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Exploring the Explanatory Power of Actability – The Case of Internet-based Software Artefacts

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Abstract

This paper is an inquiry into the empirical grounding of actability—an important concept for the understanding of information systems pragmatics. The paper describes the structure and the application of an analytic framework based on actability and the semiotic framework. Actability has been proposed as an important concept for the understanding of information systems pragmatics and the semiotic framework provides a layered model of information systems that balances the technical and more social issues. The framework has been used as a tool to direct attention during a qualitative analysis of the Internet-based software artefact. The results show that actability and the semiotic framework can be used effectively to gain understanding of specific information systems phenomena.

Keywords: Actability, Semiotic framework, Internet-based software, Operationalization, Empirical grounding.

1 Introduction

Actability has been proposed as an important concept for the understanding of information systems pragmatics (e.g., Goldkuhl and Ågerfalk 2000). It has been defined as (*ibid*.): '*an information system's ability to perform actions, and to permit, promote and facilitate the performance of actions by users, both through the system and based on information from the system, in some business context*'. The concept draws on the body of knowledge developed within the fields of Human-Computer Interaction (HCI), Information Systems Development (ISD) (more specifically Requirements Engineering (RE)) and Communication Modelling (CM) (including the so-called Language Action Perspective (LAP) as well as Organizational Semiotics (OS)). The aim has been to reconcile these different knowledge domains to gain a better foundation for the understanding of information systems, including their development and businesses usage.

In a sense, actability can be understood as summarizing a theory of information systems as *information action systems*—an action theory of information systems (Ågerfalk 1999). Theory should in this context be understood as consisting of a set of related concepts directing attention to certain important aspects of information systems that have, at least partly, been overlooked by other similar conceptualizations. One characteristic of the theory is that it is concerned with human action in relation to information systems and that human action also is its ultimate purpose. It represents knowledge about action, intended for action. Goldkuhl (1999) refers to such knowledge as *action knowledge*. According to Goldkuhl (*ibid*.), action knowledge should be grounded in three different ways in order for it to be considered valid. The three types of grounding of action knowledge are referred to as (*ibid*.) *internal grounding*, *external theoretical grounding*, and *empirical grounding*. Internal grounding has to do with the completeness and coherence of the concepts. External theoretical grounding relates the knowledge to other existing knowledge within the same domain. Empirical grounding has to do with the applicability of the knowledge in relation to empirical data. To date, most work on actability has focused on internal grounding (e.g., Goldkuhl and Ågerfalk 1998) and external theoretical grounding (e.g., Cronholm *et al*. 1999). Less effort has so far been put into empirical grounding, even though some work was reported by Ågerfalk (1999).

The goal of this work is to strengthen the empirical grounding of actability with a special focus on an analytic framework for analysing information systems phenomena according to actability. More specifically, actability is used to gain a better understanding of the Internet-based software artefact (IBSA). The paper aims to provide concrete examples of actability concepts and to establish that these concepts are useful to discuss this type of system. The results of the analysis will be used in our further research on methods to support the development and evaluation of such artefacts. However, in this paper we will focus on the analysis *per se* as a way towards empirical grounding while exploring the explanatory power of actability. That is, we aim to present good, empirically justified reasons as arguments for the concept of actability.

The work was performed in co-operation with an industrial partner, Volvo IT. Volvo IT's interest in the work is to gain a better understanding of Internet-based software in order to tailor their development process according to its needs.

The choice of IBSAs as the topic for empirical grounding of actability is not self-evident. The reason for doing so is that Internet-based systems often imply that communication between human actors (typically between supplier and customer in a business setting) is to a large extent performed through the software artefact. Therefore, the qualities promoted by actability are particularly crucial in that type of system. Hopefully, this will become clear as the concept of actability is more thoroughly discussed in Sections 3 and 4 of the paper. Firstly, however, we will elaborate on the approach used for the empirical grounding of actability and its relation to internal and external theoretical grounding. Secondly, we will present actability in more detail, and discuss its operationalization into the analytic framework. Thirdly, we will present examples from the analysis of IBSAs performed using the analytic framework (details are presented in Karlsson *et al*. 2001). Finally, we will conclude the work by reflecting upon the performed analysis and the explanatory power of actability.

2 Operationalization and Validation of Action Knowledge

Actability can be regarded as an instance of what Goldkuhl (1999) refers to as *action knowledge*, i.e., '*theories, strategies and methods governing people's action in social practices*'. Action knowledge might exist in different forms of abstraction—from 'pure' abstract theoretical knowledge, to knowledge directly applicable in everyday situations (Ågerfalk 2001a).

