Fred Morrison
CSC-366

The Architecture of Jumbo

The main topical theme of the section is the architecture on which Jumbo is built, and the concepts underlying it. Jumbo is nothing more than an attempt to model the mental processes that go on during a game of Jumble, from an atomic level (letters), up to a higher, more concrete level (words). The long term goal of Jumbo and some of Hofstadter's other AI projects is to demonstrate that cognition can arise from thousands of parallel, low level processes in the mind.

The goal of Jumbo is not necessarily widely recognized or even accepted by other AI researchers. Herb Simon takes the stance that the very low level processes in the mind should be disregarded, as they happen far too quickly and are much harder to inspect than events that happen above the 100-millisecond level. Simon claims that it would be a waste of time to try and reproduce and inspect the thousands of low level processes, and instead focus should be directed toward events more easily recognizable during the "thinking" process.

Hofstadter obviously disagrees with Herb Simon, and states that the syntactic-semantic transition zone (deep perception) is the core mystery of all of intelligence. This is largely due to AI researchers leaving this problem untouched, a problem which Jumbo is attempting to alleviate.

Jumbo's concrete purpose is to emulate the methods that a human would use when playing the newspaper game "Jumble". It is less about the result and more about the methods used to achieve the result. Jumbo is a building program in the regard that it starts with a very limited knowledge base - that of atomic units (letters), and gradually builds it up by the process of glomming. Jumbo's purpose can be boiled down to modelling the mental processes of assembly and transformation. It is not in the least concerned with the efficiency of solving the "Jumble" problem, it is only concerned with how the problem is solved.

The significance of the "Jumble" game as the domain for Jumbo, is that it deals with small atomic parts that must be combined by various mental mechanisms into a larger product. The processes that lead to this are fundamental to the human thought process. Hofstadter claims that these processes happen in a "back and forth motion". When Hofstadter refers to

“back-and-forth motion” in terms of perception, he is describing how mental structures are being constantly created, destroyed, rearranged, and regrouped in the mind. It is a constant process, which seemingly happens in the subconscious.

The biological analogy that Jumbo rests on is based on the cell, and the molecules that reside within it. Just like there are multiple levels of structures in Jumbo (letters, letter groups, syllables, words), there are multiple levels of molecules in a cell (atoms, small molecules such as H2O, amino-acids, etc). The way these molecules are constructed also takes place in a manner similar to the way words are constructed in Jumbo. Glomming of lower level particles happens somewhat randomly, and in parallel throughout the architecture.

The sociological analogy that describes Jumbo is that of finding and cultivating relationships. Once again, there are multiple levels of structures (individuals, couples, larger social groups), and also there is a certain degree of randomness which decides if two individuals are “glommed” together, in a sense. There is also the creation & destruction cycle of relationships, just as there is in Jumbo with words, or molecules in the cell.

Jumbo is a parallel system, but its parallelism is based on the idea of what happens in the cell. There is a certain level of randomness in the cell, as activities are initiated by compatible enzymes and molecules bumping into each other in the cytoplasm and linking up. Similarly, Jumbo has certain letter groups or pairings that are more “compatible” with each other than others. It would be somewhat difficult to replicate, in Jumbo, the way that physical space plays a role in the processes of a cell. It would have to be done in some sort of abstract sense, in essence a “virtual cytoplasm” would have to be created.

If two letters come close enough together in Jumbo’s “virtual cytoplasm”, they can create a “spark” and potentially glom together. For example in the case of real world mating, if a potential mate crosses paths with another, there may be something that piques the interest and starts the cultivation of a relationship. This is what Hofstadter means by a “spark”.

Some letters may be more likely to glom with certain letters than others. Just as you may be more compatible with one human compared to another, the same concept can be applied to glomming and the “spark”. If three letters are close to one another, there may be a duo that is more compatible than another, and therefore will glom together first. This is due to the defined “chemistry” or “affinity” between two letters. This affinity, in the case of Jumbo, is defined somewhat arbitrarily by Hofstadter himself.