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Service as Mutualism: A Question of Viability in Systems

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Service-based industries now dominate the most advanced economies of the world. There is, however, no fully interdisciplinary foundation for research into the development of service, per se. The creation of a service science has been proposed, which would bring into question many traditional assumptions about economics. This paper explores service as a science, and proposes that the biological concept of mutualism be used as one aspect for developing a foundation of service science.

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1. Introduction

According to Spohrer and Maglio (2006), service comprised about 70% of the total economies of both the US and Japan by 2003. They account for three-quarters of the jobs in developed countries, as a whole (Bryson, et al., 2004). Does this really change anything, though, in the larger realm of economics? As long as trade continues, does it really make any difference whether we buy and sell service instead of tangible goods?

Many current arguments suggest that not only is there a difference, it is a potentially dramatic difference. As expressed by Spohrer and Maglio (2006), "The growth of the service sector of the economy is truly a wonder of human history, on par with the agriculture revolution and the industrial revolution" (p. 19). If true, then what are the implications? As will be explored, the implications include new ways of companies operating, a new profession to educate workers for needed roles, and a new way of understanding some of the fundamental aspects of economics.

Specifically, it has been suggested that a new science of service is needed in order to educate professionals for research in service systems. As these new workers move into existing organizations, it will necessitate change. This paper will begin with a description of viable systems theory, as proposed by Stafford Beer (1979, 1981), as a framework for considering organizational adaptation. It will then propose that the kind of exchange of resources involved in service systems is less like the trading of goods found in markets, and more akin to the processes of mutualism common to most biological organisms. It will be suggested that a science of service include an exploration of human interdependence with other humans, and with the biosphere at-large.

Viable Systems

Fundamentally, Stafford Beer was concerned about the exponential pace of change that organizations were facing, which created an overload of data that needed to be managed. He saw technology (especially computers) as being both a contributing factor and a potential part of the answer to the problem. In order to remain viable, organizations needed an adequate system of control (i.e. regulation), incorporated primarily through managers in the organization.

Viable systems model (VSM), as applied to organizations, consists of five nested levels, each of which is (by definition of being viable) capable of independent existence. In the simplest description, "System 1 stands for what is done in the organization and System 2 for how it is coordinated. System 3 stands for operative corporate management, System 4 for strategic corporate management, and System 5 for normative corporate management" (http://www.managementkybernetik.com/en/fs_methmod3.html). Importantly, according to Beer (1989), "The first subsystem of any viable system consists of those elements that produce it (they are the system's autopoietic generators, to use Maturana's terminology)" (p. 15). The highest system provides a logical closure to the system, and defines the system's identity.

Beer began the development of his VSM as a psychologist in the British army from 1947-1948. In his initial description in *Brain of the Firm,* Beer (1979) "proposed a neurocybernetic model of any enterprise, conceived of as a viable system. It is suggested that the human nervous system stipulates the rules whereby an organization is survival-worthy: is regulated, learns, adapts, evolves" (p. xi). As he explains the initial development, "I pursued [VSM] through neurocybernetics and social science, through the invention and study of cybernetic machines,

through the mathematics of sets and stochastic processes, and at all times through the OR [operational research] fieldwork in industry and government" (1989, p. 8).

According to Simon (1996), "the period during and after WWII saw the emergence of what Norbert Wiener dubbed "cybernetics": a combination of servomechanism theory (feedback control systems), information theory, and modern stored-program computers, all of which afford bold new insights into complexity" (p. 172). This was the basic foundation on which Beer built his VSM.

Weiner's development of cybernetics began as an effort to improve the accuracy of anti-aircraft artillery in WWII. Ultimately, he and his colleagues developed a much larger theory, as implied by the title of Wiener's (1961) book, *Cybernetics, or Control and communication in the animal and the machine*. As he explains:

> It had already become clear…that the problems of control engineering and of communication engineering were inseparable, and that they centered not around the technique of electrical engineering but around the much more fundamental notion of the message, whether this should be transmitted by electrical, mechanical, or nervous means (p. 8).