The concept of grounding of action knowledge assumes that it is possible to argue the validity of the knowledge in inter-subjective dialogues (Goldkuhl 1994). This view, with its roots in Habermas' (1984) social-critical concept of rationality, is the key to an important distinction between true and valid—something is 'true' if it is accepted as valid and useful. '*Claiming the validity of knowledge is presenting good reasons as arguments for the knowledge.*' (Goldkuhl 1999). Hence, grounding of action knowledge is to present such good reasons for it that other people will accept it as valid. This is supposed to be done by argumentatively relating the focused knowledge to other existing knowledge (external theoretical grounding), and to empirical observations (empirical grounding). Furthermore, the concepts used and their anchoring in values need to be consistent and free from ambiguities and internal contradictions (internal grounding) (Goldkuhl 1999). By 'grounding', we refer to the combination of the two intertwined, but at least conceptually distinguishable, activities of generation and validation of knowledge.

A particular concept can be grounded internally, externally, and empirically. The result of empirical grounding can be focused on as a concept in its own right and be exposed to its own three-way grounding process. Note that this implies that empirical grounding might also include elements of internal and external theoretical grounding. Figure 1 shows the grounding of the analytic framework used in this paper.

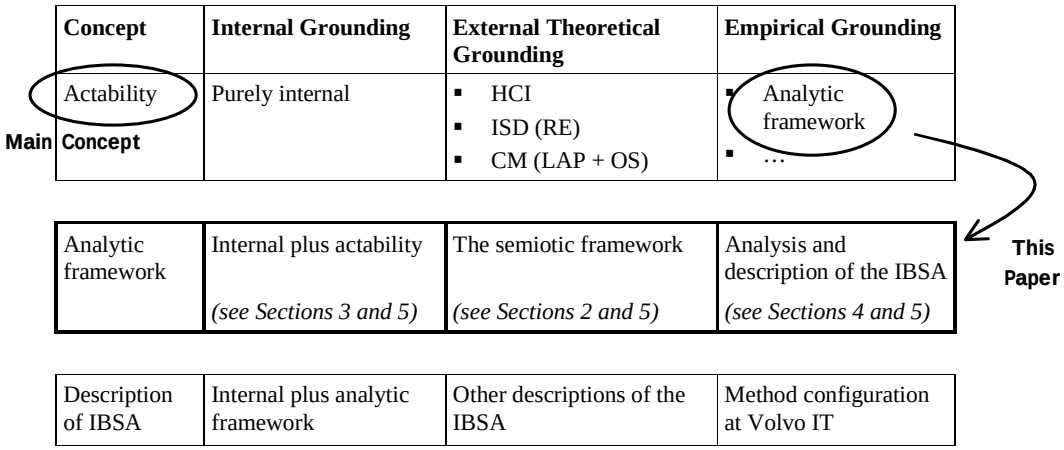

Figure 1: Grounding of the concepts discussed in this paper.

The principle is that the grounding of an operationalization (i.e., of a more concrete representation of a phenomenon), in this case the analytic framework, internally, externally and empirically yields an empirical grounding of the concept of which it is an operationalization, in this case actability. As indicated in the figure (the ellipsis), there are other possible operationalizations of actability worthy of study. It is,

however, beyond the scope of this paper to go into details of those (see Ågerfalk (2001a) for further elaboration on this topic).

For the empirical grounding of actability we have adopted a qualitative research approach that combines deductive and inductive strategies. We refer to this way of working as reflective research (cf. Alvesson and Sköldberg 2000). The adopted strategy is comparable to what Walsham (1995) describes as the approach taken when a researcher uses theory as part of an iterative process to collect and interpret data. Figure 2 illustrates the way this strategy is used. It should be interpreted as follows.

