

Towards a Language/Action Theoretic Approach to Relationship Analysis

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Abstract

Relationship analysis aims at supporting the eliciting and documenting of potential relationship structures of an application domain by providing analysts with a systematic technique. Current relationship analysis methodologies, however, are mainly semantic based and do not take the pragmatic and social dimensions of relationships into account. We propose an approach that is guided by Habermas' thoughts on the pragmatic aspects of language and communication, especially the validity claims and different world concepts. We further describe how the different world concepts as domains of reality can provide the orientation to generate brainstorming questions during an analysis process.

Keywords

Relationship analysis, systems analysis, requirements analysis, Habermas, language/action theory, hypertext, speech-act

1. Introduction

Current web applications aim to support users' access to relevant information by providing relevant relationships (or links). Discovering potential relationships within and across several application and knowledge domains is thus crucial for the development of web applications (Bieber et al. 1999). Although several authors present a variety of domain-specific relationship types (e.g., Brachman 1983; Allen 1983; Mann & Thompson 1988; Kuhlen & Yetim 1989; Redeker 2000), and many conceptual modeling and system analysis methodologies provide some kinds of techniques and guidelines to analyze and model the real world in terms of relationships (e.g., Brodie 1981; Beraha & Su 1999), only a few works explicitly focus on systematic techniques and methods for relationship analysis (e.g., Yoo 2000; Yoo & Bieber 2000; Catanio et al. 2003). Relationship Analysis (RA) is a systematic discovery approach used during the domain analysis stage of systems analysis, right after use cases have been created. Its main purpose is to enhance the understanding of the relationship structure of application domains, and as its outputs to provide system developers with potentially useful relationships associated with items of interest in application domains.

Despite their valuable contributions, the earlier RA approaches, however, are either not theory-guided, or implicitly based on ontological assumptions of the traditional and still predominant view of information systems. According to this view, information systems are regarded as repositories, storing representations of fact about the real world (e.g., in terms of data base, data class, entity, object, use case). This view has been criticized by several IS researchers (e.g., Winograd & Flores 1986; Hirschheim et al. 1995; Stamper 2000; Ulrich 2001, Goldkuhl & Ågerfalk 2002; Yetim 2002b), arguing that it mostly treats an information system as an objective and technical domain of interest, thus neglecting the communicative and discursive orientations related to the system itself and its development process.

The aim of this paper is to explore an alternative approach for relationship analysis, that overcomes its deficiencies with respect to social and communication aspects. The approach integrates the language/action theoretic view on information systems, which regards an information system as a vehicle for social action and communication within an application context. This encourages analysts to take implications and validity claims (Habermas 1984) into account when analyzing relationships. In this paper, we first discuss the deficiency of earlier approaches. Then we justify the shift from the descriptive to the language/action perspective in relationship analysis, and present our current approach based on this theoretical background.

2. Relationship Analysis: from Descriptive to Action Perspective

A domain's inter-relationships constitute a large part of its implicit structure. A deep understanding of the domain relies on knowing how all the entities or objects are interconnected. Relationships are also a key component of vital design artifacts such as ER diagrams and object-class diagrams (Brodie 1981; Bock & Odell 1998; Beraha & Su 1999). They capture an important, but often rather limited subset of relationships, and thus do not convey all the useful information they could when passed on to the designers. Relationship analysis helps analysts and designers develop a deeper understanding of the relationship structure of application domains, and provides useful relationships for implementations.

Yoo and Bieber (2000) suggest a systematic technique for relationship analysis and also provide a generic, domain-independent relationship taxonomy (Table 1) based on an extensive literature review (Yoo 2000). The taxonomy is used to create a set of brainstorming questions that an analyst uses to elicit domain information from the domain expert. Each relationship category can be further broken down into lower levels of detail

<i>Generalization/Specialization</i>	
<i>Self</i>	Characteristic Descriptive Occurrence
<i>Whole-part /Composition</i>	Configuration/Aggregation Membership/Grouping
<i>Classification/Instantiation</i>	
<i>Comparison</i>	Equivalence Similar/Dissimilar

<i>Association /Dependency</i>	Ordering Activity Influence Intentional Socio-organizational Temporal Spatial
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Table 1. Generic relationship taxonomy

Although this taxonomy may be helpful for identifying useful relationships in application domains, it has, however, several limitations. First, the relationships in the taxonomy are arbitrarily grouped and not theory guided. Second, the taxonomy is static and hierarchical, i.e., it does not consider the fact that links can belong to more than one category depending on the context. Consequently, it does not allow flexible (multi-dimensional) access to the relations.

