Chapter VI
Towards a Meta-Model for Socio-Instrumental Pragmatism

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ABSTRACT

We claim that a general conceptual framework for the IS field should provide some kind of common upper-level ontology to describe and explain artifact-mediated social interaction. Such an ontology, socio-instrumental pragmatism (SIP), has been suggested. Our aim is to refine and formalize this ontology by providing a meta-model in the form of a UML class diagram. We discuss the implications of such a model as well as its relation to other ontologies. The meta-model is validated by using it in the evaluation of an existing business modeling language.

INTRODUCTION

The rise in the use of information systems (IS) is undeniable, and every day IS become a more important part of organizations. But far from being perfect, the design and implementation of IS in organizations is still a very problematic task that is often fraught with failure (Ågerfalk & Goldkuhl, 2006). There is a need for a better understanding of IS, organizations, and their relation to come up with a framework capable of integrating these two concepts. For the past two decades, theories of communication have been imported into the IS field and the language action perspective (LAP) has been proposed as a way to understand IS and organizations based on communication (Goldkuhl, 1982; Winograd & Flores, 1986). Later on, an ontology to capture the social world was proposed and described in Goldkuhl (2001), Goldkuhl, Röstlinger, and Braf (2001), Goldkuhl (2005), and Goldkuhl and Ågerfalk (2002). This ontology was named "socio-instrumental pragmatism" since it aims at human actions which are supported by instruments and performed within the social world (Goldkuhl, 2002). Socio-instrumental pragmatism (SIP) presents a generic framework which allows for the analysis of the social world. Within this world there are six ontological categories:

1. Humans
2. Human inner worlds
3. Human Actions
4. Signs
5. Artifacts
6. Natural objects

Since SIP was intended as a generic framework which can serve as a base to analyze the social world, it is not aimed exclusively at the IS field. We think that a meta-model based on the SIP ontology but with a focus on the IS field is needed. This meta-model has its foundations in both LAP and SIP and presents a model that will allow us to view organizations and IS together with a focus on actions.

The model consists of the basic categories actions, actors, and objects. In addition to this we also consider other important aspects of organizations that are related to their functioning.

TOWARDS A META-MODEL SOCIO-INSTRUMENTAL PRAGMATISM

As mentioned before, there is a need for a framework that allows us to describe social systems in a clearer and more thorough way. Our work is based on the SIP ontology. Within the SIP ontology there are six ontological categories (Goldkuhl, 2002):

- **Humans** are the most important participants in the social world described by the SIP ontology; they act in the world based on meanings and perceptions that they derive from the world.
- **Human inner world** represents the knowledge that a human being has acquired over time about themselves and the external world; this inner world is intended to be seen as part of the human being.
- **Human actions** also form a part of the human being; they can be overt, which means that the actions are intended to intervene in the external world, thus trying to change something about it. And they can be covert when they are aimed to change some human being's inner world; covert actions try to change knowledge that is present in the human inner world.
- **Signs** are the result of communicative actions; for instance, when write a note saying, "I will be at the store", the writing of the note is by itself a communicative action but the note created is a sign which will mean something to the person that will read it.
- **Artifacts** are things which are not symbolic and not natural but which are material and artificially created. Examples of artifacts are cars, clothes, a knife, and so forth. The difference between signs and artifacts is that while signs are intended to mean something to someone (symbolic), artifacts perform material actions. For instance, a human might use a knife (artifact) to cut some carrots, that is, artifacts are needed to perform material actions.
- **Natural environment** are the objects present in the environment that are not artificially created by humans (e.g., trees).

Figure 1 shows the different realms of the world according to the SIP ontology.

