

Using Mediation Theory to Build a Requirements Conflict Resolution Model

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Abstract

Conflict is a common phenomenon in our daily life and as such conflict has an important impact on Requirements Engineering (RE). However, in the current RE literature, conflict is often addressed in terms of a technical issue leading to inconsistency in the requirements specification. Little attention is given to the socio-psychological aspects of the conflict. Furthermore, previous RE work typically views the resolution of conflicts in RE as a purely negotiation-based process, in which a requirements engineer acts as a representative of a developer site and negotiates with users. By drawing on the Information Systems and Conflict Resolution literature, we argue that conflict resolution in RE should be a mediated process, in which a requirements engineer acts as a mediator amongst different stakeholders. We introduce our narrative mediation theory and explain how it can be introduced into the field of RE.

1. Introduction

In this paper, we analyse previous literature on conflict resolution in RE and argue that requirement engineering can be viewed as a mediation process rather than a pure negotiation process. A narrative mediation model is introduced, justified, and aimed to translated into the context of RE.

RE is a human endeavour, and is significantly impacted by the social, human, and organizational factors (Sommerville and Sawyer, 1997). For example, Ramos and Berry (2005: 238) focus on the role of people's emotion, values, and beliefs in RE, and argue that implementing an IT/IS system to the organization inevitably "interacts with the users' values and beliefs and trigger emotional responses which are sometimes directed against the software system and its proponents." Although there is an increasing interest in social, human, and organizational aspects of RE (e.g Ramos and Berry, 2005; Bustard, 2002; Thanasankit, 2002), most research in RE is still technically-oriented focusing on developing methods, techniques and tools

to elicit, model and validate requirements. There remains a lack of research into the social, human, and organizational aspects of RE. In particular, conflicts among different stakeholders is one of such important human and social aspect that needs more research attention in the RE community.

Conflict is a common phenomenon in everyday life (Barki and Hartwick, 2001). More recently, conflict has also received attention in the Software Engineering (SE) community. Cohen et al. (2004) identify the causes and consequences of conflict in the software testing process. Sawyer (2001) identifies the negative relationship between intra-group conflict and poor software team performance within a software development context. Domino et al (2003) explore the role of conflict and conflict handling styles in collaborative software development. While Elliott and Scacchi (2004) describe how conflict emerges, is communicated, mitigated and resolved in a globally dispersed open source software development project.

In the RE community, conflict has also been recognized as an inevitable part of the RE process. Sommerville and Sawyer (1997:67) argue that "RE is both a social and technical process involving extensive interactions among different stakeholders from different backgrounds and with different individual and organizational goals". However, in the current RE literature, conflict is consistently recognized as a technical issue that may lead to inconsistency in the requirements specification. For example, Nuseibeh (1998) notes that inconsistencies mainly arise in RE due to conflicts of interest, goals, and viewpoints among different stakeholders. Much work in this area thus focuses on presenting technical methods or techniques for modelling, analyzing, and managing conflict or inconsistency e.g. KAOS (Van Lamsweerde, 2000), Problem Frames (Jackson, 2001) and I* (Yu, 1998) or tools for automating conflict identification and resolution e.g. Oz (Robison, 1990), Synoptic (Easterbrook, 1993), or prompting groupware systems for remote negotiation e.g. Win-Win (Boehm et al,

2001). Little attention is given to the socio-psychological aspect of the conflict. Furthermore, previous RE work consistently views the resolution of conflicts in RE as a purely negotiation-based process (Boehm et al, 2001; Damian et al. 2000; Gruenbacher et al. 2005) in which a requirements engineer acts as a representative of a developer site and negotiates with users.

This paper adopts a complementary viewpoint and differentiates itself from previous work by recognizing conflict as a social, human, and organizational issue. We adopt Barki and Hartwick (2001:157)'s definition of conflict as “a phenomenon that occurs between interdependent parties as they experience negative emotional reactions to perceived disagreements and interference with the attainment of their goals.” Furthermore, we also view the process of resolving conflict in RE is a mediated process, in which a requirements engineer acts as a mediator among different stakeholders. To address this socio-psychological aspect of conflict in RE, we aim to borrow the original narrative mediation theory from Winslade and Monk (2000) and translate it into a RE specialised mediation model to help RE practitioners effectively identify, define, and resolve conflicting interests, viewpoints, and goals. The aim of this paper is to provide a rational analysis of the literature in relation to conflict resolution in RE. This paper also aims to outline the process of translating a narrative-based mediation model to the context of RE. We do not intend to present and validate the final RE specialised mediation model. The RE specialised mediation model is presented separately in (Ma et al. 2008b). The empirical validation this model is reported in (Ma et al. 2008a).

