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List of the Author's Publication

1. Research papers in refereed international scientific conference proceedings

- Ma, N., Hall, T., Barker, T., (2008) Developing a narrative based requirements engineering mediation model, EUROSPI, 2008. European Conferences on Systems & Software Process Improvement and Innovation, Dublin City University, 01-05, Sep, Dublin. Proceeding published by Lecture Notes in Computer Science Vol. 4257, pp 1-9

- Ma, N., Hall, T., Barker, T., (2008) Using an expert panel to empirically validate a Requirements Engineering Mediation Model, IADIS 2008: International Conference on ICT, Society, and Human Beings, 23-25, July, Amsterdam, Holland.

- Ma, N., Hall, T., Barker, T., (2008) Using Mediation Theory to Build a Requirements Conflict Resolution Model, WER 2008 11th International Workshop on Requirements Engineering, 12-13, September, Barcelona, Universitat Politècnica de Catalunya, Spain , Proceeding available online on: http://wer.inf.puc-rio.br/WERpapers/, pp 23-27

2. Other scientific publications

- Ma, N., Hall, T., (2006) Do we really know the nature of human conflicts in Requirements Engineering Process? A short reflective paper published by The quarterly newsletter of the BCS Requirements Engineering Specialist Group, Vol. 41 pp 3-4, available online on: http://www.resg.org.uk/archive/RQ41.pdf

- Ma, N. (2006) Can we borrow the mediation theory to improve RE process? A poster presentation on BCS Requirements Engineering Specialist Group Annual Meeting, August 09, 2006, Imperial College, London.

- Ma, N. (2007) Building a narrative based requirements engineering mediation model, A poster presentation on The Science and Technology Research Institute Research Showcase, July 8, 2007, The University of Hertfordshire, Hatfield.

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Abstract

This thesis presents a narrative-based Requirements Engineering (RE) mediation model (NREMM) to help RE practitioners to effectively identify, define, and resolve conflicts of interests, goals, and requirements in the RE process. Conflict has received increasing attention in the Software Engineering (SE) literature. However, in the current RE literature, conflict has received fairly superficial attention. Previous research views conflict as an issue causing "inconsistency" in a requirements specification. As a result, current research has proposed a wide range of inconsistency checking and modelling tools, which address the result of conflict rather than fundamental causes and roots of the conflict. Little attention is given to the socio-psychological aspect of conflict. Furthermore, previous work views the resolution of conflict in RE as a negotiation-based process, in which a requirements engineer acts as a representative of a developer site and negotiates with users. This thesis differentiates itself from previous work by recognising conflict is more than an issue of inconsistency. This thesis argues that conflict is a social and organisational phenomenon. This thesis also argues that the process of resolving conflict in RE can be viewed as a socially mediated process, in which a requirements engineer can act as a mediator rather than a representative of the developer/user site. The fundamental difference between negotiation and mediation is that, negotiations often only involve parties themselves reaching an agreement. Mediation then involves a mediator to lead the process and help parties to reach an agreement. However, there is a distinct gap in the RE literature, in which the role of a requirements engineer as a mediator has not been explicitly explored.

To address the socio-psychological aspect of conflict, Wins lade and Monk (2000)'s narrative mediation model is introduced, justified and translated into the context of RE by following a systematic and transparent methodological approach. This leads to a new RE specialised mediation model (NREMM), which includes three phases: conflict identification, conflict definition and conflict resolution. The new model aims to be not only theoretically robust but also practically useful. It builds on the storytelling metaphor advocated by narrative mediation theory and also integrates well-established and practical RE specialised techniques.

The NREMM was empirically assessed and evaluated. I used an expert panel interview survey to empirically assess whether the NREMM is theoretically robust. The experts' feedback indicated that the NREMM is capable of helping RE practitioners to resolve conflict in the RE process. The experts also indicated that the use of story-telling as a theoretical underpinning is a strength, and matches well with current state of the RE practice. I also used a quasi-experiment to empirically evaluate whether the NREMM is practically useful in a simplified real-world scenario (University of Hertfordshire's StudyNet) by using real users of a real system. The experimental results indicated that the NREMM is a useful model to help RE practitioners to identify, define and resolve conflict in practice. This is evidenced by significantly higher satisfaction results and a better perception of the mediator's performance obtained from workshops where the mediator implemented the NREMM. The key contribution of this thesis is the NREMM, which is a useful model to not only help RE practitioners resolve conflicts among different stakeholders but also improve stakeholders' cooperativeness and satisfaction.

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1. Introduction

This thesis presents a narrative based Requirements Engineering (RE) mediation model (NREMM) that aims to help RE practitioners to effectively identify, define and resolve conflict of interests, goals, and requirements among different stakeholders in the RE process. RE is repeatedly accepted as one of the most important and problem-prone areas in Software Engineering (SE) research. Social, human, and organisational issues significantly impact the effectiveness of the RE process and the quality of requirements specification (Sommerville and Sawyer, 1997; Jirotka and Goguen, 1994; Alexander and Maiden 2004). Although there is an increasing interest in social, human, and organisational aspects of requirements engineering, most research in RE is still technically dominated and focused on developing novel methods, techniques, and tools to elicit, model, and validate requirements. There remains a lack of research into the social, human, and organisational aspects of RE (Jirotka and Goguen, 1994; Ramos et al., 2005). In particular, conflict[1] among different stakeholders is one of important aspect of RE that needs more research attention (Robison, 1990; 1994; 1999; Easterbrook, et al., 1993; Easterbrook, 1996; Boehm et al, 2001; Macaulay, 1999; Alvesand and Finkelstein, 2003; Damian et al., 2008; Finkelstein et al., 2008).

Conflict is a common phenomenon in everyday life (Pruitt et al, 1986; Pruitt and Kim, 2004; Barki and Hartwick, 2001). When two or more social entities (e.g., individuals, groups, organisations and nations) interact with one another in attaining their objectives, their relationships may become incompatible or inconsistent (Thomas 1992). Conflict also has been recognised as an inevitable part of RE. For example, Sommerville and Sawyer (1997) state that RE is both a social and technical process involving extensive interactions among different stakeholders from different backgrounds and with different individual and organisational goals. However, in the current RE research community, conflict has received fairly superficial research attention. Previous research views conflict simply as an issue of causing "inconsistency" in a requirements specification, which is often characterised by

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[1] The term conflict in this thesis doesn't only refer to conflicting requirements. I take a broad and holistic view, and refer to conflict as different understanding, interests, and goals towards the requirements of a software system emerged in the RE process.

conflicting requirements. For example, Easterbrook (1996) indicates conflict is characterised by disagreements between stakeholders and often lead to inconsistency in a requirement specification. As a result, current conflict research in RE has proposed a variety of inconsistency checking tools and automated requirement negotiation tools, which literally aim to address result of the conflict (e.g. Hoh, 1998; VanLamsweerde, 2000; Jackson, 2000; Yu, 1998; Robison, 1990; 1999; Easterbrook, 1996; Alves and Finkelstein, 2003; Finkelstein et al., 2008) rather than fundamental causes and roots of the conflict. Most previous research omits the social-psychological aspects of conflict. Furthermore, previous research views the resolution of conflict in RE as a pure negotiation process, in which a requirements engineer represents the developer site and negotiates with users (e.g. Boehm et al, 1995; 1998; Nuseibeh et al., 1996, Hoh et al., 2001; Damian et al., 1998; 2000; 2003). Most notably, Boehm et al., (1995) argues that many software projects have failed because their requirements are "poorly negotiated" among different stakeholders. In response, Boehm and his colleagues (1998) develop the win-win requirements negotiation framework and its associated negotiation support system to address issues of conflict resolution in RE.

This thesis differentiates itself from previous work by recognising conflict is more than just an issue of inconsistency characterised by conflicting requirements. This thesis argues that conflict is a social and organisational phenomenon, which exists in the every part of software development process. This thesis also argues that the process of resolving conflict in RE can be viewed as a socially mediated process, in which a requirements engineer can act as a mediator who works independently among different stakeholders rather than a representative of the developer/user site. In this thesis, Winslade and Monk (2000)'s narrative mediation is introduced, justified and translated into the context of RE. This leads to a new RE specialised mediation model (NREMM), which includes three phases: conflict identification, conflict definition and conflict resolution. The new model aims to be not only theoretically robust but also practically useful. It not only builds on the storytelling metaphor advocated by narrative mediation theory but also integrates well-established and practical RE specialised techniques.

Empirical assessment and evaluation is an essential part of any method development ensuring that newly developed methods or models are fit for purpose. In this thesis, I

first use an expert panel interview survey to empirically validate whether the NREMM is theoretically robust and fit for its purpose. I then use a quasi-experiment to empirically evaluate whether the NREMM is practically useful in a simplified real-world scenario (University of Hertfordshire's Managed Learning Environment-StudyNet).

1.1 An overview of the RE process

This section explains the theoretical background on which this thesis is based. This section not only provides an overview of the role of requirements and RE processes, but also, most importantly, justifies the originality and importance of this research by recognising that requirements are socially constructed and RE is a social process.

1.1.1 The role of RE

"The hardest single part of building a software system is deciding precisely what to build...therefore, the most important function that the software builder performs for the client is the iterative extraction and refinement of the product requirements."

Brooks, 1987, pp10

RE is repeatedly accepted as one of the most important and problem-prone areas in Software Engineering (SE) research (Sommerville and Sawyer, 1997; Aurum and Wohlin, 2005; Sommerville and Ransom, 2005). Software projects are prone to failure- delayed, over-budgets, and not meeting customer requirements (Standish Group, 1995; 2003; 2009). Although these failures may result from a wide range of factors, study after study has found that many of them fail due, at least partly, to unsuccessful RE (Nuseibeh and Easterbrook, 2000). For example, in an early paper, Weinberg (1997) shows that up to 60% of software errors originate from the RE process. A survey over 8000 projects undertaken by 350 US companies in 1995 revealed that more than half of responses indicate poor requirements usually as the major source of project failure (Standish Group, 1995). The RE problem is similar in the European software industry, a survey over 3800 organisations in 17 countries

similarly concluded that most of the perceived software problems are in the area of requirements (more than 50%) and requirements management (50%) (European Software Institute, 1996 in VanLamsweerde, 2000).

Although novel and effective SE and RE techniques and tools have been developed recently, evidence from an empirical study of software engineering practice in 12 UK companies indicates that RE problems account for 48% of all software development problems (Hall et al., 2002). In the Standish Group 2003's chaos report, it is reported that nearly two-thirds of the projects suffer from unstable requirements caused by poor RE process management (Standish Group, 2003). Most recently, the Standish Group 2009's chaos report shows a highest project failure rate over a decade, and further argues that the vast majority of the waste is completely avoidable by simply improving RE process. Sommerville and Ransom (2005) conducted an empirical study of industrial RE process assessment and improvement with nine U.K software companies. Their findings clearly suggest that significant benefits can accrue from improving the quality of requirements and, by implication, RE processes.

The figures and facts listed above depict the reality of RE depression. From an economic point of view, although RE may only amount to 10%-15% per cent of the overall cost of system development (Clark, 1999), the consequences of getting requirements wrong have a disproportionately high impact on further development phases. For example, an early study by Boehm and Papaccio (1988) indicates that it normally costs $1 to locate and fix an error in RE phase, $5 in the design phase, $10 in the coding phase, $20 during testing, and up to $200 after system delivery. Although the above example dates back over 20 years, it is believed that the ratio remains the same today. A more recent empirical study confirms this finding and indicates the high maintenance costs associated with poor RE processes (Hall et al., 2001). In this sense, the motivation of RE process is simple: "to reduce the high cost of misunderstanding between user and designer, so that computer systems are built to do what the users want, on time and at a reasonable cost (Sutcliffe, 2002, p. 4).

1.1.2 What is a "requirement"?

The term 'requirement' and 'RE' are often shared with other disciplines such as system engineering and product design (Zave, 1997). Although I cannot claim sole ownership, the term of 'requirement' and 'RE' used in this thesis is only limited to the scope of SE.

All software projects begin with a set of statements regarding the descriptions of how a software product should perform. Britton (2000) thus defines a requirement as "a feature or behaviour of the system that is desired by one or more stakeholders". Most previous research in RE also adopts this view of requirements as a set of objective and definable facts. However, requirements in real practice often remain vague and informal. For example, Harker et al., (1990) indicate requirements are often not made explicit and thus are specified in a way that lacks precision. Goguen (1996) also argues that requirements are more than just a set of definable and formal statements concerned with the functionality of the system. Indeed, a requirement is "embedded in the social worlds of users. It is informal and depends on context for its interpretation" (Goguen, 1996, pp 102). My view of 'requirements' thus is not in line with previous work (e.g. Britton, 2000; Zave, 1997), which recognises requirements are objective artefacts that can be clearly defined and captured like 'butterflies', as observed by Dobson and Strens (1994). Instead, I take the view argued by Flynn and Jazi (1998) and Coughlan and Macredie (2002) that requirements are emergent, and socially constructed by interactions between user and developers.

1.1.3 What is RE?

There are many definitions of RE, however, from very different perspectives reported in the SE literature. For example, Sommerville and Sawyer (1997: 19) adopt a process view and define RE as "all activities involved in discovering, documenting, and maintaining a set of requirements for a computer-based system". Bubenko et al., (1994: 154) focused on the principle RE task which is "how to proceed from informal, fuzzy individual statements of requirements to a formal specification that is understood and agreed by all stakeholders." Zave perhaps provides one of the most cited and comprehensive definitions of RE:

"Requirements engineering is the branch of software engineering concerned with the real-world goals for, functions of, and constraints on software system. It is also concerned with the relationship of these factors to precise specifications of software behaviour, and to their evolution over time and across software families"

Zave (1997: pp315)

In my view, much of these definitions retain a rationalistic and technical viewpoint, and emphasise the formalisation of software specification and their flowdown to system design and verification. Little attention is given on the social aspects of the RE process. As I discussed in the previous section, requirements are more than just a set of technical statements concerned with the functionality of the system. As a result, RE is more than a technical process. Instead, it is inherently a human endeavour. Nuseibeh and Easterbrook (2000: 25) argue that "the context in which RE takes place is usually a human activity system and the problem owners are people. Therefore, RE needs to be sensitive to how people perceive and understand the world around them, how they interact, and how the sociology of the workplace affects their actions" (Ibid[2]). In the next section, I discuss how RE can be viewed as a social process.

1.1.4 RE as a social process

Coughlan and Macredie (2002) suggest two dominant viewpoints that can be taken on RE research:

1. A rationalistic problem-solving viewpoint, which recognises requirements as a definable problem, and can be solved by a formalised specification of requirements and then progress in logical steps to development of a rigorous and stable system. There is an underlying assumption that requirements exist and can be captured.

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[2] Ibid (Latin, short for *ibidem*, "the same place") is the term used to provide an endnote or footnote citation or reference for a source that was cited in the preceding endnote or footnote. It is similar in meaning to idem (meaning something that has been mentioned previously; the same) abbreviated "Id.," which is commonly used in legal citation.

2. A social-oriented viewpoint, which suggest the problem area is vague and ambiguous and needs to be located and defined in context. This viewpoint therefore argues that requirements do not simply exist in the social setting waiting to be captured, but emerge as part of ongoing interactions and negotiations between stakeholders.

A social-oriented viewpoint on RE is adopted in this thesis. The fundamental assumptions behind the two viewpoints are product-centred on the one hand and human-centred on the other and so tend to "discriminate by the degree and quality of communication" (Coughlan and Macredie, 2002, pp48). Communication is of course one of the key issues in any collaborative activity such as software development and RE in particular. There have been numerous empirical studies that have been reported in the literature to investigate the different types of problems experienced in the RE process, and almost all of them repeatedly highlight communication as a key problem (e.g. Curtis et al., 1988; Al-Rawas and Easterbrook, 1996; Hall et al., 2002).

RE is a communication-intensive process, which involves the extensive interactions among a wide range of stakeholders from different backgrounds with different individual and organisational goals. Communication in RE is socially created by people who interact (Kensing and Munk-Madsen, 1993). In this sense, the fundamental nature of RE is a social interaction process. This is why Goguen (1996) argues that purely technical based RE approaches taking a rationalistic problem-solving viewpoint cannot take adequate account of the social, political and cultural factors that are so often responsible for the failure of software systems.

1.2 An overview of conflict and its resolution in RE

The importance of conflict has been studied in many fields including Philosophy, Sociology, Psychology, Communication, Organisational Behaviour, and even Biological Science. Having recognised that conflict is an important social concept, conflict is also a major organisational phenomenon (Rahim, 2000). In this thesis, I particularly focus on the conflict that may occur in developing software system within

an organisational context. This sections provides an overview of conflict and its resolution in the context of RE.

1.2.1 An overview of conflict in SE and RE

Conflict has received increasing attention in the recent SE literature, as empirical studies suggest that conflict is an inevitable part of the software development process, and that conflict consistently and negatively affects software project success and team performance (Sawyer, 2001; Cohen et al., 2004; Yeh and Tsai, 2001). For example, Cohen et al., (2004) identify the causes and consequences of conflict in the software testing process. Sawyer (2001) identifies the negative relationship in intra-group conflict and poor software team performance in a packaged software development context. Furthermore, Domino et al (2003) explore the role of conflict and conflict handling styles in collaborative software development. Elliott and Scacchi (2004) describe how conflict emerges, is communicated, mitigated and resolved in a globally dispersed open source software development project.

Conflict also has been recognised as an inevitable part of RE. Sommerville and Sawyer (1997) state that RE is both a social and technical process involving extensive interactions among different stakeholders (e.g. customers, users, developers, testers) from different backgrounds and with different individual and organisational goals. In the current RE literature, conflict is widely acknowledged as a single technical issue that may lead to "inconsistency" in the requirements specification, which is characterised with a sort of conflicting requirements. With this perspective, most current research in RE focuses on presenting automated methods or techniques for modelling and analyzing conflict e.g. KAOS (Van Lamsweerde, 2000), Problem Frames (Jackson, 2000) and I* (Yu, 1998) or automated conflict identification and resolution tools e.g. Oz (Robison, 1990), Synoptic (Easterbrook, 1996), or groupware and negotiation support tools e.g. the Win-Win (Boehm et al, 1995); Fairness analysis by Finkelstein et al., (2008). Existing works are strongly underpinned by a rationalistic viewpoint, which view the requirements are a set of objective facts and can be formalised and defined by applying scientific methods. With this viewpoint, they largely focused on addressing the result of conflict rather than its causes and roots, and pay little attention to the socio-psychological aspects of the conflict. Furthermore, little empirical work has been done to investigate the nature of conflict

and its likely impacts on the RE process. This thesis is thus a response to this knowledge gap in the RE literature.

1.2.2 A working definition of conflict

It is essential to define the term conflict as it will be used as a working definition in this thesis. As this thesis focuses on the social aspects of conflict, Barki and Hartwick's (2001:157) definition of conflict is used:

> "A *phenomenon that occurs between interdependent parties as they experience negative emotional reactions to perceived disagreements and interference with the attainment of their goals*."

This definition provides a more holistic view of conflict and captures the social aspects of conflict. Most importantly, this working definition allows this thesis to be different from those existing conflict studies in the RE literature, which superficially define conflict as something arising out of differences between goals and desires of participants in the system development, and further lead to inconsistency in a requirements specification (Van Lamsweerde, 2000, Easterbrook, 1996, and Robison, 1990). Detailed discussion of this definition and various characteristics of conflict can be found in Chapter 2.

1.2.3 Overview of conflict resolution in RE

There are many conflict resolution approaches proposed in the conflict literature. Pruitt and Carnevale (1993) indicate that conflict is best resolved by a joint decision-making process, which includes negotiation and its close cousin mediation. Negotiation involves a series of discussions between two or more parties with the 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.

In the RE literature, there is an increasing understanding of the RE process as a joint decision-making process (Evans et al., 1997; Macaulay, 1999; Aurum and Wohlin, 2002; Regnell et al., 2003). Sommerville and Sawyer (1997: 24) point out that the

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

However, both negotiation and mediation can be viewed as a form of join decision-making process. The fundamental difference between negotiation and mediation is that, negotiations often only involve conflicting parties themselves reaching an agreement. Mediation involves a third party as a mediator to lead the process and help parties to reach an agreement. This thesis argues that conflict resolution in RE is more than just a negotiation process, which is described by Boehm et al, (1998) and Damian et al., (2001). Instead, it can be viewed as a socially meditated process, in which a requirements engineer acts as a independent mediator to assist different stakeholders from different backgrounds with different individual and organisational goals to resolve conflict, and eventually produce a consistent, accurate, stable, and complete requirement specification (Ma et al., 2008c). Detailed discussion of the conflict resolution methods in RE can be found in Chapter 3.

1.3 A rationale for building the NREMM

This thesis adopts a multi-disciplined approach to building a RE specialised mediation model. Within the SE community considerable attention has paid to studying technical problems with methods based on the natural science model. However, a software system influences and is influenced by the social environment in which it is introduced. This has led researchers to call for multidisciplinary approaches which draw on other disciplines to study the complexity of its social environment (Seaman, 1999).

Nuseibeh and Easterbrook (2000) indicate that theoretical SE research provides a fundamental framework to specify the required behaviour of software systems by adopting a rigorous and systematic formal reasoning approach. But, they further note that "RE is a multi-disciplinary and human-centred process". As a result, many techniques that prove useful do not come from computer science research, but from organisational theory, group interaction research, interviewing techniques, and

practical experiences (Potts, 1991). For example, Viller and Sommerville (1999) draw on the theory from anthropology, and provide a methodological approach to observing human activities that helps to develop a richer understanding of how computer system may help or hinder those activities. The theory from the field of linguistics also plays an important role in RE, as RE is fundamentally based on communications between people. Tools from linguistics can also be used in requirements elicitation, for example, Burg (1997) proposes a linguistic instrument in RE to analyse communication patterns with an organisation. Sociology also provides a theoretical grounding for understanding the political, culture, and societal impacts on the process of introducing computer-based system (Nuseibeh and Easterbrook, 2000; Thanasankit, 1999 and 2002; Ramos et al., 2005).

In relation to resolving the human aspects of conflict and reaching an agreement in RE, I thus consider applying relevant approaches that have proved successful in the conflict resolution discipline. In this thesis, a relevant mediation approach is review and justified. The model presented in this thesis is based on the original narrative mediation model, as described by Winslade and Monk (2000). The original model is well-established in the mediation discipline, and recognises mediation as a story-telling process (Cobb, 1994). Detailed discussions of the relevance of narrative mediation to RE can be found in Chapter 3.

1.4 Research aims and questions

This thesis aims to develop a theoretically robust and practically useful NREMM to help RE practitioners identify, define, and resolve conflict among different stakeholders in the RE process. This thesis seeks to address the following four key research questions: (Table 1 summarises the four key research questions)

1. **What is the nature of conflict in the RE process?** This research question seeks to identify the nature of conflict experienced by practitioners in the RE process, and has three lower-level objectives. The first is to identify the various types of conflict in the RE process. The second is to understand the causes of conflict in the RE process. The third is to identify the consequences

of conflict not only on the quality of the requirements document and but also on the effectiveness of the RE process. The answer to this research question provides a better understanding of the nature of conflict. The answer also generates new insights into the implications of conflict, and further helps inform the development of an effective approach to the resolution of conflict. The literature review in Chapter 2 answers this research question.

2. **How can a theoretically robust narrative RE mediation model (NREMM) be developed?** This research question first examines a wide range of conflict resolution methods by reviewing the multi-disciplinary literature, and then focuses on justifying why a narrative mediation approach is being adopted as the theoretical foundation to the NREMM. This research question also seeks to show how the Winslade and Monk's (2000) narrative mediation model can be rigorously and systematically translated to the context of RE.

   Chapter 3 discusses the theoretical background of this research question by conducting an analysis of multi-disciplinary literature. Chapter 4 presents the findings of this research question by following a transparent and systematic methodological approach.

3. **Is the NREMM theoretically robust?** This research question aims to assess whether the NREMM is theoretically robust. This research question also sets out to theoretically assess whether the motivation for developing the NREMM can be justified and whether the NREMM meets its purpose, which aims to effectively help RE practitioners to identify, define and resolve conflict in the RE process.

   Chapter 6 presents the findings of this research question through an interview survey of an RE expert panel.

4. **Is the NREMM practically useful to resolve conflict?** This research question sets out to evaluate whether the NREMM is practically useful in a simplified real-world context. As the NREMM is designed to be not only theoretically robust but also practically useful.

Chapter 7 presents the findings of this research by conducting a quasi-experiment. A series of quasi-experiments also show how the NREMM being implemented in a simplified real world context.

	Research question	Aims and objectives	Methods	Designated chapter
RQ1	What are the nature of conflict in the RE process?	Identify the different types, causes, and consequences of conflict in the RE process	Literature review	Chapter 2
RQ2	How can a theoretically robust narrative RE mediation model (NREMM) be developed?	Develop a transparent, rigorous, and systematic methodological process Translate a theoretically robust NREMM	Reviewing multi-disciplinary literature	Chapter 3 and 4
RQ3	Is the NREMM theoretically robust?	Empirically assess whether the NREMM is theoretically robust and meet its objectives	An expert panel interview	Chapter 6
RQ4	Is the NREMM practically useful to resolve conflict?	Empirically evaluate whether the NREMM is practically useful	Quasi-experiment	Chapter 7

Table 1: A summary of research questions

1.5 Contribution to knowledge

This study is original and critically important as there are no previous studies that address the social aspects of conflict in RE practice by developing a RE specialised conflict resolution model (NREMM). This research will contribute to the current body of RE knowledge in the following three ways:

1. **Theoretical contribution.** This thesis is the first attempt in the RE community to apply existing narrative mediation theory into RE to improve the way RE practitioners address the social aspects of conflict. I propose a conceptual model for RE practitioners to resolve conflict underpinned by a strong "story-telling" theoretical basis. This is an important theoretical contribution to the literature, as I am the first person in the RE community to argue that conflict resolution in RE is a socially mediated process by drawing on theories from conflict resolution and mediation. Through survey interviews of a RE expert

panel, this research also highlights the social aspect of conflict and provides an improved understanding of the nature of conflict in RE.

2. **Methodological contribution.** This thesis presents a transparent, systematic and rigorous methodology to translate the original Winslade and Monk's narrative mediation model to the context of RE. I explicitly show the details of where the model originally comes from, why the original narrative mediation model is applicable to the context of RE, how the original model is translated into the context of RE, and how the RE specialised mediation model is empirically validated and evaluated by an RE expert panel and a simplified real-world context. Although many existing RE studies present their novel methods by borrowing theories from the other disciplines, there is little transparency provided into their methodological development process. The transparency makes my model development methodology transferable, reusable and replicable, and therefore contributes to further academic researchers who also seek to translate relevant theories from other disciplines to improve the RE practice. This transparency also helps the reader to gain a deep understanding of the origin and strength of the NREMM.

3. **Practical contribution.** The NREMM aims to be not only theoretically robust but also practically useful. In this sense, the NREMM also makes a practical contribution to RE practitioners. The NREMM provides step by step guidance on helping RE practitioners effectively set up requirements workshops to resolve conflicts of interest, goals, and requirements. By applying the NREMM, the RE practitioners not only can achieve an agreement on conflict but also improve the stakeholders' cooperativeness and satisfactions by jointly developing a shared story of a proposed software system. Better stakeholders' satisfaction on requirements can be vitally important for the later stages of software development (e.g. a better user acceptance of the software).

1.6 An overview of research approaches

Although many models, frameworks, and methods are proposed by RE researchers, few studies provide details of the process of methods development. My NREMM

model development process is inspired by Niazi et al.,'s (2008) work of developing a RE maturity measurement framework (REMMF). In their REMMF development, they employ a wide range of data sources (e.g. RE literature, empirical data, existing RE models, and combined with authors' industry research experience) and follow a rigorous and systematic process to ensure the validity of the proposed framework.

To develop the NREMM, this thesis adopts a combination research approach based on an analysis of the multi-disciplinary literature and an empirical approach. A variety of empirical data sources are employed e.g. interview data from a panel of RE experts and findings from an experiment study. The analysis of the multi-disciplinary literature provides a solid theoretical platform to inform the development of the theoretical aspect of the NREMM. An empirical approach is then adopted for assessment and evaluation purposes. The empirical approach is characterised by a combination of qualitative and quantitative approaches of data collection and analysis based on guidelines by Kitchenham et al., (2002b); Yin (2003), Lethbridge et al., (2005); Seaman, (1999); Beecham et al., (2005). Figure 1 shows an overview of research approached adopted in this thesis. For details of the NREMM development process and the empirical research design, see Chapter 5 and Chapter 6.
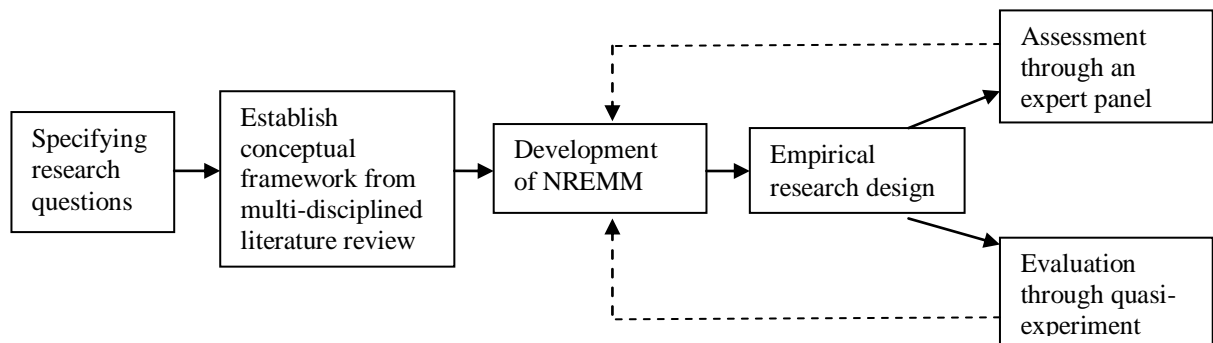
Figure 1: Stages involved in developing NREMM

1.6.1 Empirical assessment and evaluation

Empirical assessment and evaluation is an essential part of any method development. In this thesis, once the theoretical-based NREMM is proposed, it is subject to empirical assessment and evaluation. A semi-structured interview of a panel of 10 RE experts is used to assess whether the model meets its design purpose and identifies the model's key strengths as well as the areas needed to be improved. Evaluation of the

model is then through a quasi-experiment approach based on a simplified real-would RE negotiation workshop scenario using the University of Hertfordshire's StudyNet learning environment software systems (for details, see Chapter 6).

1.7 Overview of thesis

The argument of this thesis then proceeds in the following 8 chapters to address the above five research questions:

More specifically, Chapter 2 is a review of the related literature regarding the nature of conflict. This chapter responds to the first research question, which is concerned with the nature of conflict in terms of its types, the causes and the consequences of conflict in the process of RE. In addition to review the nature of conflict in RE, this chapter also examines the existing conflict resolutions approaches that are used by the currently RE research community.

Chapter 3 first presents a review of the literature addressing conflict resolution methods in the context of RE. This chapter first goes back to the original disciplines from where conflict resolutions emerge to produce a brief overview of all relevant theories related to the study of conflict resolution. This chapter further reviews the literature from the mediation literature. Chapter 3 finally focuses on discussing the theatrical background of the second research question by justifying why a narrative mediation approach is applied in this research as a conflict resolution method.

Chapter 4 details the process of translating Winslade and Monk's (2000) narrative mediation. In particular, a systematic and transparent methodological approach is described at the beginning of the chapter. Winslade and Monk's (2000) narrative mediation includes three phases. In the chapter, all three phases are translated into the context of RE based on an analysis of the multi-disciplinary literature. The result of this chapter is a purely theoretical based NREMM, which subsequently leads to be empirically assessed and evaluated.

Chapter 5 described empirical research methods used in this research. In particular, this chapter provides a detailed explanation of the rationale behind the choice of a

particular research method. Finally, the limitations of research methods used in this thesis are discussed.

Chapter 6 presents a detailed study of how a theoretical based NREMM being empirically assessed through a panel of RE expert. The key purpose of this evaluation is to determine whether the NREMM is theoretically robust. This chapter justifies the choice of choosing an expert panel and provides a detailed description of the process of designing an expert panel. Results are finally presented and discussed, which leads to recommendations for improving the NREMM.

Chapter 7 presents a detailed study of how the NREMM model being empirically evaluated in a real-life scenario by using real users of a real system. The key purpose of this evaluation is to determine whether the NREMM will be practically useful in real-life context. This chapter provides a detailed description of the process of designing and conducting a quasi-experiment. Empirical results are finally presented and discussed.

Chapter 8 presents the main conclusions of this research with a set of implications for future research. The final chapter also highlights the major contributions and the limitation of this research.

On these foundations, the thesis proceeds with a detailed description of the research.

Chapter 2: A review of the literature on the nature of conflict

2.1 Introduction

This chapter presents a review of the literature addressing the nature of conflict in the RE process. This chapter responds to the first research question posed in Chapter 1:

RQ1: What is the nature of conflict in the RE process?

To address this research question, this chapter reviews the relevant literature in terms of the types of conflict, the causes of conflict, and the consequences of conflict in the process of RE. In addition to reviewing the nature of conflict in RE, this chapter also examines the existing conflict resolutions approaches that are used by the currently RE research community. Despite conflict being recognised as an important phenomenon in the SE and RE community, few empirical studies explicitly and systematically investigate the nature of conflict. A review of the literature presented in this chapter provides a comprehensive and accessible account of what is already known and identifies what is problematic and remains to be understood.

Research into conflict is very much multi-disciplinary. Having recognised that conflict is an important social concept, conflict is also a major organisational phenomenon. This thesis is particularly interested in organisational conflict that may occur while developing software within an organisational context rather than diplomatic conflict or intrastate conflict. Therefore, the literature surveyed in this chapter is largely drawn from the fields of Organisational Behaviour, Information System (IS), and SE rather than from International Relations, Sociology, and Politics. Drawing the literature from different disciplines enables me to compare the different conflict studies against one another and to identify the common issue and the differences.

This chapter organises as follows. The first section (2.1) discusses the definition of conflict and its associated characteristics in the context of RE. Section 2.2 examines different types of conflict, which commonly exist in the RE process. Section 2.3 reviews the existing studies, which investigate the factors causing conflict in the

overall software development process. Section 2.4 identifies the likely impacts of conflict not only on the quality of the requirements document and but also on the effectiveness of the RE process. Section 2.5 summarises how current RE research community handles conflict. Section 2.6 concludes the chapter.

2.2 A definition of conflict

It is essential to define the term conflict used in this thesis and how it relates to the context of RE at the very beginning. There is a large and growing literature in the field of Organisational Behaviour on the subject of organisational conflict, however the term "conflict" has been used variously in the literature. For example, Pondy (1967) uses the term of conflict to describe an antecedent condition (e.g. scarcity of resources, policy differences) of conflicting behaviour. Thomas (1992) uses the term conflict to describe the affective states (e.g. stress, tension, hostility, anxiety) of individuals involved in a conflicting situation. Deutsch (1973) then primarily refers to conflict as cognitive states of individuals with their different perceptions or awareness of conflicting situations. Finally, Domino et al., (2003) describe conflict as "conflicting behaviour, ranging from passive resistance to overt aggression".

In the RE literature, the term conflict is weakly and vaguely defined. There are also various uses of the term conflict in the RE and SE literature. Damian (1998) argue that part of the problem of dealing with conflict in RE is that conflict is not easy to define, although many different examples of conflict have already existed in the RE literature. For example, Easterbrook (1996) particularly focuses on the cognitive states of individuals, and defines conflict as arising because of "difference between the goals and perceptions of participants in the system development process". Robinson (1990) focuses on conflicting behaviours and gives an example of user involvement and resistance in defining requirements for a university admission system. Hoh (1998) and Finkelstein et al., (2008) focuses on conflicts among quality-attribute requirements from multiple stakeholders and therefore propose their automated negotiation supporting tools. Similarly, Damian et al., (2000) highlight the scarcity of resources in RE, and indicate that conflict between stated constrains are a major type of conflict in RE. Despite these different examples of conflict have been acknowledged in the SE

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and RE literature, there is fundamentally a lack of clarification and definition of the term of conflict. Previous research largely focuses on a certain form of conflict, and fails to capture the various dimensions of conflict.

Thomas (1992) noted two-level uses of conflict in the literature by reviewing several definitions of conflict:

1. The first use refers to incompatible response tendencies at an individual level, e.g., behavioural conflict where one must choose whether or not to pursue a particular course of action, or role conflict where one must choose between several competing sets of role demands.

2. The second use refers to conflict that occur between different individuals, groups, organisation s, or other social units; thus, the terms interpersonal, inter-group, inter-organisational, and international conflict.

I adopt the second use in this research to focus on conflict among different stakeholders' group in the RE process. The nature of the RE process is rich in interactions, and therefore involves a variety of stakeholders e.g. customers, end-users, testers, requirements engineer, developers, maintainers. As Thomas (1992) argues, conflict is perceived as more serious and intensive when it involves larger numbers of people, more events, or greater influence over future interactions. Conflict is more likely to emerge between the key stakeholders who initiate system development and have more direct and extensive interactions between each other. As a result, this thesis focuses on conflict among those key stakeholders that I broadly categorise into two: user groups and developer groups. The user group typically includes customers, managers, and end-users. The developers' group includes developer, tester, project manager, and requirements engineer. With this perspective, conflict can emerge between users and developer groups. Conflict can also emerge within the same group.

Although definitions of conflict are not identical, the following three common characteristics of conflict have been identified in the context of software development by Barki and Hartwick (2001):

- **Interdependence** exists when each party's attainment of their goals depends, at least in part, on the actions of the other party. Without interdependence, the actions of each party have no impact on the outcome of the other party. Stakeholders involved in RE are all interdependent. Requirements engineers depend on the users who provide the information regarding functional and non-functional requirements of the proposed software system. Both users and requirements engineers depend on their managers who provide commitment, support, and resources. Both users and requirements engineers also reply on developers who will implement the system by translating a requirements specification into programming code.

- **Disagreement** exists when parties think that a divergence of values, needs, interests, opinions, goals, or objectives exist. However, disagreement is not necessarily sufficient for conflict to occur. Disagreements do exist at the stage of gathering customer requirements, and are regarded as the most obvious characteristic of existence of conflict in RE (Easterbrook et al., 1993; Easterbrook, 1996). This is because stakeholders involved do often have divergent opinions, interests, or goals that may potentially result in the disagreement.

- **Interference** exists when one or more of the parties interferes with or opposes the other party's attainment of its interests, objectives, or goals. Interference thus represents the central behavioural characteristic of any conflict. In RE practice, when stakeholders are involved in a conflicting situation and act solely with their own interests in mind, their actions are likely to interfere with other parties. A typical example is that users may refuse to collaborate with requirements engineers by providing irrelevant requirements information when they consider the proposed software project as a threat (Smith and McKeen, 1992).

In addition to these three characteristics of conflict, Barki and Hartwick (2001) argue the importance of incorporating negative emotion into the definition of conflict. Emotions are an important element to conflict because they define individuals' subjective interpretation of reality and reactions to conflicting situations. The negative emotions include jealousy, anger, anxiety, or frustration. Thomas (1992) points out

that conflict is often associated with stress and threat, which increase emotional responses and negative arousal. In the context of RE, these emotions are thought to occur when there are major disagreements and debates, or when parties interfere with the attainment of each others' goals. Such emotional responses are common when software systems are viewed as a threat by users (Smith and McKeen 1992). In light of this, Barki and Hartwick (2001:157) note that a good definition of conflict needs to includes the above four characteristics. Thus, they define 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*."

For the purpose of this research, I adopt the above definition to capture the four dimensions of conflict. Using this definition allows this study to be different from previous RE studies of conflict, which superficially consider conflict as a technical issue of causing inconsistency, which is the sole result of disagreements between stakeholders (Robison, 1990; Easterbrook, 1996; Hoh, 1998; Hoh and Boehm, 2001; VanLamsweerde, 2000), Moreover, the purpose of this section is not only to provide a definition of conflict, but most importantly to inform later empirical study to capture the key dimensions of conflict emerged in the RE process.

2.3 Types of conflict

Rahim (2002) suggests that it is best to classify conflict based on their cause for better understanding of its nature and implications. Different types of conflict based on cause are well-documented in the literature. Jehn (1997) indicates that two major types of conflict are predominantly reported in the literature based on cause: *substantive* and *affective*. Ware and Barnes (1992) indicate that *substantive* conflict involves disagreements over organisational practices, such as policies, procedures, roles, and responsibilities; and *affective* conflict involves highly personal perceptions and feelings about other people and about the substantive issues. Sometimes, substantive conflict is also regarded as task-related conflict, and affective conflict is regarded as emotional conflict, characterised by interpersonal disagreements not directly related to the task (Robey and Farrow, 1982; Jehn, 1997).

In the SE literature, few studies explicitly distinguish the different types of conflict that may occur in the process of developing a software project except Birkin et al., (2002)'s study of conflict in the software testing process. Three types of conflict are identified by Birkin et al., (2002): goal, cognitive, and emotional conflict. They further classified *substantive* conflict into goal and cognitive conflict. Goal conflict occurs due to each individual or group preferred outcomes appear to be incompatible or different; Cognitive conflict occurs due to understanding, ideas or thoughts are incompatible or different; Affective conflict is concerned with incompatible feelings or emotions. In this thesis, I draw on Birkin et al.,'s (2002) three types of conflict model as a framework to discuss the existence of three types of conflict in the context of RE. Birkin et al.,'s (2002) category of three types of conflict is also used in the further empirical study (Chapter 6) as a data analysis framework.

2.3.1 Goal conflict

Recently the term 'goal' has been extensively used in the RE literature, and been recognised as an essential part of the RE process (Nuseibeh, 1996; Easterbrook, 1996; Yu and Mylopoulos, 1998; VanLamsweerde, 2001; Sommerville, 2001; Elahi and Yu, 2007). As goals provide the rationale for analysing why requirements exist and some underlying objectives which provides the basis for the requirements (Yu and Mylopoulos, 1998). In general, a goal is defined as a "high-level objective of the business, organisation or something that some stakeholder hopes to achieve in the future" (Kim et al., 2004). In the context of RE, a goal can be defined as an objective the software system under consideration should achieve (VanLamsweerde, 2001; Yu and Mylopoulos, 1998). As software development gets complex and involves more stakeholders, goals and requirements gathered from different stakeholders can lead to conflict. As a result, goal conflict is recognised as the most common type of conflict in the RE process. As Boehm (1996) and Sommerville (2001) have convincingly argued that stakeholders involved in RE are from different organisational departments with different individual and organisational goals, and therefore may pull the system in different directions, which potentially leads to conflict.

2.3.2 Cognitive conflict

Cognitive conflict is other common type of conflict in organisational life. It occurs when understanding, ideas or thoughts are incompatible or different. Cognitive conflict in RE is also well-recognised, and is concerned with the difficulties people have in describing their needs of the proposed software system. For example, Nuseibeh and Easterbrook (2000) indicate that "problem domain experts often have large amounts of tacit knowledge that is not amenable to introspection; hence their answers to questions posed by requirements engineer may not match their behaviour. Also, the requirements engineer may need to model users' understanding of software user interfaces, rather than relying solely on implementers' preferences." More specifically, Easterbrook (1993) points out that cognitive conflict is about different perceptions and understandings between participants in the system development process. Coakes and Clarke (2005) further argue that even stakeholders having similar goals, conflict still often arise due to their different understanding of the same problem as different stakeholders having different educational background and cognitive perceptions.

2.3.3 Affective conflict

Affective conflict also refers to social-emotional conflict, which is characterised by interpersonal disagreements not directly related to the task (Jehn, 1997). Nevertheless, it is often possible that task-related or substantive conflict transforms into affective conflict (Ibid). As mentioned in section 2.1, emotion is an essential part of organisational life, and is inevitably involved in a conflicting situation. If organisational members cannot consistently agree on task issues, they may begin to dislike each other and attribute this task-related conflict to personality issues associated with some negative feelings such as jealousy, hatred, anger, and frustration. The occurrence of affective conflict is well recognised in the IS and SE literature. For example, Lamp et al., (2003) show how affective conflict between developers' group and users' group emerges and are handled in a case study in an Australian software company. Ramos and his colleagues (2005) carried out in-depth case studies in four organisation s to investigate the impact of introducing an IT based software system, and indicate that the introduction of any IT based software system may interact with the user's values and beliefs and trigger negative emotional responses and resistance

to change which are sometimes directed against the development process and project success.

Although the evidence from the SE literature strongly confirm the occurrence of affective conflict in the overall software development process, little attention is given on the process of RE. As a result, there is little evidence existed in the RE literature regarding the emotional aspect of conflict emerges in the process of discussing and negotiating divergent and even conflicting goals and interests among different stakeholders. This is not surprising, as Damian (1998) argued that many existing conflict studies in RE focus on proposing technical modelling methods and tools to address goal and cognitive goal, and the social-psychological aspect of conflict received little attention. In my view, the remaining question is not about whether such affective conflict exists. Instead, the key question remains regarding how affective conflict can be effectively handled by requirements engineers in real RE practice. Ramos et al., (2005) suggest a good requirements engineer also needs to be a psychologist to have a better understanding of how users' values, beliefs and motivations affecting their requirements of the proposed system. In relation to addressing the social-psychological aspect of conflict in RE, a good requirements engineer not only needs to apply various technical analytical tools by resolving goal and cognitive conflict, but also needs to have good mediation or facilitation skills to effectively manage the negative emotions associated with goal and cognitive conflict.