In a recent research plan, Catanio et al. (2003) propose a new approach to relationship analysis to overcome the theoretical weaknesses of earlier approaches. The approach is based on the Hypertext Morphology, which is proposed by Rao and Turoff (1990). Rao and Turoff examine the correspondence between Guilford’s Structure of Intellect Theory (Guilford 1956) and hypertext in order to understand the ability of hypertext systems to satisfy cognitive requirements for expressing concepts and their relationships. They propose a fundamental classification of hypertext nodes (e.g., Detail, Collection, Proposition, Summary, Issue and Observation) and links of different types such as convergent links (e.g., specification, membership) and divergent links (e.g., elaboration, opposition). An orientation on this framework for a relationship analysis may extend the earlier approaches insofar as it promotes generating node-based brainstorming questions and also provides several relationships with synonyms.

However, despite this contribution, it remains still limited to the cognitive view and does not take social and inter-subjective dimensions of relationships into account. Moreover, a critical look at the ontological assumptions of earlier approaches to relationship analysis reveals that the most of them are implicitly based on the traditional and still predominant view of information system.

In the traditional approaches—referred to also as the descriptive view of information systems—, information systems are seen as repositories storing representations of facts about the real world, which reflect reality. Thus, the important goal from this perspective is to achieve a correspondence between the representations expressed in the relationships and the facts in the world that they describe. The main focus is the semantics of information expressed through a relationship, i.e., how some actor interprets and understands a semiotic sign (a relation) mediated by an information system. The traditional view of information systems is criticized by several researchers within the information systems development field who regard an information system not as an image of reality, but rather as a vehicle for social action and communication within an application context (Winograd & Flores 1986; Hirschheim et al. 1995; Stamper 2000; Ulrich 2001; Goldkuhl & Ågerfalk 2002; Yetim 2002b). They emphasize the pragmatic aspects, mainly including the communicative and discursive orientations related to the system itself and its development process.

Seeing relationship analysis and modeling from this perspective, the social context in which a relationship is used is important in understanding the pragmatic meaning of a relationship. The relationships may be related to social actors and may be established with certain

intentions. This has certain effects and create obligations on the actors. Thus, establishing relationships requires gaining inter-subjective understanding among those actors affected by the definition of relationships with respect to their truth and normative rightness or appropriateness (Habermas 1984). If these pragmatic aspects are not sufficiently taken into account during relationship analysis and design, one might end up with an application system that may fail to be considered as legitimate and socially acceptable.

In sum, it is our claim that earlier relationship analysis has focused too much on the semantics and too little on the pragmatic aspects. In addition, the underlying methodologies are mostly analyst- and developer-centered, and do not consider the participation of all those affected. The latter is of importance, if one also takes into account the transition from the analysis to the design of relationships. In such cases, the issue of acceptance and legitimacy arise since the design creates/establishes relationships, which may have social consequences for those affected.

Although we do not intend to address all these issues in this paper, we aim to suggest an approach, which is sensitive to those issues.

3. A Language/Action Theoretic Approach to Relationship Analysis

Our approach to relationship analysis is guided by Habermas' (1984) theory of communicative action, especially his basic assumptions on the pragmatic aspects of language and communication. In the following subsections, we first describe the concepts we borrow from Habermas, and then describe their role in relationship analysis.

3.1 Concepts from the Communicative Action Theory

In his theory of communicative action, Habermas (1984) aims to establish a theory concerning communication as a way to reach a shared understanding. In line with Austin (1962) and Searle (1969), he regards communication as action, i.e., it implies doing things such as promising, commanding. Expressions carry more meaning than just facts about reality. They also carry the actors' intentions and beliefs, and are used to influence people and to change the world.

