THE UNIVERSITY OF CALGARY

# Conflict to Resolution with Computer Simulation Modelling as a Communication Tool: an Idea.

by

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A THESIS

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## ABSTRACT

This thesis looks laterally at the ARENA© by Systems Modelling Corporation simulation modelling software, with a focus toward the theoretical establishment of the software as a communication tool and offering an alternative method to the more traditional judicial approach toward environmental conflict resolution.

In developing a working simulation model in the ARENA© software, the thesis looks at attributes within the software that contribute to its application as a communication tool. However this study alone does not provide enough support for determination of success as it does not explain theoretically why such an approach is valid within environmental conflict resolution.

To support the initial study of the ARENA© software, the thesis delves into a range of topics including Environmentalism, Conflict, and Conflict Resolution. Accomplishing this exploration sets the theoretical foundations for the establishment of the proposed notion. Final determination of the thesis proposal, the resolution of whether computer simulated modelling can be used as a communication tool, is found in the assembling of the different threads and flows of information.

## ACKNOWLEDGEMENTS

My appreciation and thanks goes to my supervisory committee; Dr Dianne Draper, Dr Edna Einsedal, and Dr Thomas Rohleder for their unlimited support and encouragement during this project. I am also indebted to my personal friends for the understanding and support given during the finer moments of writing this paper.

## DEDICATION

This paper is dedicated to Alasdair J. B. Fergus.

My late father.

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# 1. INTRODUCTION

> Today's society continues to turn to the courts and administrative tribunals to resolve disputes in all sectors of activity. Yet, in the past decade, countless reports dealing with the magistrature, government and legal profession have highlighted the problems inherent in our judicial system. There is widespread consensus on the premise that we must find more creative ways of handling conflict and that litigation should be a last resort.
>
> Guy Baron. Attorney Justice Canada. In Poitras, Jean and Renaud, Pierre (1997, xxii )

## 1.1 Introduction

It is in reply to the challenge, suggested by Guy Baron in the above quote, that this thesis finds the catalyst for the ideas presented in the following pages. Conflict is prevalent everywhere, and whether we like it or not, it is something that we all have to deal with. However it is the handling of conflict, or more accurately the handling of conflict resolution that is of importance. As is discussed later in Chapter 4, conflict itself is not always negative, it is the resolution or outcome of a conflicting situation that can be detrimental.

The aim of this thesis is not to arrive at some all encompassing conclusion that can be applied beneficially to all conflicting situations; rather it is to look creatively at a possible resolution method that can be used in at least one particular area of conflict. The

goal of the thesis is to explore and illuminate, in both a theoretical and practical manner, an alternative way of looking at the resolution process within environmental conflict.

As Adam (1994: 92), Pepper (1996: 1), and Wilson (1991:17), suggest, we are in a period of *environmental* or *ecological* crisis. As society develops, in particular as western society continues to grow, the pressure on natural resources increases to a point where demand is greater than availability. By moving beyond this point of environmental sustainability, society creates conditions of uncertainty, tension and conflict with regard to the use, development and allocation of natural resources. It is within this area of conflict that the thesis focuses its study and conclusions.

Throughout the thesis there is a stream of thought influenced by the lateral thinking approach to creativity, popularised by Edward de Bono (1968, 1970,1995). By taking de Bono's notions and ideas on lateral thinking and applying them to a particular computer software program, the thesis attempts to show that computer simulation modelling can have additional uses to the ones originally intended by the manufacturers. In the case of this project, the simulation modelling and analysis program ARENA© by Systems Modelling Corporation, is looked at with a view to utilising its capabilities as a tool to help communications in the resolution process of environmental conflict.

## 1.2 The Challenge

In reply to the challenge set by Guy Baron, this thesis sets out to look at the applicability of a particular computer simulation software, as not just a simulation tool but as a communication tool. By looking laterally at the capability of the ARENA© software and applying its capabilities to the problem of communication within conflict resolution, an alternative to the more traditional adversarial approach is found. In contrast to the oppositional nature of conflict within the adversarial approach, the concept of an alternative involves such notions as cohesiveness between parties, a co-operation of effort, and a working together towards a single goal, as opposed to finding winners and losers. The notion of coalition between conflicting parties and interests is in keeping with de Bono's notions on parallel thinking, and creativity of ideas. As de Bono (1995; 216) states:

> In parallel thinking, instead of adversarial argument in which one side tries to refute the propositions of the other side, there is parallel co-operative thinking in which all parties are looking in the same direction at any one moment.

So by placing the computer simulation software program within a framework of lateral, parallel thought, an alternative use is found, a use that leads to looking at environmental conflict resolution through a different viewpoint from the traditional oppositional outlook.

## 1.3 Creativity

Edward de Bono, one of the central names in the field of creative thinking (Kirk, 1992:1), uses the themes of lateral and parallel thinking to explain ways of looking at and creatively thinking about problems. The thesis takes these notions and applies them to the ARENA© computer simulation software program.

The reasoning for the lateral thinking approach is that running parallel to the recent surge of development in the number and capabilities of the personal computer, is a reciprocal development in the volume and ability of computer software. Software is developing at such a rapid rate that only a small percentage of the users are actually able to utilise all the technological capabilities of each version of any given software. A common example of this would be Microsoft's word-processing program Word©. It would be safe to assume that most people only use a small percentage of its capabilities, and that the next version will be developed before the majority of users reach the capability boundaries of the present version. Software development is linear in direction, in that each new version is a *bigger* and *better* variant of the earlier version; there is little attempt to look laterally (de Bono, 1968) and explore the ability of any given software in areas to which they were not originally designed. Humans tend to get into habits of action and thought (Kirk, 1998: 1); in this case these habits are not necessarily creative.

A useful analogy for understanding the habitual pattern of thought that we often find ourselves in is suggested by Kirk (1998), where creative ability is like rain drops

hitting the ground. As the water falls on the surface it creates small grooves and runnels of flow; overtime these patterns of flow become more prominent creating systems of flow that are permanently used to carry water. de Bono relates these systems of flow to "our ability to perceive information." (Kirk, 1998:1). de Bono (1992) suggests that we need these systems to create some order from the constant stimulation of information that is apparent in our lives. However, these systems of flow are not created out of some "*a priori grand logic*" (Kirk, 1998:1), they are formed mostly at random, within the constraints of neurological capability. As Kirk (1998: 1) suggests:

> The initial routing on our psychological landscape was mostly random and all subsequent information is steered the same way or assimilated into emerging mental channels. Thus do we form the habits of behavior and of thought.

de Bono's methods of creative thought introduce techniques for climbing out of the ruts and valleys and for creating new systems of flow. It is acknowledged that these new patterns will in turn create other habits of thought process, but the movement from each new pattern of flow will in turn mean new creative cognition.

It is this lateral movement of thought with regard to the ARENA© simulation modelling software that this thesis uses to explore communication within the area of environmental conflict.

## 1.4 The Simulation

To explore how simulation modelling can be of use as a communication tool the thesis first develops a simulation of an actual environmental conflict, or more accurately, what appears to be an actual environmental conflict. The reason for hesitation in use of terms is that at this point there has been no clarification or definition of the terms used. This is clarified later in Chapter 4.

In Chapter 2, the conflict that is used in the simulation is established and the process of developing a simulation model is described. At the end of the chapter not only is there a working model, but the reader should have an understanding of the process undertaken in developing that model. This understanding is important in the theoretical application of the model as a communication tool within the area of environmental conflict. The focus of the thesis is the establishment of an idea, and not the effectiveness of that idea; this is a separate topic for further research. Because of this focus the supervisory committee felt that field testing the model involving the critical stakeholders should not be undertaken due to the additional time and expense required. It is recognised that this choice leads to a limitation in this study.

In establishing the suggested notion it was important to establish the model, and the modelling process first, as the premise of the thesis is to look creatively at an existing tool and apply the new perspective in shedding a different light on an existing problem. In this case, the challenge is to look at environmental conflict and to see if the alternative

perspective of co-operation can be established through the use of the simulation tool as a communication tool. A tool is needed before resolution can happen: in the case of environmental conflict the problem already exists and the challenge is to find a method or tool that can help solve the problem.

## 1.5 The Environment

In Chapter 3, an in-depth look at the influences that form, develop and establish what we now know as environmentalism is undertaken. This examination is significant as it establishes the origins and the appearance of contemporary environmentalism and the conflict that surrounds it. In particular it establishes that environmental conflict is a social action and not a political one, an important differentiation with regard to the resolution of such conflict.

The examination of the historical background and establishment of environmentalism, and environmental conflict, begins to substantiate the theoretical notions supporting the application of the simulation model as a communication tool. The examination also begins to establish the definition of environmental conflict (which is completed in Chapter 4).

## 1.6 Conflict

The inquiry continues into the field of conflict and conflict resolution in Chapter 4 and 5, with particular reference to the simulation model as a communication tool. To do this the

thesis draws upon theoretical work from other fields such as Social Work, and Industrial Dispute. It is in conjunction with these other areas that a theoretical framework is established that supports the notion of using the simulation model and the process of developing such a model, as a communication tool. Additionally within this framework a definition of environmental conflict is determined.

The inquiry into environmentalism, conflict, and conflict resolution is important in that it establishes theoretically the problem facing the application of simulation modelling as a communication tool. It is only with this theoretical background that an argument can be made for the use of simulation modelling. The problem has to be understood before the answer can be found.

## 1.7 Communication

In Chapter 5, the question of whether simulation modelling can be used as a communication tool is addressed. This is achieved by applying both theoretically and practically the benefits of simulation modelling to the problem discussed in the previous three chapters. The question of how effective a communication tool simulation modelling can be is left for further study. This thesis only hopes to establish that simulation modelling can be usefully employed as a communication tool in an alternative answer to conflict resolution. Thus in Chapter 6, the thesis puts together the examinations, lateral thoughts, and conclusions, and sums up whether simulation

modelling can be used as a communication tool within alternative conflict resolution. Additionally some recommendations for further study in this area are suggested.

## 1.8 Overall Viewpoint

By its very interdisciplinary nature the thesis draws upon a multitude of sources, theories and ideas, thus in itself the study is looking for support in a lateral manner. de Bono's notions appear not just as an idea from which to develop the thesis subject matter, but also as a structural thread or a stream flow of thought, linking differing subjects throughout the study. To use the previous analogy of rain drops dropping onto a surface, the flow and direction of the thesis starts with a few drops of ideas, in this case some lateral and parallel thinking ideas, and develops with other streams of thought to become a strong flow of argument supporting the premise of the study.

In order to understand the direction and idea of the thesis, it is possible to take this analogy one step further. Using lateral thinking to climb out of the traditional ruts of thought in conflict resolution, the thesis looks at simulation modelling as a new tool in environmental conflict resolution process. This approach can be seen as a journey of thought, starting with a craft for two conflicting parties on a journey downstream, the trip starts at *conflict*, and finishes at *resolution*; the craft is simulation modelling. At first the trip starts easily with a single stream of thought, however it is soon joined by other streams of thought strengthening the flow. A strong flow is necessary for the reaching of the destination, *resolution*. The idea and thought of simulation modelling itself will not

achieve the journey alone, as the initial flow of thought is not strong enough. It is only with the addition of other supporting flows of thought that the journey will succeed.

To map this journey the thesis is divided into three parts. Part One; Chapter 2 addresses the craft or tool of transportation; Simulation Modelling. Part Two; Chapters 3,4, and 5, give the theoretical support to the initial thought, and supply the extra flow of thought for the initial idea to reach the destination. Part 3: Chapters 6 and 7, discuss how the craft or initial idea arrives at the destination, finishing with a quick recap of the journey.

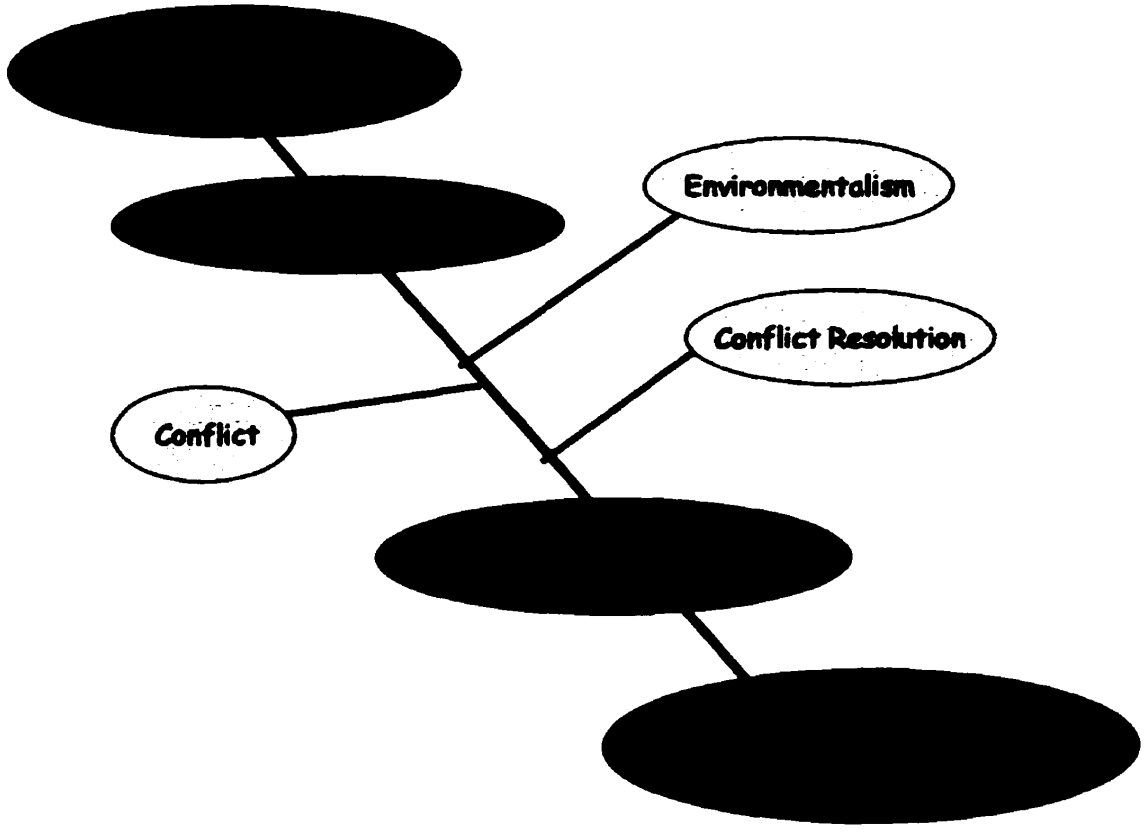



Figure 1. Showing the Metaphorical Journey Threaded Through the Thesis.

**PART 1.** ***The Vehicle: an Idea.***

# 2. SIMULATION MODELLING

> Simulation has had a long and honorable history. Sir Isaac Newton used simulation on a grand–shall I say, Universal–scale. He built a mathematical model and used this model to compute the motion of celestial bodies. Similarly, computer simulation arises in a very natural way from scientific practice.
>
> Today, as more practitioners develop greater expertise, computer simulation is moving from an *art* to a structured technique with known strengths and limitations.
>
> Stanley Winkler. Executive Office of the President Washington DC. In Knight, Cutis and Fogel (1971: 188).

## 2.1 Introduction

Before setting out from *Conflict* to *Resolution*, it is important to describe the metaphorical tool or craft used in the journey; to do this Chapter 2 is divided into two sections. The first section attempts to answer the question: What is computer simulation modelling ?, while the second part looks at a real simulation model and how it is built.

As a subject, computer simulation modelling is multidisciplinary in both use and foundation. As Neelamkavil (1987: xv), supporting Winkler's (1971: 188) notions above, suggests, "It is more than an art, but not a fully developed science." The

multidisciplinary nature of modelling has generated a large volume of papers and texts from all major disciplines of study, a mass of work that continues to increase as new applications for simulation modelling are found and developed (Neelamkavil, 1987: xv).

The purpose of the thesis in this section is not to write a comprehensive explanation of the subject, but to give the reader an awareness of the qualities found in the use of computer simulation modelling. As a computer simulated model is the metaphorical craft used in the journey, it is important that the reader have an understanding of simulation modelling capabilities.

The first section briefly defines computer simulation modelling, and then discusses simulation modelling in terms of system analysis. In doing so the advantages of simulation modelling are discussed, and the criteria for making the model viable and credible are explored.

The second section explains and describes the process involved in building the example model used in the thesis. A brief description of the conflict within the real system is followed by an examination of the model building procedure. The thesis does not give a technical account of model construction and computer language, but by following the process undertaken in building the example model, the reader should understand to some extent how a model is built.

It is important to have an understanding of the model building procedure because the process of constructing a model is often as important as the outcome. In some cases modelling is part of a continuous loop, as Hannon and Ruth (1994:5) suggest; a model is created, modified, assessed, then developed again.

## 2.2 Defining Simulation Modelling

### 2.2.1 What is Simulation Modelling ?

Simulation encompasses a large assortment of practices and procedures that imitate the behaviour of real-world systems (Kelton, Sadowski and Sadowski, 1998:3). Originally simulation itself did not involve the use of computers (in some cases it still does not); however, the power and flexibility of digital computers has been synonymous with the development of simulation modelling (Kelton, Sadowski and Sadowski, 1998:3).

For the purposes of clarification, this study uses the definition for simulation modelling given by Winkler (1971) which, although a little dated, sums up concisely what is meant by simulation. Winkler (1971: 171) states that "simulation is a technique for representing 'reality' by a model which can be manipulated in a digital computer and whose computer behaviour reasonably approximates 'reality' within the framework of interest". In the case of this study the computer software program ARENA © by Systems Modelling Corporation is used as a modelling environment.

### 2.2.2 Simulation Modelling: an Overview

Computer simulation modelling involves the analysis of systems; in particular, a model of the system is used to accomplish the analysis. Systems are studied for a number of reasons, for example; performance assessment, operational development, trouble shooting, and initial design. It is also recognised that the importance of model building may be in the actual process itself and not the final outcome. As Kelton, Sadowski and Sadowski (1998:4) state: "There is much to be learned at each step of a simulation project, and the decisions you make along the way can greatly affect the significance of your findings."

Model building as a process is fundamental to our understanding of reality, it is something we all do in our daily lives (Hannon and Ruth; 1994: 3). By developing mental models of the real world, we are able to learn and understand what is going on around us. In our quest for cognition the advent of the personal computer has meant the ability to develop more complex models of reality. Computer simulation modelling is only an extension of what we do naturally, the basic processes are the same, computers are just better able to deal with the complex variations found in complex systems.

### 2.2.3 Systems

As defined by Costanza et al. (1993: 545) systems are:

> ...groups of interacting, interdependent parts linked together by exchanges of energy, matter, and information. Complex systems are characterised by strong (usually non-linear) interactions between the parts, complex

> feedback loops that make it difficult to distinguish cause from effect, and significant time and space lags, discontinuities, thresholds, and limits.

In terms relevant to simulation modelling, systems can be categorised along three dimensions (Law and Kelton, 1991: 6). The first of these dimensions is temporal or time dependant; a system can be either *dynamic*, where the system changes over time, or *static*, where time is irrelevant. The nature of events within the system is the second dimension; systems are either *discrete*, or *continuous*. A *discrete* system is one where the conditions or state of the system change at specific points in time. A *continuous* system is where conditions are constantly changing over time. The final dimension is concerned with the nature of information used within the system. Information can be either *deterministic*, meaning that the information is certain with no randomness, or information can be *stochastic* indicating that input of information is random. Modelling real-world systems is never easy and often models can have elements of both discrete and continuous systems, and be open to both deterministic and stochastic sources of information at different points in the simulation. It is important to be aware of these variances when building a model. For a more comprehensive explanation of these dimensions of models see Law and Kelton, 1991.

As models can be complex to build and use, there may be better alternative analysis tools. Simulation modelling is not the only way in which to understand a system, and it is important to realise that it may not be the best. The following diagram shows where simulation modelling fits into the picture of system analysis.

