Janie Chroust, 2010

International Federation For Systems Research

"Systems for Education, Engineering, Service and Sustainability"

Proceedings of the Fifteenth IFSR Conversation

G. Chroust, G. Metcalf (eds.)

April 10 - April 15, 2010
Kloster Pernegg (Austria)

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Team 2: The Science of Service Systems

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This team discussing the *emerging science of service systems* extended conversations begun at ISSS Brisbane in July 2009 (Bosch, 200), and continuing at the Tokyo Institute of Technology in March 2010.

In "steps towards a science of service systems" (Spohrer, Maglio, Bailey and 2007) it is stated that "the service system is the basic abstraction of service science" (Spohrer, Vargo, Caswell, and Maglio 2008). The *IFSR Pernegg Conversation* presented an opportunity to convene leading researchers in the systems sciences toward an appreciation of service systems as part of the "new economy" of the 21st century (OECD 2000, 2007).

With industrial production having been the dominant mindset of the 20th century, the advent of the Internet and globalization has presented new opportunity and challenges for scientists, engineers, managers and designers, and the education and training programs through which knowledge is disseminated. The exploration of services science from a perspective of the systems sciences has been seen by conversation participants as a relevant knowledge development domain. Four of seven Pernegg team members had contributed to the Brisbane and Tokyo conversations, enabling some continuity in learning combined while generating additional energy through the sweeping in of additional perspectives.

The conversation began with self-reflections on personal experiences leading each of the individuals to the systems sciences, acknowledging the influence of those trajectories on their perspectives on service systems. In recognition of this science of service systems as a potentially a new paradigm, much of the time together was spent in sense making about the intersection between ongoing services research and systems sciences perspectives. This sense making led the team to focus the dialogue more on posing the right questions to clarify thinking broadly, as opposed to diving deeply towards solutions that would be tied up as issues within a problematique field.

During the conversation, the progress on ideas was recorded on flipcharts. Nearing the end of our time together, the team cut up the flipcharts with scissors, and collated the discussion threads into five clusters:
(i) philosophy; (ii) science; (iii) models; (iv) education; (v) development.
With service systems as a new domain, the team found all five clusters underdeveloped. Recognizing that all five clusters are coevolving, the phenomenon of service systems was listed in order from the most concrete (i.e. development) through the most abstract (i.e. philosophy). Each of the five clusters was then summarized by a meta-question.

- 1. Development: How do we transition from the current paradigm?
- 2. Education: How do we help others learn about service systems?
- 3. Models: How do we understand and describe service systems?
- 4. Science: What do we know about service systems?
- 5. Philosophy: Why do (or should) we care about services systems?

Each of the meta-questions is described below, with some of the dialogue content associated with the question clusters.

1. Development of service systems: How do we transition from the current paradigm?

For the majority of the world, the interest in service systems is practical. Shifts in technology, economies and societies impact our jobs and our lives. We recognize agrarian societies (e.g. groups prior to industrialization or unimpacted by that revolution) and industrial societies (i.e. with the rise of machines). The service economy, particularly segments associated with new information and communication technologies (e.g. the Internet, mobile telephony) has not yet been universally labelled (e.g. post-industrial society and post-modern society) can have other connotations.

The label of (new) service systems was applied to discussions on three themes: (i) entry points; (ii) co-creation (as "designing with"); (iii) motivations and incentives; and (iv) concrete examples. The emphasis on development reflects that transition from our prior knowledge and practices won't occur without effort.

1.1 What are the entry points to service systems from where they are?

Not all segments of societies and economies are equally impacted by the advanced technologies or globalization so that associated service systems need to be viewed differently. Comparatively, changes are generally perceived minimally in hospitality industries (e.g. hotels, restaurants) that emphasize "high-touch" service and social interaction occurs face-to-face. Moderate change is generally perceived in health services (e.g. medical care, hospitals) that centre on personal care, but rising costs surface opportunities for greater efficiencies (e.g. electronic patient records). Massive change is generally perceived in information-based businesses, such as media and entertainment (with digital downloads displacing physical distribution) and financial services (with monetary and non-monetary instruments changing hands around the globe, around the clock).