META-MODEL

Our model is divided into three main categories:

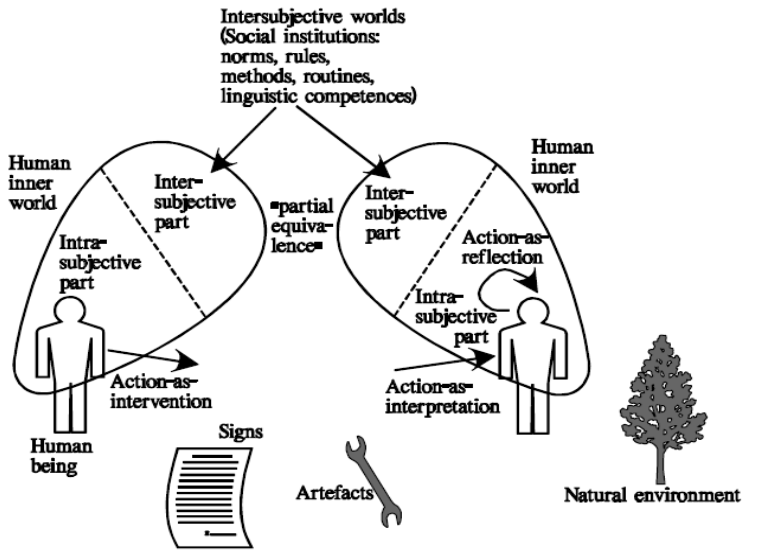
- Actions
- Actors
- Objects

Although we do not see Agent as a category; we do acknowledge the importance of agency and describe it as a special element in the model.

Actors

Actors are the main entities in our model, and they can perform either as locutor or addressee within the

Figure 1. Realms of the world within the SIP ontology (Goldkuhl, 2002)



communicative context. When actors perform actions that are directed towards another actor we speak of social actions. They can be performed either in a human-human relation or in a human-artifact-human relation. When performing as locutor the actor is trying to change some aspect of the world by means of his/her actions. For instance, when a person pays the phone bill she is trying to avoid the interruption of her phone service. When performing as addressee the actor receives and interprets an action directed to him and can act himself as a consequence of that action. Taking our example the addressee will be the phone company, which at the moment of receiving the payment will not make any attempt to interrupt the customer's phone service.

Besides locutor and addressee we can distinguish between organizational actors and human actors. The former is an actor that performs as an agent on behalf of the organization, the latter performs an action on behalf of herself.

Objects

An object may be physical or conceptual and it may be formed by other objects or related to them, but every object is unique (Embley, Kurts, & Woodfield, 1994). Under the object category we have artificial and natural objects. Artificial are those that are created by human beings; natural objects are those created by nature and found in the environment. Among the artificial objects, we have artifacts (material objects) and signs (can be material or immaterial). Artifacts are created to extend actors' capabilities. An artifact is seen as a tool. Signs on the other hand are not tools but messages in a static phase waiting to be interpreted by actors or artifacts. A message can take either a physical form (a written text) or a non-physical form (an utterance) (Goldkuhl, 2002).

We can distinguish between four different types of artifacts: static, dynamic, automated, and multi-level. Static artifacts are those that cannot perform

any operation by themselves, for example, a stone, a knife, or an axe. Dynamic objects are those capable of performing some operations by themselves but they need constant control by a human being to function properly, for example a car or a drill. Automated artifacts are those that can operate entirely by themselves and only need to be started by an actor. Here we can mention a washing machine as an example (Goldkuhl & Ågerfalk, 2005).

Multi-level artifacts are those that have a mix of capabilities and can perform either as static, dynamic, or automated artifacts depending on the circumstances. Multi-level artifacts have an important property which is the capability of creating and interpreting signs. They lack consciousness and are ruled by a predefined set of instructions that serve as a guide to perform the predefined actions they do. IT systems are an example of multilevel artifacts. Signs can be created either by human beings or artifacts, and every sign can be interpreted by human beings only, by artifacts only, or by both (Goldkuhl, 2005). A written note is a sign, an utterance performed by an actor is another example of a sign as well as a ticket printed by a system in an electronic store.

