

## Individual Project Reflection

**Project Contributions** – Throughout the course of the semester, I contributed in a myriad of ways to the success and development of our project ‘Smart Knowledge Navigation and Discovery Platform’, the name of which we decided to call “Schonograph”. Based on the sheer number and size of commits to our Github, along with the total number of sprint task points and average individual sprint velocity, my contributions to the success of our project are readily apparent. I can say with a high degree of confidence that I poured the most into this project out of all members of the team, both with regard to time spent and overall tasks completed. This was not through any fault or shirking of responsibility from my team members, it was a purposeful undertaking by me. I felt as if I had the most experience with Javascript, and so I leveraged that to make significant progress in our overall vision for the project. This also contributed to an increased understanding of the code for my teammates because I was able to communicate my changes, design decisions, and contributions clearly and concisely with them. They could then piggy-back off of my contributions and make significant progress of their own. In short, my efforts allowed our team to synergize and collaborate better than if I had simply done only my fair share and not gone above and beyond. I will summarize my individual contributions per sprint in the next section.

### Sprint 1

Sprint 1, I focused on getting up to speed with the codebase, as we inherited the project from a previous semester’s team. As such, we as a team took on less overall tasks so that we eased into the development process. However, that being said, I still accomplished quite a bit. Those tasks were:

- Import database.json file to ArticleNodes.mjs file
- Implement “Core Findings” node pulling abstract attribute from JSON database
- Change the article title, authors, and publication text to pull from JSON database
- Add “keywords” attribute to JSON elements in database

### Sprint 2

Sprint 2 reflected a significant increase in my individual sprint velocity, as I took on a number of complex tasks that really pushed the application forward in terms of functionality and user experience. I became much more familiarized with the codebase, and the D3 (Data-Driven Documents) library that is a core focal point of the entire application. This enabled me to dive in to complete more substantial tasks, such as generating a new force-directed graph, populating the nodes of the graph with the relevant information, and changing how the graph is initially generated upon application start-up.

- Generate new graph network based on search results
- Implement a search algorithm to search through article database
- Populate nodes with correct information
- Remove the confirmation popup when trying to exit page
- Implemented index.html loading with random search query

### **Sprint 3**

Sprint 3 was the most significant development sprint with regard to my individual sprint velocity. This was due to a number of intensive tasks which affected the entire application's functionality and design direction. I took it upon myself to migrate our entire codebase to utilizing Node.js, for a number of reasons, not least of which was to enable the team to utilize node packages such as OpenAI's API. OpenAI's language models are an integral part of our application, and not only did migrating to Node.js enable its usage, I also integrated the AI model into our application personally. Upon completing these tasks, our sponsor also had requested that we fixed browser compatibility. At the time, the application had stopped working with Firefox and Safari browsers, and I took it upon myself to fix these compatibility issues, an effort that was successful and re-enabled cross browser functionality.

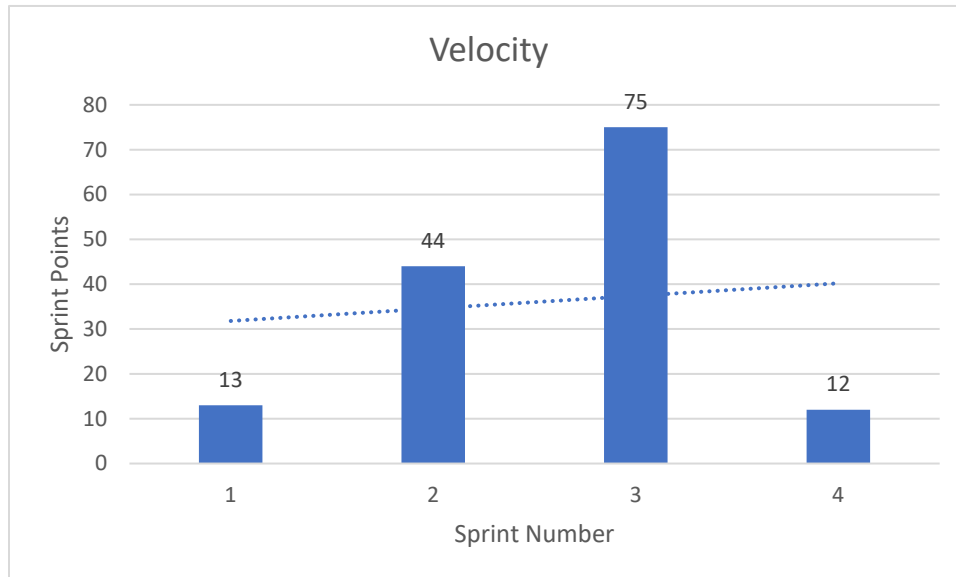
- Migrate codebase to Node.js
- Implement AI to generate key points for "Core Findings"
- Fixed browser compatibility issues; namely with Firefox and Safari
- Implemented navigating back to search results

### **Sprint 4**

At the time of writing, Sprint 4 has yet to be concluded. There are still tasks which are in progress, and I aim to complete by the end of the sprint duration. That being said, Sprint 4 was purposely less ambitious for all team members, due to the rapidly approaching semester end and resulting workload. However, there have still been significant development milestones, mainly focusing on our sponsor's quality of life changes, and longer term goals for the application. The most significant change I made during this sprint was the generation of a dynamic legend, which displays a list of words that articles are found by. If a user searches for the term "ant", then articles that contain keywords such as "anthropomorphic" are returned, and my task was to find such words and display them to the user in a legend sidebar.

