2006

Towards an understanding of process model quality. Methodological considerations

Jan Recker
Information Systems Discipline Queensland University of Technology, j.recker@qut.edu.au

TOWARDS AN UNDERSTANDING OF PROCESS MODEL QUALITY. METHODOLOGICAL CONSIDERATIONS

Recker, Jan, Queensland University of Technology, 126 Margaret Street, Brisbane 4000, QLD, Australia, j.recker@qut.edu.au

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 problem 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 the extrinsic and intrinsic traits of model quality. Taking into account the inherent social and purpose-oriented character of process modelling in contemporary organizations I present a socio-pragmatic constructionist methodology of 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 the evaluation of the 'goodness' of a business process model.

Keywords: Business Process Modelling, Model Quality, Methodology

1 INTRODUCTION

Recent years have seen an increasing popularity of methodologies, techniques and tools within the context of Business Process Management (BPM). The proliferation of BPM as an organizational paradigm has triggered substantial academic contributions aiming at advanced business process management solutions. In the centre of this hype is the conception of *business process modelling*. It is a requirement for many ISO 900x quality programs (Ould 1995) and builds the cornerstone of many IT implementations to support BPM, think of Enterprise Resource Planning systems (Robinson & Dilts 1999), for example.

From a practitioner perspective, business process modelling has been identified as one of the most popular reasons for conceptual modelling (Davies *et al.* In Press). From an academic perspective, it resides at the core of the research field of conceptual modelling, which in turn has been repeatedly proposed to reside at the core of the IS discipline (Nelson *et al.* 2005, Weber 2003). In general, 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 (Siau 2004). The ongoing and strengthened interest in modelling for business process management has given rise to a wide range of process modelling techniques since Carl Petri first published his initial ideas on Petri nets in 1962 (Petri 1962), and consequently, a competitive market is providing a plethora of complementary tools and methods.

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. Firstly, it does not allow for an ex-ante selection of competing alternatives since it leaves evaluation to the final stages of development or deployment. Secondly, 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 – 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 & 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, Moody 2005, Poels *et al.* 2003). Before this background, this research aims at arriving at an *understanding of business process model quality*.

While this research objective remains a long-term goal, at the moment this research is driven by the insight that a better understanding of process model quality can only then be developed if business process modelling firstly is appreciated in all its facets. 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. However, evidence shows that there has been comparatively little research done on the nature of methods and methodology (Rescher 1973). In this paper, I will outline a fundamental groundwork in terms of a methodology and epistemology of business process modelling, which opens the stage for some fundamental criticism of our scientific understanding of concepts in the nexus of BPM research in general and conceptual

business process modelling in particular. The contention of methodological and epistemological aspects 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. First, I briefly recapitulate previous research in the field of process model quality in Section 2. Then, in section 3 I introduce an alternative perspective upon organizational reality, socio-pragmatic constructionism, which I deem promising as a starting point for this study. In Section 4 I apply this perspective to the conception of process modelling to discuss implications of this theory towards an understanding of models. Next, in Section 5 I sketch some implications of these elaborations towards an appreciation and understanding of process model quality in a basic framework. This paper closes in Section 6 with a discussion of the conclusions drawn from this work and directions for future research.

2 RELATED WORK

Little research has 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. 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 & Rosemann & von Uthmann 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, for instance the formulation of generic general modelling guidelines, their refinement for certain views, e.g., models for business processes, 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 & Sedera & Sedera 2001).

Evaluation of process models has, to a certain extent, gained popularity since the emergence of quality frameworks with a focus on 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 languages, to outline similarities and differences between the analyzed systems. The evaluation of process modelling techniques 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 & Weber 1990, 1993). This theory of representation has been used in over twenty-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 (see (Rosemann *et al.* 2006) for an overview). The Bunge-Wand-

Weber model basically proposes a set of domain semantics for Information Systems that Information Systems modelling techniques should be able to express. As such, these types of evaluations emphasize a semantic level of model quality neglecting pragmatic facets.

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., (Wyssusek & Klaus 2005). 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. I will subsequently present a methodological perspective on process modelling that I deem very explanatory and explorative and which will serve as a starting point for an investigation of quality aspects in process models. During that 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 & Sindre & Solvberg 1994), to sketch implications of socio-pragmatic constructionism on the understanding of model quality.

