RISK ASSESSMENT AS A SUBJECTIVE PROCESS

by Ralph Strauch

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[1]ABSTRACT: Most extant approaches to risk assessment stress methodological and procedural solutions to the problem, in part because method and procedure are viewed as bulwarks against the fallibilities and limitations of human judgment. This paper examines the other side of that coin, the use of judgment and intuition as bulwarks against the fallibilities and limitations of formal methodology. Those limitations are described, and capabilities which judgment and intuition provide to compensate for them discussed. The paper calls for a greater synthesis of judgment and methodology, in which they aid and support each other instead of competing.

INTRODUCTION

In one form or another, risk assessment problems occur in all phases of defense planning and public policy analysis more generally. There are numerous extant approaches to the assessment of risk, including fault and event tree analysis, actuarial techniques of various kinds, and a variety of methods based to differing degrees on ideas derived from statistical decision theory. (Each, of course, is applicable to only certain types of problems.) All these approaches are what I will call "method oriented" in the sense that they stress formal methodology or technique. They treat risk, however they define it as something inherent in the problem being analyzed, and propose formal methods and procedures to get at and measure that risk. The idea that human judgment is seriously flawed and that methodology and technique should serve as bulwarks against its fallibilities and limitations seems to provide a major rationale for this general orientation.

Considerable evidence can be marshalled to support this rationale. The psychological literature abounds with experiments illustrating the fallibilities of human judgment, and it's easy to find well-documented examples of serious errors in judgment by high public officials. No wonder, then, that in matters of consequence we have come to distrust "judgment alone" and to seek less hazardous ways of understanding the world.

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But formal method and technique have limits of their own and very serious limits which are often neglected by their most ardent advocates. My focus here will be on that side of the coin, and on the use of intuition and subjective judgment as bulwarks against the fallibilities and limitations of formal methodology.

Some interpret any critique of quantitative methodology as an all-out attack a plea to throw analysis away and to go back to astrology and the reading of entrails. That would throw the baby out with the bath water, and that's not what I'm advocating at all. We went too far once before, in the other direction, when the "McNamara Revolution" made methodology king and "judgment" a dirty word. We're still recovering from those excesses, and it would be a mistake to swing too far the other way. What we need instead is a real synthesis of methodology and judgment in which they aid and support each other instead of competing.

Good analysts do this, of course, and always have. Good analysis depends on just such a synthesis. But it's done now in spite of our paradigms for analysis and our conventions for thinking and talking about it, rather than because of those conventions and paradigms. Those get in the way too often, and discourage rather than encourage good analysis. I believe we need to reshape those conventions and paradigms to encourage the synthesis and make it a more common and consistent part of our planning processes. To do this, we need better understanding than we now have of the limits of our methodologies and of the separate role and value of judgment and intuition. We can't get this if we always play one off against the other and interpret criticism of formal analysis as an attack to be defended against at all costs.

This paper will explore the nature of risk assessment at a general conceptual level. I want to look particularly at the subjective aspects of the problem and at the limitations of methodological and procedural solutions. I will then outline complementary characteristics of judgment and intuition and suggest directions in which the synthesis we should strive to reach might be found.

I will use the term "risk assessment" to broadly encompass problems of trying to understand and foresee potentially dangerous consequences of future situations or potential courses of action. With this broad definition, risk assessment is an important component of most of problems of policy or program choice. Accordingly, most of what I say will apply to analysis in general, as well as to the particular narrow sub-domains often labeled as risk analysis per se.

If you've given much thought at all to these issues, much of what I say should seem obvious. In a sense it is, but somehow we don't pay enough attention to it. I'm going to try to take a lot of individually familiar pieces, put them together in an overall pattern you may not have fitted them into before, and explore some of the implications of that pattern. Even if I don't show you anything new, I hope to give you a better understanding of some of the things you already know but may not often think very much about.

THE METHOD ORIENTED APPROACH TO KNOWING

I first want to develop a general characterization of what I earlier called method oriented approaches to risk assessment. At some level this characterization in fact applies to all formal approaches to knowing, including science. I'm not saying that

method oriented approaches never work their successes in the physical sciences and engineering are clear testimony that they often do. But they don't always work, and it's important to be able to distinguish between when they do and when they don't.

