*Grants.* William has already completed a weekly professional development seminar as part of his formal coursework, and a course specifically focused on writing NIH fellowship grants (taught by our colleague Lauren Alloy). I (Helion) will also meet regularly with William to discuss grant preparation across multiple funding agencies/mechanisms. William and I (Helion) currently meet regularly (~1/week) to discuss his ongoing projects and identify relevant funding mechanisms.

*Analytic Tool development.* Given the relative newness of naturalistic neuroimaging, the field is in the midst of an exciting time in terms of the development of new methodological and analytical approaches for this complex, multimodal data. William is extremely passionate about contributing to the field in this way, as evidenced by his existing Github repositories, which contain publicly available code for implementing RSA in R (ezRSA), designing experiments using naturalistic video stimuli in Python (NaStiPy), and for processing naturalistic neuroimaging data in R (neuRotools). William has also done work on making his code and functions more accessible by building them within Shiny applications, which allow users without coding experience to use programmed tools through the use of graphical user interfaces. One of the training goals for the doctoral stage of William’s proposal is making his methods publicly available and easy to use for other researchers via the creation of Shiny apps for the analyses that he will be using for this project. This is part of William’s larger overarching commitment to open science practices.

Building a successful research team

*Informal training.* William and I (Helion) currently meet regularly (~1/week) to discuss his ongoing projects, how to mentor his undergraduate research team, and responsible conduct of research practices. William also attends the Social and Affective Neuroscience (SAN) Lab’s weekly lab meeting, which includes presenting his work, and giving feedback to his colleagues/peers. In lab meeting we discuss a variety of issues relevant to professional development, including (but not limited to) manuscript preparation, study design, neuroimaging and statistical analysis, and journal article review.

*Mentoring opportunities.* One of the areas where William excels is in his ability to mentor undergraduate research assistants and more junior graduate students. Indeed, William is often an “in demand” resource for individuals not only in his “home” lab (the SAN lab) but also across the department, for his coding and analytic abilities. Moreover, this effort has already been recognized at the departmental level, as William was received an award for being the “Mentor of the Year” from the department’s honors program. This reflects William’s clear commitment (and aptitude!) for mentoring students. William’s enthusiasm for training others is perhaps most evident in William’s leadership role in the department’s coding outreach group (COG). This involves actively collaborating with other students in the department to develop coding related programming for individuals at all levels (undergraduate, graduate, postdoc, faculty). William’s tutorials in this area have primarily focused upon analyzing data in R and Python and using Shiny applications to generate interactive and reactive data visualizations. The COG group has also made these workshops (including all recordings and code) available to the wider scientific community.

William has been a critical part of my lab mentoring team, particularly as it pertains to the department’s ongoing diversity-related initiatives. I (Helion) am the co-founder and co-director of the Building Research Independence by Developing Goals and hands-on Experience (BRIDGE) program, which aims to increase the participation of under-represented groups (as identified via NIH guidelines) by providing students with paid summer positions in research labs in Temple’s Psychology and Neuroscience department. William has co-mentored (with Helion) two undergraduate students, resulting in successful departmental poster presentations. This positive mentoring trajectory speaks to William’s talent as a mentor, and I would like to see him develop more independently in this space during the training period, by having students that he works with develop posters, presentations, and manuscripts for public dissemination at conferences and in journals.

*Collaboration development and networking*

As William moves into the next stage of his career, it will be important for him to build strong collaborations with researchers across multiple disciplines (e.g., developmental neuroscience, social neuroscience, affective neuroscience).