3 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 (Gregor 2005, Weber 2004). 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). Yet, evidence show that positivism still dominates the area of IS research (Chen & Hirschheim 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. 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 & 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 & Weber 1990, 1993), a theory that is coined by the underlying assumption that the underlying ontology itself contains the necessary and sufficient categories to completely represent 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 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 & 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.

3.1 Social constructionism

Constructionism is closely related to the notion of constructivism. Both rely on an anti-positivist epistemology questioning the direct relationship between knowledge (as well as symbols or models) and reality. Constructivism, often referred to as *radical* constructivism (von Glasersfeld 2001), focuses an anthropocentric approach by claiming that reality, and thus knowledge, is constituted as a solipsistic mental construction of an individual, and is concerned with how individuals construct and interpret their world. Constructivism insists on the individual 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 stating that the acquisition of conceptual knowledge takes place in 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".

Given that reality is constructed socially through investigation, deliberation and discourse, consequently multiple perspectives upon reality may emerge. The role of language in this process must be given special emphasis, as perception and interpretation of some reality domain are shaped and mediated through language, which defines and restricts our perception of the world and our knowledge about it (Quine 1960). The admittance of multiple realities to be constructed in a community through language discourse, on the other hand, gives social constructionism a relativist tenet. None of the possible constructions of reality is preferred; multiple pictures of reality are 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. 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 and value-adding revenue streams. Clearly both pictures denote valid conceptualizations of the universe of discourse – but which one better fits to the internal model of thought that the CEO might have in mind as a pre-conception of the domain? The question that evolves is whether both pictures are really 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 outside of the particular context be established or 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., (Marshall & Kelder & Perry 2005, Wyssusek *et al.* 2001), that 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).

3.2 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 & 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 or valuable 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 but instead 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 & 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.

3.3 Socio-pragmatic constructionism

Social constructionism as a paradigm for IS research (and business process modelling) can in my belief be considerably enhanced in accepting the 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 to incorporate viewpoints and needs of various ranges of stakeholders in a given situation. In conclusion, 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 is never solipsistic but the primate of the social over the individual and moreover always bound to a certain purpose. The implication of this tenet is that conceptual models are created *within* a community *for* that community – the usage of a shared language and common practice enables its members to interpret the model. 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 practice across the newly formed team but also 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 practice shows, problems arise once such models are presented to "outsiders", for instance senior management staff or CEOs, who most probably are not members of the modelling community and have not participated in the establishment of common language and practice. While the extrinsic form of representation chosen in the model may be easily understandable, an outsider may have significant problems grasping what is represented, as 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.

4 A SOCIO-PRAGMATIC CONSTRUCTIONIST PERSPECTIVE ON PROCESS MODELLING

The implications of a socio-pragmatic perspective upon conceptual modelling in general and business process modelling in particular are significant. In exploring these implications, I follow the approach of Wyssusek *et al.* (2001) and draw on the *general model theory* (Stachowiak 1973) that distinguishes three constituent and common characteristics of models independent from any epistemological or ontological commitments, namely *Representation*, *Simplification* and *Pragmatic orientation*. 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 initial determinants of model quality from these methodological and epistemological considerations:

- *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 of the modelling subject. 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, for instance within an organization, contextualizes through established language and common practice the way that the phenomenon of investigation itself is conceptualized by the modeller, who externalizes this conceptualization within the model. Transferring these insights to the field of business process modelling, the phenomenon being modelled are 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 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).

- *Simplification*: Models possess 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 techniques have higher requirements in terms of expressive power and also a different focus which emphasizes formal rigor rather than intuitiveness. From a social constructionist perspective, the preferred set of attributes is determined by the socially contextualized background of model designers and users, viz., their established or customary model interpretation practices, which are constituted by their pre-understanding of models. Put together, socio-pragmatic constructionism stresses the need for the creation of a common horizon of meaning that contextualizes a shared understanding of what is to be neglected in a model and how possible model interpretations can be integrated, in the sense that they effectuate shared understanding and common 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. 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.

5 IMPLICATIONS TOWARDS MODEL QUALITY

Forthcoming from the preceding elaborations I will sketch out some implications towards an understanding of process model quality. 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 but rather needs to incorporate social contextual and pragmatic variables.