There is a long-standing tension with respect to technology, and computer models specifically, regarding the accuracy of the predictions and control they provide. It becomes quite important in terms of creating service systems. Beer (1981) was very explicit that he did *not* consider the VSM to be only an analogy for a firm or enterprise, but that it accurately described its workings. As noted, he based the model in large part on principles from the field of operations research (OR). This seems to follow Wiener's original ideas, as he explains:

> It became clear to us that the ultra-rapid computing machine, depending as it does on consecutive switching devices, must represent almost an ideal model of the problems arising in the nervous system. The all-or-none character of the discharge of the neurons is precisely analogous to the single choice made in determining a digit on the binary scale, which more than one of us had already contemplated as the most satisfactory basis of computing-machine design (14).

All of this suggests a strong, underlying paradigm of prediction and control. It is not to say that Wiener or Beer or any of the other theorists involved in the development of cybernetics or broader systems theories were confined to this narrow view. In fact, the truth is quite to the contrary. It is to say that there is great danger in not fully understanding the implications of change. As Beer describes this problem in relation to the introduction of computers:

> It is against this backdrop [of rapid change] that management confronts the electronic computer. This instrument offers management its own 'technology B' – something which makes the managerial world utterly different. But management has addressed itself to the possibilities in a way which virtually precludes the emergence of a new managerial order. It has tried instead to assimilate the computer into managerial technology A – improving, or let us say simply souping-up, the ways of regulating matters with which managers are already familiar (p. 14).

It is highly probable that many organizations, and many universities, will simply incorporate the concept of service to existing departments, programs, and operations, applying the same principles as have been in place for generations. It will only be an addition to their technology A, to borrow Beer's description. Those firms and learning institutions which grasp the difference, though, will see this quite differently, as will be explained.

Identifying Service Systems

Arguably, service has been around for as long as capitalism (Bryson, Daniels & Warf, 2004) – and probably much longer, depending on how it is defined. (If Bryson, et al. is correct, over half of the jobs in the US were related to service as early as 1910.) A great deal of concern and interest has been expressed in recent years, though, about the importance of service to the work of individual companies, and to national economies, particularly in the most developed economies.

Comprising such a huge portion of the economy also means that many different types of work are considered service. In one attempt to identify the industries associated with service, Bryson, et al. (2004) suggest seven economic sectors: (1) finance and real estate; (2) business services; (3) transportation and communications; (4) wholesale and retail trade; (5) entertainment, hotels and motels; (6) government at the national, state and local levels (including the armed forces); and, non-profit agencies (p. 7). Even within these sectors are individual industries

which represent large portions of the economy. For instance, in many countries healthcare is included as part of the government sector. In the US, healthcare could potentially be considered a sector unto itself. According to the website of the National Coalition on Healthcare (http://www.nchc.org/facts/cost.shtml), health costs in the US represented 17 percent of GDP in 2008, and are projected to increase to 20 percent of GDP by 2012. Also as noted by Bryson, et al., many specific jobs and functions within traditional production industries are service rather than manufacturing, further blurring the lines of distinction.

Or as Spohrer (2009) summarizes:

> Service is something we measure about national economies, service is a type of process that involves customer inputs, service is a capacity to be optimized when demand varies, service is a way of packaging capabilities for networks, and service is something that is experienced by people (p. 16).

According to Maglio, Vargo, Caswell, & Spohrer (2009), having such a wide array of industries and applications included as service led to an economic definition of service as *everything that was not agriculture or manufacturing*. This concept of *everything else* traces back to Adam Smith and the idea that any labor which did not result in the production of physical goods should be counted as unproductive labor. It is summed up in what is referred to as a *goods-dominant* (G-D) logic, in which economic exchange is fundamentally concerned with the production of physical products which are endowed with value equivalent to the effort required to produce them (Vargo & Lusch, 2004).

The Logic of Service

Philosophically, G-D logic came from economists who were aligning themselves with the science of Newtonian Mechanics. Where particles had essential properties, products had given utilities. From the perspective of G-D logic, services were treated as an intangible type of good, or a value-added property of goods. From this perspective, improving efficiency in service systems would be no different than manufacturing; inefficiencies are eliminated and cycle times improved, etc.

