A SOCIO-PRAGMATIC CONSTRUCTIONIST FRAMEWORK FOR UNDERSTANDING QUALITY IN PROCESS MODELLING

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ABSTRACT

Quality is one of the main topics in current conceptual modelling research, as is the field of business process modelling. Yet, widely acknowledged academic contributions towards an understanding or measurement of business process model quality are limited at best. In this paper I argue that the development of methodical theories concerning the measurement or establishment of process model quality must be preceded by methodological elaborations on business process modelling. I further argue that existing epistemological foundations of process modelling are insufficient for describing all extrinsic and intrinsic traits of model quality. This in turn has led to a lack of holistic understanding of process modelling. Taking into account the inherent social and purpose-oriented character of process modelling in contemporary organizations I present a socio-pragmatic constructionist methodological framework for business process modelling and sketch out implications of this perspective towards an understanding of process model quality. I anticipate that, based on this research, theories can be developed that facilitate a more comprehensive and adequate evaluation of the 'goodness' of a business process model.

Keywords: Process modelling, epistemology, pragmatism, constructionism, model theory

INTRODUCTION

Recent years have seen an increasing popularity of methodologies, techniques and tools within the context of Business Process Management (BPM). In fact, improving business processes continues to receive attention amongst chief information officers throughout industry (Gartner Group, 2007). The proliferation of BPM as an organizational paradigm has triggered substantial academic contributions aiming at advanced business process management solutions. One prominent example

in this context is the increased popularity of *business process modelling* (Davies *et al.*, 2006). Due to a strengthened interest in a more disciplined approach for Business Process Management, many organizations have been motivated to make significant investments in process modelling initiatives, which in turn has triggered substantial related research. Many studies have shown the relevance of process modelling to BPM initiatives, *e.g.*, (Davenport, 1993). Process modelling denotes a requirement for a number of ISO 9000 quality programs (Ould, 1995) and is the basis of process-related IT implementations, such as Enterprise Resource Planning systems (Robinson and Dilts, 1999) or process-aware information systems (Dumas *et al.*, 2005). The recent introduction of legislative frameworks such as the Sarbanes-Oxley Act (Nielsen and Main, 2004) further contributed to the increasing interest in business process modelling.

From a practitioner perspective, business process modelling is a way of capturing and graphically documenting how businesses conduct their operations (Curtis *et al.*, 1992). It typically includes depictions of at least the activities, events/states, and control flow logic that constitute a business process (Scheer, 2000). Process models are used, amongst others, for the purposes of business improvement, documentation, automation and simulation.

From an academic perspective, process modelling resides in the research field of conceptual modelling. Conceptual modelling is the process of building a representation of selected semantics about a domain of interest for the purpose of understanding and communication among stakeholders (Mylopoulos, 1992; Wand and Weber, 2002; Siau, 2004). It is arguably inevitable for the tasks associated with information systems analysis and design (Karimi, 1988; Garda *et al.*, 2004) and has, correspondingly, repeatedly been proposed to reside at the core of the IS discipline (Weber, 2003; Nelson *et al.*, 2005). Traditional forms of conceptual modelling accounted only for an organization's data and, if at all, that portion of its processes that interacted with data. Newer uses of information systems, however, extend deployment beyond transaction processing into communication and coordination, viz., a process-aware perspective on information systems (Dumas *et al.*, 2005), which gave rise to a heightened interested in the conceptual modelling of business processes.

The ongoing and strengthened interest in process modelling has, over time, led to a wide range of process modelling techniques (also called languages) since Carl Petri first published his initial ideas on Petri nets in 1962 (Petri, 1962). Available approaches range from simple flowcharts and typical business modelling techniques to advanced variants of Petri nets with high expressive power. Consequently, a competitive market is providing a plethora of complementary tools and methods (Sinur, 2004).

The juxtaposition of methodologies, methods, and modelling techniques leads to confusion: are there really so many different ways to analyze and design information systems let alone business processes? Where are similarities in the approaches? Which one serves a particular purpose the best? These and similar questions reveal relevance not only to academics but also to practitioners (Olle *et al.*, 1991). But why bother? Is it not acceptable to leave evaluation to evolution? Contemplating about the history of the IS discipline, it is advised that a Darwinist approach ("survival of the fittest") does not seem to be a satisfactory option. First, it does not allow for an ex-ante selection of competing alternatives since it leaves evaluation to the final stages of development or deployment. Second, it does not allow for individual appropriateness criteria since it focuses on general "best practice" solutions that seem suitable in principle rather than in context.

Clearly, there is a need for rigorous theory to assist the development, usage, and evaluation of process modelling activities in order to enhance the quality of the approaches. Simply speaking, the question can be reduced to: What constitutes a 'good' business process model? Surprisingly, this question remains not only unanswered yet but is, in the form "what constitutes a 'good' conceptual

model?", a research field that has only recently begun to emerge and that is slowly gaining momentum. To date, research on quality in conceptual modelling is still believed to be in its infancy (Moody, 2005; Nelson *et al.*, 2005). What holds true for conceptual modelling in general (Buhl and Heinrich, 2005), must be stressed even more for the field of business process modelling: several researchers explicitly state the need for research aiming at understanding and developing a common notion of business process model quality (Brito e Abreau *et al.*, 2002; Wand and Weber, 2002; Poels *et al.*, 2003; Moody, 2005; Krogstie *et al.*, 2006). Before this background, the research discussed in this article aims at arriving at an *understanding of business process model quality*.

