HANDOUT

to accompany the talk by

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LEVELS OF CONTROL SYSTEMS

that you have inside you

This list is taken mostly from Powers (1973) but also from his letters to me, and includes some of my own words.

1st. Intensity.

2nd. Quality of sensation.

3rd. Configuration, position, perception of invariants.

The first three levels deal with momentary events not long enough for us to be conscious of the flow of time.

4th. Transition, change, tracking, control of movement and other changes of configuration, sensation, or intensity.

5th. Relationships.

6th. Categories.

7th. Sequences, episodes, routines.

8th. Programs, rationality, language. Working your way to a goal along a path containing choice-points.

9th. Principles, strategy, heuristics. Values in the sense of what one puts consummatory goodness on. Going by intermittent evidence. Averaging instances.

10th. System conceptions, perceiving organized entities.

And overall and throughout: Reorganization.

THE TEST

and

THE RUBBER-BAND EXPERIMENT

How can you find out what inputs people are trying to maintain for themselves? In the following excerpts from Powers (1973), he explains The Test and then describes a brief and simple experiment you can use to demonstrate it to yourself and others.

"The Test for the Controlled Quantity" (or just "The Test"), is an adaptation of a technique used by servomechanism engineers to measure the properties of control systems. It consists of applying a known disturbance to the quantity thought (or known) to be controlled and observing in detail the subsequent behavior of that quantity under the influence of the continuing steady disturbance and the behaving system's output. p.232 p.233

Our problem is different from that of the servomechanism engineer. He knows that there is a control system and he knows what it controls; he is interested mainly in the details of *how* control is effected. We, on the other hand, are trying to establish whether or not a control system exists, and need only the most rudimentary knowledge of its detailed properties. We will therefore use disturbances differently and look for different aspects of the results. First, however, let us review some fundamentals.

Consider once again the meaning of the term *controlled quantity*. A controlled quantity is controlled only because it is detected by a control system, compared with a reference, and affected by outputs based on the error thus detected. The controlled quantity is defined strictly by the behaving system's perceptual computers; it may or may not be identifiable as an objective (need I put that in quotes?) property of, or entity in, the physical environment.

In general an observer will *not*, therefore, be able to see what a control system is controlling. Rather, he will see an environment composed of various levels of perceptual objects reflecting his own perceptual organization and his own vantage point. He will see events taking place, including those he causes, and he will see the behaving organism acting to cause changes in the environment and the organism's relationship to the environment. The organism's activities will cause many changes the observer can notice, but what is controlled will only occasionally prove to be identical with any of those effects. Instead, it will normally be some *function* of the effects, and the observer's task is to discover the nature of that function.

Since the observer cannot simply observe a controlled quantity, he must test hypotheses. He is looking for a definition expressing the quantity as some function of observations, such that a disturbance applied to the environment that tends to alter the quantity is opposed by the behavior of the organism. If every disturbance acting on the quantity is nearly canceled by an equal and opposite effect of the organism's actions on the same quantity, that quantity is a controlled quantity by definition, and the organism is organized as a control system relative to that quantity, also by definition. p. 234

The purpose of The Test is to reveal what is wrong with definitions of controlled quantities. Generally a controlled quantity will be defined as a function of several observable variables—the distance between the positions of an organism and an object, the three-dimensional orientation of something, and so on. If an irrelevant variable is made part of the definition, The Test will expose it in a very simple way: disturbances tending to alter that variable alone will not be opposed.

That is the crucial factor in applying The Test. When a potential controlled quantity is defined, that definition implies some assortment of events that (acting alone) would cause a predictable change in the defined quantity. *If the change occurs as predicted, there is no control system controlling that quantity.* If the predicted change fails to occur, or is much smaller than predicted, and if the reason for failure can be traced to the organism's behavior and nothing else, then the organism contains a control system controlling that quantity.

The Parable of the Rubber Bands p. 241

There is another demonstration/game/experiment that seems to help understand The Test and its application to experiments. It has the same main advantage as the Coin Game—it is highly portable. This demonstration also involves two players, Subject and Experimenter, and the equipment is even cheaper: two rubber bands, knotted together, as in figure 16.3.

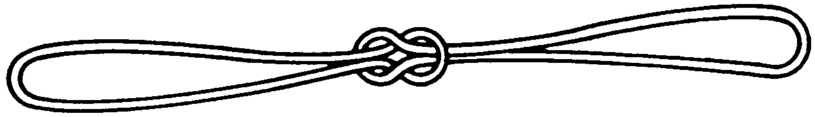


FIGURE 16.3.

S and E each put a forefinger in a loop at an end of the rubber band pair, and they hold the rubber bands slightly stretched just over a table top. S now determines to keep the knot stationary over some inconspicuous mark on the table-top. E can disturb the position of the knot by pulling back or relaxing his pull on his end of the rubber band pair; S maintains the knot where he wants it by similar means. Figure 16.4 shows how this situation relates to the basic feedback diagram used near the beginning of the book. p. 242

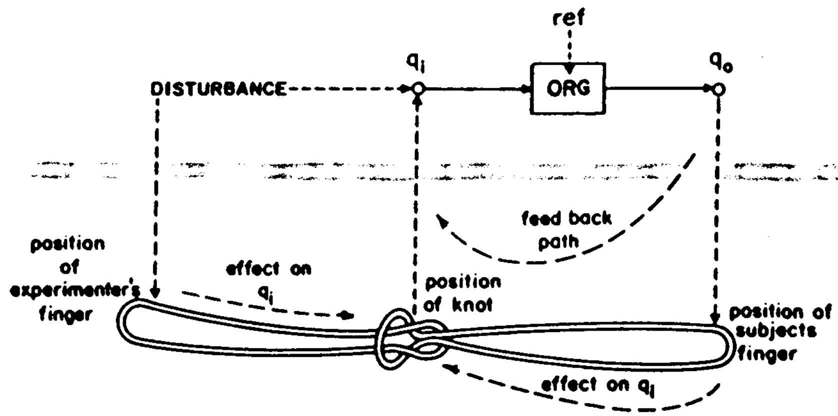


FIGURE 16.4. *Relationship of the rubber bands to the basic feedback diagram.*

The position of the knot, as seen by the subject relative to the mark on the table, is the controlled quantity, q_i. The position of the subject's finger is the output quantity q_o. One rubber band represents the environmental feedback path through which the subject's output affects his own input, the controlled quantity. The position of the experimenter's finger represents the disturbing event, and the remaining rubber band represents environmental links through which the disturbance tends to affect the same controlled quantity affected by the organism's—the subject's—output. Thus in this demonstration every aspect of the feedback control situation is visible and explicit.

If E now draws slowly back on his end of the rubber band, S will do likewise, and the knot will remain quite stationary. If E swings his end slowly from side to side, S will swing his end the opposite way and the knot will still not move. To see why it is confusing to use disturbances too rapid for the control system's appropriate time scale, E may try jerking his end around. S's control will de- p. 243
teriorate and transient movements of the knot will tend to mask the reference position. It will be seen that sudden and transient disturbances reveal little about organization per se.