Actions

The objective of human actions is to change something in the world. They can be communicative or material. The main difference between these two types of actions lies in the fact that communicative actions are intended to change knowledge. Knowledge is implicitly meaningful to someone; and knowledge handling is an exclusive characteristic of actors within an IS. On the other hand, material actions are aimed at material conditions and aspects of the world which are meaningful to someone. They are intended to change something physical among the external world. Winograd and Flores (1984) stated that language is prior to consciousness and we might add that consciousness is prior to actions performed by actors. As a human characteristic, knowledge can be learned through actions, either communicative actions (for instance, a conversation) or material actions (e.g., when studying an object). Knowledge is the result of the actor's interpretation of both communicative and material actions, and it can be acquired in a social context (from other actors transferring knowledge, for example, in a classroom) or in a non-social context (a person reading a book on her own) (Goldkuhl, 2001).

We can divide actions into i-actions (intervening actions) and r-actions (receiving actions). I-actions are those intended to make a change in the external world, for example, the action of opening a window is intended to change a particular aspect of the external world (the window will move from closed to open). R-actions are those executed covertly, for example when two people are going out and person A tells B "It's cold outside" (communicative i-action). Then person B listens and interprets the message (r-action) and maybe after that person B will take a jacket on the way out (material i-action) (Goldkuhl, 2001). Among i-actions and r-actions we have indefinite and predefined actions.

Indefinite actions are those performed by humans and we call them indefinite since it is not certain how they will be performed by the actor. The same action can vary from actor to actor. When two employees are ordered to clean a shelf, they will both do it but not in the same way; one can do it better or faster than the other one. Indefinite actions can be either r-actions or i-actions. On the other hand we have predefined actions which are performed by artifacts. These actions will always be performed in the same way following previously programmed instructions (Goldkuhl, 2005). Predefined actions are i-actions, since they are intended to change an aspect of the external world. Among indefinite and predefined actions we find both communicative and material actions.

Both types of actions are aimed at changing an aspect of the world surrounding the actor or artifact but we can see communicative actions as a two-phase action (at least) where the actor A performs a communicative action that is intended to change an aspect of the world but is directed toward another actor or artefact B in the first phase. In the second phase B (if

A was successful) executes the action that A desired. Although material, the last action can sometimes be performed without an initial communicative action.

Organizational actions can be either internal or external, and material or communicative. Material and communicative actions within organizations form patterns. Although human beings perform the actions within organizations, we can say that an organization can act. An organizational action has human origins and purposes and is done through humans, by humans, or by artifacts that act on behalf of the organization (Goldkuhl et al., 2001). We will consider organizational actions that constitute an interaction of two or more elements from the organization (actors or artifacts) within an organizational context. We can say that a worker at a clothing factory using a sewing machine to manufacture clothes is performing an organizational action. He is acting to perform an organizational objective (to produce clothes). But, for instance, a man on a farm that goes to the forest to chop wood using an axe, although using an artifact to perform the action, is not performing an organizational action since there is no organizational purpose if he merely burns the wood to warm up his house.

When performing actions by means or with the help of IT systems, we can distinguish between three different types of actions: interactive, automatic, and consequential actions. Interactive actions are supported by and performed through IS and they consist of one or more elementary interactions. Elementary interactions (e-actions) consist of three phases: a user action, an IT system action, and a user interpretation (Goldkuhl, 2001). Let us take the example of an online bank transfer done by the user online. The user will initially introduce his username and password to access the bank system (phase 1), after this the IT system will check in the database if the information is correct and if it is it will grant access to the user and display a welcome screen (phase 2). The welcome screen is interpreted, and the user now knows that he can start his transaction. This is the end of the elementary interaction. Later on the user inputs the data to make the bank transfer, such as account number, amount to be transferred, and so forth (phase 1 of a second e-interaction), and so on.