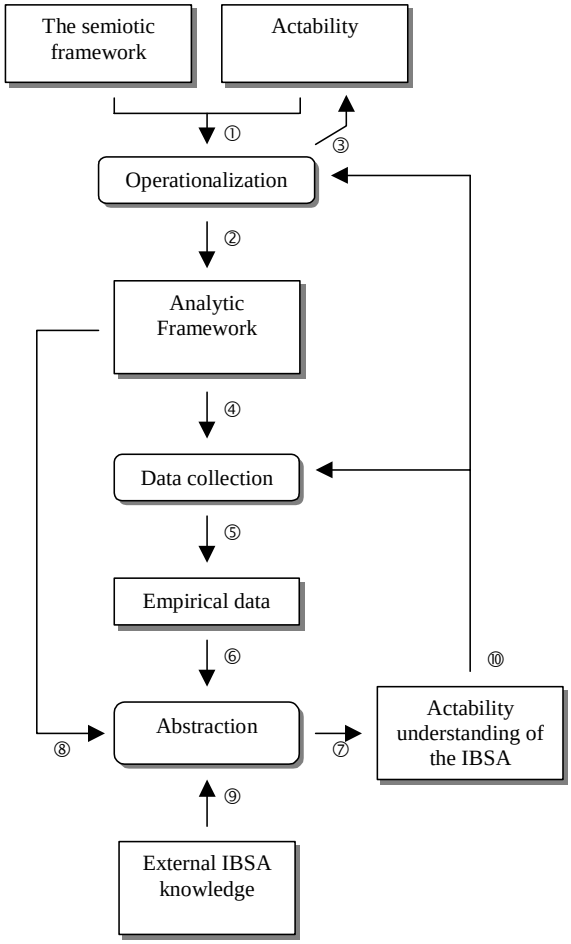

Figure 2: Adopted research process.

Actability and the semiotic framework (Stamper 1994) (1) has been operationalized into (2) an analytic framework (see Section 3). This work also led to a deeper understanding of actability as such (3), and also served as (part of the) external theoretical grounding of actability. The analytic framework has been used (4) to direct attention during data collection at Volvo IT (5). Collected data has then been abstracted (6) into categories describing various aspects of the IBSA (7) with a Grounded Theory-inspired approach (Strauss and Corbin 1998). During this abstraction (8), the analytic framework has also been used as a tool to direct attention to relevant categories and phenomena. Additionally (9), categories have been related to, and inspired by, existing knowledge about the IBSA (e.g., Conallen 2000). The emerging understanding of the IBSA has had continuous repercussions (10) on the operationalization process (and thus indirectly on actability itself, as well as on the analytic framework) and on the data collection.

3 An Analytic Framework Based on Actability

From the definition of actability (see Section 1) we can observe some central concepts for actability. Below we will address these concepts in turn to eventually arrive at an analytic framework that can be used to understand information systems phenomena according to actability—an operationalization of actability, as discussed in Section 2 above. Before doing that, however, we will present a general information systems framework referred to as the semiotic framework (e.g., Stamper 1994), as we will use it as an inspiration and point of reference for our analytic framework.

3.1 The Semiotic Framework

Stamper (1994) introduced the *semiotic framework* as an attempt to create one single conceptual framework able to capture both the social and the technical aspects of information systems. The fundamental concept for the semiotic framework is that of the *sign*. According to Stamper (*ibid*.), a sign is '*something which stands to somebody for something in some respect or capacity, in some community or social context*'. Consequently, information is 'carried' by signs of different kinds (*ibid*.). Following the semiotic framework, signs (and hence information) can be studied at six different semiotic levels. That is, we can choose to focus on different aspects of signs ranging from their physical appearance to their social consequences. The six levels are referred to as *physical world*, *empirics*, *syntactics*, *semantics*, *pragmatics* and *social world*. The first three of these are referred to as *the IT platform* and the latter three as *human information functions* (*ibid*.). The IT platform can thus be thought of as a medium for the human information functions, and the same information functions can exist within different media. However, within the human information functions, the distinction made between social world and pragmatics is problematic. Rather, as Goldkuhl and Ågerfalk (2000) argue, these two levels are so intertwined that distinguishing them is probably not only conceptually inelegant, but also misleading. Stamper (2001) states that '*Semiotics that excludes norms and attitudes as forms of information would be like physics with the concept of energy but without the concept of mass*' as an argument for adding the sixth level to the semiotic framework—the social world. We adhere to his argument in concept, but not in the way it is used within the semiotic framework. To understand why, and to see how the semiotic framework has been used in this work, we must first turn to the actability centre of gravity—the performance of actions.

3.2 Performance of Action

People perform actions to accomplish changes in the world—action is about making a difference (Goldkuhl and Ågerfalk 2000). Actions can be classified as material or communicative. Material actions aim at changing the physical state of the world. Communicative actions (or speech acts) aim at changing the socially constructed reality. (*ibid*.; Berger and Luckmann 1989; Searle 1995).

In this paper we will focus on communicative actions since they are the most important types of action in relation to the design of information systems.[1] Communicative action means that a pragmatic action mode (illocutionary force) is attached to a semantic propositional content and formulated syntactically into an uttered sentence. The action mode represents what the speaker does in relation to potential listeners. Note that actions are considered to be multifunctional and that an action mode consequently might embrace several illocutionary forces, one per function (illocutionary point). This is a pragmatic aspect of action. The propositional content represents what is talked about and consists of references to things in the world and properties predicated to those things. This is a semantic aspect of action (Goldkuhl and Ågerfalk, *ibid*.; Searle 1969; Habermas 1984).

