Statement of Purpose – Kaia Newman (User ID/email: kaian@umich.edu)

The crossword puzzle is one of my favorite art forms and a good analog for the process of academic research. Constructing crosswords requires one to be *creative* with wordplay and how it can be physically represented on a 15x15 grid. For one crossword, I came up with the theme "Apple Turnover," where common apple varieties were turned over, or reversed, and hidden within larger fills (e.g., "GALA" becoming "ST<u>ALAG</u>MITES"). I've had setbacks when constructing a crossword with collaborators, such as having too many black squares to be published, which required me to be *flexible*. In resolving these conflicts with others, I had to be *diplomatic*. I submitted this crossword to the *New York Times*, much like one might submit a paper for peer review.

Last year, I was offered a position as an undergraduate researcher in Professor Westley Weimer's lab and began brainstorming on potential projects based on previous work in the lab. After collaborating on experimental design with Dr. Brittany Johnson and Ph.D. candidate Madeline Endres, I pursued a semi-structured interview study on 26 developers that use psychoactive substances. We examined developers' use patterns and motivations to identify implications for drug culture and policy in software. This study resulted in a publication accepted to ICSE 2023, a top-tier venue, where I was the first author.

In this project, my *creativity* was essential. While prior work focused on recreational users, I was more curious about psychoactive substances in the context of mental health-related symptoms during programming, especially from the neurodevelopmental disorder ADHD. Because I was more concerned with how software developers navigate their symptoms at work, I pushed for the definition of the substances we were including as part of our paper to be broadened to cover prescription medications. My initiative on this was important to our study, as 15/26 of our final participants were diagnosed with ADHD and were prescribed stimulant medications. In the final agreed-upon code book that I helped make, 25% of the codes were related to mental health.

This study required me to be *flexible*. Participants were reluctant to be recruited for a study about drugs, but I wanted to recruit professional software developers if possible. I started recruiting on online forums, creating forum-specific posts based on my interactions with sub-group moderators and their communities' concerns. For example, the `r/microdosing` moderators directed me to their Study Inclusion Guidelines and asked about how we were maintaining the privacy of our participants. In a 25-message chain, I explained our data management plan, verified our lab account, and restructured the post. They then incorporated it into their studies list. My efforts generated 121 prescreening survey responses. My ability to be *flexible* and *resilient* when interacting with these moderators allowed us to recruit over half of our participants for this study.

When I gave our first interview, I gradually realized that the participant was a scammer. I ended the meeting and we were left to regroup. We looked at the prescreening responses and began to notice inconsistencies in most other responses. We needed a way to determine from the prescreening form which answers were likely to be legitimate. I could have felt defeated after an experience like that. Instead, I handled scammers by refactoring the prescreening survey to more easily betray when responses were disingenuous. I also looked at side-channel information such as how many responses there were in one time period or whether names were repeated in the responses. Throughout the course of the research, I was *flexible* when the project created obstacles for us.

During the analysis of the interview transcripts, resolving thematic code, or categorization, conflicts between annotators was intensive and required a lot of *diplomacy.* As we analyzed over 160,000 words, we needed to first come up with relevant themes that would generalize well to participants' words and then agree on which sentences exemplified these themes. We had to repeatedly meet in groups of two or three over the course of months to merge our coded documents by hand. I explained my perspective behind each code we were in conflict on, but listened to others' ideas and acquiesced when appropriate.

When in conflict, we used our research questions as our guide to come to an agreement. I merged around 1400 codes with others (20/26 transcripts), 77% of the total resolved codes. The balance I struck meant that we never had an irreconcilable conflict when merging transcripts. This skill of *diplomacy* was useful when writing the paper. After we had determined major themes, I sorted them into candidate paper organizations to present these options to two of the other authors. I refined these themes and created a color-coding system to do this. When I presented two of these structures, the other authors adopted my system with ease and made their own comments on which "color" a certain theme should be. The others accepted the structure that I was able to find the most support for using our research questions.

My ability to form *creative* connections extends beyond my research. While learning about the Cook-Levin Theorem during a lab discussion, I related the boolean satisfiability problem to the problem of branch coverage in software testing. I employed my usual approach of comparing a new problem to what I know about others, despite having no experience with complexity analysis. I think that finding the intersection of two ideas by asking comparative questions is often how useful research questions crop up, and I use this approach to understand new topics. I am also *brave* enough to posit these connections to an audience, even if I'm unsure. At lab lunches with ~10 people, I am usually the first person to take a shot at a question, unless I'm deliberately holding back to let someone else speak. I have seen repeatedly that it benefits me to try and fail fast, so I put myself in unfamiliar situations to gain experience with them.

In my research, I generated questions that I am still investigating now. These questions include but are not limited to, "How can we more effectively accommodate neurodivergent students in computer science without losing efficacy for an 'average' student?" or "To what degree do computer scientists value productivity over work quality, and what effects does this culture have on the software they produce and the research they do?" As university efforts help to admit more students with cognitive disabilities and disorders, professors rarely receive adequate training to handle the influx of needed accommodations or students in crisis. Similarly, communications between neurodivergent and neurotypical software developers can be hindered by affect misreads. This desire to help software engineers' wellbeing and productivity, along with my desire to be a professor, motivates me to pursue graduate school.

Because I have navigated struggles in my own mental health (including ADHD) while being a computer scientist, I have insights on the many needs of programmers with neurodevelopmental or mood disorders. I have also seen the impact well-maintained, explainable, and efficient code can have on wellbeing from working in a software engineering lab focused on human cognition. Accordingly, I am interested in doing further research at the intersection of **software engineering, computing education, cognition,** and **accessibility.** My experience is with software engineering human studies, interdisciplinary research, and qualitative methods. In grad school, I hope to continue to use these skills as well as explore quantitative methods, systems work, and teaching. My goal after my Ph.D. is to become a university professor, so I will need research, teaching, and mentoring experience to succeed. From my conversations with current students and faculty at CMU, S3D has a collaborative, systems-based environment that I would succeed in. Three professors that stand out to me the most as potential advisors are **Andrew Begel** (software for accessibility, computing education), **Bogdan Vasilescu** (socio-technical systems in OSS), and **Claire Le Goues** (APR interfaces for developers, understanding developer practices). I had the chance to meet Dr. Begel and Dr. Le Goues at the Automated Software Engineering conference this year and I was very compelled by their research and communication styles. Dr. Begel's work on constructing tools to aid communications between autistic and neurotypical developers and Dr. Le Goues's lab's work on interfaces that improve consistency when converting between programming languages are both areas I would be prepared and willing to do research in. As for Dr. Vasilescu, I believe that my experience with qualitative methods and my value of integrating research in software with software in practice would apply well to his research on toxicity, multitasking, diversity, burnout, etc. in open-source software.