HUMAN-COMPUTER INTERACTION (IS252)
CHAPTER FIVE

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CHAPTER 5:
IDENTIFYING NEEDS AND ESTABLISHING REQUIREMENTS

5.1 INTRODUCTION

5.2 WHAT, HOW, AND WHY?

5.3 WHAT ARE REQUIREMENTS?

5.4 DATA GATHERING

5.5 DATA INTERPRETATION AND ANALYSIS

5.1 INTRODUCTION

WE DISCUSSED IN CHAPTER 5, IDENTIFYING USERS' NEEDS IS NOT AS STRAIGHTFORWARD AS IT SOUNDS.

- ESTABLISHING REQUIREMENTS IS ALSO NOT SIMPLY WRITING A WISH LIST OF FEATURES. GIVEN THE ITERATIVE NATURE OF INTERACTION DESIGN, ISOLATING REQUIREMENTS ACTIVITIES FROM DESIGN ACTIVITIES AND FROM EVALUATION ACTIVITIES IS A LITTLE ARTIFICIAL, SINCE IN PRACTICE THEY ARE ALL INTERTWINED: SOME DESIGN WILL TAKE PLACE WHILE REQUIREMENTS ARE BEING ESTABLISHED, AND THE DESIGN WILL EVOLVE THROUGH A SERIES OF EVALUATION REDESIGN CYCLES. HOWEVER, EACH OF THESE ACTIVITIES CAN BE DISTINGUISHED BY ITS OWN EMPHASIS AND ITS OWN TECHNIQUES. THIS CHAPTER PROVIDES A MORE DETAILED OVERVIEW OF IDENTIFYING NEEDS AND ESTABLISHING REQUIREMENTS. WE INTRODUCE DIFFERENT KINDS OF REQUIREMENTS AND EXPLAIN SOME USEFUL TECHNIQUES. THE MAIN AIMS OF THIS CHAPTER ARE TO: DESCRIBE DIFFERENT KINDS OF REQUIREMENTS. ENABLE YOU TO IDENTIFY EXAMPLES OF DIFFERENT KINDS OF REQUIREMENTS FROM A SIMPLE DESCRIPTION. EXPLAIN HOW DIFFERENT DATA-GATHERING TECHNIQUES MAY BE USED, AND ENABLE YOU TO CHOOSE AMONG THEM FOR A SIMPLE DESCRIPTION. ENABLE YOU TO DEVELOP A "SCENARIO," A "USE CASE," AND AN "ESSENTIAL USE CASE" FROM A SIMPLE DESCRIPTION.

5.2 WHAT, HOW, AND WHY?

5.2.1 WHAT ARE WE TRYING TO ACHIEVE IN THIS DESIGN ACTIVITY?

- THERE ARE TWO AIMS.

I. ONE AIM IS TO UNDERSTAND AS MUCH AS POSSIBLE ABOUT THE USERS, THEIR WORK, AND THE CONTEXT OF THAT WORK, SO THAT THE SYSTEM UNDER DEVELOPMENT CAN SUPPORT THEM IN ACHIEVING THEIR GOALS; THIS WE CALL "IDENTIFYING NEEDS."

II. BUILDING ON THIS, OUR SECOND AIM IS TO PRODUCE, FROM THE NEEDS IDENTIFIED, A SET OF STABLE REQUIREMENTS THAT FORM A SOUND BASIS TO MOVE FORWARD INTO THINKING ABOUT DESIGN.

THIS IS NOT NECESSARILY A MAJOR DOCUMENT NOR A SET OF RIGID PRESCRIPTIONS, BUT YOU NEED TO BE SURE THAT IT WILL NOT CHANGE RADICALLY IN THE TIME IT TAKES TO DO SOME DESIGN AND GET FEEDBACK ON THE IDEAS. BECAUSE THE END GOAL IS TO PRODUCE THIS SET OF REQUIREMENTS, WE SHALL SOMETIMES REFER TO THIS AS THE REQUIREMENTS ACTIVITY.