This paper is organised as follows: Section 2 presents a literature review of conflict resolution in RE. Section 3 presents an overview of the original narrative mediation. Section 4 focuses on justifying its applicability to RE. Finally, Section 5 concludes the paper and outlines our plans for future research.

2. Conflict Resolution in RE

2.1 Conflict resolution in RE as a joint-decision making process

There are many approaches have been proposed in the conflict resolutions literature. Pruitt and Kim (2004) classify three broad classes of conflict resolution approaches: joint decision-making, third-party decision-making and separate action:

- **Joint decision making** includes **negotiation** and its close cousin **mediation**. Negotiation involves a series of discussions between two or more parties with the apparent aim of resolving a divergence of interest or goal and finally reaching an agreement. Mediation is similar to negotiation except that a third party helps the disputants reach an agreement.
- **Third-party decision making** includes adjudication (going to court), arbitration, and decision making by legitimate outside authorities.
- **Separate action** is where the parties refuse to collaborate, and make independent decisions. Struggle is a most typical and common form of separate action.

Comparing these three general approaches suggests that conflict resolution in RE needs a joint-decision making process. Generally speaking, joint decision making tends to be more benign, and have a number of advantages over third-party decision making. Pruitt and Kim (2004) point out that third-party decision making can be very expensive, e.g. additional cost for going to court and hiring a lawyer. Most importantly, they also indicate that the third-party involved may not understand the parties' interests well enough, and “win-lose” situations often result in which there is no mutual benefit. The third-party decision making approach is regarded as less successful in the case of developing software system. Boehm et al. (2001) argue that successful software development stresses the commitment and participation of all stakeholders, and the need to ensure everyone is a winner.

In addition, joint decision making is usually less costly and dangerous than struggle, as struggle often requires heavy expenditure of resource and seriously endangers the relationship between parties. In the case of software development, empirical studies of software project development suggest that refusing to collaboration means the resulting struggle between users and developers results in serious negative impacts on the project: e.g. communication channels breakdown, project are delayed ,heavy expenditure of resource and poor working relationships between users and developers (Curtis et al., 1988).

Indeed, in the RE literature, there is an increasing understanding of the RE process as a joint decision-making process. For example, Sommerville and Sawyer (1997) point out that the nature of the RE process

involves a wide range of stakeholders (e.g. user, customer, developer, project manager, maintainer, and so on) who are responsible for jointly deciding what to do, when to do it, what information is needed, and finally how to do it.

2.2 Conflict resolution in RE as a mediation process.

In section 2.1, we have justified the fundamental nature of resolving conflicts in RE is a joint decision-making process. However, both negotiation and mediation can be viewed as a form of joint decision-making process. The fundamental difference between negotiation and mediation is that, negotiations often only involve conflicting parties themselves reaching an agreement. Mediations then involve a third party as a mediator to help parties to reach an agreement. In this section, we argue that conflict resolution in RE is more than just a negotiation process. Indeed, it can be viewed as a mediated process, in which a requirements engineer acts as a mediator to assist different stakeholders from different backgrounds with different individual and organizational goals to resolve conflicts, and eventually produce consistent, accurate, stable, and complete requirement specifications.

Most of the RE literature argues that the process of resolving conflict is a purely negotiation-based process, in which a requirements engineer acts as a representative of a development site to “negotiate” with a users’ site to make trade-offs (Boehm et al, 2001; Easterbrook, 1993; Nuseibeh et al. 1996; Damian et al. 2003).

Evidence from the IS discipline also suggests that conflicting interests and goals are not only between the users’ site and the developers’ site, but are often between different user groups. For example, Robertson et al. (1996) describe a case study where the decision to develop a new production management system was predominantly led by manufacturing and production department specialists who decided to invest heavily in a new manufacturing resources planning system (MRP2). However, in this case, stakeholders from other functional departments (e.g. purchasing and marketing) had different ideas about the problems they were facing and did not believe the new MRP2 to be the solution. Eventually the new system failed due to poor management of such conflicting interests and goals between two users groups. This negotiated form of conflict resolution is seriously questioned in the above situation. It is apparent in the above situation that a requirement engineer needs to play a mediator’s

role to facilitate the two users groups to reach an agreement on requirements.

Indeed, in the RE literature, Bustard (2002) notes that it is ideal for both users and developers to adopt a collaborative style to negotiate with each other and reach an agreement. But in many cases, a facilitator should be introduced to help parties to reach an agreement. This is an obvious role for the requirements engineer/analyst. Our field study of 10 RE practitioners also indicates that RE workshops are the most widely used method of requirements elicitation, negotiation and analysis, and a requirements engineer/analyst is often required to play role of a facilitator in such RE workshop (Ma and Hall, 2008a).