As models are merely statements or sentences created in some (artificial) language, I use the semiotic theory of signs (Morris 1971) as a theoretical reference for the subsequent discussion. In IS research, some researchers turned to this theory, for instance in theories on data model quality (Lindland &

Sindre & Solvberg 1994) or information quality (Price & Shanks 2005). Basically, semiotic theory distinguishes three components within the study of linguistics signs, namely *object*, *representamen* and *interpretant*.

The object *(O)* is the phenomenon that is to be represented. Yet, such object is never 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.

Based on these relationships Morris (1971) defines three semiotic levels that can be used to measure quality: (1) *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. (2) *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. (2) *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.

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 and summarized in Table 1.

Level	*Quality criteria for process models*
Syntax	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 & 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). For instance, the grammar of the ebXML process specification technique is expressed in UML. 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). 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 is 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. Process models that are used to communicate business requirements amongst senior management staff may have lesser requirements in terms of syntax and may even posit a superiority of clarity and visualization concerns over syntactic rigor. I hence propose to relate seemingly factual aspects of quality (such as the consistency of language meta model) to social and pragmatic aspects, for instance, who is the intended audience and what is the purpose of the model created.

Semantics	The semantic criterion is concerned with the relation of model to designatum (the phenomenon it intends to represent). In the field of process modelling, this means to assess or evaluate the 'goodness' of the process model in terms of how well it represents a business process. Now, taking our methodological elaborations in consideration, we have to admit that it is impossible to assess the model against an objectively existent business process – as business processes themselves are mere conceptualizations of 'the way an organization conducts business'. The social context, in which a model is created and used, determines the way a process is conceptualized and ultimately described in a model. 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 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 events. Quite contrary, IDEF3 diagrams conceptualize processes is based on an information-flow paradigm, and contains 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 and thus, is more or less absent in the way modellers, whose pre-understanding of process models is coined by, for example, decades of IDEF3 modelling practice, conceptualize organizational 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 modeling 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 via the composition of these control flow patterns. Another example for domain preconceptions in this field is the Bunge-Wand-Weber model (Wand & Weber 1990, 1993), which prescribes a set of domain semantics that should be covered by each 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. Accordingly, in order to assess the relation between model and phenomenon being modelled, the social context, which determines the perception and cognition of the universe of discourse, must be scrutinized. This includes the assessment of social practices, which determine the individual practices, and common language, which constitutes the means by which people conceptualize 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, as the perception of the universe of discourse 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).
Pragmatics	The pragmatic criterion is concerned with the compliance of the model to the aims and purposes for which the model was created. In my understanding, the pragmatic dimension is not solely concerned with whether different stakeholders sufficiently understand the model (Lindland & Sindre & Solvberg 1994) but also 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 moreover is concerned with assessing the value of the process model for helping its interpretants to better cope with their problems of, for example, introducing process-aligned organizational structures. In order to arrive at such objective, it is necessary to form mutual agreements about the horizon of meaning of the process model amongst model designers and users. As the pragmatic judgment is subject to individual norms, ethics, values and needs, appropriate means for evaluation call for empirical research strategies rather than theoretical ones.

Table 1. Quality criteria for process models following socio-pragmatic constructionism

6 CONCLUDING REMARKS

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 perspective 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.

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 theoretical investigations in an under-represented research field, which in turn posits major practical relevance and impact. Second, the methodological considerations provide an initial understanding of 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.

Acknowledgements

I am indebted to Peter Marshall from University of Tasmania for engaging in a series of fruitful discussions on research methodologies and also for introducing to me the philosophy of pragmatism. I also would like to thank Michael Rosemann for his stimulating comments when preparing this paper.

References

Becker, J., M. Rosemann and C. von Uthmann (2000). Guidelines of Business Process Modeling. In Business Process Management. Models, Techniques, and Empirical Studies (van der Aalst, W.M.P., J. Desel and A. Oberweis, Eds.), pp. 30-49, Lecture Notes in Computer Science 1806, Springer, Berlin, Germany.

Berger, P.L. and T. Luckmann (1966). The Social Construction of Reality: A Treatise in the Sociology of Knowledge. Doubleday, Garden City, Kansas.