2.4 Causes of conflict

The prevalence of conflict makes it important to understand its cause. The cause of conflict is also referred to potentials, sources, roots, and antecedent conditions that all a unique cluster of factors may lead to conflict. A good understanding of the cause of conflict could help us to formulate methods to effectively deal with it. A variety of causes of conflict have been identified in the literatures across different disciplines. For example, in the Social Science literature, at a broad level, Tjosvold (2006) indicates that it is well-acknowledged that human beings are not identical. They will approach the same tasks with different expectations, goals, and preferred styles of working. They also will have different amounts of resource (e.g. time and money) to commit to the resolution of problem, and even different notions of what the problem

is. These differences are thus recognized as the fundamental causes to conflict (Tjosvold, 2006). In the Organisational Behaviour literature, Jameson (1999:268) point outs conflict occur in an organisation for a variety of reasons, including "scarce resources, interdependent work, differentiated work, competitive reward system, perceptions of inequity, and asymmetrical distributions of power". More recently, Himes (2008) also groups the following conditions under which conflicts frequently arise as:

1. Communicational, including insufficient exchange of information, noise, and the semantic differences that arise from selective perception and difference of background
2. Structure, which includes the goal compatibility of members of the group, jurisdictional clarity, and leadership style
3. Personal factors, including individual value systems and personality characteristics

My intention here is not to attempt exhaustive coverage of all potential causes from a variety of literature. Instead, I am more interested in the causes of conflict under certain circumstances: developing a software project within an organisational context, in particular, the process of RE. As a result, the material drawn on here is mainly from the IS and SE literature because the generation and resolution of conflict is of central theoretical interest to information system development (Newman and Robey, 1992).

The causes of conflict in the SE process probably were first described by a classic field study of software projects by Curtis et al., (1988). They focused on the behavioural aspects of a software design team, and identified three major causes of conflict: the thin spread of application domain knowledge; fluctuating and conflicting requirements; and breakdowns in communication and co-ordination. They further note that organisational and human factors should also be considered, from change in the organisational setting and business milieu, to the fact that the software will be used by different people with different goals and different needs.

Macaulay (1999) takes a similar view and suggests that software project teams involving people with differing levels of knowledge, skills and experience can be a

major source of conflict. By looking at organisational factors, Barki and Hartwick (2004) suggest that conflict maybe due to a divergence of departmental interests or goals, interference in the attainment of goals or resources, and interdependence among parties. By looking at the levels of individual human functioning, Banner (1995) proposes a theory of two-level conflict cause and points out that conflict is mainly due to people's insistence on something at either the physical or mental level. At physical level, Banner (1995) notes that when people are in a world where consensual agreement over the use of scarce resources is needed, the possibility of conflict at a physical level is high. Alternatively, when people become attached to their own ideas, beliefs, concepts, values, and think that they hold the "truth" in a given situation, they then disagree with each other at the mental level (Ibid).

Robey (1984) and Robey et al., (1993) develop a "four-categorisation" model of the causes of conflict in the IS development context. He suggests four major sources of conflict: individual differentiation, sharing of sources, interdependence and distribution of power. Based on Robey's work (1984) and an empirical study of conflict in an information system development context, Barki and Hartwick (2001) develop a more comprehensive four-categorisation of the causes of conflict in the context of software development: individual characteristics, team characteristics, project characteristics, and organisation characteristics. Each categorisation contains a number of unique factors that may affect the level of conflict (see Figure 2).

Individual characteristics
Individual behaviours
Personality
Demographics
Education and experiences
Organisational status
Organisational roles and department
Needs, interests and goals.

Team characteristics
Sharing of resource
Interdependence
Size
Team processes including participation, influence and communication
History including previous conflict, management styles, tactics, and outcomes

Project characteristics
System characteristics and importance
Resources
Time pressure and constraints
Success criteria
Top management support

Organization characteristics
Organizational culture
Organizational climate

Figure 2: Barki and Hartwick's (2001) categorisation of the causes of conflict

Individual characteristics are typically included in some human factors concerning individual stakeholders involved in the process of developing software. Most causes of conflict documented in the existing IS and SE literature are related to individual characteristics rather than team, project and organisational characteristics. For example, Trimmer et al., (2002)'s college data from 88 software development teams and suggest that individual personality diversity in software development teams can impact the perceptions of team conflict and thus be utilised in the selection of team members to produce a more effective and efficient working product. Similarly, in a more recent personality study of a software development team, Kankanhalli et al. (2007) indicate that a team member from an individualistic culture tends to value personal time and the freedom to adopt personal approaches to his/her work. In contrast, a team member from a collectivistic culture tends to value team identity and the presence of team standards for carrying out his/her work. This individualism-collectivism personality therefore has been recognised as a key cause of conflict. Furthermore, Kankanhalli et al. (2007) also suggest that apart from individual's personality diversity, team functional diversity was another key cause of conflict in software development. When people with different functional background work together, they may have dissimilar belief structures (e.g., priorities, assumptions, and understanding) based on their previous training and experiences. For example, people with business and project management background typically see opportunities and issues from different vantage points compared to people with technical background (Leidner and Kayworth, 2006).

For the team characteristics, Sawyer (2001) cites many studies to show that team characteristics serve as common causes of conflict in software development. For example, Newman & Robey (1992) highlight how the act of working together creates a set of social structures with which the software developer work and that guide resource allocation. Kiesler et al., (1994) describe how team resource sharing affects the way software developers work together and leads to conflict. In their own empirical work, Sawyer et al., (1997) also describes how the level of interdependence between software developers on the same team shapes how they deal with conflict. More recently, Paul et al. (2005)'s empirical study conclude that a larger size of project team involves more conflict than a smaller size of team by the results of intensive interactions among the team members.

Project characteristics also include a number of common factors that may cause conflict. For example, Cohen et al., (2004) conduct in-depth field interviews with 10 software testing professionals, and indicate that the most frequently mentioned causes of conflict by the tester and manager is the allocation of time between development and testing. They also cite Umble et al., (2000) and even argue that this is not unique to software testing, as time constraints are a persistent issue in all types of project management scenarios. Furthermore, Cohen et al., (2004) indicate that an organisation's policy and culture also serve one of the common organisational characteristics to result in conflict. More specific, they point out that the lack of status, respect, and support make the tester's job more difficult, as the struggle for recognition becomes the key causes of conflict. This finding is also in line with some recent empirical SE studies focusing on investigating the nature of the interaction between organisational culture and software practice (e.g. Robinson and sharp, 2005) as well as the studies focusing on exploring the de-motivators for software process improvement (e.g. Niazi et al. 2008; Baddoo and Hall, 2003)

In summary, the current IS and SE literature on the causes of conflict is generally focused on overall software and information system development process without distinguishing its specific sub-process (e.g RE process). This leads to exhaustive coverage of various factors e.g. Robey et al., (1993) and Barki and Hartwick (2001). Few empirical studies explicitly examine the cause of conflict in the context of RE. Furthermore, most previous research also fails to show how causes of conflict link to a particular type of conflict. As the scope of this thesis focusing on conflict in RE, this thesis does not intend to empirically verify the exhaustive coverage of various causes of conflict, which are previously developed in previous SE and IS literature. Instead, this thesis focuses on investigating key causes of conflict in the RE process, and particularly aims to map those key causes to the three pre-defined conflict types (goals, cognitive, and affective), which are described in early section 2.1. An analysis of cause of conflict based on their different types provides an in-depth understanding of the nature of conflict, and further help to formulate the more focused and effective methods to address certain types of conflict.

2.5 Consequences of conflict

Because conflict often has the potential to interfere with working performance and product outcome, it is important to understand what impacts it has on the work process and outcome. In much of the classic Organisational Behaviour literature conflict is generally recognised as detrimental to performance and outcome (e.g. Coser, 1956; Pondy, 1967; Deutsch, 1973). Therefore, it is no surprise that organisations view conflict as damaging and with a negative impact, and something to be avoided or resolved immediately (Jehn, 1997). Folberg and Taylor (1994:102) give us two reasons why conflict can be negative in their work on mediation:

> *"Although conflict is not necessarily bad, wrong, or intolerable, our society often views conflict negatively because it is equated with win/lose situations, and conflict is commonly viewed by the participants as a crisis. A crisis mentality lends itself to destructive processes because people will often rush to use anything (usually not the best process) they believe will relieve the conflict."*

However, some studies have shown some positive aspects of conflict: stimulating productivity and creativity. For example, a certain amount of conflict can improve organisational productivity through enhanced understanding of various viewpoints and creative options (Bourgeois, 1985; Eisenhardt and Schoonhoven, 1990). Conflict is also said by some authors as it is essential in an organisation to motivate innovation and encourage creative thinking (Thomas, 1992; Barki and Hartwick, 2001). In particular, Tjosvold (2008) wonder why we have a team if team members have similar backgrounds and think alike. By reviewing a wide range of evidences from the Organisational Behaviour literature, Tjosvold (2008) argues that conflict is highly constructive, indeed, essential to teamwork and organizational effectiveness. With his colleagues, a recent experimental study also provides strong evidence of the value of being predisposed to manage conflict cooperatively for long-term psychological development and health (Tjosvold, 2006). A recent field studies by (Chen and Tjosvold, 2007) also indicates that cooperative conflict can be constructive in the short-term as measured by understanding issues, making quality solutions, and strengthening relationships.

In the SE and IS literature, empirical findings indicate that conflict consistently and negatively affects software project success and team performance. For example, Yeh and Tsai's (2001) survey of 150 IT professionals indicates that manifest conflict between users and developers results in substantive dissension and emotional hostility that negative affect the software project outcome. Sawyer (2001) surveys 40 packaged software project teams and especially focuses on the intra-group conflict among team members to indicate that conflict negatively affects team performance, primarily due to poor communication and poor working relationships. Cohen et al., (2004) are particularly interested in the existence of conflict in the software testing process, and interview 10 testing professionals. Their findings indicate that conflict exists in the testing process and negatively affects testing team performance and their results. Gobeli et al., (1998) survey 78 organisations' 574 IT professionals and indicate that conflict has a strong, negative effect on overall software product success and customer satisfaction. In particularly, their findings suggest that user satisfaction decreases substantially with higher intensity conflict at the organisational level and even more strongly at project level. Domino et al (2003) explore the role of conflict and conflict handling styles in collaborative software development to suggest that high levels of task conflict and poor conflict handling styles have a negative impact on group performance and project outcomes. A very recent empirical study by Karn and cowling (2008) especially focus on exploring the effects of different forms of conflict (tasks, process and relationship) on software team performance during the important feasibility, requirements analysis, and design phases of software projects. By carrying out a detailed field study of three SE teams and recording their conflict experiences, their findings indicate that relationship-related conflicts were more damaging than tasks or process-related conflict. Despite this, they further suggest that the frequency and intensity of specific forms of conflicts are important factors to consider. For example, excessive task conflict can also be damaging because it can interfere with consensus and hinder the implementation of ideas. Incessant task conflict can also lead to emotional exhaustion and is inextricably bound up with psychic tension and stress (Giebels & Janssen, 2005 cited by Karn and cowling 2008).

Little empirical evidence has been reported on the consequences of conflict in the RE process. As mentioned before that most studies of conflict generally focus on the overall system development process. Most importantly, there is a lack of

understanding regarding the consequences of conflict on the quality of the requirements specification. Consistency, completeness and ambiguity are regarded as the three most important factors in determining the quality of the requirements specification (Sommerville and Sawyer, 1997). Nevertheless, some theoretical works in the RE literature do offer some conceptual lenses on these key variables of interest. For example, Easterbrook et al., (1993) indicate conflict is mainly characterised by disagreement, and those disagreements may lead to inconsistency in requirements specification. Kim et al. (2006) indicate that a wide range of inconsistencies can be originated from conflicting requirements elicited from multiple stakeholders involved in the product line development to achieve various functions. Secondly, conflict can also lead to poor communication among stakeholders which may further lead to missing some important information on the requirements (Robison, 1990; Grünbacher and Seyff, 2005). In this sense, the requirement specification can be "incomplete". Furthermore, ambiguity is inherent in the requirements specification due to the use of nature language (Sommerville and Sawyer, 1997). Cognitive conflict may be caused by different and conflicting viewpoints, and therefore may lead to different understandings of the requirements specification (Easterbrook, 1996; Kim, 2006; Damian et al., 2001). Therefore, there might be a possible relationship between the occurrence of cognitive conflict and ambiguity in the requirements specification.

This thesis therefore responds to this gap of the literature identified above, and aims to initially investigate both positive and negative consequences of conflict in the RE process by interviewing a panel of RE experts. This investigation aims to not only explore the consequences of conflict on the quality of requirements specifications, but also explore the consequences of conflict on the effectiveness of the RE process.

2.6 How conflict is currently handled in the RE community?

The term "requirements negotiation" is currently extremely popular in the RE community. Negotiation is recognised as the best way to handle conflict in the RE process. When conflict occurs, requirements negotiation subsequently becomes an essential part of RE: "users negotiate among themselves and with analysts, and tradeoffs are made to resolve conflict" (Nuseibeh, 1996:70). This is also evidenced by

a number of key figures in the SE and RE community who constantly argue that requirements negotiation is a critically important RE activity. For example:

- *"In practice, requirements are negotiated rather than captured, discovered or elicited."* (Goguen, 1994:166)

- *"How requirements were negotiated is far more important than how the requirements were specified."* (Tom De Marco, ICSE 1996's Keynote cited by Hoh et al., 2001)

- *"Problems with reaching agreement were more critical to my projects' success than such factors as tools, process maturity, and design methods."* (Mark Weiser, ICSE 1997's Keynote cited by Hoh et al., 2001)

- *"The quality of decision marking in requirements negotiation affects not only the software product but also the time taken to satisfy the stakeholders' requirements."* (Damian, 2003)

- *"Many software projects have failed because their requirements are poorly negotiated among different stakeholders."* (Boehm et al., 1998)

In 1990, Robison probably was the first person who argued that there exists a lack of clear understanding of requirements negotiation practice in the RE community. More recently, Damian et al., (2008) indicate that requirements negotiation continues to be an ongoing issue and needs more research attention. In particular, it needs more attention in relation to the social-psychological roots of conflict and how to negotiate requirements in global software development and open source development context. Damian and her colleagues conducted a series of case studies to examine how requirements can be negotiated in distributed development settings (Damian et al., 2000; 2003; 2006; 2008). To investigate the social-psychological aspects of team performance, they conducted a series of controlled experiments that compared the performance of group requirements negotiation in face-to-face meetings with that of distributed groups using the Group Support System. Similarly, Elliott and Scacchi (2002) describe how conflict emerges, is communicated, mitigated and negotiated

through a Group Support System in a globally dispersed open source software development context.

Despite the efforts being made on studying requirements negotiation in distributed and open source development setting, few studies in the RE literature examine how conflict is negotiated within a face-to-face meeting or workshop setting. In fact, according to the 1997 survey by Monge et al., (1997), most conflict is negotiated through face-to-face meetings rather than relying on computer-supported negotiation tools. Grünbacher et al., (2003) argue that computer-supported negotiation tools certainly are helpful to deal with some task-related conflicts, but inevitably omit the socio-psychological aspects of conflict. Especially, emotional conflicts are more difficult to deal with. Jehn (1997) suggests that time is often spent on managing interpersonal aspects of the team rather than on task-related and decision-making tasks. Emotional conflict often interferes with task-related effort because members focus on reducing threats, increasing power, and attempting to build cohesion rather than working on the task. Furthermore, emotional conflict causes members to be negative, irritable, suspicious, and resentful (Ibid).

This thesis therefore focuses on studying conflict resolution in the context of face-to-face meeting or workshop setting rather than distributed global software development settings. Without a better understanding of the problems in a face-to-face setting, it would be difficult to pave the way for developing methods that are both efficient and effective in more complicated settings. The use of the more rigorous empirical methods will be valuable in increasing our understanding of the problems in this difficult area. As a result, an empirical study is conducted in Chapter 6 to investigate how conflict is resolved in a series of face-to-face requirements workshop by applying a human based facilitation framework (NREMM). Furthermore, the underlying assumption of using negotiation as a way of resolving conflict in RE is challenged in this thesis. In chapter 3, a new mediation approach is proposed and justified by drawing on the literature from Mediation literature, Conflict Resolution literature, and RE literature.

2.6.1 Existing requirements negotiation models

Damian (1998) reviewed a number of requirement negotiation models, and indicated that three mainstream requirements negotiation models have been reported in the RE literature: Robison (1990)'s Oz model, Easterbrook (1996)'s Synoptic model and Boehm et al., (1995)'s Win-Win. Robison (1990) proposed a formal model of users' desires and resolution methods, and developed a semi-automated tool to promote integrative negotiation behaviour during requirements specification processes. Easterbrook (1996) proposed a model and subsequently developed a semi-automated tool called "Synoptic" for analysis and integration of conflicting domain descriptions. Both Oz and Synoptic adopted a rationalistic perspective and therefore aimed to be a technical tool and to promote the automated identifications and resolutions of conflict. With this perspective, they tended to focus on addressing conflicting requirements or inconsistencies, rather than paying attention to the underlying rational and social-psychological roots of conflict.

Most noteworthy, Boehm and his colleagues developed a highly cited requirements negotiation model – the Win-Win Negotiation Model (Boehm et al., 1998; 2001; Grünbacher et al., 2001 and 2003), which is a further extension of their famous Win-Win spiral software development model (Boehm et al., 1995). The Win-Win spiral model (see Figure 3) is a general software development model to generate stakeholder win-win situations incrementally through the Spiral Model.
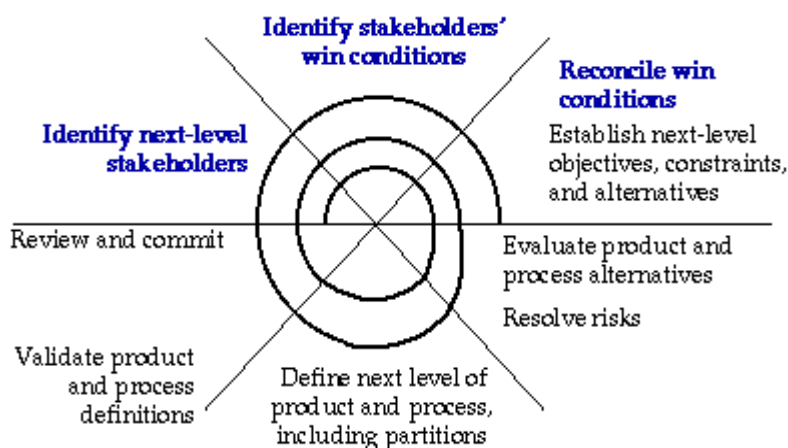
Figure 3: The Win-Win spiral Model (Boehm et al., 1995)

The Win-Win spiral model is based on general management theory W "make everyone a winner". The goal of Boehm's Theory W is to find out the win-win situations that

43

"make everyone a winner" (Boehm et al., 1989). At first glance, most situations tend to be zero-sum or win-lose. For example, he indicates that developing software quickly with little or no documentation may be a low-cost, short-term win for the software developer and the customer, but the maintainer and the user will lose because the lack of documentation makes the product unusable and difficult to maintain. Even worse are software development projects which begin in a *lose-lose* situation, e.g. setting unrealistic schedules, staffing with incompatible people, poor planning. However, win-win situations do exist, and such situations can often be created by careful attention to the interests and expectations of the people involved in the software development project.

The Win-Win negotiation model is a further extension of *step 2* and *step 3* of the Win-Win Spiral model to make it as a specific requirements negotiation model based on Theory W. The Win-Win negotiation model guides stakeholders in elaborating mutually satisfactory agreements by applying the following four steps (See Figure 4): Key Stakeholders involved begin to express their goals as win conditions. If everyone concurs, the win conditions become agreements. When stakeholders do not concur, they identify their conflicted win conditions and register their conflict as issues. In this case, stakeholders invent options for mutual gain and explore the option trade-offs. Options are iterated and turned into agreements when all stakeholders concur. It further has been extended as Easy Win-Win: a groupware-supported methodology for requirements negotiation (Briggs and Grünbacher, 2001; Boehm et al., 2001).
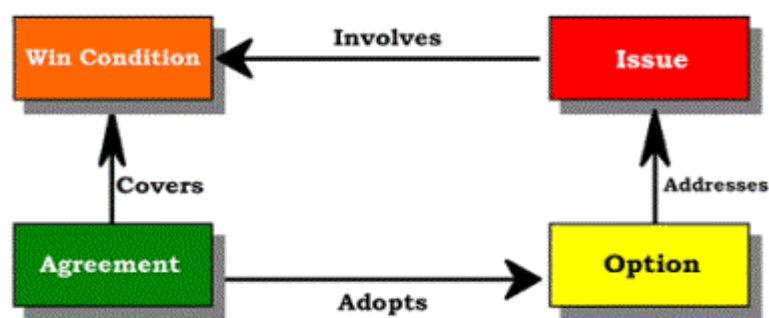
Figure 4: The Win-Win Negotiation Model (Boehm et al., 1998)

2.6.2 Limitations of the Win-Win requirements negotiation models

Although there are few empirical studies to rigorously and systematically validate the usefulness of the Win-Win negotiation model, the lessons learnt reports (e.g Boehm et al., 1998; Boehm et al., 2001) indicated that the Easy Win-Win negotiation supported methodology had been successfully piloted in more than 50 software development projects. The report also showed that the use of the Win-Win negotiation model was generally said to increase cooperativeness, focus participants on key issues and facilitate distributed collaboration. Despite the successful application of the Win-Win negotiation model, its theoretical stance of Theory W is questioned. In reality, a win-win situation that makes everyone as a winner is rare. Even if a win-win solution exists, a good conflict resolution approach should not only focus on achieving mutually acceptable solution to the short-term problem but also need to build and maintain a long-term collaborative relationship (Bush and Folger, 1996).

Typically, Boehm et al.,'s (1998) Win-Win negotiation model is underpinned by Theory W based on the idea of "making everyone a winner", which is similar to the notion of Principled Negotiation – "inventing options for mutual gain" (Bustard, 2002). Principled Negotiation also refers to problem-solving negotiation, and was developed through the renowned Harvard Negotiation Project. Although it was successfully and widely used in many conflicting situations, such as negotiating international peace treaties, industrial disputes, software project and even family mediation (Fisher and Ury, 1983), its fundamental assumption is challenged by new approaches emerged from recent mediation and conflict resolution literature (e.g. Winslade and Monk, 2000; Picard et al., 2004; Picard and Melchin, 2007). In next chapters, an analysis of the multi-disciplined literature is presented to provide a comprehensive overview of a wide range of conflict resolution theories, which are potentially useful in the context of RE. In particular, I will compare and discuss the existing problem-solving approach with a narrative based mediation approach.

Furthermore, all existing RE negotiation models including the Win-Win model, which explicitly build on a rationalistic stance, are inadequate to deal with the social-psychological aspects of conflict. Ramos et al., (2005) indicate the importance of recognition of the social-psychological aspects of RE. In their case studies, they show that introducing software systems bring organisational changes, and those changes could further interact with users' values and beliefs and trigger emotional conflicts.

They thus argue that there is a new mission for requirements engineers above and beyond that of finding functional and non-functional requirements. They must be aware of the potential emotional conflicts, and successfully project and resolve them at an early stage.

2.7 Summary

This chapter presented a review of literature to address first research question:

RQ1: What is the nature of conflict in the RE process?

This research question aims to explore the nature of conflict in terms it type, cause, and consequence. The review of the literature indicates that the existence of conflict is well-acknowledged in the existing RE literature. In terms of different types of conflict, there are three common types of common conflict that exist in the RE process: goal, cognitive, and emotional conflict.

The review of the literature also indicates that there are few empirical studies reporting on the causes and consequences of conflict in RE, most existing studies focus on the overall software and information system development processes without distinguishing its specific sub-process. In order to illuminate the potential causes and consequences of conflict in the context of RE, this chapter draws on empirical evidence from the SE and IS literature and existing theoretical studies in the RE literature.

Finally, this chapter presented a review of existing requirement negotiation models. In particular, this chapter critically reviews the frequently cited Win-Win negotiation model, which is underpinned by problem-solving negotiation theory. An analysis of existing requirement negotiation models indicates that all existing models including the Win-Win model, which explicitly builds on a rationalistic stance, are adequate to deal with task-related conflict, but inadequate to deal with the social-psychological aspects of conflict. The chapter finally raised questions regarding the underlying assumptions and theoretical underpinnings of the Win-Win model, which will be fully answered in next chapter.

Chapter 3: A review of the literature on conflict resolution

3.1 Introduction

This chapter presents a review of the literature addressing conflict resolution methods in the context of RE. This chapter discusses the theoretical background of the second research question (see below) by focusing on justifying why a narrative mediation approach is adopted in this research as a conflict resolution method.

RQ2: How can a theoretically robust narrative RE mediation model (NREMM) be developed?

This literature review includes two parts. This chapter first goes back to the original disciplines from where conflict resolution emerges to produce a brief overview of all relevant theories related to the study of conflict resolution. By reviewing and comparing available conflict resolution approaches, this chapter argues that conflict resolution in RE can be viewed as a form of joint decision-making process. More specifically, it can be viewed as a socially mediated process rather than a negotiation process.

This literature review further reviews the literature from the mediation literature, and focuses on discussing the relevance and applicability of three mainstream mediation approaches (problem-solving, narrative and transformative) to resolving conflicts in RE. There is a strong emphasis devotes on comparing the narrative mediation approach with the traditional problem-solving mediation approach, which underpins the Win-Win negotiation model. This chapter argues that the narrative mediation approach which builds on the story-telling metaphor is also potentially useful to the context of RE, as the fundamental nature of gathering user requirements can be viewed as a storytelling process. Finally, this chapter clarifies the difference between the term "narrative" used in this research and the popular term "scenarios" and "user story" used in the existing RE literature.

3.2 Theories from relevant fields

Conflict is an unavoidable phenomenon, and can be found in all social arenas, from relations between children in the playground to conflict between international nations. As a result, research on conflict and its resolution is very multi-disciplinary, and has been extensively investigated in various disciplines: Sociology, Psychology, Organisational Behaviour, Communication Theory, Economics, Anthropology, Decision Science, Law, International Relations, and Software Engineering. It is worth noting that this chapter does not aim to present a comprehensive description of all relevant theories of conflict resolution. The purpose of this section is only to provide a contextual background and a brief overview of the relevant theories that have originally emerged from the different disciplines. By reviewing and discussing the relevance of all relevant theories, this section argues that this thesis is grounded by a prescriptive theory: group decision-making.

3.2.1 Sociology: Bargaining Theory

Sociology is the study of society and human social interaction. As an inevitable part of human social interaction, conflict has been studied in this field for nearly a century. By recognising conflict as an inevitable part of society, Sociologists also outline approaches for conflict resolution. Strauss (1978) points out that conflict is best resolved by cooperative means. Despite this, Easterbrook et al., (1993) argue that sociologists pay little attention to cooperative approaches. Instead of developing cooperative approaches to settle conflict, sociologists are more interested in developing "a structural approach grounded in sociological conceptions of bargaining" (Carroll and Payne, 1991: 28). It is generally referred to as *Bargaining Theory*, which is "an attempt to produce descriptive models to settle a conflict" (Easterbrook et al., 1993). Bargaining theory originates from a sociological perspective of commercial trading in which the buyer and seller of a good or service dispute the price which will be paid and the exact nature of the transaction that will take place, and eventually come to an agreement (Muthoo, 1999). Due to its non-cooperative nature, bargaining often involves competitions, which concentrate on achieving maximum satisfaction for a participant, without regard for the degree of satisfaction of other parties.

Carroll and Payne (1991) indicate that in bargaining theory, there may be many possibilities not perceived by the participants, which may lead to better resolutions. Bargaining theory does not indicate how these might be found, concentrating instead on the process of competing, bidding and counter-bidding (Muthoo, 1999). In relation to RE, Hohin (1998) indicates that bargaining theory does not allow a cooperative negotiation and always leads to a win-lose situation. Such theory thus has been widely used in commerce and politics, but has very limited uses in the context of software project and requirements negotiation. As a consequence, bargaining theory is not considered in this thesis.

3.2.2 Applied Mathematics and Economics: Game Theory

Unlike the disciplines of sociology, the discipline of Applied Mathematics and Economics is interested in presenting theories to support conflict resolution rather than produce descriptive models to *compete* conflict. Most typically, game theory is a theory of rational decision-making for examining strategic interactions among two or more participants in a conflicting situation (Rapoport, 1974). Real life is full of situations in which people pursue their own interests at the expense of others, which eventually leads to a conflicting situation. Game theory can be used to illustrate these relationships where often the interests of two parties are in direct opposition: the greater the payoff for one party, the less for the other. A more detailed description of the game theory model can be found in (Rapoport, 1974; Shane, 2003).

Game theory provides insights into the strategies and likely outcomes available to participants in a particular situation (Dutta, 1999). Based on a rational analysis given by the game theory model, participants can better assess the potential effects of their strategies, and can make decisions that will more likely produce the desired goals and avoid conflict (Gintis, 2000). It thus has been widely advocated for planning strategies and forecasting decisions in a conflicting situation (Myerson, 1997; Dutta, 1999; Gintis, 2000). However, in the context of RE, Easterbrook (1996) points out that game theory is not applicable for the context of RE because it is highly theoretical-oriented and its applicability of the results in real practice of RE is restricted. Furthermore, he notes that due to a lack of communication in games, the parties focus on how bidding strategies are developed over a series of games rather than on single

confrontations. In the software development context, we are not concerned so much with such strategy, but with integrative thinking (Ibid).

3.2.3. Behaviour Science: Behaviour Theory

Social behavioural theory studies the psychological aspects of social interactions, and is practically interested in people's behaviour in conflicting situations. Most notably, its associated discipline, the discipline of Organisational Behaviour strongly focuses on conflicts in an organisational setting, which is more concerned with how different types of conflict impact on the performance and outcomes of organisations. Hartwick and Barki (1999, 2004) argue that the presence of conflict has an indirect or insignificant relationship with organisations' performance and outcomes. This view is consistent with the ideas presented in the classic conflict literature, which recognises that the presence of conflict is neither good nor bad. Instead, it is the way of how conflict was being managed that resulted in good or bad outcomes (e.g. Deutsh, 1973; Pondy, 1967). This leads to a behavioural theory emerged from the literature, which aims to be "descriptive" and is concerned with the psychology of how ordinary individuals manage conflict (Raiffa, 2002, pp 8).

In summary, the literature from Organisational Behavioral suggests that five different modes of behaviour in conflict situations have been identified: *asserting, problem-solving, compromising, accommodating, and avoiding* (Rahim, 2002; Hartwick and Barki, 1999; 2001; 2004; Pruitt and Carnevale, 1993; Pruitt and Kim, 2004). As mentioned previously, this thesis focuses on conflict that emerges in the process of RE within an organisational setting. This thesis draws on Hartwick and Barki (2004) discussions of five conflicts handling behaviours in the context of developing software systems:

- **Asserting** occurs when individuals strive to win or prevail. Conflict is seen as a "*fixed pie*", "*zero sum*" situations, with one party's gain coming at the expense of other parties. It is thus considered as a win-lose situation. In the Information System and Software Engineering discipline, the literature indicates that this type of behaviour has been often adopted by both developers and users, and has been referred as developer-dominated (Newman and

Sabherwal, 1989; Curtis et al., 1988) or user-dominated (Markus and Bjorn-Andersen, 1987; Franz and Robey, 1984).

- **Problem-solving** occurs when individuals attempt to fully satisfy the outcome of all parties. Conflict thus is not seen as a "*fixed pie*", or "*zero sum*" situation. Instead, all parties aim to expand the "pie" so that every party can achieve their goals and objectives. Hence, it is regarded as a win-win solution. In the IS and SE discipline, this behaviour has also been labelled "cooperation" by Newman and Sabherwal (1989), as they argue that any successful software project development lies in the collaborative cooperation between users and developers. They further note that this behaviour is more likely to occur when users do not perceive the project as a threat.

- **Compromising** sometimes is considered to be a form of problem-solving. It is also called sharing, give-and-take, and splitting the difference. Like asserting, compromising views conflict as a "fixed pie", "zero-sum" situation. In this sense, compromising behaviours attempt to attain a partial or moderate (but incomplete) level of satisfaction for all parties' concerns. In their classic study of large-scale software project, Curtis et al., (1989:73) provide a typical example of compromise at a work place, where a system engineer comments that: "he lets me win sometimes and I let him win sometimes, and the game goes on". They further indicate that this behaviour is more likely to happen when all team members were from the same corporate division, to save face and maintain a good working relationship with others.

- **Accommodating** occurs when individuals sacrifice their own needs and desires to satisfy other parties. Numerous motives can underlie accommodating behaviour- a desire to minimise, shorten or end conflict situations, the wish to be seen as friendly or cooperative, bending over backwards in the face of real or imagined injustice or unfairness, lack of perceived knowledge, skill, worth or esteem, etc. In the SE and IS literature, Hartwick and Barki (1999) indicate that accommodating behaviours on the part of users were noted when analysts exercised their power in ways that left

users with little choice but to yield to or accommodate analysts' goals and desires.

- **Avoiding** occurs when individuals are indifferent to the concerns of both party and refuse to cooperate in conflicting situations. Examples of this avoiding style are also documented in the SE and ARE literature. For example, Newman and Sabherwal (1989) found analyst "foot-dragging" in the user-dominated development process. Garner (1994:88) found in their case studies that many software projects where introverted team members, "…either withdraw into a shell or resist through passive/aggressive subversion or they won't tell you what is going on…"

In their quantitative study of 116 software development projects, Hartwick and Barki (1999) indicate that both users and developers engage in high levels of integrative problem-solving behaviours and low levels of avoiding behaviours, with levels of compromising, asserting and avoiding actions in between. They also note that problem-solving is found to be the most effective behavioural style to handle conflicts. Avoiding and asserting are each found to be dysfunctional to software project outcome and team performance. Although this thesis does not aim to directly investigate the behaviours of stakeholders engaged into a conflicting situation when developing a software system, the findings from Behaviour Science literature (e.g. Hartwick and Barki's 1999) are important for this research to inform the development of a conflict resolution method, which should promote integrative problem-solving behavioural style and avoid asserting behavioural style. Furthermore, I draw Hartwick and Barki's (1999) behaviour theory to discuss the various behaviours and its relation to the outcome in my experimental study (see Chapter 7) of requirements negotiation workshops.

3.2.4 Decision Science: Decision Theory and Group Decision Theory

Decision Science is concerned with how ideal individual decision-makers should make decisions, and how optimal decisions can be reached. Researchers in this discipline synthesise theories from Applied Mathematics, Economics, Statistics and Behavioral Science to develop a decision theory which is a "prescriptive approach-

how an analytically inclined individual should and could make wise decisions" (Raiffa, 2002, pp 8). Based on this theory, researchers in this field also develop some systematic and comprehensive software tools which are called Decision Support Systems (DSS) to facilitate individual's decision-making process.

Researchers in Decision Science are also interested in the decision-making process of small groups, e.g how individual preferences can be combined into a group decision (Pruitt and Kim, 2004). They extended decision theory to *Group Decision Theory* (Pruitt and Carnevale, 1993, Pruitt and Kim, 2004). Decision-making in a group setting involves more complexity than individual decision making. As Pruitt and Kim (2004) note the key challenge of a group decision-making is that finding a preference among different stakeholders, which satisfies properties such as fairness and representativeness, is problematic. This is because "real people are different, a real decision has to be tuned to the differential needs, capabilities, psyches, foibles, fallibilities, and emotional makeup of the individual" (Raiffa, 2002: 9). To address this challenge, researchers develop Group Decision Support Systems (GDSS), which are a kind of collaboration technology designed to support meetings and group work by providing more precise communication and more objective evaluation of decisions.

Recently, there are an increasing number of studies that recognise the RE process as a complex group decision-making process. In fact, the fundamental nature of RE process involves a wide range of stakeholders from different background and with different perspectives to collectively work out an agreed requirements specification (Evans et al., 1997; Regnell et al., 2003; Aurum and Wohlin, 2003).

In synthesising all decision theories developed from the different fields, Raiffa (2002) notes that most theories have taken one of the following theoretical perspectives:

- **Descriptive:** *how decisions are made.* The study of descriptive theory is concerned with how and why individuals think and act the way they do. Researchers who adopt this perspective are mostly from sociology and behaviour science**.** Bargaining theory and behavior theory are typical examples of descriptive theories

- **Normative:** *how decisions should be made.* The study of normative theory suggests how idealised, rational, super-intelligent people should make decision. It is coherence and rationality, which are usually captured in terms of precisely specified axioms. The vast majority of economics and game theory dominates this area of research.

- **Prescriptive:** *how decisions could be made better.* The typical prescriptive theory includes decision theory and group decision theory. Researchers in this theory aim to ask: what can a real person actually do to make a better decision? What mode of thought, novel perspectives, decision aids, conceptual schemes, analytical devices, words of advice, are practically useful?

In next sub-section, I discuss why a prescriptive perspective is needed in the context of RE based on Raiffa's (2002) three theory perspectives.

3.2.5 Conflict resolution in RE: a prescriptive perspective

"We can think of the prescribers as playing the role of engineers, whereas normative theorizers are pure scientists."

- (Raiffa, 2002: 12)

In relation to the human side of resolving conflicts during the process of requirements engineering, this research is primarily based upon a prescriptive perspective. As mentioned before, bargaining theory and behavior theory, which build on a descriptive perspective and focus on competing rather than cooperating, is not considered in this research.

The normative approach is concerned with conceptual ideas and techniques that are useful for idealised, mythical, super-rational automation (Carroll and Payne, 1991). As mentioned before, most researchers in RE superficially consider conflict as a technical issue, which may lead to inconsistency in a requirements specification. Therefore, there are a large number of studies promoting automation tools of conflict identification and resolution or negotiation support by applying various mathematics models or formal methods e.g. Roberson (1990), Boehm et al., (1995), Easterbrook,

(1996), Hoh et al., (2001), Vam-Lamsweerde (2001), Hoh and Boehm (2001), Alves and Finkelstein (2003), Finkelstein et al., (2008). Hoh (1998) provides an extensive review of those automated conflict resolution tools from the field of SE, Management Science, and Negotiation Science, and in particular RE. He concludes that a poor adopting rate in real practice is due to a mismatch between the tools developed from academia and the tools desired from industry. Sommerville and Sawyer (1997) further note that the use of natural language persists in requirements specification, and in the future that it is unlikely to be supplanted. With the inherent ambiguity and inconsistencies of nature language, it becomes the biggest barrier to adopting automated RE tools in real practice (Ibid).

As mentioned in Chapter 1, this research will take a different perspective, which does not consider conflict as a technical issue. Instead, conflict is viewed as a human, social, and organisational issue. I argue that resolving conflicts in RE is a highly human-based and creative activity. According to the 1997 survey by Monger and his colleagues, more than 60% of organisations use face-to-face meeting or workshop to resolve conflicts. Conflicts in RE are thus predominantly resolved through face-to-face meetings or workshops (Ai-Rawas and Easterbrook, 1996; Macaulay, 1999; Damain et al., 2000). Although there is an increasing attention paid to developing such automated tools in the current RE community, Taleb-Bendiab (1998) indicates that such tools only play a decision supporting role in real practice. As he further notes, computer-supported automated tools focus primarily on the automation of routine activities such as information search and retrieval, recording the negotiation process history, and task allocation. The most creative activities (e.g. solution generation and decision making) are still left to human experts. The process of resolving conflicts thus cannot be entirely automated. Furthermore, observational studies of requirements engineers at their work place have also indicated that a broad range of interpersonal skills are employed by requirements engineers, and it is unlikely that the full range of these skills can be replaced by automated tools (Fickas et al., 1987; Adelson and Soloway 1985). A normative approach, which aims to craft useful techniques and tools by promoting idealised automation means, is not considered in this research. However, there is by no mean in this thesis to undermine the usefulness of those tools.

Instead of proposing automated technical tools, the prescriptive viewpoint aims to propose practical and useful advice for real people in real situations (e.g. Fisher and Ury, 1983; Fisher and Shapiro, 2005). In the RE community, the prescriptive viewpoint was advocated by many RE authors who also proposed their prescriptive methods to improve real RE practice (Easterbrook, 1996; Nuseibeh and Easterbrook 2000; Niazi. 2002). Niazi (2002) points out that "a good RE method has to be prescriptive enough to be able to recommend RE practitioners what activities to do next and what techniques or procedures to be followed". To address the socio-psychological aspect of conflict, this thesis adopts a prescriptive viewpoint. In this sense, a conflict resolution method proposed in this thesis should be, "prescriptive in that it acts as a set of guidelines, without being a rigid technical tool" (Nuseibeh and Easterbrook 2000).

3.3. Conflict resolution

In this section, I review general conflict resolution methods. In particular, I focus on joint decision-making methods: negotiation and mediation. The previous RE literature argues that the process of resolving conflict is purely negotiation-based. The RE literature recognises a requirements engineer's role as a representative of a development site to negotiate with a users' site to make trade-offs and reach agreements. However, by drawing on evidence from the mediation literature and IS literature, this section argues that requirements are more than just negotiated between users and developers. Conflict resolution in RE is a mediation process, in which a requirements engineer acts as a mediator to assist users and developers from different backgrounds with different individual and organisational goals to resolve conflicts, and eventually produce a consistent, accurate, stable, and complete requirement specification.

3.3.1 Conflict resolutions approaches

Slaikeu (1989:389) presents the possible general approaches for resolving conflict (see Figure 5). In this thesis, I focus on the approach, which enables the decision made by parties jointly. Referring to Figure 5, it is clear that the approach such as

making decision left to chance, decision made by higher authority or by force is not applicable into the context of software development.

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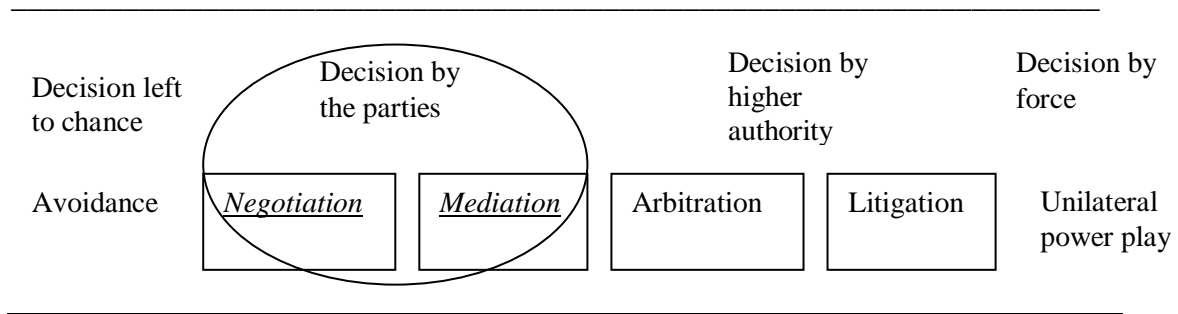
Figure 5: General approaches for resolving conflict

Pruitt and Carnevale (1993) also make a similar category and classify three broad classes of conflict resolution methods: joint decision-making, third-party decision-making and separate action.

1. **Joint decision making**, which 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 like negotiation except that a third party helps the disputants reach an agreement. Thus, mediation can be thought of as assisted negotiation (Pruitt and Carnevale, 1993).

2. **Third-party decision making,** which includes adjudication (going to court), arbitration, and decision making by legitimate authorities from outside organisations (Ibid).

3. **Separate action,** in which the parties refuse to collaborate, and make independent decisions. Struggle is a most typical and common form of separate action (Ibid).

By comparing the above three general approaches, I argue that conflict resolution in RE needs a joint-decision making process. Generally speaking, joint decision making tends to be more benign, and may lead to a better outcome. Most importantly, a joint decision-making process has a number of advantages over third-party decision

making and separate action. Pruitt and Carnevale (1993) point out that third-party decision making can be very expensive, e.g. the additional cost of 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 a "win-lose" situation results 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., (1998) argue that successful software development stresses the commitment and participation of all stakeholders, and the need to ensure everyone is a winner.

In addition, Fisher and Ury (1983) indicate that joint decision making is usually less costly and dangerous than struggle, as struggle often requires heavy expenditure of resources and seriously endangers the relationship between parties. In the case of software development, empirical studies of software project development suggest that refusing to collaborate means the resulting struggle between users and developers results in serious negative impacts on project success: e.g. communication channels breakdown (Sein and Bostrom, 1989; Curtis et al., 1988; Franz and Robey, 1984), project are delayed (Curtis et al., 1988), heavy expenditure of resource (Sein and Bostrom, 1989; Orlikowski, 1989), and poor working relationships between users and developers (Orlikowski, 1989).

Indeed, as mentioned before, in the RE literature, there is an increasing understanding of the RE process as a joint decision-making process (Evans et al., 1997; Macaulay, 1999; Regnell et al., 2003; Aurum and Wohlin, 2003). For example, Aurum and Wohlin (2003) argue that the fundamental nature of the RE process is rich in decision-making. They further indicate that RE is both an organisational activity and project activity. It is an organisational activity in terms of deciding what sort of requirements will be used to serve organisation needs. It is also a project activity when it comes to actually implementing these requirements. This dualism of RE involves a range of decisions that have to be made to ensure effective organisational as well as project decisions. 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. As a result, adopting a joint decision-making process is highly beneficial to the overall project success, as

software development is a collaborative process, which depends on commitment and participation from all stakeholders.