Entry points into changing service systems are associated with the nature of resources, and they ways in which tangibles and intangibles are negotiated, created and delivered. Institutions associated with industrial systems that benefit from economies of scale standardize outputs to for mass production and cost reduction in markets where demand exceeds supply. When supply exceeds demand, service systems rise as supplier introduce variety as a way of to capture customers and then gain financial returns based on economies of scope.

1.2 Which systems are better suited for “designing with” rather than “designing for”?

Service systems may be characterized by co-production with offerings (as either inputs or outputs) (Ramírez and Wallin 2000), and co-creation of value (i.e. (i) co-experience and co-definition, and (ii) co-elevation and co-development (Novani and Kijima, 2010)). However, more service systems that operate in a linear and sequential fashion may be characterized more simply as producer-product relations.

In software development, there is often a differentiation between (i) a waterfall method, in which specification are completely predefined before construction; and (ii) an iterative or "agile" method where users are engaged during the lifecycle so that unarticulated needs and preferences can be surfaced as the conceptual becomes more concrete. A waterfall method has analysts "designing for" their customers. An iterative or "agile" method has analysts and users "designing with" each other in mutual learning and shared outputs. Software engineering has a long history of practices developed with waterfall methods.

"Designing with" in interactions of co-creation has a premise of a shared body of knowledge, both in explicit artifacts and implicit mutual understanding. Service systems that operate towards co-producing outcomes and co-creating value require both services recipients and providers to shift their mindsets towards participation and involvement. These engagements generally involve shared benefits and shared risks, so that responsibility for outcomes is borne mutually.

1.3 What motivations or incentives encourage the shift to service systems from the legacy state?

Businesses can be compared to (i) bus lines that operate on a planned route, without regard as to whether passengers are or are not on the bus; and (ii) taxicabs that may be hailed by or dispatched to passengers, and require the specification of a destination before they can fulfill their function. The bus lines can be characterized as (i) *make-and-sell* organizations that produce outputs as a first step and worry about distribution and customers later; and taxicabs as (ii) *sense-and-respond* organizations that negotiate understandings of value, outcomes and outputs before or during operation of the system.

Make-and-sell organizations are most appropriate when maximal production efficiency is paramount, e.g. when resources and supplies are constrained so that finding customers is not an issue. Sense-and-respond organizations are most appropriate when values, outcomes and outputs are ambiguous or difficult to articulate.

Service systems are generally sense-and-respond organizations. An evolution from a society of the scarce to a society of the plenty would encourage the shift from industrial production to service systems.

Maybe evolution from a society of the scarce to a society of the plenty.

1.4 Do we know of concrete examples of the new service systems?

Service systems, when operating correctly, serve. Thus, communities centered around religion (e.g. Amish farms) and human well-being (e.g. medical hospitals) have a long legacy of service. The systems that could benefit by additional research and development have shorter histories, often associated with information and communication technologies, and globalization.

Thus, the electronic devices and media based on digital technologies that are ubitiquitous in today's advanced societies surface challenges in the design of new service systems. These businesses involve hardware platforms, application software and firmware, and service providers in complicated relationship networks. A mobile smartphone is now conventionally expected to be upgradeable with selections from application marketplaces as well with roaming partners as with the local provider.

In the music business, falling costs of content distribution over the Internet have restructured the relationship between musicians, producers and listeners. The rise of user-generated content (e.g. blogs, Facebook, YouTube, and Twitter) is a stark contrast from the broadcast and syndicated media of a decade ago.

The codevelopment of new-to-the-world innovations often has organizations operating as networks in joint enterprises. When collaboration requiring specialized expertise and resources crosses organizational boundaries, the roles and definition associated with service systems definitions can encourage productive order.

Education and development have become globalized, such as with the Global Learning Lab at the University of Queensland in cooperation with the UNESCO Man and Biosphere programme.

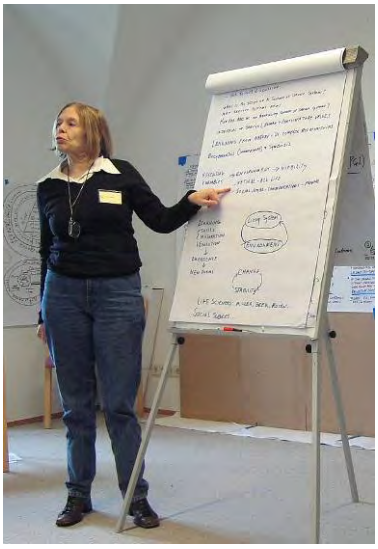
In general, an industrial orientation correlates with linear chains where coordination operates in pairwise links. Service systems are more complicated, often with three or more parties in interaction (e.g. a medical patient, the medical provider, and a third-party payer).