The alternative to G-D logic is *service-dominant* (S-D) logic. (Note that this is *service*, not *services*, as is used throughout this paper.) As explained by Maglio, et al. (2009):

> The use of the singular "service" as opposed to the plural "services," as traditionally employed in G-D logic, is intentional and non-trivial. It represents a shift from thinking about value in terms of operand resources – usually tangible, static resources that require some action to make them valuable – to operant resources – usually intangible, dynamic resources that are capable of creating value. That is, whereas G-D logic sees services as (somewhat inferior to goods) units of output, S-D logic sees service as the process of doing something for and with another party. Value creation, then, moves from the firm, or "producer," to a collaborative process; in S-D logic, value is always co-created (p. 4).

This shift in logic is really anything but trivial. More than simply re-defining ideas about products or outputs, S-D logic fundamentally challenges traditional assumptions about economics. According to Maglio, et al. (2009), it actually recaptures foundational ideas which Adam Smith had established before he moved on to worrying about wealth at the national level. In essence, service is always exchanged for service, whether the service is in the form of a product or directly applying a skill to create an outcome.

Productivity in Service

Many of the concerns which sparked recent interest about service seem to be related to economic measurements of productivity. As explained by Spohrer and Maglio (2006), for instance, over half of IBM's 2007 revenues came from service-related work. The problem, though, was that:

> Software had gross margins of 85%, whereas services had margins of only 27%. Doubling service productivity would result in margins over 60%, and improving productivity by ten times would result in margins over 90% (p. 4)

The most obvious answer to the productivity problem would seem to be applying well-established, existing principles developed in manufacturing. For instance, minimize production costs and optimize the efficiency of all processes; optimize production rates in order to maximize profits (i.e. control supply so as to meet but not exceed demand); market aggressively in order to influence the purchasing behaviour of consumers, etc. In essence, you simply treat a service as a product (which is actually the logic that has been adopted in recent decades by many

providers of healthcare, government services, and so on.) If the idea of a shift to S-D logic is taken seriously, though, then even the traditional assumptions about manufacturing and industrial operations need to be reconsidered.

2. Mutualism and Economics

Despite the work that has been done thus far, there remain many questions about establishing a foundation for service science. If, as has been proposed, economics is fundamentally the exchange of varying types of service – whether converted into tangible products or not – then we will have to reconsider issues such as how value is produced and what it means in the process of exchange.

For Spohrer (2009) and his colleagues (Maglio, et al., 2009), service is defined as *the co-creation of value*. More specifically, "it is the interactions between entities that results in value being created (or destroyed, with or without compensation) for one, both, and sometimes all entities. Service system entities can be people, businesses, non-profits, government agencies, cities, etc." (Spohrer, 2009, p. 17)

Service science is understood to be a specialization within the larger realm of systems science. "Systems science includes both the science of the natural and artificial, or human-made, world. Service science restricts its attention to artificial, in the sense of being real human-made, worlds, and is thus a specialization of systems science" (Spohrer, 2009, p. 13)

If the study of service is to become a branch of science, in what ways should it build upon existing theories? The most fundamental aspects of science are sometimes thought to lie in the realm of physics. Is, then, service an aspect of physics? Are there principles of physics which evidence some concept of service? Spohrer (personal communication, July 26, 2009) is working on developing such a concept, to include symbolic systems. At the level of chemistry, autocatalytic sets demonstrate processes of production which have been extended, at least metaphorically, to the study of sociology and economics (see Crick, 1970).

Biology and Mutualism

Moving to the level of biology, though, a very different picture appears. Symbiosis and mutualism are longstanding and essential ideas. According to Bronstein, Alarcón and Geber (2006), mutualism underlies the concept of the balance of nature, and can be found in the writings of Herodotus, Aristotle, and Cicero. It is also a critical part of Darwin's theory of evolution. It was not until the late 1990s, however, that evolutionary theories about mutualism began to be developed. Approaches to these theories have included population genetics models, game theory, economic theories, and adaptive dynamics.

With his emphasis on the human-made world, Spohrer (2009) draws a connection between service science and the work of Simon (1996). While Simon covers a vast territory of ideas, from basic concepts of science, to economics, to human psychology and cognition, to complexity and systems theories, there are central themes. One of these is the rejection of the notion of perfectly fixed and knowable environments or markets. Humans progress and adapt, not through perfect algorithms, but through heuristics (rules of thumb) by which we search and learn. As he draws a comparison with biological systems:

> From the fact that an economic system is evolving, one cannot conclude that it has reached or is likely to reach a position that bears any resemblance to the equilibria found in the theory of perfect competition. Each species in the ecosystem is adapting to an environment of other species evolving simultaneously with it… If the adaptation of both the business firm and biological species to their respective environments are instances of heuristic search, hence of local optimization or satisficing, we still have to account for the mechanisms that bring the adaptation about (pp. 47-48).