*Informal networking opportunities.* One of the most effective ways to do this is to give oral presentations at conferences and local lab meetings. William has already taken strong steps in this area, including co-chairing a symposium (and giving a talk) on contextual influences on emotional experience at the annual meeting of the American Psychological Society (APS). He also gave a talk at BJ Casey’s lab, a trailblazer in developmental neuroscience research. One goal for his remaining doctoral training is to apply to give a talk and/or organize a symposium at the Society for Affective Neuroscience and FLUX Congress (the annual meeting of the Society for Developmental Neuroscience). We will also leverage our (co-sponsors) professional networks through presenting in local lab meetings. The Philadelphia area is uniquely well suited for academic development given its proximity to multiple R1 universities both in Philadelphia proper, but also in New Jersey and the New York metropolitan area. William is a talented public speaker, and I am excited to see him continue to develop this skill.

*Formal collaboration development.* William will also more formally grow his professional network through participation in collaborative neuroimaging workshops (identified in the lower third of Table 1). These workshops generally involve team-based collaboration, and result in a final group project that leverages both the skillsets that individuals brought to the table independently, as well as the skills that they will have learned over the workshop period.

### 4. Environment and Research Facilities:

William’s co-sponsors have a history of collaboration, and are co-authors on an affective neuroscience paper. Dr. Chein is also the director of Temple’s TUBRIC imaging facility, a state-of-the-art facility for neuroimaging research. Dr. Chein and Dr. Helion informally meet regularly, and will develop a formal meeting schedule (along with William) as part of this proposal.

Temple University is an exciting and dynamic environment for conducting neuroscience research. The department is comprised of faculty across multiple subareas (Social, Developmental, Cognition & Neuroscience, and Clinical), and thus has a strong multidisciplinary focus. In particular, the Cognition & Neuroscience program (where William is a student) is a particularly collaborative group. Many faculty publish together (including the two sponsors on this application), and students are frequently co-mentored. One of Temple’s strengths as a program is its concentration in quantitative methods, which William has specialized in, and is taught by faculty across multiple sub areas. This has set William up well with the kind of advanced analytic knowledge and skill set that he will need to conduct the proposed research.

Specific available resources and equipment are detailed in the **Facilities and other Resources** and **Equipment** sections of this proposal. They are summarized below:

* A Siemens MAGNETOM Prisma 3-T whole-body 3T MRI scanner in the basement of Weiss Hall. This imaging center – TUBRIC -- was specifically designed to be welcoming to children and patient populations.
* A high-performance computing cluster called Owl’s Nest, to be used for computationally-demanding analyses.
* Site licenses and/or subscription access for essential software and database applications, including MATLAB, SPSS, SAS, RedHat, Qualtrics, Adobe Cloud Services, MS Office, etc.
* A library of commonly-used neuropsychological testing materials (e.g. WAIS, WMS, VOSP, etc.)

### D.Number of Fellows/Trainees to be Supervised During the Fellowship

Dr. Helion supervises 3.5 predoctoral students (including the applicant). Dr. Chein co-supervises 2 predoctoral students.

### E. Applicant's Qualifications and Potential for a Research Career

William is an exceptional scientist, and I can truly think of no student that would be more deserving of this fellowship. As reflected in his application, William is insightful, thoughtful, and has a brilliant sense of experimental design. His genuine enthusiasm for science is unparalleled, and I am certain that he will be a rising star in psychology and social neuroscience.William graduated *magna cum laude* from Loyola University Maryland, where he a recipient of both the Presidential and University scholarships. Prior to matriculating in our program, William worked as a research coordinator at both Johns Hopkins University and the Children’s Hospital of Philadelphia (CHOP; University of Pennsylvania). It is this latter experience, of conducting research with children and families in a clinical context, that particularly sets him up well for his future career as a developmental neuroscientist.

### While William entered the lab without a background in coding/programming, he immediately hit the ground running, and quickly became a valued departmental resource for his expertise. In ~3 short years William has developed an advanced set of technical skills in both quantitative methods (e.g., multilevel and linear mixed modeling) and multivariate neuroimaging methods. Part of William’s ability to quickly master a space that would take most much longer is undoubtedly due to his strong organizational skills. This was fostered in his earlier experiences at CHOP, where he oversaw database development and specimen collection of pediatric gastroenterology samples (i.e., enteroids), resulting in one of the largest databases of this type of tissue in the country. That William was entrusted with this important of a task, with clear clinical and research ramifications for many individuals across the country, speaks to his maturity, professionalism, and ability to successfully oversee complicated tasks with multiple moving parts. While the domain is quite different, this skillset will undoubtedly serve him well as he collects the data outlined in this proposal.

