GOOD COMPUTING: A VIRTUE APPROACH TO COMPUTER ETHICS

A book under contract with
Jones & Bartlett Publishers
40 Tall Pine Drive
Sudbury, MA 01776
http://www.jbpub.com/

DRAFT FOR
June Puerto Rico writing retreat

Chapter 3

Solution Generation

Version 1: 03/22/05 by Chuck Huff
Version 2: 04/10/05 by Chuck Huff
(to do: add section on developer as a third party mediator)

Based on writings in www.computingcases.org prepared by Chuck Huff and Bill Frey and class documents from University of Mayaguez, PR, FILO 3185 prepared by Bill Frey

This chapter introduces you to principles and techniques of discovering and constructing solutions to ethical difficulties. We often think of creativity as something one is born with – one either has it or doesn't. But what we have learned about virtues (see chapter 12) suggests that one can get better at them with practice. Similarly with creativity, one can get better with practice and by learning some of the principles and procedures that make finding creative solutions more likely (refs to creativity lit).

We approach solution generation in this chapter as though one is doing it in the early stages of software development – establishing requirements, making a business case, connecting requirements to program architecture, etc. But this is mostly a pedagogical device. Creativity is required throughout the software design cycle, and even in areas on the periphery of software design (like establishing rules for team functioning). So, feel free to be creative about where you apply our advice about creativity.

We first introduce reasonableness as a foundational virtue for solution generation. That is because, from an ethical perspective, solution generation is almost always about resolving conflicting values and interests among different actors in the socio-technical system. This requires finding creative solutions that satisfy multiple constraints (multiple values among multiple parties and their expectations or requirements for the computing system). And doing that requires reasonableness.

We then move to a section that assumes that reasonable people are trying to find a solution and we propose two constraints on solution generation and two outcomes of successful solution generation. In this last section we give what high-level advice we can about how one stimulates creativity to find solutions.

We provide two running examples throughout this chapter. First, the Hughes case (see chapter 6 for the case in full detail) in which some decidedly unreasonable people make it difficult for two workers to resolve an issue involving testing of computer chips. This is really a personnel and procedures case rather than a software design case. Later in this chapter we present a software design case of an intelligent business system that helps in assigning tasks to skilled workers.

The Hughes whistleblowing case

In the mid 1980s, Hughes Microelectronics was manufacturing what were called hybrid microchips for use in guidance systems and other military programs. When computer chips are embedded in expensive weapons systems, the chips need to be tested to make sure they can withstand years of exposure to the extreme environmental hazards they might face. Unfortunately, the need to manufacture and deliver these chips on time can compete with the desire to test them thoroughly.

This case is about what happened when employees of Hughes Microelectronics noticed that these tests were being skipped. The decisions they made to report this makes this one of the classic cases in the history of whistleblowing.

Margaret Goodearl and Ruth Ibarra are the two whistleblowers in this case. Goodearl was in charge (along with Donald LaRue) of the floor area in which the testing was done. Ibarra was a quality control agent hired by the company to provide an additional audit of the accuracy and completeness of the tests. A series of incidents led up to the decision by Goodearl and Ibarra to blow the whistle.

On several occasions, a tester was ordered by Donald LaRue to pass a hybrid that had failed one or another of the tests. Goodearl, with Ibarra's support, reported each incident to upper management. On two of these occasions, Goodearl was later threatened with loss of her job if she did not reveal "who the squealer was," and I she continued to not be "a team player."

After several of these threats, Goodearl decided to file harassment charges in Personnel. She was summoned into the office of a middle manager who had been given the harassment documentation by Personnel. He tore up the harassment charge in front of her, flung his glasses at her, and told her that he was going to fire her if she ever went above him to complain again.

After Goodearl began to report incidents internally to upper management, her performance reviews took a sharp drop. Her earlier reviews had been excellent and she had been promoted to her current position because of them. The feedback she was getting from upper management was clear, she had to shut up and get with the team, or lose her job.

Finally, Goodearl and Ibarra, placed a telephone call to the Fraud Hotline of the Office of the Inspector General and agreed to "blow the whistle" and begin to look for clear evidence of fraud.

Reasonableness as the foundation for Solution Generation

Reasonableness is a virtue, that is, a disposition to act in a certain way when in a certain kind of situation. For example, the disposition of glass is brittleness. It behaves in a certain way (shatters) when put in certain situations (dropped on a cement floor). But virtues are more than just dispositions and reactions; they are habits developed by humans to act in specific, patterned ways when they perceive themselves to be in certain kinds of situations.

This last point can be restated by saying that virtues are *natural* dispositions that have been reshaped by moral reason. For example, say I have a natural disposition toward anger when insulted. Someone calls me a name, and I turn red, shout, and wave my arms about. A virtue emerges when we rework such natural dispositions through the guidance of moral reason. Because my natural disposition is to overreact when people provoke me, I make a special effort to hold back. I practice discerning insult from injury; I learn not to take it personally; I reserve my anger for those situations in which I am under a real threat. The virtue of temperance emerges as I gain proficiency in controlling and rationally directing my anger. It's not that I don't feel anger any more. It's rather that

my anger is now directed by and channeled through moral judgment. To borrow—and slightly modify—a phrase, I develop a moral virtue when I learn to respond relevantly to moral relevance. (ref to Herbert Fingarette, On Responsibility)

Aristotle points to another characteristic of virtues; they can often be charted out as the mean between two extremes, one of excess, the other defect. Again, take my anger. At the slightest provocation, I react angrily; I have too much anger. On the other hand, my friend Pedro is too passive; he readily accepts even the most outrageous, undeserved insult; he doesn't get angry even when the situation calls for it. He has too little anger. Therefore, I display the vice of excess with respect to anger while Pedro displays the vice of defect. The mean, the virtue, consists of the cultivated disposition to respond to anger situations in a proper and proportionate way; it consists of measured and appropriate anger when confronted with situations that call for it such as injustice or wrongful injury. In the Hughes case we find actors who do not deal with their anger well (tossing their glasses at offending employees) and those who take more measured steps in the face of provocation.

Characteristics of reasonableness

With this in mind, we turn to the virtue of reasonableness. Pritchard presents six characteristics of reasonableness and we add a seventh: (ref to Michael Pritchard, Reasonable Children: Moral Education and Moral Learning (1996) University of Kansas Press, p 11)

The reasonable person:

1. Seeks relevant information.
2. Listens and responds thoughtfully to others.
3. Is open to new ideas.
4. Gives reasons for his or her views.
5. Acknowledges mistakes and misunderstandings.
6. Aims first for creative, integrative solutions.
7. Failing that, compromises without compromising personal integrity.

