COMPARISON BETWEEN THE BUSINESS MODELLING METHODS PROVIDED BY MEASUR AND RUP

Hui Du, Tingting Li and Dan Ding

Beijing Philosophy and Social Science Research Center for Beijing Transportation Development
School of Economics and Management, Beijing Jiaotong University, Beijing, China

Abstract: Business modelling is a primary task in information systems development lifecycle. Although both MEASUR (Methods for Eliciting, Analyzing and Specifying User's Requirement) and RUP (Rational Unified Process) provide their own Business Modelling Method (BMM), each has obvious merits and drawbacks. In order to devise a combined BMM, which can keep the merits and avoid the drawbacks at the same time, in this paper, comparison between the two BMMs respectively from semantics, pragmatics and social world of the semiotic framework is specified. The method to extend UML activity diagrams with the deontic operators "permitted", "prohibited" and "obliged" is proposed.

1 INTRODUCTION

It has been widely accepted by current Information Systems (IS) researchers that IS are social-technological systems. That is to say, to develop a successful information system, first of all, developers have to fully understand the business in which the information system works. Therefore, business modelling has been a primary task in IS development lifecycle.

As two kinds of IS development methods, although both MEASUR (Methods for Eliciting, Analyzing and Specifying User's Requirement) and RUP (Rational Unified Process) provide their own Business Modelling Method (BMM), each has obvious merits and drawbacks. To keep the merits and avoid the drawbacks at the same time, there are researchers who have correlated the two BMMs. In (Xie, Liu and Emmitt, 2003), it was pointed out that Ontological Dependencies (OD) in Ontology Charts (OC) can be modelled as either nested classes or inheritances in UML Class Diagrams (CD). Moreover, gathering the agents' potential actions on a particular business term and then analyzing and recording the agents' norms for each of the actions in UML Activity Diagrams (AD). In (Bonacin, Baranauskas and Liu, 2004) and (Ades, Poernomo and Tsaramirsis, 2007), continuing the effort in (Xie, Liu and Emmitt, 2003), rules are provided to transfer

OC into UML CD respectively. However, until now, there's no research comparing the two BMMs from semantics, pragmatics and social world of the semiotic framework respectively and proposing a method to extend UML AD with the deontic operators "permitted", "prohibited" and "obliged".

This paper is organized as follows: in section 2, both the semiotic framework and the two BMMs are introduced. In section 3, the comparison between the two BMMs is specified. In section 4, the method to extend UML AD with the deontic operators is proposed. Finally, in section 5, conclusions are provieded.

2 THEORETICAL AND METHODOLOGICAL BACKGROUND

2.1 The Semiotic Framework

Traditionally, the division of semiotics has been syntactics, semantics and pragmatics. Stamper has added the other three, which are physical world, empirics and social world, and proposed the semiotic framework illustrated in figure 1 (Liu, 2000).

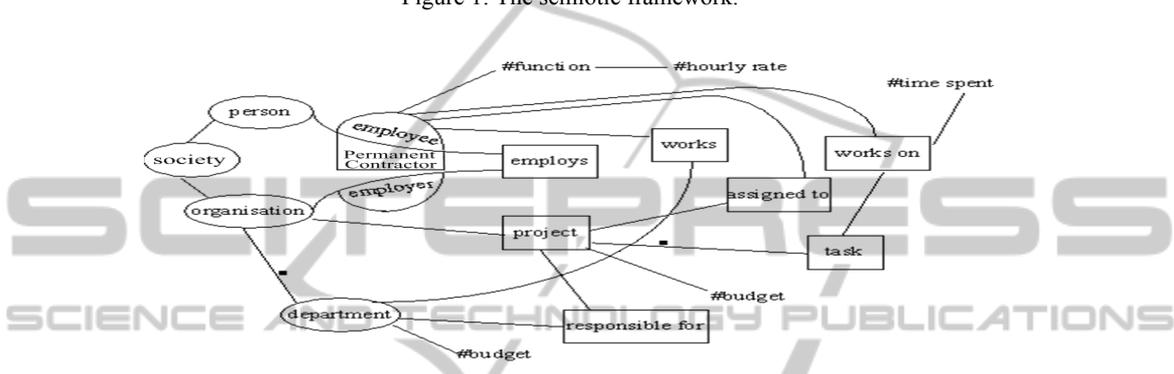| Human Information Functions			Social World	beliefs, expectations, functions , commitments, contracts, law, culture…
		Pragmatics		intentions, communications, conversations, negotiations…
	Semantics			meanings, propositions, validity, truth, signification, denotations…
The IT Platform	Syntactics			formal structure, language, logic, data, records, deduction, software, files…
	Empirics			pattern, variety, noise, entropy, channel capacity, redundancy, efficiency, codes…
Physical World	signals, traces, physical distinctions, hardware, component density, speed, economics…			

Figure 1: The semiotic framework.