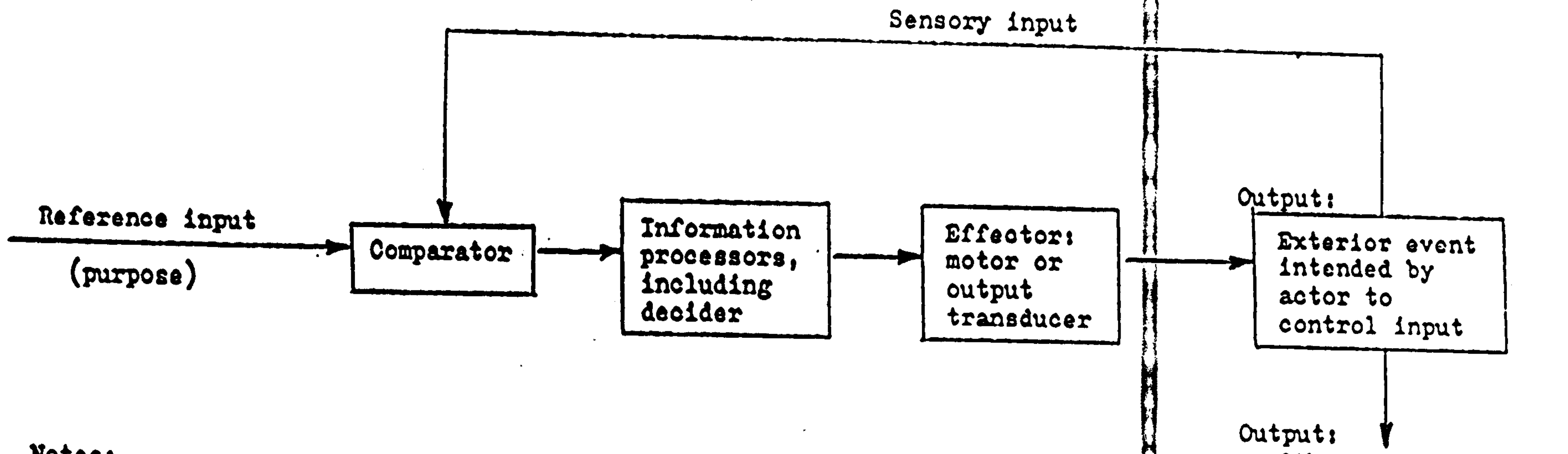
This demonstration is a nice way to introduce feedback theory to behaviorists, though they tend to become oddly silent as it progresses. From the behavioristic point of view, E's finger-movements constitute the *stimulus*, and S's constitute the *response*. Discriminable motions of various parts of the rubber bands can also serve as stimuli. That excludes, of course, the knot, if the stimuli change slowly, for the knot moves the least or not at all! The behaviorist E would try to discover how the subject's responses depend on the stimuli. Almost inevitably, such E's will begin by applying *sudden* stimuli, for that is the traditional bias. If E can reach any conclusion, it would most likely be some statement that the subject's response is generally (statistically) opposite to the stimulus in direction. If S prevails on E to slow down, that stimulus-response law will become quite clear. But unless E happens to notice that the knot stays still, he will miss the crucial feature of the situation—the purpose of S's every movement.

This demonstration has the most impact on a behaviorist if he actually deduces the correct stimulus-response law. When he does, S can point out that the knot remains in one place, and can then show beyond doubt that the stimulus-response law is a property of the rubber bands and not a property of S. Wherever E places his finger, there is only one place where S's finger can be *if the knot is to remain stationary*. The relationship between those positions depends *only* on the relative elasticity of the two rubber bands, and could be determined in advance using no subject at all.

Adding two coins, we can illustrate "control by manipulation." Place one coin under the knot, and the other about six inches from that location, toward S. S is to keep the knot over his coin, and *E is now to place S's finger over the other coin*. S cannot control *both* his fingers and the knot: they are connected. Therefore if S wants to control the knot, E can control S's finger, as long as the result does not inconvenience S (as by running the finger into a hot soldering iron). This is an endlessly illuminating demonstration, and amusing to try.

In ordinary behavioral situations, the "rubber bands" are hidden or invisible, and the knot—the controlled quantity—is far from obvious. All that *is* obvious is the relationship between the disturbance and the subject's output. Ponder that, and you will understand clearly what led psychology into the fatal misinterpretation. p. 244

And be sure to carry a couple of rubber bands with you at all times.



Notes:

In living systems, the reference input is interior.

The sensory input signals the input of information, matter, or energy. The system compares the sensory input with its reference input, the latter being interpretable as what the system "wants."

To be complete, the diagram should show another source of sensory input: independent events in the environment.

This diagram is my interpretation of Powers's text, especially that at bottom right of page 419.

HUNTING FOR THE REFERENCE STANDARD

or

THE CASE OF THE TALKATIVE TOILER

The rubber-band experiment, described elsewhere in this packet, is very clear, persuasive, and simple. But how can we find the reference standard--the spot under the knot--in workaday situations? I made up the story below to see whether I could imagine my way through a likely and complex situation. If you know of an actual hunt to substitute for this fiction, please let me know.

Weisbord (1984), by the way, has told an instructive story of a hunt for the reference standard he made with his employees--though he didn't use the idea of reference standard in his writing. He told how they tried first the classic ploy of separating employees who were giving unwanted input to one another, which didn't work, and then went on to find the organizational arrangement that brought almost all the employees the inputs they wanted to keep stable. He also reported that one person could not stand the new arrangement--a reminder, never made too often, that one person's happiest input is another's poison.

Anyway, here is my fictional story.

Suppose a worker is hired and stationed on an assembly line. The worker is told that it is against the rules to talk with other workers while on the job. Nevertheless, the supervisor finds that the worker frequently engages in shouted conversations (it is a noisy place) with workers at nearby stations. The supervisor doesn't like that. Here are some hypotheses the supervisor might entertain.

1. The worker will gabble if you let him; he won't if you don't.

2. He is new on the job, and he wants reassurance from other workers that he is doing things right.
3. Since he is new in town, he is trying to strike up a few friendships.
4. He chafes at rules, and he has happened to pick on the rule against talking as one to violate.
5. He seeks camaraderie--he wants to feel himself to be an accepted member of the work group.

To test one of those hypotheses, we need to choose a "quantity" the worker might be controlling, and then find a way to alter that quantity through means that operate outside the worker. If we succeed in altering the quantity, our hypothesis will be wrong; the worker will have been found <u>not</u> to be controlling that quantity. If the worker brings the quantity back to its former level despite our disturbance, then we will have found the controlled quantity--or at least one of them.

Suppose we try Hypothesis 1 in the standard manner; that is, we ignore feedback theory. The supervisor tells the new worker to stop his gabbling. After a few days, his shouted conversations come back to the frequency they were at before. That doesn't tell us much. It tells us there might be a quantity associated with his talking that he is trying to control, but we suspected that before, since he was going against the rule. It doesn't give us a clue about whether any of the other hypotheses might be a better bet. The supervisor decides to drop Hypothesis 1 and try Hypothesis 2.

If we are going to try to alter a quantity, we must have a measure of it before we begin so that we can tell whether the quantity has changed. For Hypothesis 2, we have no measure of how much the new worker is talking <u>about his job</u>. You might think the supervisor should simply go to the new worker and ask him whether he is talking to the other workers about how to do the job right. Or maybe the supervisor shouldn't even mention the talking. Maybe the supervisor should simply ask the new worker whether he is getting enough feedback about how he is doing the job. If the worker says he's pretty sure he's doing the job all right, then the supervisor could give up Hypothesis 2 and go on to another. If the worker says he wants more feedback on how well he's doing, then the supervisor would know his hypothesis is correct. He could arrange, for example, for another worker to stand by the new worker for a while to answer his questions. After that, if the worker stopped his shouted conversations, the supervisor would know he was right.

Going to the new worker in that manner, however, has at least two drawbacks. First, people often do not know what quantities they are controlling. The new worker may indeed be asking questions about the work, but may think he is simply carrying on "friendly conversation." Or he may know he is asking questions about the work, but is not doing so because he wants the information, but merely to open conversation with his fellows. And he may be unaware of the particular quantity he is controlling when he feels the urge to open conversation with his fellows.

Second, if the supervisor opens the conversation about the talking or the feedback, the supervisor's sally produces environmental happenings that might contain another quantity the worker wants to control. Even if the worker were conscious of the quantity his conversations were controlling, in his shouted conversations, even if he were right about it, he might also want to control some feature of his relationship with the supervisor. He might want to keep the knowledge the supervisor has about him to a minimum. Or he might want to maximize the degree to which the supervisor thinks he is gung ho. The action of the supervisor in opening the topic might cause a disturbance in one of <u>those</u> controlled quantities, and the worker would act to restore his desired relationship to the supervisor, not to act in connection with his behavior at his station.