All method oriented approaches work on and within the context of a well-defined model, in the manner illustrated in Figure 1. The model is treated as the problem, and the problem is identified with the model. Results derived from the model are interpreted as conclusions about the problem itself (perhaps to within some fixed numerical error), assuming, in effect, that the problem structure matches or comes very close to that of the model. "Risk" is seen as an objective attribute of the problem to be uncovered, measured, and quantified through its counterpart in the model.

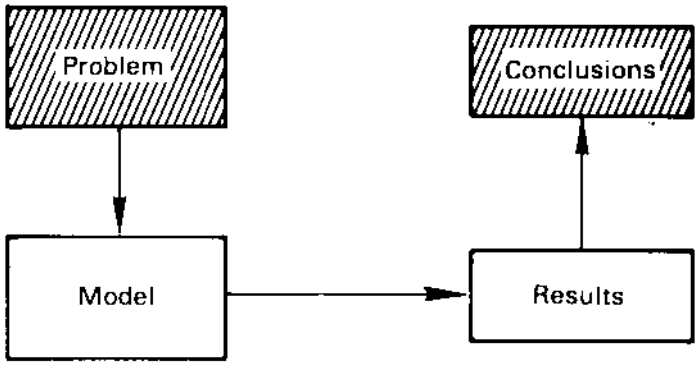

Figure 1

In this paradigm, the risk assessor plays a conceptually passive role. He uncovers and brings out what is already inherent in the problem, but he is not thought of as playing an active role in bringing structure to the problem and perceiving and defining the nature of the risk within that structure. His conceptual role is very much like the one we attach to the scientist the independent objective observer who stands separate and apart from the process which he studies and investigates.

This paradigm the model identified with the problem, the analyst and objective independent observer often works very well. It is particularly useful in problems involving well-defined and well-understood systems and processes, such as the kind of actuarial risk assessment problems faced by insurance companies, or reliability analyses of engineering systems based on well-understood physical principles. It works, in other words, in areas in which the models used have been subject to stringent acceptance criteria and strong peer review. It is these conditions, in fact, which give the paradigm its very considerable utility in science generally.

This paradigm works less well, however, in ill-defined and poorly understood problems, in one of a kind systems, or in new environments for which generally accepted and thoroughly validated models do not exist. But this is exactly the kind of problem which occurs frequently in defense and other forms of public policy analysis in assessing the risks associated with a new strategic system, for example, or the environmental risks of nuclear power.

With these kinds of problem, the relationship between the substantive problem and the model used to analyze it is generally more complex and tenuous than the characterization depicted in Figure 1 suggests. The substantive problem is likely to differ considerably from the model. There will generally be one or more layers of formulation, simplification, and redefinition between problem and model, necessitating corresponding layers of interpretation between analytical results and substantive conclusions. This situation is depicted schematically in Figure 2. Any substantive conclusions drawn from analysis must necessarily be mediated by these processes of formulation (moving down 'the left side of Figure 2) and interpretation (moving up the right). Yet methodology deals only with the relationship between model and results (the line along the bottom) and method oriented approaches tend to neglect the things which go on elsewhere (Strauch 1974).

