GP – Person/Contribution Assignment: John Henry Holland

Name: Jordan Bailey

Biographical Sketch

Model building is the art of selecting those aspects of a process that are relevant to the question being asked. As with any art, this selection is guided by taste, elegance, and metaphor; it is a matter of induction, rather than deduction. High science depends on this art. – John H. Holland

John Henry Holland (1929-2015), was a longtime professor of computer science, engineering, and psychology at the university of Michigan, and a pioneer in the study of complex adaptive systems, and what will be later known as genetic algorithms. By the mid-1960s, John developed the programming technique known as the genetic algorithm, which was able to "evolve" in ways that resemble natural selection. During the 70's, John focused on creating the genetic "code" that could represent the structure of any computer program, which eventually became his classifier system. The classifier system consisted of a set of rules, each of which performs particular actions every time its conditions were satisfied by some piece of information. The conditions and actions within this classification system were represented with strings of bits, the number '1' if the characteristic was present, '0' if not, and '*' if undetermined. In order for these classifier rules to "evolve", the system starts with a population of random strings of 1's and 0's, and rates them based on the quality of their result. High-quality strings "mate", while low-quality strings perish. This process is is repeated, and strings associated with improved solutions will predominate. Within these algorithms, a single string belongs to all of the regions in which its bits appear, which allows for the system to test multiple regions while needing to manipulate relatively few strings. This characteristic is called *implicit parallelism*, which gives genetic algorithms an advantage over other problem-solving processes. There are many examples of modern day uses of genetic algorithms including *image processing, file allocation, codebreaking, bug detection, financial mathematics,* etc.. Holland's work on genetic algorithms helps support other research within artificial intelligence that emphasizes how lower-order activities are the building blocks for higher-level phenomenon. Holland argued that complex physical systems are not the product of abstract rules but the consequences of diverse agents and their interactions in the world.