Figure 2: One of the OC for a project management.

2.1.1 Semantics

Semantics is commonly considered as the study of interpretation of signs as used by agents within particular circumstances and contexts. People use signs in the communication to understand each other.

2.1.2 Pragmatics

When a sign has a meaning, it can be used intentionally for certain purposes in communications. Pragmatics, in such a case of the purposeful use of signs, is a branch of semiotics concerned with the relationships between signs and the behaviors of agents.

2.1.3 Social World

When a conversation takes place between two or more people, a change at social level will be caused. A conversation can be seen as a proper chain of speech acts. As soon as a speech act is addressed to the addressee, an obligation is usually built up for the addressee. In a social setting, norms govern people's behaviours.

2.2 The BMM Provided by MEASUR

Proposed in the later 1970s, MEASUR is a radically set of semiotics based methods for business modelling and requirements specification for IS development. To complete business modelling, MEASUR provides two major methods: Semantic Analysis Method (SAM) and Norm Analysis Method (NAM) (Liu, 2000).

Using SAM, required functions of an envisaged information system will be specified in OC, which describe an acceptable view of responsible agents in a business domain. Agents are people in different roles, with different responsibilities and authorities in an organization. In addition, based on the subjectivist paradigm, which regards reality as a social construct focusing on behaviours of agents, affordances are referred to as behaviours of an organism made available by some combined structures of the organism and its environment and OD are used to indicate that some affordances can be possible only if certain other affordances are available. Figure 2 shows one of the OC for a project management.

Based on OC, NAM gives a means to specify general patterns of behaviours of agents. The analysis of regularities of behaviours is focused on

the social, cultural and organizational norms that govern agents' actions in the business domain. Normally, a norm has a basic structure as follows:

whenever <condition>
   if <state>
   then <an agent>
   is <"permitted"/"prohibited"/"obliged">
   to do <action>

In the fourth clause, "permitted", "prohibited" and "obliged" are three deontic operators, which are equivalent to "may", "must" and "must not" respectively. Adopting the structure, a credit card company may state a norm governing interest charges as follows:

whenever an amount of outstanding credit
if more than 25 days after posting
then the card holder
is obliged
to pay the interest

2.3 The BMM Provided by RUP

Proposed in the later 1990s, RUP, an object oriented software engineering process, has been gradually accepted by IS industry and is widely used by IS developers nowadays. In RUP, a good business model consists of two major parts: a business use-case model and a business object model (Heumann, 2003) and (Kruchten, 2003).

A business use-case model includes UML Use Case Diagrams (UCD) containing business use cases. Business use cases describe business processes, which are illustrated as sequences of actions that provide observable value to business actors. To fully understand the purpose of a business, developers must know whom the business interacts with. Those "interactors" are business actors. For example, in figure 3, the business use case "Individual Check-in" interacts with the business actor "Passenger".
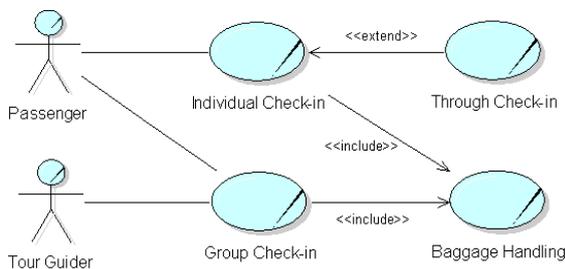
Figure 3: A UML use case diagram.

UML AD are recommended to illustrate sequences of actions involved in business use cases in detail. In UML AD, an activity state represents the

