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The Ethical Computer Grows Up: Automating Ethical Decisions

Don Gotterbarn

Abstract. Software tools to assist in the management and execution of complex ethical judgments are examined. The implementation of two ethical decision procedures in software makes clear some of the strengths and weaknesses of each method.

1. Introduction

The most significant ethical decisions are often very complex. Their complexity is often so daunting that one just makes a random choice. Many decision procedures have been offered to help manage this complexity [See Maner].

These procures offer provide structures to help keep track of stakeholders and the issues involved in the decision. Unfortunately these methods don't reduce the complexity of the ethical problem. Consequently following the procedure can become such a tedious process that again the ethical decision-maker either ignores the ethical issue or reduces the problem to a bimodal choice.

We will look at several broad base models for choosing between ethical actions. Each of these models has some weakness. We shall then return to one of the previously rejected models and show how it can be modified into a model which is useful in coming to ethical decisions.

2. Models of Ethical Action

At the National Conference on Computing and Value (1990) Terry Winograd [Winograd 1991] argued that 'ethics' and 'values' are not the kinds of things addressed with computer science theories, but they are "...a domain in which we interpret and address our actions as professionals". Many courses and programs in computer ethics concentrate on merely observing ethical behavior or more precisely primarily review a litany of computer ethics lapses. If this is not their focus then they discuss philosophical theory. Winograd took a different approach and focused on the participant in ethics, from the point of view of the individual or group that has to actually make ethical decisions. He describes three models of decision making in computer ethics.

2.1 The simple yes or no

The first and simplest model he calls "the angel or devil debate". In this model the decision maker knows what is the morally correct decision, but the morally wrong decision if very tempting. The participant knows what is right but has to exercise the moral fiber to resist the temptation to

do what is wrong.

Figure 1 Angel or Devil [Winograd]

This model is inadequate for several reasons. First, generally these questions are simply evaluated from the perspective of the person asking the question. Situations that require a conscious ethical decision and moral strength to make are generally complex. A single statement of the decision between the devil and the angel over simplifies and misses this complexity. This complexity has to be addressed in order to even formulate a simple statement of the decision question.

2.2 Pass the responsibility to the computer

Winograd's second model might help with the ethical analysis. It is the model of a "Morality Computer". In this model, the moral rules of computer ethics are made part of the program logic of the computer. One does ethics by entering into the computer data describing a moral situation. The computer then applies the ethical rules to the situations and then cranks out a decision that is a result of applying the ethical axioms and procedures. The Ethical Computer helps apply the known rules in this case.

Figure 2 Morality Computer [Winograd]

This Ethical Computer approach is reminiscent of the casuistic approaches sometimes taken in philosophy. Imagine a philosophical computer in which the moral rules were the principles of some philosophical theory. A utilitarian theory would for example use the computer to calculate the correct ethical action by doing a hedonistic calculus- comparing the quantity of positive outcomes to the quantity of negative outcomes. Philosophers and others have argued that this

casuistic approach is mistaken. Nevertheless, computer scientists quite readily adopt this philosophical computer approach. Several years ago, the author of this piece co-authored an article [Anderson 1993] that programmed the computer with the ACM's Code of Ethics and used it to show how ethical decisions could be made by applying the Code of Ethics. Others have used the Australian Computer Society Code of Ethics in a similar way. [Burmeister, 2001].

Criteria to Justify Computer Ethical Decisions

How can one be confident in the computing process and the computer decisions? McFarland [1991. He says, "...ethical knowledge is a dynamic reality, never completely within our grasp nor totally beyond it. Ethics has its own discipline and its own methodology..."] A morality computer would have to meet the condition for good ethical argument. He identifies the conditions for justified ethical argument

A valid ethical argument, like any other argument, must be 1) consistent with the facts and 2) reasonable and logically consistent. The other two conditions require the use of ethical judgement. "3) It must be based on sound principles and uphold the highest good." This requires the ability to prioritize values. "4) It must be universalizable." The person using the argument must be able to recognize similar ethical situations and hold that this ethical action is justifiable in all ethically similar situations. These 4 conditions could be used as rules to determine if the morality computer arrived at a valid action recommendation/judgement of an ethical decision. The ethical principles could be provided by a professional code of ethics, although McFarland found the IEEE Code of Ethics at that time (1990) to general to fill that role of a set of rules.