5.2.2 HOW CAN WE ACHIEVE THIS?

5.2.2 HOW CAN WE ACHIEVE THIS?

AT FIRST WE GIVE AN OVERVIEW OF WHERE WE'RE HEADING. AT THE BEGINNING OF THE REQUIREMENTS ACTIVITY, WE KNOW THAT WE HAVE A LOT TO FIND OUT AND TO CLARIFY. AT THE END OF THE ACTIVITY WE WILL HAVE A SET OF STABLE REQUIREMENTS THAT CAN BE MOVED FORWARD INTO THE DESIGN ACTIVITY. IN THE MIDDLE, THERE ARE ACTIVITIES CONCERNED WITH GATHERING DATA, INTERPRETING OR ANALYZING1 THE DATA, AND CAPTURING THE FINDINGS IN A FORM THAT CAN BE EXPRESSED AS REQUIREMENTS. BROADLY SPEAKING, THESE ACTIVITIES PROGRESS IN A SEQUENTIAL MANNER: FIRST GATHER SOME DATA, THEN INTERPRET IT, THEN EXTRACT SOME REQUIREMENTS FROM IT, BUT IT GETS A LOT MESSIER THAN THIS, AND THE ACTIVITIES INFLUENCE ONE ANOTHER AS THE PROCESS ITERATES. ONE OF THE REASONS FOR THIS IS THAT ONCE YOU START TO ANALYZE DATA, YOU MAY FIND THAT YOU NEED TO GATHER SOME MORE DATA TO CLARIFY OR CONFIRM SOME IDEAS YOU HAVE. ANOTHER REASON IS THAT THE WAY IN WHICH YOU DOCUMENT YOUR REQUIREMENTS MAY AFFECT YOUR ANALYSIS, SINCE IT WILL ENABLE YOU TO IDENTIFY AND EXPRESS SOME ASPECTS MORE EASILY THAN OTHERS.

TO OVERCOME THIS, IT IS IMPORTANT TO USE A COMPLEMENTARY SET OF DATA-GATHERING TECHNIQUES AND DATA-INTERPRETATION TECHNIQUES, AND TO CONSTANTLY REVISE AND REFINE THE REQUIREMENTS. AS WE DISCUSS BELOW, THERE ARE DIFFERENT KINDS OF REQUIREMENTS, AND EACH CAN BE EMPHASIZED OR DE-EMPHASIZED BY THE DIFFERENT TECHNIQUES.

5.3 WHAT ARE REQUIREMENTS?

A REQUIREMENT IS A STATEMENT ABOUT AN INTENDED PRODUCT THAT SPECIFIES WHAT IT SHOULD DO OR HOW IT SHOULD PERFORM. ONE OF THE AIMS OF THE REQUIREMENTS ACTIVITY IS TO MAKE THE REQUIREMENTS AS SPECIFIC, UNAMBIGUOUS, AND CLEAR AS POSSIBLE.

5.3.1 DIFFERENT KINDS OF REQUIREMENTS

IN SOFTWARE ENGINEERING, TWO DIFFERENT KINDS OF REQUIREMENTS HAVE TRADITIONALLY BEEN IDENTIFIED: ***FUNCTIONAL REQUIREMENTS***, WHICH SAY WHAT THE SYSTEM SHOULD DO, AND ***NON-FUNCTIONAL REQUIREMENTS***, WHICH SAY WHAT CONSTRAINTS THERE ARE ON THE SYSTEM AND ITS DEVELOPMENT.

FOR EXAMPLE, A *FUNCTIONAL REQUIREMENT* FOR A WORD PROCESSOR MAY BE THAT IT SHOULD SUPPORT A VARIETY OF FORMATTING STYLES. THIS REQUIREMENT MIGHT THEN BE DECOMPOSED INTO MORE SPECIFIC REQUIREMENTS DETAILING THE KIND OF FORMATTING REQUIRED SUCH AS FORMATTING BY PARAGRAPH, BY CHARACTER, AND BY DOCUMENT, DOWN TO A VERY SPECIFIC LEVEL SUCH AS THAT CHARACTER FORMATTING MUST INCLUDE 20 TYPEFACES, EACH WITH BOLD, ITALIC, AND STANDARD OPTIONS. *A NON-FUNCTIONAL REQUIREMENT* FOR A WORD PROCESSOR MIGHT BE THAT IT MUST BE ABLE TO RUN ON A VARIETY OF PLATFORMS SUCH AS PCS, MACS AND UNIX MACHINES. ANOTHER MIGHT BE THAT IT MUST BE ABLE TO FUNCTION ON A COMPUTER WITH 64 MB RAM. A DIFFERENT KIND OF NON-FUNCTIONAL REQUIREMENT WOULD BE THAT IT MUST BE DELIVERED IN SIX MONTHS' TIME. THIS REPRESENTS A CONSTRAINT ON THE DEVELOPMENT ACTIVITY ITSELF RATHER THAN ON THE PRODUCT BEING DEVELOPED.