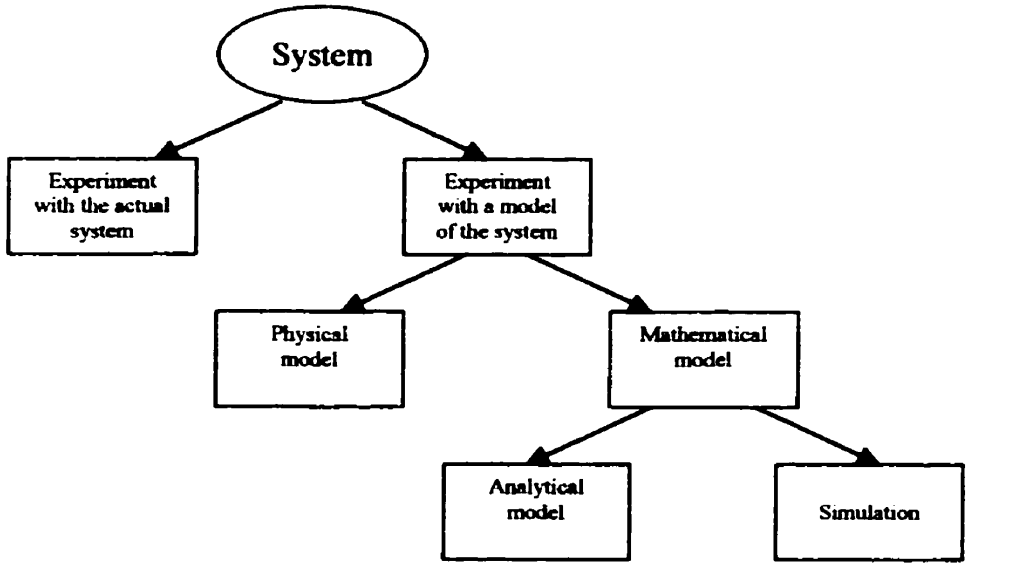



Figure 2. Ways to Study a System.

Law and Kelton (1991: 4)

Each method of system analysis has its advantages, but simulation modelling is popular because of its flexibility in trying different scenarios without directly affecting the real-world system. It is useful as a tool for trying new ideas without the fear of failure, and generating new ideas through the interactive capabilities of a model. The development of powerful computers has meant that simulation modelling can now deal with very complex models of correspondingly complex real-world systems (Kelton, Sadowski and Sadowski, 1998: 8). It can also be quite cost effective, particularly when compared to some of the alternatives; for example, the running of differing machine scenarios within a manufacturing production line would be better with a model than in the real situation.

One of the strongest advantages with simulation modelling is the animation capability of newer simulation software. The ability to display the simulation model in a static and dynamic animated form is of considerable advantage when trying to communicate new ideas. Animation gives the analyst or client a better appreciation of what is happening within the model, thus a better understanding of the analysis, in turn leading to better decision making. By utilising the improvement in model understanding, animation can also be useful in dealing with problems of validation and credibility.

The animation capability of the newer software is of particular importance to this thesis, as it is the foundation upon which the thesis argument is based. It is the animated capabilities of simulation modelling that support the idea of simulation modelling as a communication tool.

### 2.2.4 Validation and Credibility

By modelling real-world systems, computers help the understanding of the dynamics of those systems by mimicking the systems in a useable form. However, the understanding gained from a model is not useful if the model is inaccurate. Accuracy is one of the main problems dealt with by a simulation modelling analyst (Law and Kelton; 1991: 298). For effective analysis a model should be valid and credible for its intended purpose. As model validation and credibility is a large and complex subject, the thesis only gives an overview to the subject, and a flow chart (Figure 3) showing the process involved.

Further details on practical and philosophical approaches may be found in Law and Kelton (1991) , and Naylor and Finger (1967), respectively.

Three terms are used in the process of building valid and credible simulation models; *verification*, *validation* and *credibility*. *Verification* is the process of establishing the working of the model. It ensures that the conceptual model has become a working entity. *Validation* is the comparison of the conceptual simulation model and the real-world system. As Schlesinger (1979, in Neelamkavil, 1987: 76) states: "validation can be defined as the process of substantiating that the model within its domain of applicability is sufficiently accurate for the intended purpose." *Credibility* is about selling the model; once the model has been accepted as valid by the "manager/client" (Law and Kelton; 1991: 299), the model is seen as *credible*. Animation capabilities contained in the simulation software give the analyst a powerful tool in establishing credibility. Dynamic pictorial images of the simulation often help in the understanding of what is happening. Visualisation is a powerful communication tool between the analyst and client. As Law and Kelton (1991: 241) suggest:

> The major reason for the popularity of animation is its ability to communicate the essence of a simulation model (or of simulation itself) to managers and other key personnel, greatly increasing the model's credibility.

The process in which these three terms are used can be seen in Figure 3. Figure 3 is a useful tool for determining the timing and relationships between the terms. The boxes indicate stages in the model or real-world system, the horizontal lines indicate the

processes needed to move from one stage to another, and the dashed curved lines relate to the timing of the three terms. The small numbers relate to the order of process that an effective simulation modelling project would take. (See Appendix A for an explanation; Law and Kelton, 1991: 299).

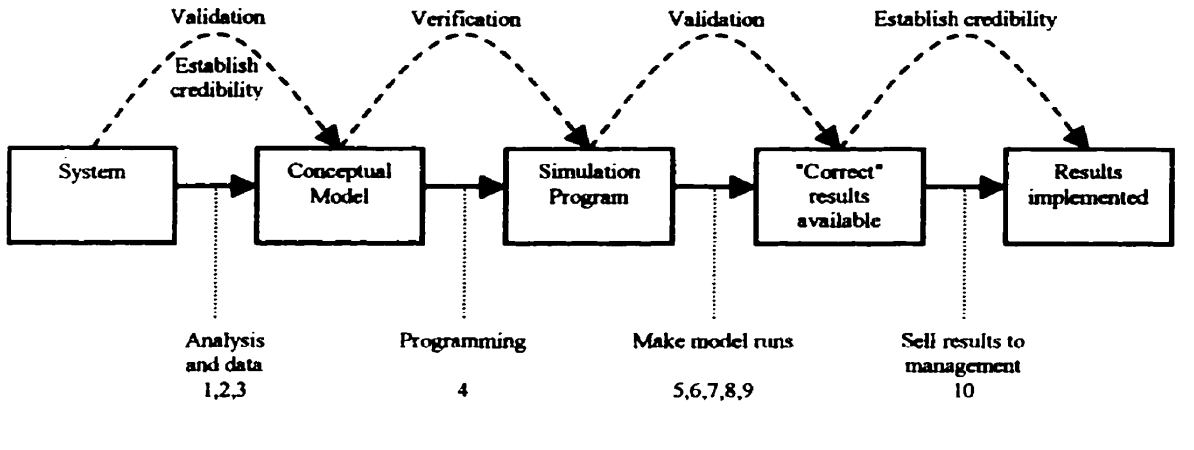



Figure 3. Timing and Relationships of Validation, Verification, and Establishing Credibility. Law and Kelton, (1991: 299)

### 2.2.5 Section Summary

From Figure 3 it is possible to see that a simulation model is only part of the whole system analysis process. It is important that the model be placed into context by the other parts of the analysis, as context provides the framework within which validation and credibility occur. This is an important point with regard to the establishment of simulation modelling as a communication tool within the area of environmental conflict. Without establishing the context to which this notion is being applied, no conclusion can be made about its applicability.

The next section of this chapter deals with model development, and complements the perspective of the first section, which gave a brief overview to the questions of what is computer simulation modelling, and what can it do.

## 2.3 The Model Building Process

### 2.3.1 Introduction

The purpose of this section is to give an account of the model building process. A real situation with the initial appearance of being an environmental conflict is introduced and a simulation model of that situation is built. (As noted in Chapter 1, the real situation is described as an environmental conflict with a certain amount of hesitation, because the term environmental conflict has not been clearly defined at this point. This is determined in more detail in Chapter 4.)

Before the real system to be modelled is introduced the choice of simulation software is examined briefly and the problems of modelling complex environmental systems are addressed. It is recognised that there is a large number of simulation software packages available, and a number of them could have been used in this thesis. The thesis does not give a critical account of each one, rather it provides the reasons why the ARENA© software was suitable. [For a more detailed review of available simulation software packages see *OR/MS Today* (February 1999).]

### 2.3.2 Why ARENA© ?

The ARENA© simulation software by Systems Modelling Corporation was chosen for three reasons: i. Personal experience with the software.

ii. User friendly and flexible simulation language.

iii. Good integration of animation.

i. Personal experience with the ARENA© software gave an important understanding of the modelling and ease of use capabilities. In general, experience with simulation software showed that for the purpose of this thesis it was important to use a software program that was user friendly and that could be understood to some extent by people with no previous simulation experience. ARENA© does this by having a flexible, integrated hierarchical language system that is visual in appearance. The visual strength of the software also becomes apparent in the ability to show the modelled system in an animated form. The visual attributes of the software were the catalyst in the initial thought process leading to the author's decision to focus on the usefulness of simulation modelling as a communication tool.

ii. One of the strengths of the ARENA© software is the ability to work on a number of differing model language levels simultaneously. ARENA© does this by having ready-made templates and modules that can be used in conjunction with the more detailed blocks and elements level. If more detail is needed the modeller can

access the basic computer language that makes up the higher levels of modelling. The advantage of the hierarchical system is that at the higher levels the program is quite visual and can be understood quite easily by an inexperienced viewer, yet access to the basic lower level language is still provided. For the purposes of this thesis the Standard edition of ARENA© is used. Figure 4 shows ARENA's © hierarchical structure.

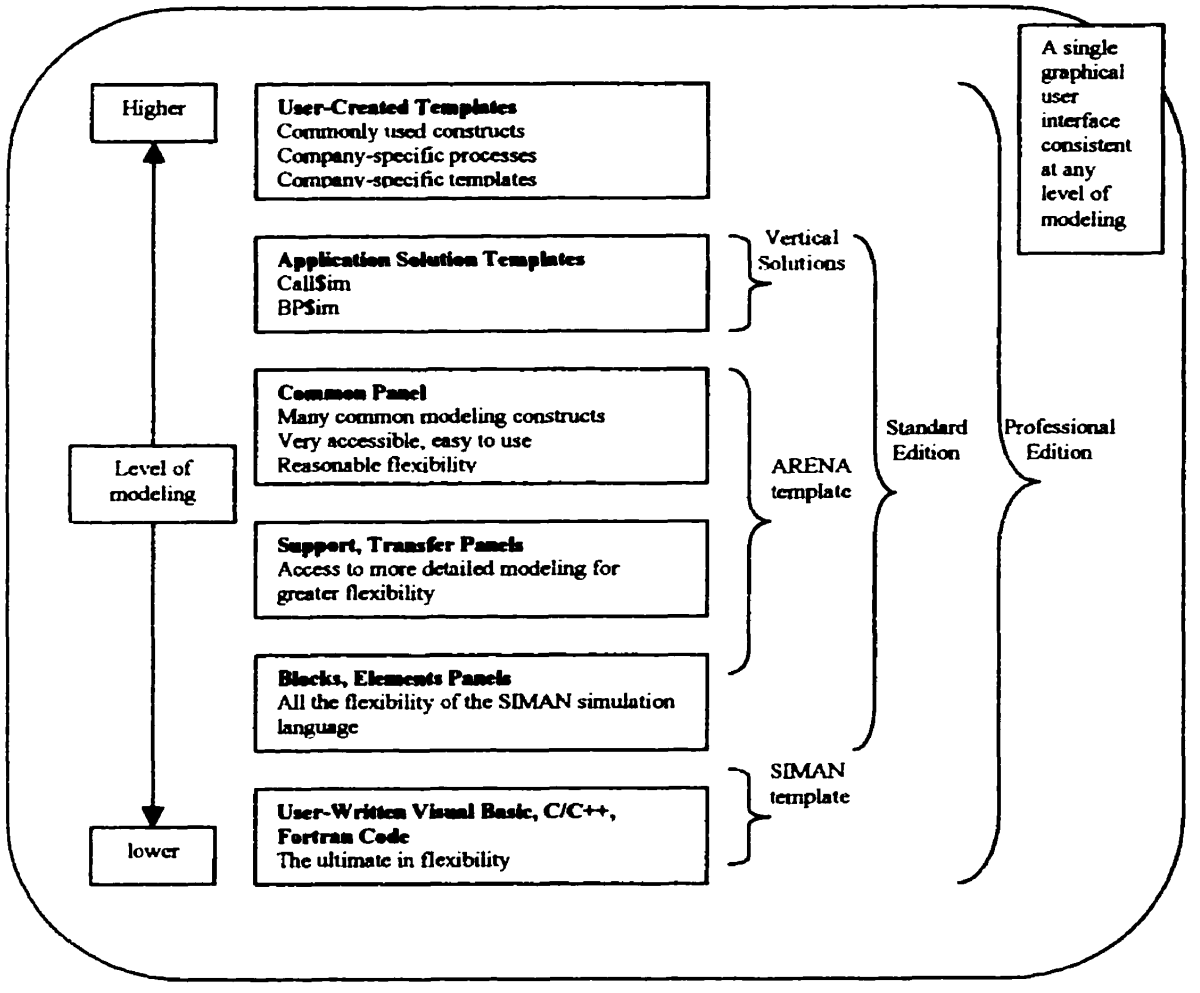



Figure 4. ARENA's© Hierarchical Structure. Kelton, Sadowski and Sadowski, (1998: 12)

iii. The ability to present the model in an animated form is crucial to the use of the software as a communication tool. ARENA© provides "dynamic animation" (Kelton, Sadowski and Sadowski, 1998: 13) in an integrated manner with the model contents, and has the ability to offer further graphical support by importing additional multimedia components.

### 2.3.3 Modelling Complex Environmental Systems

The suggestion put forward from this thesis, that computer simulation modelling can be used as a communication tool within environmental conflict, is based on the fact that an environmental system can be modelled. With the development of computers and software, models are now being built that can deal with the complexity of an environmental system. Until recently this has not been possible, as analytical methods can only deal with simple linear systems of algebraic or differential equation types of problems. This becomes a problem when trying to model a complex ecological system, as Costanza et al. (1993, 546) state:

> The problem is that most complex living systems (like economies and ecosystems) are decidedly non-linear, and efforts to approximate their dynamics with linear equations have been of only limited usefulness.

With the development of computers, modelling complex dynamic systems has now become possible; programs can simulate "evolution and acquire sophisticated behavioural patterns" (Costanza, et al. 1993: 546), and can be used to model changing behaviour over time, providing realism in the portrayal of environmental processes.

Other modelling techniques of modelling complex systems include metamodeling, where more general models are developed from detailed ones (Costanza, et al. 1993, 546) and are used together, usually in large scale evaluations.

The development of computers, and the resulting involvement of modelling applications, is linked to the realisation that the traditional reductionist techniques of classical science are not suitable for understanding the relationships within a complex system, such as an ecological system (Costanza, et al. 1993, 546). By developing capabilities that can understand a whole system, as opposed to the parts, system analysis moves away from evaluating systems in a linear fashion to analysis that is lateral in focus. With a lateral focus, system analysis crosses the traditional boundaries of scientific disciplines, yet includes something from each discipline in an integrative manner. It is the lateral focus of system analysis that this author applies in using simulation modelling as a communication tool.

By using computer simulation modelling to analyse an environmental conflict system, and the differing perspectives of conflicting parties, the thesis shows that the understanding from such a model can be used as a communication tool to help resolve that conflict. However, the capabilities of the computer simulation software and hardware have to be taken into account. To understand the influence of software and hardware on the model, the purpose of the model should be evaluated. Model purpose can be judged by three criteria: realism; precision; and generality. As Costanza et al.

(1993, 546) state "No single model can maximise all three of these goals". However computer power can help, as does very specialised software. For example "CRAY supercomputers and Connection Machines (massively parallel supercomputers) facilitate the modelling of complex systems using advanced numerical computation algorithms" (Costanza, et al. 1993, 546).

It is in response to the use of very specialised and expensive hardware and software that the thesis is looking laterally at an existing simulation software program. However, by doing so, the effectiveness of the model in terms of realism, precision, and generality, can be affected. By using a relatively easy and approachable software program, sacrifices will be made in the measurement criteria of the model. This could lead to a reduction in terms of the scope of the system modelled, possibly moving away from a lateral whole system examination, toward a less effective, narrow, linear approach. It is with the notion of avoiding too much reductionism that the following model was built.

### 2.3.4 The Real System

A large white-water rafting and kayaking industry is located on the Rocher Fendu section of the Ottawa River, 120km west of Ottawa, Ontario (Figure 5.) The industry has been established for over twenty years and has approximately 60 000 customers per season (June-September). The Ottawa River is also a major source of hydroelectricity for

Ontario Power. At present the flows of the river are controlled by the Ontario Power company, who have responsibilities of power generation as well as flood control.

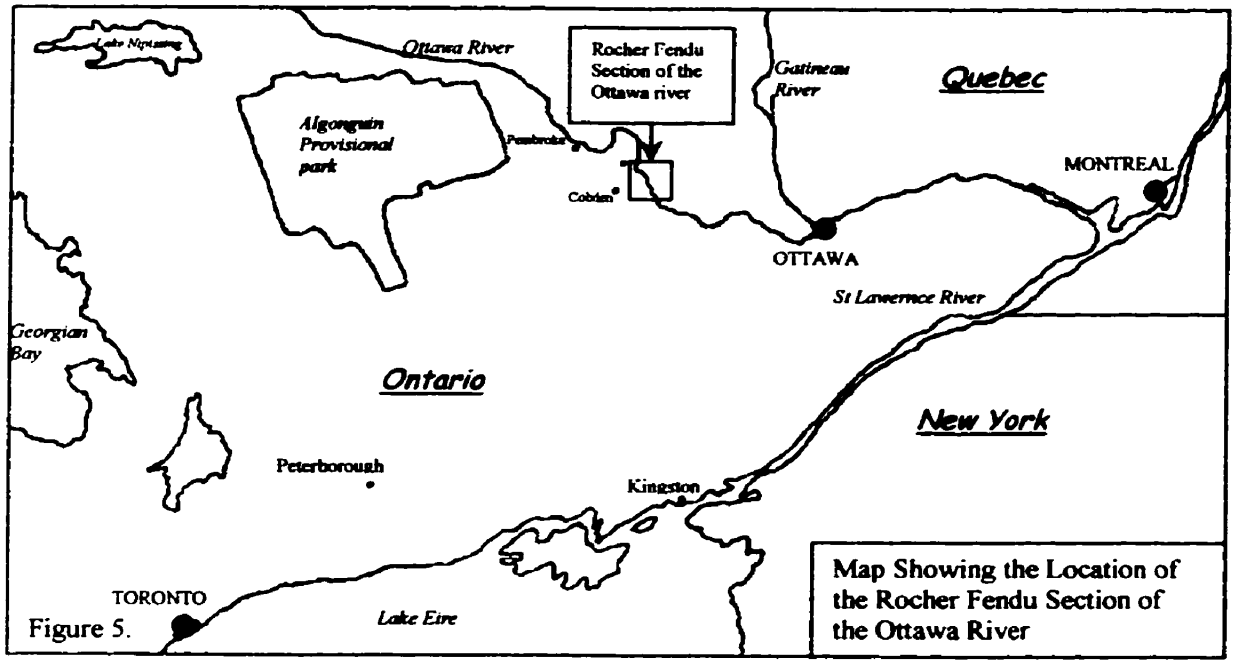



Figure 5.

The flow of the river in terms of volume can have a significant effect on the white-water industry (the river level can rise and fall as much as 27 vertical feet in a few days). As the flows are generated by Ontario Power without any consultation with the affected rafting companies, the issues of trip quality, safety, and general logistics are of issue.

It is recognised that, at present, the level of conflict between the white-water rafting companies and Ontario Power is quite low, with the white-water rafting companies dealing with the changing water levels on a daily or hourly basis. However, it was felt that this example would be suitable for the purposes of the thesis in that the software chosen would be able to model the situation without sacrificing too much in

terms of realism, precision, and generality. Additionally, the possible privatisation of the power generation companies, along with the increased use of the river as a recreation destination, also means that the present climate of cordiality between the parties may be put under pressure, resulting in an increase in the level of conflict.