Seeks relevant information

Reasonable persons look for relevant facts to defuse disagreements and inform decisions. They document their views with objective evidence. They work to uncover the constraints and limitations that surround action by asking what are the costs, technical limitations, organizational constraints, and time limits. They seek ethically relevant information by identifying stakeholders along with their needs, wants, responsibilities, and rights. They look for the ethical problems embedded in practical situations and, upon finding them, take early measures to prevent them. In short, they build their actions around the knowledge of—and sensitivity to—what is morally and factually relevant.

Doing this requires skill in seeking knowledge, judgment in ordering and recognizing relevant information, and often, specialized technical knowledge of what can be done and must be considered within particular domains (e.g. software development in military systems). In the Hughes case, Goodearl was handicapped in this respect because she did not have the engineering background that would have help her make a case for why

particular tests could not be skipped. Thus, even though she was reasonable, she was lacking in the specialized knowledge she needed to be able to suggest a solution that all sides might find acceptable.

Listen and respond thoughtfully to others

Reasonable persons are *active* listeners. They listen carefully to others and ask clarifying questions. They know how to ask questions without putting others on the defensive by conveying through their manner that they are interested in understanding what others think, not in attacking them. Moreover, when others express their views, reasonable persons restate these in their own words to check and verify their understanding. They make sure that they accurately reconstruct another's thought before responding. In addition, reasonable persons work to understand others *on their own terms.* They enter their perspectives and uncover their assumptions. They evaluate these perspectives on their own terms before applying external criteria. Finally, reasonable persons find value in what others are saying. They are sympathetic listeners and respect the views of others, even when they disagree. They may even help others to construct their arguments, so that the discussion can be held among positions that are equally well constructed.

Again, in the Hughes case we have unreasonable exemplars. They were not interested in understanding Goodearl's position or perspective. Instead they used intimidation and threats.

Be open to new ideas

New ideas—especially *good* new ideas—appear absurd in their initial formulations. Reasonable persons learn to suspend judgment until after giving them a fair and thorough hearing. Thus, reasonable persons make judgments without being judgmental. They evaluate the thoughts and opinions of others but only after careful examination. All this is another reason to help construct the ideas of others, even though they may at first seem implausible. Openness to new ideas includes willingness to seek ways of integrating them with what is familiar and acceptable. This fair and thorough hearing implies that reasonable persons are open to modifying their own views when there are good reasons for doing so.

Give reasons for one's views

Giving reasons for their views (and comprehending the arguments others offer for theirs) helps reasonable persons to understand both how they disagree with others and how they can work toward agreement. One aspect of this is distinguishing between one's interests and a particular position one might like. Later in the chapter we talk about this as a crucial move in finding integrative agreements. But giving reasons can also simply be associated with why a particular position is the best one.

Living with others means that we act in the same arena; our actions impact them while theirs impact us. This creates a series of responsibilities that reasonable persons acknowledge and honor; they answer with well-constructed reasons for their thoughts and actions; they allow that they may be called upon to account for them, to explain them, and to offer justifications couched in commonly accepted terms. In the Hughes case,

LaRue was not interested in giving reasons other than "I said so" for his orders. He did not try to persuade Goodearl of the wisdom of his approach. Instead, he bullied.

Acknowledge mistakes and misunderstandings

Reasonable persons are also responsible because they hold themselves accountable for their views and actions. They own up to their mistakes and misunderstandings, refrain from trying to shift the blame to others, and respond proactively to their mistakes and misunderstandings by offering solutions to the problems they have created. Finally, they responsibly adjust to their mistakes, taking serious measures to prevent their mistakes and misunderstandings from reoccurring. (ref to Peter French, Collective and Corporate Responsibility, Chapter 11 (1984) Columbia University Press, pp. 145-163. (Principle of Responsive Adjustment.) Tremendous effort was put into covering up mistakes and denying misunderstandings at Hughes. In the end, it unraveled, but not after ruining the careers of Goodearl and Ibarra.

Aim first for a creative, integrative solution

Reasonable people don't pursue compromise as a first course of action. Before compromising, they seek solutions that synthesize, combine, harmonize, or balance the conflicting values. These creative, integrative solutions combine rather than trade off crucial values. Because reasonableness requires creating solutions that integrate conflicting values, it values creativity and innovation. In the second section of this chapter we provide guidance on procedures that help in constructing these integrative solutions. No effort was put into designing integrative solutions to the testing problems at Hughes.

Compromising without compromising personal integrity

If they cannot find an integrative solution, reasonable people are open to compromise and are sensitive to the circumstances of compromise: (1) factual uncertainty, (2) moral complexity, (3) the need to maintain a continuing cooperative relationship, (4) the need for an immediate decision, and (5) scarcity of resources. (Benjamin) They are willing to compromise (when this willingness is met by and reciprocated by others), but they stop short of the point where it threatens personal integrity. For example, Goodearl was probably open to compromise with her supervisors, including LaRue. Within the limits of her technical knowledge and organizational power, she would have worked to find ways of speeding up chip testing and to negotiate extensions on chip delivery deadlines. But she correctly drew the line at actions that threatened the safety and health of others; she withheld consent to skipping the tests and refused to participate in efforts to conceal the test skipping to the customers.

Excess and defect in reasonableness

These seven features characterize reasonableness. They spell out reasonableness as the mean between two extremes. But what are these extremes? The vice of deficiency consists of (1) "feeling a need to always agree with others," (2) "lacking deeply held beliefs and convictions that may differ fundamentally with those of others," and (3) to "be willing to change virtually any belief or conviction, however deeply held." (ref to

Pritchard) Those suffering from a deficiency of reasonableness abandon their central beliefs at the drop of a hat. Perhaps they lack these central beliefs altogether. We can understand the vices of deficiency of reasonableness by looking at three character-types: wantons, chameleons, and opportunists.

Wantons who exhibit no enduring character because they have no lasting moral commitments. (ref to Frankfurt) Their beliefs, values, and personality traits are evanescent; wantons change frequently and unpredictably. We might be inclined to classify them as egocentric because they don't recognize and respect others. Yet this would be wrong. Egocentrism presupposes an enduring ego, a solid and persisting core of personal convictions, values, and traits, all of which wantons lack.