Actions are performed through some medium. The medium is primarily an empirical and physical aspect of action. However, the medium might also affect the

[1] See (Goldkuhl and Ågerfalk 2000) for a more comprehensive treatment of both types of actions.

possible syntax of an action, and hence is partly a syntactic aspect. If, for example, the medium is 'ink on paper', the same action mode and propositional content may be communicated both as written text and as a picture. The medium can be thought of as the instrument used to perform action.

The ultimate result of a communicative action is a change in the social world, i.e., the establishment of a social fact (Searle 1995). However, pragmatic intentions are usually directed from one actor to another and so they are social by nature. That is one reason why we do not agree with the terminology of the semiotic framework. Furthermore, the successful performance of a communicative action usually requires knowledge of certain social facts established by previous communicative actions. In general, any action requires certain external and internal prerequisites to be met. Therefore, we cannot study the pragmatic level of the semiotic framework without relying on the social world level, and so it seems to us that the whole idea of the 'ladder structure' is obstructed. We therefore choose not to talk about the 'social world' and 'pragmatics' as different semiotic levels. Rather, we prefer to talk about pragmatics as the highest, and indeed a very social, level. Nonetheless, pragmatics must be understood in relation to existing subjective as well as inter-subjective knowledge (see Ågerfalk 2001a). We refer to this knowledge, which is both a prerequisite for and a result of action, as the *cognitive base*. The cognitive base can be divided into a subjective part and an inter-subjective part—a *personal cognitive base* and a *shared cognitive base*. The personal cognitive base consists of the person's identity, personal values, norms and preferences, abilities, emotions, deliberations, intentions and plans, situational comprehension and attention, *etc*. The shared cognitive base consists of group belonging, shared values, norms and preferences, social facts, *etc.* (cf. Goldkuhl and Ågerfalk, *ibid.*). Figure 3 depicts this actability interpretation of the semiotic framework with two actors communicating.

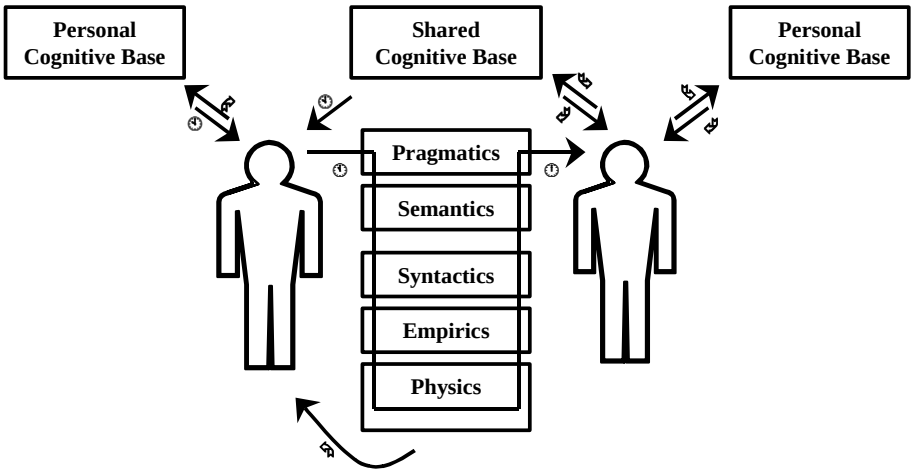

Figure 3: An actability interpretation of the semiotic framework.

The performance of a social communicative action should be understood as consisting of the following seven steps, as the figure suggests. (1) The performing actor (the speaker) uses his personal cognitive base and matches it with the cognitive base shared with intended interpreters of the action (listeners) in order to formulate the communicative action to be performed; that is, formulating a propositional content and embedding it into an appropriate action mode. (2) The action is expressed syntactically

and performed through some medium. (3) Another actor receives the action (or rather, the message in which it resulted[2]). (4) The receiving actor uses his/her personal cognitive base and matches it with the cognitive base shared with the speaker in order to interpret the performed communicative action. (5) The receiver reacts cognitively in response to the interpreted action, which changes his/her subjective knowledge (personal cognitive base) as well as the shared cognitive base—a social fact has been established. (6) During action, an actor is continuously monitoring the world and reacting to changing circumstances. This *conditioning and reflexivity* is not something that happens after the action has been performed and interpreted, as the number six in the figure might suggest, but is a continuous process. (7) As a consequence of the conditioning and reflexivity, the cognitive base might change.

An important aspect of communicative action is that of *validity* (cf. the discussion on grounding, above). In order for communication to be considered as successful, an interpreter must accept it as valid. According to Habermas (1984), validity can be evaluated with respect to a set of universal validity claims. Based on his analysis, we conclude that a receiving actor can value the information with respect to comprehensibility, truth, sincerity and correctness. That is, the information should be possible to comprehend syntactically, it should refer to the true (commonly believed) state of affairs (inter-subjective semantics), reflect sincere pragmatic intentions, and it should be communicated in accordance with accepted social norms (inter-subjective cognitive base).