Although the facilitative role of a requirements engineer has been documented in the RE literature, there are many diverse views on the facilitators’ role in the RE literature (Damain et al. 2003). The role of a requirements engineer as a mediator has not been explicitly identified in the previous RE literature. Few techniques, models, and guidelines have been developed to guide a requirements engineer as a mediator to resolve conflicting viewpoints in RE practice. In the next section, I will provide a brief overview of the original narrative mediation approach and particularly focus on justifying its applicability and importance to RE.

3. An overview of narrative mediation

Since the fundamental nature of resolving conflict in RE can be viewed as a mediation process, a suitable mediation model can be considered to be introduced into RE. The narrative perspective is that people tend to organize their experiences in story form. In narrative mediation, the process of mediation is thus viewed as a story-telling process (Winslade and Monk, 2000). It has been recognized as an innovative conflict resolution paradigm that encourages conflicting parties to reach understanding and resolution through a deep understanding of the shared personal and cultural narratives underlying the conflict. In this section, we provide an overview of the original narrative mediation model.

Winslade and Monk (2000) point out that the narrative approach involves a simple and yet profound departure from commonly held assumptions about the conflicts that embroil people. Its underlying assumption is that people live their lives according to stories rather than according to inner drives or interest. It thus privileges

stories and meanings within stories over facts and causes. Therefore, when they work with others to overcome the divisiveness of a conflict, they will find it “more productive to work with the stories in which the conflict is embedded than to pursue objective reality” (Winslade and Monk, 2000). The original narrative mediation model contains three sub-models:

1. Engagement

In this phase, the mediator focuses on establishing a relationship and identifying the problems with the conflicting parties. To achieve a workable relational context, the mediator needs to attend to the physical setting in which the mediation is to take place, to the non-verbal behaviour displayed by all parties, and to the relational moves made by the mediators and the parties. In the case of resolving conflicts in RE, we refer to this phase as the conflict identification phase.

2. Deconstructing the conflict-saturated story

This phase of the process involves the mediator developing a supportive relationship and listening respectfully to stories. The mediator works actively to separate the parties from their conflict-saturated story. The mediator seeks to undermine the certainties on which the conflict feeds and invites the participants to view the plot of the dispute from a different viewpoint. In the case of resolving conflicts in RE, we refer to this phase as the conflict definition phase.

3. Constructing the alternative story

In this phase, the mediator is occupied with crafting alternative, more preferred story lines with people who were previously captured by a conflict-saturated relationship. This phase thus may lead to a resolution that takes the form of an agreement between parties. In the case of resolving conflicts in RE, we refer to this phase as the conflict solution phase.

4. Narrative mediation’s applicability to RE

We justify the applicability of the original narrative mediation to RE based on the following four aspects:

4.1 A process-oriented perspective

The original narrative mediation model adopts a process-oriented perspective. As Winslade and Monk (2000:35) state:

“We have deliberately called this approach a process because we think the word process focuses

on the dynamic, shifting, and changing elements of mediation rather than on abstraction, facts, or structures. By concentrating on process, the mediator is invited to think about and work with the responses of the conflicting parties rather than follow some static, preconceived plans.”

This process-oriented perspective matches particularly well with the process aspect of RE practice. RE process can be viewed as a set of activities that should be systematically followed to derive, validate, and maintain a systems requirements document. The RE literature has presented many different process models, which can range from linear or iterative in structure (Macaulay, 1999).

Although these models are explicitly defined in the RE literature, the empirical studies have indicated that the systematic and incremental RE models presented in the RE literature do not really reflect the reality of the RE process in real practice. For example, Hofmann et al., (2005) indicate that most companies regard RE as an ad hoc process, with only some using an explicitly defined RE process model or customising a company standard model. Nguyen and Sawtmann (2006) indicate that RE processes do not appear in a systematic, smooth and incremental way, but are opportunistic, with sporadic simplification and restructuring of the requirements models when points of high complexity are reached.

One reason for this chaotic and dynamic RE process is due to requirements changes (Nuseibeh and Easterbrook, 2000). It is apparent that the business environment in which software is deployed continually changes. Even if the environment is constant, people’s perceptions and understandings are dynamic (Sommerville, 2005). As a result, the process of resolving conflicts in RE is a dynamic and complex process. It does not involve discrete stages, and does not follow a tidy sequence of events. In this sense, the narrative mediation model which focuses on the dynamic, shifting, and changing elements of mediation seems particularly applicable for the context of RE.