DeWaal (2009), a renowned primatologist, reinforces the connection between biology and economic principles:

> The principle of supply and demand reigns everywhere, from bees and flowers…to the curious case of baboons and their babies… The way primates trade commodities mimics our economies in surprising ways. We even managed to set up a miniature "labor market" among capuchin monkeys, which was inspired by their natural hunting behavior… In short, monkeys seem to connect effort with compensation. Perhaps owing to their collective pursuits in the wild, they grasp the first rule of the stag hunt, which is that joint effort requires joint rewards (pp. 176-177).

Friedman (2008) explores the connection between the biological and economic realms in some depth. In essence, it begins with a problem: "All social creatures face a fundamental dilemma – what's good for the individual is not always good for the group" (p. 4). This, of course, has historically been resolved in the realm of human markets through Adam Smith's notion of the invisible hand – the idea that individuals acting in their own self-interests created a greater good for societies by bringing about the equilibrium of supply and demand. In the biological realm the somewhat parallel idea has been that each individual was driven to perpetuate its own genetic material, and that the strongest or most environmentally fit would win in the struggle for survival.

Friedman (2008) challenges the idea of pure individualism, beginning at the level of slime mold. As he explains, these amoebas live primarily as individual organisms in forest soil, eating bacteria. If the bacteria run out, though, and the slime mold begins to starve, the individual amoebas ooze together until a million or so form a central mound which then sprouts a stalk. Most cluster near the top of the stalk, dry out and become spores, and then are blown by the wind to (hopefully) more advantageous places where they again can feed and reproduce. Some never make it to the top and die in the process. Many that do make to the top, though, actually possess a mutant gene which slows down the amoebas around them, giving them an advantage. The dilemma is that if the mutant gene were to spread to more individuals, it could actually kill the colony.

Friedman (2008) defines mutualism as "forms of cooperation [which are] win-win, with no dilemma" (p. 10). He gives examples such as fish schooling together to confuse predators, birds flying in formation to cut wind resistance, and dogs hunting in packs. "In these examples, individual self-interest and the group interest are served simultaneously – no sacrifice is necessary" (p. 10).

At the genetic level, the dilemma is resolved by a compromise. If you cannot perpetuate your own, individual genes, the next best choice is to perpetuate those of your nearest kin. As Friedman (2008) explains, "slime molds, bees and ants have developed a special solution to the I-versus-we dilemma: kin selection. They are hardwired for extraordinary nepotism… Kinship transforms the social dilemma into mutualism" (p. 11). At the level of social systems, yet another factor helps to solve the dilemma:

> Reciprocity pays: a reciprocator will achieve greater fitness than a non-reciprocator. Once again, the social dilemma is transformed into mutualism. This transformation comes not from sharing genes, but instead from the symmetric, ongoing relationship between donor and recipient. The algebra turns out to be exactly the same as for kin selection, with the degree of relatedness replaced by a discount factor that takes into account the delays and risks of the return favor (p. 13)

As noted, Friedman (2008) uses the term mutualism only when all parties benefit. As defined by Bronstein (2001), though, there is a much more utilitarian process involved. In one way, "mutualisms are best viewed as reciprocally exploitative interactions that provide net benefits to both partner species" (p. 277). From another perspective, "mutualisms can profitably be thought of as 'biological markets' in which species offer their partners commodities that are relatively inexpensive for them to produce, in exchange for commodities that are expensive or impossible for them to produce" (p. 277). Friedman defines one-sided exchanges in other terms. Altruism involves the sacrifice of self for the good of another. Opportunism includes shirking, predation, and parasitism. Given the realities of the world, it is worth exploring these exchanges briefly.