The goal of the simulation is to show the various routes that the rafts have to take due to the river levels produced by the releases from Ontario Power's dams. In doing this, it will be possible for the white-water rafting companies to show what effect the flows have on their operations, and it will give a chance for Ontario Power to show the level of flow and level of flexibility of flows needed for power generation and flood control.

### 2.3.5 Data

To correlate the river flow and the use of the river by the rafting companies data had to be collected from two sources. The route that the rafting companies take down the river is determined by the reading on a gauge installed by the rafting companies. This reading has significant importance to the rafting companies as some rapids have up to five differen. At present this reading is not correlated to river volume; the determination of which route to take has been made solely by the companies over the last eleven years. The readings for the river gauge were provided by Owl Rafting for every day of operation between 1990 and 1996. The release levels from Ontario Power were then acquired for those given dates and the two sets of data were correlated and graphed.

The correlation between the two sets of data was then used by the simulation to convert river flow readings into gauge readings. (See Appendix B for a graph of the data).

### 2.3.6 Steps in a Simulation Study

Although not all simulation studies follow the same strict pattern, most studies follow a series of general steps, shown here (Figure 6).

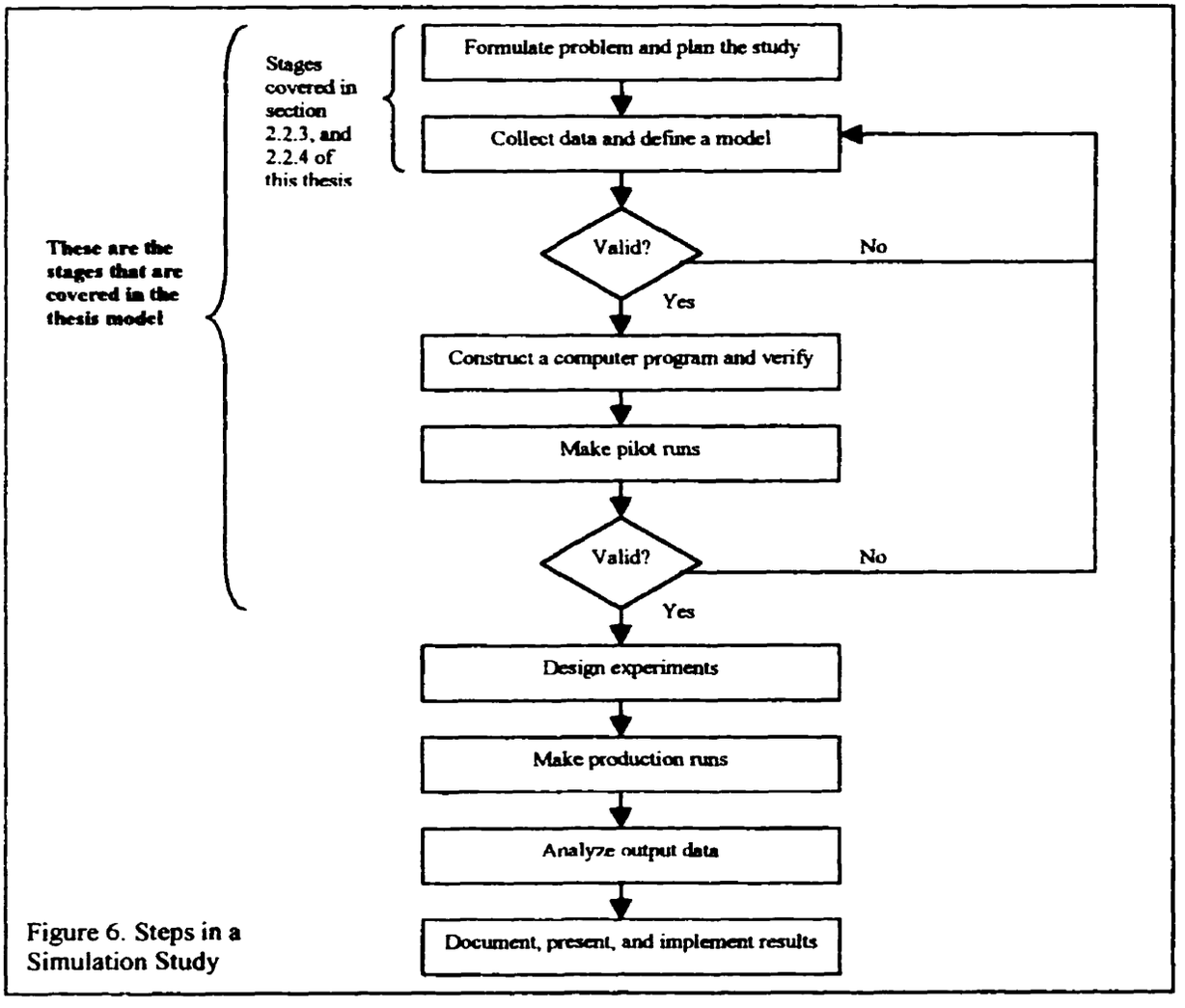



Figure 6. Steps in a Simulation Study

As indicated in Figure 6, the thesis takes the model to the second validation step. The purpose of the thesis model is as an example aimed at clarifying what a simulation model is and how it is built, with a view to establishing its use as a communication tool. The remaining steps are more pertinent for a traditional type of simulation study.

### 2.3.7 Model Flow Chart

When constructing a simulation program it is often useful to build a flow chart of the program before working with the software. The advantage of this step is that it can keep the model builders on track, as the modelling can become quite difficult with complex models. It is also useful because the parties involved in the model building get a chance to have input into the model construction and influence decisions, a step that is easier to make before the model is built than later on. Although flexibility in model construction is one of the advantages of computer simulation modelling, it is prudent to start off in the right direction.

The following flow chart was developed for the thesis model and shows in diagrammatic form the flow of entities through the simulation. As Kelton, Sadowski and Sadowski, (1998: 12) explain: "Entities are dynamic objects in the simulation"; in the case of this model, rafts are the dynamic entities.

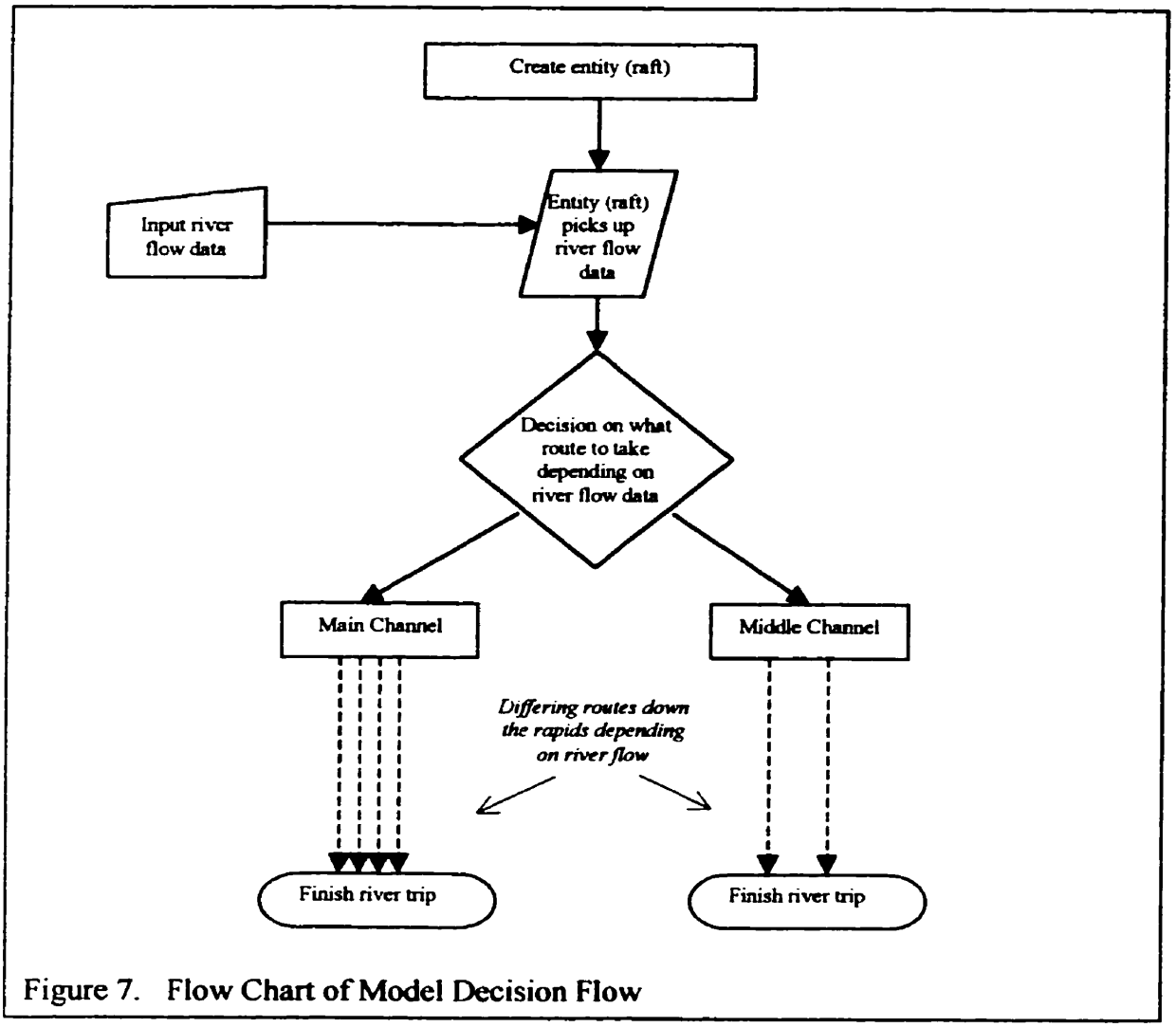
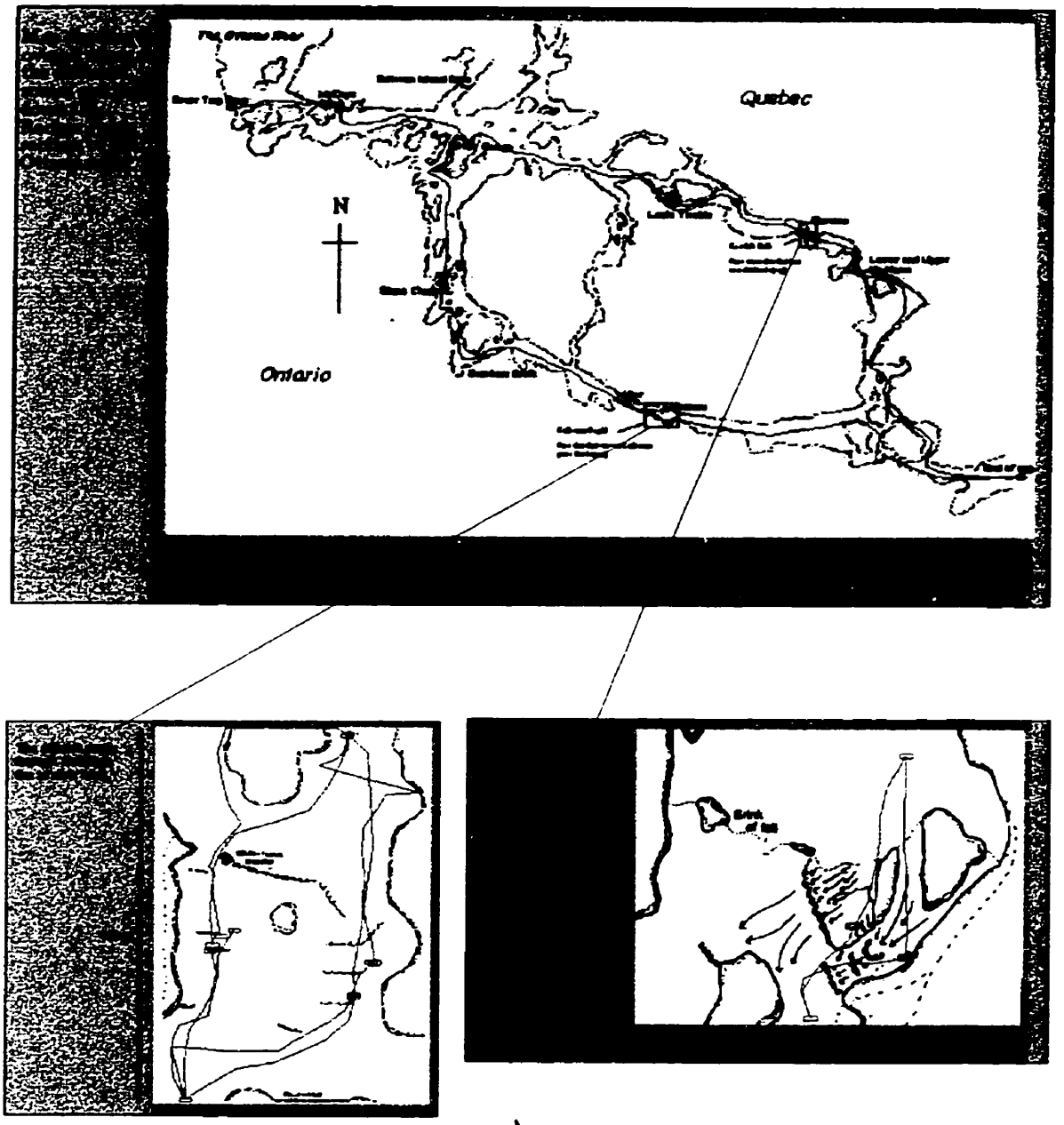



Figure 7. Flow Chart of Model Decision Flow

Using the flow chart as a framework, the next stage was to start building the model on the ARENA© software. A working copy of the model is available on the accompanying CD ROM. However the diagrams within Figure 8. show visually the maps and entity routes used within the model.




∨ – The routes taken in the model by the raft entities, indicating the various routes down the river, and rapids

Figure 8. Diagram Showing the Maps used in the Simulation Model.

### 2.3.8 Summing Up

The purpose of the chapter was two-fold; firstly to give the reader an understanding of what simulation modelling is, and secondly to clarify the process of model building. By exploring simulation modelling through a systems viewpoint, the chapter was able to set the stage for the application of simulation modelling to the area of the environment (Section 2). The questions of validation and credibility also introduce the idea of animation within simulation modelling as a communication tool. In addition, Section 1 showed, through the use of the flow diagram in Figure 3, the place modelling has in the overall analysis of a system, and emphasised the importance of context in the analysis of a system or use of a simulation tool.

By explaining the process of model building, and showing the steps needed in the construction of a model, Section 2 has given the reader a basic understanding of simulation modelling that can be constructively taken to the suggested notion of simulation modelling as a communication tool within environmental conflict. However, on the metaphorical journey threaded through the thesis, the information in Chapter 2 is not enough to get the reader to the intended destination of *Resolution*. Discussing simulation alone is not enough to assess the possibility of its use as a communication tool within environmental conflict; rather the tool has to be looked at with a view to the context in which it is going to be used. This is the goal of Part 2 of this thesis.

Part 2 of the thesis looks at three important areas that help the journey from *conflict* to *resolution*. As noted, simulation modelling alone will not complete the journey, it needs the input found from exploring environmentalism, conflict, and conflict resolution. This type of input adds theoretical support to the notion suggested in Chapters 1 and 2. Without the input, the momentum of flow carrying the idea of simulation modelling as a communication tool within environmental conflict will dry up. It is by exploring the areas of Environmentalism, Conflict, and Conflict Resolution that simulation modelling will find the support to arrive at the point of being recognised as a conflict resolution communication tool.

**PART 2.** ***The Support: Environmentalism, Conflict, and Conflict Resolution.***

# 3. ENVIRONMENTALISM

I am become Death, the shatterer of worlds.

Robert Oppenheimer, in Worster (1991: 339)

## 3.1 Introduction

Quoting from the Hindu epic, the *Bhagavad-Gita*, Robert Oppenheimer watched the first explosion of a nuclear device and, quite fittingly, whether he realised it or not, described the dawning of a new era. Significantly, it was the development of the nuclear age and its incredible power for destruction that added momentum to the realisation that humankind had the power to completely destroy life on this planet (Platig, 1971) Although the ability existed previously, it appears today in ever increasing ways (Wall, 1994: 1), including global warming, acid rain, war, chemical weapons, over population, pollution. It was in response to the feeling of 'become death', that the contemporary Green movement was born (Wall, 1994: 1).

This Chapter explores the concept of environmentalism, showing through a historical approach that conflict is an integral part of the subject area.

Beginning with a brief examination of the reasons and sources leading to the establishment of *environmentalism*, the thesis then discusses the meaning of the term conflict, which is studied with reference and acknowledgement to the scale of application. The notion of conflict resolution/management is then considered, with a view to the form that communication in this area may take. The thesis provides literature and theoretical support throughout this process of review.

## 3.2 The Foundations of Environmentalism

### 3.2.1 Environmental Thinking: the Beginning

To many people the establishment of an environmental movement or outlook may seem to be a relatively new phenomena within human history, "... like a stranger who had just blown into town,.....a presence without a past" (Worster, 1991: xiii). However, concern about the environment has existed in parallel with humanity's development from society's earliest aspirations through to the present day. Survival of early humanity was directly related to good husbandry of the environment, it supplied all the necessities for life; water, food, shelter, clothing. Whether this husbandry was as a result of what could be seen as a modern-day, environmentalist type of thinking, with moral and aesthetic view points and concerns (Hays, 1959), or a more direct concern with survival, is not of consequence here. It is clear, however that an awareness of how humanity fit into nature's bigger picture was present. This awareness was reflected in the religious beliefs of the time, with the respect of "kinship and relatedness of all life forms" (Draper, 1998:

36) found within aboriginal groups, and in the animistic and mystic ideas of the early Celtic, Nordic, and Germanic societies (Taylor, 1992). This awareness was later reflected in the Romantic's interest in the traditional folk societies of the past (Pepper, 1986). Compared to today, it could be argued that early human society lived in harmony with nature, with notions of resource utilisation, and development in balance with the natural world.

### 3.2.2 World Development

As humankind's economic and socio-political development continued at an ever-increasing rate, the relationship between humanity and available natural resources changed. In contrast to earlier days when a natural order or balance towards resource usage, had been achieved either deliberately or, more likely, instinctively. Human society started to utilise and consume resources at an escalating rate, leading to the present situation where in many spheres ongoing utilisation outpaces replenishment (Daly, 1996). With an initial abundance of natural resources available, little thought was put into the effects of this rate of utilisation. As development continued, it became apparent that there were resource limits, intensifying pressure toward the remaining resources.

The exploration, development and allocation of new resources initiated a reciprocal development in the knowledge and expertise required to locate and exploit

those resources, this resulted in the establishment and growth of "classical science" (Pepper, 1986: 98). In particular the Scientific Revolution which directly related to the growth of capitalism, manifested itself between the 16th and 18th centuries (Pepper, 1986). Growth and development of resource utilisation and scientific knowledge became of particular importance during the industrialisation of the Western World. As nations expanded and developed they began to move away from their geographical confines and started to explore new lands, resulting in the exploitation of additional resources, including human, mineral, animal and biological assets. In addition to the exploitation of resources, the invasion of settlers brought more than just humans. A whole array of foreign organisms came with them and were, according to Cosby (1986: 55), a "Biological Phenomenon" responsible for the "take-over" of these lands. As Cosby (1986:55) argues, humanity alone could not have achieved this take-over. His point is elaborated by Gaffield and Gaffield (1995: 48) who noted that "...the take-over resulted from the immigration of 'an aggressive and opportunistic' ecosystem in which capitalism and Christianity were only part of a larger ecological imperialism".