INTERACTION DESIGN REQUIRES US TO UNDERSTAND THE FUNCTIONALITY REQUIRED AND THE CONSTRAINTS UNDER WHICH THE PRODUCT MUST OPERATE OR BE DEVELOPED. HOWEVER, INSTEAD OF REFERRING TO ALL REQUIREMENTS THAT ARE NOT FUNCTIONAL AS SIMPLY "NON-FUNCTIONAL" REQUIREMENTS, WE PREFER TO REFINE THIS INTO FURTHER FOLLOWING CATEGORIES:

1. FUNCTIONAL REQUIREMENTS CAPTURE WHAT THE PRODUCT SHOULD DO.
2. DATA REQUIREMENTS CAPTURE THE TYPE, VOLATILITY, SIZE AMOUNT, PERSISTENCE, ACCURACY, AND VALUE OF THE AMOUNTS OF THE REQUIRED DATA.
3. ENVIRONMENTAL REQUIREMENTS OR CONTEXT OF USE REFER TO THE CIRCUMSTANCES IN WHICH THE INTERACTIVE PRODUCT WILL BE EXPECTED TO OPERATE. FOUR ASPECTS OF THE ENVIRONMENT MUST BE CONSIDERED WHEN ESTABLISHING REQUIREMENTS: FIRST IS THE PHYSICAL ENVIRONMENT SUCH AS HOW MUCH LIGHTING, NOISE, THE SECOND ASPECT OF THE ENVIRONMENT IS THE SOCIAL ENVIRONMENT. THE THIRD ASPECT IS THE ORGANIZATIONAL ENVIRONMENT. FINALLY, THE TECHNICAL ENVIRONMENT.
4. USER REQUIREMENTS CAPTURE THE CHARACTERISTICS OF THE INTENDED USER GROUP.
5. USABILITY REQUIREMENTS CAPTURE THE USABILITY GOALS AND ASSOCIATED MEASURES FOR A PARTICULAR PRODUCT.
6. USABILITY REQUIREMENTS ARE RELATED TO OTHER KINDS OF REQUIREMENT WE MUST ESTABLISH, SUCH AS THE KINDS OF USERS EXPECTED TO INTERACT WITH THE PRODUCT.

5.4 DATA GATHERING

SO HOW DO WE GO ABOUT DETERMINING REQUIREMENTS? DATA GATHERING IS AN IMPORTANT PART OF THE REQUIREMENTS ACTIVITY AND ALSO OF EVALUATION.

THE PURPOSE OF DATA GATHERING IS TO COLLECT SUFFICIENT, RELEVANT, AND APPROPRIATE DATA SO THAT A SET OF STABLE REQUIREMENTS CAN BE PRODUCED. EVEN IF A SET OF INITIAL REQUIREMENTS EXISTS, DATA GATHERING WILL BE REQUIRED TO EXPAND, CLARIFY, AND CONFIRM THOSE INITIAL REQUIREMENTS. DATA GATHERING NEEDS TO COVER A WIDE SPECTRUM OF ISSUES BECAUSE THE DIFFERENT KINDS OF REQUIREMENT WE NEED TO ESTABLISH ARE QUITE VARIED.

- THERE IS ESSENTIALLY A SMALL NUMBER OF BASIC TECHNIQUES FOR DATA GATHERING, BUT THEY ARE FLEXIBLE AND CAN BE COMBINED AND EXTENDED IN MANY WAYS. THESE TECHNIQUES ARE:

1. *QUESTIONNAIRES:* MOST OF US ARE FAMILIAR WITH QUESTIONNAIRES. THEY ARE A SERIES I OF QUESTIONS DESIGNED TO ELICIT SPECIFIC INFORMATION FROM US. THE QUESTIONS MAY REQUIRE DIFFERENT KINDS OF ANSWERS: SOME REQUIRE A SIMPLE YES\NO, OTHERS ASK US TO CHOOSE FROM A SET OF PRE-SUPPLIED ANSWERS, AND OTHERS ASK FOR A LONGER RESPONSE OR COMMENT. SOMETIMES QUESTIONNAIRES ARE SENT IN ELECTRONIC FORM AND ARRIVE VIA EMAIL OR ARE POSTED ON A WEBSITE, AND SOMETIMES THEY ARE GIVEN TO US ON PAPER. IN MOST CASES THE QUESTIONNAIRE IS ADMINISTERED AT A DISTANCE, I.E., NO ONE IS THERE TO HELP YOU ANSWER THE QUESTIONS OR TO EXPLAIN WHAT THEY MEAN.