4.2 A storytelling process

Narrative mediation particularly builds on a storytelling metaphor, and provides a mediator with a way of incorporating stories into the resolution of conflict. In narrative mediation, narratives are interactively developed, modified, and contested as parties elaborate portions of their own and each other’s conflict stories.

In RE, the way of gathering user requirements fundamentally can be viewed as a storytelling process. Beck (2000) indicates that new software development methodologies are increasing exploiting the storytelling aspect of the RE process (e.g. user stories in XP practice). Viewing requirements elicitation as a storytelling process not only emphasizes the final outcome – “user stories”, but also highlights the importance of verbal communication and interactions between users and developers, which can potentially minimize the ambiguity of requirements specification (Cohn, 2004).

4.3 Outsider-in perspective

Nuseibeh and Easterbrook (2000) indicate that the context in which RE takes place is a complex human activity system; eliciting and analysing requirements thus can not be performed in isolation from the organizational and social context in which any new system will have to operate. This view stresses a good understanding of the social, political and cultural changes caused by new systems. Moreover, as shown in the Curtis et al.’s (1988) classic field study of software engineering process, conflicts result from a wide range of interrelated factors, from change in the organisational setting and business context, to the fact that software will be used by different people with different goals and different backgrounds.

In narrative mediation, Winslade and Monk (2000) argue an “outsider-in” perspective, which looks at conflict as produced in the socio-culture context, where meanings are contested within the social fabric of community. The narrative mediation approach is based on the idea that people construct conflict from their narrative description of events, and concentrates on developing a relationship that is incompatible with conflict and that is built on stories of understanding and collaboration. The narrative mediation approach with an “outsider-in” perspective, which helps mediators and their conflicting parties make sense of the complex social contexts that produce conflicts is thus applicable for the social and organizational aspects of RE.

4.4 An insider-partial mediator

The original narrative mediation involves recognizing that a mediator cannot be completely neutral. Although Macaulay (1999) indicates that the role of a facilitator in RE is subject to lively debate, mostly neutral third-parties are employed to facilitate communication among different stakeholders (e.g Boehm, et al. 2001; Damian et al., 2003). This type of mediation is generally referred to as outsider-neutral mediation (Lederach, 1991).

However, in real RE practice, it seems that an outsider-neutral facilitation approach may not always be possible due to the extra cost of hiring an external facilitator. In many cases, a requirements engineer or a project manager plays the role of a mediator (Ma and Hall, 2008a; Bustard, 2002). But they are rarely neutral, being employed by either the client or supplier. Lederach (1991) further refers to this type of mediation as insider-partial mediation. In this sense, narrative mediation that emphasizes an insider-partial mediator becomes more applicable for real RE practice

5. Conclusions and future works

In this paper, we draw on the general conflict resolution literature to analyse conflict resolution in the context of RE. We argue that conflict resolution in RE is a joint decision-making process. More specifically, it can be viewed as a mediation process rather than a negotiation process. A narrative mediation theory is also introduced and justified in the context of RE.

6. References:

- Barki H, Hartwick J, (2001) Interpersonal conflict and its management in information system development, *MIS Quarterly* Vol. 25 No.2, pp195-228, June 2001
- Beck, K. (2000) *Extreme Programming Explained: Embrace Change* – Addison Wesley – 2000.
- Boehm, B. Grünbacher P. and Briggs R. (2001) *Developing Groupware for Requirements Negotiation: Lessons Learned*, *IEEE Software*, 18(3), 2001.
- Beck, K. (2000) *Extreme Programming Explained: Embrace Change* – Addison Wesley – 2000.
- Cohn, Mike (2004) “User Stories Applied: For Agile Software Development” Boston, Addison-Wesley Signature Series
- Curtis B., Krasner H. and Iscoe N., A field study of the software design process for large systems, *Communications of the ACM* 31 (1988) (11), pp. 1268–1287
- Cohen, C., Garfield, M., and Webb, H, Birkin, S, *Managing conflict in software testing*, *Communications of the ACM*, Volume 47, Issue 1 Pages: 76 – 81, 2004
- Davis (2003) A., “The Art of Requirements Triage,” *Computer*, Vol. 36, No. 3, March 2003, pp. 42-49.
- Damian, D.E. (2003) A research methodology in the study of requirements negotiations in geographically distributed