The topic of world-wide expansion and development resulting from the Industrial Revolution is beyond the scope of this thesis, however it is generally recognised (Cosby, 1986; Daly; 1996, Grosvenor, 1988; Wilson, 1991) that a few developed nations such as Great Britain, Spain, Portugal, Canada and the USA have initiated the processes of resource utilisation and development from which the continuing environmental degradation originates. (For further information on how the world developed in the

manner that it did see Diamond, 1998). It is the continuing process of industrialisation and national development, without accounting for environmental effect, that has contributed to the developing volume of environmental degradation, and through this development to the emergence of environmental conflict. As Gaffield and Gaffield (1995: 94) state with regard to these developments:

> "In some cases, knowledge of environmental degradation was simply disregarded uncaringly while, in other cases, it was seen as a necessary price to be paid for *progress*."

### 3.2.3 Economic Pressure

With industrialisation came wealth, created from meeting an increased demand for resources. A market economy was establishing itself and supporting this new economy was an increasing pressure on science to develop the necessary knowledge to locate and develop new natural resources. Additionally, as resources were found or created, the question of how they were to be utilised, allocated and distributed came to the fore.

The problem of distribution and allocation of resources is inherent in the field of economics (Simon, 1996). As resource demand becomes greater than availability, a resource scarcity is caused, leading to the domain of economics, as Simon (1996: 25) suggests:

> Because scarcity is a central fact of life -- land, money, fuel, time, attention, and many other things are scarce -- it is a task of rationality to

> allocate scarce things. Performing that task is the focal concern of economics.

With the emergence of economics, "the science of the production and distribution of wealth" (The Cassell Concise Dictionary, 1989: 418), came a change in the values of natural resources. Natural resources once seen as intrinsic to life, with an importance equal to that of human beings (Wilson, 1996: 13) were now being seen in terms of monetary values.

It was this type of monetary value measurement of natural resources and the consequences that this monetary approach implies, which was and still is an important catalyst for an alternative way of thinking. In opposition to viewing natural resources as a financial commodity which may or may not take into account qualitative values as opposed to quantitative ones, a growing number of people began to question whether the full value of such resources had been accounted for by the industries and businesses benefiting from the utilisation of natural resources. For example during the late 18$^{th}$ and 19$^{th}$ centuries the expansionist worldview, [for an explanation of *Worldview* see appendix D.] was concerned with quantities:

> ....quantities (measurability) mattered, not qualities. Values, emotions, instincts, and all nonmeasurable aspects of the environment were of secondary importance compared to science and reason.
>
> (Draper 1998: 36)

## 3.3 Alternative Thinking.

### 3.3.1 Counter Enlightenment and Romantic Movements

Reaction to this quantitative type of thinking toward natural resources motivated the Counter Enlightenment and Romantic movements (Draper, 1998). Although often described as aesthetic in their outlook (Pepper 1986; Draper, 1998), using the art forms to express themselves, the movement did initiate an alternative, or re-invent a traditional, way of thinking that promoted the value of non-materialism against the advancement of materialism. As (Pepper 1986: 76) states:

> Romanticism is sometimes described as an artistic and intellectual movement, commonly finding expression in literature, music, painting and drama. However it should not be thought of as simply a set of ideas unrelated to what was happening in the material world. For it can be seen clearly as a reaction *against* material changes in the mode of production which can be regarded as part of the emergence and expansion of industrial capitalism in the 18$^{th}$ century, following on the establishment of mercantile and agricultural capitalism.

From these roots came the thought structure reflected in today's environmentalist movement. The movement towards an increased awareness of the environment was a reaction to "the wastefulness and environmentally disruptive excesses of a developing society" (Taylor, 1992, 26) and the notion, suggested by Taylor (1992, 26) that: "...nature is seen essentially as a storehouse of resources to be employed for the satisfaction of ever-increasing material needs by an ever-increasing human population."; that gave the environmentalist movement the momentum it needed to become an established entity.

### 3.3.2 The Sustainable Development Dichotomy

With the expansion in growth, initially fuelled by the Industrial Revolution, development in the location and utilisation of the available natural resources is required to some extent for humanity's survival. As (Vredenburg, Westley, 1997) suggest "....many countries, regions and communities depend on the harvesting of natural resources for their livelihood". However, it is the idea that development is vital for survival, that creates a dichotomy in terms of the thinking within contemporary environmentalist movement. Terms such as Sustainable Development contain an inherent contradiction. What does Sustainable Development actually mean? Can any development be truly sustainable? I.e. indefinite continuation of growth.

The term Sustainable Development has many meanings and approaches (Maser, 1996). However for the purposes of this thesis, the meaning of the term "Sustainable Development", is taken from Manning and Dougherty (1995). Manning and Dougherty's meaning was based on the usage of the term in the 1987 World Commission on Environment and Development [The Bruntland Commission] which, with the 1980 World Conservation Strategy, promoted the widespread use of the term. "Sustainable Development" is:

> ...the use of natural resources to support economic activity without compromising the environment's carrying capacity, which is its ability to continue producing those economic goods and services.
> (Manning and Dougherty, 1995: 30)

By exploring further the idea of the dichotomy existing within the notion of Sustainable Development, this thesis briefly examines the sources of thinking that form the differing

viewpoints. This exploration is important, as it forms background against which the concepts of environmentalism and environmental conflict are viewed.

One of the difficulties with this exploration of Sustainable Development is that there are more than two sides to the problem, as Daly (1996: 1) states:

> Although there is an emerging political consensus on the desirability of something called sustainable development, this term--touted by many and even institutionalised in some places--is still dangerously vague. Apparent agreement masks a fight over what exactly "sustainable development" should mean--a fight in which the stakes are very high.

To unravel and understand the roots of the dichotomy the notion of natural resources is used as focus. Allocation, utilisation and development of these resources, and the relation of these actions to humanity, is at the core of the differing viewpoints within the dichotomy.

### 3.3.3 Natural Resources

One way of viewing the dichotomy is to use, as Homer-Dixon (1991) does, the Neo-Malthusian and Cornucopian perspectives. In Homer-Dixon's (1991) study of these perspectives in relation to humanity's development and usage of natural resources, he recognises that "Experts in environmental studies commonly use the labels 'Cornucopian' for an optimistic perspective, and the term 'Neo-Malthusian' for a pessimistic outlook."

Within the Neo-Malthusian perspective, the term renewable resources is divided into two concepts that distinguish the difference between resource "capital" and its "income" (Homer-Dixon, 1991: 100). "Resource capital" is the asset source which can be utilised by humanity, generating a "resource income". According to Homer-Dixon (1991: 100) those who hold a Neo-Malthusian perspective see a "Sustainable" economy, as one "that leaves the capital intact and undamaged so that future generations can enjoy an undiminished income stream". This definition is quite close to the interpretation of Sustainable Development suggested earlier by Manning and Dougherty (1995).

In contrast to the Neo Malthusian perspective, the Cornucopian perspective or the "technological determinist view" (Benton, 1994: 32) relies on a faith of "market-driven human ingenuity" (Homer-Dixon, 1991: 99) to find a way to solve the problems of resource depletion/degradation. As Simon (1981: 345), a recognised optimist (Homer-Dixon, 1991), states:

> There is no physical or economic reason why human resourcefulness and enterprise cannot forever continue to respond to impending shortages and existing problems with new expedients that, after an adjustment period, leave us better off than before the problem arose.

The two perspectives, Neo-Malthusian and Cornucopian, have differing outlooks toward the use of natural resources. The Cornucopian moves toward a "technological optimist" outlook (Benton, 1994: 32), while the Neo-Malthusian outlook is based, as Jagtenberg and McKie (1997) suggest, on the "unequal ratio between population and perpetually scarce resources" (Ross, 1994: 259). Both viewpoints, Neo-Malthusian and

Cornucopian, are still viewing the natural resource as a human asset. This focused view toward the use of natural resources for humanity's benefit, and other similar views, such as "Wise Management" (Draper, 1998: 36) have the same thought stance. This thought stance views the use of natural resources through the eyes of an expansionist, accepting that development and further utilisation of resources is necessary for the survival of humanity. Thus, from a humanitarian perspective, this focus toward "sustainable development gives priority to global *human* needs". (Paehlke, 1992, cited in Draper, 1998: 40)

In contrast to the expansionist or humanist outlook, the notions of *deep ecologists* or *righteous management* conservationists, whose thought stance originated with the *counter-enlightenment* views and ideas, are concerned with more intrinsic values. The *counter-enlightenment and Romantic* views and ideas began during the late 18$^{th}$ and early 19$^{th}$ centuries, in reaction to the "Enlightenment assumption that the universe was a great machine that rationalised mechanised humans and nature and separated them from their intrinsic spiritual value." (Draper, 1998:36) [For further reading on the historical nature of both the expansionist and ecological worldviews, see Draper (1998: 35-39); and Taylor (1992: 26-33)]

According to the *deep ecologists* or those persons with *righteous management* viewpoints, nature is not seen as a source of exploitable resources needed to fuel a developing society. Early proponents of this thinking, such as John Muir, Aldo Leopold

and Rachel Carson, (Draper, 1998) did not see conservation or environmentalism as being about cleaning up behind a developing society (Pepper, 1984). The emphasis of their argument is that if development continues unchecked, natural areas will disappear, which in time will adversely affect all living species on the planet; animals, plants, mammals, fish. This *Ecological Worldview* sees the universe as "nondualistic, a totality with all its parts interrelated and interlocked." (Draper, 1998: 38). The universe is a system, an eco-system, within which humanity is an integral part.

By exploring the notion of sustainable development through the concept of natural resources, it has been possible to see that there is a division in the outlook or worldviews towards the utilisation of natural resources. There is the expansionist world view, based on the "values of the 18$^{th}$ century Enlightenment tradition" (Draper, 1998: 35), viewing natural resources as an exclusive "storehouse" (Taylor, 1992: 26), for humanity, and there is the ecological worldview. Ecologists view natural resources and humanity as part of one interactive system that works in harmony, the eco-system. Ecologists espouse a holistic notion that means natural resources are valued not just as a financial asset, but also as spiritual and aesthetic assets. These worldviews are shown in Figure 9.

**Two Competing world views**

*Two approaches to conservation in the early 20th century*

**Expansionist World View**
***Values of the Enlightenment Tradition***

(Gifford Pinchot -- "wise management")
Nature is a resource to be used not preserved; conservation must work in league with the dominant society -- and not against them; the primary value of natural areas lies precisely in their value to modern society; conservation should work against the wastefulness and environmentally disruptive excesses of a developing society -- hence, wise scientific management which works within the dominant Expansionist World View.

**Ecological World View**
***Values of the Counter-Enlightenment Tradition***

(John Muir -- "preservation")
The universe is non-dualistic. It is a totality with all of its parts interrelated and interlocked; the biotic community and its products must be protected; nature is intrinsically valuable -- animals, trees, rocks, etc. all have value, "in-themselves"; human activities must work within the limitations of the planet's ecosystems; nature is a forum within which the state of human society can be judged; works against the dominant societal values.

(Taylor, 1992: 29)

Figure 9.

### 3.3.4 Ecocentrism and Technocentrism

To help clarify the separation of viewpoints between the *Expansionist* and *Deep Ecologist*, Pepper (1984) uses O'Riordan's theme of dividing the area of environmentalism into "Ecocentrism" on one side of the spectrum and "Technocentrism" (Pepper, 1984: 31) on the other.

An ecocentric viewpoint views humanity as part of a global ecosystem, and subject to ecological and systems laws. The ecocentric roots of modern environmentalism lie with the Counter Enlightenment and Romantic movements, whose

proponents advocated "a democracy among God's creatures" (Pepper, 1984: 27) and who saw themselves with a moral obligation toward nature, "not simply for the pleasure of man, but as biotic right" (Pepper, 1984: 27).

The technocentric has a strong belief in physical science, the use of management and objective analysis are vital tools to the technocentric in problem solving. This has particular importance when public consultation is taken into account, in that the technocentric viewpoint as opposed to the ecocentric will accept the "authoritative advice of [scientific and economic] experts, over public participation in the decision making process" (Pepper, 1984: 29).

### 3.3.5 Summing Up

From these *techno* and *eco* viewpoints, and the differing thought stances of expansionists and deep ecologists, we can see that even within the conservation/environmental movement there are major differences of opinion. These differences range from the technocentric on one end of the spectrum, to the natural world being viewed as a sacred entity within which humanity is an integral part of the natural ecosystem. As Pepper (1984) suggests the technocentric view point does not promote destruction of the environment, rather technocentrism sees utilisation of natural resources as a matter for control, where control does have an emphasis toward human and economic priorities.

> The technocentric mode does not necessarily declare itself in favour of environmental degradation: usually the reverse. But it holds that this is a matter for efficient environmental management of resources.

And

> ....in any conflict between the demands of economic man and environment, where the interests of the two were not reconcilable through management, economic man would win the day: there is no bioethical sense of nature's rights.
>
> (Pepper, 1984: 29-30)

These two main foci or thought stances, the *ecological* or *ecocentric* worldview, and the *expansionist* or *technocentric* worldview, originate from similar beginnings. It is these similar beginnings that are of importance, and although this chapter has provided a brief look at the root ideas of contemporary environmental movements or outlooks, many important milestones or turning points were omitted. This exploration does show that the principal source of motivation for an *environmental* way of thinking comes from a reaction to the uncontrolled commodifying and development of nature as a limitless supply of resources, used for the sole purposes of one animal species, namely humanity.

One of the milestones or turning points worth noting here was the publishing of 'Silent Spring' by Rachel Carson in 1962. This book, which dealt with the environmental impact and damages created from the use of pesticides, generated "widespread public awareness and concern over environmental values" (Hall, 1986: 4). The publishing of the book also served as a catalyst "in the public emergence of the environmental movement" (Hall, 1986: 4), particularly within the U.S.A. In the book Carson (1962) reflects the notion suggested at the beginning of this literature review through the following statement:

> Only within the moment of time represented by the present century has one species-man-acquired significant power to alter the nature of his world.
>
> During the past quarter century this power has not only increased to one of disturbing magnitude but it has changed in character. The most alarming of all man's assaults upon the environment is the contamination of air, earth, rivers, and sea with dangerous and even lethal materials.
> (Carson, 1962: 5)

Other notable people who had a good deal to provide to the cause of environmentalism in general and Canada include Scotsman John Muir, a strong advocate for the creation of parks and a founder of the Sierra Club, and Canadian Clifford Sifton, a lawyer, and politician, who established the federal forestry branch in 1902. Clifton is known as the father of conservation in Canada (Draper, 1998). In addition American Gifford Pinchot, who worked closely with F.D. Roosevelt, had a considerable influence on establishing the National Forest System.

### 3.4 Science

Before the concept of *Conflict* is introduced and fitted into the picture of environmental resource allocation, the notion of *science* and its place within modern society needs to be considered. As Cohen and Stewart (1995: 29) state: "The central aim of science is to render the complexities of the universe transparent, so that we can see through them to the simplicities beneath."

Science is linked strongly to the *technocentric* outlook as well as being vital for the Malthusian perspective, in that it provides the foundations for these philosophies.

However evidence of classical science can be found within almost all Western cultures, (Pepper, 1984) helping to explain humanity's relationship within the eco-system. In contemporary society, science as a source of knowledge has really displaced the traditional methods of information gathering. As Pepper (1984: 37-38) states:

> ...classical science has displaced alternative ways of understanding the world. It has displaced alternative bodies of natural knowledge, such as myth, folklore and natural magic, and the completeness of this displacement is represented by the pre-eminent position which our society accords to the scientific expert.

Draper (1998) talks about science and the effect its has on our thinking about the environment, and raises the question of value in the contribution of science to the cause of environmentalism and conservation. As Draper (1998: 27) states:

> ... science is not value free: that is, scientists have their own values, interests, and cultural backgrounds that may influence their interpretation of data. This means that we need to be able to evaluate the statements they (and others) make about the environment.

Science is recognised as being very valuable in terms of the knowledge produced, and as Cohen and Stewart (1995: 361) suggest, science is: "...by far the most successful and important worldview, in terms of delivering tangible results and making real changes to the way humanity goes about its daily purpose."

Suggesting that science is responsible for humanity's daily activities raises the question as to whether science has been all good? Many people have suggested that the science paradigm is only one way of looking at the world, as Draper (1998:27) suggests:

> Religious, moral, aesthetic, cultural, and personal values, for example, provide different and valuable ways of perceiving and making sense of the world.

Bocking (1997) suggests that the integrity of scientists and ecologists can be challenged, and that their perspectives can be swayed by the source of their funding. In his book he uses the example of Government funding to show that some, even many, but not all, ecologists have increasingly become political.

> Government funding of science in each of these countries [Britain, Canada and United States] has increased dramatically during the past fifty years. Ecologists have shared in this increase. As a result, the ecological research communities in each country are now many times larger than they were in the late 1940s. This support has had several implications for the role of ecology in environmental politics. Most important, because much of this funding has been provided by national agencies, it has tied ecologists to views concerning the organisation and direction of scientific activity in each country-that is to say national science agencies.
>
> ...it has become increasingly accepted that science can be directed toward specific social and economic objectives.
>
> (Bocking, 1997: 8)

It is clear that without science, the conservation and environmental movements would not be as informed as they are. Hays (1959) argues that conservation was a scientific movement with many conservation leaders springing from such fields as hydrology, forestry, geology. Nevertheless, as Draper, (1998) and Pepper, (1984) suggest, awareness of both the knowledge and shortcomings of science must be applied in order to gain a full understanding of the issues paramount in today's society.

### 3.5 Environmental Conflict

Before concluding the chapter the writing of Libiszewski, (1992) and his work with the Centre for Security Policy and Conflict Research in Zurich, and the Swiss Peace

Foundation in Berne is introduced. His work attempts to close the suggested theoretical gap between *ecology* and *conflict*.

The basis of Libiszewski's argument is that traditionally scholars have linked ecology and conflict as a struggle over resources. As we have seen in the preceding pages, the utilisation and development of resources has been paramount in the development of humanity and its knowledge base, particularly the sciences. Utilisation that includes the development and allocation of natural resources has also been vital to the creation of the contemporary environmental and conservation movements, in that these movements or philosophical outlooks were generated and motivated in reaction to such development. Although there is considerable difference of opinion within these outlooks or movements, the differences are not in the acknowledgement of the problems but more in the manner how they will be solved, for example the differences between the *technocentric* and *eco-centric* or Malthusian and Cornucopian outlooks.

With the continually increasing pressure on resources, it would be easy to conclude that the allocation of resources and the disputes that follow are responsible for environmental conflict. However using the example of wars such as the First and Second World wars, the Algerian war and others (Westing, 1986) that involved environmental factors, Libiszewski (1992) argues that although resources were involved in the conflict, they were not regarded as environmental conflicts. As Libiszewski (1992) suggests these wars were conflicts fought between "actors and over specific issues", such

as "divisible resources, distribution of power, so called national interests, or at least an apparently irrational hatred between ethnic or cultural groups." (Libiszewski, 1992: 7). Involvement of natural resources in a conflict may not be the deciding factor as to whether the conflict should be regarded as an environmental one. As Libiszewski (1992: 2) states:

> ... most scholars would probably agree on the fact that the multitude of wars mentioned above are not really typical examples of what we connect spontaneously with the term *environmental*. So, the involvement of natural resources is evidently not the 'differentia specifica' we mean when we speak about an *environmental* cause of conflict to distinguish it form other causes.

It is important to establish what the *differentia specifica* is as the answer formulates the background to determination of the term *environmental conflict.* Such a determination is vital to this thesis, as it is the definition of *environmental conflict* that establishes the form and type of communication needed to resolve environmental conflict.

The answer to what the *differentia specific* is can be found by accurately defining the term environmental. Until now the term has been used to loosely describe the relationship between humanity and its development within the bounds of the ecosystem. However, a more accurate definition is needed before the term *environmental conflict* can be explained.