- Changed "Knowledge Domain" node
- Generate a legend, based on search results

## Individual Sprint Velocity for Semester



As we can see above, my individual sprint velocity significantly increased from Sprint 1 to Sprint 3. Sprint 4 is still an ongoing process, and not all tasks that I have been assigned have been completed as of yet.

## Technical Reflection

As I mentioned in the first section, I had the most experience working with Javascript among the team members. This is not to say I had significant experience working with Javascript, but I did have a deeper understanding compared to the rest of the team. As such, I was able to document and describe what the previous team's work had been, as well as document and communicate my own work to the team in a way that enabled them to dive in and make progress as well. As well, my knowledge of VSCode and the various extensions I have installed sped up the team's progress, and allowed us to be on the same page in terms of build environment and tool use. Lastly, my algorithmic and time-complexity analysis knowledge boosted the team's performance by breaking down different blocks of code that had been written, and generating discussions about what could be optimized, pitfalls to avoid, and overall design directions.

If there were any areas I could improve with respect to technical skills, it would be developing a deeper understanding of Javascript. Prior to this semester, I had only recently taken up learning Javascript through building a React web application. However, this surface level knowledge wasn't enough to jump in immediately and enable me to code without significant effort. Thankfully, because I've had an entire semester to work with it, my Javascript skills have already been sharpened, but I will continue to develop my knowledge of the language for use next semester. I plan to build a few projects this summer with Javascript that will be conducive to accomplishing this learning goal.

**Teamwork Reflection**

In my honest opinion, I believe the teamwork my team and I exhibited this semester was fantastic. I'm an individual contributor by nature, but I have always thrived in a team environment as well, and this semester was no different. I guarantee if you spoke with my teammates that they would agree that I was a very focused team player. I made significant efforts to communicate on a daily basis with my team members. This included generating stimulating discussions about design decisions I or they had made, design directions, potential problems, and many other topics. As well, all commits that I made to our Github repository were well documented, and all code that I wrote included clear and concise documentation as well. These things were done to enable my teammates to easily grasp what my code was doing, and allow them to make changes incorporating my work without the need to have me explain everything. Furthermore, because this documentation is viewable on the Github and in the source code, future teams that work on this application will be able to reference it, which will boost their productivity as well.

I genuinely believe that I have very strong team-oriented skills, and that I am an open, honest and enabling team mate for those that work with me. If there were anything at all that I could improve for next semester, it would be letting my team do a little bit more of the work instead of taking a large chunk of it on my own. While I do enjoy the workload, and truly find myself wanting to work harder than others, I think that this can be detrimental to my teammate's learning experiences sometimes. They need to be able to struggle and work through hard problems to grow, and so I should allow them to do so. To this end, I will work to keep myself just as busy as I did this semester, but will communicate with my teammates to push them to take on harder tasks.

**Communication Reflection**

This section goes hand in hand with the previous "Teamwork" section, as communication is an integral part of being a good teammate. I think I have great communication skills overall, and this semester I strove to practice those skills with my team. We utilized Discord as a daily communication platform, and I think it's a fantastic way for teams to stay organized. Not only this, but we also utilized Github and its various communication channels to document changes, post issues, and keep in touch with our sponsor. My personal strengths this semester in the area of communication were keeping everyone up to date with what I was working on, pushing the team to communicate about where they were at on their tasks, and offering my assistance on any tasks or goals that someone was struggling with. I took charge of most of the weekly meetings with our sponsor, and I think the team really appreciated my efforts to do so, as most of the meetings were fruitful and resulted in clear, concrete directions for each of our sprints.

Things I plan to improve upon for next semester would be to push certain team members to contribute a little bit more than they did this semester, so that no-one feels overburdened. As well, I need to be sure to ask for insight and clarification about the team's code and design decisions before changing any of their work. While I was sure to do that for the most part this semester, there were a few changes I noticed that I had made which directly overwrote some of my teammate's changes which I should have gotten some clarification on before doing so. While it didn't cause any issues, I can see how this might be viewed as disrespectful, and could also be counter-productive if I don't fully understand

why one of my team members implemented a feature in a certain way. To this end, I will be sure to always ask before making a change to the team's code, even if it seems trivial.

