Component-Based Business
Background Material

On Systems

Richard Veryard, October 2000

Summary.

People talk endlessly about systems, in a wide variety of situations, but we are not always clear what we are talking about. Perhaps we are never entirely clear. But we still manage to understand one another, good enough for most purposes, albeit often only after a bit of a struggle.

Formal languages, models and notations have frequently been proposed to enable complete and consistent descriptions of systems. These formal languages always omit something important. (Sometimes it's precisely what they omit that is most important.)

We select systems to talk about that are meaningful and important to people. All such systems have both social and technological aspects, although these aspects are sometimes obscured by the way we talk about them.

All description of these systems (including identity and scope) is dependent on the **observer** and the **observation process**. The observer is always an active participant, at one level, and the participants are all observers – although they may not always perceive the same system. Perceptions and descriptions may differ widely.

People attach **intentions** to systems, and make **demands** from systems. People attach value to certain perceived properties of systems, and they are often eager to take action to change certain systems properties, or to create systems that possess desirable properties. Any intervention in a system relies on a **stakeholder**, or community of stakeholders, with a particular attitude and purpose. In many cases – perhaps most – there are perceived conflicts between stakeholders.

For a system to fulfil some intentions, it needs to **survive** for some definite or indefinite duration. Survival means maintaining the identity and integrity of the system, in some sense, from some point of view. Complex systems often devote considerable energies to survival – apparently for its own sake. However, there is often a tension between identity and survival.

Thus whenever we talk about systems, and the success of systems, there are some essential elements that are implicit, including values, observer, stakeholder, perspective, purpose and scope. We do not always make these elements explicit, but they're always there.

What is a system?

Systems are everywhere.

Our world is crammed with systems of all kinds. The concept of system applies to technical artefacts and social systems, as well as sociotechnical hybrids. Most interesting systems are sociotechnical ones. This applies, among other things, to markets, companies, joint ventures, IT (whatever that is), business (versus IT) and the infamous business–IT interface.

We often talk about systems as if they were familiar objects.

We usually talk about systems as if we had a clear notion of what a system is, and for whom. We often talk as if a system was a clearly marked-off region of interconnected reality. And people frequently talk about The System.

When people talk about **The System**, they are usually referring to a particular slice of reality. Technical people say The System when they want to refer to some technical infrastructure; clerical staff use the term The System to mean the computer application; and sometimes when senior business managers say The System they actually mean some complete operational business process, which may or may not be supported by computer systems. Confusion reigns.

And when customers or citizens talk about The System, they are often talking about the whole bureaucratic apparatus or "machine", which is perceived as an imposing, implacable and intransigent Other. "You can't fight the system".

No amount of prefixes will remove this ambiguity. IT people sometimes say The Business System, but they usually still mean some business-oriented computerized information system. Meanwhile when business people say The Computer System, they may well include various clerical and operational activities such as data cleansing and input, which IT people would not regard as part of the Computer System proper.

Thus there is widespread confusion in practice, and people typically talk at cross-purposes. Aha, say the technocrats: what we need here is a standard terminology. But even the use of formal system models and notations doesn't entirely eliminate this confusion, as these notations remain tolerant of multiple interpretations.

In fact, although formal models and notations can be useful for some purposes, they can also have harmful side effects. They create or exacerbate barriers between people, and they foster the illusion that a complete and consistent description of a system has been achieved.

Probably the oldest formal notation used to describe business is the accounting notation, which reduces a company to a series of financial descriptions: a cash-flow statement, a profit-and-loss statement and a balance sheet.

Obviously, there are lots of aspects of a business that cannot be described in terms of financial accounts, and not even an accountant would claim completeness in this sense. But there is at least an expectation that the accounts will accurately represent all the financial aspects of the business. This in turn depends on an assumption that the financial aspects of the business can be meaningfully separated from the non-financial aspects. The formal notations and conventions used by accountants serve to solidify and institutionalize an apparent (but, as I claim, illusory) division between "financial" and "non-financial".

This carefully constructed illusion is conclusively broken only in extreme cases, where the accounts of a company are shown (retrospectively) to be largely fictional. In these cases, accountants seem to have been incapable of seeing through the fiction. Maxwell, BCCI and Barings are the examples that spring to my mind – you may think of others.

What I want to focus on here is the fact that a formal notation, backed up by a professional gloss, gives people a false sense of security.

Another example of this is in the interface found in many organizations between IT and the rest of the business. There are some notations widely used by IT people,

which are incomprehensible to non-IT people, and these notations increase barriers between IT and the business.

A system is anything we happen to draw a boundary around.

A system is essentially a coherent lump of description. Most people will assume that this is a bounded description of a portion of reality – or projected reality, in the case of a planned system.

Difficulties of systems thinking: identity, scope and perspective.