3.3 Information Systems: Software Artefacts for Human Action

Within actability, an information system (IS) is defined as: '*a technically implemented social system consisting of an action potential (a repertoire of actions and a vocabulary), a memory of earlier actions and action prerequisites, and actions performed interactively by the user and the system and/or automatically by the system*.' (Goldkuhl and Ågerfalk 2000).

Information systems should in this view be understood as software artefacts intended for human action. IT-based information systems (software artefacts) are today obvious parts of businesses and should be acknowledged as important tools for business action and communication. Communication through an IS is an example of communicative action where an actor communicates a message to another (or possibly the same) actor. In such communication, the software artefact is a tool, or medium, for the communicative actions performed. Therefore it is inherently social by nature and so can be regarded as a technically implemented social system (Goldkuhl and Lyytinen 1982). Nonetheless, since it is technically implemented, an IS will physically consist of hardware and software that implements the required message processing (Ågerfalk 1999).

The most important aspect of an IS, however, is its action potential, i.e., the repertoire of actions that it realizes. Actions can be performed by users in interaction with the system or by the system itself. Note that this is not to take a reifying position or to claim that artefacts have human attributes such as intentions and responsibility.

[2] Within actability, a communicative action is said to result in an action elementary message (ae-message) that is communicated to (an) interpreting actor(s). See Goldkuhl and Ågerfalk (2000) for more elaboration on this topic.

Actions performed by information systems are always ultimately derived from rules stated by humans. Goldkuhl and Ågerfalk (2000) identifies three different types of actions performed in relation to information systems: interactive actions, performed interactively through the system; automatic actions, performed by the system; and consequential actions, performed based on information from the system. The artefact's interactive action potential is realized through its user interface (referred to as screen documents). Automatic actions can be realized through other sorts of documents, such as electronic data interchange (EDI) documents. An information system usually contains an *action memory*, commonly realized through database technology. This memory (which is part of the total organizational memory) can be used to remember what actions have been performed by and through the system. Therefore it serves as an important prerequisite for action and thus can be considered as part of the cognitive base.

3.4 Information System Users as Business Actors

The actors participating in the communicative actions performed in relation to an IS constitute its *users*. Actions 'in relation to an IS' can be performed *through* the IS, *based on* information from the IS, or *by* the IS. Actability distinguishes between three meta-roles of users. These are referred to as the *communicator*, the *performer*, and the *interpreter* (Ågerfalk 2001b). The communicator is the one that is responsible for the action and the resulting action-relationship established with interpreters. In doing business, it is quite possible that someone else performs actions on behalf of the communicator—thus acting as an agent. This is most evident in the case of automatic action where the artefact itself performs action. It might also be that one person performs action on commission of another, however. For example, a salesperson who communicates an offer to a potential customer does this on commission from the sales department, not as a private person.

3.5 The Business Context

All speech acts (communicative actions) must be understood within the context in which they are uttered (cf. Searle 1969). Knowledge of the context helps in understanding a speech act. Or put another way, a lack of knowledge of the context often means that a well-motivated speech act appears to be meaningless. This is so because the context implies that some references might be pre-supposed and thus need not be stated explicitly. An actor is required to understand the context to be able to successfully participate in communication. Stamper (1994) even states that '*To give the pragmatic information an operational form we need to define the context in which signs have their effect.*'

When doing business, the context of the communication is a *business context*. This means that, for example, some ethical standards as well as a basic understanding of the different actions involved in doing business can be taken for granted. Goldkuhl (1998) describes a phase model of generic actions performed by suppliers and customers in business processes, and several other such generic business models exist, e.g., Action Workflow (Denning and Medina-Mora 1995), SAMPO (Auramäki *et al*. 1988) and DEMO (Dietz 1994). Such generic models exemplify what can be taken for granted in a business context. For example, both parties are supposed to know what constitutes an offer, what constitutes an order, *etc.*, and what obligations are involved in

communicating these different action modes to the other party. What is important from an actability perspective is that information systems successfully communicate the type of actions that are performed when using the system, and hence, the current phase of the process. Even though such a model serves as a good example for delineating a business context, actability is not restricted to commercial transactions alone. The term 'business' should rather be interpreted as any sort of organized collaborative behaviour aimed at some articulated goals. It is therefore highly relevant to talk about actability in businesses such as healthcare, public administration, and possibly other non-profit organizations.