The morality computer model, however, does not adjust to the changing situations for applying these rules. This model does not take into account the dynamics and social interaction of the ethical situation.

2.3 A Dynamic Social Process

Winograd's third model - a troupe of jugglers- addresses some of McFarland's concerns. This model emphasizes the social aspect of the ethical decision making process and the social context. A juggler is engaged in a constant state of action and in a troupe of jugglers there must be constant interaction with and adjustment to the behavior of the other jugglers.

Figure 3 Troupe of Jugglers [Winograd]

Winograd's choice for a model of computer ethics is based on his emphasis that ethics is 1) an activity involving social interactions that change as each new stakeholder is involved and 2) that the actions of one stakeholder will change the situation for all of the other stakeholders. He calls the process of ethical decision making in this environment 'Ethicking' to emphasize that ethics is primarily an activity. "Ethicking" is the active side decision-making. It refers to a recommendation for action as opposed to ethical judgment about the quality of a choice or the passive review of a decision. It involves the active exercise of making a choice. He models 'Ethicking' with a troupe of jugglers. Ethicking is "...the kind of continuing judgement in action that a juggler exhibits in action, not just the kind of careful argument that a logician applies in constructing a proof." Not only are they involved in constant activity but also they must incorporate evolving standards and practices.

3. The Morality Computer Comes of Age

Winograd is right about the social dynamics of ethicking, but I think he was mistaken to totally abandon the notion of the morality computer. He is right that having the computer make the ethical decisions is incorrect, but the morality computer can still function as a tool to help us ensure that we do not overlook anything in the decision making process. This model of ethical decision-makers has the weakness of including significant distractions. The ethical deliberations may be incomplete or fail to account for significant stakeholders. The primary problem with the juggler model is that there is no formal system that helps us evaluate our decisions.

We explore the hypothesis that a morality computer, which provides the form for ethical decision-making, which includes McFarland's standards, and can accommodate different situations, can be useful in computer ethics. The goal is to have a morality computer which is an improvement over the juggler model which 1) cannot help in decision making, 2) does not provide support of the correctness of our decisions and 3) does not help address the complexity of ethical situations. To test this hypothesis morality computers were created which were programmed to follow specific ethics decision-making procedures. There are numerous ethical decision making processes. I focus

on two because of the way in which they meet McFarland's criteria. These methods are Pfeiffer's RESOLVEDD [1999] method and Collin's Paramedic method [1992].

The tools are applied to the "Tale of Two Designs" [Gotterbarn, 1996]. Briefly the case is as follows. Several sailors lost their lives in an explosion while handling dangerous materials. Software should have detected the danger but did not. A consultant has been contracted to write new protective software. The software was been designed but Captain Birk, a computer novice, wanted to substitute his own personal design for the software. The consultant thought the captain's design was not testable and that the consultant could not be confident of the sailor's safety if the captain's design was used. What should the consultant do?

3.1 Resolvedd

The RESOLVEDD method is a 9-step method used to address personal ethical conflicts, especially those where there are no perfect solutions available and which minimally compromise ethical values. This method has been expanded to include explicit stakeholder identification and the enhanced method has been implemented in a morality computer. The figures that follow are of that software and output from that software.

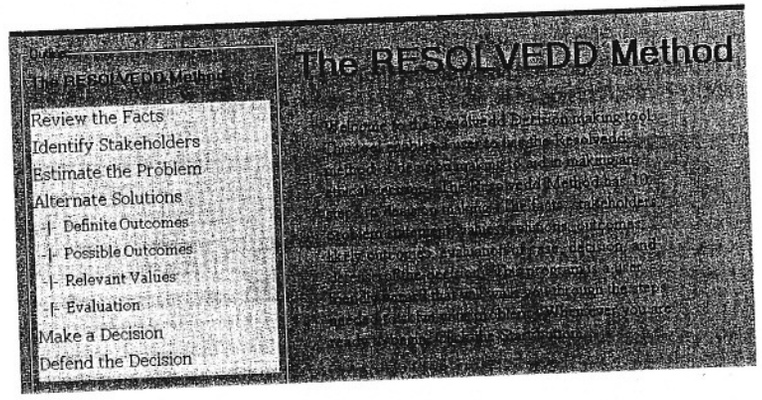

Figure 4 Opening screen RESOLVEDD Method

"Step 1: **R** Review the history, background, and details of the case."(Figure 5) All relevant facts are reviewed and only those facts that might change the ethical decision are included. Then the stakeholders are listed. This helps to keep track of the social nature of the ethics decision-making process.