Automatic actions are performed by IT systems that produce messages for the actors or other systems. They are done entirely without human intervention. Let us take the banking system again: after logging on, a message pops up in telling the customer that the due date for the credit card payment is very close. The system will execute this operation by itself and present it to the user.

Consequential actions are those performed as a consequence of a message. Taking the bank example again, when the customer sees that his payment is due he might proceed to execute the payment, or he might decide not to do it and wait for the final day.

Based on these types of IS actions, IS are seen as information action systems. This perspective is called actability. Actability is supposed to reinforce the concept of usability within the IS framework and focuses on action and communication. IS actability is the information system's ability to perform actions, and to permit, promote, and facilitate the performance of actions by users, either by means of the system or based on information provided by it in a business context (Sjöström & Goldkuhl, 2002). An IS is said to be actable when it has the following characteristics (Cronholm & Goldkuhl, 2005):

- Clear action repertoire
- Good communication satisfaction
- Easy to navigate interface
- Action transparency
- Clear feedback
- Easy access to action log
- Personalized information
- Familiar vocabulary
- Good support for business actions
- Capability to understand different communicative intentions

The components of the IS are the IT system, the actor, and the e-action. IT systems are social systems that are technically implemented and have an action

memory which stores the past actions and some future actions. Actors can play the role of communicator, performer, or interpreter in the IS.

Agents

Agents are a special type of object; we can position agents between objects and actors. They are created by actors, and perform actions to help them complete their tasks. They can be seen as servants of actors, but they have a level of communicative capabilities that allow them to act as communicative mediators, and they are also capable of creating signs for the actors or other agents to interpret. Agents have a transformative capability, a property that human beings have as well. The difference between agents and human beings lies in the fact that human beings can perform both socially aware actions (such as a conversation) and nonsocially aware actions (such as a blink) while agents can only execute the latter (Rose & Jones, 2004).

IT systems can perform as agents, but describing an IT system can be a very tricky task due to the versatility that these artifacts have. An IT system can either be seen as a static artifact (e.g., when we are reading an e-mail), it can be seen as an automated artifact (e.g., a payroll system from a bank that executes the payments for the employees automatically every 15 days), and it can be a dynamic artifact (e.g., a sales system used by a sales person in an electronics store) (Goldkuhl & Ågerfalk, 2005). In all three cases there is a common denominator: communication. In the first case the IT system is acting as an intermediate device between the sender and the receiver of the e-mail. In the second case it can also be seen as a communicative mediator between the employer and the employee, that is, by executing the payments it communicates to the employees that their employer is paying them. In the third case the system acts also as a communicative device between the salesperson and the customer. The IT system gives information about the products to the salesperson which is transmitted to the customers and it also prints a ticket of the sale which is taken by the customer. This ticket communicates to the customer what she bought and how much it cost. The IT system in this case executes other tasks which may turn into communicative actions. It decreases the inventory of the article sold and if the article inventory is low it will communicate to the inventory manager that the article is running out.

Communication is seen as a kind of action that IT systems can perform and by doing so they become communication mediators. IT systems as well as actors have the capability to create signs and process them (in the case of the IT system) and to interpret them (in the case of actors) (Goldkuhl, 2001). The relation between the signs and the interpreters/processors of them is called pragmatics. Messages are a product of communication and are also an important prerequisite of it. Within IS pragmatics, actions are divided into those that occur within the sign transfer and consequential actions that are performed in response to the transferred sign (Goldkuhl & Ågerfalk, 2002).

Organizational Actions

Roughly, we can say that within an organization every actor acts to fulfil organizational objectives; hence, they are agents helping to accomplish organizational actions. Let us take the example of an electronics store. A customer (C) comes into the store and the following dialog with the salesperson (S) develops.

(S): "May I help you?"
(C): "Yes, I would like to buy some batteries."
(S): "Which type of batteries do you want?"
(C): "Rechargeable AA batteries please."
(S): "We have X and Y brands."
(C): "I would like X."
(S) passes the batteries over the bar code reader and says "$10, please."
(C) pays.
(S) completes the sale in the system and hands the receipt to the customer.