Deficiency in reasonableness is also manifested in *chameleons* and *opportunists* (ref to Benjamin). These individuals prematurely change their convictions in response to others, chameleons to reflect prevailing opinion and opportunists to promote self interest. While reasonable persons sometimes change their thoughts and plans, they do so only for good reasons and after careful self-examination. People lacking in reasonableness (wantons, chameleons, and opportunists) change their views without this reasoned self-evaluation.

In short, wantons, chameleons and opportunists lack personal integrity which limits, guides, and controls the changing of one's beliefs. Reasonableness is firmly grounded in personal integrity; it issues out of a solid enduring core of beliefs, values, and opinions that help reasonable persons to draw an ethical "bottom line," i.e., a point beyond which they will not compromise, change, or give in. Rather than manifesting inflexibility and self-righteousness, this foundation of integrity makes it possible for us to work with and rely upon reasonable persons. In fact, integrity may be thought of as a kind of higher order virtue, one that is necessary to enable other virtues (like reasonableness) to exist (ref).

A Fistful of Dollars, Chameleons, and Opportunists

Clint Eastwood became famous for his role as the gunman with no name in the so-called Spaghetti Westerns (*A Fistful of Dollars, For a Few Dollars More, & The Good, the Bad, and the Ugly*, all directed by Sergio Leone). In the first movie of the series, Eastwood plays a gun for hire looking for employment in a town torn by conflict between two powerful and violent families. Toward the beginning of the movie, he stands on a balcony in the middle of town. "The Rojos are on one side, the Baxters are on the other, and I'm in the middle. The crazy man was right: there is money to be made in this town." His strategy is to offer his services to both families. By playing one off against the other, he plans to create a mini arms race that will guarantee a high demand for his skills.

Many view professionals as guns for hire for two reasons. First, professionals have special skills for which others are willing to pay good money. Second, professionals reputedly take on the moral values of their clients, i.e., those who pay them, but have no independent values of their own. In short, professionals as guns for hire sell their

services to the highest bidder and then, as chameleons, allow themselves to be colored by the moral, amoral, or immoral views of their clients.

But *Fistful of Dollars* takes a surprising turn. Eastwood's character discovers that he is not a chameleon, that he has already made commitments to moral principles that have become a part of his identity. He cannot stand aside and watch Ramon (the leader of the Rojo family) sexually exploit the beautiful _____ and mistreat her husband and son. His highly profitable venture unravels as he risks himself to help her and her family escape from the town. In the midst of moral decay, the gunman with no name makes a heroic, moral sacrifice.

Consider this in the context of the vice of deficiency in reasonableness. The gun for hire is an opportunist and a chameleon. But Eastwood's character is unable to maintain this in the long run because of moral commitments he has already made that enter into his very identity. He can no more set these commitments aside than deny who he is. So watch the movie. See if you can identify the point at which the gunman with no name abandons the role of chameleon to carry out the moral commitments that define him as a person.

The vice of excess forms the other extreme of reasonableness. *Self-righteous individuals* "insist that they are necessarily right and others wrong." (ref to Pritchard) This constitutes the essence of the harmful practice of polarization, a process where we convert difference into opposition; in polarization, we exaggerate the differences and deny any common ground. Polarization replaces the reasonable process of reaching agreement with the unreasonable activity of vilifying and repudiating those who disagree with you.
Because they know they are right, self-righteous individuals brand those who disagree with them as wrong. This releases them from the much harder process of listening to others, finding out what they have to say, and then working with them in the construction of common ground. Self-righteous individuals see anything short of victory for their side and defeat for the other as moral failure. This drastically limits their creativity. The self-righteous individual must win and for him (or her) "I win," always means "You lose."

Moral bullies, also "insist on having their own way." (Pritchard) Backed by the twin convictions that they are right and those who disagree are wrong (bullies and self-righteous individuals are a lot alike), they prevail by overwhelming those who dare to disagree. They replace reason, argument, persuasion, and compromise with threats, deception, manipulation, and force. In the final analysis, the vice of excess in reasonableness (that leads to bullies and the self-righteous) leads us to ride roughshod over others; we fail to recognize and respect their autonomy and dignity.

Both these approaches are characterized by what psychologists call the Fundamental Attribution Error, or FAE (refs). This is the tendency to attribute the behaviors of others to their personal dispositions. This is particularly true when the behaviors of others are perceived negatively. Thus, LaRue thinks that Goodearl is "not a team player" when she reports skipped tests, instead of thinking that she might be constrained by the procedures

for testing. The FAE leads people who disagree with each other to polarize their opinions and attitudes by:

1) *Blaming the other for unpleasant experience.* This involves assuming that the other intended the unpleasant experience (e.g. Goodearl meant to cause trouble).
2) *Interpreting ambiguous action as threat*. If, in fact, Goodearl is a "troublemaker" then when she asks questions about proper procedure, she is likely to be "looking for trouble."
3) *Being less inhibited in attacking the other.* Since the other deserves punishment, and is the sort of person who means to harm us intentionally, we have to defend ourselves vigorously. This "aggressor-defender" model of conflict is a central cause of conflict escalation (refs).
4) *Restricting communication with the other.* Since they are the kind of person who doesn't mind hurting us, why waste time and energy talking to them? Besides, it is uncomfortable and we expect retaliation.
5) *Failing to empathize with the other.* We have already concluded that it is their disposition to do bad things to us. So we do not look further for other motivations or situational constraints that might have influenced their behavior. This lack of search for alternative explanations condemns us to a cycle of self-fulfilling prophecy (refs)
6) *Interpreting all proposals as zero-sum.* Advantages for the bad guy must necessarily be disadvantages for the good guy (thus, they sum to zero). This means that all proposals for integrative solutions are automatically suspect, since if "they" like the proposal, it must be bad for us.

It is not always wrong to assume that the other person is out to get us. They might be. But by following these clearly unreasonable six steps we can assure that we will never find out if we are wrong (refs). And we may, in fact, actually end up producing the enemies we expected (thereby confirming our expectations).