More precisely, the research presented in this paper seeks to countervail the lack of a theoretically and methodologically sound and comprehensive appreciation of process model quality. The basic assumption of this paper is that a better understanding of process model quality can only be developed if business process modelling firstly is appreciated from a methodological perspective. In short, this paper argues that a methodology of process modelling is needed that exhibits sufficient explanatory power to address all those traits of quality that are relevant to contemporary process modelling activities in both practitioner and scholar communities.

In this context, I make the same distinction as Wilson (2002) between methodology and method. That is, methodology precedes method and is more fundamental in that it provides the philosophical groundwork for methods. Sadly however, evidence shows that there has been comparatively little research done on the nature of methods and methodology (Rescher, 1973). Accordingly, in this paper, I will outline a fundamental framework in terms of a methodology and epistemology of business process modelling. This will open the stage for some fundamental criticism of our scientific understanding of concepts in the nexus of BPM research in general and conceptual process modelling in particular. The contention of methodological and epistemological aspects in the framework will set the stage for the design of compliant methodical technical theories for investigating quality on the quality of business process modelling. Accordingly, in this paper I seek to discuss considerations towards an understanding of process model quality by shedding light into methodological and epistemological aspects of process modelling.

In the remainder of this paper I proceed as follows. In the next section, I briefly recapitulate previous research in the field of process model quality. Then, I introduce an alternative perspective upon organizational reality, socio-pragmatic constructionism, which I deem promising as a starting point for this endeavour. In the fourth section I apply this perspective to the conception of process modelling to discuss implications of this theory towards an understanding of models. Next, I sketch some implications of these elaborations towards an appreciation and understanding of process model quality in a basic framework. This paper then closes with a discussion of the conclusions drawn from this work and directions for future research.

The research approach chosen in this paper is that of conceptual/philosophical research, in particular that of *critique* (in the Kantian understanding). This research method is dedicated to identifying, scrutinizing and questioning the presuppositions of research approaches in order to determine their scope, applicability, possibilities and limits towards a given research objective (Kant, 1929). I will hence provide philosophical-logical arguments rather than empirical ones. However, the arguments will (where applicable) also refer to empirical research results, for instance (Chen and Hirschheim, 2004) and others. Furthermore, I will present additional evidence by giving examples from IS research practice.

RELATED WORK

Little research has comprehensively investigated the notion of business process model quality (Moody, 2005). Work related to this field mainly stems from investigations upon conceptual model quality in general. Noticeable is the work of Lindland *et al*. (1994) who developed an understanding of conceptual model quality based on semiotic theory (Morris, 1971), defining a syntactic, semantic and pragmatic level of model quality. More recently, Krogstie et al. (2006) revised this framework to address further aspects pertaining to the modelling of processes. Their approach will serve as a reference for my subsequent elaborations on the implications of a socio-pragmatic constructionist process modelling methodology towards an understanding of quality.

Early attempts that investigated process model quality include the guidelines of process modelling (Becker *et al.*, 2000), a framework that defines six general guidelines, correctness, relevance, economic efficiency, clarity, comparability and systematic design. This approach proposes the differentiation of different abstraction layers of quality assessment. On a first layer, for instance, generic general modelling guidelines are suggested. These guidelines are then refined for certain views, e.g., models for business processes, and finally broken down to fully specified guidelines for certain modelling techniques (e.g., Event-driven Process Chains). The approach, however, lacks a sound theoretical methodology, and provides only limited empirical proof as to its feasibility as a quality framework (Rosemann *et al.*, 2001).

Evaluation of process models has, to a certain extent, gained popularity since the emergence of quality frameworks with a focus on the representational capabilities and expressive power of process modelling techniques. Such frameworks have been developed either inductively from observable practice or deductively from applicable theories.

An example for inductively derived frameworks is the set of workflow patterns developed by van der Aalst *et al.* (2003). The development of this framework was triggered by a bottom-up analysis and comparison of fifteen workflow management systems, with focus on the expressive power of the underlying process modelling techniques, to outline similarities and differences between the analyzed systems. The evaluation of process modelling techniques, e.g., (Wohed *et al.*, 2003; Russell *et al.*, 2006; Wohed *et al.*, 2006) is based on the assumption that a more complete coverage of the workflow patterns leads to techniques and systems with advanced expressive power. Other aspects or purposes of process model quality are neglected.

An example for an evaluation framework that has been derived through deductive research methods is representational analysis of process modelling techniques based on foundational ontologies, in particular the Bunge-Wand-Weber representation model for conceptual modelling (Wand and Weber, 1990, 1993). This theory of representation has been used in over thirty-five research projects for the evaluation of different modelling techniques, including data models, object-oriented models and reference models. It also has a strong track record in the area of process modelling, with contributions coming from various researchers, e.g., (Keen and Lakos, 1996; Green and Rosemann, 2000; Green *et al.*, 2005; Recker and Indulska, 2007). Rosemann et al. (2006) provide an overview of these studies. Essentially, The Bunge-Wand-Weber model proposes a set of semantics representation constructs for models of Information Systems that modelling techniques should be able to express. As such, these types of evaluations emphasize a semantic level of model quality neglecting pragmatic or syntactic facets.

Other work in the area of process model quality has suggested more or less comprehensive lists of quality criteria such as soundness (Verbeek *et al.*, 2007), structuredness (Dehnert and Zimmermann, 2005) and others, e.g., (Bajaj and Ram, 1999; Soffer and Wand, 2007). These lists denote examples

of the type of research in the BPM that has traditionally focussed syntactic and semantic investigations but lacked an appreciation of further traits of model quality such as pragmatic aspects.