2. *INTERVIEWS.* INVOLVE ASKING SOMEONE A SET OF QUESTIONS. OFTEN INTERVIEWS ARE FACE-TO-FACE, BUT THEY DON'T HAVE TO BE. COMPANIES SPEND LARGE AMOUNTS OF MONEY CONDUCTING TELEPHONE INTERVIEWS WITH THEIR CUSTOMERS FINDING OUT WHAT THEY LIKE OR DON'T LIKE ABOUT THEIR SERVICE. IF INTERVIEWED IN THEIR OWN WORK OR HOME SETTING, PEOPLE MAY FIND IT EASIER TO TALK ABOUT THEIR ACTIVITIES BY SHOWING THE INTERVIEWER WHAT THEY DO AND WHAT SYSTEMS AND OTHER ARTIFACTS THEY USE. THE CONTEXT CAN ALSO TRIGGER THEM TO REMEMBER CERTAIN THINGS, FOR EXAMPLE A PROBLEM THEY HAVE DOWNLOADING EMAIL, WHICH THEY WOULD NOT HAVE RECALLED HAD THE INTERVIEW TAKEN PLACE ELSEWHERE. INTERVIEWS CAN BE BROADLY CLASSIFIED AS STRUCTURED, UNSTRUCTURED OR SEMI STRUCTURED, DEPENDING ON HOW RIGOROUSLY THE INTERVIEWER STICKS TO A PREPARED SET OF QUESTIONS.

5.4 DATA GATHERING CONT.

3. *FOCUS GROUPS AND WORKSHOPS*. INTERVIEWS TEND TO BE ONE ON ONE, AND ELICIT ONLY ONE PERSON'S PERSPECTIVE. AS AN ALTERNATIVE OR AS CORROBORATION, IT CAN BE VERY REVEALING TO GET A GROUP OF STAKEHOLDERS TOGETHER TO DISCUSS ISSUES AND REQUIREMENTS. THESE SESSIONS CAN BE VERY STRUCTURED WITH SET TOPICS FOR DISCUSSION, OR CAN BE UNSTRUCTURED. IN THIS LATTER CASE, A FACILITATOR IS REQUIRED WHO CAN KEEP THE DISCUSSION ON TRACK AND CAN PROVIDE THE NECESSARY FOCUS OR REDIRECTION WHEN APPROPRIATE. IN SOME DEVELOPMENT METHODS, WORKSHOPS HAVE BECOME VERY FORMALIZED.

4. *NATURALISTIC OBSERVATION.* IT CAN BE VERY DIFFICULT FOR HUMANS TO EXPLAIN WHAT THEY DO OR TO EVEN DESCRIBE ACCURATELY HOW THEY ACHIEVE A TASK. SO IT IS VERY UNLIKELY THAT A DESIGNER WILL GET A FULL AND TRUE STORY FROM STAKEHOLDERS BY USING ANY OF THE TECHNIQUES LISTED ABOVE. THE SCENARIOS AND OTHER PROPS USED IN INTERVIEWS AND WORKSHOPS WILL HELP PROMPT PEOPLE TO BE MORE ACCURATE IN THEIR DESCRIPTIONS, BUT OBSERVATION PROVIDES A RICHER VIEW. OBSERVATION INVOLVES SPENDING SOME TIME WITH THE STAKEHOLDERS AS THEY GO ABOUT THEIR DAY-TO-DAY TASKS, OBSERVING WORK AS IT HAPPENS, IN ITS NATURAL SETTING. A MEMBER OF THE DESIGN TEAM SHADOWS A STAKEHOLDER, MAKING NOTES, ASKING QUESTIONS (BUT NOT TOO MANY), AND OBSERVING WHAT IS BEING DONE IN THE NATURAL CONTEXT OF THE ACTIVITY.