3.6 Summarizing the Analytic Framework

Our analytic framework consists of four basic categories: the actor, the action, the artefact, and the business context. The actors are the humans performing and interpreting action through and by means of the artefact. These are related to each other in two different ways. Firstly, there is a relationship between the actor, the action, and the artefact. That is, all three components must be understood as parts of a whole. The solid ternary relation in Figure 4 depicts this trinity. Secondly, there are additional binary relationships between the actor and the action, the actor and the artefact, and the action and the artefact. That is, some properties are generic for actors in relation to artefacts regardless of what actions are performed; for example, general user interface guidelines. The dashed binary relations in Figure 4 depict these less central relations, from an actability perspective. Additionally, all these relations must be understood within the particular business context for which the information system is designed. Note that the three meta-roles of users are distributed over the categories of actor and artefact, as described above.

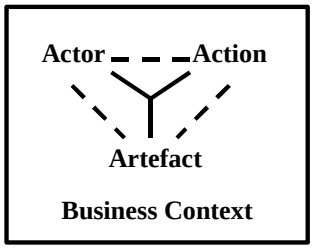

Figure 5: The four main categories of the analytic framework.

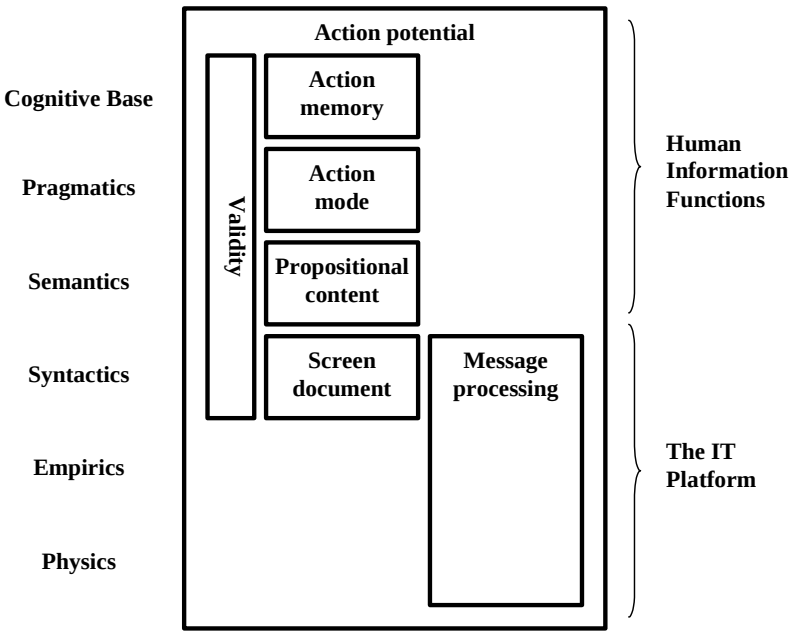

Figure 4: Main categories of the artefact part of the analytic framework.

The performance of actions by actors through artefacts can be further analysed with respect to the artefact. This is where the semiotic framework comes into play. Figure 5 shows how the actability concepts discussed above fit into the actability interpreta-tion

of the semiotic framework. Note that the category named validity in Figure 5 actually consists of the four sub-categories of rightness, sincerity, truthfulness, and comprehensibility, as discussed above.

4 The Internet-based Software Artefact according to Actability

In this work, we have defined 'Internet-based software artefact' (IBSA) as *a software-intensive artefact built by use of Internet technology*[3]. Thus, IBSA embraces everything from trivial static websites to full-blown information systems delivered via the Net.

The structure of this section follows the categorization presented in Figures 4 and 5: we start with the actors and follow on with the artefact. Action is considered in relation to these other two categories throughout the text, and the business context is referred to where appropriate. It is beyond the scope of this paper to go into details of the IBSA characteristics. The aim of the section is rather to exemplify our findings and to show how actability has been used to direct attention during data collection and abstraction (analysis). See Karlsson *et al*. (2001) for more IBSA details.

4.1 The Actors

From an actability perspective, the obvious point-of-departure for understanding the IBSA is to direct attention towards the actors to whom it is supposed to deliver value. In doing so we found two primary categories of actors in relation to IBSAs: the *host organization* (i.e., the owner of the artefact), and its *users* (i.e., the actors using the artefact). Note that both of these can take on each and all of the three user meta-roles (see above) at different times.

The users can be further categorized into three different *generic target groups*: *internals*, *partners*, or the general *public*. Internals are members of the host organization, partners are in a dyadic, usually contractually-based relationship with the host organization, and the public consists of actors to be identified outside of the host organization with no previous formal connection to it. At first glance, these three types of users seem to correspond to the three commonly used classes of IBSAs: the intranet, the extranet and the Internet. However, in order to understand this classification appropriately, we must also consider the relation between the host organization and the users in terms of delivered action potential and required authentication. Either the IBSA offers a controlled (restricted) environment, or it offers a completely open and insecure environment. Table 1 shows how these concepts relate to establish a more solid foundation for discussing different types of IBSA.

