An introduction to “Thoughts on organization theory”

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Anatol Rapoport, Anatol Rapoport, William Horvath, Professor Jeffrey Goldstein
1 Adelphi University

Abstract

Rapoport’s Career

This introduction will focus on the first author, Anatol Rapoport, because of his outstanding role in the development of systems sciences plus the fact that not much could be found out about William J. Horvath although he co-wrote with Rapoport on more than one occasion and was an esteemed scientist in his own right. Trained as a musician, mathematician, biologist, as well as psychologist, Anatol Rapoport was one of the most seminal pioneers in modern systems theory (see, Anatol Raport, nd; and Anatol Rapoport (‘1911), nd). In that capacity, he cofounded the Society for General Systems Research at Stanford University in the mid nineteen fifties (I’ve found both ’54 and ’56 as the dates of the founding) along with other systems thinking luminaries at the time such as Ludwig von Bertalanffy, Ralph Gerard, and Kenneth Boulding. This society was later renamed The International Society for the Systems Sciences (ISSSS) (Abraham, 2002; see also, Umpleby & Dent, 1999).

Born in 1911, Rapoport emigrated early from Russia to the United States, stopping along the way to study piano, composition, and conducting in Vienna. Eventually he settled at the University of Chicago where he received a Ph.D. under Nicholas Rashevsky who had almost single-handedly initiated the field of mathematical biology. Rashevsky had other students who went on to become preeminent in their fields, e.g., the very influential complexity-oriented biologist Robert Rosen.

Rapoport served during WWII in the US Army Air Corps. During his exceptionally long career, Rapoport was a professor at the University of Chicago, the University of Michigan, and the University of Toronto where he had gone to protest the involvement of the United States in the Vietnam War. He was also Director of the Institute for Advanced Studies in Vienna until 1983. He authored many books and over 500 research papers. His main areas of interest were in game theory, particularly regarding the latter’s application in studies of conflict, cooperation, and peace studies, as well as highly original research into social networks, stochastic models of contagion, and mathematical models of parasitism and symbiosis. He had a truly illustrious career, receiving numerous awards and honorary doctorates, and was the president of and on the boards of numerous associations and journals. Like so many others of the early systems thinkers, Rapoport was an authentic polymath, as at home in the abstract world of mathematical theorems, as in philosophy, social psychological experiments, computer simulations, music composition and conducting, as well as being totally engaged in the betterment of society and culture by promoting and initiating many vital currents in the study of peace.

Organized Complexity

Regarding Rapoport’s and Horvath’s paper in this Classic Paper Section of this issue of E:CO, it is first interesting to note that they quote Whitehead, in the latter role as a philosopher of science and metaphysician, in his call for new modes of thought which could break free of that type of analytical thinking circumscribed by placing physics as the prototype of how thinking ought to proceed. In particular, they followed Whitehead’s case for an organismic approach in contrast to that type of analytical thinking which sought to grasp a “complexity” by examining its components alone, the idea being that because the parts were supposed to be simpler, an examination of these parts would more easily yield insight into the complexity. More specifically, Rapoport and Horvath point to that analytical method which believes it can comprehend a complexity by erecting a superimposition of the analytical knowledge of the parts, an explanatory strategy which has proved very fruitful in analyzing actual machines as superimposition of parts. By so doing, however, one has broken up the object under scrutiny into a temporal chain of causal events. Such a scheme works in celestial mechanics if perturbations to celestial orbits do indeed remain small enough. All of this implies, of course, that the whole is composed of an adding-up process—vector laws of addition, e.g., found in the theory of electro-magnetism due to the linearity of the partial differential equations that Maxwell’s formulation relied upon.

Rapoport and Horvath were quite prescient here about such linear assumptions. Because this additive approach had worked in those fields where linearity assumptions were all that was required, it was tempting to keep applying it to other “complexities.” Again, they presaged, as an alternative, to the holistic claims of a more fertile “organismic” approach which would operate between the regions of “organized simplicity” and “chaotic complexity”. Although agreeing with the tenor of such holistic
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sponsored a computer tournament in which strategies were to be submitted for playing 200 games of prisoner’s dilemma. Axelrod (1984) was looking for a winning strategy promoting cooperation in repeated prisoner’s dilemma games. To do so, he

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Indeed, Rapoport also made seminal contributions to game theory. In the early nineteen eighties, Rapoport’s career evidently hadn’t slowed down since he won a tournament sponsored by Robert Axelrod, well-known today for his agent based modeling of cooperation, that sought suggestions for repeated game theoretical models applicable to the evolution of cooperation. Axelrod (1984) was looking for a winning strategy promoting cooperation in repeated prisoner’s dilemmas games. To do so, he sponsored a computer tournament in which strategies were to be submitted for playing 200 games of prisoner’s dilemma.
Although some of the submissions were highly intricate, it turned out that it was to be the simplest of all the submissions that achieved the highest score (on average), namely, the strategy submitted by Anatol Rapoport which he called “Tit-for-Tat,” requiring only four lines of computer code with two rules. Axelrod has pointed out that the simplicity of Tit-for-Tat’s approach stands in marked contrast to the very complex strategies found in computerized chess playing.