In brief, by going to talk to the worker, the supervisor would be trying to get a measure of the presumed controlled quantity by getting it through the verbal behavior of the worker. But that verbal behavior could be controlled by a higher-order system that was getting perceptual signals both from the worker's memory of his behavior at station and from his conversation with the supervisor. The statements the worker makes might have little connection to what he "needed" at his work station.

So the supervisor decides not to talk to the new worker, but to try to get a measure of the worker's work-related conversation elsewhere. The thought of planting a microphone at the new worker's station flits through his mind, but he does not want to violate the worker's civil rights. He decides to try to get the information from the workers on either side of the new worker. The supervisor goes to the workers on either side of our troublesome worker and asks them what that worker talks about to them. If he is talking about the job, the supervisor reasons, surely the other workers wouldn't think the worker needs to be protected from the supervisor knowing that he wants to do his job well.

"You guys didn't talk on the job before the new man came," the supervisor says, "and I guess you just want to be decent to him, not just ignore him, so I can see why you answer him. I guess there's something the new man wants to talk about even if he has to shout. So I'm wondering if there's something he needs that he doesn't want to tell me about. What does he talk about?"

"Why don't you ask him?" the workers say.

"Well," the supervisor says, "he hasn't come to me about anything that's bothering him, so if something is bothering him, he must think it's something that wouldn't go over very well with me. So he probably wouldn't tell me if I asked. And anyway, if there's something you think you shouldn't tell me I won't push on you to tell me. You just tell me what you think it's OK to tell me, and if I don't get a clue, well, that's that." All the supervisor really cares about knowing is how much the new worker talks about the job. And he thinks the other workers will be willing to tell him that.

The workers say that the new worker talks about various things--the town, baseball, his job, the company, lots of things.

The supervisor asks how much the new worker talks about the job. Well, quite a bit, says one worker. Some, the other says.

Does he ask questions about how to do his job?

Well, yeah, one worker says. That's part of it, the other says.

Does he talk about the job as much as half the time?

No, they say.

A third of the time?

Well, maybe, one says. I guess, says the other.

The supervisor wishes it had been all of the time or none of the time. But of course the new worker might be trying to match more than one reference standard in his conversations with his fellows. So the supervisor decides to try to disturb the amount of conversing the new worker can do, and to cause the disturbance by acting only on the environment, not by acting through the new worker himself. He asks the other workers not to respond to anything the new worker says for several days. Luckily, they agree. When the new worker buttonholes his co-workers at lunchtime, they say they have nothing against him, but they thought they'd better go back to obeying the rule.

The efforts of the new worker to get a reply from his co-workers on either side decrease rapidly during the first hour or two of the day on which his co-workers stop replying. He tries again once or twice in the afternoon. He gets no reply.

That afternoon, the new worker is late getting back from the coffee room after the break. During the ensuing days, the supervisor observes that the new worker is frequently late getting back after breaks. The new worker is also sometimes a few minutes late getting onto the line in the morning; he is talking with others who are leaving the earlier shift. The supervisor also notices that the new worker often does not walk right out of the plant at the end of the shift. He often waits at the time clock until he finds one or two others who are going his way; then he walks away with them. In sum, the new worker's conversations with others have not decreased; he has apparently transferred his conversations from the line to the coffee room and to the beginning and end of the shift.

So there is probably something in his talking with others that he is acting to maintain. But what? It might indeed be getting information about how to do his job right. The supervisor decides, however, that surely enough time has gone by for the new worker to have picked up anything he needs to know from other workers. After all, it's a pretty simple job. Hypothesis 2 has decreased in credibility as the time has gone on. The supervisor decides to drop that hypothesis.

How about Hypothesis 3? Has the new worker been trying to find friends? After a few more days, the supervisor decides to ask the new worker about that. Surely he ought to know whether he has found friends, and maybe he'll be willing to say so.

The new worker turns out to have no reluctance. Yes, he has found several new friends; he's had a couple over to the house, and they've invited him and his wife to return. So that's not it. That feature of the environment has changed, but the new worker's tardiness after breaks and in the morning has continued. The supervisor crosses out Hypothesis 3.

How about Hypothesis 4, wanting to break rules or defy authority? The supervisor decides to change the environment by changing the rule for the new worker.

"You've probably been wanting to get acquainted with people around here," he says to the new worker. "I know it takes time to get to know the ropes, find out how you're doing, and all that. I guess I'm kind of late with this idea, but I tell you what I'm going to do. I'm going to give you ten minutes in the morning, and ten extra minutes after break, so you can have some time to talk with the other guys. You can tell me when you're ready to go back to the regular rule."

The new worker says, gee, thanks.

The new worker uses his extra ten minutes, or most of them, but he does not violate his new special rule, nor does he violate any other rule. The amount of his talking with others does not seem to decline; perhaps it rises slightly within the ten-minute grace. In brief, his talking with others seems to stay more or less the same as it was. Since the new worker did not act to violate the new rule or some other, the supervisor crosses out Hypothesis 4. He is left with Hypothesis 5.

The supervisor now needs to alter the environment in a way that will change the opportunities the new worker has for camaraderie. If the amount of talking the new worker does with others changes, then the supervisor will have to cross off Hypothesis 5 also and start all over again. If the new worker's amount of talking does not change, if the new worker finds some way of continuing that amount, then probably the supervisor will have found what the new worker needs.

But what to do? How can he <u>decrease</u> the opportunities below what they are already and still allow some way for the worker to find friendliness? Some people say that you should not expect to satisfy all your needs at work. If you need camaraderie, you should find it after working hours. But if the worker has an internal standard for camaraderie at work, that idea doesn't help.

Maybe the supervisor could transfer the new worker to a job off in the corner of the lot where he would encounter no one but a foreman all day long. But if the new worker's need for companionship were strong enough, he'd simply walk off that job to find someone to talk to. Then the supervisor would surely be forced into "disdciplinary action," and he knows that punishment rarely gets you the behavior you want. Anyway, why should he arrange things so that the worker ends getting punished for something he, the supervisor, did? That's not ethical.

The supervisor decides that all he can do is to increase the new worker's opportunities for companionship, within the rules, and see whether the new man's communication with others stays about the same.

Luckily, the company has another division in which workers are organized into teams of four and five. Within the teams, workers are allowed to talk all they want. In fact, they are expected to confer about the day-to-day problems that come up and find solutions for those that can be solved within the operations of the team. There is a great deal of interdependence within each team, and the teams show a good deal of self-reliance and comradeship. The supervisor describes the teams to the new worker and asks whether he would like to transfer to one that has an opening. The worker eagerly says yes.

After a few weeks, the supervisor checks with the team leader. How has the new worker fitted in? The team leader says he's OK. During the first week, he seemed to want to talk to everyone, and he talked about more kinds of things than the rest of the team typically does, but since then his communication has settled into the pattern of the rest.

Did he talk much about how to do his job? Well, yes, especially during the first few days, but not more than any new man does. Now he talks about the work of the team as a team, the way the rest of them do. (So that lets out Hypothesis 2.)

How about any tardiness? No trouble about that, the team leader says. He's always on time. During the first week, especially, the team leader says, the new man often cut his breaks short. He doesn't do that as much anymore. He does it the way the rest of us do--when there's some time pressure.

Does he hang around before or after the shift? No more than the rest of us, the team leader says.

And he doesn't seem to bother people with more conversation than they want? Oh, no, the team leader says.

And he is doing his work OK? Sure, the team leader says, we're glad to have him.