	Internals	**Partners**	**The Public**
Controlled environment	Intranet site	Extranet site	Internet site
Open environment	Internet site	Internet site	Internet site

Table 1: Generic target groups and methods for connecting to an IBSA.

[3] By 'Internet technology' we refer to the variety of technologies used by TCP/IP-based internets in general and the Internet specifically.

When applying this actor classification at Volvo IT, the important thing was not the classification as such, but the way it helped an understanding of two important factors influencing the possibilities to meet user requirements. We refer to these two factors as the level of *knowledge* and the possible *power* over the users that the host organization possesses in relation to the particular target group that has been identified (see Figure 6).

When it comes to public actors, developers can only estimate and make an educated guess about the character of the actors who will use the artefact. Under these circumstances developers face a situation where their knowledge of, as well as their power over, the users is low. In the case of an IBSA that addresses partners, the level of control can still be fairly low. Nonetheless it is possible to define an exact target group more easily, and therefore to gain greater knowledge about the users. A developer can therefore adapt more efficiently to the needs of specific users. Even when it comes to internals, the knowledge about users may be low, especially in a large multinational corporation such as Volvo IT. The possibility of utilizing power over users is, however, more evident in this context and a possible lack of knowledge may not be so critical when it comes to designing an IBSA for internal use.

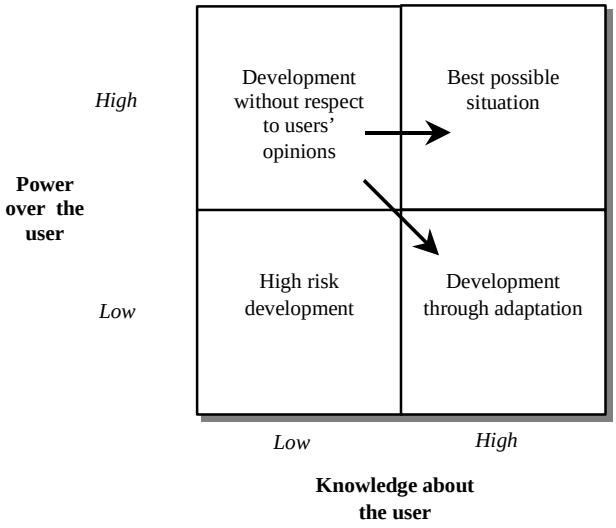

Figure 6: Power over and knowledge about users affect the development situation.

As shown in Figure 6, if power is utilized by the host organization, the possibility of pursuing the development is at its highest. Either knowledge is attained through the power (the arrows in the figure), or the power is used to implement the system without respect for the users or their situation.

4.2 The Artefact

4.2.1 Human Information Functions

An example of a human information function concept put forward as specifically important in relation to IBSA development at Volvo IT, is that of *information security*. From an actability perspective, information security relates strongly to the concept of validity (especially truthfulness, sincerity, and rightness) (cf. Ågerfalk *et al*. 2000). In order to accept an action as truthful, the communicator and the interpreter must share a common belief regarding the state of the world. This seems to be a crucial aspect of the IBSA, since a heterogeneous target group with possibly varying social and cultural backgrounds are very likely, at least in a public context or, again, in a large multinational corporation. This need for inter-subjectivity is of course important in order to understand the propositional content as well as the action modes communicated

through the IBSA. What about sincere intentions, then? This topic relates strongly to the very important concept of *trust*, in an IBSA context (e.g., Ågerfalk *et al*. 2000; Friedman *et al*. 2000). Trust is an important part of the cognitive base, which can be promoted by carefully designed artefacts (Ågerfalk *et al*. 2000).

4.2.2 The IT Platform

Software artefacts are realized through their IT platforms. Actability helps us to distinguish between the screen document and the message processing as two distinct high-level categories. In the case of the IBSA we choose to talk about *deployment architecture* instead of the more abstract 'message processing', constituting the total configuration of information technology needed to make the artefact available to its users.

4.2.2.1 Screen Documents: The User Interface

Screen documents represent the graphical user interface of the IBSA. The screen documents visualize the interactive action potential of the system (and so should make propositional contents and possible action modes comprehensible). An important example of where the IBSA distinguishes itself is that it ranges from static Web pages (so-called brochureware) to full-blown information systems. By focusing on the delivered action potential, we have found it useful to talk of an IBSA's *degree of interaction*. The artefact can be classified according to two orthogonal dimensions: affectable vs. non-affectable, and dynamic vs. static (see Figure 7). The verb 'affect' is used in this characteristic to indicate that an IBSA can be used to perform interactive actions; i.e., to affect the action memory. The terms 'dynamic' and 'static' refer to whether the information presented to an actor is stored 'as is' (e.g., static HTML), or assembled at run-time, based on information about previously performed actions stored in the action memory (e.g., by use of server-side scripting).