3.3.2 Conflict resolution in RE: a mediated process

In last section 3.3.1, I have justified the fundamental nature of resolving conflicts in RE as a joint decision-making process. However, referring to figure 3.3, both negotiation and mediation can be viewed as a form of group decision-making process (Pruitt and Carnevale, 1993). The terms "negotiation", "mediation" and "group decision making" are used interchangeably in the literature. The fundamental difference between negotiation and mediation is that, negotiations often only involve conflicting parties to reach agreements by themselves (in the case of RE, developers negotiating with users), but mediations involve a third party as a mediator to lead negotiation and assist the conflicting parties to reach agreements. In this sense, mediation is basically another form of negotiation, and is regarded as assisted negotiation.

As mentioned previously, most of the RE literature argues that the process of resolving conflicts is a purely negotiation-based process, in which a requirements engineer acts as a representative of the development site to "negotiate" with the users' site to make trade-offs (Boehm et al, 1998; Easterbrook, 1996; Nuseibeh et al., 1996, Hohin, 1998; Damian et al., 2000, 2008). However, evidence from the IS discipline suggests that the conflicting interests and goals are not only between the users' site and the developers' site, but are quite often between different user groups (e.g. Orlikowski, 1989; Robertson et al., 1996; Galliers and Swan , 2000). For example, Robertson et al., (1996) describe a case 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 even competing 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 negotiation form of conflict resolution is seriously questioned in the above

situation. It is apparent in the above situation that a requirements engineer needs to play a facilitative role to the two users groups to reach an agreement on requirements.

The facilitative role of a requirements engineer has been explicitly documented in the RE literature. In general, Aurum and Wohlin (2005) indicate that the overall goal of a requirements engineer is to transform potentially incomplete, inconsistent and conflicting stakeholder goals into a complete set of high quality requirements. To achieve this goal, it is widely agreed in the RE literature that a requirements engineer often plays the role of a facilitator. For example, Macaulay (1999) argues that facilitated meetings are regarded as one of the most successful techniques in group approaches to RE. She also notes that such group-meeting based RE methods that employ a facilitator include the Joint Application Design (Wood and Silver, 1995), Quality Function Deployment (QFD) (Sullivan, 1986), Participant Design Workshops (Jung and Mullert, 1987), ETHICS (Mumford 1993) and Cooperative Requirements Capture (Macaulay, 1996). Damian et al., (2003) further indicates that the productivity in JAD is increased by 20%-60% over traditional design methods (Jackson, 1987 in Damian et al., 2003), and more recent studies indicate that facilitator-driven requirements collection processes are more effective than the conventional interview method (Hubbard, Schroeder and Mead, 2000 in Damian et al., 2003).

However, the role of a requirements engineer as a facilitator is vaguely defined in the RE literature. Damian et al., (2003) point out that there are many diverse views on the facilitators' role in the RE literature. Macaulay (1999) reviews an extensive number of studies regarding a facilitator's role in RE and summarises that there are four types of uses of facilitator in the RE literature:

1. The facilitator as a problem solver: e.g. most existing methods stress this type of role
2. The facilitator as Project Co-ordinator: e.g. Quality Function Deployment (QFD) (Sullivan, 1986)
3. The facilitator of Human–Human Communication: e.g. Joint Application Design (Wood and Silver, 1995)

4. The facilitator as controller of activities: e.g. Dubbs and Hayne (1992)'s meeting cycle model

Despite previous attempts being made to clarify the role of a facilitator in the RE literature, the role of a requirements engineer as a mediator has not been explicitly identified. Furthermore, few techniques, models, and guidelines have been developed to guide a requirements engineer as a mediator resolve conflicting viewpoints in RE practice. If we agree that the role of requirements engineer as a facilitator, we then can consider a requirements engineer plays the role of a mediator. I therefore argue that requirements are more than just *negotiated* between users and developers. It can be viewed as a *mediation* process, in which a requirements engineer acts as a mediator to assist users and developers from different background with different individual and organisational goals to resolve conflicts, and eventually produce a consistent, accurate, stable, and complete requirement specification.

3.3.3 Conflicts resolution in RE: a socially mediated process

Section 3.3.2 has justified why resolving conflicts in RE can be viewed as a mediation process. RE is also a form of social interactions. In this sub-section, by drawing on the evidence from the recent RE literature, I further argue that mediating conflicts in RE is a socially mediated process.

In the RE community, there is an increasing understanding that eliciting and analyzing requirements should be operated within their organisational, culture and social context (e.g. Goguen, 1994; Nuseibeh and Easterbrook, 2000; Thanasankit, 2002; Ramos et al., 2005). For example, Thanasankit (2002:130) points out the requirements are socially constructed within the environment of the organisation. Ramos et al., (2005:16) further point out that "not only is the reality in which software operates socially constructed, but also are the requirements for that software. Thus, we might then expect the deployed software itself becomes part of that socially constructed reality." Goguen (1994:13) has a similar view: "it is not quite accurate to say that requirements are in the minds of clients; it would be more accurate to say that are in the social systems of the client organisation. The difficulties in RE are mainly social, political, and cultural and non-technical."

With this increasing recognition of the social aspect of RE process, the traditional RE that adopts a rationalistic and objectivist perspective has been seriously questioned. For example, Stamper (1994) indicates that most traditional RE approaches assume that there are simple answers to the deep questions about the nature of reality, meaning and truth. By taking this view, requirements thus are viewed as a set of definable and formal statements, which can be captured like 'butterflies' (Dobson and Strens, 1994). However, based on Modern Social Construction Theory that the world is constructed socially and subjectively, it is argued that requirements are emergent, and socially constructed by interactions between user and developers (Flynn and Jazi 1998; Coughlan and Macredie, 2002). By taking this view, modern RE research needs to adopt a subjectivist perspective. Moreover, decision-making in RE should be mediated by cognitive, social, organisational, and political processes among various social actors within organisations. I thus come to conclusion in this sub-section, that resolving conflict in RE is a not only mediation process, but socially mediated by a complicated social and organisational setting.

3.4 Approaches to mediation

Since the last section argues the process of resolving conflict in RE as a socially mediated process. In this section, I will describe three mainstream mediation approaches: problem-solving, transformative, and narrative approach. This section aims to be analytical rather than descriptive. In this sense, I will focus on comparatively discussing the applicability and usefulness of these three approaches in the context of RE rather than substantially describing the approaches. In particular, I will make detailed discussions on the limitation of the most dominate mediation approach- problem-solving, which underpins many existing requirements negotiation models (e.g. the Win-Win model).

3.4.1 Problem-solving approach

The problem-solving approach (for more detail, see Appendix 1) is a general negotiation or mediation approach in which parties collaborate to find a "win-win" solution to their dispute. This approach is also referred to as principled negotiation

(Fisher and Ury, 1981), an integrative approach (e.g. Pruitt and Carnevale, 1993) or an interest-based approach (e.g. Watkins and Rosegrant, 2001). It is primarily outlined by Fisher and Ury (1981; 1983). It has contributed significant to the growth of professional negotiation mediation. There is no doubt that the approach outlined by Fisher and Ury (1981; 1992; 2002) has been widely successful and remained valid for over twenty years and having been widely adopted in the various application areas.

The underlying assumptions of Fisher and Ury's (1981) problem-solving approach are that the world is made up of individuals who seek satisfaction of their own interests, needs and goals. Conflict is understood to happen because individual needs are not being satisfied, and transpires when individuals, in the attempt to fulfil their needs, encounter others who believe that their own need-fulfilment goals are threatened. This approach thus focuses on developing mutually beneficial agreements based on the interests of the disputants (Fisher and Ury, 1981). As Moore (1986) points out the problem-solving approach is an orientation to negotiation or mediation which focuses on finding a "win-win situation" in which all parties' interests are satisfied. The problem-solving approach is also promoted as an example of good practice in general software project management (O'Connell, 1996; McConnell, 1996). The Win-Win negation model is a typical example of use of problem-solving approach in the context of RE. Recently, it has also been advocated by the Software Engineering Institute as one of recommended techniques for handling the "soft side" of software process improvement (Paulk, 2000).

3.4.2 Transformative approach

The transformative approach (also see Appendix 2) to mediation does not seek resolution of the immediate problem, but rather, seeks the empowerment and mutual recognition of the parties involved. It has emerged since the publication of "*The promise of Mediation*" by Bush and Folger (1994). In their book, Bush and Folger first defined transformative mediation, in particular, in contrast to the dominant orientation of problem-solving mediation. They questioned the instrumentalism involved in relying on reaching agreements as the primary goal of problem-solving mediation. They argue that it is necessary to include some more intangible goals in any mediation such as improved understanding or communication, making people better

human beings, and social transformation through improved relationships. As they stated that, "mediation's greatest value lies in its potential not only to find solutions to people's problems but to change people themselves for the better, in the very midst of conflict" (Bush and Folger, 1996:45). In section 3.4.5, I provide detailed discussions on why a transformative mediation approach is not considered in this thesis.

3.4.3 Narrative approach

Narrative mediation is a relatively new approach to mediation, which recognises that people tend to organise their experiences in story form (Winslade and Monk, 2000; 2003). In narrative mediation, the process of mediation is viewed as a story-telling process, and the construction of an alternative "story" or "narrative" becomes the mediator's prime goal. The narrative approach originated from Narrative Family Therapy, developed in the mid-1980s by Michael White and David Epston. It first emerged in the field of mediation since the publication of "*Narrative Mediation: A New Approach to Conflict Resolution" by* John Winslade and Gerald Monk in 2000.

Cobb (1994) points out that mediation can be viewed as a storytelling process. The story is at once its content, contained within the body of the story itself (the actual set of events) and its telling, or the complete discourse around the way the story is delivered (Ibid). People can actually be said to think in terms of stories and their constituent parts (the themes, roles, and plots), which work together to create a system of meaning around particular people and events (Ibid). Narrative mediation builds on this storytelling metaphor, and provides mediator a way of incorporating stories into mediation (Picard and Melchin, 2007).

Winslade and Monk (2000:75) point out that the narrative approach involves "a simple and yet profound departure from commonly held assumptions about the conflict that *embroil* people". The underlying assumption of narrative mediation is that people live their lives according to stories rather than according to inner drives or interest (Ibid). In the story, people seek to establish coherence and produce lives, careers, relationship, and communalities. 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 (Picard

and Melchin, 2007). As Winslade and Monk (2000: 35) state that "conflict is likely because people do not have direct access to the truth or the facts about any situation." They also outline that the narrative mediation approach contains three phases:

- **Engagement**: in this phase, the mediator focuses on setting up themes and establishing an initial collaborative relationship with the conflicting parties. It can also be referred to as a preparation phase.

- **Deconstructing the conflict-saturated story:** this phase of the process involves the mediator in doing something more than developing a supportive relationship and listening respectfully to their own stories. In this phase, the mediator seeks to undermine the certainties on which the conflict feeds and invites the participants to view the plot of the conflict from a different viewpoint. It can also be referred to as a definition phase.

- **Constructing the alternative story:** In this phase, the mediator aims to craft an alternative story, 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 (Winslade and Monk, 2000).

3.5 Discussion of the Relevance of three mediation approach to RE

In section 3.4, I briefly introduced and described the three mainstream mediation approaches: problem-solving, transformative, and narrative approach. Here, I will first justify the reason why the transformative approach is *not* applicable for the SE community. I then compare the relevance and applicability of the problem-solving and the narrative approach to RE, and finally justify a choice of the narrative approach for the purpose of my research.

3.5.1 Transformative approach

Unlike the orientation of the problem-solving approach, the transformative approach to mediation does not seek resolution of the immediate problem, but rather, focus on relationships and on parties' ability to achieve empowerment and recognition by improving understanding or communication, making people better human beings, and social transformation through improved relationship. It is well acknowledged in the SE literature that improved understanding, communication and relationship is essential for any successful software project development. However, due to its "transformative" focus and nature, the transformative approach is usually thought to be more useful in dealing with interpersonal conflicts such as family conflicts, conflicts between neighbours, and conflicts between co-workers (Bush and Folger, 1994; 1996). It is not applicable for the SE community due to the following three reasons:

- **Lack of understanding of the nature and origin of conflict**. Picard and Melchin (2007) point out that the transformative approach is less interested in probing previous and underlying issue in search of the origins and nature of conflict and is more interested in probing the actual interactions between parties during mediation for the signal opportunity for fostering empowerment and recognition. In the context of RE, a good conflict resolution method necessarily emphasises an accurate understanding of the rationale and the nature of the conflicts. For example, Easterbrook (1996) emphasises the importance of gaining a better and deeper understanding of the nature and root of conflict in the process of RE, which includes where and why conflict occurred, and hence the types of conflict, the extent of the conflict, and the additional issues involved.

- **Mediator's role**. A transformative mediator works very differently than a problem-solving mediator who plays a very directive role in the whole mediation process. Usually, a transformative mediator explains the concept of mediation, but let parties set goals, direct process, and design ground rules (Bush and Folger, 1996). In the context of RE, the facilitative skills of a requirements engineer play a very important role in determining project success (Macaulay, 1999; Aurum and Wohlin, 2005). A requirements engineer not only needs to facilitate conflicting parties with process, but also, most

importantly needs to evaluate the product- "requirements specification" to ensure it meets design constraints. A requirements engineer's role thus tends to be not only facilitative but also directive and evaluative. In some extreme situations, a requirements engineer even may play the role of an arbitrator who proposes a solution and works hard to "sell" it to the parties when a project deadline approaches and no agreement is produced (Damian, 1998; Nuseibeh, 1998).

- **Use of time.** In a transformative mediation, time is open-ended (Bush and Folger, 1996). Parties spend as much time on each activity as they want to, as the focus of the transformative mediation is on building open and friendly long-term relationships rather on producing a short-term settlement. In the context of RE, maintaining good relationships between users and developers is certainly essential for any software project success. But meeting a deadline is far more important, as most software projects are all scheduled by a strict deadline. This is why a requirements engineer or a project manager even may play the role of an arbitrator to make a final decision where approaches a project deadline.

3.5.2 Problem-solving verses narrative approach

In this sub-section, I comparatively discuss the applicability of the existing problem-solving approach and the new narrative approach in related to the context of conflict resolution in RE. Two key factors are taken into considerations: underlying assumptions and the 'neutrality' role of the mediator.

Underlying assumption

Although the problem-solving approach seems currently to dominate the literature and practice, its underlying assumptions and theoretical underpinnings have been strongly challenged by researchers and practitioners. The most important critiques of the problem-solving approach concern its underlying assumption (Pruitt, 1981; Bush and Folger, 1996; Winslade and Monk, 2000; Picard and Melchin, 2007). In a problem-solving approach, the underlying assumptions are that the world is made up of

individuals who seek satisfaction of their own interests, needs and goals. As a result, an "insider-out" perspective is adopted, and conflict is understood to happen because individual's needs are not being satisfied, and transpires when individuals, in an attempt to fulfil their needs, encounter others who believe that their own need-fulfilment goals are threatened (Winslade and Monk, 2000). The problem-solving approach then focuses on finding a "win-win situation" that satisfies the interests, needs, and goals of all the conflicting parties concerned. However, this "insider-out" perspective may not be appropriate for the overall purpose of RE, in particular, in the case of resolving requirements conflicts. Nuseibeh and Easterbrook (2000) indicate that the context in which RE takes place is a complex human activity system, and the idea that eliciting and analysing requirements cannot be performed adequately in isolation from the organisational 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 computerisation. Moreover, as mentioned in a classic field study of software engineering process by Curtis et al. (1988), conflicts result from a wide range of interrelated factors, from change in the organisational setting and business context, to the fact that the software will be used by different people with different goals and different backgrounds. This is certainly in contrast to the "insider-out" perspective adopted by the problem-solving approach, which looks at conflict as created within the so-called natural desires, interests, and goals emanating from the individual. Therefore, Winslade and Monk (2000) argue an "outsider-in" perspective is needed, which looks at conflict as a result from a wide range of social and organisational factors. With this "outsider-in" perspective, Winslade and Monk (2000) argue that a narrative mediation approach can be helpful for the mediators and their conflicting parties to make more sense of the complex social contexts that shape conflicts. The narrative approach starts from the idea that people construct conflict from narrative description of events, and concentrates on developing a relationship that is incompatible with conflict and that is built on stories of understanding, respect, and collaboration (Ibid).

The neutrality of a mediator

Narrative mediation also challenges the traditional view of neutrality in the problem-solving model that is prevalent in the field of mediation today. The biggest concern of the problem-solving approach has been about the expectation that the mediator should

be a neutral third-party (Winslade and Monk, 2001). Narrative mediation involves recognising that a mediator cannot be completely neutral. This is in contrast to problem-solving approach which requires a neutral third-party to ensure fairness for both parties (Fisher and Ury, 1981; 1983; 1998).

What are the implications for the SE community, and especially the field of RE? Although Macaulay (1998; 1999) indicates that the role of a facilitator in RE is subject to lively debate, most work that adopts a problem-solving perspective employ a neutral third-party as a facilitator to mediate conflicts among different stakeholders (e.g Boehm, et al., 1996; Damian et al., 2003; Macaulay, 1996; Sullivan, 1986; Wood and Silver, 1995; Dubbs and Hayne, 1992). We generally refer to this type of mediation as outsider-neutral mediation (Maiese, 2005). However, in real RE practice, it seems that an outsider-neutral facilitation approach may not be widely used due to the extra cost of hiring an external facilitator. In many cases, requirements engineers or project managers play the role of mediators. But they are rarely neutral, being employed by either the client or supplier. This type of mediation is referred to as an insider-partial mediation (Maiese, 2005).

In addition to practicability, evidence from the field of mediation also suggests that an outsider-neutral mediator may not be as effective as it is deemed to be (Thompson 1990; Thompson and Hastie, 1990; Carnevale and Conlon, 1988). For example, Thompson (1990) reports that a neutral mediator was no more likely to understand the available solutions. Carnevale and Conlon (1988) made a similar point from their laboratory study, which shows that neutral mediators are poor judges of conflicting situations, and only recommend solutions that the negotiators have already offered. Maiese (2005) argue that insider partial mediators know the situation better, have cultural ties, and are more easily accepted and trusted. Moore (1996) also argues that because the insider-partial mediator has close links with the participants, he or she has a personal interest in a successful outcome and will stick around to make sure any settlement is implemented. These findings are particularly relevant and important in the context of resolving conflict in the process of RE. An "insider" requirements engineer is apparently more familiar with the conflicting situation than external consultants. His or her personal knowledge of project and organisation and the issues in hand is likely to be extremely useful in helping parties to resolve their differences.

Finally, because an insider requirements engineer is close to and known by each side, their presence helps to ensure sincerity and openness throughout mediation. In this sense, a narrative perspective mediation that emphasises the non-neutrality of a mediator seems more applicable for real RE practice.

Apart from the above two factors, both the process of RE and the narrative mediation share the metaphor of "storytelling". As mentioned in section 4.3.3, narrative mediation particularly builds on storytelling metaphor. In the RE process, the fundamental nature of gathering user requirements can also be viewed as a storytelling process (Alvarez, 2001; Alvarez and Urla, 2002; Cohn, 2004). In the next sub-section, I will briefly clarify and discuss the use of the term narrative, story, and scenario in SE and RE in particular.

3.6 The use of the narrative approach in SE and RE

"We enter into stories, we are entered into stories by others, and we live our lives through stories."

- Michael White (1989:33)

Redekop (2004) indicates that a narrative is "a talk organised around consequential events, or, a story with a beginning, middle and end". However, it does not need to be told in sequence, for example, the ending may be told first. The narrative approach is now being advocated by many sociologists, and is well validated by sociologists as an effective method to understand the complexity of human and social behaviours. For example, Frank, (1993) who declares that in future the work of sociologists will be judged on the quality of their narratives. He argue that science is "meaningless", in the sense that it is unable to answer fundamental questions of meaning, like how we should act, and how we should live. In this sub-section, I do not intend to give a comprehensive review of the use of the narrative approach in the social science literature. Instead, I will focus on discussing the use of the narrative approach in the SE community. The intention of this review is to clarify the use of term "narrative" in this research, and particularly distinguish it with the other use of terms like "user story" and "scenario", which are widely used in the RE and SE literature.

With the increasing use of the narrative approach in the social science community, research on narratives has also recently begun to emerge in the area of IS and SE community. It is primarily used as a research method. For example, Brown (1998) examined the use of narratives that organisational members produced to explain and create meaning in power struggles during an IT implementation. Brown and Jones (1998) also examined a failed IS project and the types of individual narratives that emerged. Duve and Robey (1999) examined stories as symbols of organisational culture to generate insights into the collective interpretation of management practices by competing groups during a software development project.

In the Human Computer Interaction (HCI) community, narratives are used as a technique to improve communication between end-users and developers in the design of user interfaces, task modelling and prototyping, and in supporting the specification of user interfaces (Bodker, 2000). In terms of a software project lifecycle, Hedman and Borell (2004: 285) state that "the use of narrative can serve different purposes at different phases of a software lifecycle. Narratives written prior to a project would typically be used to express requirements, as well as to build and control expectation and support. Narratives from this phase form the basis for decisions and actions, and assume the role of defining the strategic objectives, vision and mission of a project. During the implementation phase, narratives are used to express the project status, the need for further improvements, and refinement of scope, as well as to track the decisions made. During the end of a project, narratives are used to evaluate and justify the outcome of the project.

3.6.1 Narrative in RE: user stories

In RE, a user stories approach is widely recognised as an effective means to elicit and analyse user requirements. In particular, it is widely used in agile development. Clausen (1994:45) states that:

> *"Using narratives in the system development process seems to be a way in which designers will be able to come up with the kind of descriptions that are asked for by the users."*

One of the primary means for obtaining information during requirements analysis is the direct interview (Alvarez, 2001; Alvarez and Urla, 2002). Davis et al., (2006) reports a systematic review of empirical studies concerning the effectiveness of requirements elicitation techniques, and suggests that interviews appear to be one the most effective elicitation technique. Polkinghorn (1988:153) point out that, during interviews "people always strive to organise their temporal experience into meaningful wholes and to use the narrative form as a pattern for uniting the events of their lives." He also notes that interviews are therefore recognised as critical events for the creation of narratives, and in return, narrative analysis can help us to understand the interpretive processes involved in the interview context. Alvarez and Urla (2002) use narrative analysis to examine the structure and content of different types of narratives users use during requirements analysis interview. Their findings reveal that users organised their experience, sought to persuade listeners, and convey information to requirements engineers using "stories," "habitual," and "hypothetical" narratives. User narratives provide a pragmatic view of proposed software system, offering insight into the ways the system is actually used and the habitual practices of the work environment (Ibid).

On the other hand, with the increasing recognition of the use of agile software development methodologies (e.g. Extreme Programming-XP), the narrative-based "user stories" also becomes the starting point of any agile development. Using the user stories recognises RE as a storytelling process. In particular, it emphasises the importance of verbal communication and social interactions between users and developers. Cohn (2004) states that a user story can be used to describe major functionality that will be valuable to either a user or purchaser of a system, and is composed of three aspects:

1. A written description of the story used for planning and as a reminder;
2. Conversations about the story that serve to flesh out the details of the story;
3. Tests that convey and document details and that can be used to determine when a story is complete.

The review of literature concludes that, the narrative approach is largely used as a research method in the IS and SE community. In the RE community, the user story is

then considered as a simplified technique to elicit user requirements in the agile software development environments. However, the use of the user stories is oversimplified and technical-oriented in the XP environment. The purpose of the user stories is to swiftly capture the key technical functionalities of the proposed system, and contains little other information such as user's personal beliefs and values towards the proposed system. The agile methodology does little or no requirements to reduce the cost and shorten the development period. Due to this simplified version of the user stories, Grunbacher and Hofer (2002) state that the XP practices have some potential problems and risks that is particular relevant to the requirements elicitation and negotiation: e.g. insufficient information of the project vision/mission, limited set of stakeholders involved, limited perspective of the on-site customer, and separation of concerns in decision-making. In this respect, the user stories approach with a strong emphasis on eliciting technical requirements within a short period of time is clearly inadequate to deal with social aspects of the conflict in RE.

3.6.2 Narrative verses scenario

In the RE literature, the terms of 'narrative' and 'scenario' are used extensively and colloquially in a variety of ways. It is therefore essential to clearly define what we mean by a narrative in this thesis, and how it will be different from a scenario. Scenario have attracted considerable attention in the RE literature (e.g. Kuutti, 1995; Sutcliffe, 2002, 2003; Alexander and Maiden 2004). Sutcliffe (2003) indicates that, in the RE community, scenario is mainly used to describe a form of examples or stories grounded in real world experience. Gruen et al., (2002) defines scenarios as "descriptions of sequences of events that represent selected elements of a setting and activity." He further argues that "scenarios around a technological artefact typically focus on the way a system is used to perform a specific task, but often do not included detailed descriptions of the people involved in a task, or their motivations, values and goals."

Unlike scenarios focusing on capturing the right sequence of technical functionalities being performed by a system, narratives, which are by very nature specific, aim to capture in detail the social and organisational context in which a new software system will be used (Gruen et al., 2000). It thus helps us understand the people who will use a

system and the value it will bring to their lives. In this thesis, I particularly value narrative to address those social, human and organisational aspects of conflict. This is because that narrative with its detailed description of people's value, beliefs, and motivations will be more helpful for us to understand its nature and formulate effective solutions to its.

3.7 Summary

This chapter presented a review of the literature addressing conflict resolution methods in the context of RE, and discussed the theoretical background of the second research question (see below) by focusing on justifying why a narrative mediation approach was applied in this research as a conflict resolution method.

RQ2: How can a theoretically robust narrative RE mediation model (NREMM) be developed?

By reviewing the multi-disciplinary literature, this thesis points out that resolving conflict in RE is a form of joint decision-making process. More specifically, it is a socially mediation process rather than a negotiation process. This chapter further reviews three mainstream mediation approaches from the mediation literature. The chapter particularly focuses on comparatively discussing the relevance and applicability of the problem-solving and narrative mediation approaches to resolve conflicts in the context of RE. This chapter argues that the narrative mediation approach, which builds on a story-telling perspective and has a robust theoretical underpinning, is more suitable for the purpose of resolving conflict in real RE practice. As a result, Winslade and Monk (2000)'s narrative mediation model is considered and translated into the context of RE in the next chapter. This chapter finally clarifies the difference between the terms 'narrative' used in this research and the popular terms 'scenarios' and 'user story' used in the RE literature.

Chapter 4 Developing a narrative based RE mediation model (NREMM)

4.1 Introduction

This chapter explains and describes the process of developing the NREMM by translating Winslade and Monk (2000)'s narrative mediation model into the context of RE. This chapter responds to the second research question:

RQ2: How can a theoretically robust NREMM be developed?

In doing so, this chapter first explains the methodological approach of the framework development, and justifies the reason of having a transparent, rigorous and systematic development process. As mentioned in Chapter 3, the original narrative mediation model contains three phases: Engagement, Deconstruction and Construction. This chapter accordingly shows these three phases being translated into the context of RE by following a systematic methodological approach. The result of this chapter is a theoretically robust NREMM, which is then subject to empirical assessment and evaluation in subsequent chapters.

4.2 Model Development Methods

Although many existing RE studies present their novel methods or models by borrowing and translating theories from the other disciplines, there is very little in the RE literature that directly and explicitly explains their methodological approach and their detailed process of how their model is systematically and rigorously borrowed and translated. Providing such transparency will benefit subsequent researchers who also seek to borrow relevant theories from other disciplines to improve RE practice. This transparency also will benefit the RE practitioners who wish to gain a deeper understanding of the NREMM. To ensure a rigorous and systematic model development process, I follow three development activities (See Figure 6):

- **Activity-1**: In the first activity, each element of the original narrative mediation model (defined as model version V1.0, 2.0 and 3.0, which also refers to the three phases of the original narrative mediation model) is mapped onto the context of RE according to its detailed relevance to RE. This means that all elements irrelevant to the context of RE will be removed from the original model. The outcome of this activity is model version V1.1, 2.1 and 3.1, which will retain the structure of the original model but only contain elements relevant to RE. To give a reasonable and subjective assessment of each element's relevance of RE, a scoring scheme has been developed (See Table 2). A Cohen's Kappa measure of inter-rater reliability test has been carried out to ensure the reliability of the scoring scheme (for details see Appendix 3).

- **Activity-2:** A RE specialised mediation model requires the integration of contemporary RE techniques. In this activity, model version V1 will be improved and integrated with specific RE techniques. The outcome of this activity will be defined as model version V1.2, 2.2 and 3.2 which contains specific RE techniques from the RE literature. To ensure the RE techniques fir for purpose, justifications are included accordingly.

- **Activity-3:** After carrying out the first and second development activity, the structure of the model is messed up and left unbalanced. The original mediation model itself contains a degree of overlap and inconsistency. Activity 3 will re-structure the model version V1.2, 2.2 and 3.2. The outcome of this activity will be the final model version V1.3, 2.3 and 3.3.
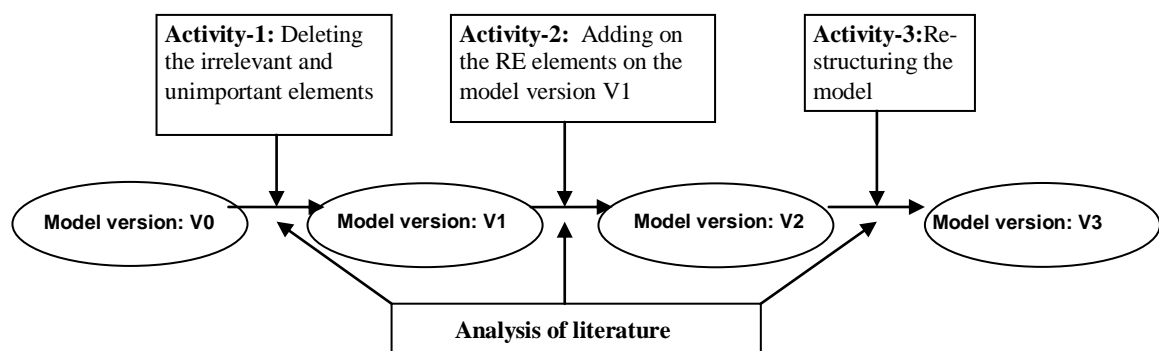
Figure 6: Three activities of model translation

The original narrative mediation model includes three phases. Therefore, the above 3-activity model development method will be individually applied into all three phases. The sequence of the model translation process is described in the following Figure 7.
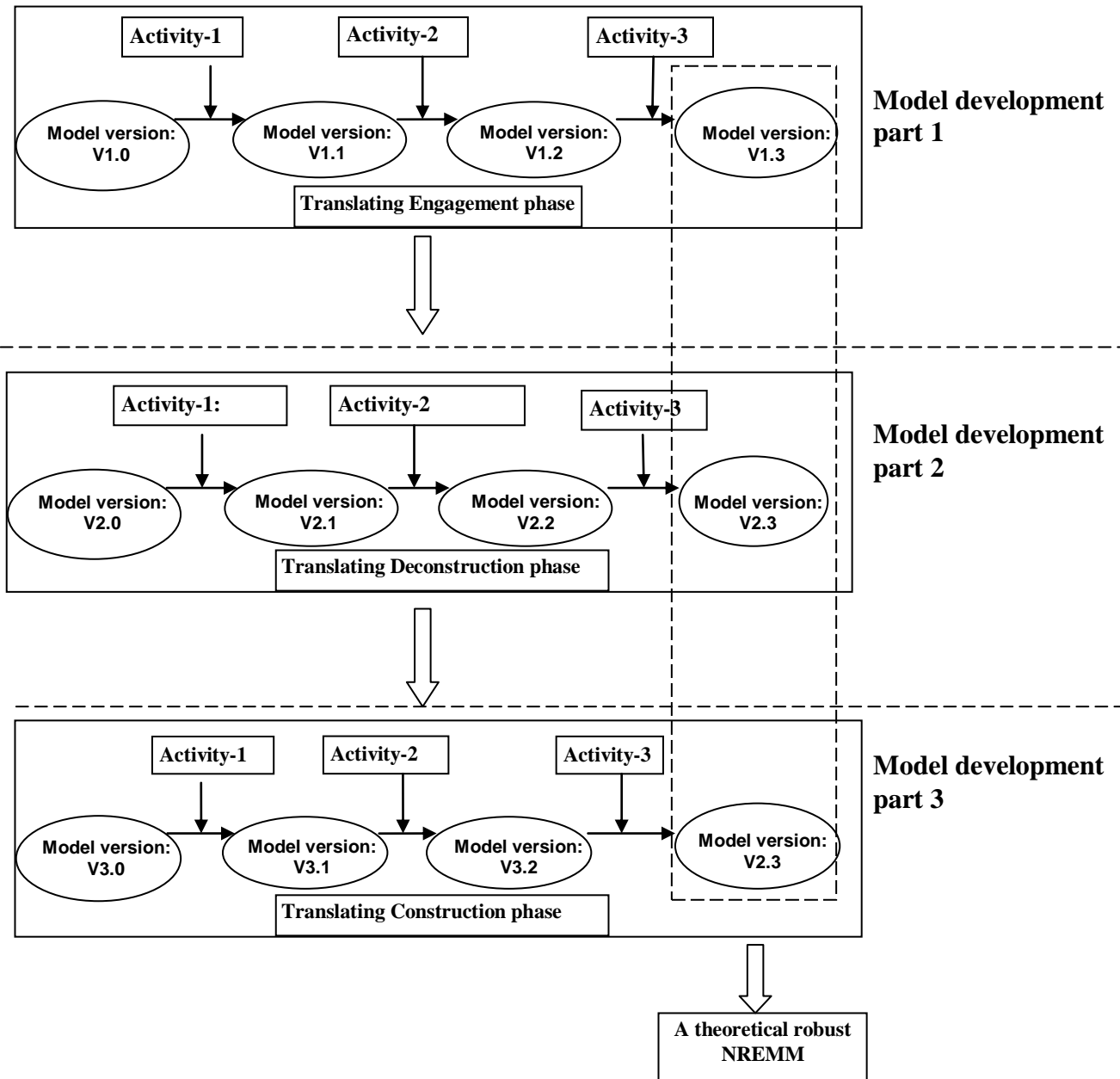
Figure 7: The sequences of the model translation process divided into 3 parts

	Definition
Irrelevant (IR)	The element is not directly relevant to RE. This means either the element has been rarely or never mentioned in the current RE literature, or mentioned as unimportant to RE.
Maybe Relevant (MR)	The element is to RE only under certain circumstances. This means the element has received some attention in the current RE literature, but has only been specified as important to RE under certain contexts.
Relevant (R)	The element is relevant to RE. This means the element has received considerable attention in the current RE literature, and has been recognised as an important factor to achieving successful RE.
Very Relevant (VR)	The element shows complete relevance to RE. This means the element has been well-acknowledged in the current RE literature, and has been recognised as a critical factor to achieving success.

Table 2: A scoring scheme to assess the relevance of the original model

4.3 Model development part 1: translating Engagement phase

This section describes the process of model development for the engagement phase, which is the first of the three phases of the original narrative mediation model that will be translated to RE. Figure 8 presents the original phase of engagement, which is defined as model version V1.0.

4.3.1 An overview of the engagement phase

Winslade and Monk (2000) state that, in the original phase the mediator aims to establish a workable relationship with the conflicting parties (See Figure 8). The mediator thus needs to pay particular attentions on the physical setting in which the mediation is to take place, the non-verbal behaviour displayed by all parties in early interactions, and the relational moves made by the mediators (Ibid). The major activities in this phase include selecting suitable meeting settings, identifying meeting objectives, and inviting the telling of the stories to initially identify the conflicts. In the context of resolving conflicts in RE, I refer to this stage as the conflict identification, which involves mediation preparations and RE meeting planning.

The Conflict identification phase is recognised as one of important phases of any negotiation and mediation. For example, Thompson et al., (2005) defines an 80-20 rule applied to a negotiation or mediation: about 80 percent of your effort should go towards preparation and initial planning; 20 percent should be the actual work

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involved in the actual negotiation or mediation meeting. In the RE literature, Robison and Volkow (1997) indicate that most RE literature focuses on developing the negotiation support tools to facilitate the actual interaction among conflicting participants. They therefore argue that beyond the actual negotiation one should also consider pre-negotiation phases as part of the negotiation process covering activities such as initial problem recognition and participant solicitation and initial communication (Robison and Volkow, 1998).
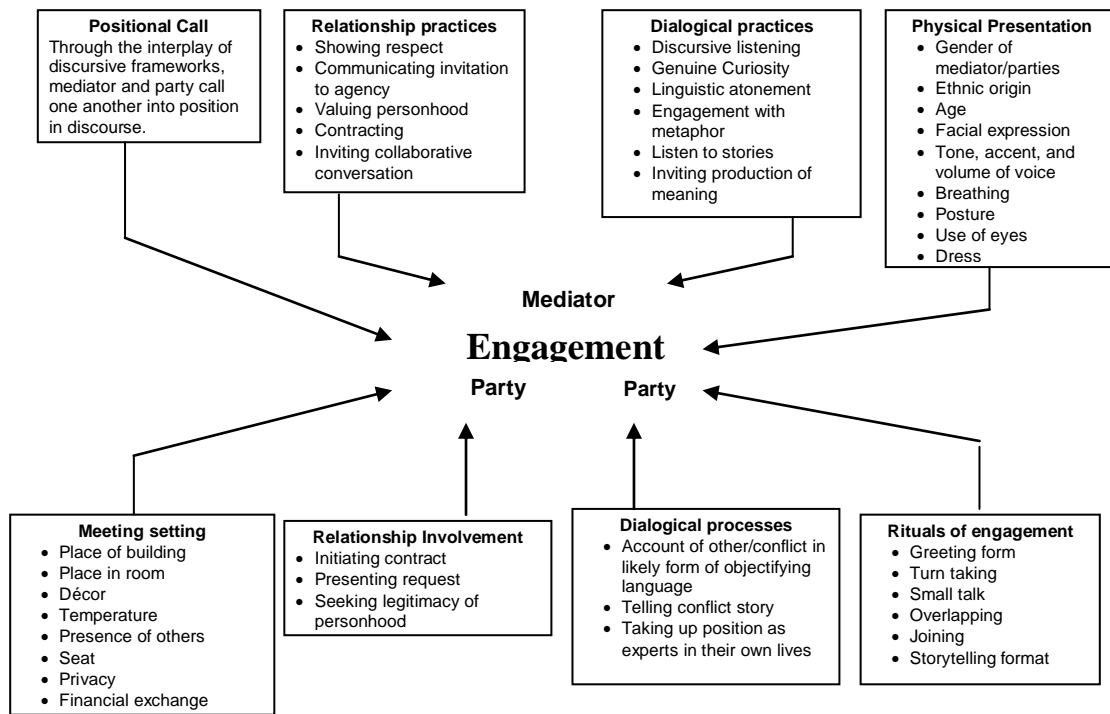
Figure 8: The engagement phase Model version 1.0 (Winslade and Monk, 2000:14)

4.3.2. Activity-1: Deleting the irrelevant elements

By performing the model development activity 1, model version V1.1 (see Figure 9) is produced. Full justification of the relevance of each element to RE is given as follows.
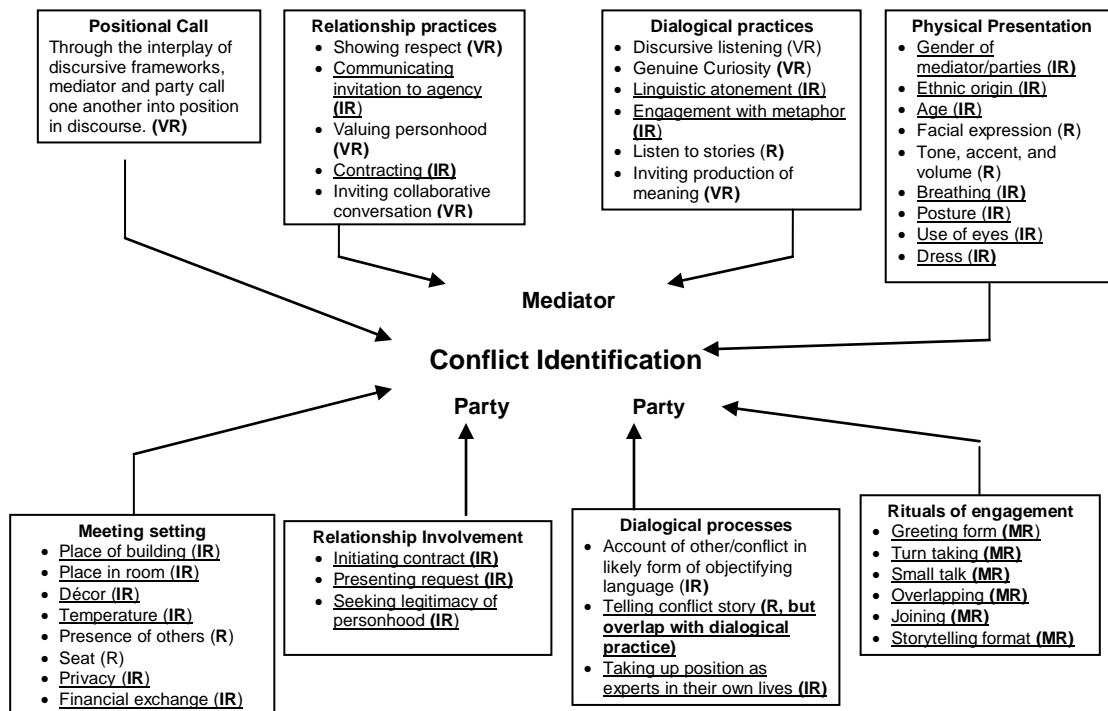
Figure 9: Conflict identification phase model versionV1.1

Note: (VR: very relevant; R: relevant; IR: irrelevant; MR: Maybe relevant). Referring to Figure 4.4, the underlined elements stand for the irrelevant or overlapped elements to RE, which will be removed from the model version V1.1. The remaining elements stand for the relevant elements, which will be retained by providing full justifications.

Meeting setting

The original narrative mediation model for typical family mediation stresses the physical setting in which the mediation meeting is to take place (Winslade and Monk, 2000). It emphasises that the conflicting parties involved must feel respected and comfortable in a physical setting that best reflects their cultural location (Ibid). As a result, in many cases, the mediator may have to ask the parties to select their preferred mediation venue to demonstrate respect, understanding, and trustworthiness in the mediation process.

However, in the case of a RE meeting, selecting meeting setting is different from a typical family mediation. Rather than focusing on creating a "psychologically" safe environment for family mediation, selecting meeting setting in RE focuses more on the meeting layout and the use of artefacts to facilitate meetings. For example, Macaulay (1996) suggests that RE meetings should take place in rooms where the

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furniture can be arranged to facilitate face-to-face communication between group members. The tables and chairs are set in a horseshoe shape so that all members can see all other members, and also see the facilitator (Ibid). The lighting, heating and general ambience of the room must allow for intense and uninterrupted periods of discussion (Macaulay, 1996). Furthermore, Maiden and Bright (1996) indicate that it is essential to have certain types of artefacts available for use during RE meetings, which include flip charts, whiteboards, projector sliders, overhead projector transparencies, video tape/films, audio tapes and A4-size paper documents. Some electronic artefacts such as word processing documents and structured diagrams supported in current computer-aided software are also necessary. Detailed discussions of each individual element of the meeting setting are below:

- **Place of building and room**: A RE meeting must be located in a suitable and comfortable place. However, there is no evidence in the RE literature to suggest that the building and room makes a significant impact on the effectiveness and efficiency of a RE meeting. In this case, these two elements from the original model are considered as irrelevant to RE.

- **Decor**: Decor is considered an important element for creating a "psychologically" safe environment for family mediation. However, in the case of a RE meeting, it becomes less relevant. As we mentioned before, selecting the meeting setting in RE focuses more on the meeting layout and the use of artefacts to facilitate meetings. In the context of RE, décor is considered as irrelevant to RE.

- **Seating**: Allocating suitable seating is relevant and important for any meeting settings. In the case of a RE meeting, as we mentioned before, to demonstrate the strength of the face-to-face communication, the table and chairs should be set in a horseshoe shape so that all members can clearly see all other members and the facilitator. As a result, seating is considered as relevant to RE. But it does not seem to be critically important, and therefore remains in the model version V0.

- **Temperature**: In the RE literature, Viller (1991) acknowledges that lighting, heating and the general ambience of the meeting room must allow for intense and uninterrupted periods of discussion. Temperature is thus recognised as relevant to RE, but not critically important, and therefore remains in model version V0.

- **Presence of others**: In family mediation, the presence of others is considered a serious ethical issue (Winslade and Monk, 2000). The mediator must ensure whether the presence of others is accepted by each party. However, in the context of RE, the presence of others does not seem to be a serious ethical issue. Resolving conflict in RE is a collaborative task that emphasises all stakeholders' involvement (Macaulay, 1996).

- **Privacy**: This is classified as maybe relevant. In the case of a RE meeting, the privacy of a meeting is only considered as relevant and important under certain circumstances, e.g. the software project is highly confidential; the stakeholders require a confidential hearing.

- **Financial exchange:** In the case of family mediation, financial exchange is concerned about negotiating a fee for the proposed mediation services. However, in the case of a RE meeting, this financial exchange seems irrelevant.