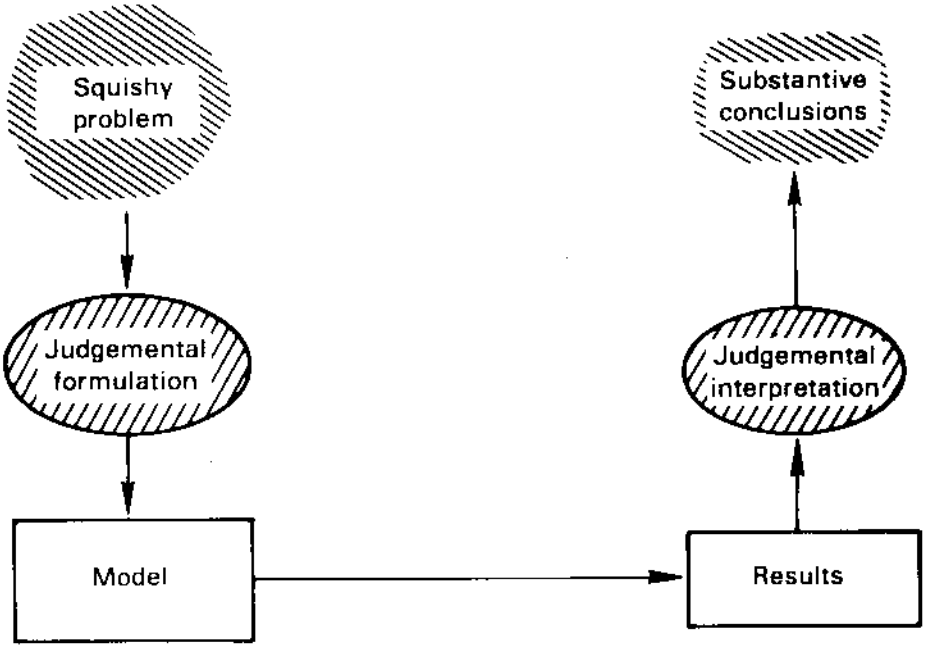

Figure 2

In this sort of situation, the role of the assessor must necessarily be different from that described above. He can no longer play the independent observer standing apart from and above a well-defined problem "out there." Rather, he is himself a part of the process which articulates the problem, brings it into focus, and distinguishes it from the surrounding environment. His subjective judgment plays a critical role which cannot be diminished by appeals to procedure and method. Too much dependence on procedure and method, in fact, may get in the way, acting to inhibit rather than to encourage good risk assessment by drawing attention away from risks which fall outside the scope of the methodology.

It is worth noting in passing that while these criticisms are directed primarily at the uncritical application of formal quantitative techniques, they apply equally well to the uncritical application of less formal methods and procedures as well. Any assessment based on a rote procedural analysis of a consensual model is subject to the same pitfalls, whether the underlying model is quantitative or qualitative, formal or informal. See Strauch (1971) for an example of this in a nonformal situation.

A PERCEPTUAL PARADIGM FOR ANALYSIS AND RISK ASSESSMENT

I now want to outline an alternative view of analysis (and risk assessment in particular) as a form of organizational perception, and reexamine these questions in the light of that view, Analysis may be seen as a process through which an organization perceives and understands its environments in the same way that vision is a process through which individual human beings perceive and understand theirs. The parallels between vision and analysis are quite strong, and I will draw on them repeatedly. Some are discussed in greater detail in (Strauch 1974), while the nature of perceptual processes in general and visual perception in particular is discussed in (Strauch, 2000).

A central tenet of this perceptual paradigm is that "the map is not the terrain." The visual image is not the object and the model is not the problem being modeled. The visual image or the analyst's model are only simplified representations of the external reality they represent, and the perceiver or analyst who makes those simplifications must use them accordingly, In the visual case, it's clear that the image is not the object simply from the difference in dimensionality. An object is a three-dimensional space-filling thing, while any visual image of it is necessarily flat and two-dimensional. As Figure 3 illustrates, the same object may look very different from different perspectives, each showing some aspects of the object and hiding others. No single particular perspective can be said to be "best" in any absolute sense. So it is with models of complex weapon systems, political/military interactions, or social programs. Any complex real world problem will always have more dimensions and a greater richness than any single model can capture, and different models will capture different aspects just as different perspectives show different aspects of a physical object. There is unlikely to be any single "best" model, and apparently contradictory models may seem that way only because they capture different dimensions of the problem. In modeling squishy and ill-defined problems, the nature of the simplifications made must be kept in mind when interpreting any results obtained.