System descriptions use language, and much of the deep difficulty in systems thinking can be traced to deep problems with language.

To start with, we have no clear way of pointing to a system. When we try to point to a system, we are usually pointing to some part or aspect of the system. We name systems in terms of something else, such as their location (Whitehall, the White House) or primary activity (Order Processing). Or we simply give them names that refer to themselves: MIRAS, BACS, IMS, CICS.

We also have no clear way of **not** pointing to a system. When we name or point at a building or district, we cannot avoid referring implicitly to the human activity systems associated with it. Thus "The White House" never means just a load of bricks and décor, but always something more. Hardware always implies some software, and for that matter, software always implies some hardware. Even when we try to talk about a single component or building block, this is implicitly a system in its own right.

If we are going to define a system as a coherent lump of description, we need to have a reasonably clear notion of coherence. But that also causes difficulty. Coherence is in the eye of the beholder – it depends on your perspective and value system.

Some people imagine that the "real world" contains real coherent lumps that correspond to the lumps in our descriptions. But this is a subject of philosophical debate between different schools of systems thinking, and I don't intend to take sides in this debate here.

In any case, there are several different (but perhaps overlapping) notions of coherence: activity, power-proximity-interest, knowledge, culture.

All complex systems have to be decomposed somehow, to make them manageable.

A system may be composed of subsystems. This means that a complex description can be regarded as a joined collection of smaller and simpler descriptions.

(At least, we normally assume that the descriptions will get smaller and simpler as we decompose into subsystems. There is a class of systems known as fractal systems, where the complexity of the subsystem is equal to the complexity of the whole system.)

Large complex systems have a structure that reflects a complex history.

Wholes and parts are vitally connected.

As in many fields of science and technology, there is a crucial and complementary relationship between the whole (holism) and the part (reductionism).

> "On the one hand, one can move down a level and study the properties of the components, disregarding their mutual interconnection as a system. On the other hand, one can disregard the detailed structure of the components, treating their behaviour only as contributing to that of a larger unit. ... We cannot conceive of components if there is no system from which they are abstracted; and there cannot be a whole unless there are constitutive elements."
>
> Francisco Varela, ***Principles of Biological Autonomy*** (New York: Elsevier Science Publishers, 1979) p102.

All systems are sociotechnical systems.

This is a bold statement, which many readers will regard as evidently false.

After all, it is usually possible to come up with a description of a technical system that appears not to mention any human activity, either past or present. (Marx called this **Fetishism**.) And it is usually possible to come up with a description of a social organization that appears not to mention any technology. (This is related to what Borgmann calls the **Device Paradigm**.) And thirdly, even when a system evidently contains both human and artificial activity, it often seems possible to draw a straight line dividing a sociotechnical system into a social half and a technical half. Or perhaps a sociotechnical system is a composite system, containing some social subsystems and some technical subsystems.

What I'm claiming here is that these descriptions are simplifications, and can be dangerously misleading. All social systems are technically mediated. We get an increasing amount of our information about our social world through technical media: email, telephone, management information systems, television, Reuters newswire. And all technical systems are socially mediated. Technology is produced, distributed and managed by people within social structures, for socioeconomic or political purposes. It is interpreted and used according to social intentions.

For some purposes, therefore, it is appropriate to treat all the subsystems, even the smallest components, of a sociotechnical system as if they were themselves sociotechnical.

People perceive systems differently.

One reason why different people perceive systems differently is that they have different values, and this is reflected in the different judgements they make about systems.

Another reason is that people have different knowledge and beliefs, and this affects the way they perceive systems. We'd expect a trained surgeon to be able to perceive the innards of a human body on the operating table, whereas the rest of us might just see blood and guts. We may know the names of the major internal organs, but we don't know exactly where to find them, or what they look like, so we cannot make sense of what we see.

As a consultant, I have often found myself in the position of the facilitator, trying to help people from different sides of a situation to reach a common understanding, and a shared action plan. Where there are strongly argued differences between different sides, this can sometimes be traced to simple differences in objectives – although it makes it harder when people are not open and honest about their objectives and preferences. But even when there are hidden agendas, these differences are usually still easier to diagnose than to resolve.

Where different sides appear to have the same objectives, differences in opinion are often attributed to different knowledge and beliefs – usually characterized as a lack

of knowledge or false beliefs on the other side. This leads to the hope that simple interventions, such as facilitation, education or training, will resolve these differences. In practice, this hope is often disappointed. However, such interventions may play a useful role in helping the participants to surface, understand and even perhaps appreciate the differences.

Systems have many stakeholders.

The fact that we choose to pay attention to a particular system is a sign that some people (or communities of people) have an interest (or stake) in this system. We call these people stakeholders. The word stakeholder was introduced by analogy to the word shareholder.