Exploitation

Much as in many human interactions and processes of exchange, the relationships and outcomes appear to lie along a spectrum rather than in pure categories. Each entity receives some relative benefit from a given interaction, which can be purely negative, that is, a loss. There seems to be a great deal of interest, in fact, in what has commonly been termed *cheating* in mutualism. (Bronstein, 2001, prefers the term *exploitation*.) In such cases, one entity acts in a role familiar to the other, but offers no benefit in return for what is received. An example is that of insects which may feed on the nectar of a flower but without transporting pollen. This line of research has led to the use of the Prisoner's Dilemma as a model for explanation, with the idea that the best individual outcome is that which produces the greatest individual benefit with the least cost or effort. Bronstein rejects that explanation as too simple, though, suggesting that:

> Entirely new theoretical approaches are needed that are tailored more to the empirical realities of specific kinds of exploitation, particularly cases in which exploiters and mutualists are different species. Exploitation of mutualism grades subtly into other, well-studied antagonistic phenomena, including predation, parasitism, herbivory and competition. Bodies of theory developed to explore the ecological and

> evolutionary persistence of antagonists within those interactions ultimately prove more informative… (p. 285).

This is all quite familiar, of course, within the human realm of economics. In essence, capitalism espouses that when each individual operates for his or her own good, it creates a greater good for all. One outcome of this philosophy is the idea of *caveat emptor*, or *buyer beware*. Prices within markets are set according to a natural balance of supply and demand, which is supposed to be a self-regulating mechanism of maximum efficiency. There is no necessary notion, though, of mutuality between the individuals involved. One simply uses the other in the way thought to be most advantageous.

DeWaal (2009) strongly challenges the usual application of biological evolution to human economics. As he explains:

> Social Darwinism is all about what Gordon Gekko called "the evolutionary spirit"… This ideology was unleashed by British political philosopher Herbert Spencer, who in the nineteenth century translated the laws of nature into business language, coining the phrase "survival of the fittest"… he said of the poor that "the whole effort of nature is to get rid of such, to clear the world of them, and make room for better"… The United States listened attentively… John D. Rockefeller even married it with religion, concluding that the growth of a large business "is merely the working out of a law of nature and a law of God" (p. 28).

As suggested by Bronstein (2001), exploitation is similar to the relations between predator and prey, regulated by available resources. The question in this case is whether predation might be seen as mutuality on a different scale. As food supplies increase, so do the populations which use them. For instance, as vegetation increases in seasons of rain, populations of herbivores tend to increase. This creates greater food supplies for the carnivores which feed on them. In turn, as resources decrease, predation removes the weakest members first (those being the easiest prey) which helps to decrease the competition for remaining food within herds of herbivores.

The distinction is that, for the most part, members of the same species do not prey on each other. Alpha males, for instance, do not seek to kill their competitors, but only to subordinate them in order to maintain the hierarchy (see Grossman, 2009).

In the human realm, addressing problems of cheating and exploitation differ at different magnitudes of organization. As described by Friedman (2008), "morals go back to our human origins, and work best in small groups. Markets work best at large scale, and their rise 200 years ago ushered in the modern world" (p. 4).

For most of human history we lived in relatively small groups as hunter-gatherers, with others who were closely genetically related. Such networks reinforced essentially every aspect of mutualism described by Friedman (2008). As he explains, "All known hunter-gatherer groups manage their social dilemmas pretty much the same way, relying on an egalitarian moral system. It builds on kinship and reciprocity…" (p. 18). In such groups, moral codes are relatively easy to enforce, often without the need for violence or punishment. Offenders are openly identified and shunned by the group, limiting their access to help or resources. "When people who uphold the code do better than those who do not, the code transforms social dilemmas into win-win mutualism" (p. 20).

This system broke down at the dawn of the agricultural revolution. While hunter-gatherers function best in tribes of several dozen members or so, agricultural communities do best with hundreds or even thousands of members.

DeWaal (2009) and Friedman (2008) seem to agree that the development of agriculture was also a pivotal point in human social functioning. According to DeWaal:

> Because of interdependencies between groups with scarce resources, our ancestors probably never waged war on a grand scale until they settled down and began to accumulate wealth by means of agriculture. This made attacks on other groups more profitable. Instead of being the product of an aggressive drive, it seems that war is more about power and profit. This also implies, of course, that it's hardly inevitable (p. 25).