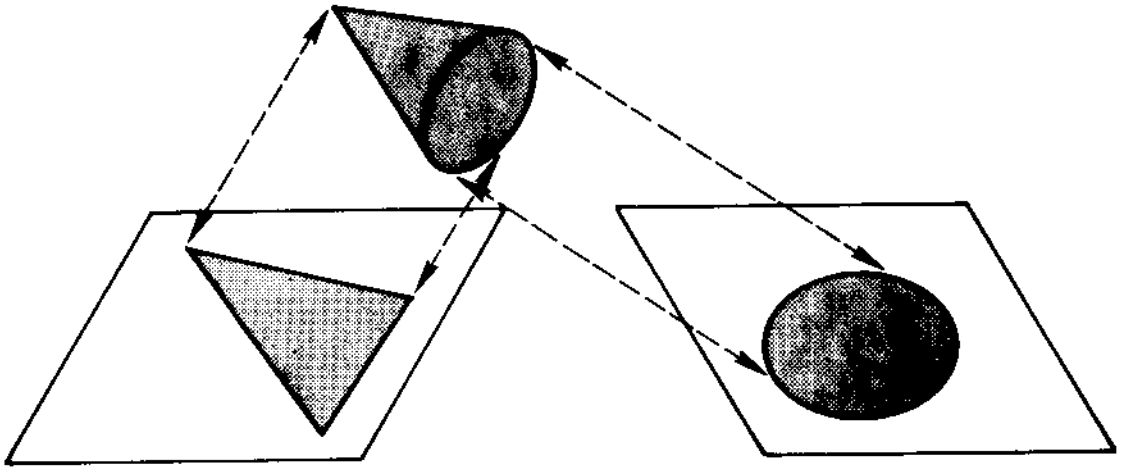

Figure 3

While some of the differences between problem and model can be seen by analogy with two dimensional images of three dimensional objects, the issue is not simply one

of perspective and dimensionally. The particular problem aspects included in the model, and the ways these aspects are represented and interrelated, depend on choices made by the analyst (or by the methodology he uses). Not all these choices are explicit or even conscious, but what they are and how they are made can have a significant impact on any conclusions ultimately reached. This happens with vision, too, and here again the analogy can be instructive.

When you look out at the world around you, it seems like you see things as they are, see an objective image of the external world. It's not like that, really. What you see results from a mixture of the flow of information across your retina and your own expectations and past visual experience. It is as much your own creation as it is external. It depends on what you bring to the perceptual experience as well as on what comes in from the external world. Though this aspect of perception is easy to demonstrate, even with simple figures such as Figure 4 which can be readily seen in more than one way, we don't pay much attention to it **most** of the time because the images we construct seem close to what's really "out there." (At least they seem close to the general consensus about what's there, which is really what we have to check ourselves against.)

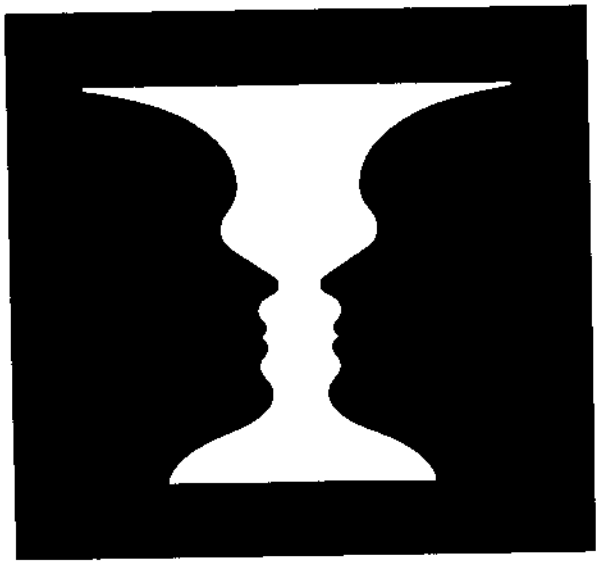

Figure 4

But if we can see things in more than one way, we can also see them the wrong way. We can fail to see things that are right in front of our eyes, or can imagine we see things that are not really there. One of my favorite demonstrations of the first possibility is an experiment in which playing cards were flashed before subjects' eyes at speeds which allowed them to be identified but not carefully examined. A few cards were the wrong color a red six of spades, for example. Subjects just failed to notice this anomaly. Some saw an ordinary six of spades and others a six of hearts, depending on whether they responded to the shape or color cue. At longer presentation intervals they began to become uncomfortable about the anomalous cards, though without knowing why. At still longer intervals they were able to see the card as it was and make the correct identification. Once they had done that, they could correctly identify anomalous cards at the shorter intervals, because they now had perceptual categories in which to place those cards (Brunner and Postman, 1949).

Figure 5 shows an example of the second possibility, of seeing something that isn't really there at all. Most people clearly see a solid white triangle resting on top of a black-edged triangle and three black circles, even though there's no white triangle there at all objectively. Its edge is clearly visible, though there's no objective stimulus in the figure to provide such an edge. This illusion seems to come from the fact that we normally to perceive a world in which visual patterns are caused by physical objects, so we create "objects" (in this case the triangles and circles) to explain the visual patterns we see.