In summation, most of the work presented defines methodical approaches towards the investigation of certain aspects of quality in process models. Only the BWW model approach is based on a sound methodological foundation, which however has at times been subjected to criticism, e.g., (Lyytinen, 2006; Wyssusek, 2006), especially with regards to its negligence of social and pragmatic traits of modelling quality. As I concur with Wilson (2002) that methodical solutions only reveal pertinence to certain methodological presuppositions, there is henceforth a need to investigate underlying methodological foundations of process modelling to arrive at a better understanding which methodical solution is applicable to appreciating process model quality. I will subsequently present a methodological perspective on process modelling that I deem very explanatory and explorative. It will serve as a starting point for an investigation of quality aspects in process models. During this investigation I will refer to aspects of related work whenever appropriate. In particular, I draw on the work of Stachowiak (1973) to discuss characteristics of process models, and the work of Morris (1971) on a general theory of signs, which has for instance been used in the semiotic quality framework (Lindland *et al.*, 1994; Krogstie *et al.*, 2006), to sketch implications of socio-pragmatic constructionism on the understanding of process model quality.

Socio-pragmatic constructionism

The following elaborations proceed on the basis of the paradigm debate that has evolved in the IS research discipline lately, refer, for instance, to (Benbasat and Weber, 1996; Weber, 2004; Gregor, 2006). In particular, traditional positivist research approaches have been subjected to a powerful base of criticism originating from the post-modern turn in the human and social sciences, see (Eden *et al.*, 1981; Mir and Watson, 2000). Yet, evidence show that positivism still dominates the area of IS research (Orlikowski and Baroudi, 1991; Chen and Hirschheim, 2004; Mingers, 2004). I will neither re-cite the well-know criticisms nor repeat the debate of positivism versus anti-positivism here. Instead I seek to outline an alternative way based on perspectives of social constructionism and pragmatism, which, in my belief, offers powerful perspectives on IS research in general and process modelling in particular.

Information systems research positions itself at the intersection of historically well-established research fields such as management sciences, technology sciences, social sciences, human sciences etc (Vessey *et al.*, 2002). Yet, the diversity of influential fields is hardly reflected in IS studies. Only few studies present multiple perspectives upon the phenomenon being studied. Despite the social nature of information systems and the fact that contemporary organizations are exposed to continuous and rapid internal and environmental changes, many IS research papers still present models and theories as universal panaceas holding objective truth (Chen and Hirschheim, 2004). An example of this is the use of representational theories based on philosophical ontology as axiomatic reference frameworks for the evaluation of the "goodness" of a conceptual model, e.g., (Wand and Weber, 1990, 1993), a theory that is coined by the underlying assumption that the underlying model of representation itself contains necessary and sufficient semantic categories to appropriately represent relevant real-world domains.

I argue that two particular developments, namely social constructionism and a recently re-emerging pragmatism, have significant explanatory power as a modelling methodology and hence may pose significant implications to modelling-related research. These developments emerge from post-modern ideas that have for a significant amount of time influenced and guided research in related disciplines such as philosophy (Lyotard, 1984), management science (Calás and Smircich, 1997), organizational studies (Chia, 1996) or knowledge management (Styhre, 2003). In the following, the

basic principles of social constructionism and pragmatism will be outlined and I will then reconcile these perspectives in the paradigm of socio-pragmatic constructionism.

Social constructionism

To start with the introduction of (social) constructionism, the term first needs clarification. *Constructionism* is closely related to the notion of *constructivism*. Both rely on an anti-positivist epistemology questioning the direct relationship between knowledge (expressed in symbols or models) and reality. Constructivism, often referred to as *radical* constructivism (von Glasersfeld, 2001), focuses an anthropocentric approach by claiming that reality, and also knowledge, is constituted as a solipsistic mental construction of an individual. Correspondingly, constructivism is concerned with how individuals construct and interpret their world. It insists on the mental states of singe individuals as the sole instance of knowledge creation. Consequently, as realities are subjective, so are knowledge, symbols and models. Social constructionism, on the other hand, has a social focus and proposes "the redefinition of social realities as constituted through discourse" (Neimeyer, 1998, p. 135). It emphasizes the social aspect of cognition. It states in particular that the acquisition of conceptual knowledge takes place before the background of a social community that defines language and action amongst its members. Consequently, realities are shaped through social discourse and are not the sole achievement of an individual. Berger and Luckmann (1966, p. 95) call such a social reality a "symbolic universe". This notion, even more so than constructivism, appears naturally conducive to an understanding of process modelling. Process modelling teams exist in every BPM-affiliated organization. Each of these has defined and is and using their own approaches, languages and techniques to conduct process modelling tasks. It would appear sound, then, to assume that the social interaction between the individuals would have an impact on how each one of the individuals perceives organizational reality and describes the knowledge about it in the form of process models.