When we analyze this business interaction according to our meta-model we arrive at the results shown in Table 1. We will see organizational actions as those actions performed to fulfill an organizational objective.

Table 1. Sales process for an electronic store

Actor	Action	Type of action	Details
Salesperson	Utterance: May I help you?	Communicative i-action	S performs an i-action
Customer	Utterance: Yes I would like to buy some batteries	R-action; followed by a Communicative i-action	C interprets the utterance performed by S (r-action) and makes an utterance (i-action)
Salesperson	Utterance: Which type of batteries?	R-action; followed by a Communicative i-action	SP interprets the utterance performed by C (r-action) and makes an utterance (i-action)
Customer	Utterance; Rechargeable AA batteries please	R-action; followed by a Communicative i-action	C interprets the utterance performed by S (r-action) and makes an utterance (i-action)
Salesperson	Take the batteries and pass them through the bar code reader	R-action; followed by an Interactive i-action	S interprets the utterance performed by C (r-action) and performs an interactive i-action
IS (Agent)	Reads bar code and gets the information for the product from database	Automatic action	IT system performs an automatic action and displays articles details on the screen
Salesperson	Gets information of product and tell it to the customer	R-action; followed by a Consequential i-action	S interprets the message on the screen (r-action) and makes an utterance (i-action), telling the customer about the details
Customer	Pays for the batteries	R-action; followed by a Material action	C interprets the message of S and performs a material action (payment)
Salesperson	Receives payment and give receipt	R-action; followed by an Interactive i-action; followed by an Automatic action; Material action	S receives the payment and closes the sale in the IT system, IT system executes the automatic actions of modifying the inventory and printing the receipt, S hands the receipt to C (material action)

In Table 1, this objective is to sell batteries. We can also notice that many of the actions are multi-functional, that is, one "surface" action corresponds to a number of implied, "hidden" actions. When the salesperson asks for the type of batteries, he performs an implicit r-action by correctly interpreting the request "I would like to buy some batteries". At the same time he also responds appropriately by performing the i-action of asking for the type of batteries.

As a result of the contemplations in the previous sections we have developed a meta-model (see Figure 2) that covers the most important aspects of socio-instrumental pragmatism as discussed in the relevant literature. Technically the meta-model takes the form of a UML class diagram with generalization/specialization and association.