2. Education on service systems: How do we help others learn about service systems?

In the absence of commonly accepted textbooks and curriculum on service systems, pedagogy becomes a challenge. Dialogue included topics on (i) learning methods; (ii) the contribution of the systems sciences; and (ii) comparisons to current methods in education. Practically, educators will start from their existing bodies of knowledge and practices, with varying appreciations of the changing contexts in society and economies.

2.1 Through which processes will novices / beginners best learn about service systems?

Service systems often involve technologies, and always involve human beings. Individuals commonly have roles as customers or recipients from service providers, and thus gain a perspective when each is an actor external to a service system. Co-producing a single outcome is, however, different from taking responsibility for co-producing or designing a service system that will operate effectively for multiple customers and/or service providers in cooperation. Becoming involved in the design of a service system drives the need for a deeper understanding of constituents and tradeoffs.



The practical appreciation of human practices is often gained through experience. While anthropologists are skilled at observing cultures at work, learners hands-on to a service system may have the option of assuming the identity of a service provider -- at least briefly -- or shadowing an experienced professional in his or her natural world. A phenomenological engagement includes prior expertise, proficiency with tools of the trade, and working styles with colleagues and customers.

In structured pedagogical methods, experience-oriented approaches, such as Problem-Based Learning, can provide a setting for productive engagement. To emphasize the complexities of working in a service system, a study involving three or more actors develops the appreciation multiple perspectives. While field studies require planning, students with initiative should have access to service systems within their lives, e.g. a dentist (including patients and payers), or a public service (e.g. a city department with citizens and labour unions).

2.2 How do the systems sciences help in learning about service systems?

The systems sciences provide a common language that can help bridge the many varied aspects of the world. Perspectives can include individual, organizational, technical, economic and political aspects. While the science of service systems is continuing to evolve, clarity in basic concepts (e.g. function, structure and process), models (e.g. living systems, inquiring systems) and methods (e.g. dialogue) provide a general body of knowledge that can be specialized as the discipline and subdisciplines become established.

The value of knowledge in the systems sciences after the domain of service systems has been well-established may diminish when conventional wisdom has been established, but the systems sciences can always provide a critical view that continues to sweep in new perspectives if the discipline becomes too inwardly-focused.

2.3 How is the approach to service systems different from prior approaches to education?

In systems thinking, synthesis precedes analysis, where (i) the whole in which the part is contained is identified, (ii) the behaviour or properties of the containing whole are explained, and (iii) the behaviour or properties of the part is explained in terms of its role or function in the containing whole (Ackoff 1981). Accordingly, a service system should be viewed not just reductively, but as part of a larger system. The service system is part of a larger world.

Following this systems perspective, learning should develop an appreciation of the functions or roles of a service system in the expanded contexts before taking them apart. This suggests that learning should emphasize synthesis before analysis. Both synthesis and analysis are important. Developing an intuitive appreciation of a service system in its containing whole should be prioritized earlier with continuing refinement and depth, rather than integration only as a final activity (e.g. in capstone projects or units). The relationships and interactions within the containing whole for a service system can be more complicated than those inside.

3. Models of service systems: How do we understand and describe service systems?

Models can range from the informal and implicit to the formal and rigorous. Models of service systems are represented from person to person as ways of conveying conceptual phenomena on negotiations,

designs and operations. Understanding and describing service systems raises questions about (i) the scope and purposes of modeling; (ii) transitions and alignment of models across a variety of disciplines or professions; and (iii) how these types of models might be different from others.

