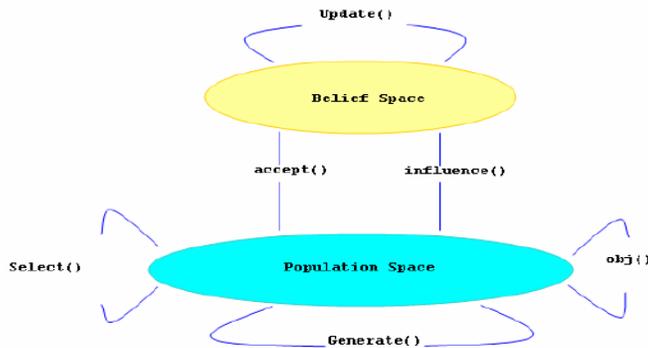


CULTURAL ALGORITHMS: THEORY AND PRACTICE

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Culture can be viewed as the universal human capacity to classify and encode human experiences symbolically, and to communicate symbolically encoded experiences socially. The **Cultural Algorithm** is a class of computational models derived from observing the cultural evolution process in nature. It can provide a flexible framework in which to study the emergence of organizational complexity in a complex system. The Cultural Algorithm has three major components: a population space, a belief space, and a communication protocol that describes how knowledge is exchanged between the first two components. The protocol can be used to support reinforcement learning between the Belief Space and the Population Space.



A Cultural Algorithm is a dual inheritance system that characterizes evolution in human culture at both the macro-evolutionary level, which takes place within the Belief Space, and at the micro-evolutionary level, which occurs in the population space. Knowledge produced in the population space at the micro-evolutionary level is selectively accepted or passed to the Belief Space and used to adjust the knowledge structures there. This knowledge can then be used to influence the changes made by the population in the next generation.

Cultural Algorithms are particularly useful in **knowledge intensive** optimization problem solving such as big data applications. In this tutorial we discuss the basic phases of the problem solving process in Cultural Algorithms and how those phases emerge from the interaction of the knowledge sources in the belief space, knowledge swarms, and the population of problem solvers in the population space. We then discuss how to design a Cultural Algorithm in order to support various general categories of optimization problems such as single objective, and multi-objective problems.

Cultural Algorithms have been successfully applied to the solution of a wide variety of knowledge intensive problems, problems related to the design of complex system in the real world for several decades. Example applications from Engineering, the Social Sciences, and Bioinformatics are presented in order to illustrate the diversity of applications that have been produced.