Libiszewski (1992) employs the concepts of *ecology* and *environmental change* to deal with environmental conflict. He uses "Haeckel's definition of ecology as the doctrine of the interrelations between living beings and their environment" (Libiszewski, 1992: 3), and incorporates that into an understanding of *ecosystem*. Libiszewski (1992) uses a *biotope* outlook to describe the ecosystem. By this he means that the ecosystem is autopoietic in concept, in that there is a wholeness and self-sufficiency to the system. An autopoietic system as Whitaker (1998) states:

> ....is organised (defined as a unity) as a network of processes of production (transformation and destruction) of components that produce the components that:
> 1. through their interactions and transformations continuously regenerate and realise the network of processes (relations) that produced them; and
> 2. constitute it (the machine) as a concrete unity in the space in which they (the components) exist by specifying the topological domain of its realisation as such a network.

The concept of "complex interrelations within the system and its self-regulating capacity" (Libiszewski, 1992: 3) is supported by such environmental philosophies as the Gaia hypothesis (Lovelock, 1979) which sees the Earth as a "single self-sustaining unit" (Wall, 1994; 78). Continuing on with this concept, Libiszewski (1992: 3) suggests that the eco-system is continually adapting itself to a steady state:

> In general, ecosystems show a tendency to find and maintain a condition in which the single components control and delimit each others extension by feedbacks. We can therefore speak about a dynamic equilibrium that oscillates around an ideal average.

Because of this feedback system a human-caused change in the environment does not just imply an "interaction between human beings and their environment" (Libiszewski, 1992:

3) it means a "destabilising interference in the ecosystems equilibrium". (Libiszewski, 1992: 3)

Considering that the term *nature* is a social construction, it is only from a human perspective that environmental change can be described as a loss of quality, or degradation. As Libiszewski (1992: 3) suggests: "from the perspective of an ecosystem environmental change is just a process of adaptation and regulation." This does not indicate that *nature* will either benefit or lose from change, it just means that the concepts of *nature* and *ecosystem* are human ones, and that from *nature's* perspective change is only a process of adaptation through time. Conceptually, this autopoietic notion of nature adapting, evolving and growing is supported by Adam (1994: 95):

> The natural environment is thus a temporal realm of orchestrated rhythms of varying speeds and intensities as well as temporally constituted uniqueness. It is also a world of organisms with the capacity for remembering and anticipating, of beings that time their actions, synchronise their interactions and reckon time. The very essence of life, furthermore is growth and evolution.

Using the notion of environmental degradation as a human social construct means that, as Libiszewski (1992: 3) suggests, "The term *environmental degradation* understood as a human-made environmental change having a negative impact on *human society* expresses rather precisely what we mean by an *environmental* cause of conflict"

## 3.6 Conclusion.

As humanity increased demand for natural resources and as the knowledge base changed from traditional methods of husbandry to a scientific approach, the ecosystem from a humanistic perspective has become unbalanced. Unbalancing has lead to a reaction in the direction and participation of humanity within the ecosystem, realising itself in questioning the manner and bearing of society, and motivating a number of differing outlooks and philosophies, such as ecocentrism, deep ecology, technocentrism and expansionist viewpoints.

Using a resource based outlook to study the notion of *sustainable development* and the continually developing interaction of humanity within the ecosystem, this thesis has come to the point where environmental conflict is seen as a *resource degradation* concept, as opposed to a *resource scarcity* problem (Libiszewski, 1992). One important point to note is that the notion of *environmental* in terms of cause of conflict, suggested by Libiszewski (1992), is based on a more *ecocentric* ideal than a *technocentric*.

Libiszewski (1992) views the concepts of humanity and natural resources as one ecosystem, implicitly linked together, not as separate entities:

> By *ecosystem* we understand a circular feedback control system encompassing the living beings and their biotic and abiotic environment in a certain space. Both definitions stress the idea of complex interrelations within the system and its self regulating capacity.
>
> (Libiszewski, 1992: 3)

The philosophical source of the notions suggested by Libiszewski (1992) is of importance because it forms the framework of definitions that will decide how communication fits into the picture of *environmental conflict*. In the following chapter the meaning that *resource degradation* has in relation to the concept of *environmental conflict* is explored.

# 4. CONFLICT

## 4.1 Introduction

Conflict seems to be a readily understood subject. As Lewis (1993: 123) states: "Conflict erupts when people with competing interests and different values interact". However, as we have seen in the preceding chapter the question of accurately defining conflict is quite a bit more complex. As Thomas (1976: 889) suggests: "Conflict, like power, is one of those fascinating but frequently abused and misunderstood subjects". The purpose of this chapter is to define what conflict means in an environmental sense with a view to resolution using simulation modelling.

The thesis takes a two-stage approach to defining environmental conflict. The first stage develops some criteria of measurement, against which a definition of environmental conflict is be assessed. The second stage applies the definition chosen by this author against those criteria.

## 4.2 Developing the Criteria for Definition

### 4.2.1 A Realist Approach

Conflict has been studied and written about for centuries, going back at least to Greek times when Thucydides looked at the Peloponnesian War in the 5$^{th}$ Century (Malnes, 1993). In more modern times it was the publication in the 16$^{th}$ Century of the English philosopher Thomas Hobbes's book *The Leviathan*, in which a theory of conflict was first established. The emphasis of Hobbes's book was toward understanding social conflict

and civil war, with the main thrust of the explanation looking at the motives and choices of individuals (Malnes, 1993). Hobbes based his theory of conflict on differing goals, using three primary causes of contention; "Competition, Diffidence, and Glory" (Malnes, 1993: 25), and established that these areas of contention or quarrel are the motivators toward violent conflict.

Though this is a basic understanding of his theory, the main point portrayed is that Hobbes's thesis of "inevitable escalation" (Malnes, 1993: 29) is in the realm of realist thinking, in that it suggests that politics, "civil governance and administration" (Cassell Concise English Dictionary, 1989: 1024) is "pervaded by conflict and the struggle for power." (Malnes, 1993: 12). As Malnes (1993: 13) states:

> There are different renderings of political realism and, although they revolve around kindred assumptions, their divergences are substantial. I shall indicate some of these varieties below, but my main aim is to develop a coherent and plausible version of the realist perspective. For this purpose the work of *Thomas Hobbes* provides useful guidance. He is sometimes spoken as the "quintessential realist," and political realism has been spoken of as the "Hobbesian tradition" (Hanson, 1984, p.329; Bull, 1981, p717).

The Hobbesian or realism view of social conflict is well established and used as a basis for a number of differing theories of conflict, for example Malnes (1993) and Ignataieff (1998). Nevertheless, there is a question of applicability in using the Hobbesian or realist view in looking at conflict from an environmental perspective. The Hobbesian or realist view does base itself in viewing social issues as the base for conflict

(Malnes, 1993) as does, to some extent, the ecological view. It is the question of the perspective through which these viewpoints regard the environment that is of importance.

Motivated by the notion of peaceful living, a realism perspective of conflict resolution concentrates on the power of the state. People must live in governmentally controlled cities and states, where the government has the "power to make up and enforce laws." (The Cambridge Dictionary of Philosophy, 1995: 334). Thus the world or environment may be separated into political segments, using international and national borders as limiting barriers.

These politically constructed barriers are not totally applicable to environmental issues. Even though the term nature is a social construction, nature as a subject itself does not abide by any political boundaries or borders. The Hobbesian or realist system or view of society does not take this environmental perspective into account. As Homer-Dixon (1991: 84-85) states:

> ...this emphasis on states means that theorists [of a modern realist perspective] tend to see the world as divided into territorially distinct, mutually exclusive countries, not broader environmental regions or systems. Realism thus encourages scholars to de-emphasise transboundary environmental problems, because such problems often cannot be linked to a particular country, and do not have any easily conceptualised impact on the structure of economic and military power relations between states.

Homer-Dixon's (1991) comments indicate that a realist will try to compartmentalise nature into unrealistic concepts, with no respect or understanding of the

ecosystem's own boundaries or limits. A lack of understanding of the natural boundaries of an ecosystem leads to a misunderstanding of "the important aspects of global environmental problems" (Homer -Dixon, 1991: 85)

Although the Hobbesian approach does not provide a solid understanding of conflict theory in terms of the environment, it does indicate that any definition of the term *environmental conflict*, must view the notion of nature and the environment as a whole system with divisions separate from the divisions of political maps with countries and states, or power bases. The notion of viewing nature as a whole with unique areas of influence also should apply to any notion of environmental conflict management and resolution.

### 4.2.2 A Semanticist's Approach

As Libisweski (1992) suggests there has been little attempt to "clarify *theoretically* what *environmental* causes of conflict are" (Libisweski 1992:2). This notion is also supported by Homer-Dixon (1991: 83) who states that much of the writing on "the link between environmental change and conflict has been anecdotal." However there has been a good deal of study on the subject of conflict itself, as shown by Hobbes.

One particular view that is of interest is the semanticist's conceptualisation of conflict. As suggested by Bernard (1957: 40) the semanticist school of thought "hold[s] that conflict in the sense of mutually incompatible values and goals does not exist." This

semanticist viewpoint is in contrast to Lewis's (1993) suggestion of conflict noted previously. The argument as used by the semanticist viewpoint is that conflict in the "social-psychological" sense (Bernard, 1957: 40) does indeed exist, but it only does so because of a misunderstanding in communication. This point suggests that if the misunderstandings were to be avoided, and communication effective, then "conflict itself would disappear" (Bernard, 1957: 40). According to Bernard (1957: 40) the view in its simplest form is that:

> Many conflicts are due not to natural cuussedness but to the failures in evaluation... Whatever improves... and clarifies communication is sure to help agreement... Nearly every human quarrel is soaked in verbal delusions. If they could be squeezed out, as one squeezes a sponge, many quarrels would simply vanish.

This semanticist viewpoint is an "application to social life of a theory of logic considered the Aristotelian fallacy" which was the "work of the so-called Vienna circle" (Bernard, 1957: 41). Through the use of logic and scientific methods the Vienna circle hoped, "by removing all ambiguities from syntax and definition, to solve the major philosophical problems which had arisen from the inaccurate use of the language." (Bernard, 1957: 41). Contributions of the Vienna circle, or logical theorists such as Moritz, Schlick, Carnap and Wittgenstein, were "a profound contribution" to logical, intellectual and scientific problems (Bernard (1957: 41). However, it was when the "disciples" of Moritz, Schlick, Carnap, and Wittgenstein started to apply the logical positive viewpoints to social problems, that the difficulties arose (Bernard, 1957: 41). The semanticist approach to conflict is considered an appr. . of the positive logical theory to social problems and, as such, is open to critique (Bernard, 1957).

Though the semanticist viewpoint has not become an established theoretical approach to conflict it does, within its critique, provide two valuable points (Bernard, 1957). The first of these points is that the semanticist's approach does not account for the fact that disagreement does exist. The second point is that this disagreement does not always lead to conflict. As Bernard (1957: 41) states:

> ... mutually incompatible values do exist, and ... there is no unequivocal evidence that misunderstandings always lead to conflict....

Another important notion from the semanticist's approach is the linking of communication (or the lack thereof) to the formation of conflict. The semanticist's suggestion is that by improving communication one will remove conflict (Bernard, 1957). A critique of the semanticist's linking of communication with conflict resolution is the belief of the semanticists that conflict resolution is solely attributed to the improvement in communication (Bernard, 1957). In reality, communication is only a part of the whole solution of conflict resolution.

In relation to Bernard's (1957) second point of critique where he suggests that not all misunderstanding creates conflict, Thomas (1976: 889) suggests that:

> A balanced view of conflict is emerging in the literature which recognises that conflict can have constructive or destructive effects, depending upon its management.

The positive outlook on conflict suggested by Thomas (1976) is also supported by Kruk (1997), Maser (1996) and Moore (1982; in Radford Hall 1986: 38) who all propose that

conflict has the potential to create and motivate the production of "new standards, new institutions, new patterns of relationships, and may be necessary in the pursuit of justice." (Radford Hall, 1986: 38).

### 4.2.3 The Defining Criteria

By initially looking at conflict through the framework of a Hobbesisan or Realist approach, and assessing how the Hobbesisan or Realist approach applies to notions of conflict within nature or the environment, and then by adding a critique of the Semanticist's views, in relation to conflict and the part communication has to play in the resolution of conflict. A number of criteria for the definition of environmental conflict have been developed.

Any definition used by this thesis has to be considered within the framework suggested by Homer-Dixon (1991), in that the definition of environmental conflict cannot be founded within the socially constructed political boundaries of the Hobbesian and Realist perspectives. Additionally, the definition of environmental conflict has to reflect the notion suggested by Thomas (1976) that not all conflict is destructive. Finally, any definition of environmental conflict also has to recognise to some extent the semanticists approach that communication is a key to resolving conflict. However, the point that communication is only one of a number of tools in conflict resolution also needs to be taken into account.

Libiszewski's (1992) suggestion of environmental conflict as an environmental degradation problem and not a renewable resource scarcity problem, also needs to be assessed with regard to the established criteria.

## 4.3 Assessing the Definition against the Measurement Criteria

### 4.3.1 Libiszewski's Definition

In relating to Homer-Dixon's (1991) perspective of the relationship between the environment and conflict, Libiszewski (1992) differentiates between *renewable* and *non-renewable* natural resources. The premises of his thoughts are based on the fact that *non-renewable* resources can be depleted but not degraded. This difference originates in the integration of the resource into the autopoietic ecosystem mentioned in Chapter 3. As Libiszeweski (1992: 3) states:

> The main fields we think of when we speak about environmental problems, namely fresh water, soil, forests, air, atmosphere and climate, oceans, and biodiversity, represent all *renewable* "goods" or "services". They are renewable because they are *ecologically* integrated in a feedback circle system which guarantees their replacement or the preservation of their quality. Minerals and fossil fuels, on the other hand, which are the traditional objects of resource conflicts, are non-renewable resources because they are not integrated in such an ecosystem. Therefore they can be *depleted* but they cannot be *degraded."*

The argument put forward by Libiszewski (1992) is that *non-renewable* resources are not part of an autopoietic ecosystem because they are in a non-regenerating state; thus any use of them is depletion and not degradation. [It could be argued that fossil fuels are a renewable resource because of their organic origin, however in terms of the time scale

required and their present "disproportionate" use by humanity, they are "from a human perspective, non-renewable" Libiszewski (1992: 10).]

In contrast to *non-renewable* resources, *renewable* resources are open to degradation. By being integrated into an autopoietic ecosystem *renewable* resources are constantly being regenerated and decontaminated. This regenerating cycle should continue indefinitely; the exceptions arise where humanity with over-use and disregard for the renewable rate of such resources, has caused a degradation in quantity and quality leading to a scarcity of resources. The degradation of resources links to Libiszewski's (1992) concept of *environmental degradation* previously stated, as an explanation for what is meant by an "*environmental* cause of conflict" (Libiszewski, 1992).

Conflict over the access, control and ownership of *non-renewable* resources is not regarded as *environmental conflict* (Libiszewski, 1992). These types of conflict fall into the economic category of conflict, as suggested by Simon's (1996) explanation of scarcity and economics.

In addition to the concept of *non-renewable* resources as a source for economic gain, the differentiation between *renewable* and *non-renewable* resources is important because the issue of resource substitution can be explored. The loss of a *non-renewable* source means that a substitution has to be found. For example, the loss of one power resource can make way for the development of another, which up until the time of loss

may not have been viable, for a number of reasons such as economics, safety, or accessibility. In contrast, the loss of a *renewable* source is of much greater importance. *Renewable* resources are valuable both in an economic sense, but also in a biological sense. *Renewable* resources are fundamental to humanity's existence. The notion that *renewable* resources are fundamental to life can then be tied into the concept of environmental degradation, suggested by (Libiszeweski, 1992) as mentioned previously in Chapter 3.

To Libiszeweski (1992: 3) the term *resources* indicates in a broad sense:

> "...not only material *goods* provided by nature. The capability of the environment to serve as a sink for wastes and products of human activities can, in its instrumental dimension, also be interpreted as a natural resource".

Viewing the environment as a pool of resources, and as a disposal pit for waste, the degradation of fundamental life supporting resources introduces a third factor. Libiszewski (1992: 4) calls this factor the "space of living" which alludes to existentialism, or to a lesser extent the inclusion of an aesthetic element in viewing the environment.

However, in considering Libiszewski's (1992) concept of environmental conflict, all these factors should be looked at within the parameters of the concept of scarcity. Libiszewski (1992: 4) states that four distinct types of scarcity should be distinguished:

1) *physical scarcity* means that a resource is only available in a finite amount;

2) *geopolitical scarcity* means that resources are often distributed unequally on the surface of earth so that some countries depend on deliveries from others;

3) *Socio-economic scarcity* concerns the unequal distribution of purchasing power and of property rights to provide natural resources between or within societies;

4) A last type of resource scarcity concerns resources that have traditionally been regarded as plentiful and naturally renewable but are becoming scarce now because of the failure of human beings to adopt sustainable methods of their management. We should call this type *environmental scarcity* - scarcity caused by environmental degradation!"

Although these types of scarcity can be "causally interrelated" they should be viewed separately, as Libiszeweski (1992: 4) states:

> Unequal geopolitical and socio-economic distribution are often a source of degrading behaviour; and the physical scarcity of a renewable resource can be a reason for the depletion of the resource 'capital stock'. Nevertheless, we should regard them as distinct *dimensions* of scarcity.

It is the distinction between them which is important to Libiszewski (1992) as it defines the environmental origin of the type of conflict. It is here that Libiszewski (1992) addresses the realism notion suggested by Homer-Dixon (1991). As is seen from the quoted passage only the fourth scarcity is attributed to *environmental degradation*. The others, although linked to some extent, are really elements of *resource distribution*. Conflicts caused by these elements are not *environmental conflicts*, but are consistent with the traditional forms of conflict (Libiszewski, 1992).

By including the notions of scarcity, with the dimension of *space of living* and the concepts of renewable resources, Libiszewski (1992: 4) comes to the following definition of *environmental conflict:*

> An environmental conflict is a conflict caused by the *environmental scarcity* of a resource, that means: *caused by a human-made disturbance of its normal regeneration rate*. Environmental scarcity can result from the *overuse* of a renewable resource or from the overstrain of the ecosystem's sink capacity, that is *pollution*. Both can reach a stage of a *destruction of the space of living*."

By excluding non-renewable resources from the definition and then differentiating the renewable resources by way of their scarcity, Libiszewski (1992) recognises the argument put forward by Homer-Dixon's (1991) critique of the realist outlook towards environmental conflict. In the fourth type of scarcity Libiszeweski (1992) supports Homer-Dixon's (1991) view point. In defining environmental conflict as caused by environmental scarcity, Libiszeweski (1992) acknowledged that the environment goes beyond the social constructed limits set by the realist outlook. The environment is bigger than society, indeed society or humanity is only a part in the whole system of ecology.

Nevertheless, Jessie Bernard (1957: 34) suggests that conflict is a complicated social phenomena:

> Conflict is not something separate from organisation; disintegration implies integration. Inherent in the whole problem of conflict are such phenomena as power leadership, the elite, control.

However, Libiszewski (1992: 6) acknowledges Bernard's (1957) suggestion by stating that:

> ...environmental effects do not lead directly to conflicts. They produce and will increasingly produce several casually interrelated social effects. Only these, in turn, *may cause* specific types of violent conflicts.

This acknowledgement that *environmental conflict* is only part of sociological phenomena is also important in answering the other two criteria set earlier for a definition of *environmental conflict*. The inclusion of environmental effects producing inter-relations of society indicates that communication will have a part to play in any interaction, management and/or resolution of conflict. As Bernard (1957: 63) states when discussing a systematic orientation towards conflict:

> Research on conflict which is based on a systemic orientation assumes that all social life consists of interaction within and between social systems.

This statement indicates that interactive communication is a vital building block in the structure of humanity, a building block that is of particular importance in the expression of views and argument.

## 4.4 Conclusion

By looking at environmental conflict using Libiszewski's (1992) notion of environmental degradation, and then establishing the parameters with Homer Dixon's (1991) critique of the realist approach, and the concepts suggested by the semanticists, a definition of *environmental conflict* has been established, one that recognises how *environmental conflict* fits into the sociological framework. The definition recognises the dimension of *space of living*, and acknowledges the part that interactive communication has to play in the management and/or resolution of conflict.