Brito e Abreau, F., B. Henderson-Sellers, M. Piattini, G. Poels and H.A. Sahraoui (2002). Quantitative Approaches in Object-Oriented Software Engineering. In Object-Oriented Technology. ECOOP 2001 Workshop Reader (Frohner, A., Ed.), pp. 174-183, Lecture Notes in Computer Science 2323, Springer, Berlin, Germany.

Buhl, H.U. and B. Heinrich (2005). Empirical Research Strategies in Conceptual Modeling - Silver Bullet or Academic Toys? Wirtschaftinformatik, 47 (2), 152-162.

Calás, M.B. and L. Smircich Eds. (1997). Postmodern Management Theory. Ashgate, Aldershot, UK.

Chen, W.S. and R. Hirschheim (2004). A Paradigmatic and Methodological Examination of Information Systems Research from 1991 to 2001. Information Systems Journal, 14 (3), 197-235.

Chia, R. (1996). Organizational Analysis as Deconstructive Practice. Gruyter, Berlin, Germany et al.

Davies, I., P. Green, M. Rosemann, M. Indulska and S. Gallo (In Press). How do Practitioners Use Conceptual Modeling in Practice? Data & Knowledge Engineering, forthcoming.

Dewey, J. (1988). The Middle Works of John Dewey. Southern Illinois Press, Carbondale, Illinois.

Eden, C., S. Jones, D. Sims and T. Smithin (1981). The Intersubjectivity of Issues and Issues of Subjectivity. Journal of Management Studies, 18 (1), 37-47.

Gadamer, H.-G. (1989). Truth and Method. 2nd Edition. Continuum, New York, New York.
Gregor, S. (2005). The Struggle Towards an Understanding of Theory in Information Systems. In Information Systems Foundations: Constructing and Criticising (Hart, D. and S. Gregor, Eds.), pp. 3-11, ANU E Press, Canberra, Australia.
Hradesky, J. (1994). Total Quality Management Handbook. McGraw-Hill, New York, New York.
Lindland, O.I., G. Sindre and A. Solvberg (1994). Understanding Quality in Conceptual Modeling. IEEE Software, 11 (2), 42-49.
Lyotard, J.-F. (1984). The Postmodern Condition: A Report on Knowledge. University of Minnesota Press, Minneapolis, Minnesota.
Marshall, P., J.-A. Kelder and A. Perry (2005). Social Constructionism with a Twist of Pragmatism: A Suitable Cocktail for Information Systems Research. In Proceedings of the 16th Australasian Conference on Information Systems (Campbell, B., J. Underwood and D. Bunker, Eds.), Australasian Chapter of the Association for Information Systems, Sydney, Australia.
Moody, D.L. (2005). Theoretical and Practical Issues in Evaluating the Quality of Conceptual Models: Current State and Future Directions. Data & Knowledge Engineering, 15 (3), 243-276.
Morgan, G. Ed. (1983). Beyond Method: Strategies for Social Research. Sage, Beverly Hills, California.
Morris, C.W. (1971). Writings on the General Theory of Signs. Mouton de Gruyter, The Hague, The Netherlands.
Neimeyer, R.A. (1998). Social Constructionism in the Counselling Context. Counselling Psychology Quarterly, 11 (2), 135-150.
Nelson, H.J., G. Poels, M. Genero and M. Piattini (2005). Quality in Conceptual Modeling: Five Examples of the State of the Art. Data & Knowledge Engineering, 55 (3), 237-242.
Olle, T.W., J. Hagelstein, I.G. MacDonald, C. Rolland, H.G. Sol, F.J.M. van Assche, et al. (1991). Information Systems Methodologies: A Framework for Understanding. Addison-Wesley, Wokingham, UK et al.
Ould, M.A. (1995). Business Processes: Modelling and Analysis for Re-Engineering and Improvement. John Wiley, Chichester, UK.
Petri, C.A. (1962). Fundamentals of a Theory of Asynchronous Information Flow. In IFIP Congress 62: Information Processing (Popplewell, C.M., Ed.), pp. 386-390, North-Holland, Munich, Germany.
Poels, G., H.J. Nelson, M. Genero and M. Piattini (2003). Quality in Conceptual Modeling - New Research Directions. In Advanced Conceptual Modeling Techniques (Olivé, A., Ed.), pp. 243-250, Lecture Notes in Computer Science 2784, Springer, Berlin, Germany.
Price, R. and G. Shanks (2005). A Semiotic Information Quality Framework: Development and Comparative Analysis. Journal of Information Technology, 20 (2), 88-102.
Quine, W.V.O. (1960). Word and Object. The MIT Press, Cambridge, Massachusetts.
Rescher, N. (1973). The Primacy of Practice. Basil Blackwell, Oxford, UK.
Robinson, A.G. and D.M. Dilts (1999). OR & ERP: a Match for the new Millenium? OR/MS Today, 26 (3), 30-35.
Rosemann, M., J. Recker, M. Indulska and P. Green (2006). A Study of the Evolution of the Representational Capabilities of Process Modeling Grammars. In Advanced Information Systems Engineering - CAiSE 2006 (Dubois, E. and K. Pohl, Eds.), p. forthcoming, Lecture Notes in Computer Science, Springer, Luxembourg, Grand-Duchy of Luxembourg.
Rosemann, M., W. Sedera and D. Sedera (2001). Testing a Framework for the Quality of Process Models – A Case Study. In Proceedings of the Proceedings of the 5th Pacific Asia Conference on Information Systems (Kim, J.S., J.K. Lee, K. Suh, K.K. Wei and H. Lee, Eds.), pp. 978-991, The Korea Society of Management Information Systems, Seoul, Korea.
Siau, K. (2004). Informational and Computational Equivalence in Comparing Information Modeling Methods. Journal of Database Management, 15 (1), 73-86.
Stachowiak, H. (1973). Allgemeine Modelltheorie. Springer, Wien, Austria et al.
Styhre, A. (2003). Understanding Knowledge Management. Critical and Postmodern Perspectives. Copenhagen Business School Press, Herndon, Virginia.

