ENVISIONING INNOVATION IN SERVICE SYSTEMS: INDUCTION, ABDUCTION AND DEDUCTION

David Ing
IBM Canada Ltd, 3600 Steeles Avenue East, Station H7,
Markham, Ontario, Canada, L3R 9Z7; and the
Helsinki University of Technology,
Department of Industrial Engineering and Management, Espoo, Finland
daviding@ca.ibm.com

ABSTRACT

An initiative to transform or redesign a service system can be centered on envisioning a future that may be explicit or implicit, shared or tacit. When that future represents a discontinuous change from the current state, detailed analysis from a single frame (e.g. process modeling) may mislead or confuse collective choices and priorities.

Four envisioning engagements – across a variety of service businesses – are reviewed as case studies to surface commonalities in approach. Success in the engagements has largely been attributed to the sequencing of consultations into sequential phases of induction, abduction and then deduction. Challenges to adoption of this three-phase approach are outlined, as a departure from current practice in envisioning innovations.

Following an inductive style of description, conclusions are presented with theoretical saturation of research concepts based on the philosophy of phenomenology.

Keywords: service systems, innovation, system envisioning, induction, abduction, deduction

INTRODUCTION

Envisioning alternative future states for a service system lacks a concreteness common in envisioning product enhancements. Product development typically follows a pattern that includes rendering tangible prototypes or proofs-of-concept. Envisioning innovation in service systems, in contrast, centers primarily on changes in intangibles or socially-constructed arrangements. Changes in processes, organizational arrangements, informational workflows and pricing structures will be welcomed and/or defeated by service providers or external coproducers. Radical innovation in service systems calls for articulation of a coherent future state vision and plan. This vision and play may be developed by external consultants, or a dedicated task force of skilled internal analysts. The ways in which these change agents assist an innovation champion deserve deeper inquiry.

The phenomenology of service systems has human beings engaging in social interaction in a mediating context of three dimensions: physical, social and informatic (Ing & Simmonds 2002). Innovating in a service system may be introduced with a focus on one of the three dimensions, but the nature of group work generally results in related impacts

in the other two. Understanding the nature of innovations can be analyzed in the three two-way intersections between these mediating contexts, i.e.

- workplace infrastructure (physical / social enablement), e.g. colocating coworkers most benefiting from face-to-face communications;
- conversation workspaces (social / informatic enablement) e.g. supporting electronic communications – in interactive speech and text, and in persistent artifacts such as softcopy documents, drawings or video; and
- information architecture (informatic / physical enablement) e.g. streamlining data flows so that human-computer and computer-computer interactions are efficiently served.

The redesign of workplace infrastructures has a long tradition with architects, interior designers and organization developers. Innovation in conversation workspaces and information architectures has been more recent, due to the rapid – and somewhat unpredicted – rise and evolution of Internet-based technologies. Interactive electronic communications now include "wikis" and "blogs" – words not found in any layman's dictionary more than five years old. Synchronous Internet-based interactions (e.g. instant messaging) are still not as common between business enterprises or with consumers, as compared to interactions between teenagers. In the business-to-business context, this new wave of Internet technologies includes service-oriented architecture (SOA) and web services based on standards that are entering a stage of technical maturity. SOA and web services are infrastructures that enable greater fluidity between departments of a single enterprise, and between alliance or supply chain partners. Their technical sophistication often presents a challenge to organizations in describing how collaborative work will change on a day-to-day basis.

Much of the challenge of innovation in a service system is the challenge of envisioning. (Hodgson 1998). Collaborative information environments largely exist in intangible worlds of data and logic, where both the content and infrastructural technologies continually evolve. Following an inductive case study style (Eisenhardt 1989), the article that follows reflects on experiences gained across four consulting engagements in which the author was involved. These engagements each had a goal of envisioning a future state for a service system where work practices would be modified by Internet-generation technologies. The major sections that follow shed light on the following questions:

- Case study contexts: what was the expected scope of service innovation?
- Envisioning approach: which steps were most essential to understanding the potential innovation?
- Challenges to conventional consulting practices: how was the envisioning approach applied in these cases counter to orthodox envisioning practices?
- Foundational sciences: which theoretical bases provide insight in the generalization across these experiences?

The relevance of these experiences is most salient in services systems impacted by changes in their information environments (Spohrer, Maglio, Bailey and Daniel 2007), in businesses concerned with "world is flat" considerations (Ing 2007, Friedman 2005). Innovation is often approached as change in business processes, with altered

organizational roles and procedures: formal authority is restructured, and work activities are then sorted out through organizational sensemaking (Weick 1995). As a complementary – and under some conditions, a more constructive – approach, innovation can be approached by modification of socio-informatic mediating spaces. The development of low-detail high-precision information models changes worlds of collaborative work with more direct access to data and rechanneled communication flows.