The question of where communication fits into the picture of environmental conflict management and or resolution is a vital element in this thesis, and is dealt with in more detail in the next chapter. By looking at the literature from environmental sources, as well as other areas, the various methods for the resolution of environmental conflict are explored. The exploration is achieved by looking through the framework established by the definition of environmental conflict given in this chapter

# 5. CONFLICT RESOLUTION

> The dynamics of a conflict situation are determined by the issues underlying the opposition, i.e. conflicting interests or conflicting means for satisfying a common or shared interest.
>
> Poitras and Renaud (1997: 7)

## 5.1 Introduction

Conflict resolution presents itself in many forms; indeed, there are as many ways to resolve conflict as there are conflicting situations, and each situation has to be resolved in its own unique way (Bingham, 1986; Dearden and Mitchell, 1998; Johnson and Duinker, 1993, Susskind and Cruikshank, 1987).

By exploring contrasting approaches to conflict resolution, this thesis briefly sets out the strengths and weaknesses of each approach. The place of communication within the resolution process is then considered, with particular reference to environmental conflict and the alternative dispute resolution process. Industrial dispute resolution is then used as a subject as it provides an applicable model for dispute resolution that moves away from the weaknesses found in the judicial approach. From this approach, communication as an interactive medium is then explored in terms of social action and conflict resolution.

## 5.2 Approaches to Conflict Resolution

### 5.2.1 Litigation

A number of different general methods or approaches can be applied to the resolution of conflict, each of which can be then modified or customised to fit each particular situation. Traditional approaches use "political, administrative and judicial means" (Dearden and Mitchell, 1998: 250) to solve the disputes, with the judicial approach the most common (Radford, 1986). Litigation, the main effect of the judicial approach, is founded on centuries of process and law, and puts an emphasis on finding a winner or disciplining a loser (Bacow and Wheeler, 1984, Dearden and Mitchell, 1998). Although as an approach litigation is falling out of favour due to the process being viewed as "unduly adversarial, time consuming, and expensive" (Dearden and Mitchell, 1998: 50), litigation does have a number of benefits which should not be dismissed.

Litigation is significant for two reasons; the first is that it is an important tool for the "interpretation and enforcement of environmental laws" (Talbot, 1983, vii), and the second is that litigation can offer empowerment. Through litigation "small groups or individuals" (Bacow and Wheeler, 1984: 2) can take on larger corporations and government agencies. By involving an entity or group in litigation, the larger corporations and government agencies are obliged to respond; in the words of Bacow and Wheeler (1984: 2), litigation "forces action". The disadvantage to the smaller groups or individuals is that as a lawsuit develops, often taking a long time to come to any conclusion, the benefits of initial involvement are outweighed by the financial clout of

bigger organisations. However, the actual filing of the lawsuit is often the needed catalyst to start other types of negotiations (Bacow and Wheeler, 1984; Ury, Brett, and Goldberg, 1988). As Bacow and Wheeler (1984:13) state:

> Litigation can be attractive because it is cheap, relatively speaking, at least in the early stages. The costs of instituting a lawsuit are usually minimal. Subsequent stages-retaining expert witnesses, engaging in extensive discovery, and the like-can be extremely expensive, of course, but some of the advantages of litigation noted previously may be obtained at the outset.

Litigation has its place as a conflict resolution tool, but it seems that the full judicial procedure through the approach of appointing blame and punishment, does not get to the core of the conflict. The real issues often get lost in the process: "...environmental lawsuits seldom resolve the real differences between the contending parties." (Bacow and Wheeler, 1984: 18). See also Susskind and Cruikshank (1987: 9), who state that in particular:

> ... the courts are often unwilling (and in many instances, unable) to fashion remedies that meet the needs of all sides. Simply put, the court's purpose is to interpret the law, not to reconcile conflicting interests.

The appointment of blame, or dealing of punishment, can encourage people to approach the resolution process in a very defensive and/or aggressive manner. Instead of looking to see how the conflict can be resolved, and working toward this goal, the participants find themselves in a battle, where there are winners and losers, and winning the battle takes precedence over resolving the conflict (Edmond, 1987).

### 5.2.2 ADR (Alternative Dispute Resolution)

In response to the oppositional attitude, the consensual approach introduces a more positive attitude to the conflict resolution process. The processes involved in the consensual approach are often grouped together under the title of ADR, Alternative Dispute Resolution (Coates, Furlong and Downie, 1997). ADR includes all methods of conflict resolution other than the "formal adjudication" (Coates, Furlong and Downie, 1997: 3), that is, methods previously described by Dearden and Mitchell (1998: 250) as "political, administrative and judicial" (Costantino and Merchant, 1996).

In contrast to litigation and judicial processes, negotiation/mediation puts the emphasis on the parties establishing the goals of the final decision (Bacow and Wheeler, 1984). Because of this, "negotiation is more likely to produce results that accurately reflect the preferences of the parties" (Bacow and Wheeler, 1984:19), with the outcome that the real issues will be addressed (Bacow and Wheeler, 1984, Bingham 1986). As Bingham (1986: xv) states, the objective in the processes of litigation, and judicial type approaches such as "administrative procedures, and arbitration", is not to come to a "consensus amongst the parties", but to establish a winner.

If the objectives of litigation and judicial approaches are not to achieve consensus, the question that directly follows is: Do alternative dispute resolution approaches arrive at consensus amongst the parties? The answer is: not in every case (Johnson and Duinker,

1993), but unlike the judicial processes at least the direction of the process is toward a common goal, and not to a win/lose outcome.

An alternative consensual approach toward dispute resolution involves collaboration, which entails that participants voluntarily or willingly come to an agreement, with a genuine desire to work together and reach a "mutually acceptable agreement" (Dearden and Mitchell, 1998: 251). This process involves effective "face to face" negotiation (Dearden and Mitchell, 1998: 251) with the participants themselves deciding what the paramount resolution issues are, with the emphasis on the issues as opposed to the resolution procedure (Sadler and Armour, 1987). Although the consensual approach is proving popular and effective (Amy, 1983), the applicability of the resolution mechanisms is still a debatable topic. It is important that the right techniques, whether they be judicial or consensual, are used at the appropriate times to avoid negative resolution. The topic of whether conflict is negative or positive was discussed earlier in Chapter 4, where it was noted by Thomas (1976: 889) that if resolved properly, conflicts or disputes offer a positive, constructive way forward (Maser, 1996; Morse and Ivey, 1996). However if there is poor resolution, either through the method chosen or the manner in which it was achieved, the effect will then be negative and destructive (Johnson and Duinker, 1993).

Although this is a brief look at conflict resolution approaches, it is recognised [by the researcher] that there is considerably more information on each of the topics. Each of the above readings referred to is a useful source of information on the various areas.

## 5.3 Communication and Conflict Resolution

### 5.3.1 Introduction

For this thesis the important question is how does communication fit into the picture of conflict resolution. In particular, the integration of environmental conflict, communication, and conflict/dispute resolution, is key to understanding the argument suggested in this thesis, as Johnson and Duinker (1993: 20) state, "Communication among individuals and groups is the only way to resolve conflicts properly."

However, the decision pertaining to the type of communication required in the resolution of environmental conflict needs to be taken looking through the framework established by the definition of environmental conflict by Libiszeweski (1992) that has been utilised by this thesis. In doing so the concepts of social space, social action and the effects of such concepts on natural resources, should be taken into account.

As is shown in the previous chapter, environmental conflict is concerned directly with the environmental scarcity of renewable natural resources (Libiszeweski, 1992), resulting from the poor management and action of humanity. Thus, social action or inaction lies at the heart of environmental conflict, with the consequence that any

resolution of environmental conflict could be an integral part of the scarcity. As Thomas (1976) suggests, conflict and its resolution can have a negative as well as positive outcome.

### 5.3.2 Alternative Sources for Conflict Resolution

In exploring the notion of the ADR approaches further, the use of literature from the areas of labour conflict and social work is important to the thesis argument. These areas appear [to this researcher] to be better established than the available environmental research literature with regard to viewing communication as a vital ingredient in the resolution of conflict. This is not to say that the environmentalists do not recognise the importance of communication, rather that they tend to assume its existence and look more closely at how the results of communication can be used. For example, the majority of the environmental conflict literature is concerned with the processes of mediation and negotiation, within which communication is apparent. However even within this area of mediation and negotiation, there is some critique as to the application of these areas to environmental issues. As Jacobs and Rubino (1988:18) state: "The negotiation process as applied to environmental conflicts has not been adequately justified in theory and is fortified only by scant empirical study". Thus, it appears that relatively little of the environmental conflict resolution literature looks at the underlying theory of communication, and the reason for its importance. For this reason, notions of conflict resolution from alternative sources have been explored.

### 5.3.3 Labour Relations

The notion of using the knowledge gained from labour conflict resolution in the study of communication within the concept of environmental conflict resolution is not new. For example, when discussing environmental mediation, Talbot (1983: 91) also suggests "a parallel here to labour-management mediation". This point is supported by Blackburn and Bruce (1995). However, Talbot (1983: 91) also illuminates the differences between labour conflict/mediation and environmental conflict/mediation:

> ...the setting for environmental mediation is more complex and less structured [than the setting for resolution in labour disputes]. There is no contract that is about to expire. There are usually more than two parties. The issues [within resolving an environmental dispute] are measured not only in dollars and cents, but are cast also in conflicting values about how decisions affecting natural resources should be made.
>
> (Talbot, 1983: 91)

Such differences are of importance when using examples or models from labour relations and applying them to environmental conflict, particularly in the area of measuring the value of natural resources. As has been noted previously, the commodifying or pricing of natural resources without the total cost to humanity taken into account, is the source of many environmental conflicts.

### 5.3.4 Resolving Disputes

The work completed by Ury, Brett and Goldberg (1988) in their study of conflict/disputes within the labour work force offers a model which explains the escalation through which social action can lead to serious conflict/disputes. This model is applicable here [to this particular research] in that it deals with the differing, escalating areas where

conflict/disputes in general exist, not the specifics of labour conflict/disputes. This satisfies the critique stated by Talbot (1983) by avoiding the issue of valuing natural resources. [Throughout the discussion of this model, I use the terms dispute and conflict interchangeably, as the differences between them are relative to particular areas within the *distressed/effective* dispute resolution system (Ury, Brett and Goldberg, 1988: 19). *Conflict* can mean an "opposition of interests" (Cassell Concise English Dictionary, 1989: 273), and *dispute* can mean "to strive against another, to compete" (Cassell Concise English Dictionary, 1989: 378). These are differing notions that have separate implications when applied to the *distressed/effective* dispute resolution system.]

Ury, Brett and Goldberg (1988) suggest that conflict/disputes evolve through a three tier resolution process or system, shown in Figure 10. Ury et al. (1988) note that a disagreement in *interests* if not recognised or dealt with quickly, can lead to a discussion and establishment of *rights*, which if unresolved then can become a battle or statement of *power*. They also recognise that a conflict/dispute can start at any point on the continuum, not all conflict/disputes start with a disagreement of interests. In addition Ury et al. (1988) also understand that not all conflict/disputes can be resolved with an agreement or resolution of interests. "The problem is that rights and power procedures are often used where they are not necessary", creating a distressed system of resolution (Ury, Brett, Goldberg, 1988: 18). For example, an environmental conflict situation may occur in a condition where resolution could be achieved by having a discussion. However, it might be the case that the parties involved do not know how to accomplish this, so one or

both parties resort to the traditional method of using the courts. This wastes judicial resources on a situation that could have been resolved quite easily and, additionally, fails to resolve the true cause of the original dispute.

The key to avoiding a distressed system of resolution is to move into an effective system where "most disputes are resolved through reconciling interests" (Ury, Brett and Goldberg, 1988:18). As Kruk (1997: xii) states, "...disputes can have constructive consequences if the parties air their different interests."

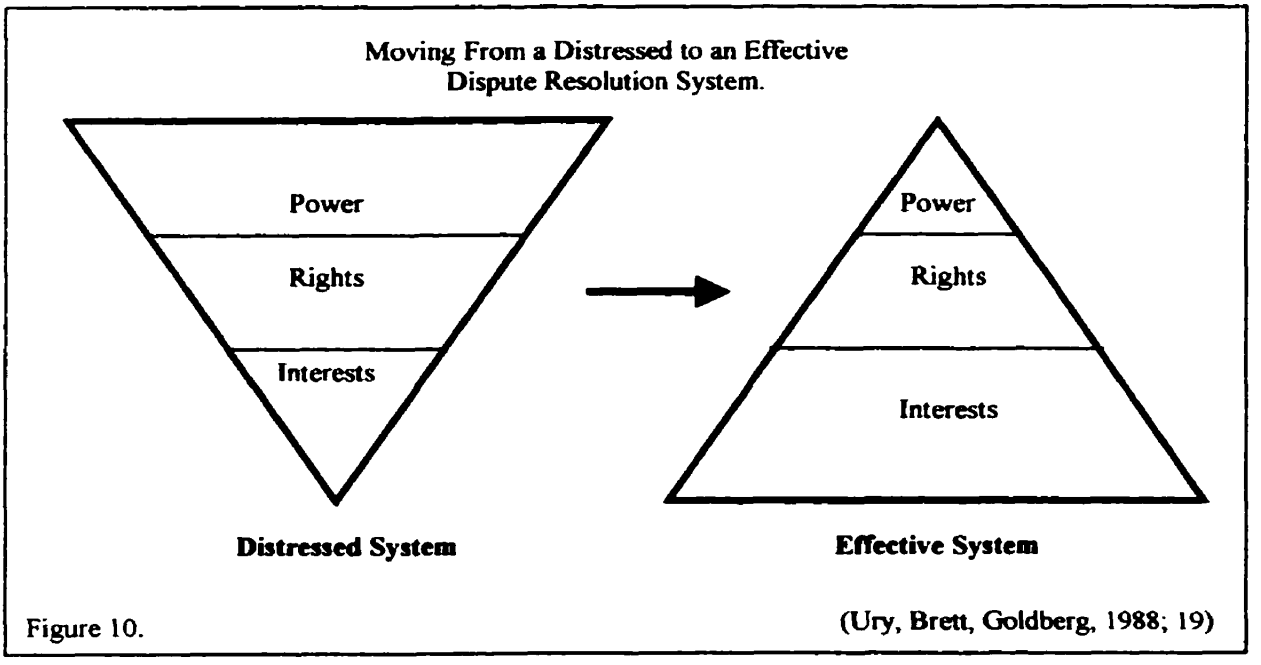



Figure 10. (Ury, Brett, Goldberg, 1988; 19)

### 5.3.5 Resolution as Social Action

As suggested previously, environmental conflict is a result of social action which has caused an environmental scarcity of a renewable resource (Libiszewski, 1992: 4). The resolution of this type of conflict must also involve social action. As we have seen, conflict involves power relations (Thomas, 1976), differences in interests (Lewis, 1993), and the establishment of rights (Ury, Brett and Goldberg, 1989). These differences traditionally have been resolved using the "political, administrative and judicial means" (Dearden and Mitchell, 1998: 250) with the judicial approach being the most widely used tool for establishing a resolution. Use of the judicial system results in many dispute/conflict situations being resolved or decided by the establishment of rights and or power, which in turn may create or change the *Distressed* model of dispute/conflict resolution (Ury, Brett and Goldberg 1989).

As suggested earlier (Bacow and Wheeler, 1984; Susskind and Cruikshank 1987), the use of the judicial approach does not really get to the root of the problem, because of the emphasis on *rights* and *power*. To get to the real source of a conflict, an ADR method of resolution, which includes tools such as mediation, negotiation and arbitration (Coates, Furlong and Downie, 1997), would prove beneficial in many cases (Maser, 1996). The reason for this is that dealing with conflict at an *interest* level means communicating in an interactive manner and, as Forester (1983: 236) states: "Communicative interaction lies at the heart of social action." By moving the emphasis of the resolution technique away from conflict/disputes about *rights* and *power*, and by

dealing with the conflicting parties with a view to reconciling *interests*, interactive communication can have a positive effective in the resolution of environmental conflict/disputes. In this way the traditional and sometimes less effective adjudicative approach could be avoided. At the same time, the "Distressed model of Dispute resolution" becomes an "Effective model." (Ury, Brett and Goldberg, 1989:19).

## 5.4 Conclusion

Through the exploration of selected traditional and alternative forms of conflict resolution, and through the use of some notions of conflict/dispute resolution from alternative sources, in particular the concept of a *distressed* and *effective* dispute resolution system, (Ury et al. 1988: 19)( Figure 8.), and by linking the concept of a *distressed* and *effective* resolution system suggested by Ury. et al. (1988) with the definition of environmental conflict previously established by Libiszewski (1992). It has been possible to establish the form of communication required to deal with the resolution of environmental conflict.

By using a definition of environmental conflict that is based on social action, it has been established that interactive communication is vital for the resolution of environmental conflict. Interactive communication is vital for environmental conflict resolution because by communicating in an interactive manner it is possible to explore and reconcile differing interests. This is an idea supported by Ury et al. (1989: 14) who

suggest that for true resolution to take place, a more determined effort should be made to reconcile interests:

> Reconciling interests thus tends to generate a higher level of mutual satisfaction with outcomes than determining rights or power. If the parties are more satisfied, their relationship benefits, and the dispute is less likely to recur.

The notion of reconciling interests is in contrast to use of the more traditional approach of institutional forms of adjudication. Indeed as Forester (1983: 236) states, "actions such as judicial sentencing or applying an organizational rule....rely on prior communicative actions and conventions", resulting in the apportion of blame, but not clarification of reason. Forester's points support's the notion that interactive communication, when used in conjunction with reconciling interests, can be an important tool in the resolution of environmental conflict.

Although it is recognised that there are a number of differing types of interactive communication, the following chapter focuses on the concept of computer simulated modelling as a possible interactive communication tool. This is achieved by exploring two avenues. The first of these involves exploration of the notion of animation as opposed to text or speech, with a view to creating a base level of understanding for all participants. Because text and speech can have very specific individual or local meanings, for example technical or scientific language, images can sometimes cross barriers formed by these individual or local meanings. Images have the possibility of universal understanding that goes beyond text and speech. It is along this avenue of

universal understanding that the focus of computer simulation modelling is developed in this thesis.

The second avenue explores the notion that the model creation process is a communal activity. Creating a situation that requires the participation of all concerned will be beneficial as it can create a framework for interactive communication. The communal process of model development is of particular importance, as the process of achievement can be as important as the product.

**PART 3.** ***The Application***

# 6. ANIMATED COMPUTER SIMULATION MODELLING AS INTERACTIVE COMMUNICATION

> "One of the strongest forms of communication is when words and images are combined in equal proportions."
>
> Lester (1995: 72)

## 6.1 Introduction

The quotation "*a picture is worth 10,000 words*' (Larkin and Simon, 1987: 65), may or may not be true, however the notion suggested by the quote, that a single visual image may be as effective as many words, is certainly a popular conception (Larkin and Simon, 1987).

Images are powerful communication devices, often working across boundaries created by the use of language and text. Examples of these types of images can be seen throughout society across different cultures, societies, and language, images such as the Coca Cola logo; the blue helmets of the United Nations peace forces; the swastika adopted by the Nazis and the red cross and crescent belonging to the Federation of the Red Cross and Red Crescent societies.

Given the capability of images to communicate, this chapter explores the notion of using animated computer simulation as a communication tool, and looks at the suitability of such a tool as an interactive medium that can be utilised within the resolution of environmental conflict.

As communication theory is as diverse as the complexity of communication itself (Littlejohn, 1989; Trenholm, 1995), this chapter does not provide a detailed theoretical review, with the goal of finding the most accurate theoretical outlook. As Littlejohn (1989: 3) states:

> "[l]ooking for the best theory of communication is not practically useful in as much as communication is not a single, unified act but a process consisting of numerous clusters of behaviour."

What this chapter attempts to achieve is to utilise different aspects of communication theory, and to assimilate what with relevance to the simulation modelling focus of the thesis.