It is difficult to compare the amounts of comradeship the new worker was getting in his job on the line with the amount he is now getting in the team. On the line, however, he was clearly acting <u>against</u> the "disturbance" of the rules. In the team, he seems to have settled into a stable pattern of comradely behavior and does not seem to be acting against anything. The supervisor believes he has found the new worker's controlled quantity.

That's the end of the story. It sounds like a happy ending. All's well that ends well.

But there are some weaknesses in the story as an application of The Test.

First, my hypotheses are rather arbitrary. The plant may be located in Iowa, and the new worker might have been keeping his voice in shape for the upcoming hog-calling contest. But there might have been other possibilities more likely than that. The supervisor's search might have been much longer than in my story.

Second, the workers on either side might not have been as cooperative as they were in my story.

Third, the job might not have been the kind where the new worker could use tardiness as a way of having for time to talk with others; the movement of the line might have forced him to get back on time or quit. If he stayed on the job, his yearning for camaraderie might have taken a form of action not visible to the supervisor.

Fourth, the new worker might not yet have found friends. That would have complicated the supervisor's detective work.

Fifth, the supervisor's tactic of allowing the new worker ten extra minutes might have had side effects he wouldn't want. Other workers might have complained about the special treatment being given the new worker. Or some of them might have thought they, too, could get ten extra minutes by breaking the rule about talking. Or the new worker might have refused the favor, thinking he would be resented by the other workers; that would <u>increase</u> the "error" between the amount of camaraderie he was getting and the amount he wanted.

Sixth, the company might not have contained a division with the teams in it. What would the supervisor have done in that case? I couldn't think of anything. That's the reason I invented the division with teams in it.

Finally, the supervisor's superiors might not have condoned the time he took and the actions he took to correct the "simple" matter of a worker talking too much on the job.

Despite my effort, in other words, to make my story reasonably realistic, it may not be so. It may be that in most instances in most plants in the United States with assembly lines, a supervisor would be very lucky to be able to apply The Test even as sloppily as my supervisor did.

But the big thing wrong with the story is that throughout, the supervisor wants arbitrarily to control the worker. The whole plant, the assembly line, the very posts and beams of the buildings, are built on the supposition that some people have to control other people.

If the supervisor did not believe that it was his job arbitarily to control the workers, what could he do? He could confer with the new worker. He could say, "Here we are within these fences. We've agreed that in exchange for our wages, we will limit our behavior in certain ways. But we have our individual limits, too, and the company's limits seems to be exceeding your limits. What can we do?"

That won't bring an immediate solution. The usual norms are all against that procedure. The worker will immediately be suspicious. If he is not suspicious, he will probably think the supervisor is a well meaning bumbler who won't have his job very long anyway.

But suppose the company is one--some now do exist--in which a fair level of trust has been built up among the employees, where there is a lot of self-management on the shop floor, a lot of conferring in groups about improving working conditions, and so on. (I have heard of one plant with three rotating shifts, with two shifts doing immediately productive work while the third shift does nothing but talk about how things can be improved and try out improvements!) Then the new worker might try out some problem-solving behavior with the supervisor. Even then, the effort might falter through the worker's unawareness of his own reference standards. The supervisor might try some verbal exploration: "Do you think you might like it if you were in a job where X happened? What about Y? What about Z? If you were in a job that was so good that you jumped out of bed in the morning eager to get to work, what would it be like? If you were in that kind of job, what might you find yourself telling your wife, when you got home, about how the day's work went?" The idea would be to find clues about reference standards that might be controlling the worker's behavior.

In a group where there is good trust in one another's intentions (these guys won't knowingly do anything to hurt me), that kind of exploration is better done in the group. Members can report to the person his behavior they are actually seeing. That enables the person to see behavior on his part that he was unaware of. And members can make guesses about conditions or behavior the person would feel good about. The person can accept or reject the guesses according to whether they "feel right." Members can offer help or trades. "How would you feel about your doing this and my doing that? Would you be able to promise to do this if I'd promise to do that?"

That kind of process is a groping one, but it often works. It is not nearly as precise as finding the quantity a person is controlling when he is controlling a spot of light on a screen. But it has the advantage of mutual helpfulness. The person comes to see that he can control the relevant part of his environment through agreements with the others who are a part of that environment. It fits the requirement of letting the person tailor the solution to his own reference standards, not to someone else's.

Then the supervisor could try one or more of the proposed solutions, watching to see whether the behavior of all the members of the group will stabilize. Actually, what happens is ultrastability, not simple stability. As things change, the group returns to finding new stabilities. After a while, they come to understand that continual experimentation is a way of life.

It's not easy to bring a group to the point where they are capable of continuous mutual problem solving. But I don't think it burns up more energy than continual rewarding and punishing, continually patching up a bureaucratic treat-everyone-alike kind of organizing that fits no one well, abondoning buildings to build new ones to try a new organizing experiment (to be impressed on the workers by the designers of the new scheme for controlling their behavior), and so on.

The big difficulty, as I said before, is in trying to set up an island of mutual adaptation in the group in the midst of an ocean of control by others. The old bad norms keep seeping into the new good ones. But you have to start some place, and starts are indeed being made. Even trials that fail are often worth making, because they put ideas into some people's heads about what is possible. Some people, of course, say, Oh, that was just pie in the sky. Others say, By golly, maybe it will work next time.

There. That's my end to the story.

REFERENCE

Marvin R. Weisbord (1984). Participative work design: A personal odyssey. Organizational Dynamics, 13(4), 5-19.

CONNECTIONS BETWEEN THE FOUR FRAMES OF BOLMAN AND DEAL AND THE FOUR INFLUENCE STYLES OF BERLEW AND HARRISON

P.J. Runkel, 1985

I am always happy when I find ideas falling together. I was happy, therefore, when I found the four frames of Bolman and Deal (1984) falling nicely together with some ideas about influence that David Berlew and Roger Harrison put together some years ago. They set forth four "styles" with which we influence one another.

In the style of reward and punishment, we use incentives and pressures (we negotiate; offer bargains, offer rewards, threaten punishments; invoke power, status, authority); we prescribe goals, standards, expectations; we evaluate (approve and disapprove; make moral judgments).

In assertive persuasion, we propose ideas and actions (take initiative to propose what should be done, explain our positions); we reason for and against (give arguments and facts in support of or against positions; agree or disagree with facts or logic).

In participation and trust, we recognize and involve others (invite others' contributions, build on others' ideas, share responsibility with others); we test and express our understanding by "paraphrasing" others' ideas, emotions, or actions; we use personal disclosure (admit mistakes, disclose possession or lack of knowledge or resources, describe emotions explcitly).

In common vision, we articulate exciting possibilities (appeal to values and emotions, use images and metaphors to kndle excitement, help the group imagine a better future); we generate a shared identity (appeal to common values, help others to see common interests, build group cohesiveness).

The four influence styles have not yet appeared widely in the literature. The best references I can give are Harrison (]978) and Harrison and Kouzes (1980). Dick Schmuck and I (1985, pp. 257-272) describe the influence styles in the third edition of our Handbook. For common vision, Berlew (1974) is good. Training materials for the four styles and consultants certified in their use are available through Situation Management Systems, P.O. Box 476, Center Station, Plymouth MA 02361.

When we find a person viewing an organization chiefly through the structural frame, weaare also likely to find, I think, that the person uses chiefly the influence style of persuasion along with a good deal of reward-and-punishment: "It's only reasonable that you should behave according to your job description."

A person using chiefly the human resources frame is likely, I think, to use chiefly participation-and-trust with an admixture of assertive persuasion: "Let's check out our personal knowledge and abilities in this group and our readiness to work with one another. Then we'll know how we can go about solving this problem."

A person using chiefly the symbolic frame is likely to use chiefly common vision with an admixture of participation-and-trust: "We're opening new territory here. We'll blaze the trail for others to follow. It's risky and I'm a little scared, but I know we have the ability among us to carry it off, and never in my life have I been so eager to get started."