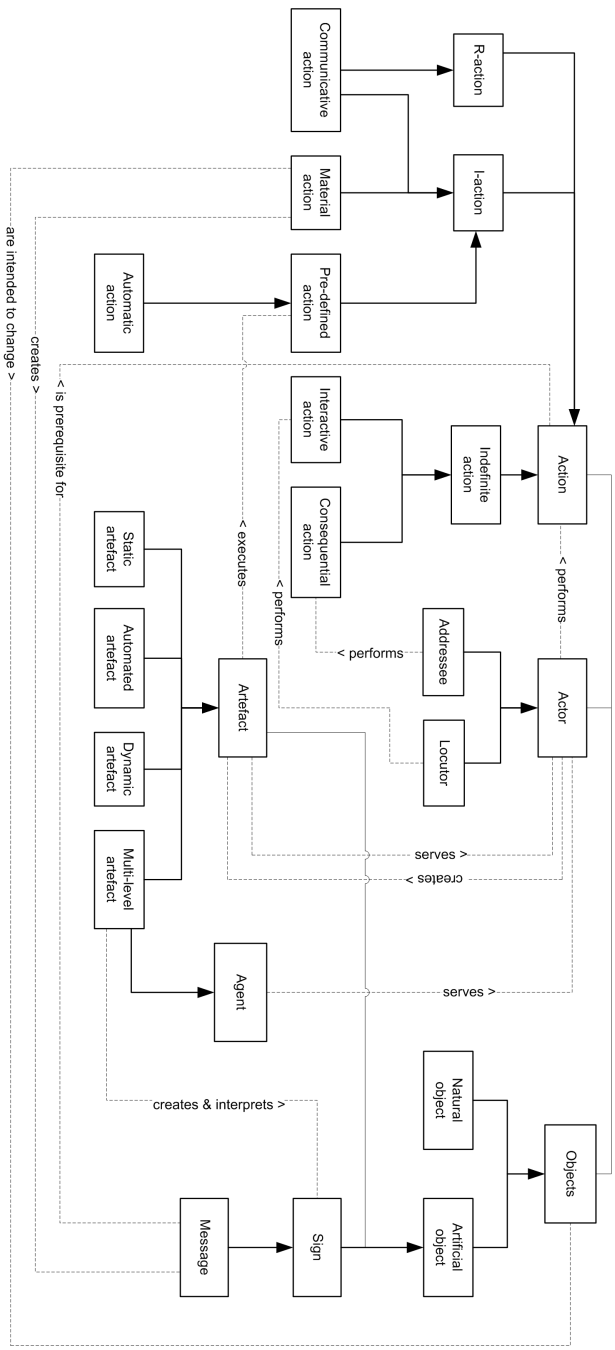
OTHER ONTOLOGIES

In the literature, we can find a number of competing ontologies that are also potential candidates for a general conceptual framework for the IS field. We look at three of them and discuss their role in such a framework and their relation to SIP.

Social Roles

This theory emphasizes the importance of social roles among the social concepts. Social roles are concepts that can be played by certain entities when they interact with other entities. Examples of social roles are money, professor, and president. The premises behind roles are (Masolo et al., 2004):

Figure 2. Meta-model of SIP



- Roles are properties and can be predicated of different entities. This means that different entities can play the same role.
- Roles are anti-rigid; this aspect regards the temporal nature of the relation between roles and their players.
- Roles have a relational nature, being properties, and they have different types of dependencies to other roles/entities. Notional, identificational, and definitional dependence are some of them.
- Roles are linked to contexts; roles are described as determined by external factors (context).

But as mentioned by Masolo et al. (2004), social roles theory "makes use of a simplified ontology, and therefore only partially characterizes social entities." With the social roles framework we can only partially describe social aspects. We can get a good description of social actors (a professor, a president, an employee) and objects, but we cannot get a description for other important aspects of social concepts such as actions. Another point to highlight is the fact that there is no explicit distinction between actors and objects, since they are both seen as endurants with the difference that objects lack intentionality.

Intentional Collectives

Collections are seen as social objects which depend on member entities and concepts. Several types of collections are distinguished: simple collections (e.g., a collection of stamps), organized collections can be conceived as characterized roles played by members of the collection and that relate among them through social objects. For instance, in a collection of senators, although all of the members have the same role (senator), one of them can be the president of the economic commission, another one can be the secretary of the agricultural commission, and yet another one can be the vice-president of the senate.

Collectives are considered to be something more than collections. Collectives are built around the concepts of intentionality, agent, and plan, the latter being the most important concept within collectives. Intentionality can be seen as the feature by which agents are directed to something. An agent is considered to be intentional and it is oriented towards producing results. An agent function is also to conceive plans. By plan we refer to a description that represents an action schema. Another concept described within the framework of this theory is that of a task, which is a course that is mostly used to sequence activities or other processes that are under the control of a planner. Collectives are a collection of agents. In collectives roles are played by agents and they actively participate in plans and roles.

This theory presents a more detailed conception of social concepts based on social roles. We can find some similarities with our perspective:

- Tasks represent actions within our perspective
- Agents represent actors within our perspective
- Plans can be seen as organizational objectives that lead to the execution of organizational actions

Actor Network Theory

The actor network theory (ANT) describes a world containing both human and nonhuman entities but at the same time it makes no difference in the importance of the elements within the network. Instead of separating the social from the technical, ANT analyzes the world in a sociotechnical manner by arguing that a merely technical or a merely social relation is not possible. Instead of actors, the term actant is used in ANT which can be used to refer either to human or nonhuman elements within the network. ANT's objective is not to analyze the nature and features of the entities in the network, but to study the relations that compound the network, the mechanics of power between the elements, and how the network relations are built (Tatnall & Gilding, 1999).