Rituals of engagement

The original narrative mediation model acknowledges that greeting rituals are culturally learned, and the mediator must be attentive to how best to greet participants (Winslade and Monk, 2000). In many communities (most western countries), the conflicting parties and the mediator are expected to get right down to the problem without any formal greeting rituals. However, in some communities (e.g. Maori communities in New Zealand), the rituals of engagement may be required for an elder or religious person (Winslade and Monk, 2000).

In the RE literature, the rituals of engagement in the RE meeting are rarely mentioned. But, this does not imply that proper rituals of engagement are unnecessary under

certain circumstances. Thanasankit (2002) explores the impact of Thai social status during the RE process of several business information system development projects. His findings suggest that Thai culture is naturally inherent in Thai daily life and Thais bring that into their work practices. Cultural differences significantly affect individual personality and behaviour (Hofstede, 1984; Thanasankit, 1999; 2002). Culture is a stabilizing force operating to resolve conflict (Robery and Azvedo, 1994). In this sense, the requirements engineers/ mediators should be cautious about the rituals of engagement if the participants are religious or there are cultural differences between participants. However, in general, resolving conflict in RE may not necessarily have any formal greeting rituals. In this sense, the elements relating to rituals of engagement in the original model are only considered as maybe relevant to RE.

Physical representations

In the original narrative mediation model, Winslade and Monk (2000) point out that the mediator needs to pay attention to the physical presentation of conflicting parties. Issues include: gender, ethnic origin, age, facial expression, tone, accent, volume of voice, breathing, posture, use of eyes, and dress.

In the case of a RE meeting, there is no direct evidence from the literature suggesting such issues as gender, ethnic origin, age, religion, class and disability have significant impacts on the RE process. Therefore, these elements are considered as irrelevant to RE. However, a requirements engineer does need to be aware of and observe facial expression, tone, accent, volume of voice, and use of eyes, and body language of the conflicting parties. For example, Sharp et al., (2000) argue that, by watching tacit communications and body language provides new insights into people's beliefs and values within certain culture contexts. The insights gained will help a requirements engineer better identify, understand, and analyze the causes of conflict, and furthermore minimise the negative emotions of participants. Therefore, the elements of facial expression, tone, accent, and volume of voice, posture, use of eyes will be considered as relevant and important in the case of a RE meeting.

Relationship practice

Mediation is a cooperative practice in which the conflicting parties are viewed as partners in the mediation. Narrative mediation is very much about creating a relational climate. Mediation is not merely about resolving the short-term problem and reaching

an agreement. The mediation in fact should be transformative in nature and eventually result in a good relationship between parties for long-term success. To achieve this relational climate, the original narrative mediation model recommend that a mediator should show "respect to the parties involved, value their personhood, and invite collaborative conversation" (Winslade and Monk, 2000). In the case of RE, all these good practices should also be followed by a requirements engineer. As a RE process is a complex social collaboration process, which will be enriched by cooperative relationships among different stakeholders.

Furthermore, the original narrative mediation model also points out that the mediator needs to have an explicitly written or verbal agreement with parties about how mediation will be conducted. The contract may outline clear procedures for managing the whole event. Possibly, the protocol that must be followed and a fee for the mediation services outlined. This form of contract ensures the need for confidentiality and respectful conduct towards all parties. In the case of a RE meeting, a certain form of contact may not be always relevant. However, the requirements engineer does need to be aware of the meeting objectives and agendas. She or he needs to make sure the parties understand and agree with the proposed agenda and objectives. As a result, all the elements from the relationship practice are retained, except the element of "communicating invitation to agency". As the requirements engineer can directly deal with conflict with the parties without communicating with any agency.

Dialogical practice

Dialogical practice is the key part of the narrative mediation. Indeed, narrative mediation strongly relies on stories. This indicates that people are encouraged to organise their experiences in story form. The key activities in the engagement phase are about inviting and listening to the telling of their conflict stories. Winslade and Monk (2000) indicate that the mediator should be more interested in learning the story from which the person is operating, not just with the story the parties are telling. The mediator should learn and listen to people as experts on their own lives. Winslade and Monk (2000:140) introduce discursive listening techniques defined as:

> *"Careful listening involves hearing not just what has happened but also what necessary constructs are at work in this particular account to make sense of*

what has happened. This is what we call discursive listening, or listening to the discourses at work in a particular account and to the position calls that are issued within each discourse."

The discursive listening technique is particularly useful in the context of resolving conflict in RE. It is well-acknowledged that traditional RE methods and techniques adopt an objective reality that assume that there are simple answers to deep questions about the nature of reality, meaning and truth (Berry, 1998; Davis, 1994; Kotonya and Sommerville, 1998; Macaulay, 1996; Nuseibeh and Easterbrook, 2000; Robertson and Robertson, 1999; Sommerville and Sawyer, 1997; VanLamsweerde, 2000). However, many researchers have recently argued that an alternative subjectivist perspective is needed in RE. For example, Thanasankit (2002) states that people with subjectivist perspectives normally view meaning, fact, and reality as socially constructed and never finalised, and thus are always contextual and open to revision. Ramos et al., (2005) also state that if a requirements engineer adopts an objectivist perspective, she or he then would expect to simply elicit requirements from the reality and proceed systematically to a specification. However, with the emergence of social, human, and organisational issues, requirements are socially constructed and embedded into its social and organisational contexts. This is why Goguen (1994) argues that requirements are not a set of facts that can be simply captured and elicited from the user.

The discursive listening aims to hear the stories as a version or construction of events rather than a set of facts (Winslade and Monk, 2000:140). It does not merely listen for a definable problem, which is some facts that form the basis of the conflict, or the underlying interests of the parties that are being expressed in the conflict. Most importantly, discursive listening adopts a subjective perspective, and involves learning and listening for the intersection of narrative in a discursive context. This emphasis of adopting subjective perspectives and the essential leaning from the users matches well with the subjective nature of the current RE context. As a result, all the elements of dialogical practice are considered as relevant and critically important to the context of RE.

Positional call

Winslade and Monk (2000) state that every story offers people positions to take up in relation to each other, and that these positions are expressed in people's conversations. In the context of developing a software project, the stakeholders involved also have their unique positions to take up based on their individual roles and responsibilities pre-defined within their organisations. For example, a requirements engineer from either a developer site or a user site needs to work hard and fairly with all user groups to elicit their needs, and translate these needs into a feasible specification for developers who implement these requirements. A user also needs to collaborate with a requirements engineer and other users to express his or her goals and needs for a software project to enable his/her daily work. It is worth noting that a requirements engineer (mediator) needs to urge parties to take their appropriate positions to achieve mutual benefit. Therefore, positional call which legitimates the positions of each stakeholder is very relevant to the context of a RE meeting.

4.3.3 Activity-2: Adding on the specialised RE elements

By performing the model translating activity-2, model version V1.2 is proposed (see Figure 10). Discussion of the addition of specialised RE techniques follows. In the conflict identification phase, two special RE techniques are considered and integrated into the original narrative mediation model to achieve better identification of conflicts among different stakeholders. I use some elements from Maiden and Bright's (1996) and Viller's (1991) RE meeting model to provide a checklist of preparing appropriate artefacts in a RE mediation meeting. I also use stakeholders modelling technique offered by Constantinue and Lockwood (1990) to provide rich pictures of the stakeholders and their detailed background information.
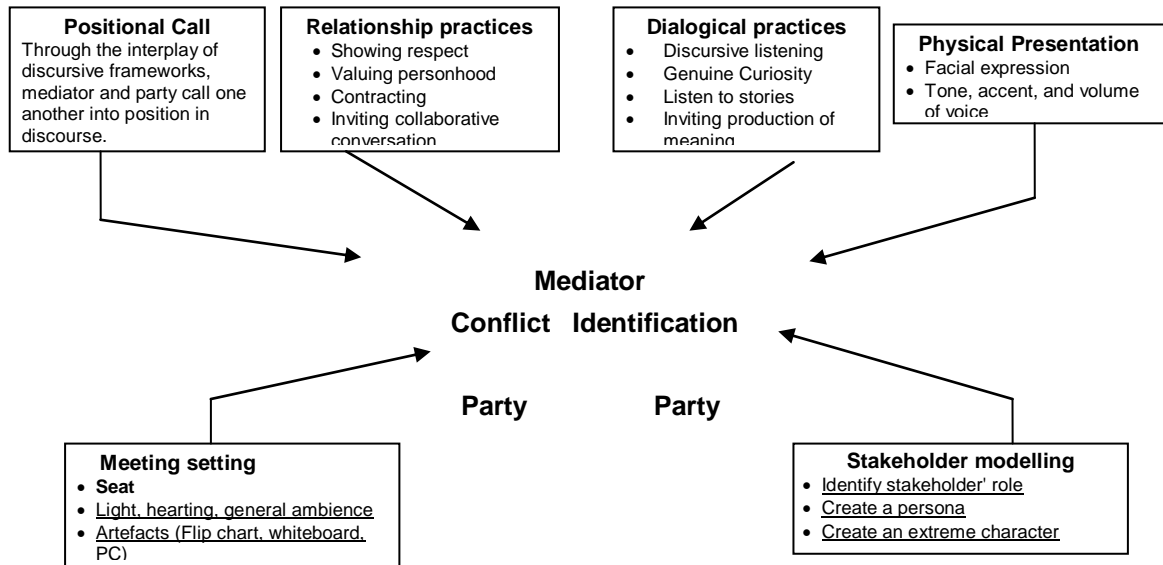
Figure 10: Conflict Identification phase model version V1.2

Note: referring to model version V1.2, the underlined elements are related to the additional specialised RE techniques. The remaining elements stand for the relevant elements to RE, which are remained from the model version V1.1.

Meeting setting

As mentioned in section 5.2.1, selecting a meeting setting in RE focuses more on the meeting layout and the use of artefacts to facilitate meetings, rather than focusing on creating a "psychologically" safe environment for family mediation. In this sense, good practices for selecting an appropriate RE meeting setting has been adopted from Maiden and Bright's (1996) a RE meeting room layout model and a RE facilitator task model, which have been mentioned in section 5.2.2. Viller's (1991) model provides detailed discussions on the tasks associated with preparing RE meeting environment such as layout and seating. Maiden and Bright (1996) then focus on providing guidance for setting up and selecting appropriate artefacts for a RE meeting such as the use of flip chart, whiteboard, and various computer diagramming tools. For more details, please refer to Viller (1991) and Maiden and Bright (1996).

Stakeholder modelling

Identifying and involving the right stakeholders is of paramount importance in RE (Sharp et al., 1999). In particular, stories in RE are interactively written through the collaborations between different stakeholders. Consequently, it is essential to identify the apparoiate stakeholders' roles and personas prior to listening to his/her story. The

disciplines of user-centred design (Constantinue and Lockwood, 1999) and interaction design (Cooper and Reimann, 2003) provide theories and techniques for identifying and modelling stakeholders as an initial step towards a successful RE mediation meeting. In this research, I follow Constantinue and Lockwood's (1999) four steps to identify and model a useful set of stakeholder roles:

- Brainstorm an initial set of user roles.
- Organise the initial set
- Consolidate roles
- Refine the roles

Furthermore, Cohen (2004:38) suggests that identifying stakeholder roles is a "great leap forward", and it is worth going one step further and creating a persona for the role. This becomes particularly important in the context of resolving conflicts among different stakeholders. Creating a persona is more than just adding a name to a user role. A persona should be described in a very detailed level which aims to provide a rich and thorough picture of the stakeholder's roles and responsibilities within their organisation. Such persona provides solid background information for a requirements engineer (mediator) to understand the conflicting party's personality and character. This eventually leads to a better understanding of the conflicting situation. Another interesting and useful technique is considering extreme characters. Djajadiningrat et al., (2000) argue that in the process of RE, it is essential to think about possible extreme characters. They give an example of designing a Personal Digital Assistant (PDA) system, and indicate that it is interesting to design the PDA system for a drug dealer, the Pope, and a twenty-year-old woman who is juggling multiple boyfriends. In the context of resolving conflict in RE, conflict is more likely to happen between parties who have exaggerated personalities and extreme characters. In Appendix 5 and 6, I provide more detailed descriptions for persona and extreme character by presenting its' templates and examples based on the works from Blomkvist (2002) and Djajadiningrat et al., (2000).

4.3.4 Activity 3: Re-structuring the phase.

In the first and second model development activity, the original structure of the model has been re-phrased. The model now contains overlaps and redundancies. By

performing the model translating activity 3, model version V1.2 is simply re-structured. The Model version V1.3 is proposed (see Figure 11), which includes four parts. The relational practice part incorporates the elements of the positional call from the Model version V1.2, as calling parties into their positions can be recognised as an important element to maintain a good relationship. The dialogical practice then incorporates the elements of the physical presentation from the Model version V1.2, as it is essential to watch physical presentation of the parties during dialogical conversations. The parts of selecting meeting setting and stakeholder modelling remain as Model version 1.2.
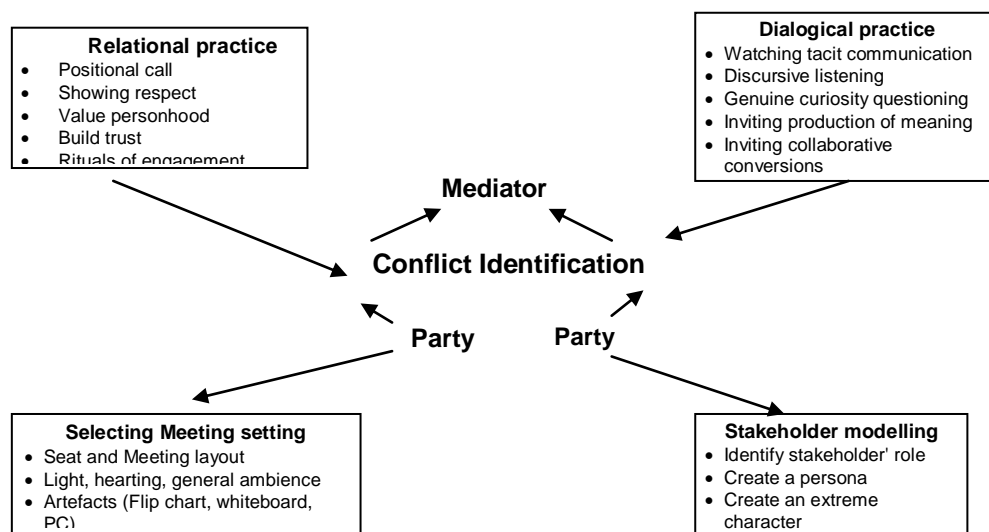
Figure 11: Conflict Identification phase model versionV1.3

4.4 Model development Part 2: translating deconstruction phase

This section presents the detailed process of translating the second phase of the original model-deconstruction to the context of RE. I follow the three model translation activities as previous. Figure 12 presents the original model of deconstructing the conflict-saturated story phase of the narrative mediation model (Winslade and Monk, 2000). I define the original model as the model version V2.0.

4.4.1 An overview of deconstruction phase

According to Winslade and Monk (2000:72), the mediator in this phase aims to work actively to clearly understand the causes of conflicts and separate the parties from the

"conflict-saturated" story. They further refer to this phase as "deconstructive" in that it gently seeks to undermine the certainties on which "the conflict feeds and invites the participants to view the plot of the conflict from a different vantage point" (Ibid, 73). The key element of this phase is dialogical practice. It involves the mediator asking questions that will open up space for reconsideration of the conflict-saturated story. At the beginning of this phase, the question might be about what has happened as each party is asked to describe their conflict. The questions then are shifted to explore in detail how the conflict began and how it unfolded. At the later process, the mediator is encouraged to develop an externalizing conversation to help people separate from a story that locates the conflict in the nature of either person or to the relationship. Using externalizing language shifts the focuses away from personalities, or blame, and focuses attention of the problematic features of the problem itself. This is similar with the idea of "separating the problem from the people" by Fisher and Ury's (1981; 1983) Principled Negotiation approach.

In the context of RE, this phase is considered as a conflict definition phase, which aims to develop a deep understanding of the causes of conflicts by using a variety of specialised questioning and listening techniques. Indeed, RE is all about a communication problem (AI-Rawas and Easterbrook, 1996; Coughlan, 2003). Those who want the new software (users and customers) must communicate effectively with those who will build the new software (developers) through oral and written communications. Robertson (2005) argues that a skill central to RE is knowing which questions will explore factual information and uncover the real requirements. Kandrup (2005) then notes that requirements engineering fundamentally lies in the dialogue between the users and requirements engineers. In this sense, dialogical practice and questioning is an essential aspect of this communication among different stakeholders.
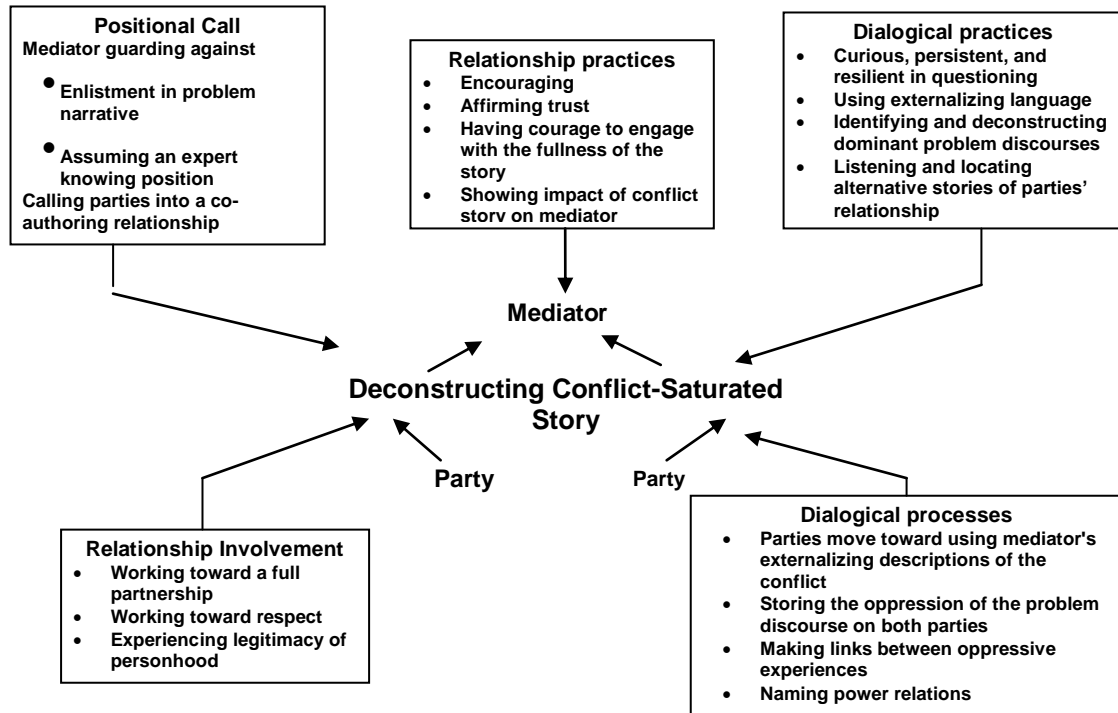
Figure 12: Phase of deconstruction model version V2.0

4.4.2 Activity-1: Deleting the irrelevant elements

By performing the model development activity-1, model version V2.1 (see Figure 13) is produced. Full justifications of the relevance of each element to RE are given as follows.
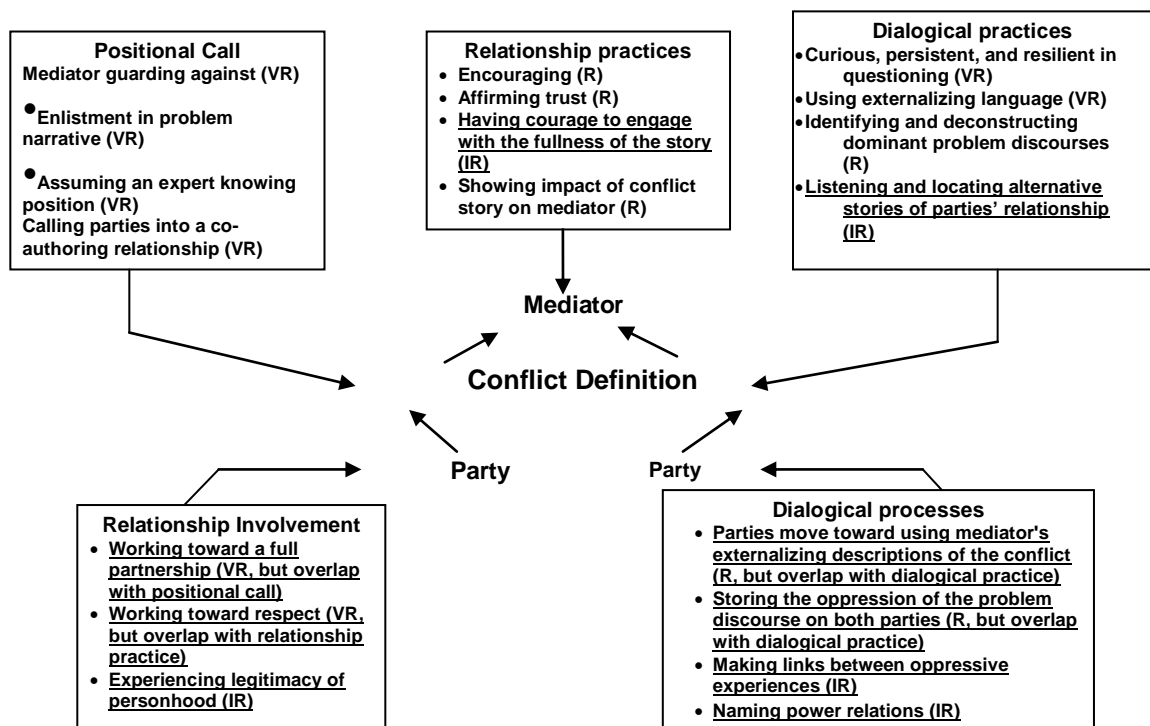
Figure 13: Conflict Definition phase model version V2.1

Note: (VR: very relevant; R: relevant; IR: irrelevant; MR: Maybe relevant). Referring to Figure 4.7, the underlined elements stand for the irrelevant or overlapped elements to RE, which will be removed from the model version V1.1. The remaining elements are the relevant elements, which will be retained by providing full justifications.

Positional Calls

As discussed in last section, the concept of positional calls is very important to the context of RE. Narrative mediation legitimises the positions of each stakeholder and offers stakeholders positions to take up in relation to each other. In this phase of mediation, Winslade and Monk (2000) indicate that a mediator is urged to be mindful of the following three issues associated with position calls. These three issues are considered very relevant in the context of RE:

- **Enlistment in problem narratives**: In the process of mediation, sometimes the mediator can be overwhelmed and convinced by a party's conflict story. The mediator then enlists his/her position into a "sympathetic rescuer of a party's victimhood" (Winslade and Monk, 2000:75). If this happen, the mediator then will lose his/her direction and effectiveness, and the mediation then becomes unbalanced and user-dominated. The example of "user-dominated" behaviour is well-acknowledged in the SE and IS literature (Curtis et al., 1988; Franz and Robey, 1984; Markus and Bjorn-Andersen, 1987). Their findings consistently indicate that user-dominated behaviours such as resistance to change will negatively impact on the project outcome. In this sense, the mediator in RE should be alert to guarding against enlistment into one party's conflict story.

- **Assuming an expert knowing position:** In the process of mediation, the mediator also can easily assume him/herself in an expert knowing position (Winslade and Monk, 2000). She or he thus calls the parties into trusting the knowledgeable expert. In this case, the mediation becomes mediator-dominated. The example of the "IS-dominated" or "IS-led" process is also well-acknowledged in the SE and IS literature (Curtis et al., 1988; Newman and Sabherwal, 1989). Their findings also indicate that IS-dominated

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behaviours such as IS staff exercising their power in ways that leave the users little choice eventually lead to poor user satisfaction. In this sense, the mediator in RE should also be alert to assuming an expert knowing position.

- **A co-authored relationship:** To avoid user-dominated and IS-dominated behaviours, narrative mediation argues that the mediator should speak in a way that invites the production of a "co-authored" relationship (Winslade and Monk, 2000:76). The mediator and the parties should share the power and responsibility for the development of the story of cooperation. In the case of a RE meeting, many authors also comment on this cooperation relationship. For example, Macaulay (1999) states that users not only needed to be consulted, but also need to be fully involved in the cooperative decision-making process. Alexander (1999) even argues that a democratic RE approach is needed to offer a specific counter-balance to the oppressive use of power, whether by a stakeholder or by a requirements engineer

Relationship practices and relational involvement

In this phase of mediation, the relationship established with the parties in the previous engagement phase needs to be continued. In fact, the deconstruction phase can proceed only if the mediator is able to continue to demonstrate respect and compassion to the parties. In this respect, the mediator should be "encouraging, affirming trust, having courage to engage with the fullness of the story, and showing impact of conflict story on mediator" (Winslade and Monk: 2000:80). It is apparent that all these relational practices are very relevant in the context of RE.

Dialogical practice and dialogical process

Winslade and Monk (2000) state that in this phase of dialogical practice, the mediator needs to ask questions that will open up space for reconsideration of the conflict story. In the RE community, Kandrup (2005) challenges the traditional "narrow-down" form of RE questioning techniques and argues that using "open-up" questions can create new knowledge, generate new insights, and eventually uncover hidden structures or non-obvious facts. In this section, I do not intend to focus on discussing the relevance of those questioning and listening techniques, as they have been discussed in the

previous sections (see section 4.2.2 and 4.3.2). Here, this section focuses on the other dialogical practice technique- developing an externalizing conversation.

Developing an externalizing conversation plays an important role in this phase of mediation to separate the parties from the "conflict-saturated" story. Externalization is used to separate the people from the conflict. It shifts focuses away from personalities, or blame, and focuses attention on the problematic features of the conflict itself. The spirit of it lies in the aphorism by Fisher and Ury (1981) – "the person is not the problem; the problem is the problem." The importance of separating the people from the problem is also acknowledged in the RE literature. For example, in relation to requirements negotiation, Bustard (2002) provides his personal experiences as an independent requirements engineer to facilitate an EH (Environmental Health) department and a software supplier to negotiate a government-funded software project. He states that, within a political organisation like EH, there is always sensitivity in the people side of the project. As a result, there is a clear need for the requirements engineer to take an explicit perspective to separate the people from the problem, focus on the problem rather than the position, and eventually help diffuse internal tensions within the client organisation. Viller (1991) also indicates that hidden agendas, power struggles, and fear of change often lead to repetitious arguments, open attacks, anger, and blame in a RE meeting. It is thus essential for a requirements engineer to shift parties away from personalities, or blame, and let parties focus more on the key issues.

4.4.3 Activity-2: Adding on the specialised RE elements

To develop a specialised RE mediation model, it is essential to integrate specialised RE techniques into the original model. The aim of the original deconstruction phase is to undermine the fundamental causes of conflicts by adopting specialised dialogical techniques such as discursive listening, curiosity questioning, and developing externalization conversation. The original model emphasises the importance of verbal communication, but does not provide guidance on how to write a good story.

Consequently, it is essential to include guidelines from the RE literature on writing a good narrative. Unfortunately, little relevant work is reported in the RE literature on this. As mentioned in the chapter 3, the term "story" or "narrative" used here is

different from the increasing use of "user story" in agile methodologies. In XP, to shorten development times, writing down a few "short placeholding sentences" provides a fast way to capture the user requirements (Cohn, 2004). The user story in agile methods is thus terse and only contains information regarding the functionality of the proposed system. These simplified versions of stories are inadequate to capture the complexity of human, organisational, and social aspects of conflict. As a result, the elements added on this phase are mainly adopted from social science in which the concept and theory of narrative first emerged (Brannigan, 1992; Burroway, 1999; Gruen et al., 2002). Mishler (1986) states that narrative theory provides theoretical grounding for understanding interviews as discursive acts and representations. Alvarez and Urla (2002) claim that software requirements generated through interviews are discursively produced. Based on their observations of a series of RE interviews in practice, they further note that users usually organise their experiences into a well-defined story form to persuade a requirements engineer. Such stories are then translated into a set of software requirements.

Nevertheless, the question of what makes a good story is a difficult one. It seems with no single answer to this question, as there are many different ways of writing a story reported in the literature. Moreover, the elements and structures of a story can vary from culture to culture. In this research, Gruen et al., (2002)'s structured template of writing a good story is adopted, which includes "defining fleshed-out characters, defending the detailed settings, defining parties' goals, identifying causality, and defining dramatic element". A detailed description of how to write a compelling story for software design can be found in Gruen et al., (2002). Based on the above discussion, the Model version V2.2 is proposed as follow (Figure 14).
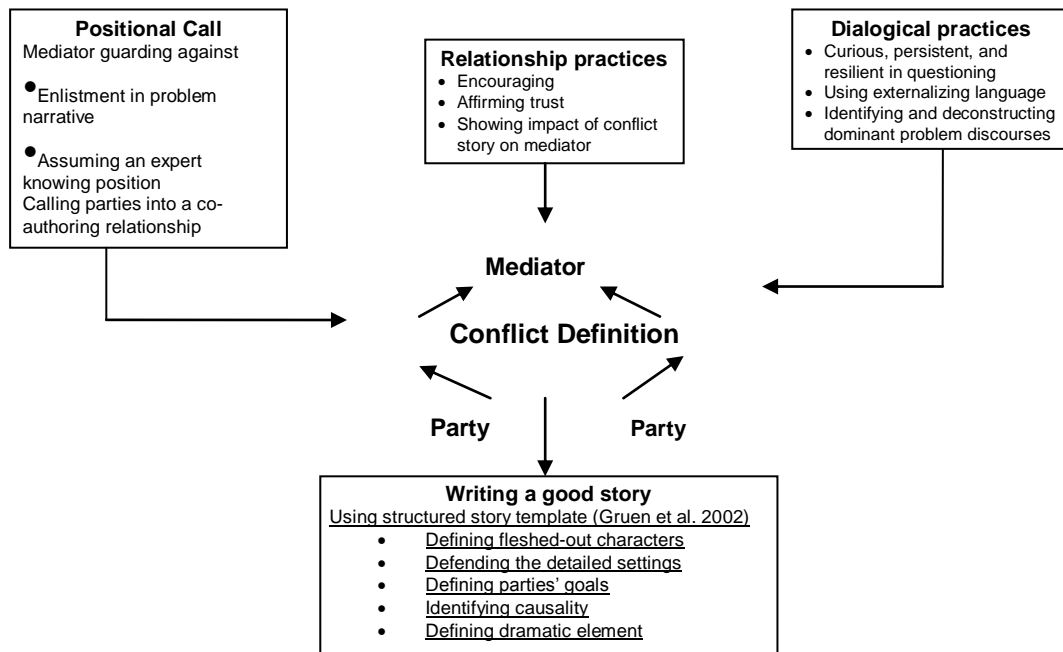
Figure 14: Conflict definition phase model version V2.2

Note: referring to model version V2.2, the underlined elements stand for the additional specialised RE techniques. The remaining elements are the relevant elements to RE, which are retained from the model version V1.1.

4.4.4 Ativity-3: Re-structuring the model

The final version of the phase of deconstruction is shown in Figure 15. The phase version V2.2 itself has overlaps. For example, the elements from relational involvement overlap with the elements of relationship practice, e.g. "working towards a full partnership" shares the same meaning with the element- "calling parties into a co-authoring relationship". "Working towards respect" is also the same as the meaning of the element – "affirming trust and encouraging". Hence, I exclude these overlapped elements. Furthermore, I combine the relational practice and the relationship involvement into together. The dialogical practice and the dialogical process are also combined together.

Relational practices
Mediator guarding against

- Enlistment in problem narrative

- Assuming an expert knowing position
Calling parties into a co-authoring relationship
Encouraging and affirming trust and respect
Showing impact of conflict story on mediator

Dialogical practices
- Curious, persistent, and resilient in questioning
- Discursive listening
- Using externalizing language
- Identifying and deconstructing dominant problem discourses

Mediator

Conflict Definition

Party　　**Party**

Writing a conflict story
Using structured story template

- Defining fleshed-out characters

- Defending the detailed settings

- Defining parties' goals

- Identifying causality

- Defining dramatic element

Figure 15: Conflict definition phase model version V2.3

4.5 Model development part 3: translating construction phase

This section presents the detailed process of translating the last phase of the original model to the context of RE. I follow the same three model translation activities as previous. Figure 16 presents the original model of constructing the alternative story phase. I define the original phase as the model version V3.0.

Positional Call
- Mediator invites parties to identify with the alternative account of relationship
- Mediator seeks to learn from parties' experience

Relationship practices
- Celebrating and honouring moves towards redecoration of relationship
- Describing impact of parties' alternative story on mediator

Dialogical practices
- Documenting change
- Drawing attention to unstudied experience
- Engaging with parties in crafting an alternative story
- Recruiting audience to alternative story

Mediator

Constructing Alternative Story

Party　　**Party**

Relationship Involvement
- Assuming full authorship and authority
- Being open to new possibilities
- Having a more respectful relationship with self and one another

Dialogical processes
- Speaking with agency and authority
- Receptive to alternative stories about the relationship
- Disputing the positions offered in processes of oppression

Figure 16: Phase of construction model versionV3.0 (Winslade and Monk, 2000)

4.5.1 An overview of construction phase

Winslade and Monk (2000:72) indicate that in this phase of mediation, the mediator aims to build "a story of cooperation". In the context of conflict resolution in RE, this phase thus aims to lead to a resolution that takes the form of an agreement between conflicting parties. A good starting point can be co-authoring with the parties their preference for a different and conflict-free description of their relationship. In this sense, the mediator and conflicting parties share the responsibility for developing the story of cooperation. This is important because only when the mediator reaching the point with a degree of good-will and respect, conversations about resolving the conflict may be much more straightforward. A problem-solving approach can be adopted on this occasion. A narrative mediator then can begin to shift focus from the relational issues to the substantive issues and propose solutions.

Normally, the mediator should focus on having either party offer a compromise. In most cases, this way is effective because parties in conflict are in fact interested in working with the relational content of a conflict for mutual benefits. In a case study of a software project development, Curtis et al., (1989) indicates compromise always exists at a work place, in particular, when conflicting parties are from the same corporate department to save face and maintain a further good working relationship with others. In the specific context of requirement negotiation workshops, Nuseibeh (1998:21) also indicates that the developers often need to negotiate with the users to develop trade-off to "make the game continue".

4.5.2 Activity 1: Deleting unimportant elements

By performing the model development activity 1, model version V3.1 (see Figure 17) is produced. Full justification of the relevance of each element to RE is given as follows.

Positional call

In the phase of constructing the alternative story, the original model asks the mediator to invite parties to identify with their preferred alternative to the conflicting relationship. In the context of RE, this can be understood as the requirements engineer invites conflicting stakeholders to propose their preferred solutions as the alternatives for the conflicting situation. This requires the mediator (a requirements engineer) to seek to learn each party's experience and understand what their preferred solutions are. It is obvious that both of these two positional calls are relevant and important to the context of RE. The detailed relevance of positional call has been well-discussed in the previous section (e.g. Section 4.3.2).
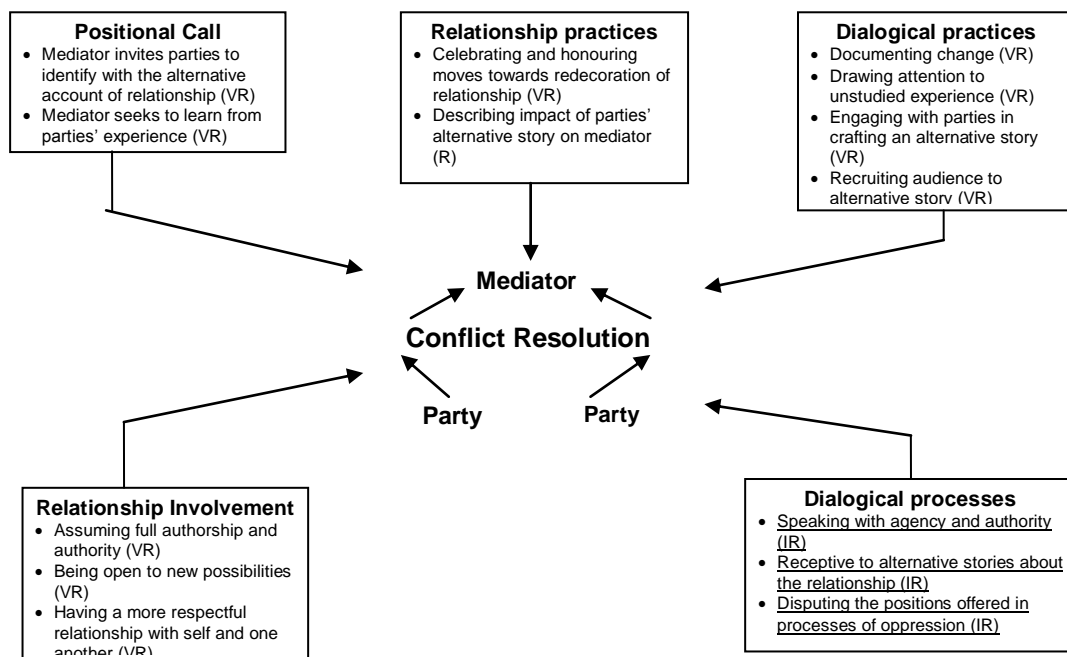
Figure 17: Conflict Resolution phase model version V3.1

Note: (VR: very relevant; R: relevant; IR: irrelevant; MR: Maybe relevant). Referring to figure 4.11, the underlined elements stand for the irrelevant or overlapped elements to RE, which will be removed from the model version V1.1. The remaining elements are the relevant elements, which will be retained by providing full justifications.

Relationship practices and relational involvement

All the elements from the relationship practices and relational involvement in this phase of mediation are clearly relevant to RE, and are retained:

- **Assuming full authorship and authority**: This means that the mediator and the parties share power and responsibility for the development of the story of cooperation. This is certainly essential for RE. As mentioned before, in the RE

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literature, many authors comment on this kind of cooperative relationship. For example, Macaulay (1999) states that users not only need to be consulted, but also need to be fully involved in the cooperative decision-making process. Alexander (1999) even argues that a democratic RE approach is needed to offer a specific counter-balance to oppressive use of power, whether by a stakeholder or by a requirements engineer.

- **Being open to new possibilities:** This means that a mediator should open his/her mind and be creative by inventing all possible alternative solutions. Creativity is widely acknowledged as vital to resolve complex problems in society (Boden, 1991; Plucker and Beghetto, 2004; Sternberg, 2005). RE as a problem-solving process means that a requirements engineer's creativity is important (Maiden et al., 2004; Hoffmann et al., 2005; Nguyen and Swatman, 2006). Nguyen et al., (2000) indicated that in many cases, requirements engineers re-conceptualise the users' requirements and propose their own solutions to the requirements as a result of unexpected and creative insight.

- **Having a more respectful relationship with self and another & celebrating and honouring moves towards cooperation of relationship:** Both are obviously essential for any collaboration based tasks, particularly, in the context of software development which is rich in collaboration among different stakeholders.

- **Describing the impact of parties' alternative story to each other:** This is also recognised as a very relevant element for RE mediation. Without a proper understanding of the potential impacts of the alternative solution, the conflicting parities will find it hard to imagine the outcome and make a firm joint decision.

Dialogical practice and dialogical process

In Section 4.2.1 and 4.3.1, I provided detailed discussions on the relevance of dialogical practice and the dialogical process to RE. The majority of the elements are relevant to the context of RE mediation. Here, I include justifications for those elements not addressed in previous sections. For example,

- **Documenting change:** Software systems always evolve as the environment in which these systems operate changes and stakeholders' requirements change accordingly. Sommerville (2005) indicate that managing change is a fundamental activity in the RE process. Nuseibeh and Easterbrook (2000) also indicate that requirements are often added due to stakeholders changing their minds, or because they were missed in the initial analysis; requirements may be often deleted to minimise cost and schedule overruns. All these requirements changes need to be carefully documented for further reference. Documenting change thus is recognised as relevant to RE and is retained in the model.

- **Drawing attention to the unstudied experience:** This is similar to the idea of "being open to new possibilities" which encourages a mediator to explore all possible solutions and invent creative ideas. Its relevance to RE have been discussed above, this element is retained in the model.

- **Recruiting an audience to the alternative story:** This means an alternative story may be a wide range of other audiences to gain new insights and increase confidence in the decision-making process. It is viewed as important to the context of RE to ensure the proposed solutions can be widely accepted by all stakeholders, not just to the representative of certain stakeholders groups.

- **Speaking with agency and authority:** This is considered as irrelevant to RE. In real RE practice, it is unlikely that any external agencies are involved in the decision-making process.

- **Engaging with parties in crafting an alternative story:** this shares a similar meaning with "assuming full authorship and authority", which means the mediator and the parties should be fully engaged into the conflicting situation and share the power and responsibility for the development of the story of cooperation. Since its relevance to RE has been discussed in the above section, this element is thus retained

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- **Receptive to alternative stories about the relationship:** this shares a similar meaning with "having a more respectful relationship with self and one another", which emphasises that the conflicting parties should be willing to compromise and accept alternative solutions. Its relevance to RE has been discussed above section, and this element is retained.

4.5.3 Activity 2: Adding on specialised RE elements to model version V3.2
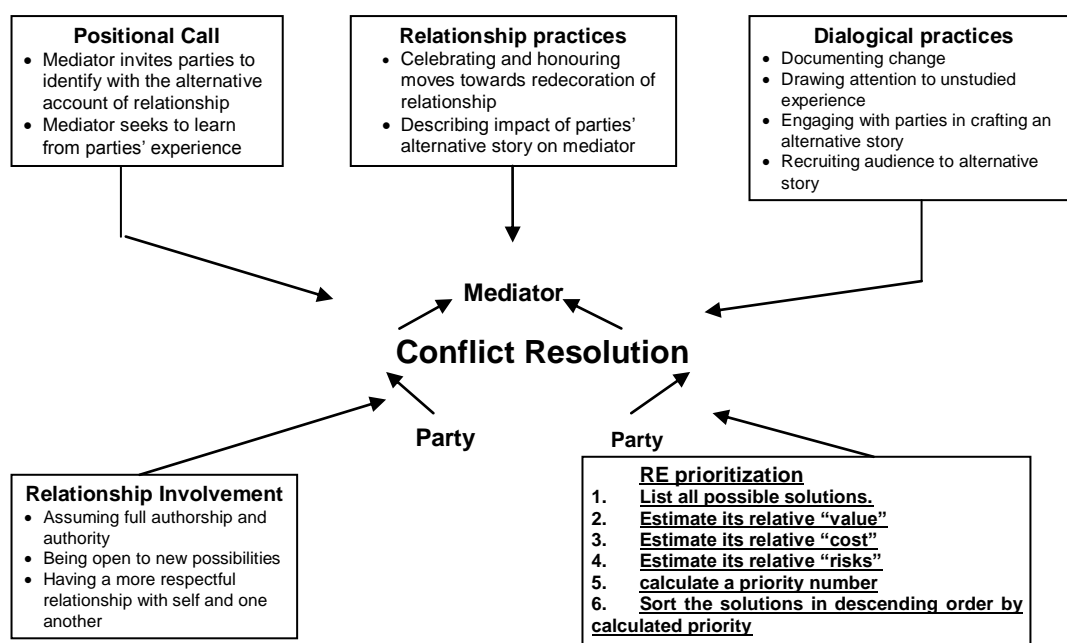
Figure 18: Conflict Resolution phase model version V3

Note: referring to model version V3.2, the underlined elements stand for the additional specialised RE techniques. The remaining elements are the relevant elements to RE, which are retained from the model version V3.1.

RE prioritisation
Although relationship practice and dialogical practice is consistently recognised as two most important parts in the previous two phases of narrative mediation, in this phase of narrative mediation they may not play a most important role comparing with the newly added activity: RE prioritization. This is because that the primary focus of the previous two phases is on identifying and defining conflict. It is inevitable to involve a great deal of dialogical and relationship practice. However, this phase of narrative mediation focuses on inventing resolution to conflict. It is a problem-solving process, which focuses more on brainstorming, selecting, and evaluating possible

solutions. This does not imply that the relational and dialogical practice will be removed from this phase. Instead, all good practices recommended by the original model will be retained, but, are considered as less important than RE prioritization.

Requirements prioritization is used to determine the relative necessity of each requirements(Fellows 1998; Wiegers, 2000). Whereas all requirements are mandatory, some are more critical than others. For example, failure to implement certain requirements within a certain period may lead to a system failure. It is thus recognised as a critically important part of requirements analysis that every requirements engineer must perform (Davis 2003). In particular, it aims to resolve conflicts when customer expectations are high, timelines are short, and resources are limited. Indeed, conflicts are more likely to emerge from those situations. As people naturally have their own interests at heart and they aren't always willing to compromise their needs for someone else's benefit. In the context of conflict resolution in RE, prioritization can be used to help the requirements engineer and the conflicting parties to evaluate their preferred solutions and eventually make a win-win decision.

Unfortunately, prioritization is a relatively new and ongoing research area in the RE community (Firesmith, 2004). Although some authors state that prioritizing requirements is important, Firesmith (2004) states that no specific guidance is presently available. He further notes that there is little agreement in the RE literature as to how, when, and why requirements should be prioritised. However, some quantitative based analytical techniques are available by borrowing theories from the field of mathematics, applied economics, and management science. I adopt a semi-quantitative technique based on the prioritization of "Value, *Cost*, and *Risk*" of requirements, which has been developed by Wiegers (1999). He proposes the following 8 steps of requirements prioritization:

1. List all of the requirements, features, or use cases that you wish to prioritise in a spreadsheet

2. Estimate the relative "value" that each feature provides to the customer or the business on a scale from 1 to 9, with 1 indicating very little benefit and 9 being the maximum possible benefit.