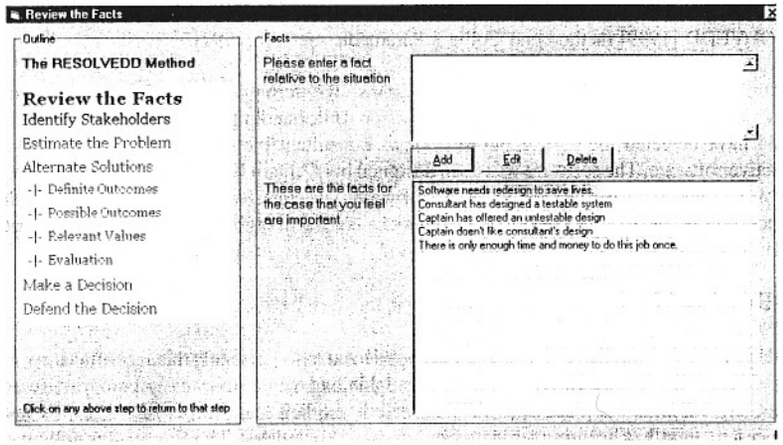

Figure 5 Collects fact about the case

Ro enhance the process, the explicit identification of stakeholders and how they are affected was added to the process. (Figure 6). The point of adding stakeholder identification is to aid in tracking the complexity of the decision-making.

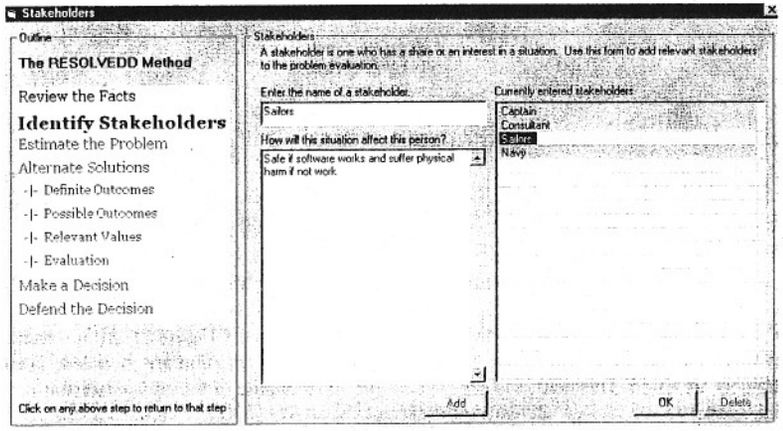

Figure 6 identify stakeholders

"Step 2: **E** Estimate the conflict or problem present in the case." In this case the question is should the consultant provide safety critical software does not meet the standards of testability or should the consultant refuse to do the job.

"Step 3: **S** State the main alternative SOLUTIONS to the case…" is a technique for recording the complexity of the case and indicating a variety of possible solutions. For each solution the analyst records definite and possible **O**utcomes for each possible solution. On each outcome screen the analyst states the "Step 5: **L** … LIKELY IMPACT of each main solution on people's lives."

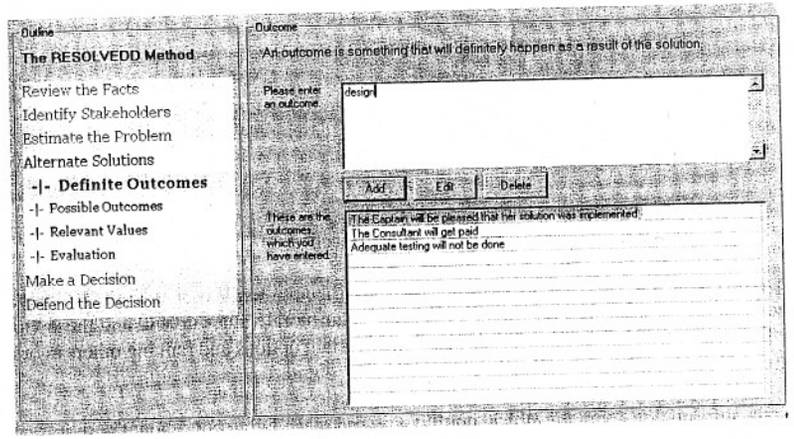

Figure 7 expected outcomes for a particular solution.