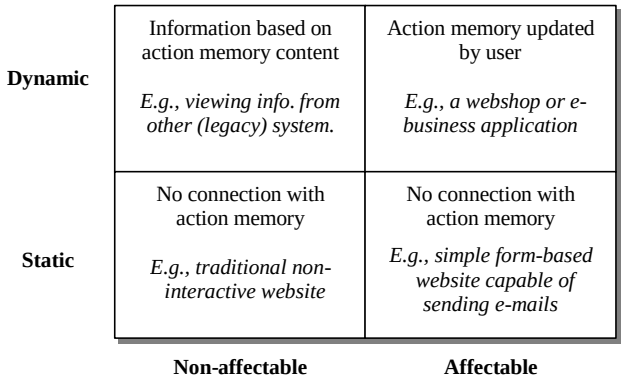

Figure 7: Different degrees of interaction provided by an Internet-based software artefact.

4.2.2.2 Deployment Architecture: The Message Processing

As stated above, an IBSA's *deployment architecture* constitutes the total configuration of information technology needed to make the IBSA available to its users. Using the Internet as a platform for software artefacts implies communication between servers and clients using a network connection. The three principal components needed to create interaction with an IBSA are: a server containing the artefact (or the software assembling the artefact), a network connection, and client configuration which is capable of handling the delivered IBSA (or parts of it). Therefore, we can divide the deployment architecture into three types of configurations: the *server configuration*, the *network configuration*, and the *client configuration*.

Each configuration consists of diverse sorts of hardware (at the physical level) and software (at the syntactic level). In the server configuration we find servers, databases and middleware/brokers. The client configuration often consists of PCs, browsers and software for communication with server parts. Network configurations are realized through network hardware and communication software. Altogether, the total 'combination of configurations' affects the *technical security* and in that way affects an actor's overall trust in the artefact (see Ågerfalk *et al*. 2000).

The combination of hardware and software can be measured with respect to *performance* (at the empirical level). Each configuration (server, client and network) has its own performance. Together they give the total performance of the architecture. The performance limits the possibilities to support different types of architectural styles, such as thin or thick clients (cf. Conallen 2000). An important aspect of deployment architecture from an actability perspective is that the performance of the deployment architecture must match the artefact's required action potential. For example, for some types of action the response time could be crucial and hence has a direct effect on the action potential.

5 Conclusion

In this paper we have discussed and exemplified the operationalization of actability into an analytic framework. The analytic framework has been used to characterize the Internet-based software artefact (IBSA), primarily as a means to empirically ground actability, but also as an important part of our future research on methods to support IBSA development. The work shows that actability can serve as an effective tool in directing attention to communicatively oriented aspects of information systems. One important contribution from actability is an understanding of the different types of actors involved in the IBSA context. This understanding has served as the baseline for the understanding of IBSA characteristics. The concept of 'degree of interaction' is, for example, one important concept for the characterization of the IBSA that is derived from the understanding of the actors and their required action potential, as is the relation between power over and knowledge about users.

In addition to actability, we have used the semiotic framework as an important inspiration. By doing that, we have arrived at a frame of reference that balances the human aspects of software artefacts with the more technological aspects. As we see it, the real strength of the actability concept lies within the conceptualization of, and in the relation between, actors, artefacts and actions. By utilizing the stricter hierarchical partitioning imposed by the semiotic framework, we achieved even more with actability, and managed to focus on different aspects more independent from each other when it comes to the artefact. Applying actability in accordance with the semiotic framework was not as easy as we first thought. There are important conceptual and terminological differences (see Goldkuhl and Ågerfalk 2000) that we needed to explicate and overcome before the analysis could be performed. Another problem that we encountered was the sometimes 'not so obvious' mapping of empirical categories to distinct semiotic levels. It proved to be the case that some categories, such as 'technical security' could not be related to one single level without separating it into possible sub-components, which were outside of the scope and purpose of the work. These problems also led to a continuous redefinition of the analytic framework. For example, the allocation of the concept of validity to distinct semiotic levels was not so obvious and

led to further elaboration of the relations between trust, information security, and validity.

The analytic framework has proved useful in finding and relating different important categories of the IBSA, and the usefulness of actability has been further empirically validated in this work. At the same time we have created a description of the IBSA that will be of importance for our future research.

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