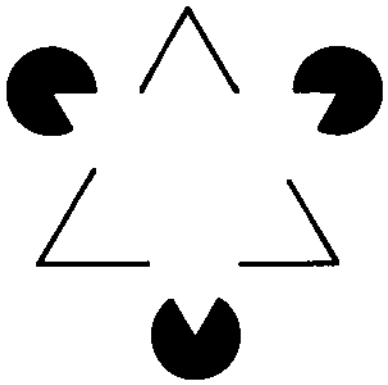

Figure 5

The point of all this is that our sense of vision, which we depend upon to understand, deal with, and even survive in the environment we live in is a far more complex process than we are conscious of most of the time. The same is true of the processes of organizational perception to which risk assessment and other forms of planning and analysis contribute. By thinking more carefully than we usually do about how well our vision works and how we use it, we can perhaps see these organizational processes more clearly as well, and better understand their limitations and the pitfalls that go with them.

The above examples illustrate the fact that our use of vision to know and react to the world around us is a two stage process. The first stage, of which we are barely conscious, involves bringing the world into focus in a meaningful way. We do this by selecting appropriate cues from the jumbled and chaotic visual flow which crosses our retinas, and assembling those cues, with the aid of expectation and past experience, into the images we consciously see as the world "out there." Only once we have done this can we engage in more conscious processes through which we use that information to cross the street, read and answer the mail, or eat lunch. The first stage operates reliably most of the time, so it makes sense to ignore it. When it does fail, however, it can have disastrous consequences, as in the case of a hunter shooting another hunter he mistakes for a deer.

Risk assessment and other forms of problem solving likewise involve two stages, a focusing stage and an analysis stage. In the focusing stage, the problem is brought into focus in a that defines the issues and makes the answer being sought meaningful. This is the modeling process, and corresponds to the subconscious process which creates our visual images. Once this is done, the model thus defined may be subjected to

quantitative risk assessment or other forms of analysis. Both of these stages are critical to the quality of any conclusions eventually reached. From this perspective, the weakness of method oriented approaches is that by prescribing methods and procedures within the context of a well-defined model,they limit attention to the analysis stage only and shortchange the focusing process.

Neglect of this focusing stage may not matter when a reliable consensus exists on the nature of the model. This is the case, for example, in the hard sciences and much of engineering, and in areas such as actuarial risk assessment for insurance purposes. But without a reliable consensus, ignoring the focusing stage can be misleading and dangerous. In the presence of an unreliable consensus,the opportunity for serious error is obvious, and we each have our own favorite examples of erroneous risk assessments in such circumstances. Two which come to mind are assessments by the U.S. intelligence community that the Shah of Iran would not fall from power, based on a consensus that religion was not a major force in political change, and the risk assessment for the mission on which the U.S.S. Pueblo was seized in 1968, which depended heavily on the consensus that vessels in international waters would not be attacked (Strauch, 1971).

In the absence of any real consensus, reliable or not, on the substantive model on which to base analysis, reliance on a method oriented approach and neglect of the focusing stage can restrict attention to the particular class of models called for by that approach. Give the problem to an analyst committed to a particular methodology and you are almost certain to find it structured in a way which ignores those aspects of the problem not considered by that methodology. As the saying goes, “to a small boy with a hammer, everything looks like a nail.”

Restricting attention to particular models or classes of models can also make it difficult to surface unconventional views, or to get serious attention to aspects of the problem which the existing consensus does not consider. The surfacer is faced with difficulties akin to those of trying to raise the issue of whether the faces in Figure 4 are young or old among people who see only the vase, and can be easily dismissed as a flake who doesn’t understand the “real problem.” This can have advantages, of course, in an organizational decisionmaking context. It keeps people in line, and limits the scope of debate. These are real advantages, not to be written off lightly. If all organizational decisionmaking had to proceed from first principles, little would ever get done.