If we assume that reality is constructed socially through investigation, deliberation and discourse, consequently multiple perspectives upon reality may emerge. The role of language (such as the languages we use to create models of reality) in this process must be given special emphasis. Perception and interpretation of whatever reality domain is shaped and mediated through language, which defines and restricts our perception of the world and our knowledge about it (Quine, 1960). Yet, given that in a language community it is still the individuals that construct realities, we have to admit that multiple realities may emerge. The admittance of multiple realities to be constructed in a community through language discourse gives social constructionism a relativist tenet. None of the potential constructions of reality is preferred. Multiple pictures of reality are thus equally valid or acceptable. Yet, this relativism considerably limits the comparison or evaluation of such pictures, viz., such models, of the domain of interest. Consider the case of business process modelling. A team of business analysts and technical systems designers might discuss the way business processes are executed in an organization and seek to develop a model of these processes to present to the CEO or CIO. The technical analysts construct a picture of these processes as they are supported through IT, while the business analysts conceptualize these processes in terms of inputs, outputs, involved stakeholders and value-adding revenue streams. Clearly both pictures denote valid conceptualizations of the universe of discourse in light of the individuals who constructed the models – but which one fits better the internal model of thought that the CEO/CIO might have in mind as a pre-conception of the very same domain? The related question is whether both pictures are indeed equal in terms of providing sufficient understanding of the universe of discourse to the target audience. If all pictures or models are partial truths, how can the validity or superiority of a model compared to other models be measured? Such are questions social constructionists may be aware of but which have not been addressed with a real answer (Morgan, 1983, p. 407). I consequently concur with fellow researchers, e.g., (Wyssusek *et al.*, 2001; Marshall *et al.*, 2005),

that social constructionism needs to be widened to embrace a means for differentiating, and establishing differences between, the multiple models of reality that may be constructed within one social community.

One means of doing so would be to include pragmatic aspects into the discussion. The embracement of pragmatic values within social constructionism opens the stage for incorporating different values and norms as relevant aspects of concerns in knowledge and quality studies. A good reference as to such an approach is the notion of *fitness-for-use* that builds the cornerstone of Total Quality Management approaches towards quality improvement of products and processes (Hradesky, 1994).

Pragmatism

In order to overcome the fallacy of social constructionism to be unable to determine what pictures of reality constitute 'better' forms of meaning creation, pragmatism offers a way to deal with the dilemma of relativism. Pragmatism was developed in the USA in the late 19th century (Wicks and Freeman, 1998). Its main claim is that the worth of a proposition, theory or model is to be judged by the consequences of accepting it. Basically, the tenet of pragmatism is that any picture, theory or model is good or true if and only if it is *useful* – in the sense of helping people to fulfil a given need. The pragmatic notion of knowledge acquisition, then, is "to gain an understanding which is necessary to deal with problems as they arise" (Dewey, 1988, vol. 4, p. 14). Pragmatists consequently do not search for universal truths. Instead, they agree with social constructionists that all construction of knowledge, i.e., the association of perceptual input to cognitive concepts, occurs before the background of our historically and socially situated pre-understanding of the context. Thus, interpretation is contextual, depending on the social environment and the horizon brought to it by the interpreter (Gadamer, 1989). In particular, pragmatism offers a criterion of usefulness spread across an epistemological (is this picture credible and reliable?) and a normative (does this picture help us in our actions?) dimension. This enables the researcher to advance the boundaries of positivist and anti-positivist philosophies (Wicks and Freeman, 1998).

The tenet of pragmatism has been reflected in some previous work on conceptual model quality, for instance in the notion of feasibility in the quality framework of Lindland *et al*. (1994), which defines a 'satisfactory' threshold for quality aspects.

Socio-pragmatic constructionism

Social constructionism as a paradigm for IS research in general and business process modelling specifically can in my belief be considerably enhanced in accepting a pragmatic viewpoint upon "truth". It advances the perspective upon research by providing means of evaluating pictures, theories, propositions, and models in terms of their relevance and usefulness to given values, norms and objectives. Hence, it opens the stage for incorporating viewpoints and needs of various stakeholders in a given situation.

Socio-pragmatic constructionism emphasizes the social aspect of knowledge acquisition and seeks to explain human action and their consequences. This claim roots the creation of conceptual models in a pre-existent social practice of communicating and acting, with the emphasis that the practices of model (or knowledge) creation are never solipsistic. Instead, these practices are coined by the primate of the social over the individual and always bound to a certain purpose. The implication of this tenet is that models are created *within* a community *for* that community. And this is actually what we see in modelling initiatives. The usage of a shared modelling language and a set of common modelling practices enable its members to build and interpret models for and from each other. Imagine the case of a process modelling team within an organization. Such team is being trained by an experienced modelling champion that establishes not only common modelling

practices across the newly formed team but also introduces a shared language that leverages a certain understanding of modelling concepts and symbols. The models that are created by this team will be easily interpreted by members of the team. As practical experiences show, however, problems arise once such models are presented to "outsiders", for instance senior management staff or CEOs, who are unlikely to be members of the modelling community and most probably have not participated in the establishment of common language and practice. The extrinsic form of representation chosen in the model may actually be easily understandable. Yet, an outsider may have significant problems grasping what is represented. The intrinsic model content has been created within the social community of the modelling team, which established a shared understanding of the content, for instance a set of business processes, through continuous investigation and discourse.

A SOCIO-PRAGMATIC CONSTRUCTIONIST PERSPECTIVE ON PROCESS MODELLING

The implications of a socio-pragmatic constructionist perspective upon conceptual modelling in general and business process modelling in particular are significant. In the following, I seek to explore the implications in more detail. In order to structure this discussion, I draw on the *general model theory* (Stachowiak, 1972, 1973) as a reference for my elaborations. The general model theory is a well-known reference theory for conceptual modelling that distinguishes three constituent and common characteristics of models independent from any epistemological or ontological commitment, namely *Representation, Simplification* and *Pragmatic orientation*. Due to its dissociation from any philosophical commitment, it serves as a well-structured framework to discuss common traits of any model. The basic idea is that modelling is essentially just a mapping from a set of original attributes from a phenomenon of interest to another set of modelled attributes. The mapping process can be described as follows (see Figure 1).

