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Q1 Knowledge Representation
1(a) When representing the expression “I put my hand on its shoulder” and “The Johnsons across the street bought a new robot” using frames:

First Sentence Frame

Put	
Subject	I
What	Hand
Who	‘Its’ (Henry)
Where	Shoulder

Second Sentence Frame

Bought	
Item	Robot
Condition	New
Who	
Cost	
Where	
When	
Why	

Family	
Who	Johnsons
Location	Across the street

Family Member Count	

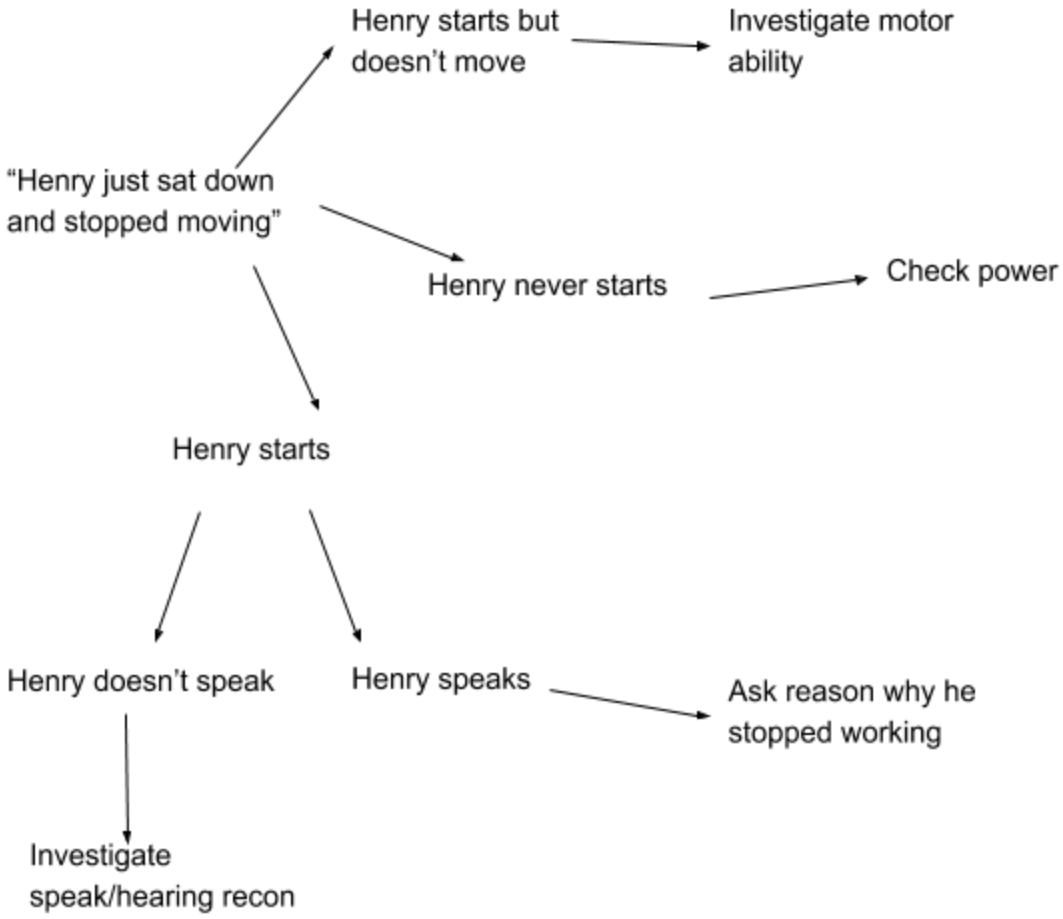
The first frame is derived from the verb ‘put’ which is broken down into actions regarding the subject, what, who and where. The second frame gets broken down into two frames. One frame for the verb ‘to buy (bought)’’ and one for the family. The family is broken down because family can be broken down into many more descriptions.

1(b) The two statements can be compared to propositional logic simply because the second statement is built off of the first statement. When analyzing the first statement, ‘I put my hand on its shoulder’ implies that we do not know whos shoulder or why we put a hand on its shoulder. However, it’s not until one analyzes the second statement that they can infer and deduct that ‘its’ simply a robot and the reason for putting the hand is because the neighbors ‘bought a new robot’.

1(c) The idea of using frames instead of basic logic is simply because of the frames nature. Frames act as a specific data structure to hold your knowledge base. It works to divide the knowledge into substructures by separating out relational situations. When using propositional logic over frames it comes with added benefit by analyzing more than one statement to make logical deductions where as frames simply act more as a full data structure.