The following text box summarizes the virtue of reasonableness by presenting the characteristics of the mean in relation to the extremes of excess and defect:

Textbox: Reasonableness as a Virtue

Reasonableness as an Aristotelian virtue, i.e., as the mean between the extremes of defect and excess

Defects	**Mean**	**Excess**
(Wantons, chameleons, and opportunists)		(self-righteous individuals and bullies)

1. *Feel a need always to agree with other team members* 2. *Lack deeply held beliefs and convictions that may differ fundamentally with those of others* 3. *Be willing to change virtually any belief or conviction, however deeply held*	1) *Seeks relevant information.* 2) *Listens and responds thoughtfully to others.* 3) *Is open to new ideas.* 4) *Gives reasons for his or her views.* 5) *Acknowledges mistakes and misunderstandings.* 6) *Aims first for creative, integrative solutions.* 7) *Failing that, compromises without compromising personal integrity.*	*1. Insist that they are necessarily right and others intentionally wrong* *2. Insist on having their own way*

Designing integrative solutions

In discussing the attributes of reasonableness, we suggested that reasonable persons aim first for value integrating, creative, middle-way solutions. In this section, we explore this further by pointing to an analogy between design and ethics with respect to how each formulates problems and creates solutions. (Carolyn Whitbeck Ethics in Engineering Practice and Research (1998) Chapter 1 Cambridge University Press, pp. 55-73.) Reasonableness requires the cultivation of a new approach to ethical problems where we work to design solutions that integrate conflicting values rather than sacrifice one to the other. Applying the ideas and techniques of solving design problems to solving ethical problems provides us with a new and powerful way for integrating ethics into computing practice.

Let's begin with a design problem in computing: construct the prototype to an intelligent business system (IBS) that assigns work tasks to appropriate individuals. The IBS has the following specifications: [IBS designed and described in dissertation of Jose A. Cruz-Cruz]

1. *Assign each work task to the best qualified individual.*
2. *Assign each work task to an available individual*, i.e., one who is not already committed to other tasks.
3. *Collect information on past work task assignments that can "informate" future work task assignments*. (When a task is assigned, the IBS will generate information on how well it has been carried out. Then the IBS integrates this information into future task assignments.) (See Shoshana Zuboff on informating)
4. *Recognize and design for constraints such as cost, time, law, decision-making structure, and technical feasibility* (including testing the software components of the IBS).

5. *Satisfy ethical constraints by respecting stakeholder rights, minimizing harm, maintaining justice, and preserving integrity*.

These specifications and constraints can be flexible in that they can often be modified, expanded, contracted, or eliminated. For example, the designer may be able to negotiate an extension of a deadline, expand technical constraints through innovation, modify cost constraints by negotiating a larger budget (or by developing cost-cutting measures), and make changes in an organization's structure to better accommodate the product, process or service. But though they can be modified, the constraints do not usually disappear. Furthermore, the designer must address the constraints early in the design process so that they can be met with a minimal impact on the other components of the design; if you have a deadline then you should address this from the beginning of the design process, rather than waiting until the end to respond to the impending due date. One of the central skills that distinguishes an experienced, professional software design manager is the ability to forecast constraints (but also to adopt to them when they inevitably change.) Both of these skills requires creative problem solving.

We present here two kinds of constraints on creative problem solving in the ethical arena: resource constraints and interest constraints. We have listed some of both in the example. Time, money and technical capacity are resource constraints. Different stakeholders in the system have different interests in the system that create ethical, value, and position constraints (e.g. privacy as perceived by employers and employees). These interest constraints are as real as resource constraints and can be the underlying reason that resources are constrained (the party with power over the budget has more power over the system).

After reviewing these constraints, we look at techniques that support successful ethical design. Successful ethical design is the embodiment of decisions to integrate and compromise. Ethical design involves working to integrate, and failing that, to creatively compromise on, the valued outcomes of all the stakeholders. It requires thoughtful work and moral creativity to craft a solution. What we cover here are techniques that may help you craft successful, ethical, software designs.

Two constraints on successful ethical design

The design is constrained by resource limitation

We must implement ethical solutions into the real world. This means that ethical (as well as technical) solutions must satisfy time constraints, be technically feasible, satisfy cost limitations, conform to legal requirements, and be realizable within certain organizational and social contexts. However (as with design problems) these constraints are often negotiable and flexible. Sometimes the only way to avoid an ethical dilemma is to renegotiate the background constraints. Goodearl's difficulty might have disappeared had Hughes Aircraft upper level management negotiated an extension of the chip deadlines. In the section on integration and compromise, we present some tools for resolving some resource problems. We explore resource limitations in more detail in

chapter 5, which covers what we call a feasibility test: is it feasible to implement a particular solution?

The design is constrained by interests

Only in the rarified atmosphere of a research lab are you likely to find design problems that are not constrained by the interests of multiple stakeholders. In any system meant to be used by people in the real world, those people (we have now learned to call them stakeholders) will likely have different interests. For example, in the IBS I mention above you have at least management and workers. Management wants accurate data on workers' competencies and schedule, while workers would be understandably worried about any system that monitored their performance in a way that gave management more power over them. One might implement that system only to find subtle sabotaging of the data in the system (e.g. if number of keystrokes matters, how about just holding down the space key?).

Interest constraints are as ubiquitous as resource constraints, and a system that does not take them into account is bound to fail (far too many refs). First, however , we need to distinguish between differences that result from disagreement about facts and difference that result from real differences in interest.

Disagreement vs conflict

In chapter two we covered the distinction between disagreement and conflict, but a short review here will be helpful. Like the employees and management in the example above, there might be a conflict based on how a system shifts power from one group to another, threatening one group's interests. But it might also be more simply based on a disagreement about the facts. Employees might not believe that the IBS will actually improve their working conditions by spreading the work load more evenly, while management might maintain that it will. Often careful requirements analysis at the beginning of the implementation of a system can help resolve these disagreements. Workers may well know the structure of their work day better than does management and thus, if they are consulted be able to suggest ways that the system can take account of their work structure.

As we covered in more detail in chapter two, the solution to a factual disagreement is often the collection of data that both sides can agree upon. When it becomes clear than even after more conversation about factual claims, and even after more investigation, the parties still disagree, one should suspect that there is an underlying conflict in interest that leads to individual interpreting data differently. Under these circumstances, it is often better to try to bridge the different interest rather than spin wheels collecting data that will not resolve the underlying tension. To do this, one needs to think carefully about how the conflicting interests are structured.