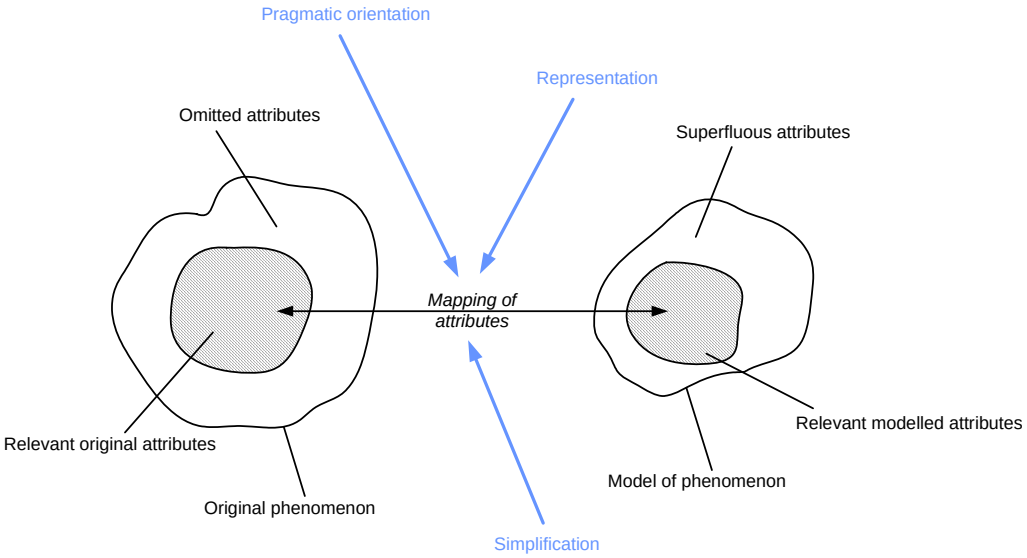

Figure 1: General model theory (Stachowiak, 1972, 1973)

Using these three model characteristics, the implications of a socio-pragmatic constructionist perspective upon process modelling can be explored, thereby allowing for the derivation of basic traits of process model quality as will be discussed later in this paper.

Representation

Models are models of something (Stachowiak, 1973, p. 131). Social constructionism states that "something", i.e., the phenomenon to be modelled, itself is being constituted within the social context in which the modeller operates. To be more concise: the universe of discourse that is subject to being modelled is a social phenomenon embedded into shared social practices and language use. The social community (let's say, a process modelling team within an organization), contextualizes through established language and common practice the way that the phenomenon of investigation (let's say a business process within the organization) is conceptualized by the modeller. This internal conceptualization of the original phenomenon is then externalized by the modeller within a model. Transferring these insights to the field of business process modelling, the phenomenon being modelled is a set of business processes within an organization. Now, obviously, both organizations and business processes are for themselves linguistic conceptualizations – a factual existence of either of them cannot be presumed. Rather, they are metaphors for certain perspectives or views upon the universe of discourse, and are thus conceptualized before the background of the established social context. The process model then is subjected to the conceptualization of the phenomenon (a business process) as it is socially contextualized within the community (a business organization).

In simple terms, this means that processes are merely metaphors we use within an organizational community to describe the actions and events that happen within the organizational context. And this is what process modellers seek to represent in a process model. The models of the processes then can only symbolizations of what the model creators understands under the concept of a business process, i.e., how (s)he perceives the series of actions and events that take place within the organization.

Simplification

Models exhibit a reductive trait in that they map a non-abundant subset of attributes of the phenomenon being modelled rather than the complete set of attributes (Stachowiak, 1973, p. 132). From a pragmatic viewpoint, the preference for a subset of attributes being modelled is determined by its relevance for the model designers and/or users. Process models may be designed for multiple reasons; yet, in a simplistic fashion there are two main kinds: first, intuitive business process models are used for scoping the project, and capturing and discussing business requirements and objectives with subject matter experts. Second, business process models are used for process automation, which requires their conversion into executable languages. These automatable models have higher requirements in terms of expressive power and also a different focus that emphasizes formal rigor rather than intuitiveness (Dehnert and van der Aalst, 2004). From a social constructionist perspective, the preferred set of attributes is determined by the socially contextualized background of the model designers and users. This implies that their existing ways of pre-understanding process models constitute their model interpretation practices. Hence, every single individual looking at a process model will deem it good or bad in respect to how well it fits the interpretation horizon (s)he is able to bring to bear. An IT analyst is more likely to judge a model based on its extent of deadlocks than a business analyst, simply because the IT analyst traditionally has had this focus when scrutinizing models. Put together, socio-pragmatic constructionism stresses the need for the creation of a common horizon of meaning. A shared understanding should be created of what is to

be included and neglected in a model. The ultimate goal of this endeavour remains to be that the model should effectuate shared understanding and successful practice.

Pragmatic orientation

Models have a substitutive function in that they substitute a certain phenomenon as being conceptualized by a certain subject in a given temporal space with a certain incentive or operation in mind (Stachowiak, 1973, p. 132). The process of creating a model is never for the pure sake of modelling, Instead, they are designed and interpreted having a certain purpose in mind – in short, to fulfil a certain need. This statement may appear obvious. Yet, recent reflections on current process modelling practice (e.g., Recker, 2006; Rosemann, 2006a, b) do not get tired of stressing this message to practitioners over and over again. The need for doing so simply stems from the observation that many organizations still invest considerable amounts of time and resources into the creation of process models without being clear about why they are doing it in the first place.