A person using chiefly the political frame is likely to use chiefly reward-and-punishment with an admixture of common vision: "I know you want to open up market B; it fits with your career goals, and it would give you a lot more influence around here. But I'm not going to let go of market A; I've built up a lot of loyalty among those customers. But you and I are in this company together. What can we trade so we can both get something of what we want?"

The influence styles can be thought of as skills one can develop. One skilled in all four styles, it seems to me, would find it easier to see pictures through all four of Bolman and Deal's frames. And vice versa, too.

Similarly, I think, the four frames can be thought of as skills; one can learn to interpret organizational problems and possibilities through any of them--all of them. That, indeed, is what Bolman and Deal claim. They claim that reframing--using more frames than we habitually use--will avoid "knee-jerk reactions and repetitious solutions. . ." (p. 240). It will "clarify many cases of confusion and conflict. When people interpret events through different frames, disagreement and conflict are inevitable" (p. 246). They say that the frames can be helpful to managers in about any kind of organization--even in "bridge clubs, sororities and fraternities, marriages, country fairs, or therapy groups" (p. 7).

I am not surprised at their claims. My own experience with the use of Berlew and Harrison's influence styles in consulting convinces me, when I see the close correspondence between the styles and the frames, that Bolman and Deal's claims are reasonable.

Bolman and Deal might have given us six or seven frames instead of four. They might have put in a couple of chapters on personality. I'm glad they didn't. I agree with McGrath (1984, p. 170): ". . . while it is 'self-evident' [to many people] that differences in personality characteristics of members affect how people communicate and how effectively they solve problems, there is virtually no evidence in support of that idea, and there is a lot of evidence that task and network type . . . <u>overwhelm</u> whatever individual differences there are in determining communication patterns, satisfaction, and task effectiveness."

References

Berlew, David E. (1974). Leadership and organizational excitement. In D.A. Kolb, I.M. Rubin, and J.M. McIntyre (Eds.), Organizational psychology: A book of readings (2nd ed.). Englewood Cliffs NJ: Prentice-Hall, pp. 265-277. Also in California Management Review, 1974.

Bolman, Lee G. and Terrence E. Deal (1984). Modern approaches to understanding and managing organizations. San Francisco: Jossey-Bass.

Harrison, Roger (1978). How to design and conduct self-directed learning experiences. Group and Organization Studies, 3(2), 149-167.

Harrison, Roger and James Kouzes (1980). The power potential of organization development. Training and Development Journal, April, 44-47.

McGrath, Joseph E. (1984). Groups: Interaction and performance. Englewood Cliffs NJ: Prentice-Hall.

Schmuck, Richard A. and Philip J. Runkel (1985). Handbook of organization development in schools (3rd ed.). Palo Alto CA: Mayfield.

SOMETHING ELSE

I feel it my duty to remind you that there is one thing more important than OD. It is death, especially the possibility of the death of all of humankind.

For a while, I intended to say something about this orally, in my talk. Then I decided that the pessimism inspired by the terrible threat of nuclear annihilation, put side by side with the optimism I wanted to bring to you about OD, would result in weakening both messages.

So I offer you these pages to take home with you and read at your leisure. I could not omit them without hiding my head in the sand and shirking my duty.

The following is a copy of Carl Sagan (1983), <u>The Nuclear Winter</u>. Boston MA: Council for a Livable World Education Fund.

Except for fools and madmen, everyone knows that nuclear war would be an unprecedented human catastrophe. A more or less typical strategic warhead has a yield of 2 megatons, the explosive equivalent of 2 million tons of TNT. But 2 million tons of TNT is about the same as all the bombs exploded in World War II—a single bomb with the explosive power of the entire Second World War but compressed into a few seconds of time and an area 30 or 40 miles across....

In a 2-megaton explosion over a fairly large city, buildings would be vaporized, people reduced to atoms and shadows, outlying structures blown down like matchsticks and raging fires ignited. And if the bomb were exploded on the ground, an enormous crater, like those that can be seen through a telescope on the surface of the Moon, would be all that remained where midtown once had been. There are now more than 50,000 nuclear weapons, more than 13,000 megatons of yield, deployed in the arsenals of the United States and the Soviet Union—enough to obliterate a million Hiroshimas.

But there are fewer than 3000 cities on the Earth with populations of 100,000 or more. You cannot find anything like a million Hiroshimas to obliterate. Prime military and industrial targets that are far from cities are comparatively rare. Thus, there are vastly more nuclear weapons than are needed for any plausible deterrence of a potential adversary.

Nobody knows, of course, how many megatons would be exploded in a real nuclear war. There are some who think that a nuclear war can be "contained," bottled up before it runs away to involve much of the world's arsenals. But a number of detailed analyses, war games run by the U.S. Department of Defense, and official Soviet pronouncements all indicate that this containment may be too much to hope for: Once the bombs begin exploding, communications failures, disorganization, fear, the necessity of making in minutes decisions affecting the fates of millions, and the immense pyschological burden of knowing that your own loved ones may already have been destroyed are likely to result in a nuclear paroxysm. Many investigations, including a number of studies for the U.S. government, envision the explosion of 5000 to 10,000 megatons—the detonation of tens of thousands of nuclear weapons that now sit quietly, inconspicuously, in missile silos, submarines and long-range bombers, faithful servants awaiting orders.

The World Health Organization, in a recent detailed study chaired by Sune K. Bergstrom (the 1982 Nobel laureate in physiology and medicine), concludes that 1.1 billion people would be killed outright in such a nuclear war, mainly in the United States, the Soviet Union, Europe, China and Japan. An additional 1.1 billion people would suffer serious injuries and radiation sickness, for which medical help would be unavailable. It thus seems possible that more than 2 billion people—almost half of all the humans on Earth—would be destroyed in the immediate aftermath of a global thermonuclear war. This would represent by far the greatest disaster in the history of the human species and, with no other adverse effects, would probably be enough to reduce at least the Northern Hemisphere to a state of prolonged agony and barbarism. Unfortunately, the real situation would be much worse.

In technical studies of the consequences of nuclear weapons explosions, there has been a dangerous tendency to underestimate the results. This is partly due to a tradition of conservatism which generally works well in science but which is of more dubious applicability when the lives of billions of people are at stake. In the Bravo test of March 1, 1954, a 15-megaton thermonuclear bomb was exploded on Bikini Atoll. It had about double the yield expected, and there was an unanticipated last-minute shift in the wind direction. As a result, deadly radioactive fallout came down on Rongelap in the Marshall Islands, more than 200 kilometers away. Almost all the children on Rongelap subsequently developed thyroid nodules and lesions, and other long-term medical problems, due to the radioactive fallout.

Likewise, in 1973, it was discovered that high-yield airbursts will chemically burn the nitrogen in the upper air, converting it into oxides of nitrogen; these, in turn, combine with and destroy the protective ozone in the Earth's stratosphere. The surface of the Earth is shielded from deadly solar ultraviolet radiation by a layer of ozone so tenuous that, were it brought down to sea level, it would be only 3 millimeters thick. Partial destruction of this ozone layer can have serious consequences for the biology of the entire planet.

These discoveries, and others like them, were made by chance. They were largely unexpected. And now another consequence—by far the most dire—has been uncovered, again more or less by accident.

The U.S. Mariner 9 spacecraft, the first vehicle to orbit another planet, arrived at Mars in late 1971. The planet was enveloped in a global dust storm. As the fine particles slowly fell out, we were able to measure temperature changes in the atmosphere and on the surface. Soon it became clear what had happened:

The dust, lofted by high winds off the desert into the upper Martian atmosphere, had absorbed the incoming sunlight and prevented much of it from reaching the ground. Heated by the sunlight, the dust warmed the adjacent air. But the surface, enveloped in partial darkness, became much chillier than usual. Months later, after the dust fell out of the atmosphere, the upper air cooled and the surface warmed, both returning to their normal conditions. We were able to calculate accurately, from how much dust there was in the atmosphere, how cool the Martian surface ought to have been.