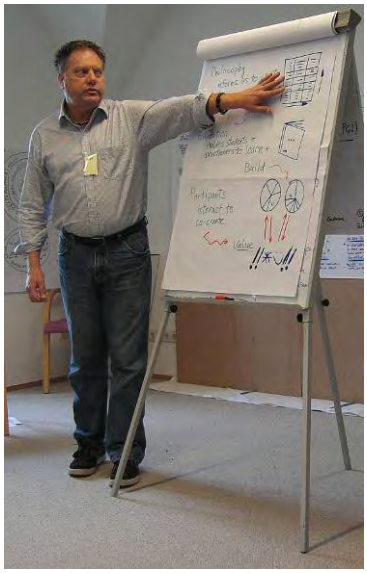
3.1 What should the model deal with? For what purposes to we model service systems?

While realists would philosophically argue that a service system can be objectively modeled, human involvement can lead to issues where one's perception becomes his or her reality. Thus, effective models of service systems need to appreciate that the breadth of a variety of perspectives -- as views, lenses or template -- may be as important as the depth of a single analysis.

The purpose of a modeling a service system varies according to context. Developing a new service system calls for models that reflect understandings of the needs and preferences of service co-creators and designers towards a converged concept. Practicalities of feasibility and viability lead to models in which service trade-offs are considered and resolved. A service system in operation may benefit by an abstract model through which improvements and extensions are envisioned.

3.2 How do we reconcile service systems across scientists, engineers and managers?

The variety of service systems models can include conceptual models, analysis models, design models, component models, implementation models and deployment models. Scientists are most interested in the nature of service systems, and how various types may be superior or inferior in the range of environments in which they are (or will be) found. Engineers are conventionally pragmatic in composing and maintaining service systems that are reliable and robust. Managers are generally interested in ensuring the performance of service systems, with efficient use of resources to produce desired outcomes.



Across these disciplines / professions / orientations, models of service systems enable collaboration and discussions on the creation and adaptation of future designs, as well as on the effectiveness of current designs on meeting the needs of stakeholders.

3.3 In which ways are service system models different from other models of the world we've already created?

Service systems include both parts that are technology, and parts that are human. Attention should be paid to the boundaries defined in models of a service system. Breaking a system down into one independent model with only technology parts and then a subsequent independent model with only human parts reflects the disciplinary view of the observer, rather than the interactive nature in reality.

Complete service system models should include not only *outputs* in response to each situation or request, but also *outcomes* as perceived by the human participants, and the *value(s)* derived by each. While subjective aspects of service systems may be more difficult to order or quantify than objective aspects, their abstractness should not deny their reality.

4. Science of service systems: What do we know about service systems?

The science of service systems is current going through a revolution, as technology and changes in the nature of social interaction reflect a world in the 21st century. Principles, inferences and conventional wisdoms from the industrial age should be treated with suspicion. In outlining what we do (and don't) know, (i) the scope of the science of service systems will need to have been accepted; (ii) new features will have to have been acknowledged; and (iii) some sense of progress will have to have been perceived.

4.1 What is the scope of a science of service systems?

While the art of service is not being denied, establishing a science of service leads to replication and reproducibility. The emphasis on systems associated with a science of services provides a common language and foundation that will be taken for granted as knowledge in the domain matures.

The emphasis including human values into the science of service systems may be controversial to scientists based in a realist philosophy, but not controversial to scientists comfortable in constructivist and interpretivist philosophies.

4.2 Are service systems really new?

Studies of service systems are not all new. Services to human beings with industrial age technologies -- mechanical, chemical and electrical -- are already well understood. Digitalization and cheap Internet technologies enabling near-real-time communications and globalization have changed the feasibility of certain types of service systems more than others.

Service scientists can enrich the understanding of service(s) by contributing a perspective on the interacting parties/parts and/with human action and values.

4.3 How far are we on advancing a science of service systems?

Much of the knowledge on services is fragmented across a variety of disciplines. As examples, textbooks on service marketing, service design and service operations represent mostly independent bodies of knowledge without integration.

With the science of service systems proposed only circa 2005, the science is arguably in its childhood or adolescence. The systems sciences have a body of concepts that can be extended and applied with frameworks, models and methods in the domain of service(s).

5. Philosophy of service systems: Why do (or should) we care for service systems?

Although potentially esoteric to practitioners, sciences are associated with foundational philosophies. The functions of philosophy with service systems include (i) purpose; (ii) associated shifts with a changing world, and (iii) scope.

5.1 Why would we need a philosophy of service systems?

In the absence of a science of human practice, we may incorporate inductive, abductive and deductive approaches to appreciating, designing and constructing service systems (Ing 2009). We may know how to design and operate service systems, but the why, when and where may not be so necessarily taken for granted.