And for Friedman, "Agriculture thus multiplies the need for efficient defense at the same time that it multiplies the population size. Unfortunately, egalitarian moral codes can't cope… Part of the problem is simply coordination… Hierarchy is the inevitable result" (pp. 32-33).

Governance via moral codes was replaced by formal systems of law. Exchange of resources, which happened primarily by way of gift exchange in small groups, was replaced by exchange in bazaars, and eventually financial markets.

Markets greatly expanded the exchange of goods, and even of ideas. This removed the limitations of small-group, personal relationships. It did not, however, change everything about the nature of the human interactions involved. As described by Friedman (2008), "promises are at the heart of finance. As a borrower, I promise to give you, the lender, money later in return for the money you give me now"(p. 95). But:

> Something is lost in making promises tradable. No longer do we have a rich human relationship between the person making the promise and the person who accepts it… Yet much is gained. An investor will pay more for a promise that she can sell whenever she wants than for a promise that she must hold until it matures – the secondary market gives her valuable flexibility… Financial markets thus become viable only when there is a strong rule of law that can trump social norms and political expediency (pp. 100-101).

Despite the tremendous increase in efficiency, and expansion of trade, offered by markets, they are never completely separated from the deeper realm of human interactions. As Friedman (2008) explains, laws do not simply replace the underlying moral system:

> The formal legal system has never replaced the informal moral system… Laws do not always trump the unwritten moral rules, or norms… Everyone agrees that laws are more effective when they reinforce a group's norms, and that laws that oppose widely held norms are problematic (p. 129).

Or, as expressed by DeWaal (2009):

> Traditional economic models don't consider the human sense of fairness, even though it demonstrably affects economic decisions. They also ignore human emotions in general, even though the brain of *Homo economicus* barely distinguishes sex from money. Advertisers know this all too well, which is why they often pair expensive items, such as cars or watches, with attractive women. But economists prefer to imagine a hypothetical world driven by market forces and rational choice rooted in self-interest… We obviously have a problem if assumptions are out of whack with actual human behavior (p. 162).

To summarize this section, then, suggesting that service science is founded in a service-dominant logic challenges many prevailing assumptions about economics and the functioning of economically-driven organizations. As shown above, the concepts of exchange and cooperation run deep into the fabric of biology. They are not simply activities found in human markets. The greatest distinctions between these basic biological tenants and our notions of human economic systems may simply be our tolerance for blind self-interest in market systems, assuming that it is somehow a natural part of the way they work. In fact, this may be an aberration in the larger context of natural systems. Correcting this may only be a matter of bringing a more natural sense of checks and balances, based on our small-group orientation, back into the equation. The implications for doing so, and what this might mean for service science, will be explored in the final section.

3. Incorporating Mutualism

As defined by Spohrer, Anderson, Pass and Ager (2008), "service is a type of interaction between particular types of entities aimed at particular outcomes, specifically value-cocreation outcomes (win-win)" (p. 5). Accepting that this is the kind of relationship described above, service would seem to be very close to mutualism. As the authors further explain, though, any given interaction between service system entities may fall short of actually co-creating value. Introductory game theory, assuming two players, describes only four possible outcomes (win-win, win-lose, lose-win, and lose-lose). The ISPAR (Interact-Service-Propose-Agree-Realize) model describes ten possible outcomes, assuming four types of stakeholders. The ISPAR model encompasses problems such as lack of understanding between the parties, lack of agreement, conflicts and disputes, difficulties in the relationship between the parties, and so on.

The obvious question for organizational leaders is how one might optimize the chances for the co-creation of value. One answer for Spohrer, et al. (2008) would seem to align directly with the concept of mutualism:

> A service provider's knowledge of a customer, and the quality of their relationship (level of trust) required to gain shared access to that customer's privileged access resources, directly relates to the quality of the value-propositions that the service provider can offer (Spohrer, et al., 2008, p. 11).

Gathering information about customers, of course, is nothing new. The issue is how to create the quality of relationship that Spohrer, et al., describe. In order to reach the level of familiarity or intimacy in which individuals or even business entities can truly engage in the co-creation of value, we need to consider thinking small-scale.

Friedman (2008) suggests that, "networks are far better than hierarchical organizations at mobilizing our moral sentiments" (p. 119). Interpersonal networks reach far back in human history. They characterize tribal life, as well as the guilds of medieval Europe. According to Friedman, they also continue to dominate the relationships found in Hollywood production arrangements, and in higher education.