Afterwards, I and my colleagues, James B. Pollack and Brian Toon of NASA's Ames Research Center, were eager to apply these insights to Earth. In a volcanic explosion, dust aerosols are lofted into the high atmosphere. We calculated by how much the Earth's global temperature should decline after a major volcanic explosion and found that our results (generally a fraction of a degree) were in good accord with actual measurements. Joining forces with Richard Turco, who has studied the effects of nuclear weapons for many years, we then began to turn our attention to the climatic implications of nuclear war. [The scientific paper, "Global Atmospheric Consequences of Nuclear War," is written by R.P. Turco, O.B. Toon, T.P. Ackerman, J.B. Pollack and Carl Sagan. From the last names of the authors, this work is generally referred to as "TTAPS."]

We knew that nuclear explosions, particularly groundbursts, would lift an enormous quantity of fine soil particles into the atmosphere (more than 100,000 tons of fine dust for every megaton exploded in a surface burst). Our work was further spurred by Paul Crutzen of the Max Planck Institute for Chemistry in Mainz, West Germany, and by John Birks of the University of Colorado, who pointed out that huge quantities of smoke would be generated in the burning of cities and forests following a nuclear war.

Groundbursts—at hardened missile silos, for example—generate fine dust. Airbursts—over cities and unhardened military installations—make fires and therefore smoke. The amount of dust and soot generated depends on the conduct of the war, the yields of the weapons employed and the ratio of groundbursts to airbursts. So we ran computer models for several dozen different nuclear war scenarios. Our baseline case, as in many other studies, was a 5000-megaton war with only a modest fraction of the yield (20 percent) expended on urban or industrial targets. Our job, for each case, was to follow the dust and smoke generated, see how much sunlight was absorbed and by how much the temperatures changed, figure out how the particles spread in longitude and latitude, and calculate how long before it all fell out of the air back onto the surface. Since the radioactivity would be attached to these same fine particles, our calculations also revealed the extent and timing of the subsequent radioactive fallout.

Some of what I am about to describe is horrifying. I know, because it horrifies me. There is a tendency—psychiatrists call it "denial"—to put it out of our minds, not to think about it. But if we are to deal intelligently, wisely, with the nuclear arms race, then we must steel ourselves to contemplate the horrors of nuclear war.

The results of our calculations astonished us. In the baseline case, the amount of sunlight at the ground was reduced to a few percent of normal—much darker, in daylight, than in a heavy overcast and too dark for plants to make a living from photosynthesis. At least in the Northern Hemisphere, where the great preponderance of strategic targets lies, a deadly gloom would persist for months.

Even more unexpected were the temperatures calculated. In the baseline case, land temperatures, except for narrow strips of coastline, dropped to minus 25° Celsius (minus 13° Fahrenheit) and stayed below freezing for months—even for a summer war. (Because the atmospheric structure becomes much more stable as the upper atmosphere is heated and the lower air is cooled, we may have severely *under*estimated how long the cold and the dark would last.) The oceans, a significant heat reservoir, would not freeze, however, and a major ice age would probably not be triggered. But because the temperatures would drop so catastrophically, virtually all crops and farm animals, at least in the Northern Hemisphere, would be destroyed, as would most varieties of uncultivated or undomesticated food supplies. Most of the human survivors would starve.

In addition, the amount of radioactive fallout is much more than expected. Many previous calculations simply ignored the intermediate time-scale fallout. That is, calculations were made for the prompt fallout—the plumes of radioactive debris blown downwind from each target—and for the long-term fallout, the fine radioactive particles lofted into the stratosphere that would descend about a year later, after most of the radioactivity had decayed. However, the radioactivity carried into the upper atmosphere (but not as high as the stratosphere) seems to have been largely forgotten. We found for the baseline case that roughly 30 percent of the land at northern midlatitudes could receive a radioactive dose greater than 250 rads, and that about 50 percent of northern midlatitudes could receive a dose greater than 100 rads. A 100-rad dose is the equivalent of about 1000 medical X-rays. A 400-rad dose will, more likely than not, kill you.

The cold, the dark and the intense radioactivity, together lasting for months, represent a severe assault on our civilization and our species. Civil and sanitary services would be wiped out. Medical facilities, drugs, the most rudimentary means for relieving the vast human suffering, would be unavailable. Any but the most elaborate shelters would be useless, quite apart from the question of what good it might be to emerge a few months later. Synthetics burned in the destruction of the cities would produce a wide variety of toxic gases, including carbon monoxide, cyanides, dioxins and furans. After the dust and soot settled out, the solar ultraviolet flux would be much larger than its present value.

Immunity to disease would decline. Epidemics and pandemics would be rampant, especially after the billion or so unburied bodies began to thaw. Moreover, the combined influence of these severe and simultaneous stresses on life are likely to produce even more adverse consequences—biologists call them synergisms—that we are not yet wise enough to foresee.

So far, we have talked only of the Northern Hemisphere. But it now seems—unlike the case of a single nuclear weapons test—that in a real nuclear war, the heating of the vast quantities of atmospheric dust and soot in northern midlatitudes will transport these fine particles toward and across the Equator. We see just this happening in Martian dust storms. The Southern Hemisphere would experience effects that, while less severe than in the Northern Hemisphere, are nevertheless extremely ominous. The illusion with which some people in the Northern Hemisphere reassure themselves—catching an Air New Zealand flight in a time of serious international crisis, or the like—is now much less tenable, even on the narrow issue of personal survival for those with the price of a ticket.

But what if nuclear wars *can* be contained, and much less than 5000 megatons is detonated? Perhaps the greatest surprise in our work was that even small nuclear wars can have devastating climatic effects. We considered a war in which a mere 100 megatons were exploded, less than one percent of the world arsenals, and only in low-yield airbursts over cities. This scenario, we found, would ignite thousands of fires, and the smoke from these fires alone would be enough to generate an epoch of cold and dark almost as severe as in the 5000-megaton case. The threshold for what Richard Turco has called The Nuclear Winter is very low.

Could we have overlooked some important effect? The carrying of dust and soot from the Northern to the Southern Hemisphere (as well as more local atmospheric circulation) will certainly thin the clouds out over the Northern Hemisphere. But, in many cases, this thinning would be insufficient to render the climatic consequences tolerable—and every time it got better in the Northern Hemisphere, it would get worse in the Southern.

Our results have been carefully scrutinized by more than 100 scientists in the United States, Europe and the Soviet Union. There are still arguments on points of detail. But the overall conclusion seems to be agreed upon: There are severe and previously unanticipated global consequences of nuclear war—subfreezing temperatures in a twilit radioactive gloom lasting for months or longer.

Scientists initially underestimated the effects of fallout, were amazed that nuclear explosions in space disabled distant satellites, had no idea that the fireballs from high-yield thermonuclear explosions could deplete the ozone layer and missed altogether the possible climatic effects of nuclear dust and smoke. What else have we overlooked?

Nuclear war is a problem that can be treated only theoretically. It is not amenable to experimentation. Conceivably, we have left something important out of our analysis, and the effects are more modest than we calculate. On the other hand, it is also possible—and, from previous experience, even likely—that there are further adverse effects that no one has yet been wise enough to recognize. With billions of lives at stake, where does conservatism lie—in assuming that the results will be better than we calculate, or worse?

Many biologists, considering the nuclear winter that these calculations describe, believe they carry somber implications for life on Earth. Many species of plants and animals would become extinct. Vast numbers of surviving humans would starve to death. The delicate ecological relations that bind together organisms on Earth in a fabric of mutual dependency would be torn, perhaps irreparably. There is little question that our global civilization would be destroyed. The human population would be reduced to prehistoric levels, or less. Life for any survivors would be extremely hard. And there seems to be a real possibility of the extinction of the human species.