The key insight gained across these cases is that consultants who rely exclusively on process modeling techniques and tools should explore the benefits and advantages of information models. In particular, while process models are good for establishing a base understanding of current work practices, information models are better for envisioning a future world in which work collaboration is mediated. Workers will chafe against procedures that prescribe to them by consultants external to their communities of practice. The definition of future work designs needs to recognize that …

> There is an inherent uncertainty between design and its realization in practice, since practice is not the result of design but rather a response to it. As a consequence, the challenge of design is not a matter of getting rid of the emergent, but rather of including it and making it an opportunity. (Wenger 1998, p. 233)

Thus, instead of over-specifying procedural aspects of collaborative work (e.g. procedures, sequential steps, exception handling by supervisors), a greater focus on the informational aspects of collaborative work enables workers to draw on information technologies as "resources for action" (Suchman 1987).

BUSINESS PROCESS MODELS DESCRIBE CURRENT STATE WELL, BUT ARE INCOMPLETE ON FUTURE INFORMATION CONTEXTS

By 2005, the potential for Internet technologies to enable greater integration in the use of information technologies across organizational boundaries had been recognized:

> Service-oriented thinking, which is becoming popular in both the business and the information technology (IT) communities, is based on the concept of service as a well-defined, self-contained function that does not depend on the context or state of other services. In the IT community service-oriented architectures (SOAs) have emerged as the main approach for dealing with the challenge of interoperability of systems in heterogeneous environments. SOAs also hold the promise of additional benefits, such as reuse of components, improved reliability, and reduced development and deployment costs. In the business world, the service-oriented approach helps automate the managing of business processes by enabling the “orchestration” of services in order to achieve the needed functionality. (Ritsko and Berman 2005)

Just as the web browser has become an almost universal interface to data sources and applications, service-oriented architecture promises to enable interfaces whereby updates in one information system trigger updates or appropriate action in another. To the average business professional, this means that the routinized task of copying-and-pasting

from one data source to feed another is more easily automated across heterogeneous platforms. Further, instead of continually having to "pull" an information data source when watching for updates, the worker can add the source to "push" a feed to his or her profile, notifying whatever level of attention is required or requested.

The PC revolution has enabled many workgroups to accumulate workarounds and "quick-and-dirty" ways of automating paper processes. These engagements were all related to service aspects of a business. Across industries, advisory engagements were conducted for:

- a national restaurant chain of quick service and family dining stores;
- a regional justice system of courts, prosecutor, public defender, sheriff and probations;
- a Hollywood movie studio post-production facility; and
- a regional wholesale electricity provider

These represent businesses in retailing, public sector, media and entertainment, and utilities. Across the four engagements, reducing manual effort and improving efficiency were common themes. Improving future state work processes through Internet-age information technologies was a common interest.

INNOVATING COLLABORATIVE WORK REFORMS BOTH WORK PROCESSES AND THE INFORMATION INFRASTRUCTURE

Since information systems have become so central in most businesses today, companies have an interest in mitigating impacts on day-to-day operational activities. New information technologies should make work easier, not more difficult. The development of a future state scenario not only depicts one potential view of improved ways of working, but also surfaces aspirations of ways the business can better serve customers and/or exploit new market opportunities.

A restaurant chain wanted consistent workforce management

The corporate parent of multiple restaurant brands – with formats ranging from quick service (e.g. eat-in or drive-through hamburgers) to family dining (e.g. chicken and ribs) to upscale casual (e.g. steakhouses) – had previously managed its workforce at the store level. Although the government classified all of the company's employees similarly, the approach to hiring and staffing of workers had more in common with independent operations than corporate-owned facilities. The corporate parent wanted improved consistency across stores to ensure compliance with labour regulations, yet recognized that each brand had work practices idiosyncratic to its segment.

Today's leading workforce management systems can either provide functionality (e.g. clock-in/clock-out) natively, or in cooperation with other software packages (e.g. in-store back office operations). Determining the functions to be made common across all

restaurant brands – relative to functions to be handled situationally – required the active participation of store operations and regional managers.

A regional justice system wanted streamlined information flows

The members of a justice system – including the court, district attorney, public defender, sheriff, and probations – had attempted to create an integrated and centralized information system in the early 1990s. After 6 months, each of the parties chose to go its own way, as the "lowest common denominator" only added to their workloads. The result was daily backlogs of documents to be scanned and/or rekeyed into each independent system. The rise of Internet-based technologies presented an opportunity to automate data flows on reports and cases as new information became available.

Privileged access to information became the key concern in this engagement. Although all parties were interested in the prospect of information technologies leading to improved justice, formal roles required clear information governance. As an example, the public defender had a duty not only to maintain confidentiality of its clients' evidence even before he or she was charged, but also potentially through the period of incarceration and/or appeals. From a larger perspective, however, the growing population in the region continually increased the number of hardcopy and electronic documents that had to be stored and searched every day.