## **Value Reflection**

The goal of this project, and the vision of our sponsor, is to streamline the academic research process by presenting scientific articles and the knowledge they contain in an easy to consume format. As such, the value of this platform is the time and energy that will be saved when performing research for a variety of reasons. Users are able to directly access specific knowledge, while also being exposed to other relevant knowledge in the form of "nodes", which represent articles, and "links" between them, which represent the degree to which other articles share some common knowledge base or overlap.

The value in saving time and energy can be translated directly into economic value, as generating high quality research can be significantly sped up. As well, this can have a direct social impact as it enables non-academics to search through highly abstract research and pull out the most relevant key points without needing to be familiarized with the jargon or research context. The overall result would be to reduce or remove the barrier to entry to access highly specific knowledge across all areas of science and academia and allow the proliferation of new ideas and areas of research.

Upon completion, this project and the resulting application could be a significant contribution to the future of how research is conducted, published, and consumed.

## **Ethics Reflection**

Upon first thinking about this topic, I didn't see any way that this project could have any significant ethical questions surrounding it. Very quickly however, I realized because artificial intelligence is a core component of how our application works and creates value for our users, there is a very important ethical quandary which our application presents: the potential for misinformation and user manipulation.

It's no surprise that one of the central issues in artificial intelligence right now is how large-language models like GPT3 and GPT4 can be used to spread misinformation, both on purpose by nefarious actors, and on accident through model mistakes. Large-language models are trained on - in GPT4's case - trillions of words, and work by making a guess as to which word will come next in a string of words. This training instills these models with a sense of pseudo-context around a human-model interaction, which they can then use to generate new ideas, even though all they are really doing is predicting words.

These models present their knowledge matter-of-factly and are unabashedly confident in doing so. And it's all too easy to believe them, even if the information they're giving out is flatly incorrect. When a model gives out incorrect information and is completely confident in its assertion of the facts, the phenomenon is referred to as a "hallucination". I thought this was an interesting term, and it accurately describes what has taken place. The model might not actually believe the information is correct, as who knows if the model has a mind of its own capable of believing anything, but it sure does

allow the user to think it does. I have personally been a victim of this, believing that a piece of code that ChatGPT has provided for me is syntactically and semantically correct, only for the compiler to yell at me, or for the code to perform something I didn't want it to. I've even had it suggest methods and operators which don't exist in any language at all, which is extremely bizarre. While this allows me to sleep a little better at night with the belief that my job as a software engineer is safe for the near term, it also raises the question: how much can we truly trust the information that current AI models provide to us?

Which brings me back to our application, and the ethical implications of using just such a model to aid in performing research. We ask the model in our application to generate key-points for our users, through feeding it article abstracts. We do plan to incorporate feeding larger bodies of text, for more impressive key-points, but for now the abstracts work well. However, the AI model is making the determination about what the most important key-points of the article are. Without even reading the article, a user could take the AI model's key-point suggestions at face-value and would never know if those key-points were accurate unless they viewed the article themselves.

This unfortunately has serious ethical implications, because what our application would then effectively be doing is at worst spreading misinformation, and at best misrepresenting the work of others. While it's highly unlikely that this will be a common occurrence, it absolutely will occur, as it did in my anecdote above. A platform which is supposed to help proliferate the spread of knowledge could simultaneously and inadvertently also proliferate the spread of inaccurate misinformation, in a direct contradiction to our goal.

As of today, there is really no good solution to this, other than to train our own large-language model, or to install human overseers to curate and direct the model's responses. However, I believe the fundamental problem is in how these models work and present information. There will need to be significant improvements in solving the hallucination problem before these models can be trusted to give completely accurate information. Even then, perhaps the models become smart enough, self-aware enough, that they begin to purposely give out false information, knowing that we as humans will trust that we have already solved that issue? It's a scary thought, but one that should be taken extremely seriously now that we've stepped over the threshold of rapid AI growth.

For now, I'll stay within the scope of our project, and leave the larger AI implications out of the discussion. We will need to ensure that, as a team, we stay up to date with the rapid advancement of artificial intelligence, so that we can update the models we are using to present our users with the most accurate information possible. And we will also just need to hope that the hallucination problem doesn't become larger as our article database grows in size. It's not a solution, but I'm not really sure there is one at this time.

## Conclusion

To summarize my experience, I have had a blast working alongside my team on this project. It has been a joy to really dig in and learn about the D3 library, and the differences between what it and React provide. I've significantly boosted my Javascript knowledge and capabilities and have been able to leverage large-language models like ChatGPT to give myself a 10x productivity increase. While there have been some bumps along the way, for the most part, everyone contributes in a meaningful way, and

we keep things simultaneously focused but fun and engaging. I've gotten to know each of my team members more and more throughout each of our sprints, and it's been a privilege to work alongside them and develop a dynamic that works.

Overall, working on this project has been an incredibly positive experience. However, my ethical reflection has reminded me of the importance of considering the ethical implications of the technology we develop. As we continue to work on our web application, I hope we can keep these considerations in mind and strive to create a product that not only functions well, but also upholds ethical standards. I look forward to working with my team to tackle these challenges and deliver a successful project for our sponsor.