Use of the term stakeholder was originally to be inclusive rather than exclusive. Many people argue that companies should be run for the benefit of a range of stakeholders, including employees, customers, suppliers and local communities, and not merely for the benefit of shareholders. By similar arguments, housing estates should be run for the benefit of the tenants, not just profit for the landlords; schools for the benefit of pupils and parents, not just the convenience of teachers; and so on. Some politicians talk about a stakeholder society. When we label a person or community as a stakeholder, this means that it is now legitimate to take action intended for their benefit.

For example, if the local community in the neighbourhood of a large factory plant is regarded as a stakeholder, it becomes legitimate for the managers of the company to donate money to this community, even if this doesn't yield any obvious benefit to the shareholders of the company.

However, some managers and analysts seem to regard the concept of stakeholder as exclusive. There is a closed list of stakeholders, drawn up at the start of a project, who may be consulted at various stages of the project. If you're not identified as a stakeholder, then your opinion doesn't matter. I deplore the exclusive use of the stakeholder concept.

A system may itself be a stakeholder.

For some purposes, we may even wish to regard a system as a stakeholder in a larger system. This can be a shorthand way of indicating that the system stands proxy for its own stakeholders. Thus we can talk about representing the commercial or political interests of a company or institution, or even the technical requirements of a technical artefact.

Stakeholders have many intentions.

As indicated in the previous section, a stakeholder is a person or community that possesses **intentions** and attaches **value** to things.

I've been at countless meetings where an important discussion has been diverted into a debate about terminology. Everyone around the table agrees that something is important, but it seems necessary to decide how it should be correctly classified: as a **goal** or **objective**, as a **strategy** or **critical success factor**.

Everyone seems to use the same labels in a different way. For some people, the long-term view of where we are going must be called an **objective**, and the short-term view of where we hope to reach this year is called a **goal**. There's another set of people who insist, equally dogmatically, that it is the **goal** that represents the long-term vision, while **objectives** merely represent the short-term steps towards these

longer-term goals. Often they're making a distinction that is visible to themselves, but not clear to anybody else.

So I'm going to lump all these things together and call them **intentions**. Broadly speaking, an intention is something someone wants to do or achieve, or wants someone else to do or achieve. This includes missions, purposes, goals, objectives, targets, policies, strategies and tactics.

Intentions are related to **values**. For our purposes, we can regard values in terms of value judgements. A value judgement is a statement of absolute or relative worth or preference, belonging to a stakeholder, or to a community of stakeholders. These judgements can sometimes (but not always) be expressed in monetary terms, or as a partial ordering.

Stakeholders attach intentions to systems. Stakeholders make demands of systems.

To hear some people talk, it is as if you can derive the objectives (or requirements) of systems from the intentions of the stakeholders.

This misses out an important step in the analysis. The fact is that stakeholders have many needs and intentions, and there may be many different routes to satisfying these needs.

For example, some people expect accurate weather forecasts from the television or radio, and are disappointed and angry when this service is unavailable or incorrect. Other people prefer to make their own weather forecasts, using simple instruments of their own such as thermometers and barometers, or from simple observations of the sky. Other people again may regard all such weather forecasts as unreliable, and prefer to organize their lives to be relatively unaffected by different weather conditions.

Thus there are three different systems that you can use. System A involves listening to the radio or television. System B involves tapping the barometer in the hallway. System C involves contingency planning – take an umbrella anyway. Let's assume you have access to all three of these systems. On a particular day, you may choose to use one or two or all three of them, depending on your beliefs, intentions and preferences. *What are your plans for today? How might rain disrupt these plans? What would be the consequences of getting caught in the rain?*

People evaluate systems relative to a set of intentions. People identify and scope systems relative to a set of intentions.

Well, this should be obvious.

Systems change

In any systems intervention, scoping is a highly charged and significant process.

In ideal, theoretical terms, the outcome of the scoping process is always provisional.

But the risks and anxieties of the wider process may sometimes only be contained if the scope is held fixed. This may also sometimes be a prerequisite for useful learning and focused creativity.

For consultants trying to engage usefully with systems, there are always practical dilemmas in managing scope. Sometimes all the energies of a situation are focused on the scoping process. The consultant may have a choice between addressing (confronting) these energies in the scoping process itself, or using the scope as a concave mirror to deflect these energies back onto the task.

Further Reading

Albert Borgmann, ***Technology and the Character of Contemporary Life.*** Chicago University Press, 1984.

Francisco Varela, ***Principles of Biological Autonomy.*** New York: Elsevier Science Publishers, 1979.

Richard Veryard, ***Plug and Play: Towards the Component-Based Business.*** Springer-Verlag, 2000 (forthcoming).

Richard Veryard, "Reasoning about Systems and their Properties". To be published in Peter Henderson (ed), ***Systems Engineering for Business Process Change Volume 2***, Springer-Verlag, 2001.