But is it worth the price? Is the extra efficiency obtained from a narrow and restricted focus worth the risk of underestimating or overlooking altogether something which falls outside that focus? The answer to that, unfortunately, must be “it depends.” Sometimes it is and sometimes it isn’t, depending on how things happen to work out. The question of how much effort should be spent on broadening focus and searching for and evaluating consequences which might otherwise be missed is itself an institutional or social choice, and one we have been making increasingly in the direction of more broadly focused risk assessments in recent years. The Environmental Impact Statement is an example of this trend. It doesn’t always work as well as it might, of course, but it does represent a clear attempt by the Congress to force broader consideration of the potential consequences of government programs of all kinds than those programs would otherwise be likely to receive.

WHERE DOES JUDGMENT COME IN?

At one level, most of what I've said seems to sum up to "choose the wrong model and you get the wrong answer," and there's nothing very profound about that. Is there really anything more than that going on, anything more to the use of judgment and intuition than the simple idea that smart people are more likely to choose the right models (and thus get right answers) than dumb ones?

I think there is. The map is never the terrain, but people know the difference, and routinely use maps to help them understand terrain without becoming confused about it. Most people, in fact, can use several different maps of the same terrain, drawing topographical information from one, political information from another, etc., to create a richer composite understanding of that terrain than is contained on any of the maps individually. The human mind can function on many levels simultaneously, and can integrate knowledge across those levels. Explicit models, on the other hand, are fixed at one particular level, like one particular map, and formal methods and techniques based on such models are similarly limited.

It's probably worth mentioning here that when I talk about judgment, I'm not talking about off the wall opinions given at the drop of a hat. Too often, the term "judgment" is uncritically applied to any opinion anyone has, independent of the knowledge and experience on which it is based or the care which went into its formation. There is good judgment and bad judgment, careful judgment and sloppy judgment. I am concerned here primarily with good judgment,with what it sometimes is and more often could be if we nourished and encouraged it properly.

Let's go back to the object/picture analogy again. Think of a complex problem as analogous to a three dimensional object, and of any externalized model of that problem (that is, any model which can be written down or otherwise brought out for external scrutiny) as analogous to a drawing or other two dimensional representation of the problem. Just as there are many possible two dimensional representations of the same object true perspectives, caricatures, in outline or with full detail, in black and white or in color so there will be many possible models of the same object. Some will be quantitative, though not all will quantify the same aspects of the problem or do it in quite the same way. Others will be qualitative verbal descriptions of problem elements and the relationships between those elements. Still others may be mixtures, quantifying some aspects of the problem but still including aspects not so quantified. Different models will stress and obscure different aspects of the problem, and so may look superficially different. None will unambiguously capture the whole problem, any more than any single picture can unambiguously capture the three dimensional object in all its detail.

Now think about the way you use your vision to move through your environment. Think about what is involved as you move past and around an object in your path, such as a chair. At any point in time , you see some particular two dimensional image of the chair, but as you move, that image changes. The chair looks different from the front, side, and back, and if all you had to go on were these images, you would probably find the changes which occur as you move very confusing. In fact, you are hardly aware of those changes, and they are certainly not confusing. The reason is that you do not simply respond to the individual changing images. Instead, you respond to the total

flow of images, and relate that flow to your internal understanding internal model, if you will) of what a chair is and how its visual images behave as you move past it.

The same is true of your visual environment as a whole. At any time you have a two dimensional image of that environment, but that image constantly shifts and changes, even as you move your head and shift your eyes. What you "see" remains remarkably stable in spite of these changes, because you interpret the changing images through a richer three dimensional image/model/understanding of your environment. This three dimensional understanding both draws from and gives meaning to the individual two dimensional images, yet is qualitatively different from them. It could never be reduced to a two dimensional image, in spite of the fact that the principal handle you have on it at any point in time is a two dimensional image.

Human decisionmakers people understand the kinds of problems and choices for which analysts make risk assessments in much the same way. They can integrate information drawn from different models or other sources into a composite understanding of the issue being addressed in a manner similar to that by which we integrate disparate visual images of the same object. Just as in the visual case most of this integration takes place below consciousness, and it is some individual model or image of the problem which fills consciousness at any point in time, rather than the composite understanding. But just as in the visual case these individual models rest on and contribute to the composite understanding, and without the composite understanding, the individual models would be of little use.