A post-production unit wanted efficient digital editing workflows

A Hollywood film studio has been positioning itself as a technology leader by moving on from the hybrid method of film editing developed since the 1980s: correcting (matching) colors on film negatives across different film stocks on different reels, cutting and splicing film physically, and inserting digital visual effects in key frames. The state-of-the-art is currently digital intermediate, changing the order of steps: negatives are scanned into the digital format first, and color correction and splicing are subsequently performed at a digital workstation. This studio had benefited by hands-on learning through some early pioneering post-production projects, and was looking to increase its volume rapidly in the coming years.

Sequencing and prioritization of work activities were recognized by managers in the motion picture imaging unit as inflexible and paper-intensive. While the quantity of work might previously have been judged by the number of reels of film piled up on a desk, digitalization removed those visual cues. In addition, the management of digital storage – since a movie in process requires 300 terabytes of online disk space, edited down to 12 to 14 terabytes of finished product – was becoming a problem, as old jobs were not being properly purged after archiving. The opportunity to improve productivity through an integrated web-based work management system was clear, but the key information content to be surfaced was not. Automation of job steps could improve coordination, and alert conditions for approvals or intervention could highlight important decisions to be made.

A wholesale electrical provider wanted daily nodal index products

A regional electricity provider to commercial and industrial customers had last refreshed its information systems in anticipation of Y2K problems. Since that time, little was done to add new features, even though the energy customers had moved on from fixed rate pricing to prices set according to options markets daily. In addition, with regional markets moving from pricing zones or more fine-grained nodes, the number of different prices available to customers could grow by one or two orders of magnitude. With brittle information systems designed for a prior era, the electricity provider had an inability to create new products, facing obsolescence by more nimble competitors.

Skilled professionals had developed workarounds over the past five years, mostly through linked spreadsheets. This caused data integrity issues, with correct references to original data sources made murkier through turnover in personnel. Skill requirements to maintain spreadsheets rose to master's level expertise, with burn-out by analysts contributing to high turnover and a planning horizon no farther than the next day's activity. Since the scope of changes required to upgrade information systems was so great, the key issue became the sequencing of initiatives that would support strategic priorities, yet not halt day-to-day transactional activity bringing in revenue and satisfying customers.

Key artifacts delivered were process sketches of the current state, and information sketches for a future state

In each of the above cases, both supervisors and workers were interviewed to understand current state processes, i.e. how work was currently being conducted. This included describing job roles, key work activities, data sources, and resources used or consumed. The scope of inquiry was not to create the most detailed model, but instead to gather sufficient appreciation to identify bottlenecks and time-consuming manual tasks (e.g. rekeying data from one system into another).

For potential future state changes, the business process orientation was de-emphasized. Instead, alternative use case sketches -- describing the types of information that could be made available to an individual, workgroup or supervisor(s) – were presented as points of discussion. Interviewees were then able to judge the types of information support that would be most helpful, and provide additional suggestions on details of an improved future work environment.

Developing process sketches (e.g. "swim lanes") for the current state and information sketches (e.g. "use cases") for the future state represents a break in logic and traceability within a consulting engagement. Process sketches emphasize work activities. Information sketches emphasize work status and coordination of data feeds between individuals. "Swim lanes" make sense to understand current work activities, but specifying them for a future state does not mean that workers will adhere to defined roles or specified tasks. Use cases are helpful in understanding future state information system features, but documenting behaviours for the current obsolete information systems is unproductive. Thus, developing an appreciation for current state work issues and

constructing future state work enablement should be seen as two distinct consulting phases.

ENVISIONING THE SERVICE SYSTEM SEQUENCED INDUCTION FIRST, FOLLOWED BY ABDUCTION AND THEN DEDUCTION

The consulting engagements described above were proposed and largely executed by a consultant acting independently, based on the experience of more than a decade. While industry specialists and presales technical experts were available to lend subject matter knowledge, the consulting process was fluid and organic. In the interest of advising other consultants on the reasoning behind the method, a self-reflection surfaces nine steps, based on the stages that primarily exhibit induction, abduction and then deduction. Definitions that contrast the logic of induction, abduction and deduction are detailed in the *Appendix*.

A. Induction of the current state involved participant selection, problem definition and business benefit

In launching a consulting engagement, an inductive approach seeks to gather business problems as described by managers and workers who collaborate and carry out their roles every day. Key features include:

- setting scope by having the right individuals involved;
- meeting interviewees with a light agenda, allowing them to speak their minds;
- documenting diagrammatically, rather than with volumes of text; and
- probing for "big picture" benefits, rather than details.

An inductive approach discourages a consultant from coming in with answers pre-baked. More details on each of the above features follow.

1. Scope was set implicitly by participants engaged and excluded

Open-ended consulting is based on the premise that having the right people involved will increases the certainty of a productive result, while having the wrong people involved almost guarantees irrelevancy.

The key role from the client was the project leader. He or she ensured interviewees were committed to the schedule, and set the context for all participants involved. This project leader attended most engagement activities, to introduce parties and provide background intelligence. This role also served as the primary interface to the executive sponsor, who provided legitimacy as the senior driver for the engagement but was generally too busy to deal with day-to-day activities.

