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.

1. 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 et al., 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 (Winograd and Flores, 1986; Goldkuhl and Lyytinen, 1982). 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 toward human actions which are supported by the use of 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: actors, objects and actions. In addition to this we also consider other important aspects of organizations that are related to their functioning.

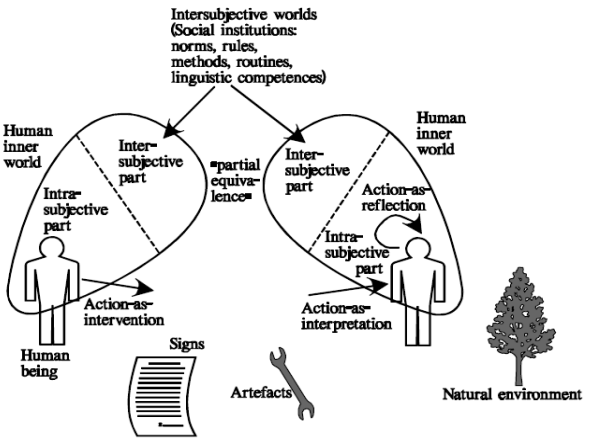
2. TOWARDS A NEW META-MODEL

2.1. 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.

Figure 1.



- **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, 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 someone writes 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, etc. 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, i.e. 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.

2.2. Meta-Model

Our model is divided into three main categories:

- Actors
- Objects
- Actions

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.

2.2.1. Actors

Actors are the main entities in our model, and they can perform either as locutor or addressee within a communicative context. When actors perform actions 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 he/she is trying to avoid the interruption of his/her phone service. When performing as addressee the actor receives and interprets an action directed to him and can act 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 his/herself.

2.2.2. 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 and Woodfield, 1994). Under the object category we have artificial and natural objects. Artificial are those created by human beings, while natural objects are those created by nature and found in the environment. Among artificial objects we have artifacts (material objects) and signs (material or immaterial). Artifacts are created to extend actors' capabilities and are seen as tools. 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 4 different types of artifacts: static, dynamic, automated and multi-level. Static artifacts are those that cannot perform any operation by themselves, e.g. a stone 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 driller. 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 and 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. They have an important property which is the capability of creating and interpreting signs, they lack consciousness and are ruled by a pre-defined set of instructions that serve as a guide to perform the pre-defined actions they do. IT systems are an example of multi-level 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.

2.2.3. Actions

The objective of human actions is to change something in the world. Actions 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 (1986) 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 (e.g. 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 (e.g. in a classroom) or in a non-social context (a person reading a book on his/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 instance, the action of opening a window is intended to change a particular aspect of the external world (the window will move from close 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). 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. A person that executes indefinite actions has the capability of performing both, i-actions and r-actions. For example, cleaning the shelf is clearly an i-action, the person is modifying something external, something physical. However, we can also find indefinite actions that execute covertly, for example, the person interpreted the order (covertly) and then started to clean the shelf.

We also have pre-defined actions which are performed by artifacts. These actions will always be performed in the same way following previously programmed instructions (Goldkuhl, 2005). Pre-defined actions are i-actions, since they are intended to change an aspect of the external world. Among indefinite actions we can find both, communicative and material actions, and among pre-defined actions we will always have material actions, sometimes with communicative intentions. Table 1 shows how pre-defined and indefinite actions can be either material or communicative. Let us take the example of printing a sales ticket. This action is performed by an IT system, it is a pre-defined i-action with communicative intentions. The objective of printing the sales ticket is to give information to the customer, who will interpret the ticket (r-action) in a communicative manner.

Organizational actions can be either internal or external, and material or communicative. 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, Röstlinger and Braf, 2001). We will consider

Table 1. Pre-defined and indefinite actions

Example	*Performer*	*Type of action*	*Nature of action*	*Intention*
Printing of a sales ticket	IT-system	Pre-defined	Material with Communicative intentions	i-action
Reading of a sales ticket	Customer	Indefinite	Communicative	r-action
Cleaning a shelf	Employee	Indefinite	Material	i-action
Change of the inventory when performing a sale	IT-system	Pre-defined	Material	i-action
E-procurement of goods transaction	IT-systems	Pre-defined	Material	i-action from the buyer, r-action from the seller

that organizational actions constitute an interaction of two or more elements from the organization (actors or artifacts) within an organizational context. A worker at a clothes 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 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 a 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, etc. (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. Taking the bank system again: After logging on a message pops up 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. In the bank example , 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 and Goldkuhl, 2002).

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 and future actions. Actors can play the role of communicator, performer or interpreter in the IS.

2.2.4. 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. 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 (such as a conversation) and non-socially aware actions (such as a blink) while agents can only execute the latter (Rose and Jones, 2004).