For example, a process model can be designed for senior management staff to intuitively conceptualize the operational details of some business operations. Or, process models can be designed for systems analysts to determine the extent of compliance of existing or future IT infrastructure to the operational business activities. The socio-pragmatic constructionist perspective here again stresses the necessity of forming a shared horizon of meaning (a mutual acknowledgement), in order to arrive at meaningful interpretations of the models amongst various stakeholders. In other words, it is required to establish upfront why the organizations engages in a modelling exercise and for what task the resulting process models will be used as input.

IMPLICATIONS TOWARDS MODEL QUALITY

Forthcoming from the preceding elaborations I will sketch out some implications towards an understanding of process model quality in a basic framework. I base my elaborations on the understanding that the concept of model quality is inherently complex and cannot completely be appreciated via a correspondence theory in a factual or objectivist sense, let alone in a list of syntactical or semantic correctness criteria. Rather, these discussion should incorporate social, contextual and pragmatic variables.

Models are in their essence merely statements created in some (artificial) language and can hence be related to the study of language and signs. I refer to the semiotic theory of signs (Morris, 1971) as a theoretical reference for the subsequent discussion. In IS research, several researchers turned to this theory, for instance in theories on data model quality (Lindland *et al.*, 1994) or information quality (Price and Shanks, 2005). Correspondingly, it would appear that Morris' theory of signs serves as a suitable starting point for deriving dimensions of a framework to structure my investigation.

Basically, semiotic theory distinguishes three components within the study of linguistics signs, namely *object*, *representamen* and *interpretant*. The relationships between these three components is in contemporary studies expressed in the so-called semiotic triangle (see

Figure 2), which originates from the work of Ogden and Richards (1923). The object (O) is the phenomenon that is to be represented. Yet, such object can never be entirely represented but merely an idea of it, the concept of that object. The representamen (R) is some type of language sign, or symbol, which substitutes (stands for) the object being studied in the absence of it. Hence, the symbol posits a conventional relation between the represented concept and the phonic or graphical form that represents it. The interpretant (I) establishes the object-representamen relationship by

imposing onto this relationship a perceived meaning. The act of interpretation is necessarily dependant on the use of the sign (θ) by the interpreter, thus on his social context (shaped for instance via linguistic norms and common practice) and on his individual background, viz., his pre-understanding and conceptualization (φ) of the context. Hence, there is no direct relationship between a linguistic symbol and some object in the "real world". The relationship can only be established by the interpretant. In this sense, any linguistic symbol (such as the elements that comprise a process model) can only be interpreted; it cannot signify a priori.

Based on these relationships Morris (1971) defines three semiotic levels that can be used to measure quality:

- *Syntax* describes the formal relations between signs. Syntactic quality hence assesses the extent to which a representamen is created in accordance to formal laws of the symbolic language.
- *Semantics* studies the relation between the representamen and its designatum, i.e., the object it represents. Hence, semantic quality describes the extent to which the sign corresponds sufficiently to the concept it seeks to model.
- *Pragmatics* studies the extent to which interpretants of a sign are able to make use of the interpreted meaning of the sign for a given use. Pragmatic quality then is the sufficiency of a sign to act as a designatum for a certain object or concept before the background of a certain purpose.

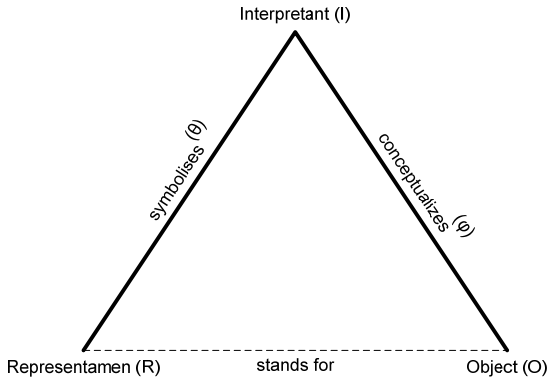

Figure 2: Semiotic Theory of Signs (Morris, 1971)

Taking together the findings from the semiotic theory of signs and the methodological considerations of process modelling based on a socio-pragmatic constructionist perspective, aspects and dimensions of quality can be sketched that need to be considered in the domain of process modelling. The following discussion is structured by the before-mentioned three semiotic levels of quality.

Syntax

The syntactic criterion describes how a representamen is meaningfully formed in accordance to the laws that govern the use of one or several types of representamen. In other words, it is concerned with the grammatical rules that describe how to use certain symbols or elements of a language to

form meaningful statements. Translated to process modelling, the syntactic criterion demands that the creation of a process model based on the symbols provided by a process modelling language is accomplished in conformance to the formal laws of the modelling language, viz., its grammar. Now, while formalization of conceptual modelling languages is still a rather under-represented concept in IS research (ter Hofstede and van der Weide, 1992), one can generally observe two notions of formalization that facilitate the assessment of syntactic quality. Meta model-based approaches rest on the depiction of the grammar of a certain language L1 using another modelling language L2 (note that L2 may equal L1) (Holten, 2003). For instance, the grammar of the ebXML process specification language is expressed in UML (OASIS, 2001). On the other hand, the syntax of a modelling language (and thus a model) can be formally specified using logical expressions such as first-order predicate calculus or set theory. An example for this is the formal specification of EPC models provided by van der Aalst (1999). Another example is the use of formal Petri-net specifications for describing the syntax of process models (van der Aalst, 2005). Based on the grammar specification, a model can be syntactically verified in the sense that it is assessed whether it denotes a well-formed model in accordance to the formal laws of the symbolic language in which it was created.