5. *STUDYING DOCUMENTATION.* PROCEDURES AND RULES ARE OFTEN WRITTEN DOWN IN MANUALS AND THESE ARE A GOOD SOURCE OF DATA ABOUT THE STEPS INVOLVED IN AN ACTIVITY AND ONLY SOURCE. OTHER DOCUMENTATION THAT MIGHT BE STUDIED INCLUDES DIARIES OR JOB LOGS THAT ARE WRITTEN BY THE STAKEHOLDERS DURING THE COURSE OF THEIR WORK. IN THE REQUIREMENTS ACTIVITY, STUDYING DOCUMENTATION IS GOOD FOR UNDERSTANDING LEGISLATION AND GETTING SOME BACKGROUND INFORMATION ON THE WORK. IT ALSO DOESN'T INVOLVE STAKEHOLDER TIME, WHICH IS A LIMITING FACTOR ON THE OTHER TECHNIQUES.

TABLE 5.1 OVERVIEW OF DATA-GATHERING TECHNIQUES USED IN THE REQUIREMENTS ACTIVITY

Technique	Good for	Kind of data	Advantages	Disadvantages	Detail for designing in
Questionnaires	Answering specific questions	Quantitative and qualitative data	Can reach many people with low resource	The design is crucial. Response rate may be low. Responses may not be what you want	Chapter 13
Interviews	Exploring issues	Some quantitative but mostly qualitative data	Interviewer can guide interviewee if necessary. Encourages contact between developers and users	Time consuming. Artificial environment may intimidate interviewee	Chapter 13
Focus groups and workshops	Collecting multiple viewpoints	Some quantitative but mostly qualitative data	Highlights areas of consensus and conflict. Encourages contact between developers and users	Possibility of dominant characters	Chapter 13
Naturalistic observation	Understanding context of user activity	Qualitative	Observing actual work gives insights that other techniques can't give	Very time consuming. Huge amounts of data	Chapter 12
Studying documentation	Learning about procedures, regulations and standards	Quantitative	No time commitment from users required	Day-to-day working will differ from documented procedures	**N/A**

5.4.1 CHOOSING BETWEEN TECHNIQUES

- TABLE 5.1 PROVIDES SOME INFORMATION TO HELP YOU CHOOSE A SET OF TECHNIQUES FOR A SPECIFIC PROJECT. IT TELLS YOU THE KIND OF INFORMATION YOU CAN GET, E.G., ANSWERS TO SPECIFIC QUESTIONS, AND THE KIND OF DATA IT YIELDS, E.G., QUALITATIVE OR QUANTITATIVE. IT ALSO INCLUDES SOME ADVANTAGES AND DISADVANTAGES FOR EACH TECHNIQUE. THE KIND OF INFORMATION YOU WANT WILL PROBABLY BE DETERMINED BY WHERE YOU ARE IN THE CYCLE OF ITERATIONS.

5.5 DATA INTERPRETATION AND ANALYSIS

- ONCE THE FIRST DATA-GATHERING SESSION HAS BEEN CONDUCTED, INTERPRETATION AND ANALYSIS CAN BEGIN. IT'S A GOOD IDEA TO START INTERPRETATION AS SOON AFTER THE GATHERING SESSION AS POSSIBLE. THE EXPERIENCE WILL BE FRESH IN THE MINDS OF THE PARTICIPANTS AND THIS CAN HELP OVERCOME ANY BIAS CAUSED BY THE RECORDING APPROACH. IT IS ALSO A GOOD IDEA TO DISCUSS THE FINDINGS WITH OTHERS TO GET A VARIETY OF PERSPECTIVES ON THE DATA.
- THE AIM OF THE INTERPRETATION IS TO BEGIN STRUCTURING AND RECORDING DESCRIPTIONS OF REQUIREMENTS. USING A TEMPLATE SUCH AS THE ONE SUGGESTED IN VOLERE (FIGURE 5.2) HIGHLIGHTS THE KINDS OF INFORMATION YOU SHOULD BE LOOKING FOR AND GUIDES THE DATA INTERPRETATION AND ANALYSIS. NOTE THAT MANY OF THE ENTRIES ARE CONCERNED WITH TRACEABILITY.