The next step involves the identification of the Values relevant to each solution. The RESOLVEDD method provides a broad set of moral values. They include Moral Principles like: Honesty-don't deceive people, Harm-avoid harming people, their projects, efforts, and property, Fidelity-fulfill your commitments and act faithfully, Autonomy-don't act so as to prevent others from acting autonomously and free from coercion, Confidentiality, Lawfulness-obey the law, and Equal Consideration of Other's Interests and Moral Rights like the Right: to Know, to Privacy, to Life, Free Expression, Right to Due Process, to Safety, to Property, to Make a Profit, of Future Generations. For each solution, the relevant values are identified for each stakeholder.

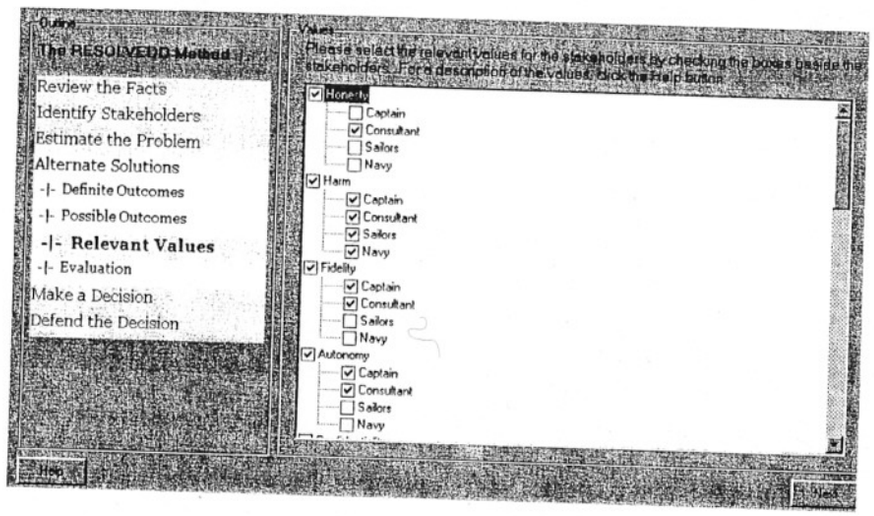

Figure 8 Value selection

Once the values related to the solution have been identified the Evaluation of the solutions can be started. The evaluation is done in terms of the particular moral values upheld and those violated by it. The result of this analysis is the elimination of certain options and ranking others in order of preference

Using the information about the ethical conflict you can make judgments about the seriousness of the ethical principles that will be violated and those that will be upheld.

"Step 8: **D1** DECIDE which solution is best; state it, clarify its details, and justify it."

"Step 9: **D2** DEFEND the decision against objections to its main weaknesses. This may require you to go back and consider other options."

The RESOLVDD morality computer meets McFarland's four conditions. Facts are recorded. It provides a set of values to apply and helps the analyst determine a priority for those values. It does not however provide a way to test the universalizabilty of the resulting decision. The computer can accommodate multiple situations, provide support for the correctness of our decisions, and helps track the complexity of our decisions.

ewrewrw

Captain	ad
Consultant	sfsf
Sailors	Safe if software works and suffer physical harm if not work
Navy	More deaths on sailor during routine maintenance will hurt their image

If there is not an effective tesable solution then many sailor will be put in danger or the project has to be abandoned

Do as the Captain wants
The Captain will be pleased that her solution was implemented
The Consultant will get paid
Adequate testing will not be done
dsfsd
sfs

Figure 9 Summary report.