The client project leader both implicitly and explicitly excluded individuals from interview schedules. These choices reflected the scope judged to be most relevant, so that the engagement wasn't sidetracked by a technical detail, nor distracted by a personal agenda not reflective of overall organizational interests. In addition, the client project

leader also provided background intelligence on the appropriate weighting of opinions of various interviewees.

2. Open-ended questions guided interviewees, allowing voicing top-of-mind issues
The consultant's first few questions framed the discussion for the 30 to 60 minutes with the interviewee. Individuals were encouraged to vent frustrations with current state business processes, and contribute personal ideas on how work activities could be improved. Further details on information systems – as specific data sources, resources used, and handoffs – we collected as a matter of course. Interviewees were often asked to draw simple flowcharts that were often reviewed with the next interviewee for further elaboration.

Maintaining a conversational rhythm favoured capturing the subjective views of the current state from multiple perspectives. For more concrete reference points, interviewees were asked to provide samples of forms or reports before or after the face-to-face meeting. The combination of subjective and objective information would gradually evolve into a coherent body of knowledge. Commonalities and differences across multiple interviewees with similar job roles supported triangulation of issues and potential solutions.

3. Process sketches were constructed and validated
In early envisioning activities, a time-boxed engagement surfaces the most salient features, but leads to incomplete specifications. Bounding the findings to the limited facts captured does not impede development of a representation and narrative, although it disables the immediate possibility of an executable simulation model.

Sketches are graphical representations that may or may not yet be rigourous models. They serve as concrete artifacts that demonstrate to interviewees that their insights and concerns have been heard. In an inductive approach, diagrams can prove to be superior to words, as the distraction of correcting phrases or punctuation is removed.

Process sketches were presented as works-in-process to encourage interviewees to surface more details, and/or redirect inaccurate depictions. As a feedback mechanism, they allowed client representatives to validate the accuracy of data collected across the organization.

4. Opinions on projected systemic business value were probed
Many business cases are reductive, as they attempt to provide precision on incremental changes in work activities. These four engagements sought a systemic approach to business value – e.g. a "big picture" impact – that better reflected the transformational nature of a changed future work environment.

These statements were garnered from interviewees with subtle encouragement, e.g. "what would happen if we did nothing?" Inaction is often the alternative to transformation. These narratives could support more quantitative estimates in later stages.

B. Abduction of a future state posed outlines and roadmaps, that were refined towards findings

Having established an inductive understanding of client issues, the next consulting phase recenters on the capabilities within the consulting team. Abduction is an act or creation, where imagination and open-mindedness are a leap from the current state. Development of a coherent narrative is an art of the possible, linked to current realities. Two features are suggested:

- defining the major features of a future state, and alternative paths for getting there; and
- voicing and refining the future state vision(s) to bring formal and informal leaders on board.

At this stage, a narrative that emphasizes function – linking the future state vision as a whole to findings on business challenges to date – is more important than a complete structure of action – i.e., all of the details of decisions yet to be made. The executive sponsor will largely judge the consultant(s) on the coherency of reasoning in proposed futures. Details of these two steps follow.

5. Scenarios of solution outlines and roadmaps featured alternatives and options
Although the issue for envisioning is often posed as the entire scope of a future innovation, the sequence of activities – what to do first – anchors the vision to current realities. A solution outline depicts the suite of technological components, potentially on a two-to-three-year horizon. The roadmap envisions certain components to be implemented before others, and/or features that must be in place before subsequent functions can be enabled.

Across the four engagements, the requirement of infrastructural components had to be balanced off against visibility of benefits. Technologists may prefer to have all of the infrastructure in place to reduce the complexity of sequencing resources, but the business community gets impatient if progress is not seen within a few months. Thus, simple initial user interfaces (i.e. web portlets) to access shared data sources received higher priority, on a path towards gradually adding more visible features and functions.

In the development of alternative scenarios, consultants should build on the perspectives of client interviewees for plausible futures. Consultants contribute largely towards internal consistency, while client participants influence external validity. Development of the roadmap should recognize potential off-ramps and on-ramps that may be encountered on the way to the ultimate solution. Systems change is unpredictable, so recognizing more options along the way improves the robustness of a final recommendation.

6. The converging wisdom on a path forward built momentum for focused action
Engagement of the consultants and the commitment of client resources for interviews are signals of an interest in change. Organizational progress can, however, be paralyzed in the complications of multiple technologies and unclear future roles and work procedures.

While conversations between the client and the consulting team support development of the resulting artifacts, the engagement provides client executives, managers and employees with a setting to discuss tactical and strategic questions. The pressures of day-to-day activities often mean that opportunities for such discussions are rare.

In the four engagements, the client project leader scheduled key meetings with groups – aligned by job roles, departments or similar interests – by booking ahead from two to five weeks. These group interviews did not coincide with normal operational activities, so the agenda for the gatherings had to be made clear. In many cases, individuals who had communicated to others only over the phone or by e-mail were introduced to each other. The focus on a new future not only provided the forum for interaction, but also energized the participants as a signal that actions – and not just words – were a reality.