Judgment and intuition are names we give the processes which produce and draw from this understanding, the processes which work below the level of consciousness to select and integrate knowledge from a variety of sources and levels. They are not simply extensions of or subconscious analogs to the kinds of processes which take place on the conscious analytic level, but are fundamentally different. They can no more be reduced to verbal or analytical form than our three dimensional understanding of our visual environment can be reduced to two dimensional form. (Though, just as is the case with the visual understanding, they can be represented or partially described by those forms.) We lose a great deal, I believe, if we ignore those differences in the attempt to make that reduction. Formal analysis sometimes appears superior to judgment purely because of the apparent ability of formal methods, especially when aided by computers, to handle far more detail and complexity than can the unaided human mind. What's really going on, I think, is that there are kinds of complexity that formal methods can handle better than intuition, and kinds of complexity for which the reverse is true. But even for those kinds which the formal methods can handle better,intuitive understanding is still required to interpret the results produced by the formal methods and give them meaning in the larger context that is ultimately always there.

Here, again, the visual analogy is instructive. Most people have a limited ability to retain (or at least to access) detail in their internal visual images. To see this, close your eyes and try to picture the details of this room. For most people, the detail is limited. A photograph, on the other hand, can retain large amounts of detail, and make it available when desired. But the photograph cannot provide the sense of relationships between elements of the scene, and of what those elements might be like in their totality rather than from just one perspective, which our three dimensional understanding of the

world provides. In fact, without the use of that three dimensional understanding in interpreting the details in the photograph, the photograph would be as likely to mislead as to inform. .

The two dimensional photograph can provide details about the object pictured which our unaided internal understanding could not otherwise retain and cope with, but only that internal understanding can put those details in perspective in a richer three dimensional world. The two together, then, provide a richer and better understanding than could either without the other. The same is true of intuition and analysis, which is why we need the greater synthesis I called for earlier.

An example of the integrative capability of the mind is shown in the next two figures. The three shapes shown in Figure 6 are clearly different, and incompatible as shapes in a two dimensional plane. At first glance, it seems difficult to believe that they could all be pictures of the same object, since you have no mental image of such an object.

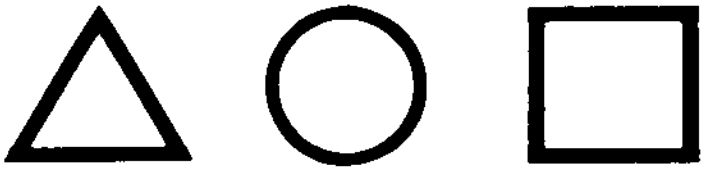

Figure 6

Now think about a cylinder as tall as it is wide. It has a circular cross section from the top and a square cross section from the side, providing two of the necessary shapes. If its sides are beveled, as shown in cylinder shown in Figure 7, we obtain an object with a triangular cross section as well. As soon as you have a mental image of such a beveled cylinder, the apparent impossibility of a single object having all those shapes disappears. Thus what was irreconcilable on the level of the picture becomes clearly reconcilable on the level of the object.

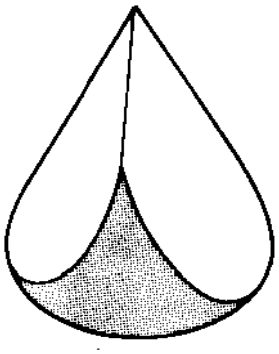

Figure 7

There is another analogy between vision and risk assessment which is also worthy of mention. We really have not one visual system but two a central fovea1 vision which

provides sharp detail in a small area in the center of the visual field,and a softer peripheral vision which provides less detail across a much broader field. Without the former we would be unable to perform many important tasks, such as reading, recognizing faces at a distance, or driving. But we would not be able to function very well without the latter either. With no peripheral vision, we could still read and recognize faces at a distance, but driving would become exceedingly dangerous and just getting around would become much more difficult. We need both central and peripheral vision to function, a need that is recognized in the fact that someone missing *either* is considered legally blind.

Formal methods and procedures are a lot like fovea1 vision. They are very good at examining detail in a narrow and restricted area with sharply defined edges. They have no peripheral capabilities, though, no ability to notice the stuff around the edges. Yet it is often on the edges, beyond the boundaries of the assumptions of consensus and conventional wisdom, that the important threats lie. Judgment and intuition, on the other hand, are more like peripheral vision softer, less sharp, but covering a much broader area. In problems of risk assessment, then, they serve as the peripheral complement to more fovea1 formal methods. Without that complement, we are in the same position as someone with tunnel vision we're fine as long as we always look in the right direction, but missing the very faculties we need to guide that looking.