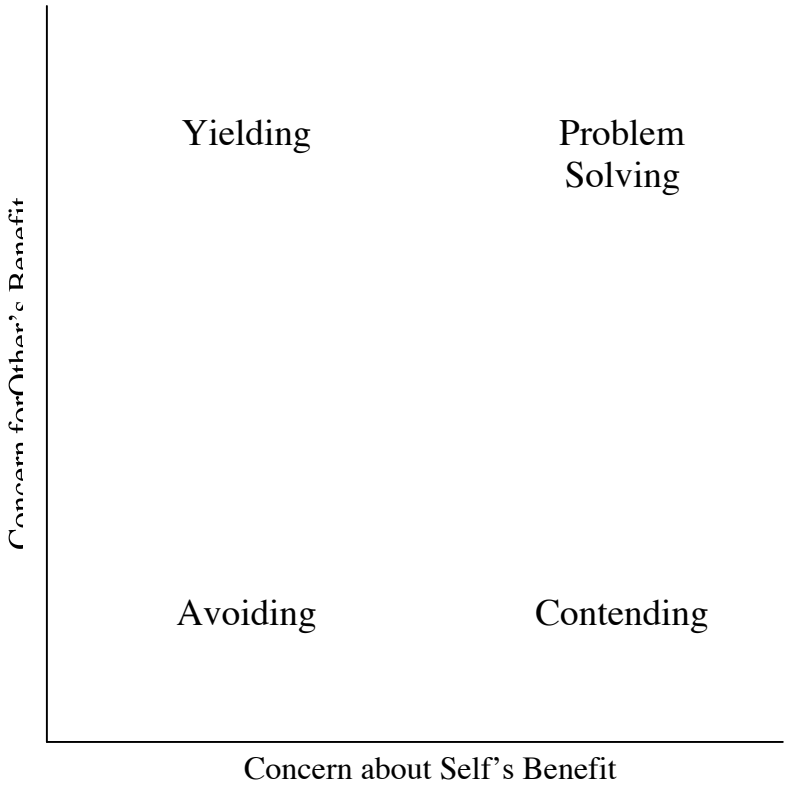
Structure of Conflict

Not all conflict can be resolved. Indeed pessimists insist that conflict can rarely be resolved and that supposed solutions usually only postpone conflict until the basic

interests of conflicting parties again emerge, or until parties can regain the strength needed to resume the conflict again (if it seems in their interest). Nevertheless, the business of software engineering is often balancing the concerns of the range of stakeholders in a system, and being aware of the structure of how those interests conflict can help.

Strategies and the dual concern model

First, we need to be clear that not all parties are interested in resolving conflict. This may be because they feel they have enough power to win the conflict without need to bother about other's interests. Or it may mean they would rather abandon the field rather go to the trouble of enduring the tensions associated with open conflict. The following graph (from Pruitt & Kim etc.) helps us understand when someone might choose one strategy or another.



Not surprisingly, when concern for self is high and fo the other is low, contending is the preferred strategy. And if one cares more about the other's outcome that one's own outcomes (you are willing to sacrifice for a valued other, or you are talking about some issue that really does not matter much) the yielding is easy to do. And when you don't care about either your own or the other's outcomes, avoiding the conflict is the easiest thing to do. One often finds this easy willingness to avoid conflict in many classroom ethical discussions, where real issues are not really at stake. In these situations it is easy to be a relativist and agree that everyone is right. But when you care deeply about the

outcome of a decision, then you are more to the right side of this chart, and the strategies of contending or problem solving.

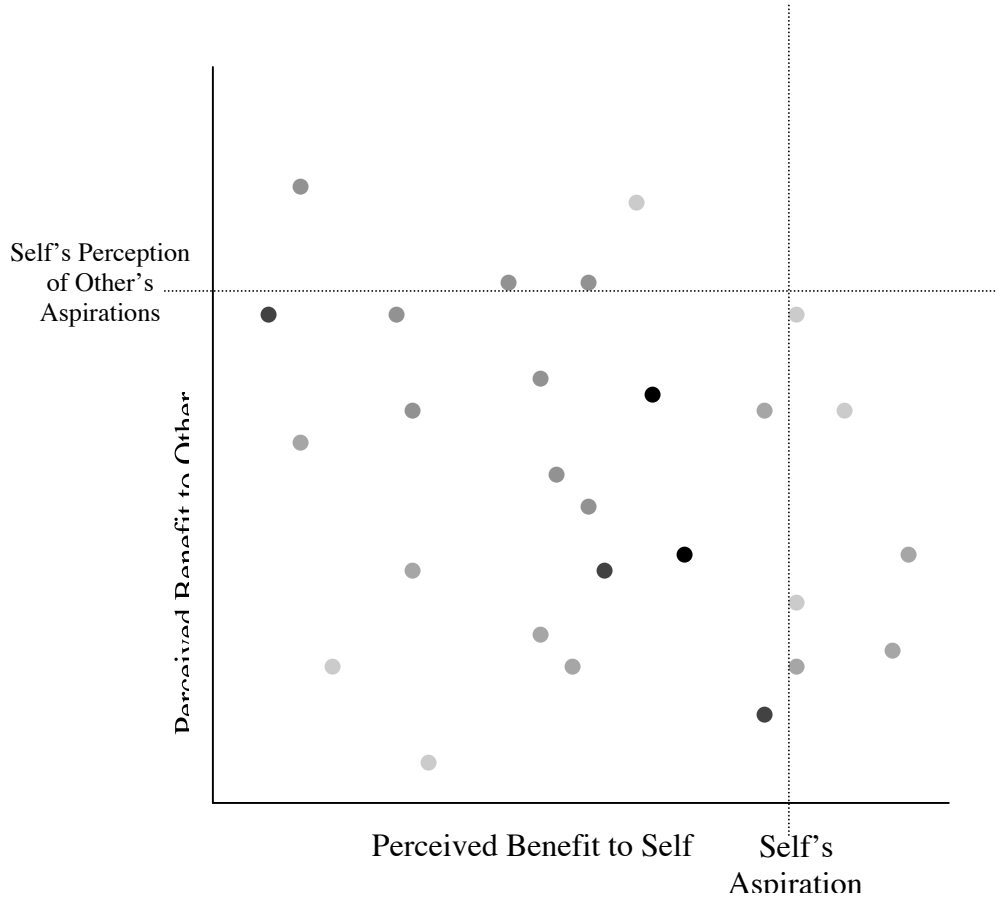
When concern for both the self and the other outcome is high, then one is likely to see problem solving on the part of an individual. Concern for the other can come about in multiple ways. One can care for the outcomes of the other for principled, ethical reasons, or because of personal commitments, or community ties. One can also be brought to care for the outcome of the other when it is clear that doing something in the other's interest is the only way to get the outcomes one wants for the self. Thus, selfless care for the other is not required to motivate parties to problem solving. What is called *enlightened self interest* is sufficient. Management may well know that their best interest is served by finding a solution to the conflict of interest over the IBS that makes both management and workers happy.