3. Estimate the relative "negative impact" the customer or business would suffer if the feature is not included. Again, use a scale from 1 to 9, where 1 means essentially no impact and 9 indicates a very serious impact.

4. The Total Value column is the sum of the relative "value" and "negative impact". By default, "value" and "negative impact" are weighted equally.

5. Estimate the relative cost of implementing each feature, again on a scale ranging from a low of 1 to a high of 9.

6. Developers estimate the relative degree of technical or other risk associated with each feature on a scale from 1 to 9. An estimate of 1 means you can program it in your sleep, while 9 indicates serious concerns about feasibility.

7. Once you enter the estimates into the spreadsheet, it calculates a priority number for each feature. The formula for the Priority column is: priority = value %/ (cost % * cost weight + risk % * risk weight).

8. Sort the list of features in descending order by calculated priority.

Wiegers's (1999) prioritization technique, which only focuses on three factors (value, cost and risk), is limited in my situation. In this research, I view conflict in RE as a result of multiple factors, which range from human factors to social and organisational factors. It is more than just a collection of conflicting requirements or requirements lacking the correct sequence. Firesmith (2004)'s case study findings indicate that different types of stakeholders tend to prioritise requirements differently (e.g., they tend to prioritise use cases higher when they are the actor and direct benefitor from the execution of the use case); even different stakeholders within the same stakeholder type prioritise them differently because of their different individual needs, experiences, and levels of training. He also notes that customers desiring the immediate implementation of all requirements might mistakenly assume that the real reason to prioritise the requirements is the developers' devious desire to eliminate some of the more difficult or risky requirements. This leads to a lack of trust between users and developers, and eventually results into serious financial consequences (Davis 2003).

Mead et al., (2009) argue that most prioritization approaches are bound to be subjective, biased, and influenced by project politics. The implications here are that the requirements engineer needs to take all relevant factors into his/her consideration

when applying requirements prioritization techniques. She/he should not insist too much on those objective criteria. Instead, she/he should only consider requirements prioritization as a decision-supporting tool.

4.5.4 Activity 3: Re-structuring the model

Again, model version 3.2 has overlaps between elements. For example, "engaging with parties in crafting an alternative story" shares a similar meaning with "assuming full authorship and authority". "Receptive to alternative stories about the relationship" shares the similar meaning with "having a more respectful relationship with self and one another". I also find that many elements from relationship practice have a similar meaning with relationship involvement. The final model version 3.3 of the phase of constructing an alternative story is re-structured as follow: (see Figure 19)

Relationship practices
- Celebrating and honouring moves towards redecoration of relationship
- Being open to new possibilities
- Mediator invites parties to identify with the alternative account of relationship
- Mediator seeks to learn from parties' experience
- Describing impact of parties' alternative story

Dialogical practices
- Documenting change
- Drawing attention to unstudied experience
- Engaging with parties in crafting an alternative story
- Recruiting audience to alternative story

Conflict Resolution

RE prioritization
1. List all possible solutions.
2. Estimate its relative "value"
3. Estimate its relative "cost"
4. Estimate its relative "risks"
5. Calculate a priority number
6. Sort the solutions in descending order by calculated priority

Figure 19: Conflict Resolution phase model version V3.3

4.6 Reflections on overall model development process

This chapter presents an RE specialised narrative mediation model (NREMM) to resolve conflicts in RE by following a transparent, rigorous and systematic model development process. It is worthwhile to summarise the key reflections on the overall model development process.

To ensure a rigorous and systematic model development process, I follow three development activities: deleting irrelevant elements from the original model, adding and integrating with RE specialised techniques, and re-structuring the model. It is noticed that the first model development activity is the most time-consuming because it involves another researcher (in some cases, a third researcher also needs to be involved) to assess the individual element's relevance to RE. Justifying the relevance of individual elements to RE is also time-consuming due to a wide range of evidence from the literature. However, further model development activities (e.g. adding and integrating with RE specialised techniques, and re-structuring the model) become much easier once justifications are established. The first model development activity also appears to be critically important as it needs to ensure that all potentially relevant elements are not mistakenly deleted at the very beginning. To add rigour and confidence to our model development process, I use the Kappa statistic for this inter-rater reliability test (See Appendix 3).

It is also evidenced that most substantial model development work was devoted to the conflict identification phase development. This is in line with the existing literature, which speaks more on the impotence of the phase of conflict identification and mediation preparation (Thompson et al., 2001). The other reason of why the conflict identification phase seems involving more substantial work is because that many elements from the conflict identification phase appear again in the further two phases (e.g. position call, dialogical and relationship practice). Once the full justifications are given at the first stage, it becomes apparent that the efforts required were reduced in the further two phases' development process.

4.7 Summary

This chapter answered the second research question as follow:

RQ2: How can a theoretically robust NREMM be developed?

In doing so, this chapter translated the original narrative mediation model by Winslade and Monk (2000) into the NREMM in the context of RE. To ensure a

rigorous and systematic model development process, I followed three development activities: deleting irrelevant elements from the original model, adding and integrating with RE specialised techniques, and re-structuring the model. The result of this chapter was the theoretically robust NREMM containing three phases (conflict identification, conflict definition and conflict resolution), which is strongly underpinned by the original narrative mediation and storytelling theory. The NREMM is also integrated with some widely used RE specialised techniques. In addition to the theoretically robust NREMM, this chapter also outlined a transparent, rigorous and systematic methodology, which can be used by further researcher who also wishes to borrow relevant theory and translate it into the context of SE and RE. In the next two chapters, empirical assessment and evaluation studies are conducted to ensure the NREMM model not only theoretically robust but also practically useful.

Chapter 5: Empirical research methods

5.1 Introduction

This chapter sets out to explain and justify the empirical research methods and techniques used in this thesis. It commences with justifications of the empirical approach that underpins the choices made in relation to addressing the research questions. To answer the research questions, this research mainly adopts a qualitative approach including a survey interview and a quasi-experiment method. The survey interview method is used to answer the first and second research question, which aim to explore the nature of conflict and elicit RE experts' view on the theoretical aspect of the NREMM. The quasi-experiment is then used to answer the last research question, which aims to empirically evaluate the practicality and usefulness of the NREMM in a simplified real-world setting. More specific, this chapter outlines the key considerations of using semi-structured interviews and questionnaires to collect data. It further describes the methods used to code and analyse data. The purpose of this chapter is to show how the findings were arrived at, to provide a full picture of the methods and demonstrate the rigor of the research process. The detailed procedures of applying the methods and detailed discussions of specific threats to validity will be presented in later relevant chapters.

This chapter is organised as follows. In Section 5.1, a brief introduction to empirical approaches in software engineering is presented. Section 5.2 shows how a qualitative based approach is adopted in this research. Section 5.3 describes the specific empirical methods (survey and quasi-experiment) used in this research in relation to the research goals and outcomes. Section 5.4 describes the main data collection methods (semi-structured interview and questionnaires) used in this thesis. Section 5.5 discusses the lessons learnt from a pilot study. Section 5.6 presents the data analysis methods used in this research and Section 5.7 concludes the chapter.

5.2 Empirical approaches in software engineering

"One clear trend, at least within the research community, is to base requirements more firmly on an empirical understanding of the social

organisational of the environment where the system will be used. The degree and kind of involvement with the social aspect is currently subject to variation and debate, but is seems likely that the use of the more rigorous empirical methods will be valuable in increasing our understanding of the problems in this difficult area, and will pave the way for developing methods that are both efficient and effective."

-Jirotka and Goguen (1994:14)

This research adopts an empirical line of enquiry. An empirical approach is defined as "the information, knowledge and understanding gathered through experiences and direct data collection" (Black, 1999). Empirical approaches have been used across fields such as medicine, social science, education and psychology, but have only recently achieved significant recognition in the broader SE research community (Seaman, 1999). This is evidenced by the growth in empirical tutorials, workshops, special issues and grants from funding groups (Perry et al., 2000). According to Perry et al., (2000), an empirical study is "a test that compares what we believe to what we observe. It helps us understand how and why things work, and allow us to use this understanding to materially alter our world." They indicate that empirical studies in SE field are under-explored, and do not achieve the same success than other fields (Ibid). They further argue that the "biggest barriers to using empirical studies lie in the details of conducting them" (Ibid: 32). For example, Fenton et al., (1994) indicate that many empirical studies have poor statistical designs, do not scale up to large systems, and are conducted over too short a time. Basil (1996) suggests that the many differences between individual software projects make comparison difficult. Johnson (1997) also remarks that practitioners may resist being measured. To address those difficulties associated with conducting and design an empirical research, I particularly adhere to the guidelines offered by Kitchenham et al., (2002b) who call for empirical methods to be reported in sufficient detail to allow for assessment, and for statistics to be used appropriately.

Empirical software engineering research has become increasingly important to improve our understanding of human, social, and organisational factors in software engineering (Well and Harrison, 2000; Seaman, 1999; Hall et al., 2005). Seaman

(1999) points out SE empiricists are beginning to address the human factor in software development, and part of the reason for this interest actually comes from practitioners. Software development presents a number of unique management, social and organisational issues, or "people problems," that need to be addressed and solved in order for the field to progress (Ibid). Beecham (2004) argues that for a socio-technical discipline like RE, empirical methods are crucial. This is because empirical methods allow the researcher to incorporate multidisciplinary and interdisciplinary factors that frequently arise such as social issues, communication difficulties, quality of processes and products (Jirotka and Goguen 1994; Wohlin 2003). As mentioned before, it becomes apparent that conflict among different stakeholders is one of such important social issues that thus need more empirical research attention.

Lethbridge et al., (2005) indicate that the results of empirical studies could be applied to serve different types of research goals in empirical SE community:

1. They could be used to derive requirements for developing novel software tools and techniques.
2. The results could be used to provide useful recommendations to improve SE real practice.
3. The analysis of result could also yield new theories or hypotheses that can then be subjected to controlled experimental validation.

This research serves all the above research goals. First, the major contribution of this research is a narrative based conflict resolution model (NREMM) that is partly elicited and validated from a panel of RE experts who will be more aware of typical conflicts and how to deal with them in real practice. Thus I can apply the empirical findings to improve the design of the NREMM. Second, some step-by-step guidelines will also be provided together with the model to help RE practitioner to resolve conflicts in real practice, as mentioned in Chapter 3 that the NREMM aims to be prescriptive in nature. Thirdly, this research tends to be exploratory in nature, as little is known about the nature role of conflict in the RE processes. The initial empirical findings thus generate hypotheses that are subjected to future controlled experimental validations or large scale quantitative survey investigations.

5.3 Qualitative and quantitative

Broadly speaking, empirical research is categorised into quantitative or qualitative research. Quantitative research use data that can be represented in the form of numbers or that can be immediately transported into numbers. In qualitative research, data then are represented as words and pictures, rather than numbers. A research study can be conducted in both ways. This study mainly uses qualitative research and quantitative data only as a supplement. Detailed justifications are below.

5.3.1 Quantitative research

Quantitative research has been widely used in various disciplines such as chemistry, biomedical sciences, physics, and economics. It is considered as "a formal, objective, systematic process in which numerical data are utilised to obtain information about the world" *(*Burns and Grove cited by Cormack 1991, p40). One particular advantage is the wide generalizability of the results and objectivity in the results. Therefore, it is commonly used to test a theory or hypothesis rather than inductively generating the theory (Patton, 1990).

This research will not follow this direction. This is because that the topic of this research is concerned with understanding of social and human aspects of conflict in RE. Although the topic of conflict is well-reported in social science literature, it is a relatively new area in RE community. This research is therefore exploratory in nature. Furthermore, this research also aims to provide the useful solutions to resolve conflict – the NREMM model, which therefore requires some rich-in-context findings on how conflict can be resolved in real world setting. Therefore, a qualitative approach seems more appropriate for this purpose, as the most data collected in this study is in qualitative form and the sample is not significant enough to conduct quantitative analysis.

Nevertheless, this is not to underestimate the importance of quantitative research methods. Quantitative and qualitative research is commonly juxtaposed in the relevant literature as the two overarching traditions that govern our approach to research (Punch, 2005; Bryman, 2001; Creswell, 1998). There is no dichotomy between

quantitative and qualitative methods of investigation as explained by Darlington and Scott (2002, p. 6) that "the questions which arise in the human services require a broad repertoire of research approaches". Walker et al., (2003) note that quantitative and qualitative research is complementary rather than competing between each other. Seaman (1999) argues that nearly any software engineering issues is best investigated using a combination of quantitative and qualitative methods.

Dremer and Dekleva (2001) indicate that quantitative science often begins with identifying conditions which, when observed, are deemed worth counting. Qualitative date therefore can be converted through coding to become frequency data, and hence quantitative. Seaman (1999) further notes that this type of transformation does not affect research's subjectivity or objectivity. In this research, quantitative form of data is therefore used in this research to identify the frequencies of qualitative results in a survey of expert panel interviews. Two forms of data increase insights into the study and the strength of resulting knowledge claims. As Glasser and Strauss (1997) point out that "in many cases, both forms of data are necessary- not quantitative used to test qualitative, but both used as supplements, as mutual verification and, most important for us, as different forms of data on the same subjects."

5.3.2 Qualitative research

Silverman (2005) indicates that qualitative methods were designed, mostly by educational researchers and other social scientists to study the complexities of human behaviour (e.g., motivation, communication, and understanding). Potter (1996) then notes that qualitative research is useful for examining certain phenomenon, developing insights, and reporting those insights to others. Seaman (1999) argues "human behaviour is one of the few phenomena that is complex enough to require qualitative methods to study it." She also suggests that the principal advantage of using qualitative method is that "they force the researcher to delve into the complexity of the problem rather than abstract it away" (Ibid). The results of qualitative research are thus rich-in-context and more informative.

Although qualitative research is widely illustrated by many authors, it seems that qualitative research means different things to different authors (Potter 1996). Tesch

(1990) argues that "strictly speaking, there is no such thing as qualitative research. There are only qualitative data". He further notes that it also seems to agreed that the term 'qualitative research' represents a certain approach to knowledge production, and 'qualitative data' is understood to mean any information the researcher gathers that is not naturally expressed in numbers (Ibid). This research primarily uses qualitative data to present a holistic picture of the nature conflict. Most importantly, the qualitative data is also used to illustrate how conflict emerges, communicated, and handled in a simplified real-world scenario by applying the NREMM. The rich qualitative data also give us broader insights that could be useful in improving the newly developed NREMM and guiding the long-term direction of future research.

5.4 Empirical Research Methods

This section describes the empirical methods used in this research in relation to the research goals and outcomes. It begins with an overview of why an empirical line of validation and evaluation is required. This section then justifies the choice of two proposed empirical methods: survey and quasi-experiment.

5.4.1 Empirical Validation and Evaluation in SE

Research in SE has produced an extensive body of knowledge, which ranges from different methods, notions, guidelines, models, and tools. As the products of academic research, I generally refer them to research artefacts. It is apparent that all these research artefacts are subject to rigorous validations to ensure them meet their objectives and certain criteria.

Wieringa et al., (2006) indicate that solution validation and evaluation is an important part of RE research, as RE researchers must predict whether the new RE artefacts will improve the current way of doing RE in a certain aspects. It is, therefore, essential to apply a process of empirical testing to validate any contribution made to RE. Although it is well-accepted in the SE and RE community that all research artefacts need to be rigorously validated, Zelkowitz and Wallace (1998) examine 621 SE research papers and point out that validation is absent in roughly 30–50% of these

software engineering papers. Similarly, Wieringa and Heerkens's (2004) case study of the RE literature indicate that the situation in RE may be just as bad, as many publication in RE fail to clearly define their research goals and provide little transparency or inadequate evaluation of the proposed theories, methods, or tools.

The question of how to validate a SE/RE research artefact has been a longstanding issue in the SE community. A panel discussion of empirical validation was organised in ICSE 2003 to discuss the large variety of issues of empirical validations in SE (Walker et al., 2003). The panel discussion notes that although it is widely agreed that empirical validation is needed in the SE community, opinions as to the method to apply to SE empirical validation are subject to be in disagreement. There are many methods which can be used for empirical validation of the SE artefacts. For example, Tichy (1998) and Pfleeger (1996) advocate quantitative, controlled, statistically-analyzable experimentation. Kitchenham et al., (2002) recognise the value of case studies and surveys in additional to formal experiment. Seaman (1999) then promotes a triangulation and "multi-evidence" approach, and particularly highlights the value of qualitative validation to address the complexity of human, social and organisational issues in software development.

Juristo and Moreno (1998) provide a general category for the methods of empirical validation in SE: laboratory validation, validation at the level of real projects (field validation), and validation by means of historical data. Laboratory validation is also referred to formal experiment where a subject (e.g. software engineers) is asked to perform a certain task (e.g. writing codes) in controlled environment. In this sense, laboratory validation allows greater control of the different parameters that may affect software development. Validation in the field setting has less control on the different parameters, but allows data considered to be relevant for the study in question to be collected. Using historical data then allows researchers to work with data on finished projects, which enable research employ the most relevant data to conduct the validation. Most recently, Easterbrook et al., (2008) proposes a similar but more precise category for the methods of empirical evaluation of SE tools and methods: controlled experiments (including quasi-experiments), case studies (both exploratory and confirmatory), survey research, ethnographies, and action research.

5.4.2 Selecting research methods

Initial clues for selecting the method used in this study derive from the context of research goals and outcomes (Yin, 2003). The goals of research drive the formulation of the research questions, which in turn drive the research design and dictate the choice of research methods (Ibid). In addition to considering the context of research goals and questions, Easterbrook et al., (2008) note that the selection of empirical methods for a given research project also depends on "many local contingencies", most notably: available resources and access to subjects. Figure 20 present the overall research design framework used in this research. The detailed justifications and descriptions of the methods are in the following sub-sections.
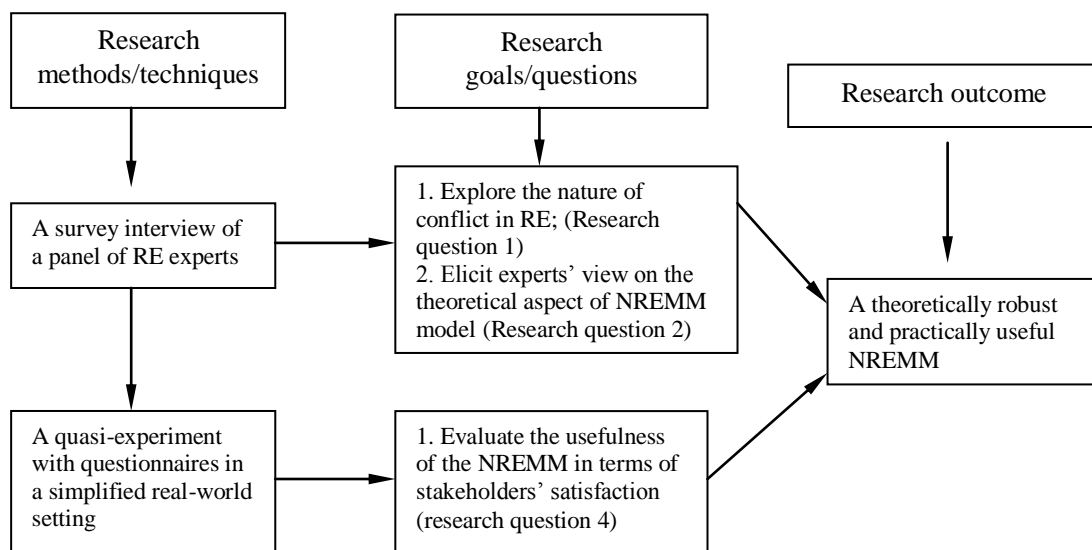
Figure 20: Overall research design framework

Figure 20 indicates that two research methods are used in this research: a survey interview of an expert panel and a quasi-experiment of requirements negotiation workshops. An interview survey of an expert panel approach is mainly used for a validation purpose by eliciting a panel of expert's views on the NREMM. It aims to validate whether the motivation of building the NREMM can be justified, and most importantly, whether the NREMM model is theoretically robust. A quasi-experiment approach is then used for an evaluation purpose, which aims to determine whether the

NREMM model is practical useful in the real world requirements negotiation workshop context. In the following section, I focus on justifying the choice of why the two research methods being selected rather than describing the procedures of using the two methods. The detail of research procedures of applying the two methods can be found in Chapter 6 and Chapter 7.

5.4.3 A survey interview of an RE expert panel

Easterbrook et al., (2008) define survey research as "a method to identify the characteristics of a broad population of individuals". They further note that although survey research is most closely associated with the use of questionnaires as the main data collection technique, it can also be conducted using structured interviews. In this research, a survey of a panel of RE experts using a semi-structured interview is adopted. Kitchenham (1995) points out that a survey can be particularly useful to collect meaningful information from a population who have extensive experience of using or have studied the method/tools of interest. In this case, my targeted population is RE experts. In the SE community, the value of expert opinion is widely recognised. For example, Emam and Madhavji (1996a) conducted a series of interviews with 30 experts to elicit criteria to develop their instrument to evaluate RE success. Rosqvist et al., (2003) survey a panel of experts using questionnaires to predict software quality. Beecham et al., (2003) use expert panels to validate their Requirements Capability Maturity Model (R-CMM). Li and Smidts (2003) also elicit expert opinions to develop software engineering measures which are the best software reliability indicators.

However, it is worth noting that the term "expert panel" is also recognised as a particular method (e.g. Delphi method by Linstone and Turoff, 1975 and Brown, 1968), which includes the gathering of a number of independent experts to predict quantities and finally reach a consensus in a "systematic, iterative and interactive" way (Rowe and Wright 1999, Rowe and Wright 2001). It provides a flexible and robust approach to elicit unbiased evaluations from a group of domain experts in a face-to-face meeting setting, and therefore has been widely used to evaluate, validate, and recommend actions on issues of importance in business, engineering, healthcare, law, science, education, government, and politics. In this research, I do not intend to

label my survey method as an "expert panel" approach, which is described by Rowe and Wright (1999) and Rowe and Wright (2001). In this research, I am only able to one-to-one interviewing a panel of RE experts due to the constraints encountered. This means that the use of expert panel in my research does not follow an "iterative and interactive" way within a group-meeting context, as Benjamin et al., (2004) criticise it as being too labour-expensive and time-consuming. Indeed, many empirical studies in SE also limit their use of "expert panels" by either asking an individual expert to complete a questionnaire (Beecham et al., 2003; Li and Smidts, 2003) or by individually interviewing a panel of experts with a series of specific questions (Rosqvist, 2003; Ei Emam and Madhavji, 1996). In Chapter 6, I present detailed discussions of conducting an expert panel.

5.4.4 A quasi-experiment

A controlled experiment is one of the most commonly used methods for empirical validation and evaluation in SE research (Tichy, 1998; Pfleeger, 1996; Kitchenham et al., 2002). It is particularly appropriate when a number of practitioners actually use a newly developed system (Adelman, 1991). A controlled experiment in SE is defined by Sjøberg et al., (2005) as "a randomised or quasi-experiment, in which individuals or teams (study units) conduct one or more SE task for the sake of comparing different population, process, method, techniques, languages or tools (treatments)". Damian et al., (2000:7) indicates the following three advantages associated with using a controlled experiment approach to investigate requirements negotiation workshops:

1. Making possible the careful observation and precise manipulation of independent variables (e.g. communication technology),
2. Allowing for greater certainty with respect to cause and effect, while holding constant other variables that would normally be associated with it in field settings
3. Encouraging the researcher to try out novel conditions and strategies in a safe and exploratory environment before implementing them in the real world.

In this research, I use a quasi-experiment approach to evaluate the NREMM. More precisely, a quasi-experiment approach is used to evaluate the usefulness of my newly

developed NREMM within a simplified real-world scenario. Unlike a randomised experiment, study units in a quasi-experiment are assigned to experimental groups non-randomly. The quasi-experiment approach thus allows investigation of cause-effect relations in similar settings when randomizations are inappropriate, impractical, or too costly (Easterbrook et al., 2008). In the empirical SE community, the quasi-experiment approach is widely used as an alternative to the randomised experiment approach (Ibid). For example, Kampenes et al., (2009:72) recently present a systematic literature review of quasi-experiments in the SE community and summarise the following reasons for using quasi-experiment in empirical SE research:

1. The costs of teaching software professionals all the treatment conditions (different technologies, tools, or methods) so that they can apply them in a meaningful way may be prohibitive.

2. When the levels of participants' skill constitute treatment conditions, or if different departments of companies constitute experimental groups, randomization cannot be used.

3. Randomization might be unethical. For example, if a new technology is compared with old technology, randomly assigning students to either of these technologies can be unethical, because the value of the experience and knowledge obtained through the experiment can differ for the two groups of students.

In my case, it is clear that training the newly developed NREMM to real RE practitioners and applying it in the real-world practice will be prohibitive and time-consuming. Although quasi-experiments have been criticised for losing realism, there are still good reasons for favouring a quasi-experiment over other methods such as field experiments. For example, McGrath (1984) indicates that conflict management and negotiation are recognised as complex human tasks and careful observation of their intimate details is often inaccessible in field settings. Hammersley (1992: 69) further notes that we do not have "independent, immediate and utterly reliable access to reality" we must take the best of what is available and judge validity on the basis of the adequacy of the evidence offered. As a result, a quasi-experiment within a

simplified real-world scenario (using real user populations) is still an acceptable alternative to those empirical research methods (e.g. field experiments or case study) that have a strong emphasis on investigating phenomenon in real-world settings. The detailed experimental design and procedure of conducting a quasi-experiment can be found in Chapter 7.

5.5 Data collection methods

The empirical data collected for this study were from the following three sources:

1. Empirical data was collected through an interview survey with a panel of RE experts to validate the theoretical aspects of NERMM (see Chapter 6).

2. Empirical data was collected through a series of requirements negotiation workshops in a simplified real-world scenario to illustrate how conflict emerges, is communicated, and handled by the NREMM in a simplified real-world scenario (See Chapter 7).

3. Empirical questionnaire data was collected to measure the participants' satisfactions level after requirements negotiation workshops (See Chapter 7).

Blaxter et al. (2006) suggest that people are naturally familiar with answering questions, either verbally or on paper, as a result they tend to be more comfortable and familiar with data collection methods like interviews and questionnaires. This section explains and justifies the selection of semi-structured interviews and questionnaires as the two main empirical data collection methods used in this research.

5.5.1 Interviews

Lethbridge et al. (2005) suggests that selecting an appropriate data collection method should be done in the context of the research purpose. The goals of research drive the formulation of the research questions, which in turn drive the research design and dictate the choice of data collection methods (Ibid). The general purpose of using

interviews in empirical studies is often to find out what is in and on someone else's mind (Hove and Anda, 2005). Therefore, interviews provide insight into people's world, opinions, thoughts and feelings. The first purpose of this validation study is to explore the causes, characteristics, and impact of conflict in the RE practice, and eventually justify the motivation of building a RE mediation model. This is exploratory in nature, because the nature of conflict is well-studied in social science but little is known in the context of RE. Secondly, this validation study also aims to elicit the expert's thoughts on the RE mediation model in terms of its practicability and ease of use. As a result, interviews are considered the main inquisitive technique to elicit these expert's perceptions and thoughts.

Interviews are also often used in empirical software engineering (Hove and Anda, 2005). For example, Emam and Madhavji (1995) conducted multiple case studies to investigate the problems faced in contemporary RE practice. In those case studies, data was collected in the form of semi-structured interviews and inspection of documents. Semi-structured interviews are particularly useful to elicit general opinions about the problems that are faced in real practice.

Semi-structured interviews

It is common to distinguish between structured and unstructured interview. In structured interviews, the interview has very specific objectives for the type of information sought for in the interview, so the questions can be very specific (Blaxter et al., 2006). In unstructured interviews, the interview suggests the theme for the interview, but has few specific questions in mind (Ibid). Many researches employ a combination of these two types of interview: semi-structured interview. In this research, I also employ the semi-structured interview. I use semi-structured interviews with individual expert for data collection as they help me to ensure the completion of data collection and avoid too much pre-judgment (Walsh, 2001). In this sense, the closed questions are primarily used to confirm and evaluate the foreseen information about the negative and positive impacts of conflict on RE process from the review of literature. The closed questions are also designed to collect the experts' demographic information and measure a certain elements of model against certain objective criteria. The open-ended questions are then designed to elicit unexpected types of information about the causes and characteristic of conflict in RE which is not uncovered in the

literature. Most importantly, the open-ended questions are designed to get an 'insider view' of the RE mediation model. As the open questions also help the researcher to avoid accidentally introducing any of his or her own preconceptions, and protect the validity of the data (Walsh, 2001).

Interview question design

A carefully constructed interview guide is needed to collect information in a manageable form for later analysis. As Patton (1990) suggests:

"The evaluator must decide what questions to ask, how to sequence questions, how much detail to solicit, how long to make the interview, and how to word the actual questions."

Patton (1990) identifies the following six types of interview questions that can be asked on any given topic. In this study, I employ all six types of question except sensory and feeling questions.

1. Experience questions – These questions are aimed at eliciting descriptions of experiences, behaviours, actions and activities that would have been observable had the observer been present. In this study, this type of question is particularly appropriate to ask interviewee's individual experiences and behaviours in a conflicting situation. *Example questions are: Have you experienced a conflicting situation in RE practice? Can you give me an example of a conflicting situation?*

2. Opinion questions – These questions are aimed at collecting data on what people think about the world. They tell us about people's goals, intentions, desires, and values. In this study, this type of question is particularly appropriate to elicit expert opinion on the RE mediation model's practicability and ease of use. *Example questions are: what is your general impression of the new RE mediation model? What is the NREMM's strength and weakness?*

3. Feeling questions – These questions are aimed at understanding the emotional responses of people to their experiences and thoughts. This type of question is

not used in this research, as this research did not intend to understand the emotional feelings of stakeholders in a conflicting situation

4. Knowledge questions – These questions are aimed at finding out what the interviewee considers to be factual. The assumption here is that certain things are considered to be known - these things are not opinions, they are not feelings; rather, they are the things that one knows, the facts, of the case. This type of question is mainly used to gain deep and rich knowledge of the interviewee. The knowledge is the facts about the existence, causes, and consequences of conflict in RE practice. *Example questions are: Do you think that conflict exists in the process of requirements engineering? Why do such conflicts happen?*

5. Sensory questions – These questions are aimed at collecting information on the sensory apparatus of the interviewee such as what is seen, heard, touched, tested and smelled. This type of question is not used in this study, because this study is not interested in understanding interviewee's sensory apparatus in a conflicting situation.

6. Background questions – These questions are aimed at identifying characteristics of the person being interviewed. Answers to these questions help the interviewer locate the respondent in relation to other people. This type of question is normally used at the outset of the interview to gain some background information about the interviewee's organisational role and individual characteristics. *Examples questions are: Could you briefly describe your previous RE experiences? What is your highest qualification?*

Wording and Sequence of the interview questions

Although there are no fixed rules of wording and sequence in organising an interview, the semi-structured interview requires the careful wording and determining the sequence of the questions prior to interview (Walsh, 2001). I thus follow the advices given by Patton (1990), Walsh (2001), as well as advice obtained from experiences of conducting semi-structured interview in empirical SE research (Hove and Anda, 2005).

Patton (1990) argues that the interview should begin with questions about non-controversial present behaviours, activities and experiences which are relatively straightforward descriptions. It will be easy to answer, and encourage the interviewee to talk descriptively. In this study, I begin by asking questions about the interviewee's expertise background, e.g. his/her experience in RE, qualifications, and overall theoretical knowledge in RE. This also involves asking an open straight-forward question, which is about asking the expert to describe one of his/her previous experience in a conflicting situation. Patton (1990) also argues once the experience question has been described, it is appropriate to ask experts' opinions on certain topic. In this case, I will ask them some opinions on the nature of conflict. His/her opinions on the RE mediation model will be also asked. Hove and Anda (2005) states that the background questions seem boring, and thus should be kept at minimum. In this case, I only ask very few straightforward questions regarding the interviewees' expertise in RE at the very beginning. Furthermore, "Why" questions and questions to which the answer can only be "yes" or "no" should be also kept at minimum (Walsh, 2001).

For the wording of questions in semi-structured interview, Patton (1990) argues that good questions should, at "a minimum, be open-ended, neutral, singular and clear". He also claims that the clarity of the question is an important part of establishing rapport with an interviewee, as unclear questions can make the interviewee feel uncomfortable, ignorant, confused, or hostile. In order to ensure the clarity of questions and other elements such as types, sequence and wording, a pilot study was undertaken before conducting the actual interviews.

5.5.2 Questionnaire

Questionnaires are sets of questions administered in a written format (Lethbridge et al., 2005). In this study, questionnaires provide a further empirical method for collecting quantitative or qualitative data to evaluate the usefulness of the NREMM through a measurement of participants' satisfaction level. They are a popular device for the measurement of concepts (Bryman, 1996) and are multi-purpose in that the design can be adapted to almost all research topics (Hakim, 1987). Berdie and

Anderson (1974) describe questionnaires are the most convenient and straightforward data collection methods.

Questionnaire surveys are widely used in empirical SE community because they can be administered quickly and easily. Nevertheless, Lethbridge et al. (2005) notes that careful attention needs to be paid to the design of the questionnaires in order to ensure valid results. They further notes that ambiguous and poorly-worded questions are unable to capture the real issue under investigation (Ibid). To overcome this issue, Pfleeger and Kitchenham (2002) have published a series on principles of survey research to give detailed information about how to design and implement questionnaires to conduct empirical software engineering research. I adhere to these guidelines to design my questionnaires.

Questionnaires also suffer from low response rate even though it is relatively easy for participants to fill out them. Lethbridge et al. (2005) found a consistent response rate of 5% to SE surveys when people are contact personally by email and asked to complete a web-based survey. However, this particular problem will not be the case in this research because questionnaires are given to the respondents who have been paid for their participation immediately after the requirements negotiation workshops.

Moreover, Baddoo (2001) notes that questionnaires suffer from reliability problems regarding the accuracy of the data collected because it is often difficult to know the exact respondents who will answer the questionnaires. He further notes that by directly targeting sample respondents can overcome this problem. In this research, the questionnaires are deliberately targeted to the participants of the requirements engineering workshops who have adequate knowledge regarding the questions posted in the questionnaires.

Questionnaire instrument design

Kitchenham et al., (2002c) indicate that it is important to closely relate your measurement instrument to the objectives of your study to improve construct validity. In relation to construct a survey instrument, Kitchenham et al. (2002c) further suggest that it is better to replicate an existing instrument, which has been assessed for

validity and reliability. In this study, I replicate some of Damian et al.,'s (2000) instruments to measure the effectiveness of a mediator in a requirements negotiation workshop (see Figure 21).

| How informative the mediator is |
| How persuasive the mediator is |
| How accommodating the mediator is |
| How cooperative the mediator is |
| How assertive the mediator is |
| How active the mediator is |
| How fair the mediator is |

Figure 21: Instrument to measure the effectiveness of a mediator (adopted from Damian et al., (2000)

Questionnaire response categories design

Another important aspect of questionnaire design is selecting appropriate questionnaire response categories. In selecting the number of points on a rating scale, Guilford (1954) provides following suggestions (Guilford, 1954, in Dyba, 2000: 369):

"If too few scale points are used, the answer generated is obviously coarse, and much information is lost because the scale does not capture the discriminatory powers that respondents are capable of making. Conversely, if too many scale points are used, the answer generated from respondents can become graded so that it is beyond the respondents' limited powers of discrimination."

Dyba (2000) reviews the relative merits of three different measurement scales (3-point scale, 5-point scale, and 7-point scale), and finally concludes that there was a consistent increase in reliability by using a 5-point bipolar Likert scale by Guilford, (1954). I thus use a 5-point bipolar Likert scale to design all questions in my questionnaires. Responses were scored from 1 to 5, with a value of 1 indicating "not at all" and a value of 5 indicating "very". I provide a typical example here of how I use a 5-point scale in this empirical evaluation study (See Figure 22).

How satisfied are you with the final outcome?	Not satisfied at all	Little satisfied	Slightly satisfied	Quite satisfied	Very satisfied
	(1)	(2)	(3)	(4)	(5)
	☐	☐	☐	☐	☐

Figure 22: An example of using 5-point scale

Once the questionnaire had been constructed, it was piloted by people who were not involved in its construction to ensure the extent to which respondents understand the questions being asked (Baddoo, 2001).

5.6 Pilot

A pilot study is an important element of a good research design. Broadly speaking, a pilot study is defined as "a small scale version or trial run' done in preparation for the major study" (Polit et al., 2001). A pilot study is especially useful to evaluate the research methods and uncover provisional findings before the main study. Consequently, two separate pilot studies were conducted before implementing the main research procedure to test the effectiveness of research design. The first pilot was piloted with an RE expert to evaluate the use of interviews as the data collection method. The second pilot was then concerned with conducting a quasi-experiment in a real-world requirements negotiation workshop scenario. The first pilot study only resulted in several minor changes on the wording and sequences of interview questions. The second pilot study then resulted in a minor change on the experiment design in terms of duration of the workshop.

5.7 Data analysis methods

The choice of data analysis methods are strongly influenced by the use of data collection methods described above and the type of data collected (Baddoo, 2001). As both quantitative and qualitative data were generated from the data collection stage, two methods are used to analyse the data. Frequency analysis is used to handle quantitative data. Content analysis is then used to analyse qualitative data.

5.7.1 Analysis of quantitative data: frequency analysis

Both quantitative and qualitative data were generated from a survey interview of experts and a quasi-experiment of requirements negotiation workshop. Due to the limited use of quantitative data (10 experts involved), the analysis of quantitative data

is very straightforward and based on frequency analysis. Black (1999) points out that one the first ways of organising raw data is to group scores or values into frequencies. Frequency tables are useful for reporting descriptive numbers of occurrence of each data variable. Black (1999) further notes that these frequencies can then be presented either in a form of tallies or in percentages. In this research, due to the small number of experts involved, the frequencies are presented in the form of tallies in Chapter 6.

5.7.2 Analysis of qualitative data

Data from interviews and experiments should be transcribed and analysed using explicit, systematic and reproducible methods. However, Miles and Huberman (1984: 16) remark that "we have few agreed-on canons for qualitative data analysis, in the sense of shared grounded rules for drawing conclusions and verifying their sturdiness." It is also argued that there is no single method of analysis that can be used for all types of interview data because different people manage their creativity, intellectual endeavours, and hard work in different ways (Patton, 1990; Tesch, 1994; Strauss and Corbin, 1998; Yin, 2003). Further, there is no rigid format to analysing qualitative data as the process can be eclectic, containing several analysis procedures (Creswell, 1998). In this research, the analysis of the data was not deferred until the end of the study. It began early and proceeded concurrently with the data collection so that the two became closely integrated (Glaser and Strauss, 1967) to the extent that they began to inform each other (Miles and Humberman, 1984). Content analysis is used to analyse the qualitative data from interview-transcripts with the RE experts. Qualitative data from video-transcripts of the five requirements negotiation workshops is then analysed against thematic category, which is extracted from the NREMM model.

Content analysis

Content analysis involves "establishing classifications, and systematic links between them, and then counting the number of instances based on the pre-defined classifications" (Silverman, 2005: 122). Content analysis is the process of identifying, coding, and categorizing the primary patterns in the data obtained from interviews and observations (Ibid). In this research, content analysis is used for analysing the RE

expert panel's interviews to categorise the causes of conflict based on the categories developed from the literature review in Chapter 2.

Silverman (2005) further argues that content analysis pays particular attention to issues of inter-rater reliability of its measure, and therefore a crucial requirement in content analysis is that the categories are sufficiency precise to allow different coders to arrive at the same results when the same body of material is examined. To ensure a 'reasonable' level of confidence in the pre-defined categories, a formal Cohen's kappa (k) inter-rater reliability test is conducted. In relation to the category for analysing the nature of conflict in an expert panel's interviews, I calculated Cohen's kappa (k) statistic 0.7931, which indicates a "substantial" level of confidence in my pre-defined categories (Dunn, 1989). For the detailed procedure of conducting an inter-rater reliability test and the data summary, see Appendix 3.

5.8 Summary of the methodology

In this chapter I have described how an empirical approach is used to assess and evaluate the newly development NREMM. More precisely, I describe and justify how an interview survey and a quasi-experiment are selected as two specific research methods to achieve the assessment and evaluation research goals. I also describe why semi-structured interviews and questionnaires are used as the main data collection techniques. Many of these research methods and techniques are commonly used in the empirical SE community. I have showed why these methods are selected and how they help to collect and analyse the data. However, it is worth noting that the methods used in this research are not necessarily the only methods suited to my research. Any method itself contains flaws. In real-world research, the researcher constantly has to adapt or compromise on methods because of the constraints encountered. As Tichy (2000: 1) notes that "experiments are done in the real world and are therefore never perfect. Any empirical study, and especially a novel one, has flaws." I finally conclude this chapter with a caveat, which is noted by Beecham (2003: 109):

> *"The findings that result from these methods are not necessarily final and complete. However, as I provide evidence that methods are reasonably justified*

and properly implemented, the combination of methods of collection and analysis should provide researchers with a sound basis for further work.

Chapter 6 Assessing the NREMM

6.1 Introduction

In Chapter 4, the theoretical based NREMM was established. Now I have reached the stages in the model development where I need to collect empirical evidence to assess whether the NREMM is theoretical robust. This chapter answers the third research question:

RQ3: Is the NREMM theoretically robust?

By answering this research question, this chapter aims to assess whether the motivation for developing the NREMM can be justified by investigating the nature of conflict, whether the theoretical underpinning of NREMM can be justified, and how well the NREMM meet its design purpose, which aims to help the RE practitioners to mediate conflicts in the RE process. More precisely, this assessment examines the three individual phases of the NREMM, and measures whether the three individual phases meet its individual design purposes. A major part of this chapter's work is devoted to reporting the procedures of conducting this assessment study and presenting the final results of the expert panel interviews.

This chapter is organised as follows. The sampling approach and procedure is discussed in Section 6.1. The data collection and data analysis procedure is discussed in Section 6.2 and 6.3. In Section 6.4, I present the findings of our expert panel interviews addressing the nature of conflict in RE and the experts' perceptions of the NREMM. I finally discuss the key findings from the expert panel and highlight the key consideration for further model improvement in Section 6.5. Section 6.6 discusses the key findings from the empirical assessment and the limitation associated with the NREMM. Section 6.7 concludes the chapter.

6.2 Sampling

In this section, I briefly justify a choice of the purposive sampling strategy used in this study, and focus on describing the procedures of selecting an appropriate expert to participate this assessment study.

Any research, whether quantitative, qualitative or both, involves sampling. Marshall and Rossman (1995, p. 50) recognise that "choosing the setting, population, or phenomenon of interest, is fundamental to the design of the study and serves as a guide for the researcher". Miles and Humberman (1994: 27) also say that "you cannot study everyone everywhere doing everything." Punch (2005) further notes that sampling decisions are required not only about population but also about settings and processes. There are two major differences in sampling in quantitative and qualitative research. Quantitative samples are normally selected from a large context-free population group in search of statistical significance whereas qualitative samples employ small sample sizes where a relatively small number of people set in their context are studied in depth (Patton, 1990). Since this study is mainly qualitative in nature (see chapter 6), this study intends to employ a small sample size where a relatively small number of people set in their context are studied in depth (Patton, 1986).

Apart from the sampling size, the sampling strategy is also different between the two approaches. Sampling in quantitative research most often is probability sampling directed at representativeness of some larger population (Kitchenham et al., 2002). Qualitative research on the other hand would use some sort of "deliberate" sampling (Punch, 2005: 187). Although the form or strategy of sampling varies, Punch (2005) further indicates that there is a clear principle across all sampling strategies, which concerns the overall validity of the research design. The sampling plan should correspond with the purposes of the study and the type of research questions addressed and must fit in with the other components of the study.

In this study, a purposive sampling strategy was adopted to target a specific population – a panel of RE experts to assess the NREMM. Purposive samples are selected according to a known characteristic and then asked to express their views on a matter (Patton, 1990). In this sense, a panel of RE experts were asked to express their views on our newly developed NREMM in terms of its motivation, theoretical underpinnings, strengths, and weaknesses. One of the strengths of this sampling strategy is that a small sample that has been systematically selected for typicality provides confidence that the conclusions adequately represent the average members of the population (Bickman and Rog, 1998; Kitchenham et al., 2002). However, it is

worth noting that the sample used in this research can also be considered as a convenience sample, as I intentionally invite several "easy-to-access" experts to take part (e.g. the experts are well-known and available within my own department).

6.2.1 Sample Size

Sample size is about determining the relative size of the population from which the subjects are studied. In this case, it is then concerned with determining the number of experts who will participate in this assessment study. Hakim (1987) argues that small samples can be used to develop and test proposition, particularly in the early exploratory stages of the research. Previous studies show how to use a small sample of experts to gain expert feedbacks to validate and support model development (Dybå, 2000; Emam et al., 1996 and 2000; Rosqvist et al., 2003; Beecham, 2005). As this research also tends to be exploratory in nature, which focuses on an initial assessment of newly developed NREMM. Therefore, a relatively "small sample" strategy was followed by interviewing 10 RE experts.