C. Deduction in action plans were the bridge from current state to future state

With an inductively-collected narrative of current state challenges and opportunities, and some convergence on abduced envisioned future states, the last step is to gain an agreement for next steps. With a generally agreed path forward, many details are left to be worked out. This requires coordinated action between the clients and downstream sales and delivery teams.

7. Artifacts and intelligence were transferred to follow-up design teams
The deliverables from the three of the four engagements were delivered as presentation packages (i.e. weighted towards graphics, landscape format, and fonts larger than 14-point). One engagement was provided with a more complete text document, which added some weeks for delivery and review.

The form of the final deliverables was clearly set in the outset of the engagements. The key consideration is the client's desire for (or aversion to) reading long text documents. In most cases, business professionals prefer simpler presentations, with verbal (i.e. face-to-face or teleconference) reviews of the content. This interactive style reduces the amount of content delivered in written form, and allows conversational questions-and-answers amongst a group. Since all members of the audience are not equally immersed in all aspects of the study, the opportunity to gain additional depth into the reasoning of the consulting team often stretches beyond the immediate situation.

At the same time, technical teams generally prefer documentation in a more static form. For this audience, graphical notation (e.g. process model swim lanes, or information model sequence diagrams) are easier to understand than pages and pages of text. With files exportable from software modeling packages (e.g. Websphere Business Modeler, Rational Software Architect), artifacts developed during the short management-oriented engagements can serve a starting point for more detailed and rigourous analysis.

The above seven steps were described to clients at a high level before the engagements formally started. As the engagements evolved, slightly different emphases arose to deal with specific circumstances, but were still consistent with high-level outcomes.

Analyzing commonalities across the engagements produces some challenges to conventional wisdoms on how innovations to service systems are introduced.

IN REFLECTION, THESE EXPERIENCES CHALLENGED SOME CONVENTIONAL WISDOMS IN SERVICE INNOVATION

System envisioning and practice of consulting have conventional wisdoms that are largely not analyzed reflexively. The success of an approach in one or more prior engagements may or may not be the best way to approach a new engagement. The methods of inquiry and experience of the project team will likely differ. Tools and templates proven in a prior situation have to be adjusted for greater relevance for the situation at hand. In the four engagement described, the small consulting teams enabled a fluidity to reflect on appropriate approaches to each case. Across the engagements emerged three challenges to conventional wisdoms in service innovation:

- Consulting professionals conventionally conduct business process modeling as a leading technique for understanding the current state of a business. The extension that business process modeling is the logical approach to an envisioned future state should be challenged.
- Management consultants are typically told that client business professionals understand only diagrams related to business process, and that information models are for technical professionals. The belief that bubbles and arrows meaning processes are understandable, but bubbles and arrows meaning information are not understandable should be challenged.
- The design of organizations as a domain for management consultants is generally portrayed as independent (and preceding) the design of information systems by technology consultants. The leads to the definition of "requirements", following a "waterfall" approach. The notion of a future state vision as a requirements checklist should be challenged.

Each of these three challenges is described in greater detail below.

Challenge: A process-centric approach for the current state means a process-centric approach for the future state follows

Business-oriented management consultants are generally trained in business process modeling. Processes, however, represent only one aspect of a business. The ways in which information is generated, stored, transferred and used is also important.

In a current state analysis, analyzing business processes is productive, as workers don't always exactly follow the procedures documented in a manual. Further, they don't always use all of the information sources provided to them. A detailed analysis follows logical branches, as different cases of work are handled, with exceptions often routed to different priorities or manual intervention.

In the envisioning of future state work activities, however, information is a resource as much as materials or equipment. When the focus of an envisioning engagement is on changing information systems, specifying business processes is akin to writing another procedure manual that workers may choose to ignore. As an alternative, future state information models can represent a changed world for collaborative work. Reconfiguration of the socio-informatic environment (e.g. supporting more immediate conversations between two individuals) can be as significant as that of the socio-physical environment (e.g. rearranging office cubicles of inter-related coworkers).

The prescription for consultants is simple: provide education and tools appropriate for information modeling in addition to those for process modeling. This may not be a prescription for all business-oriented management consultants. A new class of professionals, called business architects, are expected to have skills both in the design of organizations as well as information systems.

Challenge: Client business professionals understand process diagrams, but don't understand information diagrams

Most business professionals are now familiar with "swim lanes" representations of their work, as a result of business process re-engineering efforts. However, the completeness and correctness of these models vary greatly. A novice business analyst may be able to string boxes and arrows together, but will not capture sufficient detail or rigour for an executable model (i.e. a computer-based simulation). Still, drawings of low detail process models are probably easier to follow than the equivalent pages of text with branching from one case to another.

Information modeling has formalized notation developed by computer scientists, e.g. Unified Modeling Language (UML). The orientation of computer scientists has led the emphasis of these techniques to describe procedures executable inside a computer. Many models of this type, however, can include interactions between human beings and computers. Use case diagrams and sequence diagrams can be simplified as "sketches". The designation of "sketches" suggests a lower degree of rigour appropriate for exploratory discussions where all information design decisions have not yet been worked out.

