A theory of practice modelling - Elicitation of model pragmatics in dependence to human actions

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Der Geist der Forschers, der sich von der Erfahrung hat modellieren lassen, wird das Spielfeld von geistigen Operationen, welche die Erfahrung in Modelle verwandeln und andere geistige Operationen ermöglichen.

Umberto Eco

Abstract: Conceptual modelling is a constituting and popular theme in information systems research. With the proposal of different languages, concepts and methods, modelling has evolved to a sophisticated tool of systems design. With a focus on providing concepts with more enriched semantics, even more specific approaches have been developed, such as business process modelling and enterprise modelling. Providing a model often seems to be a means to an end, whether it is academic research or industrial cases. However, if the reasons to construct a model goes beyond analytical purposes, then the respective model must serve a sense of pragmatism, respectively needs to be utile with respect to the achievement of the different tasks an information system has. Therefore, this paper aims at a more restrained definition of the general modelling term, while it is consentient to the constructivism of modelling. Thereby, a model will be not seen as a solution, but a sophisticated manner to provide and evolve information. Having that in mind, such a conception of a model helps to purposefully create sophisticated and pragmatic models.

1 Introduction

Conceptual models offer a medium for communication that provides more semantics and less ambiguity compared to natural language, without the restrictive nature of formal approaches. With the initial proposal by CHEN [Che76] that promoted data models as a key-stone for systems development, more and more approaches were developed in order to cover structure-, behaviour- and hierarchal-related issues of system, respectively information systems [Rop78]. Promoting business process models, SCHEER [Sch00] focussed on the integration between information about system structure, system hierarchy and system behaviour. Focussing on business processes was motivated by the work of [HC06] as

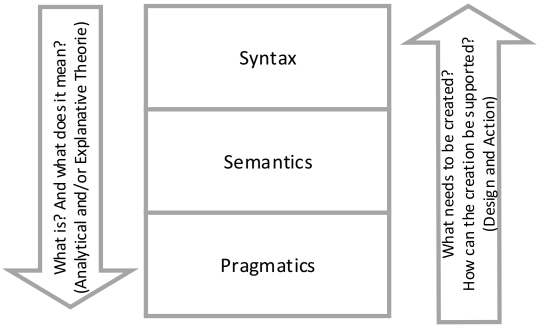

Figure 1: Procedural scope shift regarding the purpose of model creation

well as [DS90] that promoted the need for creating specifications of business processes for a strategic advantage in enterprises. According to YU, such behaviour has one key driver and these are goals of the respective executing actor [Yu99].

What can be identified from history is that generally a shift of concepts can be identified, which are either concentrated, mainly due to limitations of insights, to descriptions of a structure, a behaviour or a hierarchy [Rop78]. Hence, there seems to be a shift in required information, respectively required concepts for creating a sophisticated or perceived as complete model. In accordance to that new modelling trends are initiated by the introduction of new concepts that are initially defined by a rigid defined syntax and successfully defined semantics. However, with such an entanglement to the field of semiotics, which is rather an analytical field [Eco86], the creation of a model out-focusses the primarily needed relevance, to an outpaced conception of analytical pragmatism. Instead of identifying pragmatics based on the defined syntax and semantics, initially for a relevant model, pragmatics should focus on establishing required structures with respect to the required task-completion of the information system, which can then be found in language. Hence, in order to provide a sophisticated manner for enabling an interpreter for executing meaningful actions, the initial required pragmatics are needed to be identified at first, as depicted by the Figure 1.

Therefore this paper is considered with identifying the general nature of a model and by doing so it tries to identify the previously identified shifts. The main contribution of this paper is thereby the identification of the most important factor for creating a model, which is the actual recipient. In accordance, the identification of the recipients' needs for a specific model decides about the models correctness, consistency, completeness and comprehensibility [MDN09].

2 Research method

The particular scope of this paper surrounds the examination about the usage of a model that goes beyond communicative reasons. Therewith, in particular the relation between a model and a respective theory will be examined. With respect to the previous stated idea of defining pragmatism as a basis for the creation of needed structures for a required task-completion, the following defined research question aims to identify a relation to characteristics of an information system for this definition. Respectively, it is assumed that a model has a reciprocal relation to the general conception of a theory building process [MS95], as it may be both, the result of and expedient to building processes. As these theory building processes are performed by those that are at least temporarily part of an information system, the following research question was defined to point the dependency of modelling to theory building processes.