The importance of using images for communication purposes lies in the ability of images to surmount barriers formed by a disparity in the language used by the interacting parties. As Lester (1995: 67) suggests when discussing signs, one particular type of image, "... when used correctly, signs can offer modes of communication unknown." In the case of this thesis, the disparity in language is expressed by parties involved in an environmental conflict, which can include people from many areas of society. These areas of society involve participants with varying backgrounds in education, experience,

societal and moral values, and religion. All of these backgrounds have differing languages and meanings, which can lead to misunderstanding between participants. As DeTombe (1997: 12) suggests when discussing teamwork to overcome a problem: "The difference in professional habits, language and methodology may frustrate the communication between members of the team." Images that can cross the boundaries created by language misunderstandings should help any discourse between the parties, possibly resulting in the fostering of a resolution.

Images have a part to play in communication, a part that seems to be on the increase. As Davies, Bathurst and Bathurst (1990: ix) state: "Influential changes are taking place in society, as the balance of the means of communication tilts from words and numbers towards pictures or images."

The premises of this thesis are that interactive communication is a vital tool in the resolution of environmental conflict resolution, and that animated computer simulation is a tool that can be utilised for such a purpose. As Auzenne (1994: 11) states; "Computer animation has the ability to efficaciously convey statements, ideas, theories, and emotions." The benefit of utilising animated computer simulation manifests itself in two ways; in the power of image, and in the process of computer simulation model building. Each of these benefits is discussed briefly in section 6.3.

## 6.2 Bridging the Gap between Philosophical Approaches

As Fox and Waite (1984: 8) state: "Computer animation is the process of creating visual movement through the use of a computer" and, as Winkler (1971: 172) states: "...simulation is a technique for representing 'reality' by a model which can be manipulated in a digital computer and whose computer behavior reasonably approximates 'reality' within the framework of interest." By developing an animated computer simulation that draws upon both statements from Fox and Waite (1984) and Winkler (1971), a visual model of an environmental conflict situation can be developed. Through the use of a simulation model, and involvement in its development, participants involved in an environmental conflict may be exposed to an effective medium for interactive communication. Computer animation has the ability to communicate as a result of what Auzenne (1994: 11) calls the "...symbiotic relationship between science and art that exists in this medium. This mutual dependence bonds the creative abilities of two disciplines whose epistemology is rooted in opposing camps. "Computer simulation brings together two differing traditions in communication theory thinking; these *World Views* are described by Littlejohn (1989: 25) as *World View 1* and *2:*

> World View 1. This tradition is based on empiricist and rationalist ideas. It treats reality as distinct from the human being, something that people discover outside of themselves. It assumes knowable reality that is self-evident to the trained observer.
>
> Discovery is important in this position; the world is waiting for the scientist to find it [reality]. Since knowledge is viewed as something acquired from outside oneself, World View 1 is often called the *received view*. Objectivity is all important, with the investigators being required to define the exact operations to be used in observing events. Most mainstream physical science is World View 1, and much behavioral and social science follow suit.

World View 2 is seen as a tradition that relies:

> ...heavily on constructivism, viewing the world in process. In this view people take an active role in creating knowledge. A world of things exists outside the person, but the individual can conceptualize these things in a variety of useful ways. Knowledge therefore arises not out of discovery but from interaction between knower and known. For this reason perceptual and interpretive processes of the individuals are important objects for study.
>
> (Littlejohn 1989: 25)

These *World Views* are similar in their philosophical background to the *expansionist* and *ecological* worldviews summarised earlier by Draper (1998). *World View 1*, based on a strong scientific background, is similar to the *expansionist* viewpoint based in the views of the 18th century Enlightenment tradition in that both viewpoints see nature and/or reality as a separate entity from humanity. Alternatively *World View 2* is similar to an *ecological* viewpoint in that believers of such outlooks view the universe as a whole, or system in "process" (Littlejohn, 1989: 25), and do not look upon humanity as a superior separate entity.

Throughout this thesis the definition of environmental conflict has been founded on an ecological thought stance. This stance led to the conclusion that any resolution of environmental conflict should come from interactive communication focused toward the reconciliation of *interests*. This focus of resolution has an ecological emphasis in philosophical outlook as opposed to the traditional judicial viewpoint that is often related to an expansionist type of thinking. By incorporating both *World Views*, on vertical and

lateral planes, animated computer simulation has the ability to initiate interactive communication, both through images and through processes, to both sides of environmental philosophical thinking. By having roots in both sides of the environmental philosophical thought stance, animated computer simulation can appeal simultaneously to conflicting participants on both sides of the ecological and expansionist thought stance.

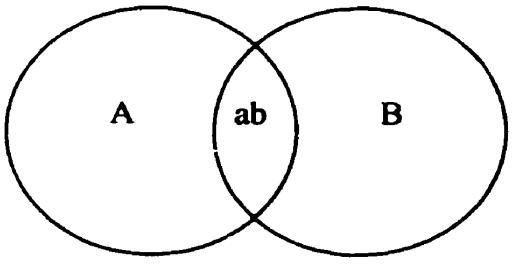
### 6.3 The Power of the Image

The power of image is used to cross boundaries established by language and text. In a conflict situation the participants may speak the same geographical language, but due to differing backgrounds it is quite likely that misunderstandings will occur through the inability of the participants to really understand opposing views and to accurately convey ideas. [By geographical language I mean the dominant language that is associated with the area in which the participant lives.] It is assumed that participants are willing to try to reach some understanding, however a participant's enthusiasm to get involved or concede early in the process, may come from the inability to communicate with the other parties. Lack of involvement that frequently results in the use of the traditional judicial methods of conflict resolution (Maser, 1996: Ury et, al, 1988). The ability of images to promote universal understanding may enable someone to go beyond any boundaries set up through the misunderstandings of language, thus creating a base level of understanding from which constructive discourse can be developed.

As Morgan and Welton (1992: 9) suggest, participants who have ideas and notions so far apart that communication is difficult, are often seen as "speaking two languages", even though geographically they are speaking the same language. Morgan and Welton (1992: 9) then go on to state that: "Wilber Schramm (1973) devised a model of communication which expressed this restriction in graphic terms."

Through this model (Figure 11), Schramm is suggesting that the basis of communication is the sharing of common experiences and ideas. "The area where A's life-space overlaps that of B is the setting for their communication" (Morgan and Welton, 1992: 9). The suggestion here for the resolution of environmental conflict is that animated computer simulation could help communication by displaying to the conflicting parties what their shared experiences are in relation to the environmental conflict. By learning what those shared experiences are, the conflicting parties might have a clearer understanding of the *interests* that each party is bringing to the conflict. An understanding on an *interest* level, as opposed to a *righteous* or *power* level, is beneficial in resolving the real source of conflict (Ury et, al, 1988).

Schramm's Model of Communication.




A - participant A's life space
B - participant B's life space
ab - shared experience of life

Figure 11.

(Cobley, and Jansz, 1997: 115)

Within the literature on/about theoretical communication, there are a number of different models for explaining communication. One example is the model by Shannon and Weaver (in Cobley and Jansz, 1997: 115) which looked at the *signal*, and how it was moved from the information source to the destination. This model was of importance to the telecommunication industry because it introduced the concept of *noise* to the process of communication (Morgan and Welton, 1992: 5). Shannon and Weaver's model also was adapted by Berlo who created a model that viewed the factors responsible for the difference between awkward, difficult conversation and clear flowing discourse (Morgan and Welton, 1992: 10).

By trying to express the act of communication each model shares a similar source of interest (Morgan and Welton, 1992), however, the notion of the shared experience in Schramm's model makes it important for the concepts suggested in this thesis. Through the learning of shared experiences, a framework for the understanding of interests can be established, since both discourses, *experiences* and *interests*, occur on a personal interactive level. An interactive level in communication is required in communicating notions of experience and interest.

How this interactive discourse is achieved is due to the ability of image to cross the possible boundaries of language, an ability that is directly related to, and integrated into, the process of building a computer simulation model.

## 6.4 The Process of Model Building as Communication

Images created by the animated computer simulation for communication purposes can only be effective if the interested parties have been involved in building the model. A model could be built by another independent party: however, this would be inadequate as the participants in the conflict would have no input into the simulation and, without input, the chances of developing shared experiences are diminished. Independent third party model building would only have beneficial results if used as a catalyst for conservation with the view to further developing the model with input from conflicting participants.

Ideally a model built from scratch involving the participants from the initial planning stages would be the most effective. Being involved from the initial stages would entail engaging the parties in interactive communication, working together to establish the model, and creating the framework for founding the reconciliation of interests. Effective simulations follow a number of stages (Winkler, 1971: 173):

1. Model Building
2. Manipulation (of the model)
3. Interpretation (of the results)
4. Comparison (with reality)

Each involves interactive communication. For example, within the first model building stage, there are a number of sub stages, in which communication is key for success:

1. Know the problem
2. State all the assumptions
3. Determine input data
4. Specify output

5. Estimate use (Winkler, 1971: 175)

By dealing with these stages of model building the conflicting participants are forced to communicate interactively. In working together to build a model, the process of building also focuses the participants to work together with the sources of the conflict as their focus. In the case of this thesis, conflicting parties would be encouraged to work together, in building a computer simulation model that would help communication in the resolution of an environmental conflict. The focus of the interactive teamwork is the resolution of the conflict, and not the relationship between the participants.

Focusing either toward or away from the source of conflict problem relates to the Dispute Resolution system described by Ury et al. (1988). By working and communicating together in building a simulation model, and focusing on the real sources of the environmental conflict, the true *interests* of the participants can be reconciled, creating an *effective system* of conflict resolution. However if the participants involved become blinded by the differences between them, and are unable to work together, then the focus of the conflict will not be the source of the environmental problem. The focus will be toward the differences in the participant's relationship. Focusing on relationships would entail establishment of *rights* and/or *power*, and would cause a *distressed system* of conflict resolution. Figure 12 shows the relationship between the participant's focus within the Dispute Resolution system described by Ury et al. (1988).

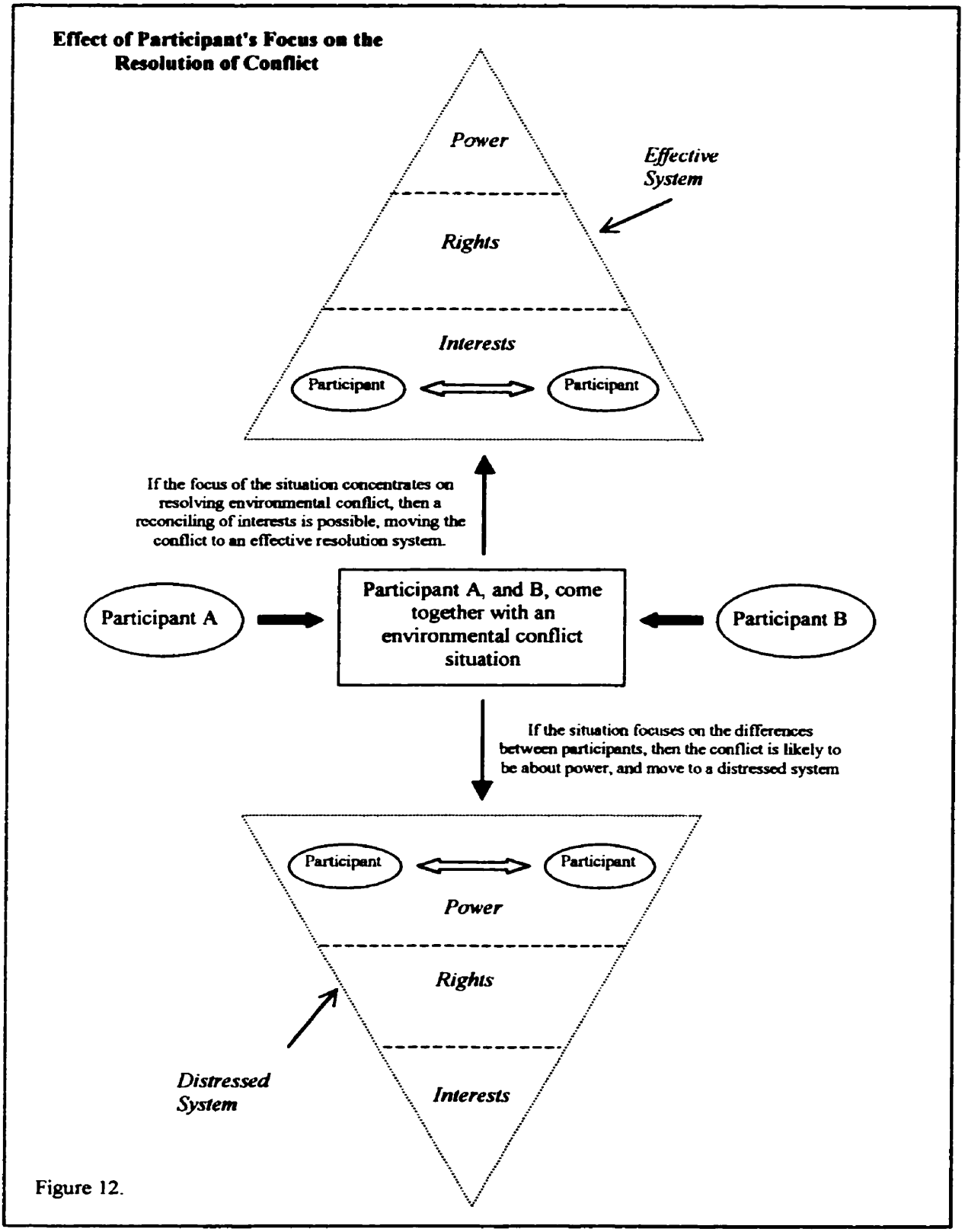

Effect of Participant's Focus on the Resolution of Conflict
Power
Effective System
Rights
Interests
Participant
Participant
If the focus of the situation concentrates on resolving environmental conflict, then a reconciling of interests is possible, moving the conflict to an effective resolution system.
Participant A
Participant A, and B, come together with an environmental conflict situation
Participant B
If the situation focuses on the differences between participants, then the conflict is likely to be about power, and move to a distressed system
Participant
Participant
Power
Rights
Interests
Distressed System

Figure 12.

Even if a working computer simulation model is not accomplished, the process that the conflicting participants go though may be enough to start the resolution process. As Eyre (1997: 16) suggests:

> Although the modelling results were not completed before the end of the Round Table [Banff Bow Valley Round Table Process] meetings, the purpose of the simulation model was not to provide predictions but to examine trends and trade-offs. Its value is in the process of conducting the exercise itself (Cornwell, Seal). To build the model and run scenarios implicitly forces stakeholders to state their assumptions about the system and their preferences in trade-offs, and thus confront their values. As such it is used as a learning and consensus building tool, to assist with decisions that have to be made regardless.

## 6.5 Conclusion

Animated computer simulation, within environmental conflict, can be an effective communication tool, as it works on a number of integrated levels. By philosophically having roots in both a scientific background and an artistic background (Auzenne, 1994) computer animation can appeal to participants from both areas of thought.

The use of image is particularly important, as language can cause barriers between users, even if the same geographical language is being used. As Saussure (1974: 13) suggests: "Among all the individuals that are linked together by speech some sort of average will be set up". As Sless (1981: 66) states, however, "...Saussure and other linguists acknowledge variability in usage." A variability in language usage is something that images can overcome. As Auzenne (1994: 128) states:

> Computer animation offers unlimited potential for communication. It is a powerful medium which has the ability to visualize the unseen, create environments, illustrate concepts, convey messages, and evoke emotions.

For the purpose of this thesis, however, it is the process of developing an animated computer simulation model that is of real importance. The process of model building forms the framework for the power of the image to be utilised, and the process brings together participants with differing philosophies. By engaging in the process of model development the conflicting participants are developing an atmosphere of interactive communication, with a focus on the environmental problem. Developing interactive communication and teamwork leads to a better understanding of each other's core interests, and through this understanding a resolution of the environmental conflict can be achieved.

# 7. CONCLUSION

> We do have to accept that our methods of solving major disputes and conflicts have been crude and primitive, inadequate and expensive, dangerous and destructive.
>
> Even if we were to operate our traditional methods with the best will in the world and with the highest available intelligence, these methods would not suffice. There is a need for a fundamental shift in our thinking approach to the resolution of conflicts
>
> Edward de Bono (1985: vii)

## 7.1 Introduction

This study was undertaken in reply to the challenge set down by Guy Baron (Poitras, Jean and Renaud, Pierre:1997, xxii ) at the outset of the paper. By creatively using a lateral thinking approach (de Bono 1968), the subject of computer simulation modelling was explored with a view to its use as a communication tool within the area of environmental conflict. In employing a lateral approach the thesis attempts the goal of establishing an alternative means of initiating interactive communication between conflicting parties. Using an approach that focuses on the understanding of interests, as opposed to the establishment of power, the study moves the emphasis of the conflict resolution away from the traditional judicial approach, involving a competitive decision process that creates winners and losers, to a situation that encourages the resolution of the true areas of concern.

To achieve this goal the thesis, in its exploration, looks at a number of topics, a process that reflects the multidisciplinary nature of the subject area. In helping to understand the process of exploration through the various topic areas within the thesis, a metaphorical analogy was used. As explained in Chapter 1, the thesis reflects a metaphorical trip or journey downstream from the starting point of *conflict* to the destination *resolution* using simulated modelling as the river craft. Simulation modelling alone can not achieve this journey, as the flow of ideas and thought are not strong enough to carry the craft to its destination. It is only by including the input of thought from the additional areas that there was enough flow of ideas and thought for the destination to be reached.

## 7.2 Simulation Modelling

By initially exploring simulation modelling, the thesis through the use of a practical example establishes what is involved in a simulation model, and the benefits to be found in using such a tool. In particular, the hierarchical component construction method and the animation capabilities are of importance.

The hierarchical development structure is significant as it enables people with little or no experience in computer language to some extent construct, and to a larger degree understand, what goes on in the model construction. This ability opens up the process of model building to anyone with an interest, thus enabling conflicting parties to be able to input their interests into a model, and resulting in a possible method of

portraying the conflict situation from both sides of the dispute. Both parties have the ability to input their suggestions, eliminating to some extent the problem of bias in the resolution process.

The ability to include animation, graphics and media within the model also helps in the inclusion of all participants and their ideas. Portraying the conflict situation in a graphical form breaks down the possible language barriers created by differing backgrounds and training. (See Figure 13 and 14 for a representation of the model with animation and visual media.).