Diagrams – whether process-oriented or information-oriented – require a strong narrative to help readers follow reasoning in a diagram. Any diagram is mystical if the reader doesn't understand what a bubble or line means. The assumption that any diagram should be self-explanatory parallels an assumption that any written document is understandable. Laymen lean on lawyers to interpret laws, and so should also be comfortable with leaning on computer analysts to interpret information systems designs.

Challenge: The future state envisions a world with requirements as a checklist

Equipment in the physical world – maybe best described as hardware – is not readily redesigned. In a world of mass production, while some equipment (e.g. hammers) can be constructed in a modular function (e.g. head and handle). After complicated equipment

assemblies have left the factory, they can be difficult to modify or generally call for the expertise of a technician. Hardware design therefore places a premium on requirements specifications that are well-defined and stable. If a customer can be involved early in the design and specification of the product, the provider can create a checklist to ensure compliance.

In the most customized types of services, requirements tend to be negotiated. The customer prefers some features over others, and the provider may be able to configure the offering by assembling components in different ways. In the world of information technology products and services, some software can provided "off the shelf", with options available as features. The options may either be modular packages of pre-existing code, or custom-written plug-ins that fit into "exits". Code that is "built to plan" is intended to satisfy multiple customers, whereas code "built to order" is (at least initially) designed and implemented for one or a very few customers. Integration testing of software modules – ensuring that multiple fragments of code work together well, and don't conflict with each – often leads to modules being packaged together for expediency. In a parallel context, it's cheaper to buy a bicycle shipped as a whole, than to purchase each of the parts (e.g. frame, forks, handlebar, wheels) and assemble them afterwards.

In the four engagements, the future state envisioning of an information environment were positioned as a discussion on potential function wanted, versus economic cost for a structural component. In one engagement, the following metaphorical logic was described:

- Solution features can be described in three categories: compliance-driven needs, base features and optional features.
- Compliance-driven needs are required by legislation. As an example, every automobile comes with seat belts. The buyer doesn't get a choice to pay or not pay for seat belts.
- Base features represent functions normally associated with an offering. Offers satisfy these in greater or lesser ways, and the buyer can specify a hurdle that qualifying offers must clear. As an example, all automobiles come with brakes. The buyer may choose to specify that a car can stop within a certain distance. The absolute minimum may be set as a compliance-driven need (e.g. the government can set standards).
- Optional features are desired by the buyer, but the interpretation of value is personal. As an example, most drivers would like a sunroof. Almost anyone would pay $1 for a sunroof, and fewer would pay $2000.
- In comparing offers from alternative suppliers, the bundling of features significantly impacts pricing. Supplier A may have the better price to meet the minimum level of compliance-driven needs and base features, but Supplier B may be a better value for higher quality, better reliability and/or more features (e.g. the car drives better, comes with longer warranty, and is only $100 more including the sunroof). The lowest cost offer meeting "requirements" may not be the best value.

In envisioning a future system, creating a checklist of requirements overly constrains the consideration set of alternatives. "Soft" factors such as the reputation of the supplier and the openness of the solution architecture may lead to decision-making in a multi-criteria qualitative style. Since the future is uncertain, locking into a plan earlier than required closes off alternative opportunities that may unexpected emerge.

The above three challenges are supported by a disparate body of research, described below.

RESEARCH INTO INNOVATION IN SERVICE SYSTEMS WITH PHENOMENOLOGICAL INFLUENCES IS DISTINCTIVE

The four cases outline earlier in this article ground a body of research influenced by phenomenology. This philosophical foundation is helpful in understanding and envisioning worlds where human beings engage in a world with other human beings, and equipment the includes information technologies (Dreyfus 1991, Dreyfus and Dreyfus 1985). Innovations in collaborative work are impacted not only by the availability of new technologies, but also in the social reproduction of practices (Bourdieu 1979, Bourdieu and Wacquant 1992). The following research concepts are helpful to inform an approach:

- Innovating in collaborative work practices includes having to deal with identity, meaning and learning
- Abstract visions of the future can be made more concrete through the use of sketches as boundary objects, around which multiple subjective perspectives are bridged
- The architecture of equipment (e.g. information technologies) can be portrayed as shearing layers of innovation, with some systems components placed as pre-requisites of others.
- Roadmaps that sequence innovation subcomponents can better deal with uncertainties by recognizing options whereby future alternative paths are cut off no earlier than necessary

Collectively, these research foundations provide a rich context for innovating in service systems. They reflect a world where human beings have choice, where technologies and tools at hand may or may not be used, and where innovating does not suggest prescience. Each of these ideas is elaborated briefly, below.

Innovation in practice involves identity, meaning and learning

Innovations that impact practice – either as changes in the way customers are predisposed towards or use offerings, or as changes in the way workers coproduce value – occur in a social content (Ing 2007). The emphasis in practices has largely centered on communities of practice (Wenger 1998) within departments, companies and professional. More generally, however, the innovation in situated practices can be taken from a larger

perspective of any set of coproducers, e.g. customers-provider or client-supplier relationships.

