Towards Interactive Procedures in Simulation and Gaming: Implications for Multiperson Decision Support

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1 Introduction

In multiperson decision analysis there are two basic types of decision situation. One is the case of *collegial decisions*, where the nature or an institutional mechanism of decisions implies that only cooperative decisions are considered (such as in collegial discussions about joint budget allocation). Multiobjective decision analysis, cooperative game and bargaining theory have provided many tools for this case and several types of decision support systems have been already developed, see e.g. (Lewandowski and Wierzbicki, 1987; Bronisz, Krus and Lopuch, 1987). The other is the case of *individual multiperson decisions* where there is no institutional mechanism forcing the decision makers to make cooperative decisions, each of them can make individual decisions. This case has also motivated intensive studies in noncooperative game theory together with more experimental or computer tournament studies of strategies for repetitive games of social trap type, see e.g. (Rapoport, 1984; Axelrod, 1985); however, no clear implications for decision support have been derived from these studies.

On the other hand, a frequent tool of analyzing complex multiperson decision situations in modern systems analysis consists in building simulation models and performing gaming experiments with them. While such simulated gaming experiments have considerable educational and analytical advantages, not much has been achieved yet in equipping gaming and simulation models in tools of decision analysis and support. Without such tools, however, simulated gaming experiments model quite simplified decision situations, since analytical and computerized support is typically used in real life decisions if they are complex and important enough. The issue discussed in this paper is how to use various concepts and tools derived from game and decision theory to support decisions in simulated gaming.

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2 Conflict escalation and rationality perceptions

In many simple game or *social trap* prototypes, such as *tragedy of commons* or *prisoner dilemma*, illustrated in its essential features in Fig. 1a, it is a known phenomenon that noncooperative (Nash) equilibria are not (Pareto) efficient. If such a game is played repetitively with an infinite or uncertain number of repetitions, the short-term maximizing rationality that leads to the noncooperative outcome becomes paradoxical. Instead of a single-step "rational" decision, we must look for a rational strategy that takes into account all history of previous decisions in the repetitive game. But such a strategy is nonunique, it depends on the strategy applied by the opposite player. Since this opposite strategy is typically not fully known and subject to changes, a reasonable approach is to choose strategies that perform well when confronted with a variety of strategies in frequent encounters.

This leads to the concept of *evolutionary rational* strategies — see (Axelrod, 1985). The most successful evolutionary rational strategies — exemplified by the TFT (Tit For Tat) strategy of Rapoport and its various modifications [1] — cannot be explained in the terms of simple maximization of gains. Amazingly, however, they can be explained in terms of *rational ethics*: an evolutionary rational strategy should be *nice*, that is, starting with cooperation, *righteous and provocable*, that is, quickly discriminating and retaliating attempts to doublecross it, *forgiving*, that is, reverting to cooperation after retaliation, and *consistently clear*, that is, easy to recognize in its straightforward honesty and consistency; it *should not be envious*, that is, should never try to get better than the opponent — instead, it accumulates positive results from cooperation with various confronting strategies.[2]

However, the game of the prisoner dilemma type is not the most dangerous of social traps. If the penalties for defection (or persistence, in another interpretation) of both sides increase, then the structure of the game changes and two separate noncooperative (Nash) equilibria appear, see Fig. 1b. This social trap is called the *battle of sexes* game, or the *game of chicken* and differs somewhat from the previous prototype. Theoretically, the result of one-shot game can be in either of the two noncooperative equilibria denoted by N1 and N2; psychologically, the temptation to persist and achieve a favourable equilibrium is even greater than the temptation to defect in the prisoner dilemma case. Thus, a rather probable outcome of such a game is a persistent disequilibrium outcome denoted by E; this is a prototype of conflict escalation processes caused by the nonuniqueness of noncooperative equilibria.

[1] The simple Tit For Tat strategy that was robustly most successful in evolutionary sense in various experiments performed by Axelrod consists in starting with cooperation and doing in the next rounds the same what the opposite strategy did last time; there are many more complicated but not as robustly successful variants of this simple strategy. The author of this strategy, Anatol Rapoport, observed in a private communication that even more robust would be a more forgiving strategy that starts with cooperation, retaliates when the other side tried to doublecross it, but after retaliation reverts to cooperation no matter what the other side did last time; this modification has not been investigated in Axelrod book.

[2] The amazing point are not the ethical principles, but the fact that Axelrod *has shown analytically their evolutionary rationality* in his excellent and astounding book. Thus, the book constitutes a major challenge to the very core of neopositivistic philosophy and supports the view of marxist philosophy that ethical rules are rational results of social evolution.