If networks could be created which replicate ancient patterns of relationships, fostering a sense of trust and connection, they might offer a means by which participation between service system entities could be enhanced, or even optimized. As described by DeWaal (2009): "In close and intimate relationships we prefer to operate on the basis of attachment and trust, reserving our marvelous accounting abilities for relationships with colleagues, neighbors, friends of friends, and so on" (p. 174). In essence, we work on the basis of trust with those we feel closest to, and tend to keep score with others.

It would be extremely naïve, and really not helpful, to suggest that we simply retreat to an earlier state of existence. (We are not all moving back into tribes as hunter-gatherers.) To be clear, that is not what is being suggested. In fact, those deeper aspects of our humanity which connect us to the mutualism found in other species never left us. They simply got buried or incorporated in our more recent behaviors. The question is how to tap into those basic tendencies.

A fundamental dilemma is the tension between the large-scale, highly interconnected world in which we now live, and the small-scale networks more naturally conducive to trust and cooperation. As noted earlier, legal systems seem to be necessary as an assurance for trust in large-scale systems, but must still be founded on basic moral codes. An alternative might be better connecting small-scale networks.

Another begging question is the role (if any) which technology plays, or should play, in the development of service science as described here. It would seem that social networking, and other communications, technologies of all kinds might be of value. The degree of value will probably be determined by the quality of relationship fostered. As described by Friedman (2008), networks based on moral codes are protective and self-regulating in many ways. Predators and cheaters are dealt with effectively, but that requires a sense of community and commitment, and on-going engagement. The degree to which virtual communities or networks can foster and maintain such relationships is an important issue.

With respect to research into service science, there will probably be efforts to model the systems (prospective or existing) as part of that work. In light of the research about mutualism, some cautions should be noted.

Simon (1996) draws a distinction between the fields of OR and artificial intelligence (AI). OR uses very elaborate mathematical formulas whose "power is brought at the cost of shaping and squeezing the real-world problem to fit their computational requirements… The alternative method provided by AI, most often in the form of heuristic search (selective search using rules of thumb), find decisions that are 'good enough,' that *satisfice*" (p. 27). Interestingly, Beer (1981) provides almost exactly the same distinctions:

> An algorithm is a technique, or a mechanism, which prescribes how to reach a fully specified goal… An heuristic specifies a method of behaving which will tend towards a goal which cannot be precisely specified because we know what it is but not where it is… Heuristics prescribe general rules for reaching general goals, then, and do not typically prescribe an exact route to a located goal as does an algorithm… The strange thing is that we tend to live our lives by heuristics, and to try to control them by algorithms (pp. 52-53).

As Simon (1996) goes on to explain, the algorithms of OR are primarily used at the middle levels of management. At senior executive levels of decision-making, heuristics dominate.

Connecting again to the moral codes which support mutualism, Friedman (2008) explains:

> We all have a natural tendency to regard morals as absolute and unchanging… But in all times and places, there has been a gap between the prescribed proper behavior and actual behavior – that's the way the moral system works (p. 172).

Interpreted, we use moral codes as heuristics by which we create mutualism. It is doubtful that we will be able to manufacture these kinds of relationships, or create them artificially. Given the research on mutualism, it is much more likely that organizations will have to invest in the kinds of commitments more typical of other human

relationships. Economic transactions work fine in traditional markets. Developing environments of trust which foster the co-creation of value will probably require more.

As a final note, Spohrer and Maglio (2006) describe the immense complexity they faced when first contemplating the development of service science as a new discipline. As they state:

> We had recruited PhDs in anthropology, cognitive psychology, computer science, cognitive science, education, human factors, industrial engineering, and organizational psychology, among others. The communication challenge alone of getting such a diverse population of scientists to speak a common language around "service innovation" required training everyone in each others' disciplines to some extent, as well as the injection of new, practical concepts fresh from the front lines of our own services business (p. 6).

For better or worse, this has been a long-standing issue in the system sciences. As explained by Wiener (1961):

> For many years Dr. Rosenblueth and I had shared the conviction that the most fruitful areas for the growth of the sciences were those which had been neglected as a no-man's land between the various established fields… There are fields of scientific work…which have been explored from different sides of pure mathematics, statistics, electrical engineering, and neurophysiology; in which every single notion receives a separate name from each group, and in which important work has been triplicated or quadruplicated… It is these boundary regions of science which offer the richest opportunities to the qualified investigator (p. 2).