The ANT approach appears as radical, and the main issue with it is the symmetry between humans, non-human objects, and natural objects. Within our

model, the distinction between all these elements is very important in order to understand the functioning and communication within organizations.

For the ANT theorists, the elements of the network relay and prolong collective actions, and no element is considered as the source of the actions. Therefore, instead of being actions, they are seen as events. As we can see, events can be mapped to organizational actions within our perspective. Organizational actions are collective actions performed by one or more actors, agents, or artifacts within organizational boundaries and with a common goal. Thus, events are described in the same way as being collective actions that have no source but that are performed by the actants of the network (McLean & Hassard, 2004).

EVALUATING A BUSINESS MODELING LANGUAGE

To validate the completeness and correctness of the meta-model, we investigated an existing business modeling language. We have chosen the language of SIMM (situation-adaptable work and information systems modeling method), Goldkuhl (1996), because we have considerable experience with this language in action research projects. The analysis proceeded in the following way. First we have extracted the constituting concepts from the diagrams. The diagrams are: collaboration graph, interaction graph, process graph, and action graph. These concepts can be found in the left column of Table 2.

In the second step, we have related the concepts of SIMM to the categories of SIP as formalized in the meta-model. For this step we have thoroughly analyzed the documentation of SIMM (Röstlinger & Goldkuhl, 2006). The result of this step is presented in the middle column of Table 2. The right column contains a textual description of the respective concept.

In the third step, we have analyzed the table to identify deficiencies of the meta-model and the language SIMM. We found that all business concepts of SIMM could be captured accurately by some category of the meta-model. Only concepts originating from a different domain (knowledge) or belonging to general upper-level ontology (time and place) could not be represented.

On the other hand, we discovered some minor shortcomings of SIMM. One is that of construct (or concept) overload where one concept takes on different meanings in different contexts and is therefore mapped to several ontological categories. An example of that is *Initialization*, which can be both an actor and an object/sign.

Another issue is that of construct (or concept) redundancy where one and the same ontological category can be expressed by several concepts of the modeling language. An example of this are *directly related actions* and *Indirectly related actions*. Both concepts cannot be distinguished ontologically which can be seen as a case of over-specification from the point of view of the ontology. In the latter it is not considered to be relevant whether actions follow each other immediately or not.

CONCLUSION

We started our chapter with the assumption that socio-instrumental pragmatism might contribute towards the development of a general conceptual framework for the IS field. We then set out to capture both the breadth and depth of the SIP literature with a suitable meta-model. This process consisted of uncovering the central concepts and their (often implicit) relations and making them explicit in a clear and concise way. We did this with the help of a UML class diagram, a modeling language which is well established and documented and can therefore be expected to support the communication of and about the meta-model among a large group of IS researchers.

We are well aware of the fact that such a meta-model is not, and cannot be, the ultimate solution to a general conceptual framework for the IS field. But we think that it can stimulate a fruitful discussion about the vital components of such a framework. We do not know of any other meta-models that cover the breadth of IT-mediated social action with similar stringency.