What is the proper modelling of an information system, if an information system is conceived as a social system that is primarily constituted by its respective comprised individuals?

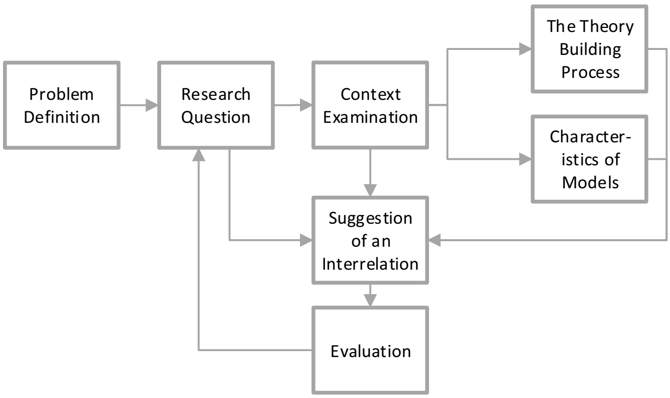

Figure 2: Conceptualisation of the utilised research process

In order to examine the presented research thoroughly, the research process was imposed as follows. Initially, the problem definition served as a basis for defining the research question. Based from that research question, the respective context was examined, which is mainly surrounded by two topics. Firstly, the theory building process was examined with the focus on qualitative information that enables respective individuals to act properly in their surrounding information system. Secondly, characteristics of a model were examined. The proposition of information was examined through the usage of a model and modelling languages. As a result from both examinations, an interrelation will be suggested that defines the usage of a model for proper theory building. With respect to that it was identified that a model may be used as impetus for proper theory building, as it may contain information that can't be experienced within the information system. As a theory is rather something intangible [GH13], the means for measuring a proper theory building may be the possession of knowledge that enables the performance of meaningful actions. Respectively these meaningful actions contribute to the achievement of the task targeted by the information system. In order to finally evaluate the developed theory of practice modelling, an argumentative approach was chosen [Fra06], combined with predicate logic and natural deduction. In doing so, we can at least show that the given argument is logically valid based on the given assumptions. Therewith, all the made assumptions are explicated within this paper that finally lead to the following conclusion.

$$\forall m, \exists i, h, a : D_{erivable}hma \wedge P_{ragmatic}ia \rightarrow P_{ragmatic}im \quad (1)$$

The given conclusion states that only a model (m) is pragmatic, if it is is possible to derive actions (a) from that model, at least by one individual (h), that are pragmatic by means of the achievement of the respective tasks within the information system (i). The proof will be given in the latter of this paper. The research process is given by Figure 2. However, with respect to the initial stated research questions, within this presented research it will be proven that modelling generally depends on the recipient's habitus, respectively the actions, which the individual is capable of performing.

3 A humanistic purpose of models

3.1 A glance on the structure of action within information systems

Research artefacts are generally divided by four different classes; the method, the construct, the model and the instantiation [MS95]. Since that, the importance of models for research has been identified [HMPR04] as a model may state the structure of reality and further, because a model, instead of a theory, may become completely materialised [GH13].

Particularly the description of a model is measured theoretically by three different magnitudes; the syntax, the semantics and the pragmatism. Whilst clear definitions are available for checking syntactical correctness, e.g. through meta-models or formal definitions, semantics that go beyond formal or operative semantics have to be validated by the respective recipients [LSS94]. Therewith, if a mapping between the modelled statement and the implied action is not explicitly possible [CEK02], verification is not sufficient for proving correctness. Additionally, pragmatics is given at most, if formal semantics are given and the recipient is a machine-driven recipient [Sel03].

The materialisation by a model happens through the use of language, respectively with the expression of a human that has formed certain ascertainment based on a theory building process and tries to express these by means of *language*. So, the respective materialisation of one's statements are driven by the syntax of a language, respectively the concepts the language offers and its interrelations, as well as the language's semantics. Whereby, the pragmatics of a language may be driven by the respective intentions, how the language serves the individual to express itself [LSS94]. Hence, pragmatics of a language, are external to it.