In the four service system reviewed, the engagements made at least four identities prominent: executive sponsor, client project team member, and subject matter expert, and consultant. System envisioning began only with the support of the executive sponsor, who committed resources to investigate alternative potential futures. Some executive sponsors have the foresight to engage in the exploration of potential innovations, while others act on a much shorter horizon with environmental or competitive changes. Members of the client project team have hands-on experience on daily activities, as well as intuition about whether potential innovations can or can not be pragmatically adopted. Subject matter experts, whether from the client or consulting team, have in-depth knowledge on industry trends and/or technologies in the near future. Consultants may or may not be experts on a particular subject, but possess the analytical skills to interview subjects, analyze information and develop reports and presentations.

Constructing shared meaning across these identities was a key contributor to success. Although total convergence across the disparate perspectives was not required, the voices of all participants needed to be included. In group discussions, the opportunity to share intelligence – often beyond the scope of the consulting engagement – seemed to help coherency in overall organizational direction in an informal manner. More important than constructing a single meaning was the removal of irrelevant perceptions counterproductive to forward movement. Concurrence is a hurdle lower than agreement.

As part of the construction of a potential shared future, group learning was supported by continued dialogue amongst all parties. This required an openness to alternative views and communication in all participating roles and identities. Resistance to innovations is sometimes an outgrowth of ignorance, which can be reduced through open forums where concerns can be addressed, and misunderstandings easily corrected.

Sketches are boundary objects to ground conversation

Features of proposed innovations can be complicated, and verbal intercourse is not enough. Illustrations or diagram – more formally called sketches in the four cases – can aid understanding. These sketches served as boundary objects (Bowker and Star 1999) to add richness on features, e.g. business direction, workflows and technical details. Artifacts such as these also enable peripheral participation of beyond the core project team, who may have interests that coincide or conflict at a grand level.

While precision in developing the sketches were a virtue, the absolute correctness of these representations was not of primary importance in such early stages of envisioning. The artifacts were more generally landmarks where a high-level common understanding was attained. Improving the precision of the sketches into more formal models (e.g. information system designs) was seen as a follow-on activity when the innovation program was to be formally launched with the appropriate level of resources.

Innovation in systems happens in shearing layers

In service systems, it's common to complain that the infrastructure can't change as rapidly as human beings can, but varying layers of change are a reality. Drawing parallels between businesses and built structures, change can be seen layers (Brand 1994) where components of similar speeds shear against others moving at slower and at faster rates. In envisioning an innovation, "slow constrains quick; slow controls quick". Routine tasks can be automated, while negotiations and exceptions are better handled with the human touch.

In the four engagement studied, all of the employees studied were fully utilized, and the goal of the innovations was to improve productivity and remove drudgery, rather than reduce headcount. Over the past decade, technological advances such as the Internet have obsolesced activities that might have been distinctive competences when first established. Instead of bridging the myriad of information systems with point-to-point adapters, an intermediate layer of middleware presented an opportunity to simplify workflows and reduce maintenance of technologies. These solutions are, in fact, a reflection of moving system features that were once rapidly changing into infrastructural layers with a more stable and predictable evolution. Removing the clutter at faster-moving layers opened up opportunities

Roadmap recognize uncertainties with offramps for potential obstacles yet to be encountered

The four engagements describe situations in which organizations were predisposed towards innovation. Although some facts support of the "why" of innovation (e.g. business case, case for change) were collected along the way, the emphasis tended to be much more on "how". Innovation may be portrayed, after the fact, as a step function, or a discontinuous jump. In reality, it's better understood as a series of small steps, which accumulate into a "tipping point" or critical mass. Thus, the sequencing of activities within initiatives becomes a major concern in the presentation of recommendations.

Since the future is uncertain, a common approach to innovation is a plan, complemented by a mitigation plan. An alternative view is to present a roadmap that recognizes the network of alternative paths towards the same direction. "Rather than make detailed, brittle plans for the future, wisdom puts its efforts into expanding general, adaptive ones". (Brand 2000)

In practice, across the four cases, a consensus on the general direction for the innovation was probably obtained less than halfway through the engagements. More time was spent figuring out those technologies and activities to be moved earlier and those to be deferred later. These were partially driven by prerequisites (e.g. data should be cleaned up before users are provided with portal access). Of significant importance, however, was the explicit signalling of early progress. Thus, if the reality of the innovation was to be hidden to end users, opportunities to solicit their input or to demonstrate basic functionality were sought. Infrastructure projects are commonly invisible to the majority

of people, so pilots and demonstrations were highlight to foreshadow greater changes coming soon.

CONCLUSION

This article has described four consulting engagements at the commencement of formal commitments towards major innovations in service systems. The insights from these engagements have not been formally adopted as standard methods to be adopted by either a consulting practice or even within a consulting team. The approach, however, has proven to work for an experienced consultant, and is grounded in theories of phenomenology. To generalize these insights into broader use, interested readers should watch for parallel circumstances when a philosophy and approach may be appropriate.