6.2.2 Selecting an RE expert

Miles and Humberman (1994:34) provide six general questions against which to check a purposive sampling plan:
1. Is the sampling relevant to your conceptual frame and research questions?
2. Will the phenomena you are interested in appear? In principle, can they appear?
3. Does your plan enhance the generalizability of your findings, through either conceptual power or representativeness?
4. Can believable descriptions and explanations be produced, ones that are true to real life?
5. Is the sampling plan feasible, in terms of time, money, access to people and your own work style?
6. Is the sampling plan ethical, in terms of such issues as informed consent, potential benefits and risks, and the relationship with informants?

Given the initial literature review and sampling guidelines by Miles and Humberman (1994:34), this study used the above set of criteria to guide the selection of experts.

As this research is about interviewing a panel of RE experts to assess a RE technique, selecting right RE experts becomes crucial to ensure the validity of this study. According to Tan (1997), an expert is "someone who consistently performs at a high level in a specific field of human activity" (Tan, 1997 in Al-Ani and Sim, 2006). An expert not only needs to have an extensive level of theoretical knowledge, but also needs to be practical and domain-specific (Ericsson and Charness, 1994). This leads to the definition by Al-Ani and Sim (2006:23): "expertise is a complex function of theoretical knowledge and practical skills that will determine an individual's performance in a particular domain". They further represent this definition by using a graphical notation (Figure 23):
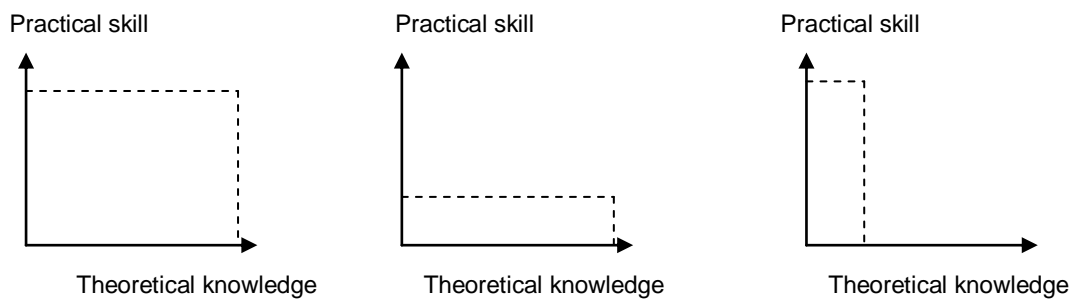
Figure 23: Three graphical notations of an expert

Figure 23 presents three different types of experts proposed by Al-Ani and Sim (2006). The first represents the person having a high level of practical skill and high level of theoretical knowledge. The second represents the person in this category having a high level of theoretical knowledge, but a small degree of practical skill. The last figure represents the person normally having a high level of practical skill, but low level of theoretical knowledge.

In relation to the context of RE, Al-Ani and Sim (2006) suggest that a RE practitioner can be classified as being "novice, beginner, professional, expert or an elite" requirements engineer based on their expertise. Such expertise primarily depends on their educational background, years of practice, nature/quality of practice, domain of practice, and so on. In the context of this study, all these factors were taken into consideration for sampling purpose. In particular, the RE experts were targeted from a population, which include experienced RE practitioners who may just have a high level of practical skill, but may be limited in their degree of theoretical knowledge;

and well-known RE scholars who may have not only a high level of practical skill but also a high level of theoretical knowledge. These two groups of experts either publish extensively in the RE field, or have extensive years' practical experience. To target scholars in RE, I mainly used the RE journal's editorial board as a primary source. To target experienced RE practitioners, I primarily replied on personal networking developed from previous industrial conferences and existing department's industrial partnership.

These two different types of experts are not really alternatives but are rather complementary for each other. The proposed NREMM aims to be not only theoretically robust but also, most importantly, practically useful. In this sense, the experts invited from academia provide useful insights on theoretical aspects of the NREMM. The experts invited from industry then provide useful recommendations on the issue of the NREMM's ease of use and practicality. I debilitate exclude young researchers and inexperienced practitioners whose expertise is mainly based on theoretical knowledge. This is because the NREMM finally aims to be a practically useful and ease of use RE framework for use by practitioners.

6.2.3 Demographics

Figure 24 shows the demographics of the 10 RE experts who participated in this study. Most of the experts (9 out of 10) have more than 10 years of RE experience. It is worth noting that the experts who participated have different educational backgrounds, which ranges from SE, RE to IS. This enables me to blend a multi-disciplinary viewpoint. It is also worth noting that most experts (9 out of 10) involved hold a higher postgraduate degree. For example, 5 out of 10 experts have their highest qualification at PhD level. 4 out of 10 experts have their highest qualification at masters' level. The expert who only has a bachelor degree, she has 32 years of practical experiences as a requirements engineer and project manager.

	Roles	Years of experience	Highest Qualification	Organisation
1	A mix of academic and RE practitioner	11	PhD in IS	University
2	Academic	7	PhD in HCI	University
3	A mix of academic and RE practitioner	12	PhD in SE & PhD in organisational behaviours	University
4	A mix of academic & RE practitioners	14	PhD in IS	University
5	RE Practitioner	11	MSc in IS/IT	IT Consulting company
6	RE Practitioner	14	MSc in Management	IT Consulting company
7	RE Practitioner	11	PhD in Management	IT Consulting company
8	RE Practitioner	25	MSc in SE(specialised in RE)	A world-leading Independent RE consultant
9	RE Practitioner	32	BSc in Mathematics	IT Consulting company
10	RE Practitioner	13	MSc in IS	IT Consulting company

Figure 24: Demographics of 10 RE experts

6.3 Data Collection Procedures

As mentioned in Chapter 5, semi-structured interviews were used as our primary data collection technique. Our interview script included a combination of closed questions and open-ended questions. Our closed questions were measured on a 3-point measurement scale - agree, disagree and don't know. Although answers generated from a 3 point scale are coarse, and much information can be lost (Dyba, 2000), due to the small number of experts involved, responses in this form ease interpretation and analysis of the data (Beecham et al., 2004). In addition to the closed questions, I also used open-ended questions to elicit experts' overall comments on the model. Appendix 8 shows the interview scripts.

I conducted a pilot study involving interviewing one expert to evaluate the research design. Our main study was conducted from February to March in 2008. In total, 10 RE experts were interviewed in the U.K. Each interview took place in an appropriate environment, either in the interviewee's office or in a company meeting room. No other person was present during the interviews. Before each interview, participants were provided, via email, with details of the purpose and procedures for the interview.

All interviews were audio recorded and relevant notes were also taken during the interview. To safeguard the confidentiality of the data and privacy of the participants I also sent to each interviewee a statement of the ethical approval that is issued from the University of Hertfordshire. To avoid any pre-judgment bias I did not provide participants with interview questions in advance. Each interview lasted 45 to 60 minutes and included the following 4 main activities:

1.   Interviewees completed a demographics questionnaire.
2.   Interviewees were asked questions regarding the nature of conflict they perceive   in RE.
3.   The researcher made a 25-minute presentation of the NREMM (see appendix-2 for the PowerPoint presentation slides).
4.   Interviewees were invited to comment on the model's structure, presentation, theoretical underpinning, practicability, ease of use and the level of required training needs

I deliberately asked for experts' perceptions of the nature of conflict prior to making a presentation of the NREMM. This is because that my presentation includes some background information regarding the nature of conflict in RE, which may affect the expert's responses on this issue.

6.4 Data analysis procedures

Both quantitative and qualitative data were generated during data collection. Interviews were transcribed and analysed after each session. Due to a small number of experts involved, the analysis of quantitative data is very straightforward and based on frequency analysis. Qualitative data was analysed based on a content analysis approach. Although as mentioned in Chapter 5 that there is no agreed way of analysing qualitative date, in this study I particularly followed the 14 systematic procedures offered by Burnard (1991) to analyse and interpret the qualitative data gathered from the expert panel interviews:

1. *Notes are made after the interview recording topics talked about in the interview*

2. *Transcripts are read through and notes are made on general themes within the transcripts*

3. *Transcripts are read through again and as many headings as necessary are written down to describe aspects of content. Open-coding is made where categories are freely generated. This often leads to many detailed categories.*

4. *The list of categories is surveyed and grouped together under higher order headings. The aim is to reduce the numbers of categories by 'collapsing' some of the categories that are similar into broader categories.*

5. *The new list of categories is again refined to remove any repetitions or similar headings*

6. *Two colleagues are invited to generate category systems, independently without seeing the researcher's list. This list is discussed with the aim of enhancing validity of the categorising method and guard against researcher bias.*

7. *Transcripts are re-read alongside the finally agreed list of categories and sub-headings to establish the degree to which the categories cover all aspects of the interview. Adjustments are made as necessary.*

8. *Each transcript is worked through with the list of categories and sub-headings and is 'coded' according to the list of category headings.*

9. *Each coded section of the interview is cut out of the transcript and all items of each code are collected together. Retaining the associated quote gives the code a context.*

10. *These cut sections of the transcripts are combined with the associated category headings and sub-headings*

11. *Interviewees are asked whether the quote and category associations are appropriate. Adjustments are made as necessary*

12. *The findings are filed together and written up. Copies of the complete interviews are kept to hand.*

13. *Once all the sections are together, the writing up process begins*

14. *The researcher must assess what parts of the transcript to include; whether to use verbatim examples of interviews to illustrate the various sections, or just reference the text.*

In procedure 6, two researchers were involved to generate category systems, and then count the number of instances based on the pre-defined categories. A formal inter-rater reliability test was conducted. I calculated the Cohen's kappa (k) statistic - 0.7931, which indicates a "substantial" level of confidence in the categories. See Appendix 3 for the details of data summary.

6.5 Result of assessment

I present the findings of validating the NREMM through interviewing the RE expert panel. This section first presents the findings, which are related to the nature of conflict perceived by the RE experts. This section then presents the assessment results for the three phases of the NREMM. This section finally summarises the overall results of the assessment study.

6.5.1 Perceived nature of conflict

This sub-section presents the findings regarding the RE experts' perception of the nature of conflict in terms of its occurrence, causes and consequences. The findings help us to gain new insights from RE practitioners to better understand the implications of conflict in practice and eventually help to improve the NREMM. Most importantly, these findings help to justify the motivation for building the NREMM.

6.5.1.1 Occurrence of conflict in RE

Table 3 indicates that 9 out of 10 experts agreed with our proposition regarding the occurrence of conflict in RE. For example, Expert 3 said:

> "*Obviously, conflict is very part of any system development.*"

Expert 5 also acknowledged that

> "*Conflict always appears between different stakeholders involved in an information system project.*"

Although an expert disagrees, he also acknowledges that

"Conflict does often occur, but not inevitably" from: Expert 1

This result strongly supports the existing literature that reports on the occurrence of conflict in RE (e.g. Easterbrook, 1996; Sommerville and Sawyer, 1997; Nuseibeh, 1996)

Questions/propositions	Agree	Disagree	Don't know
Conflicts among different stakeholders are an inevitable part of RE process.	9	1	0

Table 3: Occurrence of conflict in RE

6.5.1.2 Key causes of conflict in RE

I also am interested in knowing what experts' perceive to be the causes of conflicts. I use an open-ended question to elicit the causes of conflicts from the experts. Experts suggest many different factors cause conflict. To identify the key causes of conflict, we use the criterion approach proposed by Niazi et al., (2005): If a cause of conflict is cited in the interviews with a frequency of >=50%, then it is treated as a key cause of conflict.

Table 4 suggests that differences between goals, cognitive understanding, education background, and organisational roles are four most frequently cited causes of conflict. For example, Expert 2 said:

"The causes of conflict can be a different understanding of the same problems and different individual or organisational goals. Most importantly, conflict occurs often due to people's different holistic perceptions on the whole project rather than different perceptions on a certain aspect of a software requirement."

Expert 5 pointed out two other causes that

"*People always approach the same problem with sorts of different understanding. They try to be different. This is particularly inherent between*

people from different departments with different organisational roles and

education background."

Causes	Definition	Frequency (N=10)
Goals	Stakeholders have different organisational and individual goals on the project	10
Cognitive understanding	Stakeholders have different understanding on the same problem.	9
Education background	Stakeholders have different education background.	6
Organisational roles	Stakeholders have different organisational roles and responsibility within an organisational	5

Table 4: Four key causes of conflict in RE

6.5.1.3 Consequences of conflict

It is evident that conflict is generally viewed as negative in RE (see Table 5). For example, 9 out of 10 experts believed that conflict leads to disagreements or arguments between stakeholders. 8 out of 10 experts believed that conflict leads to poor user satisfaction on final system. 6 out of 10 experts viewed conflict as leading to negative emotions, resistance and failure to collaborate. This confirms the recent empirical findings indicate that conflict consistently and negatively affects software project success and team performance (Yeh and Tsai, 2001). However, fewer experts (2 out of 10 experts) viewed the overall success of the project is impacted.

Questions/propositions	Agree	Disagree	Do not know
1. Conflict leads to disagreement.	9	0	1
2. Conflict leads to poor user satisfaction on final system	8	0	2
3. Conflict leads to resistance and failure to collaborate	6	1	3
4. Conflict leads to negative emotions	6	0	4
5. Conflict leads to ambiguity in RE specification	3	1	6
6. Conflict leads to inconsistency in RE specification	2	2	6
7. Conflict leads to overall project failure	2	6	2
8. Conflict promotes creative thinking	2	3	5
9. Conflict encourages stakeholder involvement	0	5	5

Table 5: Consequences of conflict in RE

It is worth noting the expert's further comments on the issues of disagreements caused by conflict. For example, Expert 5 said:

"Although conflict does lead to disagreements, in some cases, arguments may also happen; this does not necessarily indicate a bad consequence."

Expert 6 then commented that:

"Disagreements even arguments happened every project that I have been involved before, it could promote creative thinking if they are well balanced and managed by a good project manager."

Interestingly, it is evidenced that conflict does not necessarily lead to inconsistency and ambiguity in the specification in the opinion of the experts. Only 2 out of 10 experts agreed that conflict leads to inconsistency in RE specification. Only 3 out of 10 experts agreed that conflict leads to ambiguity in RE specification. This appears to contradict what is reported in the RE literature. For example, Easterbrook (1996) indicates that conflict is mainly characterised by disagreements, and those disagreements lead to inconsistency in the specification. Sommerville and Sawyer (1997) say that conflict may be caused by many different and conflicting viewpoints, and therefore may lead to ambiguity in the specification (Sommerville and Sawyer, 1997). One expert's comments on this issue seem to provide an insightful viewpoint:

"I cannot really see how an organisational phenomenon affects the requirements specification technically. In my experience, existing technical software methods seem to suppress conflicts rather than clearly expressed it. A specification is often seen as a contract between developers and users, it thus tends to provide one concrete perspective and avoid competing perspectives."

The findings generated from the experts did not strongly support the claim reported by the previous literature (e.g. Thomas, 1992; Barki and Hartwick, 2001) that conflict promotes creative thinking or encourages stakeholder involvement. Nonetheless, Expert 7 pointed out that

"Conflict certainly can be a good thing, but it all depends on how it is brought out, when it is brought out and most importantly how well it is being managed. If it has been surfaced early and managed well, it will definitely lead to a better

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understanding of the problem situation and a better requirements specification."

In relation to the negative consequences of conflict, I finally asked all experts whether conflicts need to be explicitly managed. All 10 experts agreed the necessity of managing conflicts in RE. In particular, a very experienced expert (Expert 10) commented:

"Based on my practice, users often had conflicting attitudes towards each other and developers. They were enmeshed in politics and power games. They behaved just like human beings. In many cases, I was required to be a mediator between them. I was soon aware that I need to learn more from other disciplines, and your social-psychology based mediation approach certainly seems very interesting to me and timely to address this problem."

6.5.2 Three phases assessment results

This section presents the assessment results regarding whether the NREMM meets its objectives. The NREMM includes 3 phases. I thus assess whether each individual phase meets its individual objectives.

6.5.2.1 Results for conflict identification phase

Table 6 presents the findings regarding validating conflict identification phase. As mentioned before, this phase aims to establish a workable relationship with the conflicting parties and initially identify conflict between them. Our results show that 9 out of 10 experts agree with the importance of making conflict "surface early" (Expert 3). Expert 3 said:

"Conflict often remains as hidden rather than surfaced. It more likely occurs when different perceptions, goals, and motivations have not been brought out and resolved early on."

Expert 2 also noted that

"Conflict is quite often ignored at the early stage. Traditional software development methodologies always keep conflict suppressed rather than expressed."

Expert10 further commented that

"Many failures of software systems are due to conflicts, which are only found out at the later development stage."

The results also showed experts agree that the techniques described in the phase meet its aim. In particular, experts recognised the value of techniques described in dialogical practice. For example, expert-5 noticed that

"In my practice, two key success factors in RE are using the right questioning and listening skills to uncover the right requirements."

All experts (10 out of 10) involved agreed with the use of stakeholder modelling to help practitioners get sufficient background information of conflicting stakeholders. For example, Expert 6 commented that

"Stakeholder modelling is an essential part of our daily RE practice. It is absolutely critical for us to know what the key stakeholders are, and how helpful their background information could be."

Expert 1 also said that

"We could not start problem-solving without knowing who the problem owners are."

However, some experts (4 out of 10) thought that the techniques described in relationship practice are *"just common sense, and don't need to be highlighted in this phase* (Expert 8).*"* Expert 7 then noticed that

"Surely a good relationship with users is important, but the relationship practices given by you are like a code of practice that every IT professionals commonly know.

Questions/propositions	Agree	Disagree	Do not know
1. The phase, which focuses on clearly identifying conflict, is important for RE conflict resolution.	9	0	1
2. The discursive listening and curious questioning techniques help practitioners clearly identify conflicts.	9	0	1
3. Stakeholder modelling techniques help practitioners get sufficient background information of conflicting stakeholders.	10	0	0
4. Relationship practice techniques help practitioners develop a strong starting relationship with conflicting stakeholders.	6	0	4
5. The techniques described in the phase are easy to understand.	9	0	1

Table 6: Findings for conflict identification phase

6.5.2.2 Results for the conflict definition phase

Table 7 presents the results regarding the assessment of the conflict definition phase. As mentioned in Section 2, this phase aims to gain an accurate understanding of the nature conflict such as its causes. Our results show that all 10 experts agreed with the aim of conflict definition phase. For example, Expert 2 said that

"*It is no doubt the importance of having a clear understanding of the causes of conflict.*"

Expert 1 further argued that

"*If we don't know what exactly cause the conflicts, how come we could provide effective solutions to deal with it?*"

Expert-10 even argued that

"*Probably 80% of work needs to be devoted to analysing the rational of conflict. Only 20% of work needs to be devoted to resolution. Only when we reached a shared and deeper understanding of the factors actually causing the conflict, we then are in a better position to solve it.*"

The experts also generally agreed the techniques described in this sub-model are easy to understand, and fit for purpose to gain an accurate understanding of conflict. The experts also generally agreed that the use of curious, persistent, resilient questioning techniques as well as externalising language help practitioners gain an accurate understanding of the nature of conflict. For example, Expert1 commented that:

> "*I also come from a psychological background. I discover that asking good questions to elicit right requirements is not about narrowing down the information by asking very purposeful questions. Instead, we need to ask questions curiously and persistently to open up and generate new insights.*"

Expert-7 further said that:

> "*I always find out that as a requirements analyst, we limited our questions to those that would elicit some obvious facts such as what functionalities do you want the system to have? We really need some resilient and innovative questioning techniques to elicit those hidden structures and non-obvious facts.*"

However, the use of a rich and detailed story in real practice was questioned by the 3 experts. Our results show only 4 out of 10 experts agree with our proposition 4 in Table 7 and 3 out of 10 experts clearly disagreed with it. Although the 3 experts questioned the possibility of using a detailed story in practice, they generally appreciated the value of a rich and detailed story, which aims to provide new insights and deep understandings of a conflicting situation. For example, Expert 8 said that

> "*I can see the value, but it is simply not realistic in practice*".

Expert 5 also said:

> "*We are certainly interested with the stories generated from users. But, it's not possible to document it in a detailed and structured way. We simply more prefer documenting and representing it in a form of diagram e.g UML.*

Expert 10 further noticed that

"A detailed story may only be verbally described and exchanged. No one will be interested to read it even if it is included in the requirements documents."

Questions/propositions	Agree	Disagree	Do not know
1. The sub-model, which focuses on gaining an accurate understanding of conflict, is important for RE conflict resolution.	10	0	0
2. The curious, persistent, and resilient questioning techniques help practitioners gain an accurate understanding of conflict.	9	0	1
3. Using externalising language helps separate the problem from the problem.	9	0	1
4. A rich and detailed story helps practitioners gain new insights and better understandings of conflict.	4	3	3
5. The techniques described in the sub-model are easy to understand.	9	0	1

Table 7: Findings for conflict definition phase

6.5.2.3 Results for conflict resolution sub-model

Table 8 presents the results regarding the assessment of conflict resolution phase. As mentioned before, this sub-model aims to lead to a solution. The key part of this sub-model is the use of requirements prioritisation techniques. Although 6 out of 10 experts agreed that "requirements prioritisation can offer practitioners a rational analysis to evaluate possible solutions", 2 out of 10 experts showed a lack of confidence with the use of requirements prioritization techniques to achieve this aim. For example, Expert 7 said:

"Different groups of stakeholders tend to prioritise requirements differently…e.g., they tend to prioritise a certain requirement higher when they are the direct beneficiary from the execution of the requirement; even different stakeholders within the same group prioritise them differently because of their different individual needs, experiences, and hidden agendas."

Expert-8 also noticed that:

"Requirements prioritization is always dominated by project politics. The result is thus likely subjective and biased. It only plays a supporting role. Anyhow I personally do not think there will be a magic solution."

Questions/propositions	Agree	Disagree	Do not know
1. The phase, which focuses on finding out a solution, is important for RE conflict resolution.	10	0	0
2. Conflict can be more easily resolved when stakeholders have established a firm and collaborative relationship.	9	0	1
3. Requirements prioritization can offer practitioners a rational analysis to evaluate possible solutions.	6	2	2
5. The techniques described in this phase are easy to understand.	9	0	1

Table 8: Findings for conflict resolution sub-model

6.5.2.4 Overall findings of the NREMM

At the end of each interview, I asked for experts' overall impressions of the NREMM in terms of its structure, presentation, theoretical underpinning, practicability, ease of use, and the possibility of being adopted by practitioners. The key findings are summarised as follows:

- NREMM is capable of helping RE practitioners to identify, define, and resolve conflicts in the RE process**.**

- Borrowing the relevant theories from the other disciplinary is a useful idea.

- NREMM is easy to understand by these 10 experts.

- NREMM has a clear structure and presentation.

- The use of story-telling as a theoretical underpinning is a particular strength, and matches well with the current state of the RE practice.

- NREMM can be applied as a generic framework to most project types. It particularly suits those business Information Systems, which are enmeshed in a complex human, social and organisational environment.

- NREMM does need further improvements in terms of integrating with some RE modelling and goal analysis techniques.

6.6 Discussion

In this section, I discuss the main findings from the expert panel interviews. I first discuss the findings concerning the nature of conflict perceived by the experts in their RE practice. I then discuss the assessment results gained from the experts regarding how well the NREMM meets its design purpose. I finally discuss the key considerations for the NREMM improvement and the key limitations associated with the use of interviews as the main data collection techniques in this study.

6.6.1 Nature of conflicts

It is important to note that the intention of validating the NREMM is not just about measuring how well the NREMM met its purpose of helping RE practitioners to identify, define and resolve conflicts in the RE practice. The part of this assessment devoted to ensuring whether the fundamental motivation of building the NREMM can be reasonably justified. In doing so, the nature of conflicts in terms of its occurrence, causes, and consequences are vitally important for justifying the motivation of building the NREMM.

The findings confirm the occurrence of conflict as an inevitable phenomenon in RE. This is not a surprising finding because the existing RE literature has reported that conflict is an inevitable part of RE (e.g. Easterbrook, 1996; Sommerville and Sawyer, 1997; Nuseibeh, 1996). In relation to the key causes of the conflict in RE, the findings are also not surprising and in line with the existing RE literature. The four key causes are goal difference, cognitive difference, educational background difference, and organisational responsibility difference. In particular, it is worth highlighting that goal difference was the most cited cause in this study. All 10 experts admitted that goal difference was the most recognisable factor causing conflicts in RE. Indeed, conflicts as a result of the goal differences are well-documented in the existing RE literature. For example, Boehm (1996) and Sommerville (2001) have convincingly argued that stakeholders involved in RE have different individual and organisational goals, and therefore may pull the system in different directions, which potentially leads to

conflict. This results in a great deal of research that focuses on modelling and reasoning about the goals in the RE community (e.g. VanLamsweerde, 2001; 2008; Yu and Mylopoulos, 1998; Renaud et al, 2004).

Although being recognised as an inevitable phenomenon, little RE work explicitly and empirically investigates the potential consequences of conflicts in RE. In relation to the consequences of conflicts, this study provides contradictory findings to the existing RE literature. My findings are in line with the existing RE literature by indicating that there is no doubt that conflicts lead to disagreements even arguments. This is evidenced by 9 out of 10 experts agreeing with proposition 1 in Table 5. However, a most significant contradiction with the existing literature is whether the disagreements caused by conflicts will lead to inconsistency and ambiguity in the requirements specification. Although little empirical work explicitly examines this issue, it seems widely agreed that conflict will lead to inconsistency and ambiguity e.g. (Robison, 1990; 1996; Easterbrook, 1996; Sawyer, 2002). For more details, see Chapter 2. In this study, the findings generated from interviewing 10 RE experts did not strongly support these two claims, as only a few experts (2 to 3 out of 10) agreed that conflict lead to inconsistency and ambiguity. The possible "cause-effect" relationship between conflicts and inconsistency and ambiguity in the requirements specification remains uncertain as most experts (6 out of 10) chose "don't know". This implies an urgent call for empirical researches on this issue in the future.

My findings also contain contradictory views regarding the positive consequences of conflicts in RE. For example, when I asked the 10 experts whether they agreed that conflicts will promote creative thinking, mixed responses were collected: 2 out of 10 agreed that conflict promotes creative thinking; 3 out of 10 disagreed with this proposition; 5 of them chose "do not know". This contradiction indeed is not surprising, and can be related to the long existing debate in the organisational behavioural literature, which aims to determine whether conflict is a good or bad thing for an organisation (Bourgeois, 1985; Eisenhardt and Schoonhoven, 1990). Although this study cannot assert whether conflict is good or bad for RE based on the findings collected through such a small-size sample, my findings strongly indicate that conflicts need to be effectively managed. This is shown when all 10 experts

agreed with the importance of managing conflict in RE. In this sense, this finding provides strong evidence to justify the motivation of building the NREMM.

6.6.2 Experts' views on the NREMM

In general, positive feedback was gained from the experts. The experts generally agreed that the NREMM met its overall purpose of helping RE practitioners to deal with conflicts. However, some key findings and considerations for future improvements are discussed as follows:

1. **The use of story-telling as a theoretical underpinning is robust, and matches well with the current state of RE practice.** The use of story-telling as an underlying concept was highly appreciated by the experts as a key theoretical strength. This finding confirms that a strong theoretical underpinning makes the model more robust. For example, Avison and Fitzgerald (2002) note that a well-defined method is much more than just a series of techniques along with the use of supporting software tools. A good method should specifically address the critical issue of its underlying theories that the author of the method believes in and that have shaped the development of the method (Ibid). In this sense, the use of narrative mediation underpinned by story-telling concept is regarded as a strong theoretical strength by the experts. The experts also commented that the use of story-telling was not only theoretical robust, but also highly pragmatic and matched well with the current state of the RE practice. As mentioned in section 3.5.1, the use of story-telling has become increasingly popular in the current RE practice (e.g. Clausen, 1994; Hotzblatt & Beyer, 1995; Alvarez, 2001; Alvarez and Urla, 2002). This finding therefore implies that the NREMM which builds on the story-telling concept is more likely and easier to be adopted by the RE practitioners.

2. **NREMM has a strong emphasis on the pre-mediation phases of conflict resolution.** The NREMM contains three phases: conflict identification, definition, and resolution. The overall findings from the experts (see Section 6.4.2) indicates that the NREMM is capable of helping RE practitioners to

identify, define and resolve conflicts in the RE process. However, it is worth noting that the experts generally recognised that the first two sub-models play a more substantial role than the last sub-model. For example, one expert commented that *"probably 80% of work needs to be devoted to analysing the rational of conflict. Only 20% of work needs to be devoted to resolution."* Interestingly, this finding is in line with the mainstream negotiation literature. As Thompson et al., (2001) defines an 80-20 rule applied to a negotiation: about 80 percent of your effort should go towards preparation; 20 percent should be the actual work involved in the negotiation meeting. This is an important and timely finding for RE researchers who aims to develop conflict resolution methods. Robison and Volkow (1997) indicate that most work regarding RE negotiation or conflict resolution focuses on developing the methods or tools to aid the interaction among conflicting participants. They further argue that beyond the negotiation one should also consider pre- and post-negotiation phases as part of the negotiation process covering activities such as initial problem identification, participant solicitation and communication, and stakeholder identification (Ibid). The NREMM, which has a strong emphasis on the pre-mediation phase thus, is considered strength compared with existing RE conflict resolution work.

3. **NREMM offers RE practitioners an innovative way of requirement questioning and listening.** Although this expert panel does not show that the new listening and questioning technique would be effective in real practice, the experts are very interested in the use of the techniques such as discursive listening, positional call, externalisation language, and curious questioning technique. The finding indicates that the NREMM underpinned by social-constructionist theory, potentially offers an innovative way of questioning and listening for RE practitioners. Indeed, there is increasing attention in the RE literature on social-construction theory in relation to adopting a social subjectivist perspective in RE (e.g Thanasankit, 2002; Ramos et al., 2005). For example, Thanasankit (2002) states that a subjectivist perspective always views meaning, fact, and reality as socially constructed and never finalised, and thus is always contextual and open to revision. Ramos et al., (2005)

further argues that an absolute true requirement doesn't exist. In relation to the requirements questioning techniques, Kandrup (2005) even borrows the questioning techniques from family therapy, which aims to open up and generate new knowledge in and around systems that numerous people inhabit. In Chapter 7, I will demonstrate how these questioning and listening techniques being implemented in a simplified real-world scenario.

4. **NREMM needs further improvements in terms of integrating with some existing RE modelling techniques and especially goal modelling techniques.** This recommendation was clearly made by 4 of the RE experts who had an extensive industry background. Instead of following a detailed story line, some RE experts thought the NREMM would be more practical and accessible if it integrated with some of the most widely used RE modelling techniques such as *Unified Modelling Language* (*UML*) and *Data Flow Diagramming* (DFD). This is not a surprising finding because requirement modelling is widely and consistently recognised as the most fundamental and overriding activity in the RE literature. As a result, there is a great number of RE researches that focus almost entirely on different modelling methods and their associated analysis techniques (e.g. DeMarco 1979; Yourdon 1989; Yu and Mylopoulos, 1994, 1998; Avison and Fitzgerald, 2002). One of the clear benefits of modelling is improved understanding of complex system, as Avison and Fitzgerald, (2002) suggest that a model is an abstraction, which can be viewed as a simplified representation of the real world. Despite a massive number of requirements modelling techniques being developed in the RE community, Nuseibeh and Easterbrook (2000) propose a challenging question: "what are they good for?" They further note that the answer to this question should always be in terms of the kind of analysis and reasoning the modelling techniques can really offer. In relation to conflict resolution in RE, the feedback gained from the experts clearly indicate that goal difference is the single biggest cause of conflicts. Yu and Mylopoulos (1998) argue that goal modelling approaches offer an effective way of dealing with conflict because the meeting of one goal may interfere with the meeting of others. However, due to time constraints of this study, this recommendation will only be considered in the future study. In the future, the NREMM could be improved

by integrating with some existing goal modelling techniques to address those goal conflicts

6.6.3 Limitation of study

One key limitation is the degree of generalisability of findings across settings. Due to a relative small simple size, there is an obvious need for caution in drawing general conclusions from a small sample. However, the aim of this expert panel study is to gather authentic views of the newly developed NREMM from a small sample of RE experts at the very early development stage to initially assess the model. I am in line with Stake's view "the purpose is not to represent the world, but to represent the case" (Stake, 1995, p. 245).

6.7 Summary

In this chapter, I presented an empirical assessment study of the NREMM through interviewing a panel of RE experts. In particular, this chapter answered the third research question:

RQ3: Is the NREMM theoretically robust?

The results of the assessment indicate that conflict is an inevitable part of system development, and needs to be carefully managed. The findings further suggest that the NREMM, which uses story-telling as a theoretical underpinning, has a strong theoretical foundation, and matches well with the current state of RE practice. This also leads to the NREMM being more easily understood by the RE experts. The overall findings indicate that the NREMM is capable of helping RE practitioners to identify, define, and resolve conflicts in the RE process**.** However**,** this assessment is by no means the completion of model development. As mentioned in Chapter 1, it is important to ensure that the model is not only theoretically robust, but also practically useful. In Chapter 7, an empirical evaluation study of the NREMM is presented in a simplified real-world scenario (University of Hertfordshire's StudyNet).

Chapter 7: Evaluating the NREMM

7.1 Introduction

In Chapter 6, the NREMM was empirically assessed through interviewing an RE expert panel to measure whether the newly developed NREMM is theoretically robust and whether it met its design purpose. This chapter presents an evaluation study of the NREMM, which aims to determine whether the NREMM is practically useful in a "simplified" real-world scenario. This chapter particularly answers the last research question:

RQ4: Is the NREMM practically useful to resolve conflict?

In doing so, the following two key criteria are used to evaluate the NREMM's practical usefulness:

1. Stakeholders' perceptions of the mediator: how well the mediator chairs the workshop and leads the discussion by applying the NREMM.
2. Stakeholders' satisfaction with the outcome: to what extent stakeholders are satisfied with the outcome of the RE workshop in terms of a set of negotiated requirements.

A major part of this chapter's work is devoted to reporting the procedures of designing and conducting a quasi-experiment based on a simplified real-life scenario-Hertfordshire University's StudyNet requirement negotiation workshop. Section 7.2 presents the experiment design. Section 7.3 presents the findings of the evaluation study. Section 7.4 discusses the key findings of the study together with the limitation of the NREMM. Section 7.5 concludes the chapter.

7.2 A quasi-experiment

As mentioned in Chapter 5, a quasi-experiment approach was adopted to gain greater control of variables. In this case, to see the real effects of the NREMM, I particularly compare the different results obtained from RE workshops where the mediator applies

the NREMM and the workshops where the mediator do not apply the NREMM. 5 RE workshops were conducted. In the first 3 RE workshops (A1, A2 and A3), the mediator actively applied the NREMM. In the last 2 RE workshop (B1 and B2), the mediator did not apply the NREMM. In this section, the experiment design and procedures are presented.

7.2.1 Experimental Setting

I used a simplified real-world scenario based on negotiating requirements for the University of Hertfordshire's StudyNet to illustrate how conflicts emerged, are communicated, and eventually resolved. StudyNet is a Managed Learning Environment, which provides a university-wide set of systems and tools for educational delivery. The system allows learning, assessment and interaction to take place in a structured and managed way. The system involves a wide range of stakeholders from the end-users to the developers. It is used throughout the whole of the university to support teaching and learning at all levels. This means that all stuff and students are real users of this critical organisational system.

In this experiment, I focused on key user groups, which were the main sources of those requirements. There are three key groups of users involved in this study:

1. Undergraduate and postgraduate taught students. Their use of StudyNet is primarily based on using learning materials uploaded by academic staff.
2. Postgraduate research students. Their use of StudyNet is primarily concerned with accessing and searching academic journals and other publications.
3. Staff. Their use of StudyNet focuses on editing and uploading teaching materials as well as managing this supportive learning community.

It is clear that these three groups of users use the system differently and are likely to have different perspectives on the requirements for StudyNet. To create more conflicting perspectives in this scenario, a time constraint and financial incentive is deliberately designed into the experiment as conflict is likely to be more intensive when time and resources are limited. The users will be told that implementing all their

requirements is not feasible within the limited development time and resource. As a result, a human mediated RE workshop using the NREMM is used to negotiate an agreement on the final requirements specification that meets the development timeframe.

7.2.2 Experiment Participants

Although a quasi-experiment approach is adopted in this study, the participants were real users of the StudyNet. Using real users of a real system offers a distinct advantage over the previous RE negotiation experimental studies (e.g. Damian et al., 2000a; 2003; 2006; 2008), which predominately rely on using undergraduate students playing unfamiliar roles in the development of hypothetical systems. Real users of StudyNet have extensive domain knowledge, and are clearer and more familiar about their requirements. This is important, as stakeholders' detailed domain knowledge leads to more interactions. As a result, conflicting interests and goals towards different requirements are more realistic than in previous similar studies, which are simulated in an artificial setting. For each RE negotiation workshop, 4 participants were involved:

1. 1 undergraduate student (final-year CS/SE students are purposefully targeted)
2. 1 research student (PhD students in CS/SE are purposefully targeted)
3. 1 academic member of staff (Staff from School of Computer Science are purposefully targeted)
4. 1 mediator (the researcher plays the role of a mediator)

A purposive sampling strategy was used to target the first three types of real user. For the undergraduate student users, I focused on the whole population of the final-year CS/SE undergraduate students for two reasons. First, final year students know more about StudyNet as they have used StudyNet longer than first and second year undergraduates. Secondly, undergraduate final year students with a computing background are more likely to have some better knowledge of SE and RE in general. For the same reason, the purposive sampling strategy was also applied to the population of all PhD students within the School of Computer Science. In doing so, a

call-for-participation e-mail (See Appendix 9) was forwarded to the final-year CS student and PhD students' population.

A convenience sampling strategy was used to target a participant from the academic staff. StudyNet has been developed in-house by the University, and some members of academic staff from the School of CS had been actively involved in StudyNet development or evaluation projects. I therefore deliberately targeted this kind of academic staff due to their extensive knowledge and experiences of StudyNet.

The researcher himself played the role of a mediator in all workshops. This is because training a competent mediator to use the NREMM would be expensive and time-consuming. To see the consistent effects of applying the NREMM, it is essential that the mediator has a full understanding of the NREMM. As the designer of the NREMM, the researcher has knowledge of implementing the NREMM. Moreover, consistently using one mediator in all workshops also minimises the effect of different confounding factors such as the style and personality of the mediators.

7.2.3 Tasks for the participants

Initially, the 3 types of users were given 5 preliminary requirements separately (See Table 9). The requirements in each category were in no particular order of importance and dependence (Damian et al., 2003). At the beginning of a RE workshop it was important to provide stakeholders with a preliminary list of requirements as a source of information. This was because the stakeholders may not know exactly what they want at the very beginning. A list of preliminary requirements may also help them identify the scope and encourage their creative thinking (Gottesdiener, 2002).

Undergraduate student	Research student	Academic Staff
• provide links for additional support resources: careers, personal development, counselling service • view subject specification and teaching material online • view coursework and submit coursework online • view all marks for all modules taken • view past year exam papers	• provide links for LRC resource: Voyager, IEEE explore, ACM portal, and other database. • provide information or links about generic research training • provide information about the forthcoming research conferences and seminars. • view and submit internal working papers • provide information for available research grants	• upload and edit coursework and teaching material • edit and view a list of the student enrolled on the module • view and mark a list of submitted coursework by students • module leader may manage and change user roles and access rights for students and staff • set up an online discussion forum

Table 9: A preliminary list of 15 requirements

The 3 users were told that the list of 5 preliminary requirements only acted as an information source. They were allowed to suggest 2 more new requirements to add on the list as long as they can justify their new requirements' importance and relevance. They were also told that there will be only 5 final requirements in total (rather than their wanted total 21 requirements) that could be successfully implemented to meet a project deadline for avoiding a financial penalty. This meant that their highly-prioritised requirements need to be re-considered and even re-structured in a logical order based on the individual requirement's importance. Under such circumstances, the individual user may only be concerned that his or her 'personal' requirements are implemented, and thus may be reluctant to cooperate. It is also interesting to note that in this scenario there would be not be a win-win situation, as 5 requirements could not be equally allocated to the 3 different users. The following situations were expected:

- There would be a clear "winner" who gets his/her 3 highly-prioritised requirements implemented in full and the remaining 2 stakeholders only have their 1 each requirement implemented.

- There would be two "winners" who both got his/her 2 highly-prioritised requirements implemented and the remaining 1 stakeholder only has 1 requirements implemented.

This design deliberately leads to a competitive and conflicting situation, as I expect the participants to adopt a variety of competitive strategies to negotiate with each

other to satisfy their real needs. I also expected conflicting goals, shifts of political power and ownership attached with strong personality, blame, open attack, and even anger are possible. All participated student were paid £15 as minimum incentive for their participation. The member of academic staff was not paid for their participation. I also offered the "winning" student an extra £15 to ensure all participants are fully motivated and committed to their tasks.

This scenario also aimed to be highly interactive, in which different user groups only had detailed domain knowledge of their required features. Each participant would only discovery how their requirements relate to other users' requirements during the workshop with the help of the mediator. 3 different users then needed to understand the relative importance of requirements, explore alternatives and work collaboratively with the mediator to reach an agreement.

7.2.4 Procedures

Each mediation session was about 60 minutes. Prior to the each mediation session, a 15-minute warm-up session was given to enable the participants to be familiar with their roles and tasks. All workshops were video-recorded. To avoid pre-judgement, participants were only be given their brief (See Appendix 10) when they arrive at the meeting room. The following procedures were followed:

- Participants were given a briefing about their roles and tasks.
- Participants were given a preliminary list of 5 requirements separately (See Table 9).
- At the beginning of the workshop, participants initially discussed the system scope and the importance of their 5 preliminary requirements, and may suggest any 2 additional requirements to add. The mediator introduced a time constraint, which indicated that only total 5 requirements rather than the original 21(3*7) requirements can be implemented to avoid a financial penalty.
- Participants were encouraged to collaborate with each other to develop tradeoffs, which only contain a list of 5 agreed requirements. The mediator

worked closely with all 3 participants by applying the NREMM to help them achieve an agreement.

- When agreement was reached, a post-session questionnaire (see Appendix 9) was given to all 3 participants.

7.3 Findings

In this section, I present empirical findings based on the data collected from the post-session questionnaires and content analysis of video-tapes. This section is organised into three sub-sections. The first sub-section presents findings from the first three workshops (A1, A2 and A3), in which the NREMM was adopted by the mediator. The second sub-section presents findings from the final two workshops (B1 and B2), in which the NREMM was not applied by the mediator. The findings presented in this way enable the contextual richness of each individual workshop to be captured. In the third sub-section, we compare and contrast the findings of all five workshops. Finally, I discuss the threats to validity of the study.

7.3.1 Findings of Workshop A1, A2, A3

In this sub-section, I present findings of the workshop A1, A2, and A3, in which the NREMM was adopted by the mediator. This sub-section begins with an overview of each workshop to provide a contextual background and summarises the key quantitative data collected from the post-session questionnaires. Detailed quantitative data can be found in later sub-sections to demonstrate the NREMM being implemented.

7.3.1.1 Overview of workshop-A1

Overall, workshop A1 took 45 minutes for participants to reach an agreement on a list of 5 requirements. Most notably, in workshop A1, the member of academic staff clearly dominated the workshop, and eventually "won" the workshop by having his 3 requirements on the final list of 5 requirements. He quite often rejected other participants' requirements by taking advantage of his academic position and strong personality. An undergraduate student and a research student, both with slightly softer personalities, only got 1 requirement each on the final list. Nevertheless, quantitative

data gathered in the post-session questionnaire indicates a good level of satisfaction on the workshop outcome across the 3 participants (M=4.6 out of 5). The post-session questionnaire also indicates that all participants had a very good impression of the way that the workshop was conducted by the mediator. Table 10 summarises the results of the post-session questionnaire.

Workshop A1 (45 minutes)				
Reached an agreement?	Yes			
How satisfied are you with the final outcome?	U 4	R 4	S 5	M 4.3
How informative the mediator is	5	5	5	5
How persuasive the mediator is	5	4	3	4
How accommodating the mediator is	4	3	3	3.3
How cooperative the mediator is	5	4	5	4.6
How assertive the mediator is	2	3	2	2.3
How active the mediator is	5	5	4	4.6
How fair the mediator is	5	5	5	5

Table 10: Overall result of the post-session questionnaire for Workshop A1

U: Undergraduate student. R: Research student. S: Academic staff.
M= Mean of the corresponding values

Scoring system: 5- very, 4-quite, 3-slightly, 2-little, 1-not at all

7.3.1.2 Overview of the workshop-A2

In workshop A2, all participants went through a very smooth process in a collaborative and friendly manner. The mediator therefore played a less assertive role. Workshop A2 involved few disagreements. This might be the reason why workshop A2 took the shortest time- 40 minutes to reach an agreement. In the final list of 5 requirements, there are 2 requirements from an undergraduate student, 2 requirements from a member of academic staff, and 1 requirement from a research student, which means that both the undergraduate student and the academic staff "won" the workshop. In terms of participants' perception of the mediator, the post-session questionnaire indicates a very good level of satisfaction on the way that the workshop was chaired by the mediator. The questionnaire result also indicates a good level of satisfaction with the outcome (M=4 out of 5). Table 11 summarises the results of the post-session questionnaire.