Therewith, several approaches have been identified for judging a model generally [LSS94], or specific types of models [KDJ06, RMR10]. However, while a model would be able to meet most of the criteria, the judgement about the pragmatic value is external by those that are involved in the respective domain the model targets [Joa93, p. 248]. So with the assumption that a theory is not expressible at all [GH13], further investigations about whether a model may act as a support for the derivation of meaningful actions are obsolete. Generally, a model should be regarded as a set of information. Moreover if the model requires the clarification of further information by extensive face-to-face communication, the pragmatism of that particular model should be refuted based on the not-included information. This leads to the assumption that creating a model is not a problem-solving process, as the only intention could be collection of information. Thereby, in order for a model to be pragmatic, it needs those informations that are relevant and revealing to the subject. If so, then a model is suited to contribute, as an impetus, to the theory building process, even to one that refers to a design theory [Gre06]. Reflectively, the pragmatic value of a model relies in its possibility to be used in a theory building process by its recipients. In accordance to that the relevance relies in the needed contribution to the act, as a possible theorizing about the respective reason for a certain act, which needs to be taken in the second place.

So, if one wants to create a model about a respective information system, one must consider the various components of the respective information system, which are the task, the human and the technology [Hei01]. Therewith, as formalised by the following predicates, an information system includes tasks (t), humans (h) and technology (c).

$$\forall i, \exists t : I_{ncludes} it \tag{2}$$

$$\forall i, \exists h : I_{ncludes} ih \tag{3}$$

$$\forall i, \exists c : I_{ncludes} ic \tag{4}$$

So, with considering an information system as a partly social system, this respective information system enables the performance of certain actions. Respectively these actions are considered with the completion of the respective tasks (t). As, obvious, only those humans that are part of the information system may perform those actions with the technology that is available, again within the information system. Therewith it is possible to abstract from individual humans and technology, to generally assume that there are actions that can be performed within an information system for the achievement of the respective tasks.

$$\forall t, \exists a : F_{inishes} ta \tag{5}$$

Therewith, a modelling process should be restricted to those actions that can be perceived as pragmatic, if it can be shown that actions can be performed within an information system, which do not offer any utility, respectively pragmatic value. Therewith, if an action does not contribute to any completion of any task, it is rather doubtful that one should model anything that contributes to the execution of the respective action. However, there will be definitely actions that do not contribute in any sense to the completion of the respective information systems task.

$$\forall i, t \exists a : I_{ncludes} it \wedge \neg P_{ragmatic} ia \rightarrow \neg F_{inishes} ta^{1} \tag{6}$$

$$\forall i, t \exists a : F_{inishes} ta \rightarrow \neg I_{ncludes} it \vee P_{ragmatic} ia \tag{7}$$

$$\forall i, t \exists a : \neg I_{ncludes} it \vee P_{ragmatic} ia \tag{8}$$

As an information system definitely includes tasks (cf. assumption 2), with the application of the *disjunctive syllogism* the following predicate is proven.

$$\forall i, \exists a : P_{ragmatic} ia \tag{9}$$

So, every information system comprises actions that are pragmatic. These actions should stay in focus, as to promote such actions may be a pragmatic value that modelling could offer. The main goal might be the fostering of social interactions between individuals, as identified by WEBER [Web78] as the most important behaviour of individuals in social systems. With considering these identified pragmatic actions, the pragmatic value of a model then depends on the possibility for transforming the provided information into knowledge and certainly extends the recipients habitus [BN13, p. 214], respectively extends the available set of actions one can perform. Hence, any value of a model is a priori restricted by the possible contribution it can make towards those tasks that are pragmatic, and the prevention of those actions that are not pragmatic. So, one could infer, based on the specificity of an information system for having different individuals, technology and tasks that the set of meaningful actions differs also between the information systems. Therefore, the respective information requirements differ as well. Accordingly, one could infer that for each created model, at least one information system can be identified that does not comprise the focussed task, technology or individual, in such a manner that the respective model does not serve any pragmatic in that particular information system. So, it will be assumed that

$$\forall m, \exists i : \neg P_{ragmatic} im \tag{10}$$

With the definition of the acting that reflects a certain value for an information system, further investigation within the upcoming section are considered with the theories that enable a human to execute these valuable actions and what the role of a specific model is.

