Report on a General-Problem Solving Program (1959)

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0.1 Context

0.2 Learned in this study

0.3 Things to explore

1 Overview

2 Notes

- The major features of the program that are worthy of discussions are:
  - The recursive nature of its problem-solving activity
  - The separation of problem content from problem-solving technique as a way of increasing the generality of the program
  - The two general problem-solving techniques that now constitute its repertoire: means-ends analysis, and planning
  - The memory and program organization used to mechanize the program
- The principal means of investigation is synthesis: programming large digital computers to exhibit intelligent behavior, studying the structure of these computer programs, and examining the problem-solving and other adaptive behaviors that the programs produce
- A genuine problem-solving process involves the repeated use of available information to initiate exploration, which discloses, in turn, more information until a way to attain the solution is finally discovered

2.1 The Executive Program and the Task Environment

- GPS operates on problems that can be formulated in terms of objects and operators
- An operator is something that can be applied to certain objects to produce different objects
- The objects can be characterized by the features they possess, and by the differences that can be observed between pairs of objects
- Operators may be restricted to apply to only certain kinds of objects; and there may be operators that are applied to several objects as inputs, producing one or more objects as output
- To operate generally within a task environment characterized by objects and operators, GPS needs several main components:
  - A vocabulary, for talking about the task environment
  - A vocabulary, dealing with the organization of the problem-solving processes
  - A set of programs defining the terms of the problem-solving vocabulary by terms in the vocabulary for describing the task environment
  - A set of programs applying the terms of the task-environment vocabulary to a particular environment: symbolic logic, trigonometry, algebra, integral calculus
- To specify problems and subproblems, GPS has a discrete set of goal types
- With each goal type is associated a set of methods related to achieving goals of that type

- When an attempt is made to achieve a goal, it is first evaluated to see whether it is worthwhile achieving and whether achievement seems likely
- All the heuristics apply the following general principle:
  - The principle of subgoal reduction: Make progress by substituting for the achievement of a goal the achievement of a set of easier goals

2.2 Planning as a Problem-Solving Technique

- This planning method consists in
  - abstracting by omitting details of the original objects and operators
  - forming the corresponding problem in the abstract task environment
  - when the abstract problem has been solved, using its solution to provide a plan for solving the original problem
  - translating the plan back into the original task environment and executing it

3 See also

4 References

- https://www.u-picardie.fr/~furst/docs/Newell_Simon_General_Problem_Solving_1959.pdf