IT systems can perform as agents. They can be seen as static artifacts, automated artifacts or dynamic artifacts (Goldkuhl and Ågerfalk, 2005). In all three cases the common denominator is communication. 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 to process them. Actors can also interpret them (Goldkuhl, 2001). The relation between the signs and their interpreters is called pragmatics. 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 and Ågerfalk, 2002).

2.2.5. Organizational Actions

Roughly we can say that within an organization every actor acts to fulfill organizational objectives, hence they are agents helping to accomplish organizational actions. In Example 1, we provide an example of how our meta-model can be applied. Let us take the case of an electronics store.

Example 1.

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 dollars, please."
(C) pays.
(S) completes the sale in the system and hands the receipt to the customer.

Table 2. Sales process for an electronic store

Actor	*Action*	*Type of action*	*Details*
S	Utterance: May I help you?	Communicative i-action	
C	Utterance: Yes, I would like to buy some batteries.	R-action → communicative i-action	C interprets utterance by S and responds
S	Utterance: Which type of batteries?	R-action → communicative i-action	Dto. (switched roles)
C	Utterance: Rechargeable AA batteries, please.	R-action → communicative i-action	Dto. (switched roles)
S	Takes the batteries and passes them trough the bar code reader.	R-action → interactive i-action	S interprets utterance by C and performs interactive action
IS (Agent)	Reads bar code and gets product information from the database.	Automatic action	IT system performs automatic action and displays product details on screen
S	Reads product information and informs C.	R-action → consequential i-action	S interprets message on screen and passes info to C
C	Pays for the batteries.	R-action → material action	C interprets utterance of S and pays
S	Receives payment and hands C the receipt.	R-action → interactive i-action → automatic action → material action	S receives payment, S closes sale in IT system, IT system modifies inventory and prints receipt, S hands receipt to C

When we analyze this business interaction according to our meta-model we arrive at the results shown in Table 2. We will see organizational actions as those actions performed to fulfill an organizational objective. In Table 2, the objective is to sell batteries. We can also notice that many of the actions are multi-functional, i.e. 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.

3. 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. Social roles, for example, were introduced by Masolo et al. (2004). They characterize social entities only partially and do not cover the issue of actions which is central in the social realm. Intentional collectives (Bottazzi et al., 2006) introduce actions but mainly in the form of plans and tasks. In this model action objects are not seen as an important issue. Nevertheless, this theory has a very detailed description of social concepts based on social roles.

The Actor Network Theory (ANT) (Tatnall and Gilding, 1999) argues for the symmetry of the elements in the social world (i.e., the network of social actors). This means that both actors and action objects are viewed as so-called actants. This implies that we cannot distinguish between the different roles that these elements have in social action (McLean and Hassard, 2004). 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. Events are described in the same way as being collective actions that have no source but are performed by the actants of the network (McLean, and Hassard, 2004).

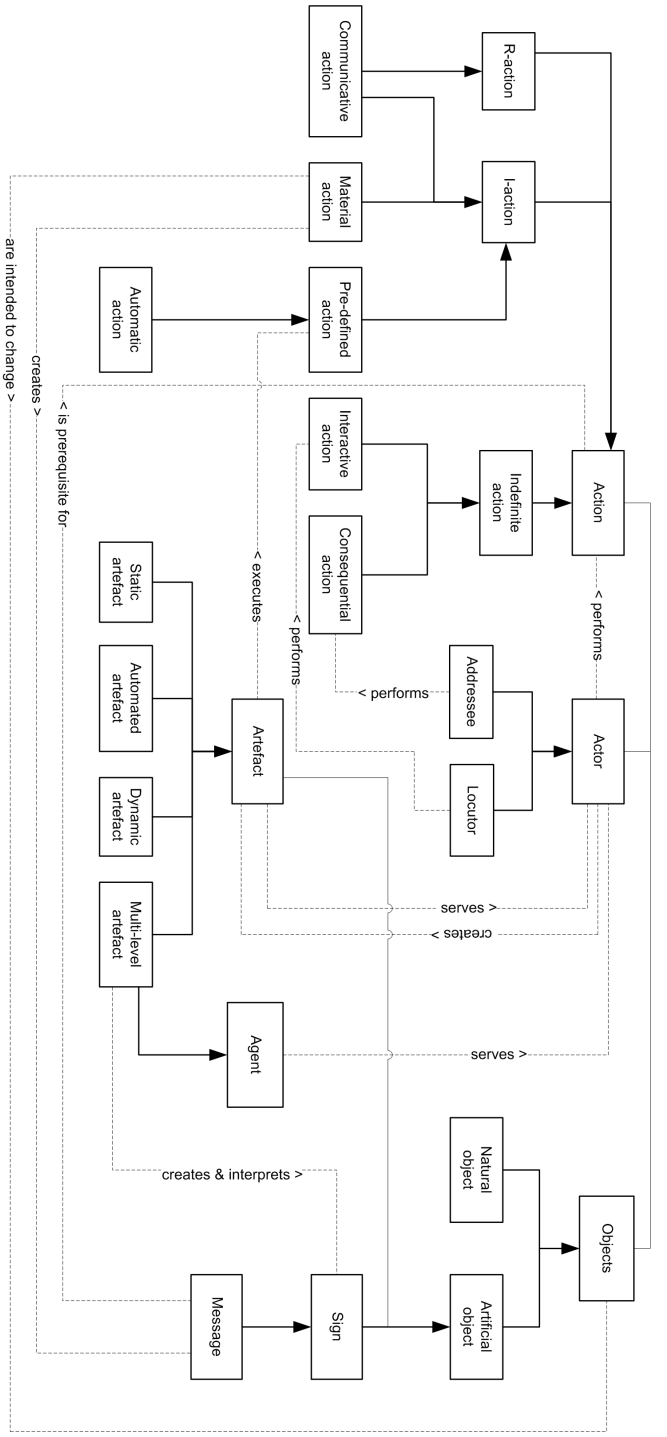
As a result of the contemplations in the previous sections we have developed a meta-model (see Figure 2) that covers the most important aspects of Socio-Instrumental Pragmatism as discussed in the relevant literature. Technically the meta-model takes the form of a UML class diagram with generalization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