By criticizing earlier approaches to the classification of speech-acts (or communication acts), Habermas (1984) distinguishes three main classes: constatives (representing state of affairs), regulatives (establishing interpersonal relations) and expressives (expressing something from self).¹ Habermas, version of the classification of speech-acts is based on the following three dimensions, which are relevant to the approach of the current paper:

1. *An ontology of three worlds*: Habermas (1984, p.100) divides reality into three worlds. He distinguishes between *objective world* (the totality of all entities about which true statements are possible), *subjective world* (the totality of the experiences of the speaker to which he has privileged access), and *social world* (the totality of all legitimately regulated interpersonal relations).
2. *Pragmatic functions of language*: Based on Buehler (1934), Habermas (1984) presupposes that a language serves three different functions: (a) *the representation*

¹ The details of Habermas' critiques on Austin's and Searle's approach are not relevant for the purpose of this paper (see Eriksson 1999 for a discussion).

(*symbol*) function, i.e., referencing the objects and state of affairs; (b) *expressive (symptom) function*, i.e., expressing the intentions (subjective experiences) of a speaker; and (c) *appellative (signal) function*, i.e., establishing relations with an addressee. He argues that it is possible due to these pragmatic functions to relate propositional contents of a speech act to the three worlds.

3. *The concept of validity claims*: Habermas (1984) contends that a speaker raises three validity claims when performing a speech act (i.e., an utterance): the *truth* of what is said, the *sincerity* of the speaker, and *rightness* (or appropriateness) of an utterance in relation to a normative context. The truth claim is related to the objective world, the sincerity to the subjective world, and the rightness claim to the social world.

Table 2 summarizes three main classes of speech-acts and their relations to the dimensions mentioned above².

<i>Class Name</i>	<i>Pragmatic Functions</i>	<i>Referred World</i>	<i>Validity Claims</i>
Constatives	Representing states of affairs	Objective world	Truth
Expressives	Expressing subjective experiences	Subjective world	Sincerity (Truthfulness)
Regulatives	Establishing legitimate interpersonal relations	Social world	Rightness (Appropriateness)

Table 2. Habermas’ dimensions for the classification of speech-acts

It should also be mentioned that Habermas’ concepts have not only received positive attention in information systems field, but have also faced some critique. Regarding adopting speech act concepts in information systems development (e.g., Suchman 1994) for example, some authors question the usefulness of the validity claims for designing information systems and instead argue for applying it as vehicle for reflection (e.g., Ljungberg & Holm 1996). Still others transform them into further useful (but not universal) communication claims (e.g., Goldkuhl 2000). Further philosophical debates concerning Habermas’ basic ontological assumptions can be found in Thompson and Held (1982). In this paper, we cannot deal with these discussions and regard Habermas differentiations as useful heuristics for relationship analysis as we illustrate next.

3.2 Application to Relationship Analysis

For the language/action theoretic approach to relationship analysis the pragmatic function of language—the universal validity claims—and their world relations are essential. Since we use language to express the relationships, expressing relationships (like linguistic utterances in everyday communication) can be construed as claims to validity. Habermas’ different worlds characterization facilitates analysis of relationships with respect to the reality (or knowledge) domains of the items they connect and their inherent validity claims.

The knowledge domains contains different types of items and relationships:

² Habermas uses also power claims to classify imperatives as a distinct categories. This, however, also can be considered as a subclass of regulatives as proposed in (Eriksson 1999).

- The objective knowledge domain consists of objects and state of affairs. It contains relations such as:
 - Relations between objects
 - Intra-object relations describing objects' parts and components
 - Relations expressing activities, physical actions and states in the objective world.
- The subjective knowledge domain consists of personal views, beliefs, desires, feelings, etc. Relations that can be considered as belonging to the subjective domain are those such as:
 - Relations expressing personal views, attitudes, experiences, beliefs, desires, and assessments of entities and actions
 - Relations expressing individuals' reflexive relation to other relations
 - Relations expressing intentions, arguments, clarifications, interpretations and self-presentation
- The social knowledge domain consists of norms, actor relationships, and institutions. Its relations are, for example:
 - Relations establishing, organizing and directing norms, rules, and processes of the social world
 - Relations expressing legitimacy, social acceptability and rightness of individual behavior, norms and rules
 - Relations regulating, organizing, directing the interaction between actors in the social world.