Trust

Now that we have explored the shared concern chart, we can understand one approach to what trust is in a relationship. It is the belief that the other party cares about your outcomes (and is thus likely to problem solve rather than contend). And this makes it clear that trust can be based on clearly perceived mutual self-interest rather than on naïve underestimation of the other's deviousness. Trust, and the belief that that a feasible solution might be found, are together what make problem solving possible in ethical design. This latter item is called *perceived integrative potential* by students of negotiation.

Perceived Integrative Potential

One might want to problem solve, but still not think that a solution can be found. And, of course, there are degrees of motivation to problem solve, and the belief that a solution is unlikely may well reduce the desire so far as to make problem solving unlikely. What things influence the belief that solutions are worth working towards or not? The candidates are legion. If one has little technical knowledge or shallow experience in an area, one has less reserve of knowledge to use in constructing solutions. If one does not trust the other party, or is unconcerned about the other party's outcomes, then one might think a solution could be found, but not be willing to waste the time looking for it. We look here at three other items that influence perceived integrative potential: perceived levels of aspiration for self and other, and the likelihood that a solution meets those expectations.



In this graph, the dots represent possible solutions, and the darkness of each dot represents self's understanding about how likely it is that solution can be achieved. The solutions are plotted in a space representing the perceived benefit of each possible solution to the self and to the other. The dotted lines represent what the self thinks are its own aspirations and what it perceives the other's aspirations to be. If, for instance, I an Goodearl and want to problem with Larue, I may be willing to do so, and even think LaRue would be willing, but be deterred from trying if I though LaRue's aspirations (the horizontal dotted line) were so high as to keep make no solution acceptable to him. IN fact, in this graph, both lines and the likely solutions are positions so that there are no solution to the upper right of the intersection of the two dotted lines. Thus, one either needs to work to find solutions in this space, or work to lower expectations. Lowering expectations may be compromise (if both parties lower them to find a solution), or it may be yielding if only one party lowers aspirations.

Thinking about conflicts of interest in terms of shared concern and perceived integrative potential gives us a language to talk about why parties choose particular strategies in a conflict or a negotiation. But it also gives us a language to talk about how one might begin to construct creative solutions.

Techniques for successful ethical design

We provide you here with principles and techniques of creative integrative software design. Successful design embodies decisions to integrate and to construct compromise among the interests of the various stakeholders in the socio-technical system. We will talk here about approaches to doing this that allow you as the designer to maintain your commitment to quality and to ethical principles.

How to Integrate: basic interest vs. specific positions

A standard principle in the literature on negotiation is that it is often more successful to bargain about basic interests rather than about specific positions. A specific position in the IBS socio-technical system that workers take might be that performance data about individuals not be identifiable, and that data only be kept on work groups. Management might take the position that individual level data is essential to the performance of the system. This is a difficult disagreement, and one that is central to the IBS system and to the performance monitoring system at National Insurance (see chapter 7 on privacy for this case). Positions like these then might be fed into a negotiation as the system is designed and requirement are collected. The usual outcome in this sort of a negotiation is that positions are stated and the side with more power (usually but not always management) makes a decision in its favor. Depending on your perspective, this might be called contending on the part of management or deciding on a process to select a winner. We will see in a moment why choosing winners is problematic (though sometimes unavoidable) in situations like these.

A way to avoid having a fight over who wins given these positions is to ask what the basic interests are on both sides and try to find solutions that satisfy both sides' interests. Clearly, their positions cannot be integrated, but perhaps their basic interests can. In several other chapters in this text you have been learning to analyze interests of various stakeholders in a socio-technical system. So you might try to do so for this instance too (or try for the nore detailed situation in the National Insurance case). For instance, the position of the workers seems to be motivated by a concern for privacy (a basic interest), or perhaps by a concern that data will not be used appropriately to assess their performance. Management's interest in its position might be that they have the information they need to both train workers for better performance and to dismiss them if they do not improve. A little creativity here might allow one to find a system that satisfies all these basic interests. We present here several ways that basic interests can be integrated.

Expanding the Pie

If the difficulty is a resource constraint (not enough time, money, personnel, etc.) then often simply increasing the available resource can resolve issues. If you can make a data-based argument for the value that increased resources will provide, you are more likely to convince those with the resources to allocate more. Making the case itself may require some resources (e.g. time), and you may need to ask for those. In the IBS situation, you might be able to make the case that building a system that collects less data that is

carefully targeted will cost less, and make resources available for enhancements to parts of the system that ensure that the data cannot be misused.

Nonspecific Compensation

This approach involves trading off different interests that the parties have. Thus, one side makes a concession to the other, but is compensated for that concession by some other coin. For instance, workers may also be frustrated with the way management makes task assignment decisions, and be willing to agree to more intrusive monitoring if they are allowed a representative on the team that does task assignment (and thus have access to the data and how it is used). Of course, in order to find out that one can trade these sorts of things off, one needs to know something about the various interests of each party. That is why data collection as a part of the analysis of the socio-technical system is so important. But in tense workplaces, both management and workers may be unwilling to lay basre their basic interests and their willingness to accept tradeoffs because they may feel admitting that a tradeoff is acceptable puts them in a vulnerable situation. There is no easy solution to this sort of difficulty, but solution is almost impossible if you have no information about the parties in the socio-technical system.

Logrolling

This involves each party lowering their aspirations on items that are of less interest to them, thus trading off a concession on a less important item for a concession from the other on a more important item. For instance, management might be willing to accept reduced data collection if workers agree to a process for handling disputes about task assignment and discipline. Each party gets some of what it wants, and gives the other party something they are willing to concede. Again, determining which tradeoffs are acceptable in a socio-technical system can be difficult, particularly if there is a history of mistrust.

Cost Cutting

Cost-cutting is really a form of non-specific compensation. I means that one party (e.g. workers) makes an agreement to reduce its aspirations on a particular thing (e.g. the level of detail of the data being collected on performance) and the other party agrees to compensate the party for the specific costs that involves (raising wages, for example, or other benefits).

Bridging

Bridging involves finding a higher order interest on which both parties agree and constructing a solution that serves that agreed-upon interest. For instance, in the initial description of this disagreement over monitoring, it looked like both parties are interested in data that is appropriate to assessment of performance. If may be that research from the literature on intelligent business systems can help them agree on what is the best data to collect here and how it can be used to both enhance worker autonomy and the ability of management to assign tasks and discipline workers. This approach has two difficulties to surmount. First, as in the other approaches, it may be difficult to get the various parties to talk about their basic interests. Secondly, there may not be the standards, best

practices, or other information that allows you to construct a solution that integrates the two interests.