4. CONCLUSIONS

We started our paper 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. However, we think that our model 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.

Figure 2. Meta-model of SIP



REFERENCES

Bottazzi, E., Catenacci, C., Gangemi, A., and Lehmann, J. (2006). "From collective intentionality to intentional collectives: An ontological perspective". *Journal of Cognitive Systems Research, Special Issue on Collective Intentionality (in press)*.

Embley, D., Kurtz, B. and Woodfield, S. (1994). *Object Oriented System Analysis: A model-driven approach*. New Jersey: Prentice Hall.

Goldkuhl G. (2001) "Communicative vs material actions: Instrumentality, sociality and comprehensibility", *In Proceedings of the The Language-Action perspective on communication modelling 2001*.

Goldkuhl G. (2002) "Anchoring Scientific Abstractions: Ontological and Linguistic Determination Following Socio-Instrumental Pragmatism", *In Proceedings of the European Conference on Research Methods in Business and Management Studies (ECRM 2002)*, Reading, UK: MCIL.

Goldkuhl G. (2005) "Socio-Instrumental Pragmatism: A Theoretical Synthesis for Pragmatic Conceptualisation in Information Systems", *In Proceedings of the Action in Language, Organisations and Information Systems (ALOIS 2005),* Limerick, Ireland.

Goldkuhl, G., Lyytinen, K. (1982). "A language action view of information systems". *Proceedings of the 3rd international conference on information systems*, TIMS/SMIS/ACM.

Goldkuhl G., Röstlinger, A. and Braf, E. (2001) "Organisations as Practice Systems – Integrating Knowledge, Signs and Artefacts and Action", *In Proceedings of the IFIP 8,1 Working Conference Organisational Semiotics: evolving a sience of information systems,* July 2001, Montreal.

Goldkuhl, G. and Ågerfalk, P. (2002). "Actability: A way to understand information systems pragmatics". Sweden.

Goldkuhl, G. and Ågerfalk, P. (2005). "IT Artefacts as Socio-Pragmatic Instruments: Reconciling the Pragmatic, Semiotic, and Technical", *International Journal of Technology and Human Interaction*, pp. 29-43, July-September 2005.

Masolo, C., Vieu, L., Bottazzi, E., Catenacci, C., Ferrario, R., Gangemi, A., and Guarino, N. (2004). "Social roles and their descriptions". *In Ninth International Conference on the Principles of Knowledge Representation and Reasoning*, Whistler Canada.

McLean, C. and Hassard, J. (2004) "Symmetrical Absence/Symmetrical Absurdity: Critical Notes on the Production of Actor-Network Accounts". *Journal of Management Studies.* Vol. 41, No. 3, pp. 493-519.

Rose, J., and Jones, M. (2004). "The double dance of agency: a socio-theoretic account of how machines and human interact". Denmark.

Sjöström, J., Goldkuhl G. (2002). "Information systems as instruments for communication – Refining the actability concept", *In Proceedings of the 5th International Workshop on Organisational Semiotics,* June 2002, Delft.

Tatnall, A. and Gilding, A. (1999). "Actor-Network Theory and Information Systems Research". *In Proceedings of the 10th Australian Conference on Information Systems*.

Winograd, T. and Flores, F. (1986). "Understanding computers and cognition: A new foundation for design", Ablex, Norwood.

Ågerfalk, P., Goldkuhl, G., Fitzgerald, B., Bannon, L. (2006). "Reflecting on action in language, organizations and information systems". *European Journal of Information Systems*, Vol 15 (1), pp. 4-8.