### Since joining the lab, William has developed a multitude of skills that will be critical for completing the proposed research. This includes multivariate neuroimaging analytic approaches (RSA), time series data analysis, physiological data collection, structural and functional fMRI data collection, and advanced quantitative methods. William recently published a first-author paper that used RSA to examine neural similarity in children and adults as they viewed positive, negative, and neutral film clips. He found that children exhibited higher levels of pattern similarity in the ventromedial prefrontal cortex (vmPFC) relative to the amygdala and ventral striatum. Notably, this pattern was not observed in adults, who showed comparatively low (relative to children) levels of pattern similarity across all three regions. This may be indicative of developmental differences in appraisals of emotional meaning for complex affective stimuli. For this work, William received a SANS Poster Award and a Best Poster Award from the Society for Personality and Social Psychology’s Emotion preconference.

### William recently submitted another first-author manuscript to *Emotion* examining emotion regulation strategy usage in high-intensity emotional contexts. Prior research had found an association between emotional intensity and emotion regulation strategy choice, such that individuals prefer to engage in low-effort strategies (e.g., distraction) when regulating emotion towards high-intensity emotional stimuli and prefer high-effort strategies (e.g., reappraisal) when regulating emotion towards low-intensity emotional stimuli. William had hypothesized that this pattern may reflect how the association has typically been tested (i.e., static or decontextualized images or auditory sounds) in the lab rather than being a more general pattern in real-world emotional contexts. Leveraging a quasi-naturalistic and high-intensity affective environment (a local haunted house during Halloween), William found that this previously identified pattern did *not* reflect patterns of recalled strategy usage. Taken together, this project speaks to William’s immense creativity as a researcher, and his unique ability to link extant theory to complex naturalistic study contexts.

### During his third year, William became very interested in examining the emotional ramifications of uncertainty, and identifying the extent to which is can be regulated effectively. The work he has done in this space has served as the behavioral and neural foundations for this proposal. He ran a behavioral pilot study that served as the basis for his second aim for this proposal, and has begun to collect preliminary neuroimaging data that has served as the basis for the first aim. In this process, William has learned how to code (and troubleshoot) tasks in Python, reached level 3 training in order to operate the scanner to collect data, and has begun to prepare the behavioral work for publication. As he begins to transition to developmental data collection for the proposed research, both my (Helion) and co-sponsor Chein’s background in developmental fMRI data collection will be incredibly valuable. In addition, I (Helion) have experience in advanced quantitative methodology, and will help William develop his skills in this area. Although William his highly advanced at this stage, I should note that he has never actually collected developmental neuroimaging data (a key component of this proposal) nor has he done some of the more advanced statistical modeling (e.g., Hidden Markov Modeling) that his research approach will require. Thus, receiving the D-SPAN training would be an invaluable experience for him, and more firmly set him on a successful path as an independent researcher.

### William is an excellent candidate for the D-SPAN program, and has an incredibly strong analytic skill set, work ethic, and degree of intellectual aptitude and creativity. He will undoubtedly be an innovative and successful PI of his own lab one day, who will create a productive and inclusive lab. This prediction is bolstered both the diversity of awards that he has already received (for both research *and* mentoring) in his young career. William is one of the most promising students that I have ever worked with, and is exactly the kind of researcher that we as a field should be investing in. William is someone who is unfailingly hard-working, incredibly innovative and brilliant, and is the ideal recipient for the D-SPAN fellowship. He has my absolute highest recommendation and full support.