Relationships exist not only between items of the same reality (or knowledge) domains (i.e., relations within objective, subjective and social domains) but also between those of different domains (i.e., between subjective-objective, subjective-social, and social-objective domains).

Depending on the knowledge domains, different validity claims can be in foreground. The idea is that we can take an 'objectivating attitude' (as an observer) towards a relation that expresses something that happens in the world (accept or contest its truth); or we can take an expressive attitude, in which a subject in representing himself (or herself) reveals to the public something to which he (or she) has privileged access (accept or contest its sincerity); or we can take a norm-conformative attitude, in which a member of a social group satisfies legitimate behavioral expectations. To each of these fundamental attitudes corresponds a concept of "world" and associated validity claims. Although some relations may have all three claims, i.e., truth, normative rightness and sincerity, some of them are in foreground.

Consider, for example, the following relations and validity claims related to them.

A. (subjective world)

1. John *loves* Mary (sincerity)
2. John *likes* Book-1 (sincerity)
3. John *criticizes* new-law (sincerity, truth, appropriateness)

B. (social world)

1. Law *forbids* Book-1 (appropriateness, truth),
2. Government *declares* new-taxes (appropriateness, truth)

3. University *increases* student-fees (appropriateness, truth)

C. (objective world)

1. Section-1 *is-part-of* Book-1 (truth, appropriateness)
2. NJIT-University-Campus *is-near-to* Rutgers-University-Campus (truth, appropriate)
3. Book-1 *extends* Book-2 (truth, appropriateness)

The examples demonstrate that the nature of relations depends on the type of entities involved and validity claims associated with them. The sincerity claim can be contested only in the subjective domain. A relation in the example A.3 above can be questioned for example in the following ways:

- (1) Did he really mean what he expressed? (sincerity)
- (2) Is it true that he expressed this criticism? (truth)
- (3) Is it appropriate that he criticizes the law? (appropriateness)

The advantage of classifying relationships based on the validity claims is that it would allow negotiation (and reflection) on the expressive validity (sincerity), normative rightness (acceptability) and empirical validity (truth) of relationships established through the analysis and design. Further differentiation can be made according to criteria whether the relation refers to objects, facts, activities or states.

In the following, we describe how the characterization of different reality domains can provide orientation during the analysis process, i.e., elicitation of relations.

3.3 Analysis Process and Generating Brainstorming Questions

For doing relationship analysis, the analyst may carry out first a context analysis, for example, by starting with one or more use cases to understand the domain context (actions, functional requirements, and a starting set of objects). The analyst then can begin with the analysis and communicate with domain experts and users. Within this process, the general categories based on different knowledge domains provide orientation for generating a list of brainstorming questions.

An item can be an element of the objective, social or subjective worlds. Accordingly, there can be different relations to other items from different worlds. One can, for example, start with an item, say from the objective world, and explore the relationships to the item within the same domains as well as across domains, e.g., by exploring rules (social world) and views (subjective world) about it. Table 3 gives an example of general brainstorming questions that an analyst may ask to elicit domain information from the user.

Objective-Objective	Are there any objects related to that item? What are the parts, attributes or components of this item?
Objective-Social	Are there any rules, norms or institutional facts related to this item? Or are there any objects related to (or influenced, touched by) the social items? (when the item at hand is social)
Objective-Subjective	Are there any subjective views, opinions, experiences expressed about this item? Or are there any objects related to (or touched by) the subjective item (e.g., views, opinions)? (when the item at hand is subjective)
Social-Social	Are there any social items (norms, rules, conventions, institution) related to that social item?
Social-Subjective	Are there any subjective views, opinions, experiences

	expressed about this social item (norm, rule, convention, institution, etc.)? Are there any social items related to (or influenced, touched by) the subjective item (e.g., views, opinions)? (if item at hand is subjective)
Subjective-Subjective	Are there any other subjective views, opinions, experiences expressed about this subjective item (view, experience, opinion, belief, feeling, etc.)?