Table 2. Mapping SIMM concepts to meta-model categories

SIMM concept	Related SIP concept	Comment
Activity/action	Action	Describes what is done and by whom (executor); this is complemented by place, time, and instrument of execution
Actor	Actor	Person, group of persons, role, organizational unit
Alternative actions	Action (with conditional sub-actions, # = 1)	One of two or more actions/action sequences is carried out
Alternative prerequisites/ results	Object (with conditional sub-objects, # = 1)	One of two or more objects is required for or the result of an action
Artifact	Artifact	Artificial system that performs actions automatically, for example, an IT system
Being	Actor/object	Human being or animal
Cancellation	Object/sign	The action is canceled when a certain object is present or at a certain time
Closed information	Sign	Information that can only be interpreted with the help of some instrument
Collaboration object	Object	Information, material
Combined actions	Action (with concurrently ordered sub-actions)	Two or more actions/action sequences are carried out
Combined or alternative actions	Action (with conditional sub-actions, # > 0)	One or more of two or more actions/action sequences is carried out
Combined or alternative prerequisites/results	Object (with conditional sub-objects, # > 0)	Two or more objects are required for or the result of an action
Combined prerequisites/ results	Object (with sub-objects)	Two or more objects are required for or the result of an action
Composite action	Action	A number of actions that is carried out together
Composite executor/unit	Actor/artifact	Several executors that together form a named unit for execution
Composite process	Action	A number of processes that are combined to a meaningful unit
Condition	Sign	Condition for prerequisite, result or action
Conditional action	Action (conditional)	Action that is carried out or not depending on some condition
Customer	Actor	A special role of actor as the final receiver of a product
Data storage	Artifact	Place to store closed information
Directly related actions	Action (with sequentially ordered sub-actions)	Actions that are immediately follow each other
End	Sign	End of process
Executor	Actor/artifact	Performer of an interactive action
Executor	Actor/artifact	Performer of an action in a process
Executor	Actor/artifact	Person, group of persons, role, organizational unit or artifact
Independency relation	Action (without effect)	Control flow between actions
Independent actions	Action (with sequentially ordered sub-actions)	Sequential actions that have no causal relation
Indirectly related actions	Action (with sequentially ordered sub-actions)	Actions that follow each other but not immediately
Information	Sign	Messages that can be interpreted directly by human beings

Table 2. continued

SIMM concept	Related SIP concept	Comment
Information relation	Communicative action	Flow of information between executors/units
Information relation	Communicative action	Flow of information between actions
Information storage	Artifact	Place to store information/messages
Initialization	Actor	Actor that starts a mutually interactive action
Initialization	Object/sign	An action is started when a certain prerequisite becomes available or at a certain time
Instrument	Object/artifact	A tool that is used in an action
Interaction partner	Actor/Artifact	Executor/unit that performs interactive actions
Interaction sequence	(Ordered) actions	A number of actions that is ordered in time
Interactive action	Action	An action that the sender directs towards the receiver
Knowledge	(refers to an ontology of the mind)	Internal state of the mind
Marked actor	Actor	A focused actor
Marked collaboration object	Object	A focused collaboration object
Marked interaction partner	Actor/artifact	A focused interaction partner
Marked process	Action	A focused process
Material	Object	Material objects that can be accompanied by information
Material relation	Material action	Flow of material between executors/units or between actions
Material storage	Artifact	Place to store material that can be accompanied by information
Mutually interactive action	Action	Two or more interactive actions that follow an initiative/response pattern
Non-object	Object	Hypothetical object
Parallel actions	Action (with concurrently ordered sub-actions)	Actions that are performed concurrently
Place	(refers to an upper-level ontology)	Describes where an action is performed
Prerequisite	Object	Action object that is required for an action
Process	Action	A number of actions with a common goal
Process object	Object	Product/result of a process that is useful for the customer or order that initiates a process
Producer	Actor/artifact	Executor/unit that produces and directs information and/or material for/towards the receiver
Receiver	Actor/artifact	Executor/unit that receives and uses information and/or material
Result	Object	Product of the executed activity/action
Reused process	Action	A process that occurs in different places in the process graph
Sequential actions	Action (with sequentially ordered sub-actions)	Actions that follow one after the other
Start	Sign	Start of process
Time	(refers to an upper-level ontology)	Point in time for execution of an action
Variants	Action (with conditional sub-actions)	One action is chosen from a number of alternatives

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