[1] For purposes of clarity, the quantifiers will not be excluded throughout the application of the natural deduction logic.

3.2 The conditional alignment between abstraction and theory building

A conceptual model represents a general conception of a domain [WMPW95]. More specific, to just any domain, an information model represents information that are considered with a particular information system [Tho06, pp. 66-71]. While an information system is still a vague term, and can consider any technological induced and task oriented social system, the term of enterprise model is considered with enterprises as special form information systems [Fra12]. Conclusively, the more specific a specific system, the more concrete needs the language to be to formulate expression within this particular domain. Concepts needs to be less abstract and the transition from information provided by a model to expertise must be completed with clearly a lower effort.

A special and specifically pragmatic example for the usage of models for the enabling of certain actions is model driven engineering (MDE) [Ken02, Sel03]. In short; MDE is considered with the creation of certain models that can be specifically understood by machines and enable them to perform certain actions. These actions then achieve certain tasks, which can be either required on their own or in support for additional actions executed by humans or again machines. The pragmatic value of MDE is that the required amount of information is a priori known by the machine itself and in such a manner automatically rejects "incomplete" models. Hence, the modeller will be socialised by the machine, as he will be in charge for fitting the respective models. Although, one could barely speak from a social relation, the acting will be accordingly refined by the modeller. So, because of the strictly defined information needs, the level of abstraction for models that are going to get interpreted by machines can be checked consistently. The human, respectively the modeller, has then to check that the performed actions correspond to the initially set intentions.

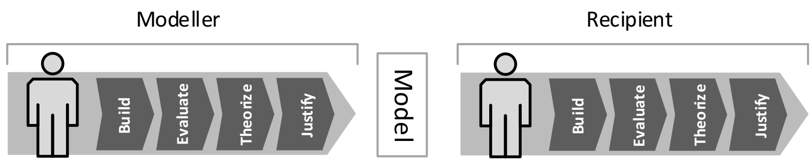

Figure 3: Production and consumption of a model with respect to [MS95]

This process of “socialisation”, respectively the identification of the information needs of a human recipient, is at a completely different scale, if a human is in charge of interpreting the model. As language skills, experiences and time-to-adapt, among other magnitudes, will be extremely different between several individuals, even if they share a common information system. Therewith, the role of abstraction for a specific model drastically impacts the required information that an individual needs to get through a model in order to enable the performance of a certain action. Thereby, as depicted by Figure 3, a model needs to serve a theory building process of a recipient that hopefully enables the individual to perform a meaningful action within its information system. The respective representation of Figure 3 is rather idealistic, although it represents the ultimate goal of a sophisticated model, especially an information model, to enable individuals to build at least partially a proper theory based on the given insights of the model. However, as specific case studies considered with conceptual modelling reveal, the pragmatic value of a model is considered mainly with communicative reasons [HPV05].

Referencing to theories of argument, such as STEPHEN TOULMIN'S [Tou03], one could infer that the informational content of a model is only convincing, if the information is supported by grounds that help to establish a belief [BT13]. In accordance to that, the transformation of a model into required knowledge is only possible for a human, if it possesses certain grounds, from which the transformation can be initialised. Hence, the level of abstraction needs to be in accordance to the knowledge or expertise a human already possesses (cf. Figure 4).

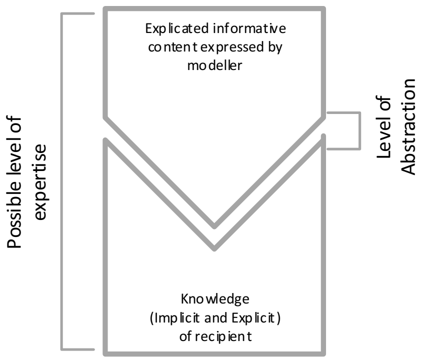

Figure 4: Abstraction requirements for possible expertise extension through a model