It is limited because it is expressly a decision-making procedure for an individual, or for a small group of individuals working closely together, who face a problem about which the law is either silent or vague. The RESOLVEDD cautions against doing simple arithmetic—counting which upholds the most and goes against the least number of values. But method does not provide a way to go beyond this simple arithmetic-

3.2 Paramedic Method for Computer Professionals

This four-step method is designed to enable computing professionals to organize and evaluate information related to an ethical conflict. The method is designed to consider the interactions between the various elements of the ethical situation and determine the best choice.

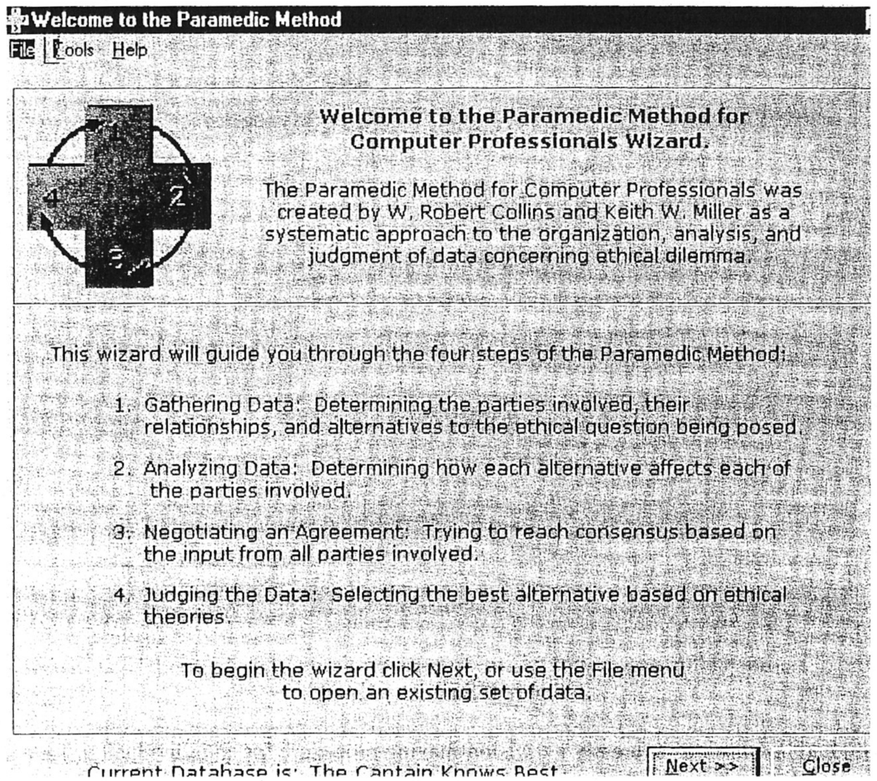

Figure 10 Introductory screen

Step one is to gather data. Each of these steps also has several parts. The first part of step one involves determining all of the alternative actions. In The Tale of Two Designs case, the obvious options are to a) do the Captain's design or not do the Captain's design. But whichever option is chosen the consultant can also whistle blow. There are more than just two options and each feasible option must be examined. Step one also includes the identification of all stakeholders (figure 11).