It is now almost 40 years since the invention of nuclear weapons. We have not yet experienced a global thermonuclear war—although on more than one occasion we have come tremulously close. I do not think our luck can hold forever. Men and machines are fallible, as recent events remind us. Fools and madmen do exist, and sometimes rise to power. Concentrating always on the near future, we have ignored the long-term consequences of our actions. We have placed our civilization and our species in jeopardy.

Fortunately, it is not yet too late. We can safeguard the planetary civilization and the human family if we so choose. There is no more important or more urgent issue.

Carl Sagan

from Scientific American, 1985, 253(5), 103-104.

SCIENCE AND THE CITIZEN

Nuclear Famine

In the aftermath of a nuclear war it is now widely accepted that a dense, high cloud of smoke and dust would cover most of the Northern Hemisphere. In one or two weeks the normal circulation of the atmosphere at high altitudes would spread the cloud in thinner layers over the Southern Hemisphere as well. The devastating consequences for the temperature and sunlight at the surface of the earth have been summarized by the term nuclear winter. The term has been criticized on the ground that many post-nuclear-war scenarios might not lead to the deep and sustained cold that is characteristic of winter in the mid-northern latitudes. An international body of 300 scientists from more than 30 countries, including the U.S. and the U.S.S.R., has now reached consensus that such criticisms are largely academic. The stresses a strategic nuclear attack or exchange would impose on the world agricultural system and on other systems people might depend on for food would lead to massive starvation in combatant and noncombatant nations alike.

The conclusions of the scientists are set forth in a two-volume study, *Environmental Consequences of Nuclear War.* The study is the outcome of three years of investigation by the scientists under the coordination of the Scientific Committee on Problems of the Environment (SCOPE), a permanent committee of the International Council of Scientific Unions (ICSU). In October several of the scientists outlined their findings in hearings before the Senate Armed Services Committee.

According to Sir Frederick Warner, chairman of the Steering Committee for the study, the SCOPE scientists intentionally stopped short of considering the possible political and social disruptions that would result from a nuclear war. Russian investigators made it clear that their participation was contingent on limiting the discussions to physical, atmospheric, ecological and biological effects.

The physical and atmospheric studies are based primarily on three-dimensional computer simulations of unprecedented sophistication. A. Barrie Pittock of the Commonwealth Scientific and Industrial Research Organization and five other atmospheric scientists collaborated on the volume that summarizes the findings of the simulations. The ecological and agricultural predictions are derived from computer models, historical analogues, statistical analyses, expert judgment and laboratory tests of the responses of plants and animals to various kinds of stress. Mark A. Harwell of Cornell University integrated most of these findings for the SCOPE report. In spite of its self-imposed silence about the social responses to nuclear war, the report presents a case-by-case analysis of the stored food supplies in 15 countries, a physical constraint that no surviving society could ignore.

Earlier studies of the potential post-war environment have drawn attention to the effects of the dust and debris that would be drawn into the atmosphere by nuclear explosions and the complex hydrocarbons that would be injected by burning forests. According to the SCOPE study, however, the most serious threat to food supplies following a nuclear war would be suspended particles of soot, or elemental carbon. Soot particles strongly absorb energy at the wavelengths associated with the heat and light energy of the sun. Nevertheless, they readily transmit the long-wavelength energy reradiated by the earth into space.

Large quantities of soot are released by the burning of fossil fuels and materials derived from fossil fuels such as plastics, rubber, asphalt, roofing materials and chemicals. All such materials are concentrated in urban and industrial centers. Because many military targets are geographically isolated from such centers, a so-called counterforce nuclear strategy might therefore appear to eliminate most of the dangerous effects of soot in the atmosphere. The authors of the SCOPE report explicitly reject this view. They write: "Enough important military and strategic targets are located near or within cities so that... even relatively limited nuclear attacks directed at military-related targets could cause large fires and smoke production."

Even if early rainfall washed away about half of the smoke, a major nuclear exchange could leave about 30 million tons of black, sooty smoke in the upper atmosphere, circulating as high as 10 to 15 kilometers. If the war were begun during the northern spring or summer, the heat of the sun would carry the soot even higher and shift it toward the Equator. The warming of the upper layers of smoke could also stabilize the atmosphere and keep the air from mixing vertically, thereby extending the time the particles would stay aloft to several months or more.

The net effect would be a significant average cooling even over equatorial regions, and an average reduction of between 40 and 70 degrees Fahrenheit over the northern interior continental landmasses. The sunlight reaching the surface under large, patchy clouds of smoke could drop to less than 1 percent of normal, and in some areas the rainfall associated with the convective movement of the atmosphere would practically cease.

The most surprising conclusion of the SCOPE report is the vulnerability of agriculture even to much smaller disruptions. For example, even if the average cooling were much less than 40 degrees F., extreme fluctuations could develop about the average. A short-term frost at a critical point in the growing season can destroy a year's crop. Rice is particularly sensitive. If the transient temperatures were to reach even the low 50's F., the crop would be lost, although the rice plants would survive. An average drop of only about five degrees F. would eliminate a year's crop of cereal grains in Canada and the U.S.S.R., and an average decrease of between five and 10 degrees F. would virtually eliminate agricultural production in the Northern Hemisphere.

Rice production is also seriously threatened by the loss of convective rainfall. The SCOPE report predicts large crop losses from the cessation or displacement of the monsoon rains. In the countries of Africa, Asia and the Pacific such losses would be disastrous. Imports from other nations would presumably be cut off or at least seriously disrupted after a nuclear war, and so these countries would be left to fend for themselves. The authors of the report predict the deaths from the famine in India that would be caused indirectly by a nuclear war would exceed all the casualties caused by the direct effects of blast, fire and radiation in the U.S. and the U.S.S.R. combined. In Africa more people would die of the indirect effects of nuclear famine than would die of the direct effects of nuclear war in Europe.

The SCOPE scientists also investigated many secondary factors that could substantially reduce crop production. For example, global increases in ultraviolet radiation could result from the partial breakdown of the ozone layer in the upper atmosphere. Soil, air and water could be contaminated not only by radioactivity but also by the release of toxic chemicals into the environment. The loss of fertilizer, fuel and pesticides would lead to a breakdown of mechanized agriculture, even if crops could be made to grow. Other natural sources of food such as marine life would be adversely affected by the loss of sunlight, but even if they were not affected, they could not replace the agricultural losses.

Furthermore, such environmental factors might well interact in ways that magnify their individual effects. The vulnerability of crops to disease and pests might be increased by radiation and air pollution. Reduced temperatures could depress the activity of insects in pollinating crops. The enforced low-calorie diet of the survivors could increase their susceptibility to disease.

In its study of the food stores that would remain after a nuclear war, the SCOPE report makes the optimistic assumption that within each country the distribution of the remaining food supplies would not be affected by the war. Even with this assumption the survivors of the war in the U.S. would have only about three years in which to re-establish agricultural systems or face starvation. In most other countries stored food would last only from three to six months.

The social responses to nuclear war that are avoided by the SCOPE study may still be addressed in other scientific forums. Can the likely effects of food hoarding and conflict over the scarce nutritional resources remaining to a postwar society be quantified? To what extent would the destruction of market, transportation and communications systems affect the perfect distribution of remaining food supplies that is assumed by the SCOPE report? How would imperfect allocation affect the distribution of necessary nutrients, such as vitamins and proteins? Although the SCOPE scientists advocate the study of such issues, wide scientific consensus about them would seem difficult to achieve.

So quite aside from the two billion or so people (not to speak of other animals) who would die in first first few minutes or days after a nuclear exchange, the article above tells what would happen to the (temporary) survivors.