performance of an activity within the process. A swim lane indicates who performs a given activity. A transition shows what one activity state follows another. A decision with a set of guard conditions are defined to control which transition follows once an activity is complete. For example, figure 4 shows the UML activity diagram illustrating the sequence of the actions involved in the business use cases "individual Check-in" and "Baggage Handling" in detail.
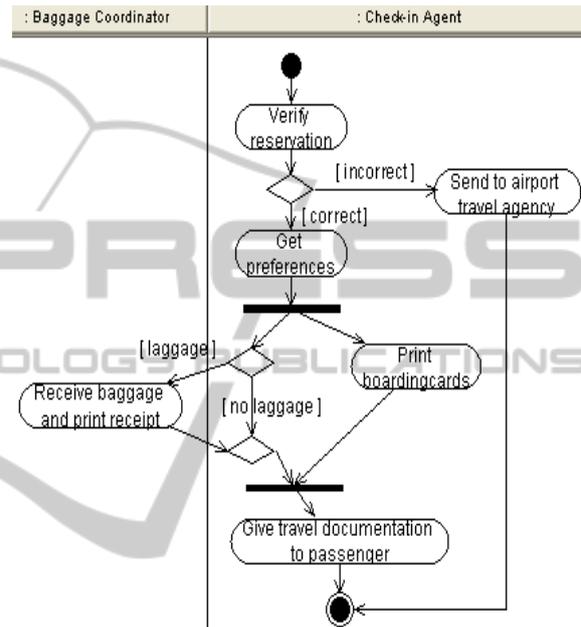
Figure 4: The UML activity diagram.

Whereas a business use-case model focuses on sequences of actions involved in business processes, a business object model focuses on business workers and business entities involved in business processes and their relationships. A business worker represents a role or set of roles in a business, which interacts with other business workers and manipulates business entities. A business entity represents a significant and persistent piece of information that is manipulated by business actors and business workers. For example, figure 5 shows the UML class diagram illustrating parts of the business workers and business entities involved in the business use cases "individual Check-in" and "Baggage Handling" and their relationships.
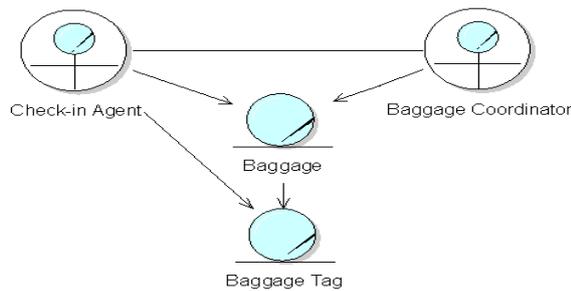
Figure 5: The UML class diagram.

3 COMPARISON BETWEEN THE BMMS

To compare the two BMMs, their relationship must be firstly identified.

According to the previous introduction of OC, UML UCD and CD, it is quite apparent that all of them are used mainly to define meanings of terminology used in business models. Therefore, from view of the semiotic framework, all of them concern with semantics of the framework.

Although purposes in communications are difficult to model by formal means, their underlying mechanisms can be understood by studying social norms at the social level (Liu, 2000). Therefore, from view of the semiotic framework, norms are the formal result concerning with both pragmatics and social world of the framework. Likewise, purposes in communications are not modelled formally and obviously in UML AD either. However, communications between business actors and business workers are obviously and formally represented in them, which make the analysis of purposes much easier. Moreover, although norms are not specified in UML AD, business rules, which are similar to norms and generally state that if conditions are met, certain events will happen or actions will be taken, are hidden behind them. For example, in figure 4, following the structure defined in (Liu and Ong, 1999), the business rule hidden behind the transition pointing to the activity state "Get preferences" can be explicitly expressed as follows:

if the reservation

is correct

then get preferences

To sum up, from view of the semiotic framework, UML AD concern with both pragmatics and social world of the framework too.

Table 1 summarizes the relationship of the two BMMs from the semiotic framework view.

Table 1: The relationship of the two BMMs.

	MEASUR		RUP	
	Methods	Formal results	Methods	Formal results
Semantics	SAM	OC	UML UCD and CD modelling methods	UML UCD and CD
Pragmatics	NAM	Norms	UML AD modelling method	UML AD
Social world				

Based on table 1, the two BMMs can then be compared. Here, the comparison focus is on the formal results respectively in semantics, pragmatics and social world of the semiotic framework. The purpose of the comparison is to find obvious merits and drawbacks each of the formal results has. Table 2 shows the result of the comparison.

Table 2: The result of the comparison.

	Formal results	Obvious merits	Obvious drawbacks
Semantics	OC	Model OD directly and clearly	Narrowly used
	UML UCD and CD	Widely used	No OD are defined
Pragmatics	Norms	Three deontic operators are specified	(i) Purposes are not modelled formally and obviously; (ii) Communications are not modelled directly and obviously; (iii) Narrowly used
	UML AD	(i) Communications are modelled directly and obviously; (ii) Widely used	(i) Purposes are not modelled formally and obviously; (ii) No deontic operators are defined
Social world	Norms	Three deontic operators are specified	Narrowly used
	UML AD	Widely used	Business rules rather than norms are specified indirectly