So, in general, the following conception of the use and design of a conceptual model is driven by the question what are the value of semantics and syntactical correctness, if a model can be justified based on its impact, namely its enabling factor. Based on this discussion of the role of abstraction for the establishment of expertise by means of conceptual models, the initially defined predicate model can be properly extended. Therewith, to express the relation properly the following predicate states that based on a model, an individual may derive a certain action. However, the possibility of derivation depends principally on the individual or human that interprets the respective model, as the expertise differs between individuals.

$$\exists h, m, a : D_{erivable} hma \tag{11}$$

4 A modelling theory for the design of social contexts

4.1 A restrictive view on the effort for modelling

Conceptual modelling remains as a capstone in an engineering process, in which the primary goal is the creation of an artefact, respectively the conceptual model. However, while during this process the respective designer can gather multiple requirements by means of a requirements analysis from a multitude of stakeholders, the actual relation between the conceptual models and the requirements needs to be validated. This is also the case, when multiple designers are involved in the creation of one conceptual model, e.g. due to complexity. The various theories must be aligned by the outcome of the conceptual modelling process in order to ensure its validity. However, due to the social system the alignment must happen in accordance with multiple individuals that a modeller will cope with. Assuming that a model is created with a certain intention, the pragmatic relationship will be established based on the respective actions the recipient derives [Web78, Joa93]. In that relation, even a non-perceivable reaction, such as being "silent" is considered as an action as well [Kur95].

Therewith, the support is mainly individual dependent, as the models should support the reduction of complexity in order to promote meaningful actions [Luh91a]. Therewith, in order to promote pragmatic actions, whereby pragmatism also refers to the acceptance within a social system, the provision of information by means of a model follows the respective dispersion of values throughout a social system [LB91]. Specifically as a model will be stated and becomes materialised, the model reaches value only when the different underlying theories of the respective individuals are particularly aligned. Hence, models can act as manner to come to a common theory between two individuals. In accordance to that, the respective model reaches epistemological value, if a recipient can assume that by the model some belief is expressed that has been evaluated by a certain respective peer group [BNK04, BN07] and the recipient can gain the needed information from the respective model. Respectively, the particular model still has a strong subjective relation to the respective peer group, but with grounding it on a common theory, the inference of any value for upcoming individuals is possible. Hence, with respect to the cognitive effort to interpret the model accordingly based on the individual's experiences and background, it is assumed that although a model may be pragmatic and the derivation of pragmatic actions is possible, not every human will derive those actions (cf. assumption 12).

$$\forall m, i, a, \neg\forall h : [P_{ragmatic} im \rightarrow D_{erivable} hma] \rightarrow P_{ragmatic} ia \tag{12}$$

$$\forall m, i, a, \exists h : \neg([P_{ragmatic} im \rightarrow D_{erivable} hma] \rightarrow P_{ragmatic} ia) \tag{13}$$

$$\forall m, i, a, \exists h : [\neg P_{ragmatic} im \vee D_{erivable} hma] \wedge \neg P_{ragmatic} ia \tag{14}$$

$$\forall m, i, a, \exists h : [\neg P_{ragmatic} ia \wedge \neg P_{ragmatic} im] \vee [\neg P_{ragmatic} ia \wedge D_{erivable} hma] \tag{15}$$

The disjunction enables the splitting of branches and it is possible to continue with the left branch.

$$\forall m, i, a : \neg P_{ragmatic} ia \wedge \neg P_{ragmatic} im \tag{16}$$

$$\forall m, i, a : \neg P_{ragmatic} ia \tag{17}$$

Respectively, a contradiction has been identified with respect to conclusion 9. Therewith, the pursued left branch is false and the right branch must be true (according to the disjunctive syllogism).

$$\forall m, h, a, \exists i : D_{erivable} hma \wedge \neg P_{ragmatic} ia \tag{18}$$

Additionally, it will be a harder task to interpret a certain model by a human of another information system, as this requires the model to have a certain level of abstraction [Tho06] and thereby, the human to be cognitive-capable to turn this high-level information to any value for the information system. To ensure such a proper derivation, or to at least reduce the level of misinterpretation mostly, quality frameworks have been developed, e.g. for the domain of business process modelling [LR13]. However, as examined in other works, such as [SMWR10], highly creative work can't be subject of being captured by means of an explicit model. Respectively, work that requires tacit knowledge can be at least supported by information provision [KPV03], but neither captured nor is solved simply by means of a model. Thereby, one can infer that knowledge is existent in information systems that can't be supported by any modelling activity. So, it is assumed that not for every pragmatic action, either a respective model is not pragmatic in that particular context or the action can be derived from a particular model by at least one human (cf. assumption 19).