Tit-for-Tat is a variation of the iterated prisoner dilemma two-person game which has been used extensively to model situations of conflict and cooperation (see Tit_for_tat, nd). The prisoner’s dilemma game is typically described in terms of two alleged perpetrators of a crime who are first arrested and then placed in separate interrogation rooms. The police give each of the perps the same choice, either confess to the crime (called “to defect” in game theory, a condition that automatically implicates the other as having in fact committed the crime) or to remain silent (called “to cooperate” in game theory since they both are not admitting to the crime and accordingly are also not implicating the other). During the interrogation, the police intentionally try to get each of them to implicate the other in the crime. The rule is that if one of the accomplices “defects” and the other “cooperates,” then the defector gets off free but the cooperator receives a sentence of 10 years of jail time. Each of the perps are informed that a confession which implicates the other will lead to the confessor’s release plus, as an added incentive, to a small reward (Meredith, 1998). If both confess, each one will be imprisoned. But if one individual implicates the other and not vice versa, then the implicated partner receives a harsher sentence than if each had implicated the other. However, if both cooperate (i.e., remain silent), then they both get six months in jail. Yet, if both accomplices defect, then they both receive six years of jail time. Also, it must be kept in mind that the interrogation process in each room does not leave that room, that is, neither of the suspects has true information about what choices, defection or cooperation, the other one makes.

One of the implications of the game is that if both alleged perpetrators are perfectly rational, then it should be a no brainer for each accomplice to conclude the best course is to implicate the other even though, in fact, they both would both be better off trusting each other, i.e., not confessing or implicating the other (see Grossman, 2004; Meredith, 1998). To get deeper into the type of thinking involved in the dilemma, imagine how one of the accomplices might think. If the partner does not implicate him/herself, then one would think that he/she should consequently implicate his or her partner and thereby received the most advantageous pay-off. But, the situation is even more complex since each of the players’ decisions will be an important factor in future encounters. This means it is not just the immediate current situation faced by the two players that is relevant, anticipation about the future is also a significant prospect that needs to be taken into consideration. For example, if the two players know that they will never meet again, then defection, that is, confessing and thereby implicating the other, would seem to be the only rational choice. If that happens, then both will wind-up with a poor outcome. But if the prisoner’s dilemma is repeated a number of times, then it may be advantageous to cooperate on the early moves and cheat only towards the end of the game. When people know the total number of games of prisoner’s dilemma, they do indeed cheat more often in the final games.

Rapoport’s Tit-for-Tat is a modified form of the iterated prisoner’s dilemma in the following way. One player opens by cooperating with their opponent. Then, at the next play, the same player plays exactly as the other player did in the previous game. Thus, if the other side had defected in the previous game, the first player also defects but only for one game. However, if the other side had cooperated, the player continues to cooperate. In this manner, the players are punished for selfish behavior and rewarded for cooperation, but the punishment only lasts as long as the selfish behavior lasts. Tit-for-Tat proved to effectively demonstrate the value of cooperation.

The success of Tit-for-Tat took many by surprise because of its primarily cooperative orientation. Even when in successive competitions, various complex strategies were used to undercut it, Tit-for-Tat eventually prevailed. The theoretical hope remains that its cooperative results provide insight into how cooperation in animal and human social groupings have evolved during evolution.

Axelrod published the results of the tournament leading to the inauguration of a second round although this time, to avoid special cheating strategies for the last game, there would only be a median of 200 games each of random length. Rapoport again submitted Tit-for-Tat and it won again. From an analysis of the 3-million choices made in the second competition, four features of Tit for Tat emerged (Meredith, 1998):

1. Never be the first to defect;
2. Retaliate only after your partner has defected;
3. Be prepared to forgive after carrying out just one act of retaliation;
4. Adopt this strategy only if the probability of meeting the same player again exceeds 2/3.

These results provide a model for the evolution of cooperative behavior.

Axelrod emphasizes that a formal theory for the evolution of cooperation needs to answer three questions:
1. How can a cooperative strategy get an initial foothold in an environment which is predominantly noncooperative?

2. What type of strategy can thrive in a varied environment composed of other individuals using a wide diversity of more or less sophisticated strategies?

3. Under what conditions can such a strategy, once fully established, resist invasion by mutant strategies (such as cheating)? According to Axelrod, Tit-for-Tat is successful because it is ‘nice’, ‘provokable’ and ‘forgiving’. A nice strategy is one which is never first to defect. In a match between two nice strategies, both do well. A provokable strategy responds by defecting at once in response to defection. A forgiving strategy is one which readily returns to cooperation if its opponent does so; unforgiving strategies are likely to produce isolation and end cooperative encounters. The most important theoretical result of those tournaments was that although the Tit-for-Tat-Strategy cannot possibly win the iterated Prisoner’s Dilemma in an encounter with another single strategy, it is more likely to win in a “war of all against all” of different strategies (for details, see Axelrod. 1984).

References