As shown in table 2, for UML UCD, CD and AD, it is their obvious merits that they are all widely

used by current IS developers because UML has been approved by the Object Management Organization (OMG) as a standard since 1997. On the contrary, for both OC and norms, it is their obvious drawbacks that they are used at present only by a small group of people and no commercial effort has been made to popularize them yet. Moreover, at the semantics level, as an important and indispensable relationship, OD are modelled directly and clearly in OC but not defined in UML UCD and CD (Xie, Liu and Emmitt, 2003), (Bonacin, Baranauskas and Liu, 2004) and (Ades, Poernomo and Tsaramirsis, 2007). At the pragmatics level, three deontic operators are specified in norms but not defined in UML AD, which make the presentations of communications and the analysis of purposes in communications more precise. On the other side, UML AD can model communications directly and obviously but norms cannot, which make the analysis of purposes in communications much easier. At last, it is their common drawbacks that purposes in communications cannot be modelled formally and obviously in both of them. At the social world level, similarly, three deontic operators are specified in norms. However, in UML AD, business rules rather than norms are specified indirectly. As stated in (Liu and Ong, 1999): "with the help of the deontic operators, norms can handle both business rules and exceptions, which are situations difficult to anticipate and specify in advance and are situations, where decisions occur on an ad hoc basis and are made solely on human judgment".

4 THE METHOD TO EXTEND UML AD

As Kecheng Liu stated that "A sound modelling method must cover the issues in semantic, pragmatic and social aspects. Issues at the three semiotic levels are closely related. The focus must be first on semantic issues. A model containing a clear description about the organization, which may be in terms of general patterns of actions, states, etc., is the first bases for further analysis. The model of this kind can be taken as a foundation on which the intentions of actions can be discussed. Furthermore, the rationales, limits and consequences of the actions at the social level can be addressed" (Liu, 2000).

As pointed out previously, UML AD can model communications directly and obviously but norms cannot, which make the analysis of purposes in communications much easier. In addition, UML AD

are widely used by current IS developers as an OMG standard. Furthermore, although no deontic operators are defined in UML AD, it is not hard to extend them with "permitted", "prohibited" and "obliged" to handle exceptions as norms. In conclusion, it is more reasonable to choose UML AD rather than norms as the formal results to model business both at the pragmatics and the social world level in the combined BMM envisaged, which is supposed to keep the merits and avoid the drawbacks each of the BMMs has.

To extend UML AD with "permitted", "prohibited" and "obliged", only three simple rules below have to be followed:

- Each transition pointing to an activity state should be extended with one of the three deontic operators;
- When the "permitted" or the "prohibited" is used, the text "permitted" or the text "prohibited" must appear at the end of the guard condition and separated with the guard condition by "/";
- When the "obliged" is used, the text "obliged" can be omitted. Otherwise, it should appear at the same place as the other two.

For example, figure 6 shows the UML activity diagram derived from a slight modification of a Workflow Activity Diagram (WAD) used in (Liu and Ong, 1999) by complementing the "Customer" and the "Insurance agent" swim lanes, the start state and the end state.

Following the rules proposed above, figure 7 shows the UML activity diagram extended, which expresses the same meaning with the WAD extended by norms illustrated in (Liu and Ong, 1999) but in a much simpler and more direct way. In figure 7, the norm hidden behind the transition pointing to the activity state "Accept form" can be explicitly expressed as follows:

whenever an form has been accessed
if criteria are met
then an insurance agent
is permitted
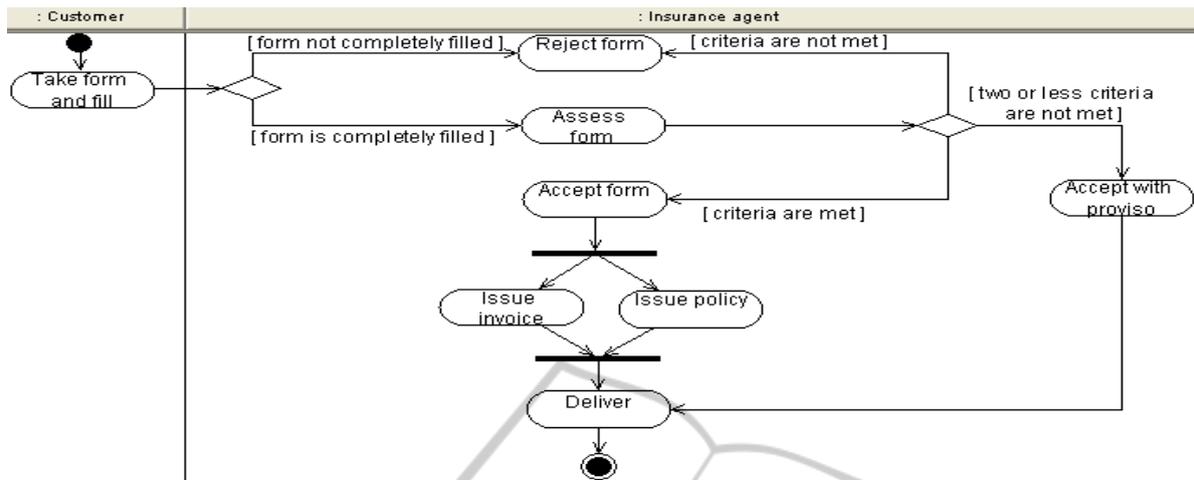*to* accept the form