Workshop A2 (40 minutes)				
Reached an agreement?	Yes			
	U	**R**	**S**	**M**
How satisfied are you with the final outcome?	5	4	5	4.6
How informative the mediator is	5	5	5	5
How persuasive the mediator is	5	5	4	4.6
How Accommodating the mediator is	4	4	5	4.3
How Cooperative the mediator is	5	5	5	5
How Assertive the mediator is	1	1	1	1
How Active the mediator is	5	5	5	5
How Fair the mediator is	5	4	5	4.6

Table 11: Overall result of the post-session questionnaire for Workshop A2

7.3.1.3 Overview of workshop-A3

In workshop A3, a manifest conflict emerged between an undergraduate student and a research student, and as a result this workshop took the longest (55 minutes) to reach an agreement. The undergraduate student and the research student both had a strong personality and played a very active and forceful role in the workshop. In particular, on behalf of a relatively small user population, the research student strongly argued their needs were overlooked and StudyNet was currently too "teaching-focused". The undergraduate student then argued that the undergraduate user group is the largest StudyNet user population, and therefore their needs should drive the key direction of StudyNet development. At the end, both the undergraduate student and the research student agreed with a trade-off having their 2 requirements each on the final list. The member of academic staff only scored 1 requirement. The post-session questionnaire indicates that all participants had a good level of satisfaction with the way that the workshop was chaired by the mediator. They also indicated a good satisfaction level with the final outcome (M=4 out 5). Table 12 summarises the results of the post-session questionnaire.

Workshop A3 (55 minutes)				
Reached an agreement?	Yes			
	U	R	S	M
How satisfied are you with the final outcome?	3	5	4	4
How informative the mediator is	4	3	5	4
How persuasive the mediator is	4	4	4	4
How accommodating the mediator is	4	4	3	3.6
How cooperative the mediator is	4	4	4	4
How assertive the mediator is	3	3	3	3
How active the mediator is	5	4	3	4
How fair the mediator is	3	5	4	4

Table 12: Overall result of the post-session questionnaire for Workshop A3

7.3.2 Qualitative data (Workshop A1, A2, A3)

Qualitative data was also collected during each workshop via videotape. Qualitative data is analysed thematically based on the category containing the key elements of the NREMM. The category (see Table 13) is based on the NREMM, and captures the five key elements of the NREMM: positional call, relational practice, and dialogical practice (directly drawn from the original narrative mediation model), stakeholder modelling and requirements prioritization (drawn from the existing RE literature). The presentation of findings is based on the structure of the classification scheme to illustrate how the NREMM is being implemented.

The category below summarises the key elements of the NREMM being applied to the workshops and its potential benefit for the workshops. I have to note that the elements listed in Table 13 are not all elements of the NREMM. This is because this experiment is based on a simplified real-world scenario, and focus on the actual negotiation and resolution phase rather than pre-negotiation phase. Within such context, I could only possibly employ and evaluate key elements of the NREMM from the conflict definition and resolution phases. Elements from the conflict identification phase were not included in this analysis. However, I did follow the principles given by the conflict identification phases to set up a meeting setting, prepare relevant meeting artefacts, and model stakeholder background information. The whole point is that, even if in real practice, all elements of the NREMM may not

be necessarily applied in all cases, as mediators apply different elements of NREMM selectively based on the characteristics of each individual case.

Key elements in NREMM	Individual techniques applied into the workshop
Positional call	P1: Calling stakeholders to share their positions between each other. P2: Encouraging stakeholders to express their requirements based on their position.
Relational practice	R1: Calling stakeholders into a respected, cooperative and friendly relationship R2: Celebrating any progress being made
Dialogical practice	D1: Genuine curiosity questioning D2: Inviting production of meaning D3: Developing externalizing language
Requirements prioritization	R1: Estimate the relative "value" of the requirements
Stakeholder modelling*	S1: Identify the key stakeholders S2: Create a persona for all stakeholders involved
Selecting meeting setting *	M1: Selecting appropriate seating and meeting layout M2: Preparing meeting artefacts (Flip chart, whiteboard, PC)

Table 13: The category for analysing qualitative data (*: applied prior to the workshop and not included in this analysis)

7.3.2.1 Positional call

Positional call is a technique related to asking conflicting parties to share and understand the positions between each other. It was widely used in all three workshops; in particular, in workshop A1 and workshop A3, where a manifest conflict emerged between two participants. Table 14 lists the detailed techniques of positional call being adopted in the particular workshop and its likely benefits.

Position call techniques applied into the workshop			Likely Impact
WorkshopA1	WorkshopA2	WorkshopA3	Urge the parties to take their appropriate positions to speak out their relevant requirements, and eventually achieve a mutual benefit.
P1, P2,	P2	P1, P2	

Table 14: Positional call applied into three workshops

Winslade and Monk (2000) state that every story offers positions for people to take up in relation to each other, and these positions are expressed by the conversation. In workshop A1, participants often took up their defined positions (e.g as a member of

academic staff, an undergraduate student) to express their requirements. For example, the undergraduate student stated in workshopA1:

> *U-WorkshopA1: "As an undergraduate student, I mainly use StudyNet to view online teaching materials. I think this should be the key requirement not only for me, but also for all taught students."*

The research student in the workshop A1 made a similar statement based on their unique position as a research-based postgraduate student:

> *R-Workshop A1: "I use the system differently. I am a PhD student. I regularly use StudyNet to search journal articles to inform my research work. I can understand the importance of uploading teaching materials for those taught students, but it is nothing to do with me. I am not bothered. My only concern is whether StudyNet can provide a customised journal searching feature."*

I also found out that it was important for the mediator to urge participants to take their appropriate positions to achieve mutual benefit. In particular, when conflict emerges, it was useful for the mediator to ask participants to share positions between each other. In workshop A1, the member of academic staff played a very dominant role, and often rejected other participant's requirements in order to promote his requirements being implemented first. For example, he had the following debate with an undergraduate student:

> *A-WorkshopA1: "I totally disagree with the requirements proposed by you, which want StudyNet to provide more career resources for final-year undergraduates. We have to note that StudyNet is for studying purposes. We need to put learning as the key focus when the budget is limited. I want my requirements of uploading video broadcasts at the top of the list."*

In the above scenario, the mediator clearly intervened by asking the academic member of staff to consider and share the student's position:

M-WorkshopA1: "We all know StudyNet is a learning focused system. But, you used to be a student. You should know how important it is for final-year students to find a good job. The University's ultimate goal is to ensure every student success. This is also measured by employment rate, and not just exam results. Just consider the student's perspective, is it a reasonable requirement?"

A-WorkshopA1: "ok, we can talk about it in more detail later on."

In workshop A3, there was a conflict between the undergraduate student and the research student due to their different perceptions of the purpose of Study-Net. The research student complained that StudyNet overlooked the research student's purpose, as they are the smallest user group. The undergraduate student then argued that StudyNet should serve the majority. The research student wanted to introduce a new requirement to improve online booking for research training courses. The undergraduate student then emphasised the importance of integrating some personal communication mechanisms to improve communication between tutors. Both of them were unwilling to compromise. The mediator intervened by asking them to consider and share the position:

M-Workshop A3: "Apparently, you have both got important points. Now, we are not going to argue who is right or wrong. What we need to do now is to decide whether both of you can appreciate and share each other's point, and understand its importance for each other's different requirements. And then possibly, we can settle down to an agreement."

U-Workshop A3: "Ok, I can understand how important it is for the research students to attend their required research training. But, how can we more effectively communicate with our tutors?"

M-Workshop3: "Well, there are many others ways, which doesn't need to be included in StudyNet. You can use instant messagers or e-mail, whatever way that you and your tutor prefer."

7.3.2.2 Relational practice

Mediation is a cooperative activity. This thus requires the mediator to follow the relational practices offered by the NREMM to create and maintain a cooperative and relational climate. Table 15 lists the detailed techniques of relational practice being adopted in the particular workshop and its likely impacts.

Relational practice techniques applied into the workshop			Likely Impact
WorkshopA1	WorkshopA2	WorkshopA3	A respected, cooperative climate was created and maintained.
R1, R2,	R1	R1, R2	

Table 15: Relational practice applied into three workshops

In workshop A1, although the member of academic staff adopted a dominant role, all other participants were generally friendly and cooperative. In workshop A2, all participants worked in a friendly and collaborative manner. Consequently, the mediator did not need to fully employ the relational practice techniques from the NREMM. Nevertheless, the mediator often generally stressed the importance of cooperation among stakeholders. For example, in workshopA1:

M-Workshop A1: "we have just had a discussion on the issues and requirements related to our current StudyNet. It seems there is a little disagreement between each other. But this is inevitable. The only way we can resolve this is through a respected and joint decision-making process. Cooperation is the only way to put us forward."

Another example in workshop A3 is given below when the research student and the undergraduate student engaged with a debate:

M-Workshop A3: "It is clear that different people have different ideas about StudyNet. We need to collaborate rather than struggle or compete. I hope both of you can compromise each other's point. You let others win first, and the others will let you win second."

In workshopA1 and A3, the mediator also attempted to encourage and celebrate any good progress being made when conflict became a key barrier to making progress. In particular, the mediator often used this technique to play an assertive role and encourage the stakeholders to reach agreement when the workshop was approaching its end. For example, in workshop A1:

M: "We have made good progress so far. We have found out that much common ground is shared between taught students and academic staff. Many requirements proposed by academic staff can also benefit the taught students. For example, the requirement for uploading teaching material; the requirement for submitting coursework, and the requirement for viewing coursework marks online. We have now got 15 minutes left and only one issue remains to be resolved (a requirement asked from the research student to submit technical reports online), let us finish this off."

It is worth noting that the above relational practice techniques played an important role in achieving mutual agreement between stakeholders, despite the likely effects of applying relational practice are subjective in nature and difficult to be measured. It is evidenced that the workshop could be enriched by a cooperative, respected, and friendly climate.

7.3.2.3 Dialogical practice

Dialogical practice provides an innovative way of questioning and listening techniques to help the mediator develop a dialogue between stakeholders. The genuine curiosity questioning technique was often used by the mediator in workshops A1, A2, and A3 (See Table 16). In doing so, the mediator also carefully and persistently inquired into the meanings of the elements of the stories that were told by the stakeholders to explore more meaningful information. For example,

M-Workshop A3: "Just now you have described your most important requirements for StudyNet. And you seem to disagree with the taught student's requirements by saying that you use StudyNet for different purposes and goals. Could you clarify a bit more about the meaning of your purposes and goals?

Dialogical practice applied into the workshop			Likely Impact
WorkshopA1	WorkshopA2	WorkshopA3	More meaningful and insightful information can be elicited through the curious and persistent questioning technique.
D1, D2,	D1,D2	D1, D2, D3	Separating people from problem through developing an externalizing language can help parties focus on the key issues.

Table 16: Dialogical practice applied into three workshops

Curious questioning sometimes needs to be pursued persistently for its best effect. In doing so, the mediator followed up the above conversion by asking:

M-WorkshopA3: "If possible, could you describe a little further about your purpose of StudyNet? And what do you think the difference is between your purposes of using StudyNet with taught students'?

I found out that this type of questioning technique often elicited some more meaningful and insightful information to help the mediator to have a better understanding of the problem domain. This type of question also elicits some important requirements which are not covered in the preliminary list given by the mediator at the beginning. Continuing with the above scenario, the member of academic staff answered the above question as follows:

A-WorkshopA3: "Apparently, we use the system differently to taught students. We intend to use the system to be focused on facilitating student's learning needs, and this can be varied<………>There are some key requirements missing in the list, and I think they are more important for my teaching purpose. For example, the requirement of uploading multi-media video broadcasts is so critical for me, as I am teaching a multi-media design course for final year students……"

Apart from the above curious questioning techniques, I also found out developing an externalizing conversation helps the mediator to separate people from the problem.

This technique was particularly applied in workshopA3, as I mentioned before, the workshopA3 involves a manifest conflict between a research student and an undergraduate student. Therefore, the mediator needed to get involved by developing the following externalizing conversation:

> *M-WorkshopA3: "All right, all right… I can see both of your points. What I want to emphasise is the disagreement was caused by your two different types of study mode, not you two individual people. People is not the problem, the problem is how we can deal with requirements that are required by two different types of learning needs."*

Although there was no obvious negative emotion generated by the participants in workshop A3, such types of conversions could shift focus away from personalities, or blame, and focus attention on the problematic features of the conflict itself.

7.3.2.4 Stakeholder modelling and meeting setting

It is of paramount importance for any requirements engineer to clearly identify the key stakeholders at the early stage of system development. The stakeholder modelling techniques were thus applied prior to all three workshops. In particular, the technique of creating a persona was used to provide a rich and thorough picture of the stakeholders' roles and responsibilities within their organisation. In this case, such personas provided solid and rich background information regarding taught students, academic staff, and research students and how they potentially interact with StudyNet. These personas led the mediator to a better contextual understanding of the different functionalities required by the different participants, and also helped the mediator to anticipate potential conflicts among them ahead of the actual workshop.

Prior to the meeting, I also adopted the elements from conflict identification phase to set up meeting layout and prepare relevant artefacts. To demonstrate the strength of the face-to-face communication, the table and chairs were set in a horseshoe shape so that all members could clearly see all other members and the facilitator. To facilitate the information sharing and visualization, relevant artefacts were also employed such as Flip chart, whiteboard.

7.3.2.5 Requirements prioritization

In all three workshops, prioritizing the relative "value" of the requirements was used to determine the importance of the requirements. I do not prioritise the relative "risk" and "cost" of the requirements because the aim of these workshops was to initially discuss the scope of StudyNet and determine a set of key requirements for the users. I found out that whereas all requirements are relevant and necessary, some requirements are recognised as more critical than others by the participating stakeholders. For example, an undergraduate student argued that in workshop A1:

> *U-workshop A1: "All listed 5 requirements are important for me, but critically, the most important one is downloading the teaching materials, which are uploaded by academic staff. I think it is far more important than the others. Failure to implement this requirement will definitely lead to poor user satisfaction. All taught students heavily rely on this requirement. This is particularly true for those lazy students who are always absent from the lectures…"*

Another example from the workshop A2 is given by a research student as follow:

> *R-Workshop A2: "From the list that you give, I can see a most important requirement to me is searching academic literature. Providing information for generic research training is also relevant, but not really important for me… Provide information about the forthcoming research conferences and seminars sounds a bit trifling. I can easily get such information through e-mails or newsletters, and it is more relevant to my area of research."*

Once stakeholders perceive the requirements with different value, the requirements prioritization technique can help the mediator and stakeholders to evaluate the potential importance of each individual requirement for different participants and eventually make a joint decision. In the all three workshops, the mediator asked the stakeholders to provide a ranking list of 5 requirements based on their perceived value:

Undergraduate student	Research student	Academic Staff
• **U1**: Provide links for additional support resources: careers, personal development, counselling service • **U2**: View subject specification and teaching material online • **U3**: View coursework and submit coursework online • **U4**: View all marks for all modules taken • **U5**: View past year exam papers	• **R1**: Provide links for LRC resource: Voyager, IEEE explore, and other database. • **R2**: Provide information or links about generic research training • **R3**: Provide information about the forthcoming research conferences and seminars. • **R4**: View and submit internal working papers • **R5**: Provide information for available research grants	• **A1**: Upload and edit coursework and teaching material • **A2**: Edit and view a list of the student enrolled on the module • **A3**: View and mark a list of submitted coursework by students • **A4**: Module leader may manage and change user roles and access rights for students and staff • **A5**: Set up an online discussion forum

Table 17: A list of 5 preliminary requirements provided for each stakeholder group.

All requirements listed above are equally important and independent, which means there is no dependence between each requirement. Each participant is only given his/her own 5 preliminary requirements at the beginning of the meeting. Participants will only find out other participants' requirements through an interactive discussion between each other. Detailed results of requirements prioritization in all three workshops are presented in the next sub-section.

Results of requirements prioritization in workshop A1

Table 18 summaries the results of requirements prioritization performed by all participants in workshopA1. It is clear that the member of academic staff has 3 out of 5 requirements on the final agreement list. The post-session questionnaire of workshop A1 (also see Table 9) also indicates that the member of academic staff had a 100% satisfaction level (5 out of 5) on the workshop outcome. Although the taught student and research student only scored 1 requirement each in the final list, the post-session questionnaire of workshop A1 still indicates a good level (4 out of 5) of satisfaction of the outcome. This may because both of their most top-ranked

requirements were placed on the final list. For example, the research student noted in the post-session questionnaire:

R-WorkshopA1: "I am clearly aware that the staff played a dominant role in the meeting. So I am not surprised that he is the winner, but I don't really brother as I only use StudyNet for searching academic literature. I am happy to see my most wanted requirement on the list, and that is all."

Rank ing	Final list of 5 requirements in workshopA1
1	**U3**: View coursework and submit coursework online
2	**A1**: Upload and edit coursework and teaching material
3	**A5**: Set up an online discussion forum
4	**A6**: Uploading multi-media video broadcasts
5	**R1**: Provide links for LRC resource: Voyager, IEEE explore, and other database

Table 18: Result of requirements prioritization in workshopA1 Note: Requirements A6 is newly created by the member of academic staff.

Results of requirements prioritization in workshop A2

Table 19 summarises the results of the requirements prioritization performed by all participants in workshop A2. In the final list of 5 requirements, there are 2 requirements from an undergraduate student, 2 requirements from the member of academic staff, and 1 requirement from the research student. This means both the undergraduate student and the staff student "won" the workshop. In terms of participants' satisfaction of the outcome (see Table 10), the questionnaire results indicate a good level of satisfaction (M= 4.6 out of 5). It is interesting to note that although the research student only got 1 requirement on the final list, I still received positive feedback (4 out of 5) in terms of satisfaction on outcome. The research student noted in the post-session questionnaire:

R-workshopA2: "Apart from a bit disappointing outcome, I quite enjoyed the process. I can see how different users' perceptions on StudyNet, and how differently their requirements are. Although we are the smallest user groups, the mediator provided us equal opportunity with those big user groups. I can feel he encourage me to do so."

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However, I have to note that this good level of satisfaction in workshopA2 have been linked to all participants' gentle personalities. As mentioned in the beginning, all participants had a very friend and gentle personality who did not generate much argument between each other. For example, the member of academic staff noted in their questionnaire:

A-workshopA2: "It seems there is no big conflict between each other. Instead, just a little difference between the required features of StudyNet."

Rank ing	Final list of 5 requirements in workshopA2
1	**U3**: View coursework and submit coursework online
2	**A1**: Upload and edit coursework and teaching material
3	**R1**: Provide links for LRC resource: Voyager, IEEE explore, and other database
4	**U5**: View past year exam papers
5	**A5**: Set up an online discussion forum

Table 19: Result of requirements prioritization in workshopA2

Result of requirements prioritization in workshop A3

Table 20 summarises the results of requirements prioritization performed by all participants in workshop A3. In the final list of 5 requirements, there are 2 requirements from an undergraduate student, 2 requirements from a research student, and 1 requirement from a member of academic staff, which means both the undergraduate student and the research student "won" the workshop. In terms of participants' satisfaction on the outcome (see Table 11), the questionnaire result indicates a good level of satisfaction (M= 4 out of 5) on the outcome. It is interesting to note that although the member of academic staff only got 1 requirement on the final list, I still received positive feedback (4 out of 5) in terms of satisfaction on the outcome. The member of academic staff noted in the post-session questionnaire:

A-workshop A3: "The meeting was well-balanced by the mediator, and he did offer me many opportunities to stand up my personal requirements. I did not

take it as to some extent, those requirements proposed by students are also helpful for my teaching and research job."

Ranking	Final list of 5 requirements in workshopA3
1	**U3**: View coursework and submit coursework online
2	**A1**: Upload and edit coursework and teaching material
3	**U5**: View past year exam papers
4	**R1**: Provide links for LRC resource: Voyager, IEEE explore, and other database
5	**R2**: Provide information or links about generic research training

Table 20: Result of requirements prioritization in workshop A3

7.3.3 Findings of non-controlled group: WorkshopB1 and B2

In this sub-section, I present the findings from workshop B1 and B2, in which the NREMM was not adopted by the mediator. The mediator in these two workshops acted passively and only facilitated the process and the structure of the workshops. The mediator did not get involved in any substantial decision-making process, which means all participants negotiated amongst themselves to reach an agreement rather than were mediated and helped by the mediator.

7.3.3.1 Findings from Workshop B1

Workshop B1 took 58 minutes to reach agreement on a list of 5 requirements. The research student began with a series of continuous complaints about the poor functionalities provided by StudyNet for all research students. The research student then clearly tried to dominate the workshop by pushing his research-based requirements into StudyNet. He then focused on the strategic level of StudyNet and disagreed with many teaching-oriented requirements proposed by the undergraduate student and the member of academic staff by arguing that the university needs to be research-led to improve its league table ranking. In the final list of 5 requirements (See Table 22), there are 2 from the research student, 2 from the undergraduate student, and just 1 from the member of staff. Although an agreement was reached at the end, the questionnaires indicate an unsatisfactory result from both the undergraduate student and the member of academic staff (See Table 21). In particular, both of them not only clearly demonstrated their disappointment on the final outcome

(M=1.3 out of 5), but were also disappointed with the performance of the mediator in workshop-B1 (See Table 21).

Workshop B1 (58 minutes)				
Reached an agreement?	Yes			
How satisfied are you with the final outcome?	U 0	R 3	S 1	M 1.3
How informative the mediator is	3	3	3	3
How persuasive the mediator is	2	1	2	1.6
How accommodating the mediator is	3	3	3	3
How cooperative the mediator is	4	4	5	4.3
How assertive the mediator is	1	1	1	2
How active the mediator is	2	2	2	2
How fair the mediator is	4	3	3	3.3

Table 21: Overall result of the post-session questionnaire for Workshop B1

The member of academic staff noted in the questionnaire:

S-Workshop B1: "The workshop seems to be chaired by the research student rather than the mediator. The mediator simply lacks of control in the meeting."

The undergraduate student made a similar statement as follow:

A-Workshop B1: "The mediator needs to interrupt the research student's 'non-stop speech', and show us there is an equal opportunity for all participants. I think the staff was definitely disappointing with the result and he seems totally lose his interest."

Ranking	Final list of 5 requirements in workshopB1
1	**U3**: View coursework and submit coursework online
2	**A1**: Upload and edit coursework and teaching material
3	**R1**: Provide links for LRC resource: Voyager, IEEE explore, and other database
4	**U5**: View past year exam papers
5	**R2**: Provide information or links about generic research training

Table 22: Result of requirements prioritization in workshopB1

7.3.3.2 Findings from Workshop B2

Workshop B2 did not manage to reach an agreement within an agreed timescale (60 minutes) due to an unresolved disagreement between the research student and the undergraduate student. The undergraduate student clearly adopted a competitive strategy by continuously emphasizing they are the biggest user group of StudyNet. The undergraduate student also tried to push some teaching-oriented requirements to win over the member of academic staff to isolate the research student in the workshop. However, the member of academic staff participated in this workshop has a strong research profile. He therefore didn't really value teaching-oriented requirements and argued that the university spending limited resources to increase research profile. This eventually led to an endless debate without a clear focus, in which no participant could persuade another to trade-off. The mediator acted passively throughout, not offering any useful inspirations and guidance. The post-session questionnaire indicates a very poor level of satisfaction in terms of both the workshop outcome (M=0.3 out of 5) and the mediator's performance (See Table 23).

Workshop B1				
Reached an agreement?	No			
How satisfied are you with the final outcome?	**U** 0	**R** 0	**S** 1	**M** 0.3
How informative the mediator is	3	1	1	1.6
How persuasive the mediator is	1	2	2	1.6
How accommodating the mediator is	2	1	1	1.3
How cooperative the mediator is	5	4	4	4.3
How assertive the mediator is	2	1	3	2
How active the mediator is	2	1	3	2
How fair the mediator is	3	3	3	3

Table 23: Overall result of the post-session questionnaire for Workshop B2

7.4 Discussion

In this section, I first contrast and discuss the findings of all five workshops related to my last research question posed in Chapter 1:

RQ4: Is the NREMM practical useful to resolve conflict?

The discussions of the main research question are based on the following two criteria:

1. Stakeholders' perceptions on the mediator: How well the mediator chairs the workshop.

2. Stakeholders' perceptions on the outcome: to what extent the stakeholders are satisfied with the agreement of the RE workshop in terms of identified a set of requirements.

In addition to discussing the main research question, I also aim to compare and discuss the results of our requirements prioritization analysis of all five workshops. Furthermore, I discuss several important aspects of these findings.

7.4.1 Stakeholders' perceptions on the mediator

	A1				A2				A3				M	B1				B2				M
	U	R	S	M	U	R	S	M	U	R	S	M		U	R	S	M	U	R	S	M	
Informative	5	5	5	5	5	5	5	5	5	5	4	4.6	**4.8**	3	3	3	3	3	1	1	1.6	**2.6**
Persuasive	5	4	3	4	5	5	4	4.6	4	3	5	4	**3.8**	2	1	2	1.6	1	2	2	1.6	**1.6**
Accommodating	4	4	4	4	4	4	5	4.3	4	3	3	3.3	**3.8**	3	3	3	3	2	1	1	1.3	**2.1**
Cooperative	5	4	5	4.6	5	5	5	5	4	4	3	3.6	**4.8**	4	4	5	4.3	5	4	4	4.3	**4.3**
Assertive	2	3	2	2.3	1	1	1	1	1	1	1	1	**1.5**	1	1	1	1	2	1	3	2	**1.5**
Active	5	5	4	4.6	5	5	5	5	5	4	3	4	**4.7**	2	2	2	2	2	1	3	2	**1.1**
Fair	5	5	5	5	5	4	5	4.6	3	5	4	4	**4.7**	4	3	3	3.3	3	3	3	3	**1.2**

Table 24: Stakeholders' perceptions on the performance of the mediator in five workshops

U: Undergraduate student. R: Research student. S: Academic staff.
M= Mean of the corresponding values
Scoring system: 5- very, 4-quite, 3-slightly, 2-little, 1-not at all

In terms of stakeholders' perceptions of the mediator, the overall results in Table 24 show that the workshops where the mediator applied the NREMM gained better satisfaction results. In general, Table 24 shows that participants in the three controlled workshops scored the performance of the mediator higher than participants in the final two non-controlled workshops. This is not surprising since the mediator in the controlled three workshops was fully and actively engaged adopting the NREMM. In the two non-controlled workshops, the mediator was passively engaged and only focusing on facilitating the process and the structure of the workshops.

Although the role of a requirements engineer as a facilitator in a requirement workshop has been well-documented in the RE literature (Wood and Silver, 1995; Macaulay, 1996; Macaulay, 1999; Damain et al., 2003), the role of a requirement engineer in a workshop as a facilitator is subject to a debate. As a vague term, there are many diverse views on the facilitators' role in the RE literature. For example, Dubbs and Hayne (1992) argue a requirement engineer as facilitator only needs to act as a controller of process and structure, and should not get involved in any decision-making process. Macaulay (1999) then argues that a requirement engineer should not only facilitate the workshop process and structure, but also needs to fully participate in the decision-making process as a problem-solver. Our findings strongly support Macaulay's (1999) claim. In terms of stakeholders' perception of the mediators' performance, our findings suggest that mediators applying the NREMM and actively engaged in the decision-making process in workshop A1, A2, and A3 were perceived better than when the mediator did not use the NREMM.

By comparing the first three workshops (A1, A2, and A3) in the controlled groups, we find that participants in workshop A2 scored the performance of the mediator higher than participants in workshop A1 and A3. This is probably because workshop A2 is the only workshop demonstrating little conflict among the participants. It is also interesting to note that workshop A2 took the shortest time (40 minutes) to reach an agreement. My results also show that the performance score for the mediator in workshop A1 is slightly better than the score in workshop A3. This might be because workshop A3 involved more intensive conflict than workshop A1, and took longer than workshop A1. Most importantly, the mediator in workshop A3 needed to adopt more techniques from the NREMM to settle down the conflicts. In particular, to encourage participants to meet the deadline, the mediator pushed the participants to draw a conclusion at the end of workshop. This might be the reason why the performance of the mediator in workshopA3 was recognised as slightly worse in all three controlled groups, and also why participants perceived the mediator in workshop A3 as more assertive than workshop A1 and workshop A2.

There is no perceived difference between the performance of the mediator in the two non-controlled groups (workshop B1 and B2). Although all participants in workshops B1 and B2 recognised the mediator as reasonably "cooperative" and "fair", they

considered the mediator were less informative, less active and less persuasive compared to the performance of the mediator in workshop A1, A2 and A3.

7.4.2 Stakeholders' perceptions of the outcome

	A1				A2				A3				M	B1				B2				M
Agreement or not?	Yes				Yes				Yes					Yes				No				
How satisfied are you with the agreement?	U 4	R 4	S 5	M 4.3	U 5	R 4	S 5	M 4.6	U 2	R 5	S 5	M 4	**4.2**	U 0	R 3	S 1	M 1.3	U 0	R 0	S 1	M 0.3	**1.5**

Table 25: stakeholders' perceptions of the outcome.

U: Undergraduate student. R: Research student. S: Academic staff.
M= Mean of the corresponding values
Scoring system: 5- very, 4-quite, 3-slightly, 2-little, 1-not at all

Table 25 summaries and compares stakeholders' perceptions of the outcome. Overall, all controlled workshops (A1, A2 and A3) reached an agreement with a very good level of satisfaction. It is interesting to note that although the non-controlled workshop B1 also reached an agreement, the post-session questionnaire generated poor satisfaction results in terms of participants' perception of the final outcome. Workshop B2 did not manage to reach an agreement. By contrasting the overall average results, Table 25 clearly indicates that the controlled workshops that applied NREMM achieved better satisfaction results (M=4.2) on the outcome than the non-controlled workshops without applying the NREMM (M=1.5). This is clear evidence to support Macaulay's (1999) claim that the requirements engineer as a mediator in a workshop needs to be actively involved in not only the process and structure, but also most importantly, the decision-making process.

By looking at the individual level of all workshops' satisfaction results, although workshop A3 had good average satisfaction results, Table 25 clearly indicates that the undergraduate student was less happy with the outcome than the research student and the member of academic staff. This is because that the undergraduate student deeply believed that the biggest user group should be most influential, and should get most requirements. Although an agreement was reached superficially, the undergraduate student clearly demonstrated disappointment in the post-session questionnaire. This possibly implies that although the mediator applying the NREMM can help

participants to reach a mutual win-win agreement, it doesn't guarantee a 100% satisfaction for all participants behind-the-scenes. Indeed, in reality, a perfect "win-win" situation probably does not exist in a conflicting situation. A win-win situation only occurs when each side in a conflicting situation feels they have "partly won" (Rapoport, 1974). In others words, at least, both sides felt that they can benefit from such a scenario, and any resolutions to the conflict are likely to be accepted voluntarily (Fisher and Ury, 1983). The so-called "win-win" situation is only the best offer available at the negotiation table for all participants. Furthermore, Deutsch (1985) indicates that any negotiation will be reframed and placed in a new context so that expectations should be lowered. The final level of satisfaction largely depends on how each side perceives their outcome relative to their standing position before the negotiation (Pruitt and Kim, 2004). In the case of workshop A3, as the biggest user group, the undergraduate student certainly held a higher expectation before the workshop. This is why, although an agreement was reached at the end, the undergraduate student still noted a lower level of satisfaction on the outcome.

7.4.3 Comparison of results of requirements prioritization in all workshops

Ranking	WorkshopA1	WorkshopA2	WorkshopA3	WorkshopB1
1	U3	U3	U3	U3
2	A1	A1	A1	A1
3	A3	R1	U5	R1
4	R1	U5	R1	U5
5	A6	A5	R2	R2

Table 26: Result of requirements prioritization in all workshops.

(Note: workshop B2 did not reach an agreement. Please also refer back to Table 19 for the details of each individual requirement)

The results of requirements prioritization in all workshops are summarised in Table 26. Although four workshops reached an agreement, Table 26 indicates 4 completely different requirements prioritization results. However, 2 key requirements were consistently ranked at the top in all 4 workshops: U3-Viewing coursework and submitting coursework and A1-Uploading and editing coursework and teaching material. This is not surprising as these 2 requirements are the most fundamental features for all kinds of E-learning systems.

In addition to these two requirements, the ranking of the remaining requirements appears to be different. For example, in workshop A1, requirement A3 (viewing and marking a list of submitted coursework by students) was ranked in third place. But in workshop A2, research students' requirement R1 (providing links for LRC resource) was ranked in third place. This is also not surprising as the different types of stakeholders do have different perceptions on the use of StudyNet to fit their individual learning needs, which thus leads to a slight inconsistency in the requirements prioritization results.

However, most significantly, even if the different participants are from the same stakeholder groups, they ranked their requirements differently. For example, although the member of academic staff in workshop A1 ranked requirement A3 (Viewing and marking a list of submitted coursework by students) as the second important requirement, the member of academic staff participated in workshop A2 then ranked requirement of setting up an online discussion forum as the second important requirement. This implies that although participants are from the same stakeholder group, they still have different perceptions of the same requirements. This might be as a result of their different personal backgrounds and individual goals within the organisation. For example, some academic staff are more research-led, and some are more teaching-oriented.

In summary, these findings on requirements prioritization are in line with Firesmith (2004)'s case study of requirements prioritization in real practice. His findings indicate that different types of stakeholders tend to prioritise requirements differently (e.g., they tend to prioritise use cases higher when they are the actor and direct beneficiary from the execution of the use case); even different stakeholders within the same stakeholder group prioritise them differently because of their different individual needs, experiences, and levels of training.

7.4.4 Negotiation behaviours and negotiation outcomes

In this sub-section, I discuss the behaviours of participants displayed in the workshops and its likely impacts towards the outcomes. As Barki and Hartwick's (2001)

empirical study of negotiation behaviours in the context of information system development indicates that the nature of conflict itself can have a weak negative or insignificant relationship with outcome. This finding is consistent with the thinking in the previous conflict literature that the presence of conflict is neither good nor bad. Instead, it is the way in which parties manage conflict behaviourally that result in good or bad outcomes (Pruitt 1971; Thompson 1990). It becomes important to discuss the behaviours of the participants involved in all workshops. A deeper and better understanding of negotiation behaviours displayed by the participants also helps the mediator to better understand the conflicting situation and formulate the best practice to achieve the best outcome. In this discussion, I only focus on the two most fundamental negotiation behaviours: competitive and integrative behaviour.

Competitive behaviour involves the use of dominant or combative tactics such as threats, promises, position, commitments, and persuasive agreements (Pruitt and Lewis 1975). It occurs as individuals strive to win or prevail. Conflict is seen as a *fixed pie, zero sum* situation, with one party's gains coming at the expense of other parties. In doing so, he or she frequently holds back information, makes extreme demands, firms in his/her position and utilises numerous power and influence tactics (Barki and Hartwick, 2001). This type of behaviour often appeared in my five workshops. For example, in workshop A1, the member of academic staff clearly tried to dominate the workshop by taking the advantage of his academic position. In workshop A3, a manifest conflict emerged between an undergraduate student and a research student. The undergraduate student insisted on maintaining his original position as the representative of the biggest user group and played a dominating style.

Integrative behaviour is cooperation and information-exchange oriented, strongly focusing on problem-solving and mutually satisfactory solutions (Pruitt and Carnevale, 1993). It occurs when individuals in a conflict situation attempt to fully satisfy the outcome of all parties (Barki and Hartwick, 2001). With this style of behaviour, conflict is not seen as a *fixed pie, or a zero sum* situation, as was the case for competitive behaviour. Instead, actions are aimed at expanding the pie so that all parties can achieve their goals and objectives. To do so, an open and candid exchange of information is needed with the underlying concerns of all parties revealed in detail. The individuals then work with this information, incorporating the valid insights of all

parties, flexibly considering all possible alternatives, and ultimately coming to a joint, integrative solution that is mutually beneficial. This type of integrative behaviour often appeared in our five workshops. For example, in workshop A2, all the participants went through a very smooth process in a collaborative and friendly manner. In workshop A1, although the member of academic staff demonstrated competitive behaviour, both the undergraduate student and the research student reacted collaboratively and calmly by orientating towards facts rather than emotions.

It is acknowledged in the previous studies (e.g. Pruitt and Carnevale, 1993; Barki and Hartwick, 2001) that different behaviours result in different outcomes. However, our findings suggest that, workshop A2 in which all participants adopted integrative behaviour, scored the highest satisfaction level on the outcome (see Table 25). It is suggested that the average level of satisfaction of workshop A2 is 4.6 (see Table 25), which is clearly higher than the other workshops. This finding is consistent with findings in the existing negotiation literature, in which integrative behaviours have been reported as more positively related to negotiation outcomes than competitive behaviours (Deutsch, 1985; Pruitt and Carnevale, 1993; Barki and Hartwick, 2001). Although the average level of satisfaction on the outcome in workshops A1 and A3 is slightly lower than for workshop A2, Table 25 still suggests a very good level of satisfaction of outcome (workshop A1- 4.3 out of 5) and (Workshop A3 - 4 out of 5). This is contradictory to the existing literature, which argues that the competitive behaviour often leads to a win-lose situation and poor satisfaction level on outcome (Barki and Hartwick, 2001). However, it is critically important to note that the findings of those studies (e.g Barki and Hartwick, 2001) are in a negotiation context, in which there is no external help from a mediator. In my case, although competitive behaviour often emerged in workshops (e.g. workshop A1 and A3), the mediator clearly intervened to make the workshop well-balanced with the help of applying the NREMM. Furthermore, to some extent, our findings from the non-controlled group (workshops B1 and B2 without applying the NREMM) are in line with Barki and Hartwick's (2001) claims that competitive behaviour can result in a poor level of satisfaction on outcome. This also speaks more about the usefulness of the NREMM. Even if the NREMM could not lead to a win-win situation, our overall results clearly indicate that it does improve the satisfactions level of the participants through the process.

7.4.5 Limitations of NREMM

Overall, based on the findings and discussions above, the NREMM helped the mediator to identify, define and manage conflicting interests, goals, and requirements among different stakeholders groups in this simplified real-life environment. However, the findings from the five workshops indicate that the NREMM itself has limitations. In this sub-section, I discuss these limitations of NREMM.

One of the distinct limitations of the NREMM is that, even if the NREMM can only help the parties to reach a fairly neutral agreement, it doesn't guarantee a 100% satisfaction for all participants. As I mentioned before, the overall satisfaction of outcome more likely depends on the stakeholder's expectation prior to the workshop rather than the actual performance of the mediator during the workshop. Nevertheless, the findings imply that some techniques only work out superficially, and do not make a major impact on the outcome. For example, in workshop A1, the mediator used the technique of positional call to urge the member of academic staff who was very competitive to take the students' perspectives into consideration. The technique seemed to work well and resulted in the member of academic staff superficially willing to consider students' perspectives. However, the final list of requirements (see figure 8.10) suggests that the member of academic staff with these competitive behaviours dominated the outcome with 3 out of 5 requirements on the final list. In my view, this speaks more about the role that participants' personalities played in the workshop rather than the limitations of NREMM because the NREMM can only mediate the outcome, and cannot entirely change people's personalities.

7.4.6 The role of personality in the workshops

One of the most interesting findings that emerged from our five workshops is the role that personality played in all workshops. Despite the fact that I did not pre-test the personality of all participants, it seems that the personality of the participants played an important role in their behaviours. Indeed, many researchers in the field of negotiation and group behaviour also believe that personality affects both the negotiation process and outcomes (Brewer, 1999; Jaeger et al., 1999; Ma and Jaeger,

2005). For example, Ma and Jaeger (2005) indicate that personality inclines individuals to certain ways of behaving during negotiation, which in turn leads to certain types of negotiation behaviours and subsequent outcomes.

However, empirical evidence for the role of personality in negotiation and group behaviour is often inconclusive and contradictory (Bazerman et al.; 2000; Pruitt and Carnevale 1993). Many researchers even question whether there is a direct impact of personality on the negotiation process and outcome (Bazerman et al.; 2000). These results suggest that assertive negotiators are normally characterised by strong personality and are more likely to behave competitively towards a better outcome. For example, the member of academic staff played in workshop A1, the undergraduate students and research students participated in workshops A3 and B2. However, this can only be considered as a hypothesis, which needs to be investigated in the future to determine whether the role of personality has a direct impact on the requirements negotiation outcome.

7.5. Threats to validity of the study

In this section, I discuss the potential threats to validity of the study based on *internal validity*, *external validity* and *construct validity*, which is proposed by (Cook and Campbell, 1979; Shadish et al., 2002; Kitchenham et al., 2002).

7.5.1 Internal validity

Internal validity is the approximate truth about inferences regarding cause-effect or causal relationships, and is only relevant in studies that try to establish a causal relationship (Cook and Campbell, 1979). For example, the studies that assess the effects of social programs or interventions, internal validity becomes the primary consideration. In my case, I would like to assess the effects of our NREMM and be able to conclude whether our NREMM made a difference in a simplified real-world scenario.

The lack of random assignment is the major weakness of any quasi-experimental studies (Shadish et al. 2000; Kampenes et al. 2009). Despite this lack of random assignment in the quasi-experimental design method may allow studies to be more practical in real world, this also poses many challenges for the investigator in terms of internal validity (Shadish et al. 2002). For example, because randomization is lacking, some background knowledge about the data can be approximated, but conclusions of causal relationships are difficult to determine due to a variety of extraneous and confounding variables that exist in a social environment (Brewer, 2002). In this study, the key confounding factors can be the amount of requirements negotiation experience of participating students. To minimise this effect, I adopted a purposeful sampling strategy to deliberately target the whole population of the final-year students who are long-standing real users of StudyNet. I also deliberately target the whole population of those final-year CS/SE students with some basic knowledge of requirements engineering. In my view, this is not a major issue for this study. Even in real requirement negotiation practice, the participants are ordinary users of the proposed system, and may not always have a strong negotiation background. In addition, I consistently used one mediator through all five workshops to minimise the effects of different mediators' styles on the outcome. I am also aware that the different personality of participants can be another confounding factor, as participants with different personalities will behave in different ways, which in turn leads to different outcomes. In the future, I suggest a personality pre-test should be carried out prior to the workshop to minimise this effect.

The second key limitation of a quasi-experiment is the personal bias of researcher may intrude (Srinagesh, 2006; Babbie, 2009). This becomes particularly apparent in this research because the researcher himself plays not only the role of the mediator but also the role of the designer of the quasi-experiment study. As a result, the study may produce some "artificial" results (Babbie, 2009). However, from a theoretical viewpoint, although any researcher does bring bias to experimentation, bias does not limit an ability to be reflective (Shadish et al. 2002). An ethical researcher should think critically about results and reports those results responsibly after careful reflection. From practical viewpoint, this bias is also inevitable at the initial stage the NREMM development as training a competent external mediator can be time-

consuming and expensive in real world. Finally, quasi-experiments have also been widely criticised for losing realism (Shadish et al., 2000; Kampenes et al., 2009). In my case, even if I had deliberately designed a conflicting situation, the intensity of conflict in such artificial settings is still questionable as conflict is a naturally human phenomenon. However, McGrath (1984) indicates that conflict and its management is complex human phenomenon and tasks and careful observation of their intimate details are often inaccessible in the real-world setting. Therefore, the use of quasi-experiment is still a sound choice.

7.5.2 External validity

External validity refers to the approximate truth of conclusions in terms of generalisations (Kitchenham et al., 2002). My relatively small sample size and single experimental context makes any generalization of conclusion problematic. However, my purpose is in line with Stake's view "the purpose is not to represent the world, but to represent the case" (Stake, 1995, p. 245). My purpose of this study is to evaluate a newly developed RE model in a simplified real-world scenario and to provide some preliminary results, and not to extrapolate our results to all contexts.

Another potential threat to external validity, which may reduce the generalisations of the study's outcomes to domains outside the scope of study, is that our experiments were performed in a single setting- University of Hertfordshire's StudyNet. StudyNet is a real system, which allows learning, assessment and interaction to take place in a structured and managed way. It involves a wide range of users across the university, and is also fully integrated into and links with all university processes and systems. In this sense, StudyNet can be regarded as a typical business information system. I therefore believe that my results concerning the usefulness of the NREMM can be applicable to similar types of business information system, which involve a wide range of users and are enmeshed in a complex human, social and organisational environment.

7.5.3 Construct validity

Construct validity is about assessing validity by investigating if the measure really is measuring the theoretical construct it is suppose to be (Brewer, 2000). In my case, a threat to the construct validly is posed by the question whether the participants' perceptions on the mediator's performance and the participants' satisfaction on the outcome are the two right measures to determine the usefulness of our NREMM. It could be argued that there are many well-defined measures to determine the usefulness of RE techniques, methods or frameworks in the RE literature. However, the two key measures used in this study are most widely used in the mediation literature to evaluate the usefulness/effectiveness of mediations (e.g Bercovitch, 1984; Bercovitch and Langley, 1993; James and Brett, 1984). In this thesis, the NREMM is considered more than just a RE model. Instead, it aims to be a practical framework to deal with human aspect of conflicts during the RE process, and thus is partly borrowed from the mediation literature.