Firm flexibility

This oxymoron is a description of the attitude that a system designer needs to have when trying to construct a creative solution to the interests of various parties in a socio-technical system. Firmness in commitment to the basic interests of the parties, and flexibility in the way that those interests are accommodated. Of course, firm flexibility is required by the parties too in order to construct a solution. If they are only interested on contending, then the system designer will be required to choose among the parties. But if the designer can help the parties find a solution that accommodates both their interests, the designer is no longer caught in the difficult choice. Constructing these creative solutions is itself difficult, but it can produce higher quality software that is effective in organizations for the purposes for which it was designed.

How to be creative

There is a large literature on creative processes (ref)s and even some work on creativity in software design. We review here some of the basic ideas in creativity that may help you are you try to construct solutions.

Brainstorming

Brainstorming has become a generic term to simply thinking up lots of ideas. But research (refs) makes it clear that there are better and worse ways to brainstorm. If a group is going to brainstorm ideas face-to-face, the best thing is for each individual to do generate as large a list of ideas beforehand (or to set aside a time for this at the beginning). Each participant then has a list of items that they have thought of. Them the interactive brainstorming begins. Participants should be committed to getting the group to consider every idea that has been listed by any participant in their private list. Initially, ideas should be welcomed and some attempt made to improve them, only later should they be rank ordered in terms of desireability. This approach allows the most ideas to be generated, taking advantage of the creativity that is sparked by group discussion, while also limiting the ability of the group to quash an idea from ever coming up (refs). Some work in the area of computer supported cooperative work has been done on brainstorming support software, and there is some evidence that anonymous brainstorming is helpful in situations were there is a large power differential among participants.

Abstraction (higher order concepts)

Literature on creativity (refs) suggests that abstracting out the higher order goals can help jog the mind loose from particular solutions. This is, or course, what we were talking about when encouraging you to look for interests rather than positions. The bridging solution we suggested above was using abstraction to change the ground of solution generation to somewhere more fertile. But it also helps in other ways. For instance, if you have worked on the chapters on privacy in this book, you know that some of the philosophical work suggests there are different kinds of privacy that people care about.

Moving to this abstract level might help you recognize that the workers initial position is one about informational privacy, but at the center of their demand is really something more like decisional privacy, or autonomy. They may really care about the ability to influence decisions that affect them and they may not in principle be opposed to the collection of appropriate (and appropriately used) data on their performance.

Geneplore

The geneplore model of creativity (ref) is based in early models of cybernetics. You will be familiar with the test-operate-test-exit sort of control loop. You have a criterion that you want to match (or exceed). You test to see if it is matched. If not, you operate to move it closer to the desired value, then test again. Once it is matched or exceeded, you exit. The psychologists who have created the geneplore model suggest a procedure something like this for working with creative ideas. Generate ideas and explore them, testing them to see it they satisfy criteria. Both generation and exploration are important. For example, in brainstorming, one should not initially dismiss ideas (even if they look silly on their face), but should instead explore ways of modifying them, or modifying constraints, or reducing aspirations, or logrolling, etc. that might allow the idea to work.

Best Practices

Another very valuable source for creative ideas in software design comes from best practices in the field. Here is where technical knowledge in computing and in your field of application (e.g.. business systems) combines with ethical practice most closely. In many fields (Privacy, for instance) various organizations have established principles of best practice that you can use as guidelines in generating your own solutions. We provide some references to these best practices in the areas our case chapters cover, but best practices exist all over the professional and non-professional world are too numerous for any single compendium. The ACM and IEEE special interest groups are a good place to begin looking for these, but practitioners in any area will have ideas about where they can be found. If they do not exist, often they can be constructed by looking at the methods that others use in similar situations, and asking what criteria one might use to evaluate them in terms of quality.

How to Compromise

The need to compromise arises when, for various reasons, it is not possible to develop a creative middle way solution. Decision-makers now must look for ways to resolve the conflicts by, say, trading off less important values to promote those more important; by partially realizing the conflicting values; by realizing one value now and others at a later time. We call compromises those methods of conflict resolution that fall short of integrative solutions and involve trading off one or more of the conflicting values. Martin Benjamin distinguishes compromise as an outcome from compromise as a process. Compromise as an **outcome** consists of splitting the difference between two positions. Consider a company that has to choose between policies that promote immediate profits (within the next quarter) and those that seek to bring about profits in the long term (after ten years). We could split the difference through a policy that would aim at bringing about profits in five years (0+5 and 10-5). (More sophisticated ways of compromising might involve pursuing both policies at the same time by dividing

resources and energy between the two or pursuing the short term strategy first and then the long term strategy.)

Compromise as a **process** involves valuing rational persuasion, mutual trust and reciprocal concession over force, threat, and intimidation. The components of reasonableness are still in operation, but this time they are directed away from optimizing all values (which has been tried and has failed) toward trading off these values in ways that are acceptable to the parties involved. What Benjamin calls compromise as a process is more or less what we have discussed as the virtue of reasonableness. The difference lies in the outcome: reasonableness aims at optimizing and integrating conflict values while compromise seeks outcomes that result in acceptable trade offs between conflicting values that we are unable to realize all together at once.

Compromises and the Problem Taxonomy

In chapter 10, we looked at a taxonomy of the different kinds of ethical problems professionals might face. We repeat here what we said there: it is always best to first aim at value integrating, creative middle-way solutions. But each problem form suggests general forms that compromise solutions could take:

1. **Compromises on factual disagreements**. The resolution to factual disagreements is to uncover the facts in question. But, as we saw above, this is not always possible; a degree of uncertainty may be necessary. Compromise solutions would touch on what to do with this uncertainty. For example, if the uncertainty concerned the risks involved in a computing system, then the parties bearing the risk might agree to a formula that distributed these risks in an equitable way and would compensate those who wound up bearing the risks.

2. **Compromises on conceptual disagreements**. Ideally, we work to solve conceptual disagreements by working through some procedure that generates a definition that we can all agree upon. (An example might be to identify positive and negative paradigms and then draw the line with respect to the case at hand.) Falling short of this ideal, we could stipulate a conceptual agreement or decide on a course of action while putting the conceptual disagreement in abeyance.

3. **Compromises on conflicts**. Ideally we design a value integrating solution. But falling short of this, we can split the difference if the values are (at least partially) quantifiable. Or one party can concede to the other with the understanding that on the next tough case, they will get the call. Finally, it may be possible to put the conflict in abeyance, carry out a necessary action, and return to the conflict when there is more time to work out a creative middle way solution.

When is it appropriate to compromise? When is it necessary to compromise? Benjamin answers these questions by discussing what he calls the "circumstances of compromise."