ter Hofstede, A.H.M. and T.P. van der Weide (1992). Formalisation of Techniques: Chopping down the Methodology Jungle. Information and Software Technology, 34 (1), 57-65.
van der Aalst, W.M.P. (1999). Formalization and Verification of Event-driven Process Chains. Information and Software Technology, 41 (10), 639-650.
van der Aalst, W.M.P., A.H.M. ter Hofstede, B. Kiepuszewski and A.P. Barros (2003). Workflow Patterns. Distributed and Parallel Databases, 14 (1), 5-51.
Vickers, G. (1970). Freedom in a Rocking Boat. Penguin Books, London, UK.
von Glasersfeld, E. (2001). The Radical Constructivist View of Science. Foundations of Science, 6 (1-3), 31-43.
Wand, Y. and R. Weber (1990). An Ontological Model of an Information System. IEEE Transactions on Software Engineering, 16 (11), 1282-1292.
Wand, Y. and R. Weber (1993). On the Ontological Expressiveness of Information Systems Analysis and Design Grammars. Journal of Information Systems, 3 (4), 217-237.
Weber, R. (2003). Editor's Comments: Still Desperately Seeking the IT Artifact. MIS Quarterly, 27 (2), iii-xi.
Weber, R. (2004). The Rhetoric of Positivism Versus Interpretivism: A Personal View. MIS Quarterly, 28 (1), iii-xii.
Wicks, A.C. and R.E. Freeman (1998). Organization Studies and the New Pragmatism: Positivism, Anti-positivism, and the Search for Ethics. Organization Science, 9 (2), 123-140.
Wilson, T.D. (2002). Alfred Schutz, Phenomenology and Research Methodology for Information Behaviour Research. In Proceedings of the Fourth International Conference on Information Seeking in Context, Universidade Lusiada, Lisbon, Portugal.
Wyssusek, B. and H. Klaus (2005). Ontological Foundations of Information Systems Analysis and Design: Extending the Scope of the Discussion. In Business Systems Analysis with Ontologies (Green, P. and M. Rosemann, Eds.), pp. 322-344, Idea Group, Hershey, Pennsylvania.
Wyssusek, B., M. Schwartz, B. Kremberg, F. Baier and H. Krallmann (2001). Business Process Modelling as an Element of Knowledge Management – A Model Theory Approach. In Proceedings of the 2nd International Conference on Managing Knowledge: Conversations and Critiques, Leicester University, Leicester, UK.