5.2 What shifts in philosophy might be associated with a service systems approach?

Service systems now operate in new levels of complexity in dealing with transnational societies, global businesses and new technologies that were only science fiction a few decades ago. Cultures need time to absorb those changes, and many people will experience friction as they maintain traditions and prior practices, either as preferences or as anachronisms out of step with the advances in civilization.

5.3 What is the scope of a philosophy of service systems?

The presumption that service systems should serve is sometimes lost. The aesthetics, morals and ethics of service systems are foundational questions that should continue to be explored and challenged.

6. Continuing inquiry

The conversation on a science of service systems at Pernegg in April 2010 provided the research team with a richness of contemplative time to advance our collective thinking. In July 2010, an overview of research interests and orientations was presented in a panel at the INCOSE International Workshop in Chicago, and a preliminary digest of the Pernegg conversation was outlined at ISSS Waterloo 2010. The learning on a science of service systems continues.

References

Ackoff, Russell L. 1981. Our Changing Concept of the World. In *Creating the Corporate Future: Plan or Be Planned For*, 3-24. New York: John Wiley and Sons.

Bosch, O.: *Proceedings of the 53rd Annual Meeting of the International Society for the Systems.*

Haeckel, Stephan H. 1999. *Adaptive Enterprise: Creating and Leading Sense-and-Respond Organizations*. Boston, MA: Harvard Business School Press.

Ing, David. 2009. Envisioning Innovation In Service Systems: Induction, Abduction and Deduction. In *Proceedings of the 53rd Annual Meeting of the International Society for the Systems Sciences*. Brisbane, Australia.

Novani, Santi, and Kyoichi Kijima. 2010. Value Co-Creation Model of Service Innovation: Symbiotic Hypergame Analysis. In *Proceedings of the 54th Meeting of the International Society for the Systems Sciences*. Waterloo, Canada. http://journals.isss.org/index.php/proceedings54th/article/view/1378.

OECD. 2000. A New Economy? The Changing Role of Innovation and Information Technology in Growth. http://www.oecd.org/document/62/0,3343,en_2649_34273_2675198_1_1_1_1,00.html.

OECD. 2007. OECD Science, Technology and Industry Scoreboard 2007: Innovation and Performance in the Global Economy. http://www.oecd.org/document/10/0,3343,en_2649_33703_39493962_1_1_1_1,00.html.

Ramírez, Rafael, and Johan Wallin. 2000. *Prime movers: define your business or have someone define it against you*. Chichester, England: Wiley.

Spohrer, Jim, Paul P. Maglio, John Bailey, and Daniel Gruhl. 2007. Steps Toward a Science of Service Systems. *Computer* 40, no. 1 (January): 71-77. doi:10.1109/MC.2007.33. http://dx.doi.org/10.1109/MC.2007.33.

Spohrer, Jim, Stephen L Vargo, Nathan Caswell, and Paul P Maglio. 2008. The service system is the basic abstraction of service science. In *Proceedings of the 41st Annual Hawaii International Conference on System Sciences*. HICSS, 104. doi:10.1109/HICSS.2008.451. http://doi.ieeecomputersociety.org/10.1109/HICSS.2008.451.

The aim of the Fifteenth IFSR Conversation in 2010, held in Kloster Pernegg, Austria in April 2010, was to continue the tradition that had been established in 1980, but with a renewed focus on coordination between the participating teams. The overarching theme for the conversation was how to support and disseminate systems research and education. The deliberations the 4 teams supported the over-all theme in different ways

- systems education and curricula
- learning sustainability of systems
- linking systems thinking to service systems
- system thinking in systems engineering.

The Conversation was able to build on previous and ongoing work within the member organizations of the IFSR. The outcome of this Conversation, while at a high conceptual level, also supports and encourages further practical applications through individual member activities.

The Conversations essentially followed the successful scheme used in earlier Fuschl Conversations as devised by Bela H. Banathy. 28 renowned systems scientists and systems practitioners from 9 countries took part in this 5-day cooperative effort.

The outcome of the conversation is summarized in 4 team reports plus several contributed papers. A short description of the IFSR's activities closes the proceedings.

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