CONCLUSIONS

Even if judgment and intuition do give us fundamentally different capabilities than those provided by the more formal method oriented approaches to analysis, so what? Does that fact have any prescriptive implications, suggest any fundamental changes in the way we do things? I believe it does, and I want to conclude by examining some of those implications.

Let me reiterate that none of this implies that we should abandon formal methods and analytic tools. We need them, but we need intuition and judgment as well. The major implication of what I've said above is that we need to work for a better synthesis of both ways of knowing, in which each aids and supports the other instead of competing with it.

Earlier I characterized problem solving as a two-stage process, consisting of a focusing stage and an analysis stage. We need to give more explicit attention to that focusing stage, and to the importance it plays in the final solution. Analysis, after all, does nothing more than to flesh out the logical implications of the focusing stage, so it is the focusing stage which really determines the eventual conclusions. Alternative ways of looking at problems should be encouraged, and we should not be too anxious to prune down to a single "best." We should keep clear that the model is not the problem, the map is not the terrain. This must be recognized as having operational consequences, not just as a truism to which to pay lip service on the way to claiming that the results must be true because "the analysis says so." We need to treat models differently, and to encourage, if not require, more careful judgmental interpretation of results.

We need to encourage the development of judgment, and look for ways to train and sharpen it. This can be done, and indeed, has been a traditional part of the military profession for centuries. (At least it was until we began to denigrate judgment and discourage its use in favor of quantitative methods.) We must acknowledge judgment and intuition as the ultimate sources of understanding about squishy and ill-defined problems, not as second rate substitutes to be used only till something better comes along. We must also recognize that good judgment is the result of experience, intelligence, and hard, careful thought, not top-of-the head opinion that anyone can give on any subject anytime.

We must particularly encourage the development of broad substantive professionals, knowledgeable about the substance of the problems they address as well as about the methodologies they bring to those problems. The synthesis I called for earlier can be brought about only by such professionals, because it requires an intuitive gestalt for both substance and method. We must acknowledge the necessity for substantive understanding and experience, and avoid excessive faith in method alone. The bottom line, perhaps, is the question of responsibility, and of where the responsibility for conclusions and decisions lies. Method oriented approaches appear to take responsibility, by attributing to the problem an objective reality and seeming to provide an objective solution. The analyst is simply an impersonal agent uncovering what is already there, and the decisionmaker who follows his advice is simply acting on that "objective" solution.

My view suggests that the analyst bears a much greater personal responsibility for any conclusions reached, and the decisionmaker for any decision taken on the basis of those conclusions. That responsibility may be uncomfortable, but it's there and cannot be ignored. People generally make better decisions when they acknowledge their responsibility than when they have some external agent (the "objective" answer) to which they can shift it. What's involved is what Pirsig (1974) called "quality," and the importance of how people feel about what they do.

I'm calling some very basic premises into question, and asking for some fundamental changes in extant attitudes about knowing and responsibility. These changes bring no guarantees of success, because they rely on inherently fallible human judgment. But method is fallible too, and I think we've got a better chance in the long run if we acknowledge that and move toward a real synthesis of method and subjective human judgment. In our infatuation with methodology and technique we sometimes forget that the human mind is the best general purpose problem solver yet devised honed and tested against a wide range of problems and environments across 3 million years. It may not be perfect, but it's well ahead of whatever's running second, and we should be looking for ways to exploit it and assist it, rather than trying to replace it with procedures and formal methodology.

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ABOUT THE AUTHOR

Ralph Strauch has a private practice in the Feldenkrais® Method in Pacific Palisades, California. He was trained by the founder of the Method, Dr. Moshe Feldenkrais, and is the author of *THE REALITY ILLUSION: How you make the world you experience* and *LOW-STRESS COMPUTING: Using awareness to avoid RSI.* Ralph received his Ph.D. in Statistics from the University of California, Berkeley, and was formerly a Senior Mathematician with the Rand Corporation, where his research focused on various aspects of human and organizational decisionmaking.

Ralph Strauch, Ph.D.
P.O. Box 194
Pacific Palisades, CA 90272
(310)454-8322,
rstrauch@somatic.com
www.somatic.com