- software system, Proceedings of 11 the IEEE International Requirements Engineering Conference, 2003
- Domino M.A. and Collins R.W. and Hevner A.R. and Cohen C. (2003) Conflict in Collaborative Software Development, Proceedings of the 2003 ACM SIGCPR Conference on Computer Personnel Research (SIGCPR-03), pp. 44-51, ACM Press, April 10-12 2003.
- Easterbrook S. M. (1996) "Resolving Requirements Conflicts with Computer-Supported Negotiation". In M. Jirotko & J. Goguen (eds) Requirements Engineering: Social and Technical Issues, Pp41-65. London: Academic Press.
- Jackson M. (2001) "Problem Frames: Analysing and Structuring Software Development Problems" Addison-Wesley Longman Publishing Co., Inc.
- Hoffmann, O., Cropley, D., Cropley, A., Nguyen, L., Swatman, P. (2005) Creativity, Requirements, and Perspectives, Australian Journal of Information Systems 13(1), pp159 - 175.
- Grünbacher P. , Halling M., Stefan Biffl, Hasan Kitapci, Barry W. Boehm (2003) : Repeatable Quality Assurance Techniques for Requirements Negotiations. HICSS 2003: 23
- Gottesdiener E. (2002). Requirements by Collaboration Requirements by Collaboration: Workshops for Defining Needs, Addison-Wesley
- Lederach J.P., (1991) Of Nets, Nails, and Problems: The Folk Language of Conflict Resolution in a Central American Setting. Conflict Resolution: Cross-Cultural Perspectives. Ed. Kevin Avruch, Peter W. Black and Joseph A. Scimecca. Greenwood Press: New York, Westport, Connecticut, London, 1991. Pp. 165-186.
- Ma N. Hall T. Barker T. (2008a) "Using an expert panel to validate a Requirements Engineering Mediation Model" a paper submitted on EASE 2008 conference, 26, June, 2008, Italy,
- Ma N. Hall T. Barker T. (2008b) "Building a narrative-based Requirements Engineering Mediation Model" a paper To be appeared on EuroSPI 2008 conference, Lecture Note in Computer Science, 3-5, Sep, 2008, Dublin,
- Macaulay, L. (1999): Seven-layer model of the role of the facilitator in requirements engineering, Requirements Engineering Journal 4, 38-59
- Nuseibeh B., To Be And Not To Be: On Managing Inconsistency in Software Development , Proceedings of 8th International Workshop on Software Specification and Design (IWSSD-8), pp164-169, Schloss Velen, Germany, 22-23 March 1996, IEEE CS Press.
- Nuseibeh B. and Easterbrook S., Requirements Engineering: A Roadmap , Proceedings of International Conference on Software Engineering (ICSE-2000), 4-11 June 2000, Limerick, Ireland.
- Nguyen, L and Swatman, P., (2006). Promoting and Supporting Requirements Engineering Creativity (chapter 10) In Rationale Management in Software Engineering, edited by A. H. Dutoit, R. McCall, I. Mistrik, and B. Paech, Springer-Verlag.
- Pruitt, D. G., & Kim, S. H. (2004). Social conflict: Escalation, stalemate, and settlement (3rd ed.). New York: McGraw-Hill.
- Robinson, W.N. (1990) Negotiation Behaviour During Multiple Agent Specification: A Need for Automated Conflict Resolution, Proceedings of 12th International Conference on Software Engineering (ICSE-12), 268-276, Nice, France, IEEE Computer Society Press, March 1990.
- Robertson M, Swan J, Newell S. (1996) "The role of networks in the diffusion of technological innovation". Journal of manage studies 1996; 33(3):335-261
- Ramos I., Daniel M. Berry (2005), Is emotion relevant to requirements engineering? Requirements engineering, 10, 238-242
- Sawyer S. (2001) Effects of intra-group conflict on packaged software development team performance, Journal of Information System. 11(2), p. 155, 2001
- Sommerville I. and Sawyer P. (1997) Requirements Engineering: A Good Practice Guide, Wiley, 1997,
- Sommerville Ian (2005) Integrated Requirements Engineering: A Tutorial. IEEE Software 22(1): 16-23
- Thanasankit, T. (2002). Requirements engineering-exploring the influence of power and Thai values. European Journal of Information Systems, 11, 128-141
- Van Lamsweerde, A. Requirements Engineering in the Year 00: A Research perspective, Invited Paper for ICSE'2000 - 22nd International Conference on Software Engineering, Limerick, ACM Press, June 2000.
- Winslade John and Monk Gerald (2000) "Narrative Mediation: A New Approach to Conflict Resolution" Jossey-Bass
- Yu, E. and Mylopoulos, J. Why Goal-Oriented Requirements Engineering, Fourth International Workshop on Requirements Engineering: Foundation for Software Quality (REFSQ'98), E. Dubois, A. Opdahl and K. Pohl (ed.), Pisa, Italy, 1998.