APPENDIX: DEDUCTION, INDUCTION, ABDUCTION

The presentation on deduction, induction and abduction in Minto (1976) is well-written and clear.

Analytic Abduction

C. S. Peirce's insight was that in any reasoning process you might always deal with three distinct entities

1. A Rule (a belief about the way the world is structured)
2. A Case (an observed fact that exists in the world)
3. A Result (an expected occurrence, given the application of the Rule in this Case).

The way in which you can consider yourself to be reasoning at any one time is determined by where you start in the process and what additional fact you know. To illustrate the differences:

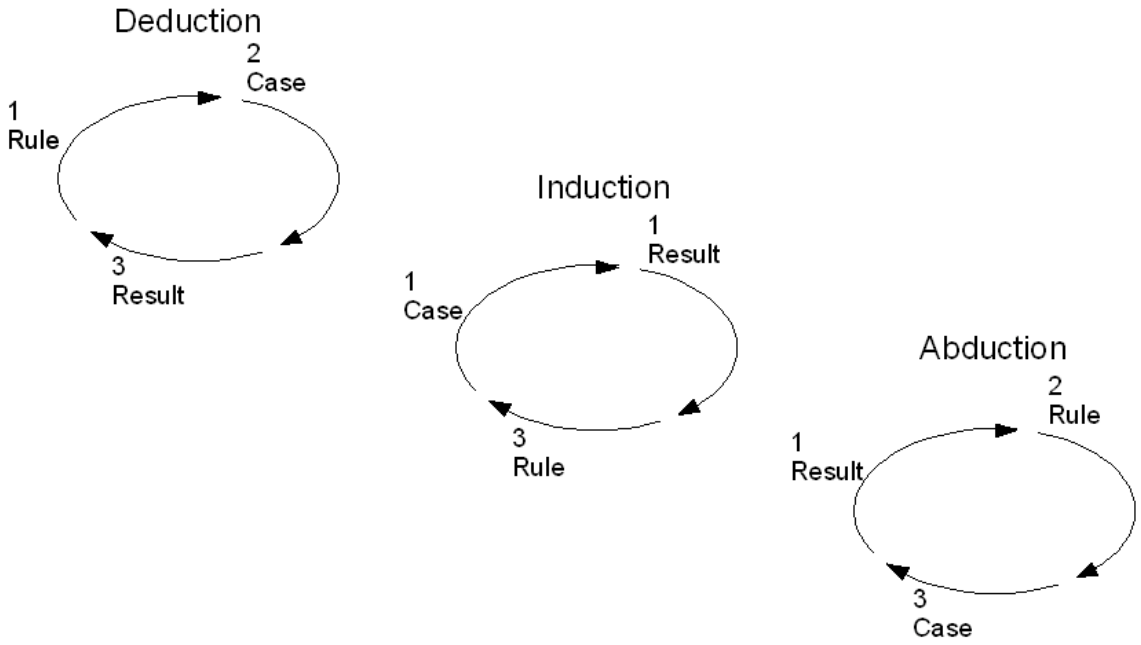
Deduction		
Rule	If we put the price too high, scales will go down	If A then B
Case	We have put the price too high	A
Result	Therefore, sales will go down	Necessarily B
Induction		
Case	We have put the price up	A
Result	Sales have gone down	B
Rule	The reason sales have gone down is probably that the price is too high	If A then probably B
Abduction		
Result	Sales have gone down	B

Rule	Sales often go down because the price is too high	If A then B
Case	Let me check whether in fact the price is too high	Possibly A

We have been saying throughout that analytical problem solving consists of noticing an Undesirable Result, looking for its cause in our knowledge of the structure of the situation (Rule) and testing whether we have found it (Case). You can see that this exactly matches the Abductive reasoning process shown above. [p. 211]

Even though Abduction is different from Induction and Deduction – and it is important to note the difference – they are also closely related. Thus, in any complex problem-solving situation, you are likely to be using be using all three forms of reasoning in rotation. As I said earlier, the form you are using, and the result you can expect from it, depend on where you start in the process (Exhibit A-1)

Exhibit A-1 Where you start determines the form of thinking you will use



Scientific Abduction

The major difference between the analytical problem solving discussed in Chapter 8 and the so-called creative or scientific problem discussed here is that we know the structure that creates our result and the scientist does not. That is, we have two of the essential elements and can reason our way to the third. He must invest invent the second before he can reason to the third.

In reasoning to the third, the scientist follows the classical scientific method:

- Hypothesize a structure that could explain the result
- Devise an experiment that will confirm or exclude the hypothesis
- Carry out the experiment to get a clear yes-or-no answer
- Recycle the procedure, making sub-hypotheses or sequential hypotheses to define the possibilities that remain, and so on

The hallmarks of the scientific method are generating hypotheses and devising experiments. Both activities demand high levels of visual thinking.x

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