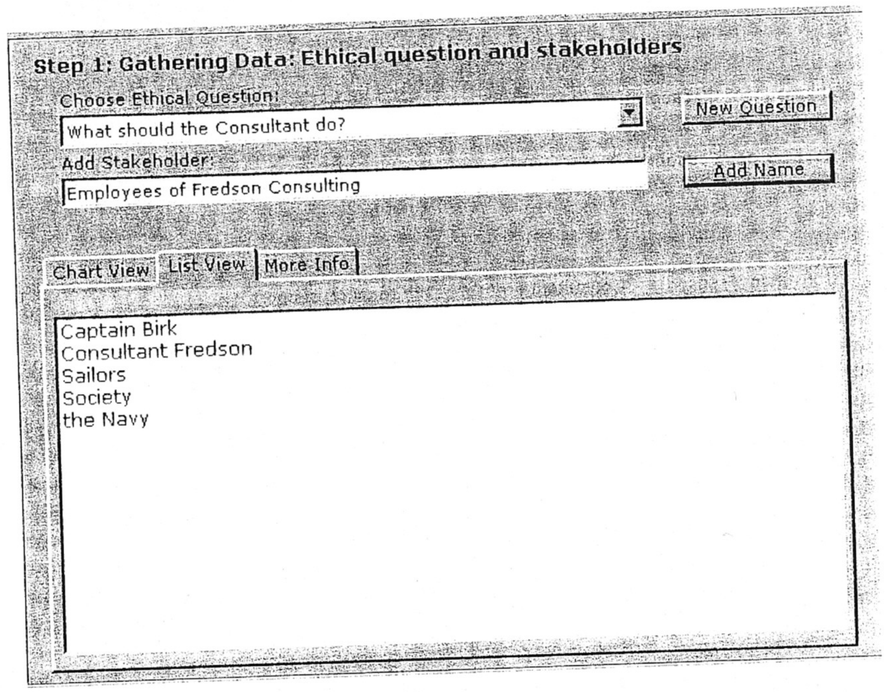

Figure 10 Stakeholder identification

The obligations between all of the stakeholders are identified and a graph whose nodes are stakeholders and vertexes are obligations is drawn to give a visual representation of the obligation relationships. (Figure 11)

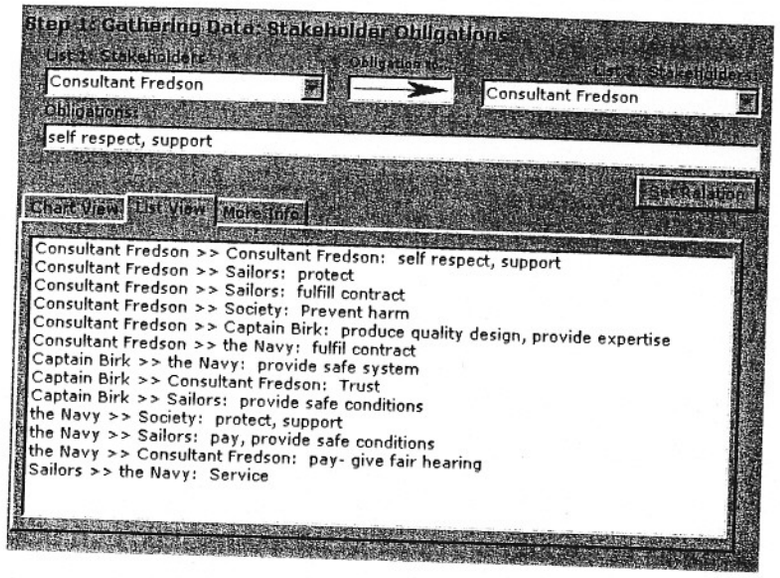

Figure 11 List View of Obligations between stakeholders

These obligation relations can also be presented as a graph in the chart view. (Figure 12)

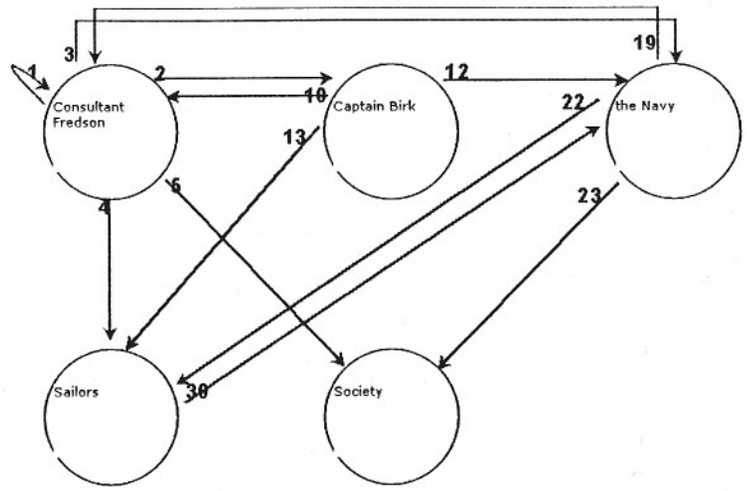

Figure 12 Chart view and key to the obligations.

