Analyzing Arrival Through the Lens of NLP

In Arrival, one of the biggest challenges the characters face is figuring out how to communicate with an alien species that has no shared language or reference points with humans. The aliens, called heptapods, use a completely unfamiliar system of circular symbols, where each logogram represents a full idea or sentence. This creates major problems when it comes to interpretation. From what we’ve learned in class, this is similar to how NLP systems struggle with ambiguity and context. For example, in the movie, the heptapods’ word for “weapon” could also mean “tool” or “technology,” and that misunderstanding nearly causes a war. It’s a perfect example of how difficult it is to translate language without full understanding, especially when there’s no shared culture or intent. The film also highlights issues like idioms and sarcasm, which are difficult to explain in a literal way. In NLP, these are still common problems, because machines can recognize patterns in text but don’t always grasp what those patterns mean in real-world situations.

At the beginning of the movie, the scientists try to use a very structured, rule-based method of communication. They treat the alien language like something that can be decoded through grammar and formal rules. That mirrors early approaches to NLP, like using manually crafted rules and dictionaries. As they realize that doesn’t work, they shift to something more like what we see in modern NLP models, where meaning is learned from repeated exposure and context. Louise, the main character, builds understanding over time by watching how the heptapods respond in different situations. She starts with basic words, like “human” and “Ian,” and builds a shared vocabulary. This reminded me of tokenization and embedding, since they basically have to create a kind of feature space for the alien logograms. The scientists eventually recognize patterns in the alien writing, and they treat the symbols almost like word embeddings that carry meaning based on their shape and relationship to other symbols. But the biggest twist is that the heptapods don’t communicate in a linear way. They present their entire message at once, which challenges the usual way NLP models handle sequences. Traditional RNNs depend on the order of words and context built up one step at a time, but that wouldn’t work here.

The movie takes this even further by showing that Louise, as she becomes fluent in the alien language, begins to experience time differently. She starts having visions of events that haven’t happened yet, and this suggests that the language actually changes the way she thinks. That idea connects to NLP because it reminds us that meaning and memory are deeply tied together. In our class, we talked about how RNNs are designed to hold on to previous inputs so that they can make better predictions. Louise’s understanding grows step by step, just like how an RNN updates its internal state after each new word. But the movie also pushes us to think beyond that. Instead of learning from just the last few words, Louise starts to process ideas in a non-linear way, which is closer to how attention mechanisms work in newer models like Transformers. Attention lets a model look at the whole input, not just the most recent part, which is similar to how Louise starts to see entire outcomes in advance.

For me, the biggest takeaway is that understanding language isn’t just about breaking it into pieces and feeding it into a model. It’s about reasoning, inference, and seeing the bigger picture. The movie shows that language can shape our entire view of the world. In terms of NLP, that means we need models that can go beyond just text and start to make connections between language, thought, and context. I think the heptapod language is a good metaphor for how future NLP systems might need to work. Instead of relying only on sequence and pattern, we might need systems that can deal with meaning in a more global or circular way. That could include better memory, reasoning, and even handling non-linear inputs. Watching Arrival made me think about how much progress NLP has made, but also how much more there is to understand when it comes to true language comprehension.

Overall, this assignment helped me connect what we’ve learned in class to something more creative and real. Seeing how language and sequence modeling play out in a story made the technical concepts easier to relate to. It also reminded me that language isn’t just a system, it’s something that shapes how we think and how we understand time, people, and meaning. Arrival shows that communication is more than just exchanging symbols, and I think that’s a lesson that applies to NLP too. The future of deep learning for language might not just be about more data or better algorithms, but about understanding how humans think in the first place.