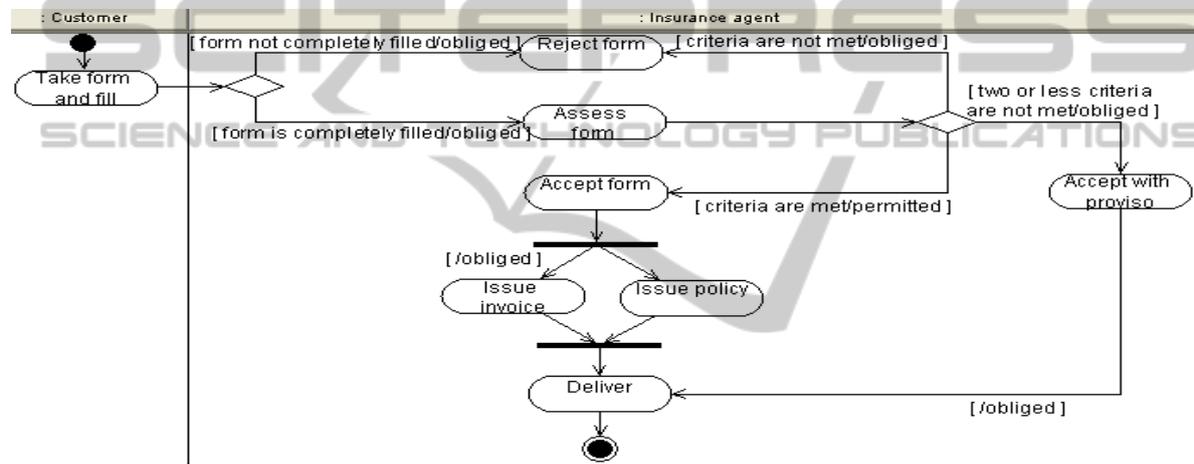Figure 6: The UML activity diagram derived.

Figure 7: The UML activity diagram extended.

5 CONCLUSIONS

Business modelling is a primary task in information systems development lifecycle. Although both MEASUR and RUP provide their own BMM, each has obvious merits and drawbacks. In order to devise a combined BMM, which can keep the merits and avoid the drawbacks at the same time, in this paper, comparison between the two BMMs respectively from semantics, pragmatics and social world of the semiotic framework is specified. The method to extend UML AD with the deontic operators "permitted", "prohibited" and "obliged" is proposed.

Based on the comparison specified and the method proposed, it is the next task to devise the complete combined BMM and to test it in practice.

ACKNOWLEDGEMENTS

REFERENCES

Xie Z., Liu K., Emmitt D., 2003. Improving Business Modelling with Organisational Semiotics, In *Gazendam H., Jorna R., Cijsonw R.(eds.), Dynamics and Change in Organization - Studies in Organizational Semiotics, Kluwer Academic Publishers,* 85-102.

Bonacin R., Baranauskas M., Liu K., 2004. From Ontology Charts to Class Diagrams: Semantic Analysis Aiding Systems Design. *Proceedings of the 6th International Conference on Enterprise Information Systems*.

Ades Y., Poernomo I., Tsaramirsis G., 2007. Mapping Ontology Charts to UML: an SNF Preserving Transformation. *Proceedings of the 10th International Conference on Organisational Semiotics*.

Liu K., 2000. *Semiotics in Information Systems Engineering.* Cambridge University Press. Cambridge.

Heumann J., 2003. *Introduction to business modeling using the Unified Modeling Language,* at http://www.ibm.com/developerworks/rational/library/360.html, [accessed 13/02/2011].

Kruchten P., 2003. *The Rational Unified Process: An Introduction*, Addison Wesley. 3rd Edition.

Liu K., Ong T., 1999. A Modelling Approach for Handling Business Rules and Exceptions, *The Computer Journal,* 42(3), 221-231.