The answer for Wiener and his colleagues resulted in the now-famous Macy Conferences, which allowed for the cross-disciplinary conversations that created the foundation of cybernetics. Maybe a similar process would be in order for service science. In any case, it is the suggestion of this paper that concept of mutualism be considered as a basis for starting the discussions about a fully interdisciplinary foundation for research on the development of service.

References

Beer, S. (1979). *The Heart of the Enterprise*. New York: John Wiley & Sons.

Beer, S. (1981). *Brain of the Firm* (2nd ed.). New York: John Wiley & Sons.

Beer, S. (1989). The viable system model: Its provenance, development, methodology and pathology, in *The viable system model - Interpretations and applications of Stafford Beer's VSM*, R. Esperjo and R. Harnden (Eds.), John Wiley http://www.managementkybernetik.com/dwn/Viable_System_Model.pdf

Beer, S. (1993) Origins of team syntegrity, in *Organisational fitness - Corporate effectiveness through management cybernetics*, Raul Espajo and Markus Schwaninger (Eds.), Campus, Frankfurt,http://project.comex.ru/down/Stafford_Beer_-_Origins_Team_Syntegrity.pdf

Bronstein, J. L. (2001). The exploitation of mutualisms, *Ecology Letters, 4*: 277-287.

Bronstein, J. L., Alarcón, R. and Geber, M. (2006). The evolution of plant-insect mutualisms, *New Phytologist, 172*: 412-428.

Bryson, J. R., Daniels, P. W., and Warf, B. W. (2004). *Service worlds: People, organisations and technologies*. London: Routledge.

Crick, F. (1970). Central dogma of molecular biology, *Nature*, 227, 561-563.

De Waal, F. (2009). *The age of empathy: Nature's lessons for a kinder society.* New York: Harmony.

Friedman, D. (2008). *Morals and markets: An evolutionary account of the modern world*. New York: Palgrave Macmillan.

Grossman, D. (2009). *On killing: The psychological cost of learning to kill in war and society* (Rev ed.). New York: Back Bay.

Maglio, P. P., Vargo, S. L., Caswell, N. & Spohrer, J. (2009). The service system is the basic abstraction of service science. *Information Systems and e-business Management,* 7.

Maturana, H. R. and Varela, F. J. (1998). *The tree of knowledge: The biological roots of human understanding* (rev. ed.). Boston: Shambala.

Rosen, R. (1985). *Anticipatory systems: Philosophical, mathematical and methodological foundations*. Pergamon Press, New York.

Simon, H. A. (1996). *The sciences of the artificial* (3rd ed.). Cambridge, MA: MIT Press.

Spohrer, J. (2009). Service science and systems science: Perspectives on social value, *Proceedings of the 5th Symposium of the 21st Century COE Program "Creation of Agent-Based Social Systems Sciences" on February 27 and 28, 2009, at Tokyo Institute of Technology,* Tokyo, pp. 9-33.

Spohrer, J., Anderson, L., Pass, N. & Ager, T. (2008). Service science and service-dominant logic, Otago Forum 2 [Electronic version]. Retrieved November 30, 2009, from http://marketing.otago.ac.nz/events/OtagoForum/Final%20forum%20papers/Otago%20Forum%20Paper%202_Spohrer.pdf.

Spohrer, J., and Maglio, P. (2006). *The Emergence of Service Science: Toward systematic service innovations to accelerate co-creation of value*, IBM Almaden Research Center, http://almaden.ibm.com/asr/SSME/jspm.pdf

Spohrer, J. & Maglio, P. P. (2009). Service science: Toward a smarter planet. In W. Karwowski & G. Salvendy (Eds.), *Introduction to service engineering*.

Spohrer, J., Maglio, P. P., Bailey, J. & Gruhl, D. (2007). Steps toward a science of service systems. *Computer, 40*, 71-77.

Vargo, S.L. and Lusch, R. F. (2004). Evolving to a New Dominant Logic for Marketing. *Journal of Marketing, 68*(1), 1-17.

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