Chapter XII
The Generative Power of Signs:
The Importance of the Autonomous Perception of Tags to the Strong Emergence of Institutions

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ABSTRACT

The first intelligent agent social model, in 1991, used tags with emergent meaning to simulate the emergence of institutions based on the principles of interpretive social science. This symbolic interactionist simulation program existed before Holland's Echo, however, Echo and subsequent programs with tags failed to preserve the autonomy of perception of the agents that displayed and read tags. The only exception is Axtell, Epstein, and Young's program on the emergence of social classes, which was influenced by the symbolic interactionist simulation program. Axtell, Epstein, and Young's program has since been credited for strong emergence. This chapter explains that autonomy of perception is the essential difference in the symbolic interactionist implementation of tags that enables this strong emergence.

In the beginning was the Word, and the Word was with God, and the Word was God. The same was in the beginning with God. All things were made by him; and without him was not any thing made that was made. In him was life; and the life was the light of men. And the light shineth in darkness; and the darkness comprehended it not. (John 1:1-5, KJV)

INTRODUCTION

Holland saw the creative power of the word as important in the formation of living systems when he included the tag as one of the three basic mechanisms of complex adaptive systems. A "tag" is simply a sign, such as a name or a physical trait, which is used to classify an agent. In the social world, a tag may be a social marker, such as skin color, or simply the name of a social group. A tag goes hand in hand with the other two mechanisms Holland thought important

to complex adaptive systems, an internal model (whether tacit or explicit) to give meaning to tags, and building blocks to accumulate and recombine the structures that result from those meanings into hierarchical aggregates (Holland 1995).

Holland is commonly thought to be the first to use tags to simulate social phenomena. However, there is another variation on tags, the symbolic interactionist simulation technique, that was developed before Holland's complex adaptive system research program, the Echo project (Duong 1991, Holland 1992). Like Echo, symbolic interactionist simulation recognizes the primacy of signs in the formation of living systems, but differs from Echo in that its agents have autonomous perception of the meaning of signs. The difference is understandable, because the principle of autonomy of perception is more prominent from the social sciences standpoint than from the biological standpoint, even if it exists in biology as well (Maturana, Lettvin, Mcculloch and Pitts. 1960). Many of the ideas in microsociology are inherited from phenomenology and hermeneutics, philosophies that contemplate the mysteries of autonomy, such as the paradox that human beings can only interpret meanings through their individual experiences with their senses, and yet they still come to share meaning (Winograd and Flores 1987). This hermeneutic paradox is core issue of micro-macro integration in sociology from the angle of perception: to solve the hermeneutic paradox is to solve the mystery of the "invisible hand" by which autonomous, selfish agents synchronize their actions into institutions for the good of the whole. Since emergence in agent-based social simulation is fundamentally about solving the micro macro link, symbolic interactionist simulation seeks to solve the hermeneutic paradox. It is by virtue of the preservation of autonomy that symbolic interactionist simulations exhibit strong emergence and constitute minimal social engines.

BACKGROUND

In Holland's Echo program and its successors that simulate the emergence of cooperation in iterated prisoner's dilemma (IPD) programs, tags are implemented with replicator dynamics. Referring to the work of Riolo, Cohen, and Axlerod as well as the work of Hales and Edmonds, Hales discusses the tag implementation: "the models implement evolutionary systems with assumptions along the lines of replicator dynamics (i.e. reproduction into the next generation proportional to utility in the current generation and no 'genetic style' crossover operations but low probability mutations on tags and strategies)." (Hales, 2004). Replicator dynamics do not keep the principle of autonomy of perception: one agent interprets a sign the same way as another agent because they have a common ancestor, not because they both induced the sign separately based on their individual experiences. Simulations of the emergence of common meaning of tags using replicator dynamics exhibit high amounts of genetic linkage (biological or mimetic), so that the relation between the sign and the behavior is an artifact of the method, rather than emergent from the simulation. Any simulation of contagion that explains macro level institututions with micro-level imitation does not exhibit strong emergence: since institutions are behaviors held in common, institutions would be an aggregate of copying behavior rather than emergent phenomena. Micro macro sociologist James Coleman believed that to explain institutions, we must explain the arise of a network of relations in a social system, and not just an aggregate (Coleman, 1994).

Autonomy of perception has been proposed as a necessary requirement for strong emergence in social systems. Bedau (2002) and other philosophers of emergence agree that "emergent properties have irreducible causal power on underlying entities." Downward causation, or "immergence" as Gilbert (1995) called it, is necessary for emergence in the strong sense. Desalles, Galam and Phan (2007) give more details, saying that for strong emergence to occur, agents must be equipped to identify emergent phenomena, and Muller adds that this must be through the physical world, rather than by direct copying of other agent's perceptions (Muller 2004). According to Desalles et al, agents must describe the emergent phenomena they observe in a language other than the language of the lower level process itself, and agents must have a change of behavior that feeds back to the level of observation of the process. This insightful definition of strong emer-