Table 3. Example of brainstorming questions for knowledge domains

The questions in Table 3 are rather condensed and highly generic. Obviously they should be tailored to each item of interest. To formulate detailed questions for lower-level categories, the integration of the relationship taxonomies of earlier approaches as discussed in section 2 can help. Since they provide a rich set of semantically distinguished relationship types with all their synonyms, their integration in the analysis process allows analysts not only in formulating detail questions but also finding appropriate names to express relationships.

Table 4 illustrates the application of the above categories in the domain of an on-line public library. Our example element is a “book” which is regarded as an item of the objective world. Exploring the relationships of the “book” within the objective domain would facilitate determining its related items such as related books, other formats such as video, books attributes (e.g., price, page number, publisher, edition), etc. (As noted above, these are detailed questions of a lower level, which needs further attention). The objective-social dimension leads to exploration of whether any norms or rules are related to the “book”. This would provide detailed relations such as borrowing or availability conditions, e.g., who can borrow it and how long. At the objective-subjective dimension, we can find out any subjective views or opinions related to the book (e.g., recommendations, reviews of readers). The other dimensions are regarded as not applicable to the “book” as an item of the objective domain.

Objective-Objective	Are there any objects related to that book? What are the parts and attributes of this <i>book</i> ? Etc.
Objective-Social	Are there any rules or norms related to this <i>book</i> ? Etc.
Objective-Subjective	Are there any subjective views, opinions, experiences expressed about this <i>book</i> ? Etc.
Social-Social	<Not applicable>
Social-Subjective	<Not applicable>
Subjective-Subjective	<Not applicable>

Table 4: A case example: “book” as an item of the objective world.

If the process is repeated for other items, a set of relationships will be identified and documented. After documenting the relationships in an application domain, analysts and designers (and also other stakeholders) can work together on a preliminary proposal for a relevant list of application domain-specific relationships for design. They can propose a relationship analysis diagram (Catania et al. 2003) and prioritize them according to their view, which then can lead to a final solution through participation of all stakeholders. This process includes the discussion and consideration of all issues such as cost, implementation problems, other social and normative implications, etc. A systematic examination of these basic issues through the participation of all those affected is in line with the discursive approaches to information systems development (e.g., Hirschheim et al. 1995; Ulrich 2001; Yetim 2002a).

However, dialogical determination of relevant relationships involves a trade-off between efficiency and the goal of mutual understanding. The more our conversations are directed at mutual understanding, the less efficient they are in producing a determinate outcome that can be acted upon. Hence, the approach proposed so far may take longer than a regular relationship analysis. Nevertheless, this does not marginalize discourse as an essential component of legitimate relationship design. Instead it enriches the resulting analysis and design, as well as understanding among the users and domain experts, systems analysts and designers.

5. Conclusion

In this paper, we have argued that earlier approaches to relationship analysis have focused too much on the semantic aspects of relationships and too little on the pragmatic aspects. To remedy these shortcomings, we have proposed an approach that takes the different domains of reality and validity claims into account. This ontological standpoint implies that relationship analysis and design should be sensitive to issues such as normative rightness or appropriateness, truth, and sincerity of that being related. It is our expectation that the integration of these aspects with the semantic-oriented approaches will lead to a legitimate and social more acceptable relationship design.

The current status of our approach can be regarded as a general orientation within the analysis process. We have suggested that the type of items connected by a relation and the corresponding reality domains should be taken into account during an analysis. Further research will be done to refine the level of brainstorming questions, by integrating the rich set of semantically well-distinguished categories of earlier approaches. Implementing additional tools and support mechanisms such as templates for each category of relationship will provide computer-support during the analysis process and can significantly enhance the effectiveness of the human analyst. The prototyping of the tools will address whether a plethora of relationships tends to confuse or enlighten. Finally, our evaluation should show that relationship analysis significantly improves the software development process.

We envision developing a systematic and theoretically-based relationship analysis technique and corresponding mechanisms. This will provide an invaluable tool in the toolkit of the analyst for developing software. It also will serve as an effective communication tool. Analysts, designers, and the users can develop a shared understanding of the domain, and work out differences in terminology, assumptions and viewpoints. The enhanced relationship analysis should result in legitimate and socially acceptable software applications.

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