While in general it would appear safe to assume that syntactically lawful models are desirable, the relevance of this criterion may diverge with respect to pragmatic considerations. For example, a process model that serves as an input to a workflow execution engine has higher requirements in terms of syntactical rigor, for example a verification of the model concerning the possibility of deadlocks or starvation areas. Process models that are used to communicate business requirements amongst senior management staff, however, may have less rigid requirements in terms of syntax and may even posit a superiority of clarity and visualization concerns over syntactic rigor. For instance, Dehnert and van der Aalst (2004) concede that process models used for business purposes demand intuitiveness rather than unambiguity and understandability rather than machine-readability.

I hence propose to relate seemingly factual aspects of quality (such as the consistency of language meta model) to social and pragmatic aspects such as, for instance, who is the intended audience and what is the purpose of the model created. This way, it can be established whether certain syntactic quality criteria, e.g., (Kiepuszewski *et al.*, 2003; Verbeek *et al.*, 2007) should be taken into account or not.

Semantics

The semantic criterion is concerned with the relation of representamen to designatum (the object it intends to represent). In the field of process modelling, this relates to the assessment of the 'goodness' of the process model in terms of how well it captures a business process. Now, taking the preceding methodological elaborations in consideration, admittedly it is impossible to assess the model against an objectively existent business process. Business processes themselves are mere conceptualizations of 'the way an organization conducts business'. As such, a business process is no more than a *metaphor* (Hirschheim and Newman, 1991) that stands for some organizational phenomenon. The social context, in which a model is created and used, determines the way a process is conceptualized and ultimately described in a model. In the theory of signs, this is acknowledged by the fact that there is no direct relationship between representamen and object – instead this relationship is established through the interpretant who conceptualizes the object and symbolizes it in a representamen. Established language and modelling practices influence this conceptualization. For instance, the chosen representation language for process models influences the way we perceive, conceptualize and ultimately depict business processes. As an example, the EPC notation (Scheer, 2000) is based on an event-driven paradigm and conceptualizes business

processes as an interleaved series of events that trigger certain business activities that in turn lead to series of events. Quite contrary, IDEF3 diagrams (Plaia and Carrie, 1995) conceptualize processes based on an information-flow paradigm. They contain sets of so-called 'units of behaviour' that process and exchange information objects amongst themselves. The notion of events as triggers for business activities, is more or less absent in this language. Hence, the notion of events is likely to be absent in the way modellers, whose pre-understanding of process models has been coined by their IDEF3 modelling practice, conceptualize business processes.

What holds true for the development of process models holds true for their evaluation as well. As an example, an academically acknowledged theory for the evaluation of business process models is based on a series of control flow patterns (van der Aalst *et al.*, 2003). A process modelling language is evaluated with respect of how many and how well it allows for the depiction of these workflow patterns. The underlying conception, obviously, is that a business process domain can be described as a composition of these control flow patterns. Another example for domain preconceptions in this field is the Bunge-Wand-Weber model (Wand and Weber, 1990, 1993), which prescribes a set of domain semantics that should be covered by any process modelling technique. Again, such a preconceived model of domain representation has to be continually assessed as to its relevance as a model of domain understanding within every social modelling context. In other words, the question is whether these reference frameworks for model quality evaluation match the existing pre-conceptions within process modelling domains that are brought to the evaluation task by the members of the community, viz., the model creators and model users within an organization.

A social constructionist perspective postulates that in order to assess the relation between model and phenomenon being modelled, the social context that determines the perception and cognition of the universe of discourse must be scrutinized. This includes the assessment of social practices. They determine the individual practices and the common language by which the modellers within the organization conceptualize and model the relevant phenomena. The pragmatic claim of a socio-pragmatic constructionist perspective furthermore demands an investigation of values, norms, needs and interests of the stakeholders involved in the modelling practice. This means that the perception of the universe of discourse (the set of processes to be modelled) is selected by the stakeholders interests (Vickers, 1970) – it is driven by their needs. Hence, the semantic criterion is concerned with the relation of the process model and the socially contextualized and purpose-driven conceptualization of the phenomenon being studied (here: a business process). In simple terms, a good process model would be one that matches the way the model reader thought a process model should look like – based on their needs and historically established understanding of the organization.

Pragmatics

The pragmatic criterion is concerned with the compliance of the model to the aims and purposes for which the model was created. In other words, pragmatism is concerned with establishing what the end user of the model actually seeks to do with it. Accordingly, the pragmatic dimension is not solely concerned with whether different stakeholders sufficiently understand the model (Lindland *et al.*, 1994). Rather, it is concerned with whether the model, as a sort of statement or sentence, enables its interpretants to make use of it for fulfilling their need. That is, the pragmatic dimension transcends pure information delivery concerns such as the ease of retrieving desired information about the process from the process model or the suitability of the presentation form to the comprehension capabilities of different stakeholders. The pragmatic dimension instead is concerned with assessing the value of the process model for helping its interpretants to better cope with their problems. And these problems are typically manifold. They may include, amongst others, the tasks of introducing process-aligned organizational structures, meeting process improvement objectives

or simulating and automating office procedures. In order to arrive at an evaluation of how well a model helps achieving these goals, it is necessary to form mutual agreements about the horizon of meaning of the process model amongst model designers and users. This means, it is vital to establish upfront within the community of model creators and users for what task exactly the model will be needed. For instance, imagine an organization that recently spent considerable time and money to upgrade their IT infrastructure. Yet, the upgraded infrastructure still induces problems in the day-to-day business operations. Given the extent of resources already spent, the ongoing process improvement exercise is imposed the restriction that the IT infrastructure in place for the business process under scrutiny is not to be changed and hence should not be included in the process models. This restriction should then be a valid criterion in the judgment of the process models.