$$\exists i, h, \neg \forall a, \exists m : \neg P_{ragmatic} im \vee [P_{ragmatic} ia \rightarrow D_{erivable} hma] \tag{19}$$

$$\exists i, h, \neg \forall a, \exists m : P_{ragmatic} im \rightarrow [P_{ragmatic} ia \rightarrow D_{erivable} hma] \tag{20}$$

$$\exists i, h, a, \neg \exists m : P_{ragmatic} im \rightarrow [P_{ragmatic} ia \rightarrow D_{erivable} hma] \tag{21}$$

$$\exists i, h, a, \forall m : \neg (P_{ragmatic} im \rightarrow [P_{ragmatic} ia \rightarrow D_{erivable} hma]) \tag{22}$$

$$\exists i, h, a, \forall m : P_{ragmatic} im \wedge \neg [P_{ragmatic} ia \rightarrow D_{erivable} hma] \tag{23}$$

$$\exists i, h, a, \forall m : \neg [P_{ragmatic} ia \rightarrow D_{erivable} hma] \tag{24}$$

$$\exists i, h, a, \forall m : P_{ragmatic} ia \wedge \neg D_{erivable} hma \quad (25)$$

$$\exists h, a, \forall m : \neg D_{erivable} hma \quad (26)$$

In accordance, there is at least one human existing that is not capable of deriving a unique action from any model available.

4.2 The pragmatic implications of a model

In order to establish a conceptual model as a sophisticated manner for distributing information, based on the previous given insights, a shift of the epistemological value of conceptual models is required. However, the creation by one individual of a model, whether it is conceptual or mentally held, still relies on well-established and identified cognitive processes, such as discussed in [BNK04, BN07]. Moreover, the question occurs how common sense of a conceptual model is created between more than one individual. Therewith, a focus on pragmatics with an elicitation of utility is required. So the pragmatics of a conceptual model may be refereed as the possibility for deriving meaningful actions based on the information offered by the conceptual model.

Unfortunate, such a proceeding needs contribution by more than two individuals that receive a model in isolation and without any discursive relation, as it needs to be ensured that no information is exchanged that goes beyond the information content of a model. Required exchanges of information between participants would reveal the respective conceptual model as incomplete. While completion must not necessary refer to a conceptual model that comprises all of the respective knowledge kept in a particular domain of focus. However, it rather requires requirements at the level of abstraction a respective conceptual model is characterised with. Hence, the level of abstraction must orientate towards to the information needs of the respective recipient. As an interpreter will have a certain expertise in a certain field that enables him to consume a specific model, this expertise must be identified a priori and related with the level of abstraction of the respective model.

One particular example, for meeting such a rather pragmatic level of abstraction is MDE [Sel03]. The level of abstraction must exactly meet the information needs of the respective compiler that is in charge for generating software code based on or interpreting the model. Therewith, certain assumptions are made based on the algorithms language capabilities, as the compiler is only able to interpret the received model in one specific way without the need for the consumption of further information beyond the model. This is possible, due to the homogeneous creation of different machine actors, which are identical with respect to their knowledge (or rather information) and their set of performable actions.

However, initiated by gained insights from a respective model, an individual needs to act, as certainly, acting is the only manner an individual can seize in a social-system [Web78]. Additionally, a prerequisite for a proper acting is the development of a respective theory, based on the given information that gives the individual to decide for its actions. This is important, as certainly the individual may be capable of selecting between multiple ways of performing an action as well as multiple actions. Thereby, the value of a model can be judged by its possible contribution to the sense selection of the respective actions, as apart from theories models can become material and provided to individuals [GH13].