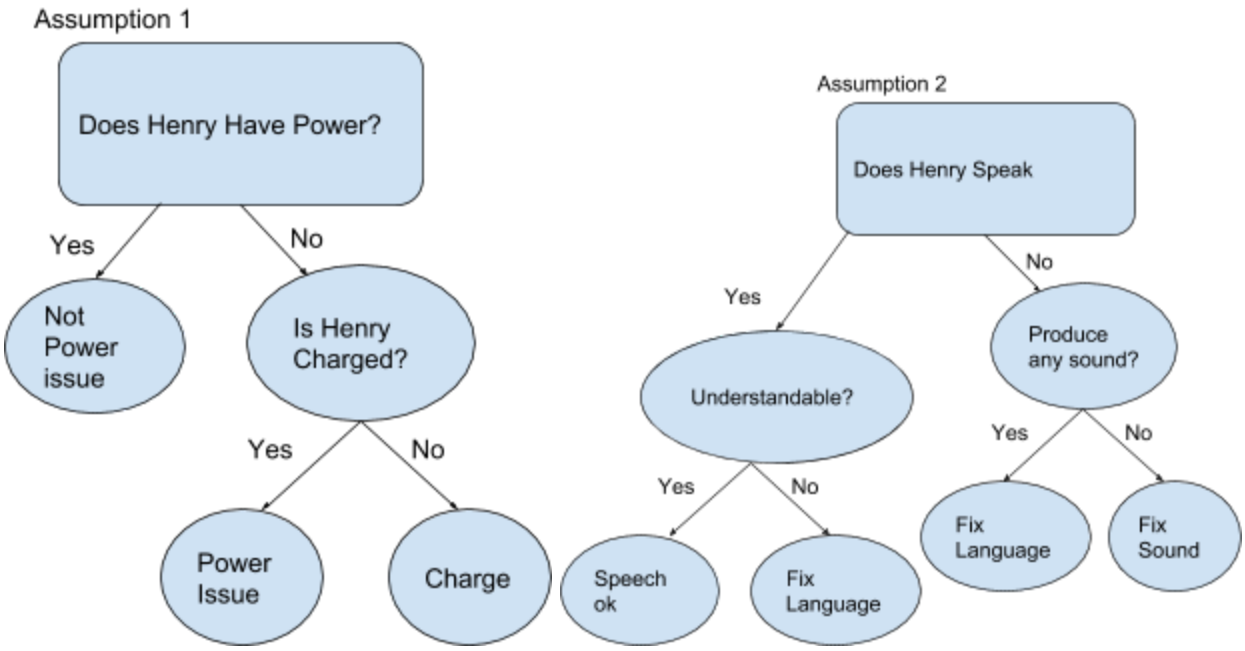
Q2: Reason Methods

2(a) Figure below shows production system architecture with actions and rules.



The interesting aspect of this architecture is that it could even be expanded in more depth from the image above. When the action of Henry doesn't speak, this could be broken down into finding out the cause of hearing recognition along with speaking problems. As you read deeper into the story this production system would change because at one point states "Unit NX-6401, respond to my voice" and "Henry, the robot corrected me in a surprisingly human voice". This would follow the architecture along the lines of henry starts and speaks, which would occur to ask the reason why he stopped working.

2(b) When trying to diagnose why Henry isn't moving or turning on using case-based reasoning we would keep records of previously recorded cases that have been seen before. The figure below shows how case based reasoning would work using a discrimination tree.



The reason that I used the two assumptions above are because henry will not be able to speak without power. These two assumptions can build off each other using case-based reasoning. If the problem states that henry cannot speak, the case of henry having power would then get retrieved and follow the assumption diagram above. The first assumption will almost always become the first to get executed as a robot cannot operate without any power.

2(c) The advantages of using rule-based reasoning over case-based is simply that it does not need to have a history of previous cases stored to come to a conclusion. In fact, it tries to solve the problem by deriving new assumptions on the system. For example “Henry just stayed down and stopped moving”, each possibility of what could go wrong would be assumed and then each action would become inferred. However case-based reasoning would come to a better solution from pulling similar information stored in history. The new problem would be compared to previous problems and adjusted accordingly then finally stored back into memory. Having a system like case-based reasoning will essentially take much more storage and process much more retrieval time but grant a much better solution.

2(d) If a rule was missing in the long-term memory of the production system then the system would learn a new rule from making adjustments to a previous rule. This would happen when a problem arises that is similar to a problem stored in memory. When trying to solve the new problem, the system would make general assumptions that were previously encountered. However if entirely new constraints are implied, then the system would apply new constraints and store as a new entry that it has encountered.

Q3 Design of Intelligent Agents

In question 1 and question 2 the assumption that I had made were specifically from a human perspective. However this brings upon a very interesting topic of knowledge based artificial intelligence when analyzing the situation in a robots perspective. In this situation, it is hard to contrast the difference between a human and a robot simply because a human uses case-based reasoning to solve problems as a robot would do the same. In the medical field, a doctor spends many years going through medical school, then completes a 3 to 4 year residency depending on specialization. The newly practicing doctor is forced to complete this residency to build their cases. As time goes on, the doctor will continue to see new problems for which he will solve using his knowledge of past experiences. In such situation, a robot that is designed using such a system of case based reasoning would in fact react the same. However, the robot is limited to the process of time, memory and power through years of its life. To answer this question however, I believe that in this situation a human would only be able to solve this problem because its touching on an issue that only humans can experience which is human emotion. If we live in a world where robots can inherently feel and express emotion then they would be able to better model human cognition.