Hence, the pragmatic judgment of process model quality is subject to individual norms, ethics, values and needs. Appropriate means for evaluation accordingly call for empirical research strategies rather than theoretical ones. Interestingly, other domains of conceptual modelling have taken into account some aspects of pragmatism in their studies. Taking the example of conceptual data modelling research, for instance, several researchers have turned to the exploration of different modelling forms and styles and the impact on problem solving tasks, such as, for instance, devising data structures (Khatri *et al.*, 2006) or formulating database queries (Bowen *et al.*, 2006). Yet, the domain of process modelling has not yet been thoroughly approached from this perspective and thus, examples for investigations into pragmatic aspects of process modelling quality are scarce at best. One of the few examples includes the work by Danesh and Kock (2005) who examined how two different process model styles impact redesign success. In summation, I see potential and first evidence that some of the successful research streams from related conceptual modelling domains could be adopted to the area of process modelling o extend the current body of knowledge.

CONTRIBUTIONS & CONCLUSIONS

This paper presented a socio-pragmatic constructionist perspective on the methodology of business process modelling. Driven by the objective of better understanding the quality of a process model I outlined a framework that places emphasis on both the social context in which modelling occurs and the pragmatic aspects of process modelling. I sketched implications of this methodology towards an understanding of process model quality in a basic discussion framework.

The main tenet of the work presented in this paper it to place emphasis on the “why” and “where” questions of process modelling initiatives. The paper sought to elicit why it is of importance to establish the purposes and tasks for which process models are to be used in order to be able to ascertain whether the models are ‘good’. Also, this paper sought to stress that process modelling, similar to any other form of communication through language discourse, is bound to the social context in which it is exercised. Especially in the case of business process management, where an organization is perceived and discussed as a set of intangible business processes, it is essential to establish that everyone involved brings to bear the same understanding of the subject matter in order to facilitate meaningful discussion.

Given the conceptual/philosophical nature of this paper, the research presented exhibits some obvious limitations. Most arguably, the paper does not provide empirical proof for its arguments. As such, it fails some of the traditional assessment criteria nominally ascribed to scientific theory, *e.g.*, (Carnap, 1950; Hempel, 1965). However, similar to other post-positivist research approaches, think, for instance of action research (Susman and Evered, 1978; Baskerville and Wood-Harper, 1996), the ultimate sanction of the approach towards process model quality presented should be in the

perceived functionality of the methodology to produce desirable and accurate consequences for research and practice, for instance, by means of providing comprehensive explanatory power. The framework presented aims at providing an epistemology that enables the production of knowledge contingent to the particular context in which it is being applied.

Implications for Practice

Although methodological and/or philosophical argumentations often appear 'far-stretched' rather than directly applicable to IS practice, there are arguably practical merits of the work presented. First and foremost, the incorporation of social and pragmatic considerations into the discussion of process modelling and the model(s) produced facilitates an appreciation of the organizational and situational context in which modelling activities occur. By focusing aspects of model quality that transcend traditional syntactic and/or semantic concerns it is made possible to ultimately produce modelling outcomes that are not only of interest to relevant stakeholders but moreover are *helpful* in solving concrete modelling problems. This way, the ultimate goal of establishing and maintaining business success through principles and methods associated with business process management can be assisted through process modelling. And this should indeed be the goal of every process modelling exercise - rather than building 'correct' models that are more or less useless for solving organizational problems.

A second practical benefit stems from the implications that the framework described presents for education domains. Teaching domains can draw upon the discussion in this paper and derive conclusions as to the design of modelling-related curricula. Instead of focusing traditional aspects of modelling technique and/or tool features, more consideration can be placed upon situational and motivational aspects. By sharpening an understanding for the roles of actors, stakeholders, pragmatic motivations and the role of knowledge historicity, a better appreciation of the possibilities as well as limitations of process modelling can be taught. Existing curricula should be scrutinized in respect to the emphasis they place on syntactical, semantic and/or pragmatic aspects of process modelling. It would not surprise me to learn that to date, most process modelling courses are well-equipped to teach grammars and syntactical aspects (e.g., how do I model a feedback loop and what is an OR-join?) but falter when it comes to educating about the role of social discourse, organizational conventions and the prevalent question of the "why" of process modelling.

Implications for Theory

This work may contribute as a reference for further research on at least two premises: first, it presents a methodology of business process modelling that provides strong explanatory and explorative power for understanding modelling activities in contemporary organizations. Given that the research field of BPM is only slowly "catching up" on its practitioner's counterpart, I argue that the existence of a rich and multi-perspective theory may serve as a fruitful starting point for further investigations in an under-represented research field, which in turn posits major practical relevance and impact. Second, the methodological considerations presented in this paper provide an initial framework for understanding process model quality and can serve as a basis for deriving adequate and theoretically sound dimensions and measures of quality. As such, the current criticisms of model evaluation approaches that claim a lack of theory in the evaluation research field can be counteracted. Furthermore, as the methodology presented in this paper stresses the pragmatic, social and contextual aspects of modelling it naturally calls for a well-developed interplay between theoretical and empirical research strategies. This will not only allow to develop an academically stimulating approach but also to provide applicable and relevant results to the business community.

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