These are (1) factual uncertainty, (2) moral complexity, (3) the need to maintain a continuing cooperative relationship, (4) the need for an immediate decision, and (5) scarcity of resources. (Benjamin) We discuss each of these in more detail below by describing the condition, giving an example, and detailing a compromise strategy:

1. **Factual Uncertainty**. In Chapter 10 we identified several areas where factual disagreements become difficult to resolve: (1) situations where conflicting testimonies of witnesses create intransigent disagreements on *historical facts*; (2) uncertainties that arise from limitations in our ability to resolve scientific questions; (3) limitations on our ability to gather or collect facts imposed by time and money constraints. An *example* of factual uncertainty requiring compromise might be how much we should test the above-mentioned IBS before implementation. Software testing cannot validate with 100% certainty that the programming is error free. The programmer might want to continue the testing while the company wants to start using the IBS now. A compromise solution would split the difference. Compromising strategy: One could agree to design around the uncertainty and distribute the created risks equally. Or one could split the difference as in the above example. All such compromises involve all parties understanding the extent of the uncertainties and the inherent risks.
2. **Moral Complexity**. Moral conflicts, that is, conflicts between competing moral values that can't be realized at the same time, are unavoidable. Benjamin makes this point by quoting from the philosopher, John Rawls:

> "Diversity naturally arises from our limited powers and distinct perspectives; it is unrealistic to suppose that all our differences are rooted in ignorance and perversity, or else in the rivalries that result from scarcity….Deep and unresolvable differences on matters of fundamental significance…[must be acknowledged] as a permanent condition of human life."

An example of such moral complexity is the conflict between the competing demands we impose on our Internet browsers. On the one hand we want browsers that give us access to as much information as possible. On the other hand, we want to protect our privacy and anonymity as we operate on the Internet. These conflicting moral values—and the difficulty of realizing both at the same time—create the need to compromise. Compromise strategies: (1) the conflicting moral values could be ranked and preference given to those with higher priority or (2) if the relation between the parties is ongoing, one party could agree to sacrifice now with the understanding that the others will do so in the future. Important here is the consent of all the parties involved in the compromise and their agreement to compensate those who wind up with the short end of the stick.
3. **Continuing Cooperative Relationship**. Some problems can be solved simply by severing the relationship. Hughes aircraft tried to do this by transferring LaRue away from the quality control group. However, severing the immediate relationship is not always possible. Even from his new position, LaRue was still involved in chip testing and exercised influence to speed up the

process. Compromise Strategy: One side compromises now with the understanding that the other side will give way the next time. Another strategy requires each side to make an equal concession; this justice would set future relationships on an equal footing.

4. **Decision Cannot be Deferred**. Often, we can postpone a decision to make time to develop a creative middle way solution. But sometimes (as in the Hughes case) this is not possible; postponing may not be possible because of deadlines or additional costs imposed by delaying action. In this case, it may be necessary to compromise; one compromises on a lesser harm to avoid the greater harm imposed by further delays. An example: in the Hughes case, a compromise with the clients on chip deliveries might involve hiring more people to test chips and Hughes splitting the additional costs with the clients. Compromise strategy: Pursue a course of action for a trial period and then have all the parties assess the results. Or accept a less than optimal solution with all the parties equally sharing the additional burdens.

5. **Scarcity of Resources**. There is not always enough money, time, or resources to satisfy the needs of all the stakeholders involved. As Benjamin puts it (32), "We often lack the time, money, energy, and other human and natural resources to satisfy everyone's rights or interests let alone their wants and desires. And when rights or interests conflict because of scarcity compromise may seem to be both necessary and appropriate." An example: there are not enough computer technicians to maintain the equipment in a university computer lab. Compromise strategy: if the resources are quantifiable, then they can be divided equally (or according to any other mutually acceptable formula such as need or merit). The *time* of the computer technicians could be equally divided among the competing needs. Thus, all parties would share in the burdens produced by the scarce resources; this could be a temporary solution until the laboratory prepare a grant proposal to hire more technicians to cover the work load.

Reasonableness, Compromising, and Integrity

Robert Bolt's play, A Man for All Seasons, provides excellent insight into how personal integrity sets the limits to compromise. He explores this through the character of Sir Thomas More, an English politician of the 16th century who was executed for high treason against Henry VII, the king of England. But the charge of treason was specious; More's real dilemma was whether to compromise his religious beliefs in order to conform to the political demands of the time; in our terms whether to abandon personal integrity in order to become a political opportunist. Bolt affirms this as the central theme of the play in the following passage from the Preface:

> At any rate, Thomas More, as I wrote about him, became for me a man with an adamantine sense of his own self. He knew where he began and left off, what area of himself he could yield to the encroachments of his enemies, and what to the encroachments of those he loved….[A]t length he was asked to retreat from that final area where he located his self. And there this supple, humorous, unassuming and sophisticated person set like metal, was overtaken by an

absolutely primitive rigor, and could no more be budged than a cliff. (xi)

More was asked to take an oath affirming a political position that went directly contrary to personal beliefs in terms of which he defined himself. During the play, he is asked by his friend, the Duke of Norfolk, why he simply cannot abandon these views and join everyone else who had made the oath.

> And what would you do with a water spaniel that was afraid of water? You'd hang it! Well, as a spaniel is to water, so is a man to his own self. I will not give in because I oppose it—I do—not my pride, not my spleen, nor any other of my appetites but *I* do—I! (71)

More has chosen to define himself—his personal identity and integrity—in terms of a set of religious beliefs. The oath he has been asked to take requires that he publicly renounce these beliefs and hence to renounce himself. All persons of integrity have this ethical "bottom line" which they will not trade off in compromise and which therefore stands as a limit to compromise.

Deciding on a procedure for who wins

We mentioned earlier that deciding on a procedure for who wins in a dispute is often selected as a way of resolving choices in system design. When attempts at integration and compromise fail, often the only thing to do is to select a procedure for who will win in a dispute. Procedures include things like, voting or presenting conflicting options with their attendant arguments to management who then decide. In business and in politics we have paradigms of fair treatment and we often rush to use them when there is a decision between conflicting positions, even though we might be better off looking for an integrative solution. Procedures like these, even though they may be perceived as fair by all sides, ultimately create winners and losers. And these decisions reverberate throughout the socio-technical system and can ultimately result in the product being sabotaged or neglected by those who lost (see the example of the misuses of Lotus Notes we give in chapter 11).

Add a section here about the software developer as a third party in a negotiation.