While every human acts distinctively different, namely the possibilities for interpreting a specific model are distinctive, over time and gained experiences, these interpretations should follow a specific schema. While one could claim that on optimal and idealistic circumstances, the interpretations of different individuals will become homogeneous over time [BNK04], different and varying circumstances should be taken into account by means of a specific by-the-human-offered creativity. In particular, that variation is something a machine cannot contribute. Moreover, models include information that aim at the reduction of complexity in order for an individual to make decisions and to perform certain actions in an information system [Luh91b]. In that sense, abstraction segregates between the complexity that can be reduced based on the information provided by the model and the decisions that can be made based on the individuals knowledge and expertise [LP13]. If these requirements are met and although unstable as well as volatile circumstances, the derivation of sophisticated actions based on the information content is possible, a model certainly becomes pragmatic.

With respect to the discussion in section 3.2 and based from the previous given insights, abstraction in terms of practical modelling can be defined as the level of knowledge, which needs to be possessed by the recipient in order to make the respective model applicable [BC87]. With accordance to the identified “knowledge-doing gap” [PS99], a proper abstracted model provides information that enables a human to perform a certainly described action. Hence, an according level of abstraction would provide a specific individual with the required information for turning his knowledge gained from the particular model into actions.

Finally, the process of modelling for a pragmatic model cannot end by the respective "modeller", as the model is required to evolve during various theory building phases by different individuals. Commonly, these processes require a discourse between a domain expert and the respective system analyst [HPV05, BC11], whereby the domain expert judges for pragmatics and the system analyst tries to capture the meaningful action within a specific corset of syntax and semantics. However, to reach for consensus, it is necessary to include any exchanged information that has been discussed [HPV05], but not included by the respective model. This left-for-inclusion information then decides for a possible derivation and the proper derivation of meaningful actions. Derived from the previous gained conclusions, it is assumed that a model is not pragmatic at all, if one is not capable of deriving any pragmatic action from that particular model or if no action is derivable by any human in any information system at all (cf. assumption 28). This assumption derives from the previous given conclusions 18 and 26 as well as the consideration of the initially stated assumption 10 as illustrated below.

$$\exists i, h, a, \forall m : [D_{erivable} hma \land \neg P_{ragmatic} ia] \lor \neg D_{erivable} hma \tag{27}$$

$$\exists i,h,a,\forall m : \neg P_{ragmatic} im \rightarrow [D_{erivable} hma \wedge \neg P_{ragmatic} ia] \vee \neg D_{erivable} hma \quad (28)$$

5 Conclusion

$$\exists i,h,a,\forall m : \neg P_{ragmatic} im \rightarrow [D_{erivable} hma \wedge \neg P_{ragmatic} ia] \vee \neg D_{erivable} hma \quad (29)$$

$$\exists i,h,a,\forall m : \neg([D_{erivable} hma \wedge \neg P_{ragmatic} ia] \vee \neg D_{erivable} hma) \rightarrow P_{ragmatic} im \quad (30)$$

$$\exists i,h,a,\forall m : \neg[D_{erivable} hma \wedge \neg P_{ragmatic} ia] \wedge D_{erivable} hma \rightarrow P_{ragmatic} im \quad (31)$$

$$\exists i,h,a,\forall m : [\neg D_{erivable} hma \vee P_{ragmatic} ia] \wedge D_{erivable} hma \rightarrow P_{ragmatic} im \quad (32)$$

$$\exists i,h,a,\forall m : [\neg D_{erivable} hma \wedge D_{erivable} hma] \vee [P_{ragmatic} ia \wedge D_{erivable} hma] \rightarrow P_{ragmatic} im \quad (33)$$

$$\exists i,h,a,\forall m : P_{ragmatic} ia \wedge D_{erivable} hma \rightarrow P_{ragmatic} im \quad (34)$$

$$\exists i,h,a,\forall m : D_{erivable} hma \wedge P_{ragmatic} ia \rightarrow P_{ragmatic} im \quad (35)$$

$$\forall m, \exists i,h,a : D_{erivable} hma \wedge P_{ragmatic} ia \rightarrow P_{ragmatic} im \quad (36)$$

□

Therewith, it was shown that the pragmatic value strongly depends on the cognitive possibilities of the interpreting human and the surrounding information system that marks the possible set of actions. With respect to the initial stated research question, it was found that the creation of a model, if it needs to be interpreted by a human, depends on the actions that are able to be performed by the human. Thereby, a model needs to either respect these actions or needs to contribute to an enhancement of the respective recipient's habitus.

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