PURSER

On Defining Systems
September 1995

It is a pity that you quote the definition of a system from On Purposeful Systems. That was one of the things I had hoped to correct in our second, revised edition. This second edition never came to pass. One of the reasons for responding to Russ' pleas to come to Wharton in 1982 was to do this job. Others had warned me that Russ was past cooperating with anyone but, in my arrogance, I thought that could apply to he and I. I was wrong. He regarded OPS as a bible and wanted us to further formalize it. I though it was a temporary approximation in which we gone along with contemporary falsehoods in order to argue that there were purposeful systems beyond the goal-seeking systems. It was scaffolding that we erected in OPS, not the building and certainly not the foundations. In helping Ackoff with this book, an update of a manuscript that he and West Churchman had been beavering away at in the forties and fifties, I was prepared to take a step backwards in order to advance thinking about individual systems to 'purposefulness'.

To define a system as a set of elements and the relations between the elements is totally inadequate. When we define a system in this was we deny the observation that with systems 'the whole is greater than the sum of its parts'. We take the aggregate, the summation, as our focus because allowing for the individuality of each part and its relations would be too complex (as in the Law of Gases we assume an average and work from that). As Charles S. Peirce would say such formulations are still at the Newtonian level of interactions, SECONDS. (It is a pity that the boys at the Santa Fe Institute do not realize that they have locked themselves into this level).

If we are to stay true to the observation that in some cases 'the whole is greater that the parts' i.e. not a summation, however complex, then we must have a definition that refers to transactional properties, THIRDS (in C.S. Peirce's terms). The steps towards this have been taken:

1. A system is a unitas multicomplex. Only if we can identify the system principle which explains this unity can we demarcate the system. If we identify more than one system principle then we have the entanglement of more than one system. This requirement already raises our concern to the transactional level. A system principle is not to be found in any part or its relations. (Angyal, 1941). A common sense statement of this requirement is Drucker's idea that business organizations first ask themselves 'what business are they in'. When this question is raised many existing elements may be found redundant, despite their interactions, and others sorely lacking. This begins to answer the question of

what defines the set that constitutes a system. An aggregate can be defined by the summation of the present elements and their interrelations, but not a system.

2. In a system parts are not related directly according to their individual attributes but indirectly via their relation to the system principle. (Angyal, 1941). The 'more' that the whole presents is not the addition of not some physically immeasurable quality like soul or elan vitale but a measurable degree of organization. Measurable, however, only within the parameters of that organization.

3. A statement of system principle (mission or goals) is a short-hand way of referring to the special forms of interdependence that exist between the system and its environment. (Emery, 1962). Without this statement the system principle is open to be interpreted as a God-given entelechy, sui generis to the system.

4. Thus, 'a system can only be properly characterized if we also characterize its environment' and , conversely, an environment can only be characterizing the kinds of systems it provides support to. This requires description of each term in the set L11, L12,L21,L22. (Emery, 1963). In practice I have simply used the four steps as they are practically second nature. That means being conscious of when one is taking short-cuts e.g. OPS.

A definition that encapsulates these principles might read as follows:

> *System*: A set of entities that are interdependent with respect to the principle governing the set i.e. the system principle. The system principle is not sui generis to the set but defines a special relation of interdependence between the set and its environment.