

## PROBLEM FINDING AND PROBLEM INVENTION

Most descriptions of creativity focus on the novelty and utility of problem solutions, but many creative people say that problem finding and problem invention are at least as important. Problem finding may be defined as the process of identifying the most important and tractable problems among many. Problem invention may be defined as discovering or perceiving important and tractable problems where others do not. Both processes involve analysis and evaluation of problem formulations.

The importance of problem finding and invention follows from the well-documented observation that the better defined a problem is, the closer one is to finding solutions, and the more obvious are criteria for evaluating solutions. It is often much more difficult to invent a well-behaved problem statement than it is to solve one. Many Nobel laureates in all fields are therefore credited with asking questions that other people never thought to ask or were too timid to propose. Thus, many creative people place the major part of their creativity in problem generation rather than in problem solution. It follows from this perspective that any creative intelligent system will need to be able to find and invent novel, useful, and tractable problems.

Unfortunately, very little has been written in any field on the nature of the problem finding and problem inventing processes, and most of that is anecdotal. The purpose of this paper will be three-fold: 1) to review the heuristics that have been developed to date with particular regard to scientific problem generation; 2) to describe how such heuristics might be implemented in artificial intelligence systems; and 3) to outline some of the many outstanding problems that need to be addressed regarding useful problem generation.