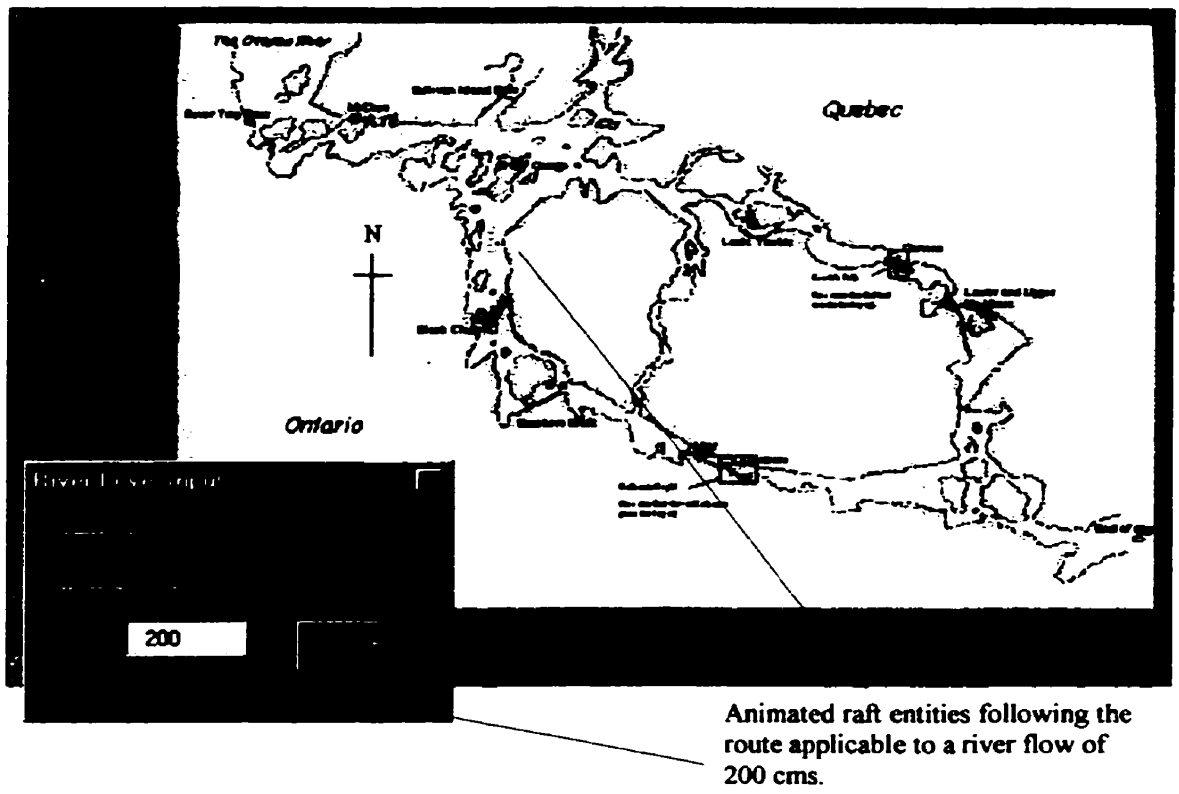
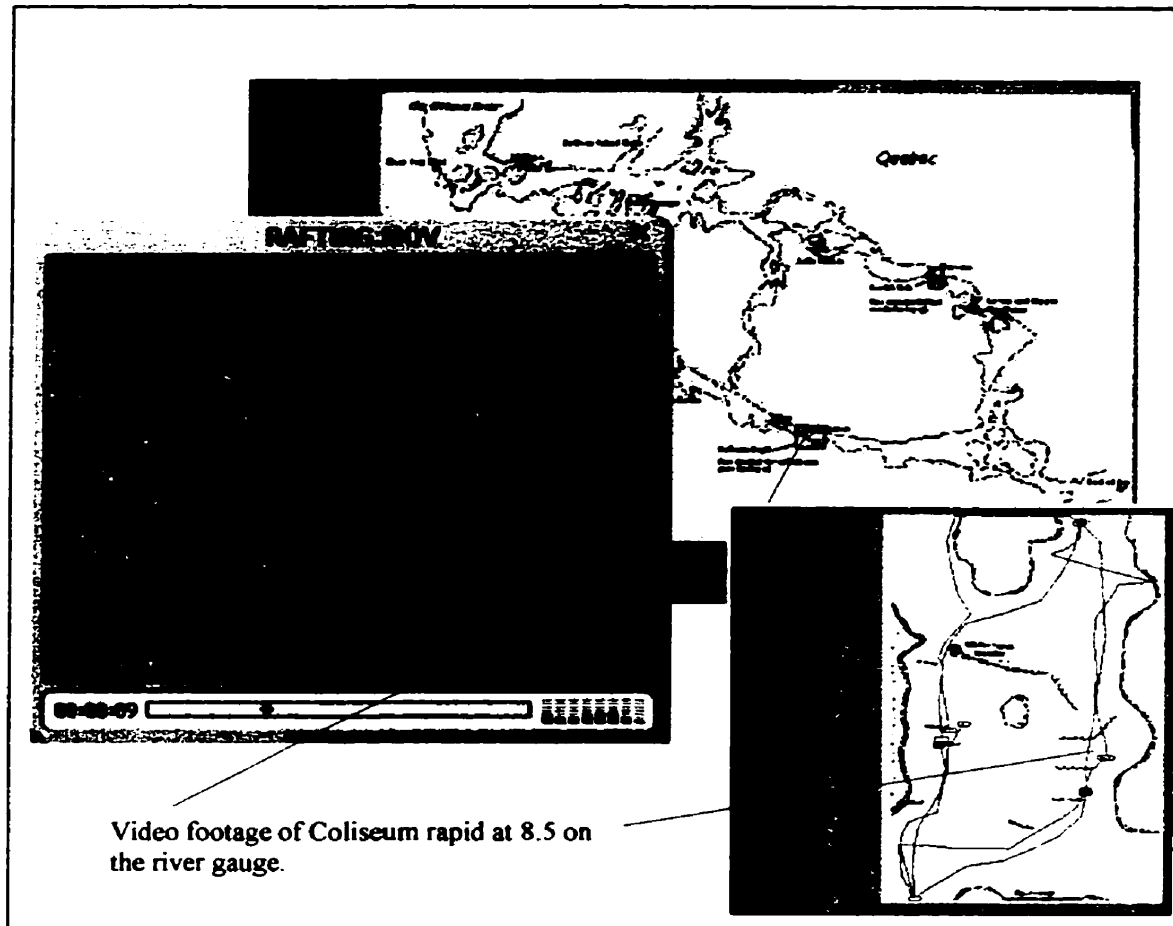
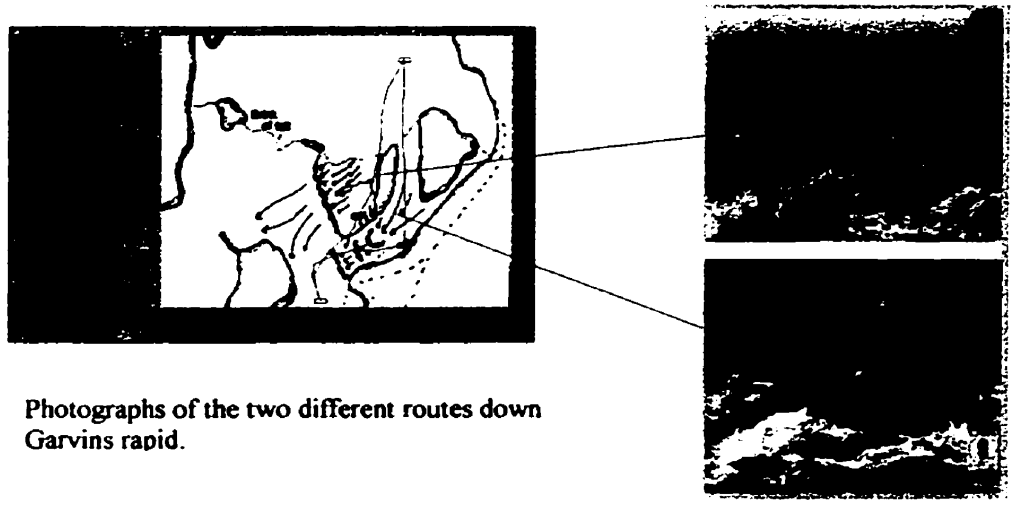



Figure 13. Diagram Showing Animated Entities.



Video footage of Coliseum rapid at 8.5 on the river gauge.



Photographs of the two different routes down Garvins rapid.

Figure 14. Diagram Showing Visual Media Used Within the Model.

Both these attributes, the hierarchical development process, and the ability to include animation, graphics and media in a simulation model can help the process of conflict resolution by introducing a tool for eliminating some of the language and comprehension barriers apparent within the resolution process. Furthermore, by including the participating parties within the model development process from the outset, involved participants are more likely to indicate their true interests, as opposed to displaying strategic behaviour resulting in a defensive approach (Borisoff and Victor, 1998: 40). Once a model is built, a participant will be unable to state that the model is unrepresentative without explaining what makes it so. Additionally a possible outcome of working co-operatively in the model construction, is the development of an understanding between participants, again enhancing the resolution process.

However, these attributes alone do not show that simulation modelling can be used as a communication tool within environmental conflict. To show how the attributes mentioned above and in Chapter 2 can be employed within the area of environmental concern, three subject areas were explored; Environmentalism, Conflict, and Conflict Resolution. It is only by including the input from these areas that the metaphorical journey can be completed, and simulation modelling can be seen as a possible, viable communication tool for environmental conflict resolution.

## 7.3 Environmental Conflict

Through a brief historical overview of environmentalism the thesis was able to show the sources and development of environmental conflict, a process which established a framework within which a form of communication particular to environmental conflict resolution could be conceived. By exploring topics within environmentalism such as *sustainable development*, and *science*, and through a resource based viewpoint studying the differences in outlook of the various thought stances, it was possible to demonstrate that environmental degradation is a social construct and that any environmental conflict results from a detrimental change on human society from the effect of human action. This is of importance as it sets the direction, in Chapter 4 for a final definition of the term *environmental conflict*, which in turn facilitates the understanding of the resolution process.

In definitively establishing what the term *environmental conflict* means, the thesis takes an approach that firsts sets some criteria of measurement, a necessity given the vastness in range of *conflict* as a subject. Using the thought stance of a realist perspective the thesis briefly examines Homer Dixon's (1991) ideas of natural boundaries and their lack of conformity to the realist standpoint of political boundaries. From this it was concluded that any definition had to account for environmental conflict in a holistic manner, in that human society is recognised as only being part of the whole environment.

The other main focus of criteria came from a study and critique of the semanticist's viewpoint. From this viewpoint came the link that communication had a part to play in any resolution that was established. From developing and then applying the thoughts and definition suggested by Libiszeweski (1992), to these criteria, it was possible to then explore the type of communication needed in the resolution process.

From developing a definition of *environmental conflict* it was recognised that the example used in the simulation model was not strictly an environmental conflict situation. This conclusion could only have been made once the study had been completed, and does not detract from the final outcome. As the simulation model is only being used as an example, exhibiting the attributes available to the reader, it is felt that the purpose of including the model was not compromised in any way. As was stated earlier in the paper, the purpose of the thesis was to establish the possibility of using computer simulation modelling as a communication tool within environmental conflict, and not to measure the effectiveness of such an approach. However an important note to make is that for further study into the effectiveness of using such a model, it will be important to use a situation that conforms to the given definition of environmental conflict.

## 7.4 Environmental Conflict Resolution and Communication

By taking an approach to environmental conflict that is related to social action and by looking at the resolution of that conflict through the ideas of *Alternative Dispute*

*Resolution*, it is possible to conclude that interactive communication is of vital importance in the resolution process.

Interactive communication is important in that co-operation between conflicting participants helps move the emphasis away from a *power* based interaction to a *reconciling of interest interaction*, and in doing so moves the resolution process from a *Distressed* system of resolution to an *Effective* system (Ury et al. 1988). Interactive communication involves the participants, and in doing so breaks down barriers that hinder resolution. As the acts leading to environmental conflict situations are socially directed, environmental conflict in particular is open to resolution through interactive communication.

One assumption that has to be made in concluding the thoughts presented in the thesis is that the participants have to be willing to try to come to an agreement. If this is not the case and one side or the other is not ready to try and resolve the conflict, the alternative dispute resolution system with its interactive communication will not be applicable, and the traditional judicial approach may be more suitable. It is recognised that the willingness to co-operate, or not, results in limitations both in using simulation modelling as a communication tool and in effective conflict resolution. Effective resolution will only come with a commitment to the process.

Nevertheless if the conflicting parties are willing to try to come to a resolution, and to try to reconcile their interests, then interactive communication has a part to play. Thus, due to the attributes mentioned earlier, computer simulated modelling can be a useful communication tool in the resolution process.

A simulated model through the use of its animated and image capabilities presents a tool that can represent the conflict situation in a manner that all sides of the conflict can better understand. Simulation modelling can, through the involvement of the participants in the model building process, develop a situation of co-operation and teamwork. An interactive situation can only help the conflict resolution process.

So, in terms of the metaphorical journey threaded through this thesis, simulation modelling through the assistance provided by the other subject areas has managed to get to the destination set out in Chapter 1. The metaphorical craft of simulation has been assisted by the additional flow of thought to the end of the trip, and arrived at the goal of *resolution.* Guy Baron's challenge has been answered. Simulation modelling can be used as a communication tool within environmental conflict. An alternative resolution method to using the traditional judicial approach can be found.

Simulation modelling is only one of many possible useful approaches that are available; this thesis has found just one. The task now, in terms of the findings of this

thesis, is the study and assessment of the effectiveness of applying simulation modelling as a communication tool within the environmental conflict resolution process.

In a more general sense, if there is to be further creative cognition, additional effort has to be given to climbing out of the worn valleys of knowledge and new flows of thinking have to be explored. Becoming too focused will only blinker thought, and stifle creativity.

This thesis was motivated by a challenge, and in reply has attempted to develop a creative thought stance on an alternative approach to an existing problem. Finishing with the setting of challenges provides motivation for further attempts in creative thinking, encouraging new sources of thought streams.

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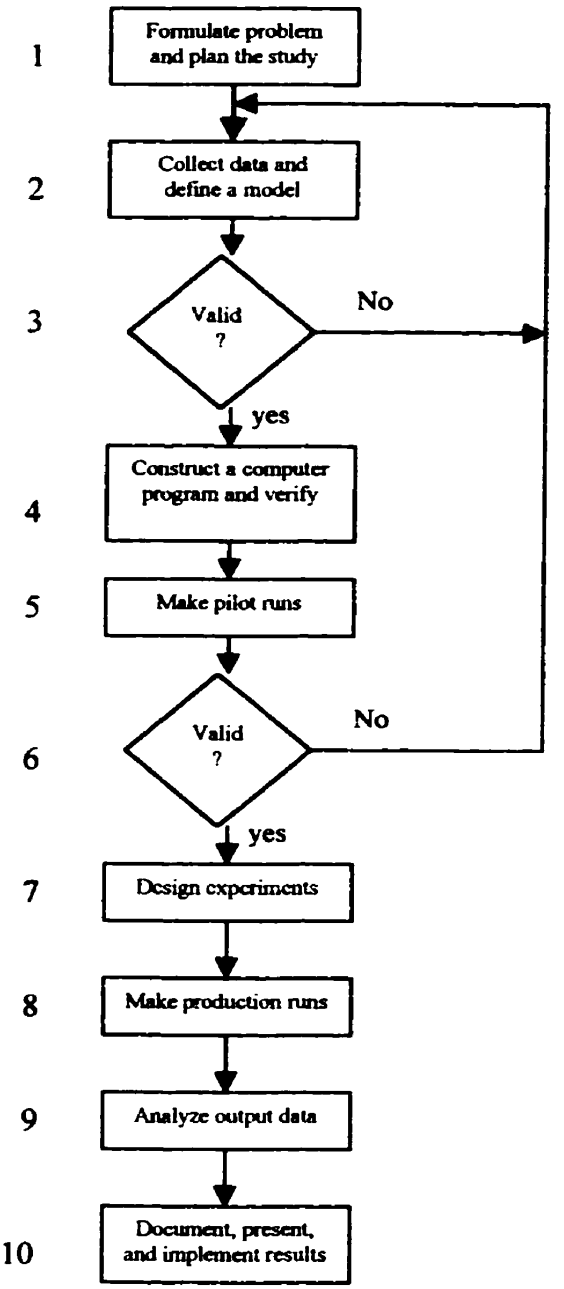
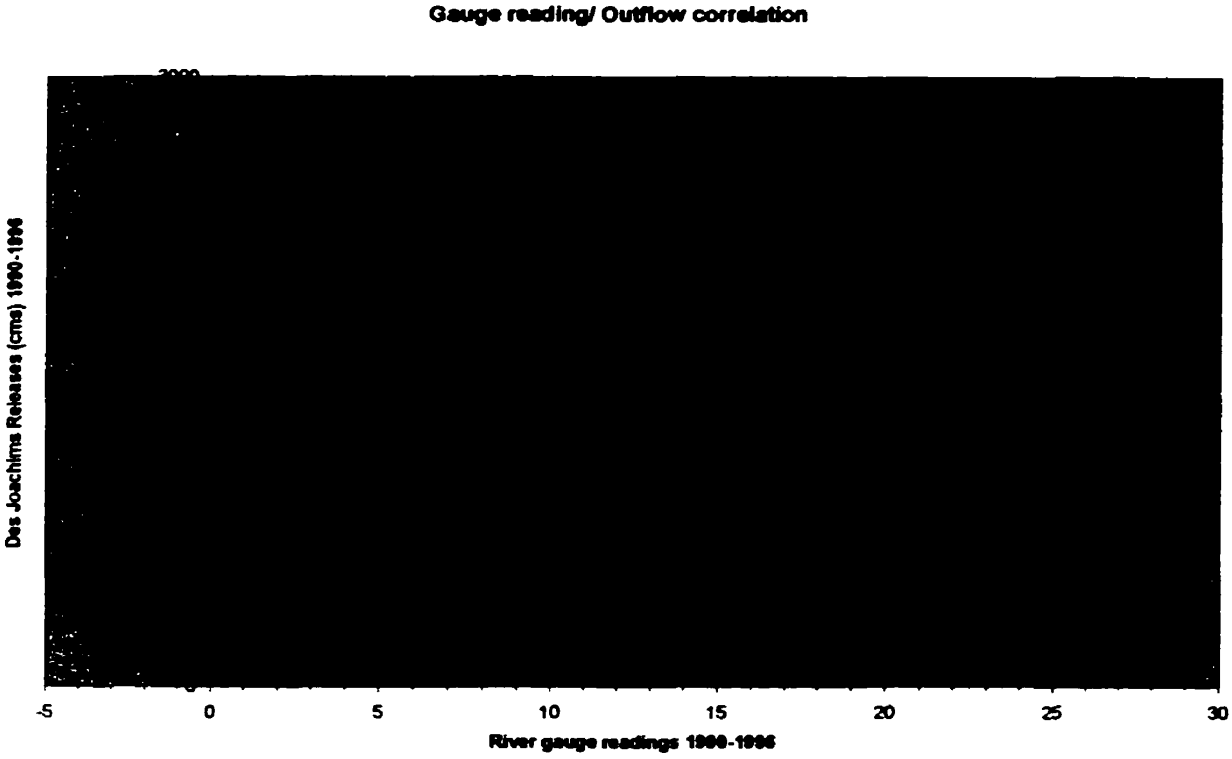
**Appendix A.**




Steps in a Simulation.

Law, Averill, M. and Kelton, David, W. (1991: 107)

**Appendix B.**




Using a best-fit line the above graph shows the correlation between the outflow from the power generating dam and the river level at the rafting section of the Ottawa river. The data was collected for a six year period, and was provided by Ontario Power, and Owl Rafting.

**Appendix C.**

**Worldviews** are "sets of commonly shared values, ideas, and images concerning the nature of reality and the role of humanity within it" (Taylor, 1992: 31-32) Each society's worldview is reflected in and transmitted through its culture. Beliefs, ideas, values and assumptions about knowledge that each culture transmits help to share attitudes toward nature and human-environment relationships. These attitudes, in turn, lead to lifestyle and behaviours that may or may not be compatible with natural systems and that may or may not cause environmental problems.

Groups of many political persuasions and as diverse as ecofeminists, deep ecologists, and advocates of maximum resources development, have adopted the term *sustainable development* as a guiding force in their activities. However, each of these groups operates with a different, sometimes conflicting, worldview. Different worldviews lead to different interpretations of sustainability and, in turn, to different decisions about use of the environment to achieve various goals. The two major competing worldviews that characterise Western society -- expansionist and ecological -- are described briefly.

(Draper, 1998: 35)

**Two Competing world views**

*Two approaches to conservation in the early 20th century*

**Expansionist World View**

***Values of the Enlightenment Tradition***

(Gifford Pinchot -- "wise management")
Nature is a resource to be used not preserved; conservation must work in league with the dominant society -- and not against them; the primary value of natural areas lies precisely in their value to modern society; conservation should work against the wastefulness and environmentally disruptive excesses of a developing society -- hence, wise scientific management which works within the dominant Expansionist World View.

**Ecological World View**

***Values of the Counter-Enlightenment Tradition***

(John Muir -- "preservation")
The universe is non-dualistic. It is a totality with all of its parts interrelated and interlocked; the biotic community and its produces must be protected; nature is intrinsically valuable -- animals, trees, rocks, etc. all have value, "in-themselves"; human activities must work within the limitations of the planet's ecosystems; nature is a forum within which the state of human society can be judged; works against the dominant societal values.

(Taylor, 1992: 29)