Stakeholder Obligation Chart

Obligation

Arrow ID	From	To	Obligation
10	Captain Birk	Consultant Fredson	Trust
13	---	Sailors	provide safe conditions
12	---	the Navy	provide safe system
2	Consultant Fredson	Captain Birk	produce quality design, provide expertise
1	---	Consultant Fredson	self respect, support
4	---	Sailors	protect
4'	---	Sailors	fulfill contract
5	---	Society	Prevent harm
3	---	the Navy	fulfil contract
30	Sailors	the Navy	Service
19	the Navy	Consultant Fredson	pay- give fair hearing
22	---	Sailors	pay, provide safe conditions
23	---	Society	protect, support

: *The **Second Step** begins the analysis of all of the opportunities and vulnerabilities for each of the parties involved for each of the possible solutions. To aid the analysis a series of charts are constructed. The chart the positive and negative elements of each potential action in terms of 'opportunities' and vulnerabilities'. (Figure 13).*

The **Third Step** is the negotiation of a social contract agreement between all the parties. Weighing the opportunities and vulnerabilities of all parties. During this negotiation a new solution may be generated. This new solution is added to the process and Step 2 is redone.

Social Contract

Stakeholder	Opportunities	Vulnerabilities	Obligations	
Consultant Fredson		self respect --, support himself +	To Captain Birk	
		self Respect +, support himself +	Produce quality design, provide expertise	+/-
Captain Birk		provide quality design -, provide expertise +		
the Navy		fulfill contract -, Provide expertise +		
		protect + -		
Sailors				
Society				

Figure 13 Opportunities and vulnerabilities

The **Fourth Step** all of the alternatives are judged according to ethical theories. For each alternative select the best deontological alternative. Select the best utilitarian alternative. Then select the best alternative. If no one alternative stands out, then either select a new alternative created from the best features of existing alternatives or return to an earlier step and begin again

STEP 5. Implement the selected alternative.

The Paramedic morality computer meets McFarland's four conditions in varying degrees. Facts are recorded. It does a better job the RESOLVEDD of demonstrating the various obligation relations between the various stakeholders. Its only method of prioritizes possibilities is in terms of the quantity of opportunities and vulnerabilities offered by each alternative action.

It does not provide a set of values to apply but points to some broad philosophical approaches to ethical decision making. It does not however provide a way to test the universalizabilty of the resulting decision. The computer can accommodate multiple situations, provide support for the correctness of our decisions, and helps track their complexity. The graphical nature of this method is an aid to understanding but it is also a severe limitation as the number of stakeholders and alternatives increase.

4. CONCLUSIONS

The process of developing and using these tools revealed information about the strengths and limits of a morality computer, and strengths and weaknesses of the methods and the software that implemented them.

4.1 The Morality Computer

This morality computer provided forms for ethical decision-making, which include McFarland's standards, and can accommodate different situations, and can be useful in computer ethics. They are an improvement over the juggler model which 1) cannot help in decision making, 2) does not provide support of the correctness of our decisions and 3) does not help address the complexity of ethical situations.

I have found that after using these tools the evaluation process can be applied quickly to complex decisions. It helps us learn the decision methodology and in that regard is a significant improvement over the juggler approach. This approach to the morality computer still emphasizes moral questioning activity from the individual.

These tools only help once someone has realized that there is a potential ethical issue. Put the use of these methods helps you learn patterns of potential ethical conflict. The processes are complex and when there is limited time to make a decision it is important to have developed habits of thought that can be trusted.

4.2 The tools

The software tools developed facilitate the correct use of these processes in a synergistic situation which might lead the ethical decision maker to ignore critical steps in the decision making process. A morality computer, which provides the form for ethical decision-making, has some limits but it can be useful in computer ethics. This approach to the morality computer is useful because it provides a certain comfort and familiarity to computing students AND gives them practice at keeping track of complex decisions. These methods look machine like and so provide comfort while the student is learning to exercise the values in making ethical judgements These tools do provide a way limiting the distraction caused by the complexity of these decisions.

4.3 The methods

Both of these methods are complex and require considerable time. Using them in a class causes much delay. When these methods are paper based processes, just keeping track of the data and introducing any change is difficult.

Both can accommodate changing situations. They both provide opportunity to revisit previous work. Unlike the morality computer, which let us relegate all difficult decisions and responsibility

to the computer, the application of these methods in software requires the interactive judgment and responsibility of the ethical individual. The final responsibility lies with the decision-maker and these tools facilitate our managing more complex decisions.

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