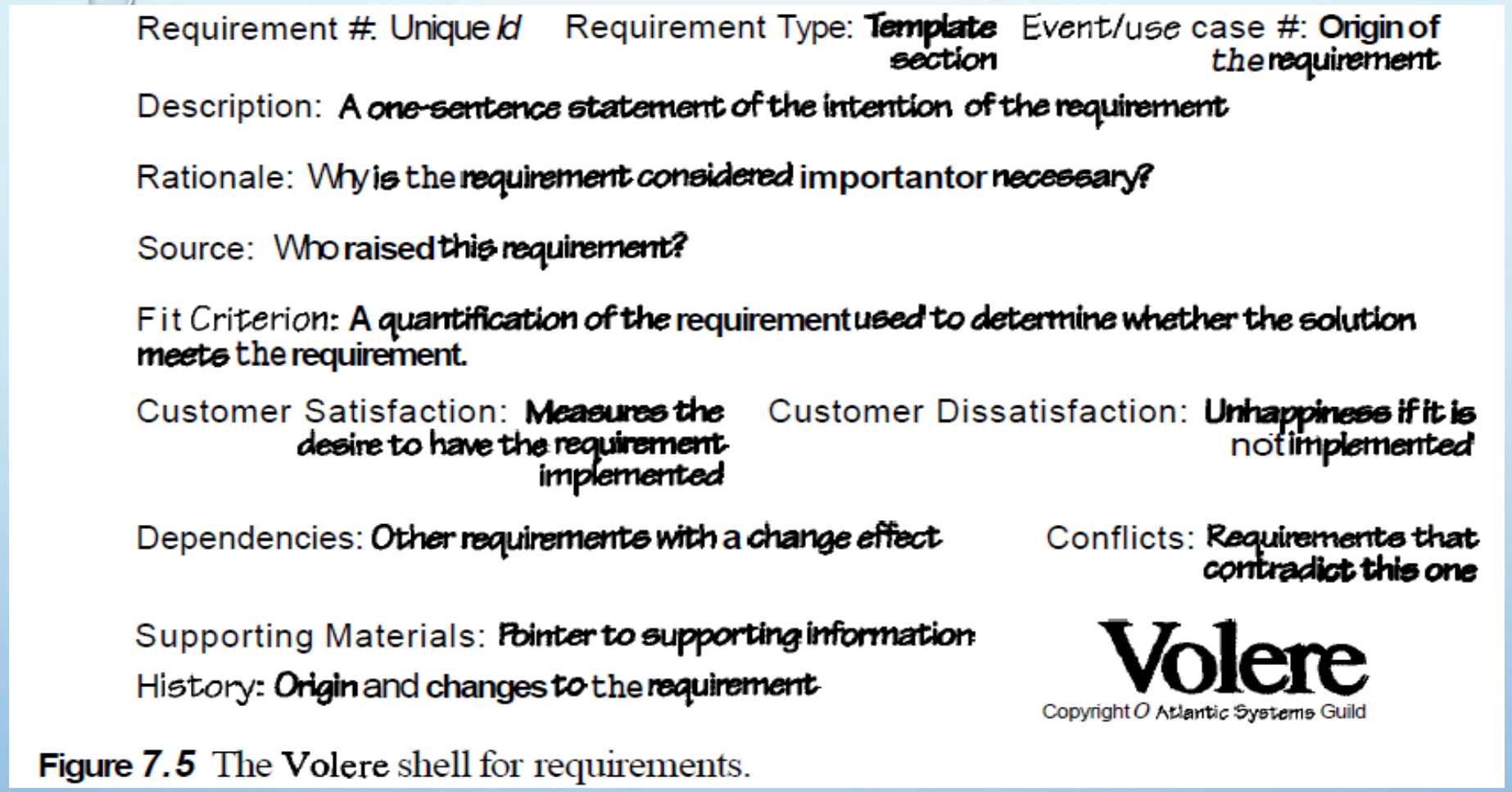

Figure 7.5 The Volere shell for requirements.

FIGURE (5.2) THE VOLERE SHELL FOR REQUIREMENTS

MORE FOCUSED ANALYSIS OF THE DATA WILL FOLLOW INITIAL INTERPRETATION. DIFFERENT TECHNIQUES AND NOTATIONS EXIST FOR INVESTIGATING DIFFERENT ASPECTS OF THE SYSTEM THAT WILL IN TURN GIVE RISE TO THE DIFFERENT REQUIREMENTS. FOR EXAMPLE, FUNCTIONAL REQUIREMENTS HAVE TRADITIONALLY BEEN ANALYZED AND DOCUMENTED USING DATA-FLOW DIAGRAMS.