Indeed, in a series of empirical studies of requirements negotiation in a distributed software development context, Damian and her colleagues also used the similar two measures to evaluate their effectiveness of virtual requirements negotiation workshops (e.g. Damian et al., 2000a; 2001; 2003). To strengthen the construct validly of this study, some questionnaire instruments (e.g. to measure the effectiveness of a mediator) are directly replicated from the studies by Damian et al., (2000a; 2003; 2008). Nevertheless, some RE-specific measures should be taken into account in any future studies, e.g. quality of requirements generated from different negotiation workshops. However, this is extremely difficult to measure because the quality of a system and the evolution of that system during its use are also required to be measured at the same time. This could lead to a longitudinal study in the future.

7.6 Summary

This chapter reports a quasi-experiment of five requirement negotiation works to illustrate how the NREMM is implemented in a simplified real-world scenario, and evaluate whether the NREMM is practically useful in such a context. This chapter answers the last research question:

RQ4: Is the NREMM practically useful to resolve conflict?

The results clearly indicate that the NREMM is a practically useful model to help RE practitioners to identify, define and resolve conflicts in the simplified context of real-world requirements negotiation workshops. This is evidenced by significantly higher satisfaction results and a better perception of the mediator's performance obtained from the workshops where the mediator clearly implemented the NREMM.

8. Conclusion and future work

8.1 Introduction

This chapter concludes the research programme. I summarise the overall research findings and the key contributions made to the body of knowledge. This chapter first explains why and how the NREMM is developed to help RE practitioners to effectively identify, define and resolve conflicting interests, goals, and requirements in the RE process. This chapter then summarises the empirical findings gained from the interview survey of a panel of RE experts and a quasi-experiment of requirements negotiation workshops to discuss the strengths and limitations of the NREMM. In addition to summarising the key research findings, this concluding chapter also includes a critique of the overall research strategy and how, in hindsight, it might be improved. This chapter reflects on the research methodology both in terms of its success and how it might be used in future research. Finally, to aid the sustainability and continuity of this research, specific action points for future research work and some ongoing activities are described in this chapter.

8.2 Summary of overall research programme

In this thesis, I had shown where narrative mediation originally comes from, and how it is relevant to the context of RE. I had also shown what theoretical basis underpinned the NREMM and how the NREMM was systematically and rigorously developed, assessed and evaluated empirically. I first drew on the literature across many different disciplines to argue that conflict is a social and organisational phenomenon, which exists in every part of software development process. Furthermore, in synthesizing many conflict resolution theories developed from the different fields, I also argued that conflict resolution in RE is a socially mediated process in which a requirements engineer could act as a mediator who works independently among different stakeholders rather than being a representative of the developer/user site. I therefore identified a narrative mediation theory underpinning the development of the NREMM. To ensure a rigorous and systematic process of NREMM development, I followed three development activities. Once the theoretical based NREMM was established, it was then subject to empirical assessment and

evaluation to ensure the NREMM is not only theoretically robust but also practically useful. I interviewed a panel of RE expert to assess whether the NREMM was theoretically robust. I finally conducted a quasi-experiment to evaluate whether the NREMM is practically useful in a simplified real world scenario.

8.3 Answers to research questions

RQ1: What is the nature of conflict in the RE process?

The literature review in Chapter 2 addresses the theoretical background of this research question. Chapter 6 presents the findings of this research question by interviewing a panel of RE experts. Overall empirical findings from a RE expert panel indicate that conflict is an inevitable part of system development, and needs to be carefully managed. More precisely, the findings suggest that differences between goals, cognitive understanding, educational background, and organisational roles are four of the most frequently cited causes of conflict. In relation to the consequences of conflict, the findings clearly suggest that conflict can lead to disagreements or arguments between stakeholders and poor user satisfaction towards the final software system. However, the impacts of conflict on the quality of a requirements specification remain unclear.

RQ2: How can a theoretically robust narrative RE mediation model (NREMM) be developed?

Chapter 3 discusses the theoretical background of this research question by conducting an analysis of multi-disciplinary literature. This multi-disciplined literature review justifies why a narrative mediation approach can be applied in this research as a robust theoretical underpinning. Chapter 4 presets the findings of this research question by following a rigorous and systematic model development process. The model development method includes three development activities: deleting irrelevant elements from the original model, adding and integrating with RE specialised techniques, and re-structuring the model. Overall, a theoretically robust

NREMM is established in this chapter, which includes three phases: conflict identification, conflict definition and conflict resolution.

RQ3: Is the NREMM theoretically robust?

Chapter 6 presents the findings of this research question through an interview survey of an RE expert panel. The findings indicate that conflict is an inevitable part of the RE process, and needs to be effectively managed. This finding justifies the motivation for developing the NREMM. The assessment study also indicates that the three phases of the NREMM meet its design purpose and are capable of helping RE practitioners to identify, define and resolve conflicts in the RE process. The experts also indicate that the use of "story-telling" as a theoretical underpinning is a strength, and particularly matches well with the current state of the RE practice. However, the experts also indicate that the NREMM needs further improvements in terms of integrating with some contemporary RE modelling and goal analysis techniques.

RQ4: Is the NREMM practically useful to resolve conflict?

Chapter 7 presents the findings of this research by conducting a quasi-experiment. A series of quasi-experiments also show how the NREMM being implemented in a simplified real world context. I conducted two separate groups of workshops. In the first group, the mediator used the NREMM. In the second group, the mediator did not use the NREMM and focused on facilitating the process rather than content. Results from our evaluation study indicate that the NREMM is practically useful for resolving conflict emerged in the RE process. This is evidenced by significantly higher satisfaction results and a better perception of the mediator's performance obtained from the first group compared with the second group. The evaluation study also indicates that the NREMM can generally increase cooperativeness, reducing friction, and eventually improving the users' satisfaction levels by providing a shared and focused vision, even if the outcome is not a win-win situation for all users. Most importantly, the findings from the evaluation study indicate that the NREMM can significantly improve the users' satisfaction, which is one of the important software quality attribute.

8.4 Key contributions to knowledge

Theoretically, this thesis is the first attempt in the RE community to translate a well-established narrative mediation theory from the mediation discipline into RE to improve the way RE practitioners address the social aspects of conflict. I propose the NREMM model for RE practitioners to resolve conflict underpinned by a "story-telling" theoretical basis. The model is also recognised by the panel of experts as a robust theoretical strength because the fundamental nature of the RE process can also be viewed as a story-telling process. Translating the original narrative mediation theory to the context of RE is a novel contribution because no previous work uses story-telling to resolve conflicts in RE.

This thesis also makes a methodological contribution. The development process of the NREMM has full transparency. I show explicitly where the NREMM comes from and how the NREMM is developed, assessed and evaluated. This contributes a methodological process, which can be transferred to other model developments and can be re-used by other researchers. Providing such transparency will benefit further researchers who also seek to translate relevant theories from other disciplines to improve RE practice. This transparency also indicates what are strengths and weaknesses of the NREMM, and where possible improvements can be made. This should enable other researchers to build on my work and continue towards seeking methods to improve the RE process.

This thesis also makes a practical contribution. The NREMM model outlines a framework together with step-by-step guidance for RE practitioners to resolve conflict in real practice. The NREMM offers unique and practically useful questioning and listening techniques such as positional call, discursive listening and curious questioning. To make it more practically useful in the context of RE, the NREMM has also integrated with several RE specialised techniques such as stakeholder modelling, narrative writing, and requirements prioritisation.

8.5 Summary of research methodology

In this thesis, a mixed research approach is adopted: an analysis of the multi-disciplinary literature is combined with an empirical approach. To establish a concrete

NREMM, different sources of empirical data are also employed e.g. interview data from a panel of RE experts and data from an experiment study. The analysis of multi-disciplinary literature provides a theoretical platform on which the development of the NREMM is based upon. An empirical approach is then adopted for assessment and evaluation purposes.

8.5.1 An examination of multi-disciplinary literature

This thesis first examines the literature from a wide range of disciplines to produce an overview account of the nature of conflict and its resolution methods. The examination of the multi-disciplinary literature first establishes a firm theoretical platform to justify the rational of developing the NREMM. It enables me to translate the most relevant conflict resolution methods into the context of RE. The examination of multi-disciplinary literature also plays an important role in developing the NREMM. It helps me to systematically and rigorously assess the relevance of individual elements from the original narrative mediation model to the context of RE. Moreover, the examination of the RE literature enables me to integrate RE specialised techniques to make the NREMM fit for the purpose of conflict resolution in RE.

8.5.2 Empirical validation and evaluation

To ensure the newly developed NREMM meets its design purpose, I used an empirical approach to assess and evaluate the NREMM. More precisely, I used an interview survey and a quasi-experiment as the two main research methods to achieve my assessment and evaluation purposes. An interview survey is mainly used for assessment purposes, in which I gain a panel of RE experts' view on the NREMM. A quasi-experiment is then used for evaluation purposes, which measures whether the NREMM is practically usefully in a simplified real-world scenario.

8.5.3 Critique of methodology

In this research, a quasi-experiment approach is used to evaluate the practical usefulness of the NREMM in a simplified real-world scenario. Quasi-experiments have been widely criticised for losing realism (Shadish et al., 2000; Kampenes et al., 2009). In my case, even if I had deliberately designed a conflicting situation, the

intensity of conflict in such artificial settings is still questionable as conflict is a naturally human phenomenon. Therefore, a case study approach should be considered as a complementary approach. A case study is a cost-effective and powerful evaluation tool to measure the impact of a particular method in a real-world environment (Yin, 1993; Kitchenham et al., 1995; Niazi et al., 2007). Kitchenham et al. (1995) note that case studies provide useful information to help the practitioner judge if a particular method will benefit his or her organisation or project. Niazi et al. (2007) note that case studies can provide insightful information to help practitioners identify areas where the method needs improvement and evaluate the practicality of the method in use. However, it is worth noting that implementing a newly developed method in a real-world context can be difficult. For example, training a competent mediator to apply the NREMM can be expensive and time-consuming. Finding a willing organisation to participate is particularly difficult.

8.6 Future work

This section discusses possible future work related to this research. My assessment study through a panel of RE experts indicates that the NREMM does need further improvement to address its limitations. A key limitation is that the NREMM strongly focuses on generating rich and detailed user narratives and lacks of integration with some widely used RE modelling techniques. This point was clearly made by 4 of the RE experts who particularly had an extensive industry background. In their views, it will be more practical and accessible if the NREMM integrates with some widely used RE modelling techniques such as *Unified Modelling Language* (*UML*) and *Data Flow Diagramming* (DFD). Some of the research-based experts further suggest that an integration of goal modelling and analysis techniques could be particularly helpful to address goal oriented conflicts. It is because the goal oriented conflicts are regarded by the experts as the most common types of conflict in RE process.

Another area of future work is to further integrate the NREMM with a groupware-supported tool to enable requirements workshops in a distributed setting. Traditionally, most RE activities are conducted in a face-to-face context. However, as the trend toward geographically distributed software development continues, a global RE

approach is required when stakeholders are geographically dispersed (Damian et al., 2008). To facilitate RE in a distributed setting, we have seen an increasing body of literature debate the usefulness of videoconferencing over audio conferencing for distributed group work (e.g. Damian et al., 2000; 2003; 2006). However, recent findings by Damian and her colleagues (2008) indicate that requirement negotiations in a distributed setting were more effective when the groups conducted asynchronous structured discussions of requirement issues prior to the synchronous negotiation meeting. The use of videoconferencing tools or other groupware-support tools are only good at facilitating synchronous communication. The design of a good supporting tool also needs to include computer-supported asynchronous communication that structure the discussion of requirements issues and enable groups to develop some common ground (Damian et al., 2008). In this sense, a jointly-written user narrative could provide some common ground and improve asynchronous communication. In the future, the NREMM can be developed as a distributed narrative generation tool, which enables the stakeholders to jointly edit and write narratives asynchronously and synchronously.

9.References

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Appendix 1: An overview of principled negotiation

Fisher and Ury (1981 and 1983) illustrate their principled negotiation approach by telling their now-famous story of two individuals who are disputing over the temperature of a room. One person is too hot and wants to open a window so as to have air circulating in the room. The other person is concerned that if the window is opened the draft will be unpleasant and possibly chill them. Fisher and Ury (1981) suggest an alternative to the traditional negotiation approach, in which the individuals compromise and give up part of what they would like (perhaps leaving the window partially open). In their alternative, the emphasis is on identifying the underlying shared need for a more favourable temperature in the room. The conflict is solved by both people recognising that opening a window in an adjacent room will allow cooler air to circulate without creating a draft. Thus the need for fresh air and an even temperature are met.

Based on this story, Winslade and Monk (2002) point out that the underlying assumptions of Fisher and Ury's (1981) problem-solving approach are that the world is made up of individuals who seek satisfaction of their own interests, needs and goals. Conflict is understood to happen because individual needs are not being satisfied, and transpires when individuals, in the attempt to fulfil their needs, encounter others who believe that their own need-fulfilment goals are threatened. This approach thus focuses on developing mutually beneficial agreements based on the interests of the disputants (Fisher and Ury, 1981). As Moore (1986) points out the problem-solving approach is an orientation to negotiation or mediation which focuses on finding a "win-win situation" in which all parties' interests are satisfied.

Fisher and Ury (1983) argue that integrative bargaining is important because it usually produces more satisfactory outcomes for the parties involved than does positional bargaining (sometime also referred to as hard bargaining) and soft bargaining. Positional bargaining (also refers to competitive bargaining), which is briefly described in chapter 2, is a negotiation approach that all parties involved holding on to a fixed idea, or position, regardless of any underlying interests. Conflict is seen as a *"fixed pie", "zero sum"* situations, with one party's gains coming at the expense of

other parties. A classic example of positional bargaining is a proprietor and customer negotiating over the price of an item. The customer has a maximum amount she will pay and the proprietor will only sell something over a certain minimum amount. Each side starts with an extreme position, which in this case is a monetary value, and proceed from there to negotiate and make concessions. Fisher and Ury (1981) summarise the characteristics of the problem-solving approach, in relation to the soft and hard approaches. (See Table 27 below)

Soft	Hard	Principled
Participants are friends	Participants are adversaries	Participants are problem solvers
Goal is agreement	Goal is victory	Goal is a wise outcome reached efficiently and amicably
Make concessions to cultivate relationships	Demand concessions as a basis of relationships	*Separate the people from the problem*
Be soft on the people and problem	Be hard on the people and problem	Be soft on the people, hard on the problem
Trust others	Distrust others	Proceed independent of trust
Change your position easily	Dig into your position	*Focus on interests, not positions*
Make offers	Make threats	Explore interests
Disclose your bottom line	Mislead on your bottom line	Avoid a bottom line
Accept one-sided losses to reach agreement	Demand one-sided gains as the price of agreement	*Invent options for mutual gain*
Search for the answer they will accept	Search for the answer you will accept	Develop multiple options; decide later
Insist on agreement	Insist on your position	*Insist on objective criteria*
Try to avoid a contest of wills	Try to win a contest of wills	Try to reach a result based on standards independent of wills
Yield to pressure	Apply pressure	Reason and be open to reason; yield to principle not pressure

Table 27: Summary of fisher and Ury's (1981) approach in relation to hard and soft approach

The problem-solving approach assumes two elements in any conflict situation: a problem part and a people part. The problem part is concerned with the conflicts that need to be solved. The people part is concerned with building a suitable working relationship among the conflicting parties. As the first and most important principle,

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this approach encourages a separation of these parts so that each is given adequate attention and that difficulties in one do not detract from the other. In this sense, "Separating the people from the problem" means separating relationship issues (or "people problems") from substantive issues, and dealing with them independently. In a conflicting situation, people often involve difficult emotions — fear, anger, distrust and anxiety for example. These emotions get intertwined with the substantive issues and make both harder to deal with. By focusing on interests, parties then can more easily fulfil the second principle--invent options for mutual gain. This means parties should look for new solutions to the problem (often refers to a win-win situation) that will allow both sides to win, not just fight over the original positions which assume that for one side to win, the other side must lose. Furthermore, Fisher and Ury (1983) also suggest the final important principle - insisting on objective criteria. This is particularly important at the final stage of decision-making, in which the parties should develop objective criteria and fair procedures and insist the choice amongst the options be determined by what actually makes sense.

Appendix 2: An overview of transformative mediation

In the transformative mediation approach, the underlying assumptions are that they believe mediation possesses the power to change how people behave not only toward their adversary in a particular conflict, but also in their day-to-day lives thereafter (Bush and Folger, 1994). Mediation, in their opinion, can transform individuals. Their approach is thus less interested in probing the conflict situation and coming up with a mutually acceptable solution to the immediate, short-term problem. Rather, they more focus on relationships and on parties' ability to achieve empowerment and recognition through mediation. *Empowerment*, according to Bush and Folger (1996), means enabling the parties to define their own issues and to seek solutions on their own. *Recognition* means enabling the parties to see and understand the other person's point of view -- to understand how they define the problem and why they seek the solution that they do (Ibid).

The ultimate goal of transformative mediation is to foster the parties' empowerment and recognition, enabling them to approach their current problem, as well as later problems, with a stronger, more open relationship (Ibid). The role of mediator is thus more facilitate-oriented and less directive than in problem-solving mediation. The table below shows the detail comparison of Transformative and Problem Solving Mediation.

	Transformative Mediation	Problem-Solving Mediation
Assumptions about conflict	Conflict is an opportunity for moral growth and transformation.	Conflict is a problem in need of a solution.
	Conflict tends to be a long-term process.	Conflict is a short-term situation.
Ideal response to conflict	Facilitate parties' empowerment and recognition of others.	Take collaborative steps to solve identified problem; maximise joint gains.
Goal of mediation	Parties' empowerment and recognition of others.	Settlement of the dispute.
Mediator role	Secondary: parties are seen as experts, with motivation and capacity to solve own problems with minimum help.	Mediator is expert, who directs problem-solving process.
	Mediator is responsive to parties.	Mediator directs parties.
Mediator actions	Mediator explains concept of mediation, but lets parties set goals, direct process,	Mediator explains goal is settlement, designs process to achieve settlement,

	design ground rules. Makes it clear settlement is only one of a variety of possible outcomes.	sets ground rules. May consult parties about these issues, but mediator takes lead.
	Mediator "microfocuses" on parties' statements, lets them frame issues themselves.	Mediator "categorises" case, frames it for disputants.
	Mediators allow parties to take discussions where they want them to go; encouraging discussion of all issues that are of importance to the parties, regardless of whether or not they are easily negotiable; Mediators encourage mutual recognition of relational and identity issues as well as needs and interests.	Mediators direct the discussions, dropping issues which are not amenable to negotiation (for example, relational or identity issues) and focusing on areas "ripe" for resolution (usually negotiable interests).
	Mediators encourage an examination of the past as a way of encouraging recognition of the other.	Mediators discourage discussion of the past, as it tends to lead to blaming behaviors; focus instead is on the present and future -- how to solve the current problem.
	Emotions are seen as an integral part of the conflict process; mediators encourage their expression.	Emotions are seen as extraneous to "real issues." Mediators try to avoid parties' emotional statements, or emotions are tightly controlled.
	Mediators encourage parties' deliberation of situation and analysis of options; parties' design settlement (if any) themselves and are free to pursue other options at any time.	Mediators use their knowledge to develop options for settlement; can be quite directive about settlement terms.
Mediator focus	Mediators focus on parties' interactions, looking for opportunities for empowerment and/or recognition of the other.	Mediators focus on parties' situation and interests, looking for opportunities for joint gains and mutually-satisfactory agreements.
Use of time	Time is open-ended; parties spend as much time on each activity as they want to. No pre-set "stages" as in problem-solving mediation.	Mediator sets time limits, encourages parties to move on or meet deadlines. Mediator moves parties from "stage" to "stage."
Mediation: definition of success	Any increase in parties' empowerment and/or recognition of the other -- "small steps count."	Mutually-agreeable settlement.

Table 28: Comparison of Transformative and Problem Solving Mediation.

Adopted from "Transformative Approaches to Conflict," by Spangler (2003).

Appendix 3: Cohen's kappa measure of agreement for the scoring scheme

In social science research, Silverman (1993) points out that any categories must sufficiently precise to allow different coders to arrive at the same results when the same body of material is examined. In the empirical SE research, Kitchenham et al. (2001) make a similar statement: "in any classification scheme, it is essential that there is common understanding of what each group presents to create data that is trustworthy." To gain a trustworthy level of confidence in my subjective classification scheme, a Cohen's kappa measure of agreement is introduced. According to SPSS (2001):

> *"Cohen's kappa measures the agreement between the evaluations of two raters when both are rating the same object. A value of 1 indicates perfect agreement. A value of 0 indicates that agreement is no better than chance. Kappa is only available for tables in which both variables use the same category values and both variables have the same number of categories".*

Landis and Koch (1977) provided the following benchmarks for the evaluation of observed *k* values. These benchmarks are as follow:

K Strength of agreement
0.00 Poor
0.01 – 0.20 Slight
0.21 – 0.40 Fair
0.41 – 0.60 Moderate
0.61 – 0.80 Substantial
0.81 – 1.00 Almost perfect

I followed the following procedures of calculating the agreement index between two independent researchers:

- The definition of the classification scheme was given to both research1 (the author) and researcher 2. Any ambiguity was discussed.

- Researcher 1 performed a manual analysis by mapping all elements from the original narrative mediation model to the RE literature. Researcher 1 gave his/her scores.

- Researcher 2 also performed a manual analysis by mapping all elements from the original narrative mediation model to the RE literature. Researcher 1 gave his/her scores.

- Researcher 1 performed a Cohen's kappa inter-rater reliability test where the results from researcher 1 and researcher 2 were compared. The analysis was performed using Vassar College's Kappa Calculator online: http://faculty.vassar.edu/lowry/kappa.html.

- The resulting k statistic was then compared to values given by the Landis and Koch (1977) benchmarks.

- Any disagreements between two researchers were resolved in the further discussions and the consultation with a third-party researcher.

Two rounds of inter-rater reliability tests were conducted in this thesis. The first test (for details of raw data, see below) was conducted in Chapter 4 to measure the reliability of the scoring scheme, which is used to determine the irrelevance of the elements from the original narrative mediation model. The second test (for details of raw data, see Table 29 below) was carried out in Chapter 6 to test the reliability of the classification scheme, which aims to code the different causes of conflict in RE.

In Chapter 4 study of the relevance of the narrative mediation model, the Cohen's Kappa statistic is 0.5888 which indicates a "moderate" agreement. In Chapter 6, the Cohen's Kappa statistic is 0.7931, which indicates a "substantial" result. It is worth nothing that the reason of the first result (0.5888) doesn't achieve a "substantial" result. In my view, this is not because of the inadequacy of the scoring scheme and the classification process. Instead, this speaks more to the social aspect of RE being neglected in the RE literature. As mentioned before that many RE authors argue that the contemporary RE research are too technical-oriented, and social, human and organisational aspects of RE is overlooked in the RE literature. For this reason, it makes the researchers difficult to judge the relevance of the elements from the original model to the context of RE. In particular, it is difficult for the researchers to

judge if the element is very relevant or relevant to the context of RE with the limited RE literature coverage. However, referring to Table 31, we can find out that a significant higher Cohen's Kappa statistic (0.7823) can be generated if I reduce the number of categories from 4 to 3 by combining the "very relevant" and "relevant" category together. As this research particularly addresses the social aspect of conflict, a slightly lower level of agreement is unavoidable. Indeed, Bryman and Cramer (1997) point out that a kappa of 0.6 or close is still considered to be an acceptable level of agreement. Furthermore, Dunn (1989) acknowledges that any series of standards such as the Cohen's kappa measure are bound to be subjective. In this sense, there is simply no best answer to the reliability of my scoring scheme. The Cohen Kappa statistic can only add rigour and confidence to the reliability of my scoring scheme.

Table 29: Inter-rate reliability first result: (Note: here is raw data from the engagement phase, which includes 40 elements)

	Research 1	Research 2		Researcher 1	Research 2
1 Positional call	VR	VR	21 Dress	IR	IR
2 Showing respect	VR	R	22 Greeting	MR	MR
3 Communicating invitation to agency	IR	IR	23 Turn taking	MR	MR
4. Valuing personhood	VR	R	24 Small talk	MR	MR
5 Contracting	IR	MR	25 Overlapping	MR	MR
6 Inviting collaborative conversation	VR	VR	26 Joining	MR	R
7 Discursive listening	VR	VR	27 Storytelling format	IR	IR
8 Genuine Curiosity	VR	R	28 Telling conflict story	R	VR
9 Linguistic atonement	IR	IR	29 Taking up position as experts in their own lives	IR	MR
10 Engagement with metaphor	IR	IR	30 Initiating contract	IR	IR
11 Listen to stories	R	VR	31 Presenting request	IR	IR
12 Inviting production of meaning	VR	VR	32 Seeking legitimacy of personhood	IR	IR
13 Gender	IR	IR	33 Place of building	IR	IR
14 Ethnic origin	IR	IR	34 Place in room	IR	IR
15 Age	IR	R	35 Décor	IR	IR
16 Facial expression	VR	VR	36 Temperature	IR	IR
17 Tone, accent, and volume	R	VR	37 Presence of others	R	R
18 Breathing	IR	IR	38 Seat	R	R
19 Posture	IR	IR	39 Privacy	IR	MR
20 Use of eyes	IR	IR	40 Financial exchange	IR	IR

Scoring scheme:

Irrelevant (IR): The element is not directly relevant to RE. This means either the element has been rarely or never mentioned in the current RE literature, or mentioned as unimportant to RE.

Maybe Relevant (MR): The element is to RE only under certain circumstances. This means the element has received some attention in the current RE literature, but has only been specified as important to RE under certain contexts.

Relevant (R): The element is relevant to RE. This means the element has received considerable attention in the current RE literature, and has been recognised as an important factor to achieving successful RE.

Very Relevant (VR): The element shows complete relevance to RE. This means the element has been well-acknowledged in the current RE literature, and has been recognised as a critical factor to achieving successful RE.

Table 30: Result summary in the form of table:

	Agreements	Disagreements	Total
Irrelevant (IR)	18	4	22
Maybe Relevant (MR)	4	1	5
Relevant (R)	2	3	5
Very Relevant (VR)	5	3	8
Total	29	11	40

Table 31: Result summary in the form of 4*4 Matrix:

	Irrelevant (IR)	**Maybe Relevant (MR)**	**Relevant (R)**	**Very Relevant (VR)**	Total
Irrelevant (IR)	18	3	1	0	22
Maybe Relevant (MR)	0	4	1	0	5
Relevant (R)	0	0	**2**	**3**	5
Very Relevant (VR)	0	0	**3**	**5**	8
Total	18	7	7	8	40

Table 32: Inter-rate reliability second result: (20 Quotes were used to measure the reliability of the pre-defined classification scheme for classifying the causes of conflict.)

	Researcher 1	Research 2		Researcher 1	Research 2
Quote 1	G	G	Quote 11	G	G
Quote 2	G	G	Quote 12	O	G
Quote 3	C	C	Quote 13	C	C
Quote 4	E	E	Quote1 4	C	C
Quote 5	E	E	Quote 15	O	O
Quote 6	C	C	Quote1 6	C	O
Quote 7	O	G	Quote 17	G	G
Quote 8	O	O	Quote 18	O	O
Quote 9	E	E	Quote 19	G	G
Quote 10	G	G	Quote 20	G	G

Pre-defined classification scheme for classifying the causes of conflict:

Goal difference (G): Stakeholders having different organisational and individual goals on the project as the causes of conflict
Cognitive understanding (C): Stakeholders having different understanding on the same problem as the causes of conflict
Education background (E): Stakeholders having different education background as the causes of conflict
Organisational role (O): Stakeholders having different organisational roles and responsibility within an organisational as the causes of conflict

Table 33: Result summary in the form of table:

	Agreements	Disagreements	Total
Goal difference (G)	7	2	9
Cognitive understanding (C)	4	1	5
Education background (E)	3	0	3
Organisational role (O)	3	0	3
Total	17	3	20

Table 34: Result summary in the form of 4*4 Matrix:

	Goal difference (G)	Cognitive understanding (C)	Education background (E)	Organisational role (O)	Total
Goal difference (G)	7	0	0	2	9
Cognitive understanding (C)	0	4	0	1	5
Education background (E)	0	0	3	0	3
Organisational role (O)	0	0	0	3	3
Total	7	4	3	6	20

Appendix 4: An overview of persona

What is a persona?

The idea of persona was first introduced by Alan Cooper in his articles (Cooper 1996) and then in his book "The inmates are running the asylum" (Cooper 1999). The word persona1 illustrates one of the important characteristics of Cooper's concept – that a model of a user also should have a bit of personality – a life-like character driven by personal motives. It is widely used as a design technique to represent patterns of users' behaviour, goals and motives, compiled in a fictional description of a single individual. Cooper (1999, p.123) defines personas as "a precise description of our user and what he wishes to accomplish." Calde et al., (2002) gives a slightly more detailed definition: "User models, or personas, are fictional, detailed archetypical characters that represent distinct groupings of behaviours, goals and motivations observed and identified during the research phase."

An example of persona: Rhonda Wilson, Nurse Unit Coordinator

Calde et al (2002) has an example of a persona used in their design of a health-care management system as follow:

Rhonda's background information

1. Rhonda is a 36-year-old registered nurse who has worked at several skilled nursing facilities. She started out in acute care but moved to long-term care so she could have more autonomy.
2. Rhonda was promoted to Unit Coordinator four years ago because she is very competent and generally well organised.
3. Rhonda is entirely overwhelmed and is drowning in paper, even more so than the average nurse. She often misses eating dinner with her boyfriend because she has to work late, filling out forms and reports.

Rhonda's goals are to:

1.   Spend time on patient care and staff supervision, not paperwork.

2.   Be proactive. Rhonda needs to understand trends in order to solve problems before they happen, instead of just reacting to crises.

3.   Know that things are being done right. Rhonda supervises the unit because she's good at what she does. If nurses aren't following procedure or documenting things, she wants to know right away.

Appendix 5: An overview of extreme character

What is an extreme character?

An extreme character is a technique which tries to steer away from the usual designing for a prototypical character from a target group. In fact, it adopts an opposite perspective. Instead of designing for characters that are emotionally shallow, extreme characters describes characters that have exaggerated emotional attitudes by taking characters that are extremes. Based on a case study of design a PDA system used for an appointment-making purpose, Djajadiningrat et al., (2000) argue that creating an extreme characters was useful for their project in highlighting issues such as secrecy, status, and autonomy not normally emphasised by traditional appointment managers. It also helps designers in achieving richness on the actions and role levels.

Example 1: designing an PDA appointment-making system for a drugs dealer (Adopted from Djajadiningrat et al., 2000)

> *Profile—* The drugs dealer is a powerful person who manages rather than commits crimes. To cover up his illegal dealings, he is also involved in legal activities. The drugs dealer is highly aware of his place in the drugs trade hierarchy. Above him in rank are the big players from whom he buys, below him are the drugs runners to whom he sells. It is a rough world, and in response the drugs dealer has adopted an opportunistic attitude in his pursuit of money and power.
>
> *Attitude towards appointments-making—* The drugs dealer has two agendas, one legal and one illegal. The information about his illegal activities is very sensitive. It should not fall into the wrong hands, be it 'colleagues' or the police. Clearly, he is very careful with whom he makes appointments and where. Meeting places are specified by their characteristics. Roads which will allow a quick get-away and buildings which will provide cover are important considerations. The drugs dealer does not plan very far ahead. Dealers come and go; the scene may look very different next week. The drugsdealer is ambivalent about exposing his appointments. On the one hand, they contain sensitive information. On the other, exposing them means enforcing his position in the hierarchy, a kind of power play which draws new trade. In his appointments he needs to express his respect for the big players and his superiority over the smaller dealers to whom he sells.

Appendix 6 Interview scripts

Yours Views on a newly developed RE mediation model (NREMM)

Name: _____

Company/Institute:

_____

Current Job Position:

_____

Date: _____**Time:**_____

Section 1 (This introduction section is to clarify the study's purpose and get experts' background information, and is scheduled to last 5 minutes**)**

1.1 Introduce myself as follows:

"Thank you very much for your interest and participation in this expert panel study. I am a third-year PhD student from the University of Hertfordshire, and currently developing a RE model to help RE practitioners to effectively deal with conflicting interests, viewpoints, and goals in RE practice."

1.2 State the purpose of this study and ethics issue. Explain the following:

"I am aware that you are a well-acknowledged and experienced RE expert. Therefore, this interview has two purposes. The first is to get your perceptions on the nature of conflict in RE, and the second is about getting your views on a new RE mediation model. The interview will be tape recorded for evaluation purposes. Your responses will be processed anonymously and all the information gathered from your answers will remain confidential."

1.3 Explain the process of interview. Explain the following:

"This interview lasts about 45 minutes. I will first ask you several general questions regarding your background and your perception of the nature of conflict in RE. I will then make a 20-mintute presentation of my new RE framework, which includes three sub-models. During the presentation, I also ask you a few questions regarding your views on each phase. Your expert views will be extremely valuable for me to improve the model and eventually come up with a set of good practice guidelines to aid requirements engineering practitioners to manage the social and human aspects of conflict during requirements engineering."

"Have you got any questions regarding the process of the interview?"

1.4 Elicit an expert's background information as follows:

"Let us start the interview. Firstly, I would like to find out your background information regarding your expertise in RE. So,

1.4.1 What is your highest qualification? (PhD, Msc, Bsc)
1.4.2 How long you have worked in the area of RE? (0 years, 1-3 years, 4-6years, 7-9years, over 10years)
1.4.3 Your background in RE is mainly as an academic or practitioner?

1.5 Ask an expert to rate his/her overall knowledge in RE.

"How do you rate your overall knowledge of RE, from novice, intermediate, to expert"

Section -2 (This section is to get experts' view on the phenomenon of conflict in RE, and is scheduled for 5 minutes. At the beginning, the open question 2.2 will be asked to probe the nature of conflict in RE. The closed questions 2.3, 2.4, and 2.5 will follow to establish causality between conflict and its negative or postive consequences in RE.)

2.1 Re-state the purpose of this section.

"This section is to get your perceptions on the nature of conflict in RE practice. The term of conflict refers to any sort of disagreements, interferences, or negative emotions between interdependent parties for example, different user group ague and demand two total different requirements. "

2.2 Ask experts' perception on the existence of conflict in RE practice. (Probe for its types and causes)

For practitioner: "*Have you experienced any conflict between stakeholders in your previous RE experiences? Between which stakeholders? (e.g. users or developers) If possible, please give me an example from your experiences." Note needs to be earlier as indicated: here, the term of "stakeholders" refers to parties with an interest in developing a software project. They could be range from customers, users, developers, analysts, tests, and project managers."*

"From your point of view, why do such conflicts happen?"

"From your point of view, which types of project involve most conflicts?"

Or

For researcher: "*Do you agree that conflicts among different stakeholders are inevitable part of RE?*

"From your point of view, why do such conflicts happen between them?"

"From your point of view, which types of project involve most conflicts?"

2.3 Ask experts' perceptions on the problems that they experienced in RE practice.

"Do you think that the problems experienced in RE are social, human, and organisational based or technical based?"

2.4 Ask experts' perceptions of the causes of conflict in RE practice.

"Do you agree that conflict may happen mostly due to different understanding of requirements or different goals for requirements or both of them? "

"Based on your experience or knowledge, what other factors can cause conflict in RE?"

2.5 Ask experts to indicate the extent of their agreement/disagreement with following statement in the context of RE: (disagree, agree, and do not know)

"Do you agree that conflict may lead to disagreement or argument?"
"Do you agree that conflict may lead to negative emotions?"
"Do you agree that conflict may lead to resistance or failure to collaborate?"
"Do you agree that conflict may lead to inconsistency in specification?"
"Do you agree that conflict may lead to ambiguity in specification?"
"Do you agree that conflict may lead to poor user satisfaction on final system?"
"Do you agree that conflict may lead to overall project failure?"

2.6 Ask experts to indicate the extent of their agreement/disagreement with the following statement in the context of a RE meeting: (disagree, agree, and do not know)

"Do you agree that conflict may promote creative thinking?"
"Do you agree that conflict may encourage stakeholder involvement?"
"Do you agree that conflict may improve team coherence?"

Section 3: (This section is to get experts' detailed and specific views on the individual sub-model. This section contains three sub-sections, which are directly linked with the three individual sub-models: preparation, definition, and resolution. This section is scheduled for 15 minutes.)

Section 3.1 – Evaluating the conflict identification model

3.1.1 Present the conflict identification sub-model in front of expert, and re-state the aim of this preparation model. Ask experts' the closed question to rate the importance of the aim.

"As mentioned before, this sub-model aims to clearly identify the conflict. So, do you agree that the model, which focuses on clearly identifying the conflict, is important for RE conflict resolution?"

3.1.2 Ask experts very specific and closed questions regarding the usefulness of the specific elements/items of the model. Ask following: (Agree, disagree, don't know)

"Do you agree that the discursive listening and the curious questioning technique can help a requirements engineer to clearly identify conflicts?"

"Do you agree that the items described in the stakeholder modeling element can help a requirements engineer to get sufficient background information and eventually better identify conflicts?"

"Do you agree that having a strong starting working relationship is important for conflict resolution in RE?

3.1.3 Present the sub-model again and ask experts to indicate his/her views on the most important item in the model.

"As you can see from the sub-model, there are four key elements, and each element contains several items for recommending a good practice. Can you please indicate the most important item to enable the mediator to clearly identify the conflict? can you also indicate the less important item?"

"Based on your expertise, what additional items or elements you think that should be added on in this sub-model"

3.1.4 Ask general questions about usefulness and ease of use of the overall conflict identification sub-model.

"In general, do you agree this sub-model will be easily adopted by practitioners? If disagree, why not?"

"In general, do you agree this sub-model will be practically useful in real RE practice where a conflicting situation has emerged?" If disagree, please indicate the areas that need to be improved in terms of its usability."

Section 3.2 – Evaluating the conflict definition model

3.2.1 Present the conflict definition sub-model in front of expert, and re-state the aim of this model. Ask experts to rate the importance of the aim of conflict definition sub-model.

"As mentioned before, this sub-model aims to clearly define the conflict. So, do you think that gaining an accurate understanding of the conflict is important for RE conflict resolution?"

3.2.2 Ask experts very specific questions regarding the usefulness of the specific elements/items of the model. Ask following:

"Do you agree that the curious, persistent, and resilient questioning technique can help a requirements engineer to gain a deep understanding of conflict?"

"Do you agree that using externalizing language can help separate the people from the problem?"

"Do you agree that a well-described and detailed story can help a requirements engineer gain new insights and deep understandings of the conflict"?

3.2.3 Present the model again and ask experts to indicate his/her views on the most important element in the model.

"As you can see from the model, there are three key elements, and each element contains several items. Can you please indicate the most important element or item? can you also indicate the less important item "

"Based on your expertise, what additional elements or items you think that should be added on in this model?"

3.2.4 Ask general questions about usefulness of the overall conflict identification model.

"In general, do you agree this sub-model can be easily adopted by the practitioners?" If disagree, please indicate the areas that needed to be improved in terms of its ease to use?"

"In general, do you agree this sub-model will be practically useful in real RE practice when a conflicting situation emerged?" If disagree, please indicate the areas that needed to be improved in terms of its usability."

SECTION 3.3 evaluating the conflict resolution model

3.3.1 Present the conflict resolution sub-model in front of expert, and re-state the aim of this model. Ask experts to rate the importance of the resolution model.

"As mentioned before, this model aims to finally resolve the conflict. So, do you think that the conflict resolution model is important to RE conflict resolution?""

3.3.2 Ask experts very specific questions regarding the usefulness of the specific elements of the model. Ask following:

"Do you agree that conflict can be more easily resolved when stakeholders have established a firm and collaborative relationship?"

"Do you agree that the requirements engineer in this stage needs a bit creativity to invent new solutions?"

"Do you agree that requirements prioritization can offer the requirements engineer insight to find out conflicting parties' preferred solutions?"

3.3.3 Present the model again and ask experts to indicate his/her views on the most important element or items in the model.

"As you can see from the model, there are three key elements. Each element also contains several items. Can you please indicate the most important element or item? Can you also indicate the less important item?"

"Based on your expertise, what additional elements or items you think that should be added on in this model?"

3.2.4 Ask general questions about ease of use and usefulness of the overall conflict identification model.

"In general, do you agree this sub-model can be easily adopted by the practitioners?" If disagree, please indicate the areas that needed to be improved in terms of its ease to use?"

"In general, do you agree this sub-model will be practically useful in real RE practice when a conflicting situation emerged?" If disagree, please indicate the areas that needed to be improved in terms of its usability."

Section-4 Overall impression

4.1 Ask experts open questions to get their overview:

"What is your general impression of the new model? (In terms of its structure, presentation, theoretical underpinning, practicability, possibility of being adopted by practitioners and level of required training needs) "

"What are the strengths and weaknesses of the model?"

4.2 Ask closed question to get their overview:

"Overall, do you think the model is useful in a conflicting situation?"
"Overall, do you think the model can be easily adopted by a requirements engineer?"
"Overall, do you think conflicts can be resolved by following this model?"
4.3 Ask experts open and specific questions to get their views on the target application area of the model:

"Do you think the model can be used for every project's RE process?"
"In your views, which types of project will benefit most by adopting this model?"

Appendix 7 Call for participation

(E-mail version)

Title: Do you want to practice your negotiation skills in a software requirements engineering workshop by participating in a research project and earn up to 30 pounds?

Dear final year students:

I am a third-year PhD student with the School of Computer Science. I am looking for students to participate in a requirements engineering workshop, which aims to discuss system requirements for our StudyNet system. Each workshop lasts for 45 minutes, and consists of 3 people, and I chair the workshop. Each participant should be a regular user of the StudyNet system.

The aim of this workshop is to enable the participants use negotiation skill in deciding on a new set of requirements from the StudyNet system. You thus are required to act as a representative of a stakeholder group (e.g taught student or research student) to negotiate with other representatives and finally reach an agreement on a set of requirements facilitated by me. You are encouraged to adopt either competitive or collaborative negotiation strategy to make more your most wanted requirements being implemented. This is an excellent opportunity for the CS/SE students to practice your requirements negotiation skills in a real software project context. We also offer the participants an up-to 30 pounds incentive.

The first two sessions of this study will take place on the 7th and 14th of May, 2:00 am in STRI. If you are interested in participating this workshop, or want some further information, please do not hesitate to contact me (n.ma@herts.ac.uk) or my supervisor Dr Tracy Hall (T.hall@brunel.ac.uk).

Best Wishes

Nan Ma

Appendix 8: Experiment description

University of Hertfordshire

System and Software Research Group

Experiment description: Negotiating a Set of Requirements for UH's Study Net System

Thank you very much for participating this requirements negotiation workshop. In this workshop, there are 4 participants: you (a taught-student representative), a representative of research student, a representative of staff, and a requirements engineer. Your role in this workshop is to act as a representative of taught students to negotiate with the other stakeholders to decide on a total of 10 new requirements of UH's Study Net. The whole workshop session will last 45 minutes, and will also be video-recorded for further analysis.

At the beginning of the workshop, everyone will receive a list of 5 preliminary requirements, which are particularly relevant to their stakeholder group. You will go through these 5 preliminary requirements, and decide whether some are more important than others. You may replace any of the original 5 requirements with new requirements that you consider more important than the preliminary requirements. At maximum, you are allowed to have 7 requirements on the list.

Once your 7 requirements are generated, you then are told by a requirements engineer that there will be in total only 5 requirements rather than the original 21 (7*3) requirements can be implemented to avoid a financial penalty. This potentially leads to a conflicting situation as 16 requirements can NOT be equally allocated to the 3 different stakeholders.

As a consequence, you are encouraged to adopt any negotiation strategy (either competitive or collaborative) to negotiate with other representatives to ensure more your wanted requirements being implemented. Every student participants will be paid 15 pounds for their participations. We offer the winning stakeholder (who implements the most requirements) with an extra 15-pounds incentive. The whole workshop will be chaired by the requirements engineer to facilitate communication between stakeholders.

Appendix 9 Post-session questionnaire

University of Hertfordshire

System and Software Research Group

Post-Workshop Questionnaire

Negotiating a Set of Requirements for UH's StudyNet System

In thinking about your experience in this requirements negotiation workshop, please answer the following questions. We are interested in your perceptions on the process and outcome of this workshop. We very much appreciate your cooperation.

Part One: Perceptions of the workshop process

1. What strategy did you personally adopt during the negotiation process?

Cooperative ○ ○ ○ ○ ○ Competitive

2. What strategy did other two representatives adopt during the negotiation process?

Cooperative ○ ○ ○ ○ ○ Competitive

3. How much control did the facilitator have over the negotiation process?

Very much in control ○ ○ ○ ○ ○ Not at all in control

4. How would you describe the facilitator's behaviour during the negotiation process?

Very, quite, slight, little, not at all

Informative ◉ ○ ○ ○ ○
Persuasive ○ ○ ○ ○ ○
Accommodating ○ ○ ○ ○ ○
Cooperative ○ ○ ○ ○ ○
Assertive ○ ○ ○ ○ ○
Active ○ ○ ○ ○ ○
Fair ○ ○ ○ ○ ○

Part Two: Perceptions of the workshop outcome

1. Have you reached an agreement? Yes ○ No: ○
2. Was the outcome as you expected? Yes, completely

○ ○ ○ ○ ○ No, not at all

3. Overall, how satisfied are you with the final outcome?

Very satisfied ○ ○ ○ ○ ○ Not satisfied at all

Part Three: Open questions

1. What was the main source of disagreement in the workshops?

2. Briefly explain how the other participants interacted with you in negotiations?

3. Do you feel everybody was satisfied (please briefly explain your answer)?