That is what would happen if only a few (say 500 from the thousands now poised) nuclear missiles hit the ground. They wouldn't have to hit "targets." That is what would happen if they hit anywhere. That is what would happen if they hit only in the USA or only in the USSR.

Maybe you think those 300 scientists from 30 countries were being overly pessimistic? If so, read on.

from Science News, 1985, 128(15), p. 232.

New estimates of radiation lethality...

A preliminary analysis of data from a new survey of acute deaths among Japanese residents who had lived within 1,300 meters of the atomic-bomb hypocenter in Hiroshima suggests that the radiation dose required to kill 50 percent of those exposed — the LD-50 — may be four times lower than previously thought. "My thesis is that the deaths that occurred after the first day were nearly all due to radiation exposure," as opposed to the explosion itself or its resulting heat, explains Joseph Rotblat, of the University of London, in England. He used data collected by two Japanese teams of researchers. The data list when individuals died, how far they were from ground zero at the time of the blast and the nature of any building materials that might have provided shielding from radiation.

Half of the acute deaths — those between 1 and 60 days after the blast — occurred within a distance of 892 meters from the point on the earth's surface that was directly below the blast. Rotblat computed radiation doses likely throughout this region for the various types and quantities of radiation that are estimated to have been emitted by the bomb. (These figures were based on preliminary calculations suggested at a U.S.-Japan joint workshop on atomic-bomb dosimetry earlier this year.) His calculations result in an LD-50 for human bone marrow of 154 rads — or one-quarter of the 600-rad bone-marrow dose that he reports "is being used in estimates of radiation casualties in a nuclear war." Rotblat says the 600-rad figure had been derived partly from animal data and partly from data on the few human radiation-accident victims (many of whom had received medical treatment); it was not derived from data on Japanese bomb victims, he points out — largely "because of the alleged difficulty in separating [their] radiation mortality from that caused by blast or heat."

...and potential deaths from superfires

U.S. government estimates of urban-fire casualties that might be triggered by the detonation of a 1 megaton (MT) nuclear bomb have been based on the assumption that the casualty rate for any given peak shock wave pressure, or "overpressure," would be similar to that experienced in Nagasaki and Hiroshima. But research by Theodore Postol, a senior analyst at Stanford University's Center for International Security and Arms Control, calls that assumption into question. His calculations indicate that the 15 million deaths this scaling rule suggests might result from 100 1-MT bombs dropped on cities would underestimate — by a factor of two to four — the likely fire deaths.

The thermal energy delivered to regions experiencing similar peak overpressures varies with bomb yield. For example, the 5 pounds per square inch (psi) overpressure zone for a 1-MT bomb would likely experience at least 3.5 times more heat than the 5-psi overpressure zone associated with the 0.15-MT Hiroshima bomb. The zone in which blast-initiated fires develop also scales up with bomb yield. For example, Postol's data indicate that the fire-zone radius associated with a 1-MT blast could be eight miles, and that the 5-psi overpressure zone might be as far as three miles inside this fire zone's perimeter. If true, that might give blast survivors only 10 to 30 minutes (or less) to escape before small fires coalesced into a giant "superfire" — with gale force winds circulating poisonous combustion gases and with ground-level temperatures above the boiling point of water. This prospect does not support the earlier speculation that even 30 percent might escape the 5-psi zone relatively unharmed or that only about 30 percent would die outright.

Finally, Postol's data indicate that cities don't have to be as dense — and hence, fuel-rich — as Dresden during the 1940s to support a superfire. The higher winds that would accompany the 1-MT bomb's larger fire zones might be able to whip up even a lightly built-up, burning city into a firestorm, he says.

The following excerpts are from Glenn W. Hawkes (1983). <u>What About the Children?</u> Parents and Teachers for Social Responsibility (P.O. Box 517, Moretown VT 05660).

What about a full-scale nuclear war?

In an all-out nuclear war, thousands of bombs would be exploded on civilian and military targets all over the northern hemisphere. It is almost impossible to comprehend what this would mean for humans. Comparisons to past disasters are totally inadequate.

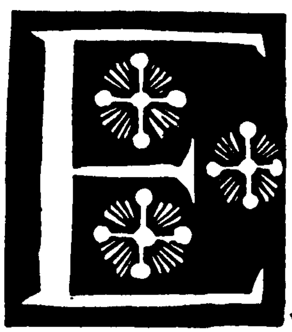
Again, we must realize that no outside help would be available. Systems of transportation, communication and power would be totally disrupted. Food, water and electricity would be unavailable. Televisions, radios and telephones would be useless.

Any survivors would have little or no medical care to ease their suffering. Hospitals, antibiotics, blood banks and narcotics for pain would be destroyed – to say nothing of doctors and nurses, themselves killed or crippled.

Some creatures, however, would thrive. Many insects and disease-carrying pests are resistant to radiation and would flourish in the aftermath of nuclear explosions. Rats would multiply. Plagues would fester and spread, abetted by huge numbers of untended human and animal corpses.

Scientists now believe that even a small number of nuclear explosions (less than 10% of the weapons at hand) could produce a "nuclear winter," with clouds of radioactive debris blotting out the sun and smothering the earth with poisons and freezing temperatures.

Finally, if there were survivors beyond such a winter, they would face irreversible environmental damage. For example, the ozone layer in the atmosphere might be so seriously depleted that many animals and plants would die, unprotected from the sun's powerful ultraviolet rays. Birds, bees and other vital links in the food chain could perish, causing the ecosystem to collapse – perhaps forever.



A new form of tyranny

Even if nuclear weapons are never used, the arms race jeopardizes our health and safety. The enormous military budgets of the world are a "theft of funds" that might otherwise be used to clothe, feed and care for the next generation. The world spends over 750 billion dollars a year on the military – that's more than one million dollars a minute.

As weapons continue to consume an ever larger share of the planet's resources, poor people everywhere suffer the most. Some, in frustration, turn to violence. Thus, the arms race not only threatens future violence, it guarantees violence now.

A less obvious effect of the arms race is psychological. Research confirms what common sense has already told us: the spectre of sudden death from the sky contributes to mental and spiritual illness.

Many children worry about their prospects for growing up. They believe that they will die in a nuclear war. For these children the future is hopeless and adults seem powerless to change the situation. In fact, children often wonder whether the adults are even trying.

We are told that nuclear weapons protect our freedoms and beliefs. But the truth is these weapons erode the very ideals they are supposed to defend. They undermine our sense of human dignity. They steal hope from our children.

Nuclear weapons represent a new and terrible form of tyranny. Daily we live as hostages to the stark reality that a single person, or even a computer accident, can destroy everything we know and love.

Twisted words, distorted images

Language plays a subtle but important role in maintaining the arms race. Nuclear weapons are given appealing names, such as Little Boy, Peacekeeper, Badger and Honest John.

Governments speak of "nuclear shields" and "nuclear umbrellas," as if there were plans to stop in-coming missiles. In fact, no such plans exist, and scientists the world over question the logic and likelihood of developing such defenses.

One government publication, written for children, describes nuclear war as if it were just another social inconvenience. The text then assures us: "Everyone will work together to help the community get back to normal."

The term "terrorism" is used when a bomb is sent through the mail or hostages are held for ransom. Yet when governments threaten to kill millions of people with nuclear weapons that is not called terrorism...it is called strategy.

Even the term "arms race" is misleading. It implies that the side with the most weapons will be a winner.

When language is distorted in this way, our perceptions of reality are also distorted. For example, the term "acceptable casualties" leads us to think of a small number, when in fact the term is used to describe the incineration of millions of human beings and perhaps an entire civilization. A so-called limited war in Europe would cause more terrible destruction than any war in human history.

At the head of this parade of misleading images, we find "defense," "security," and "national interest," where there is no defense, diminishing security, and a very serious question about whose interests, if any, are being served.

We must resist such false and twisted thinking and use words, phrases and images that convey the realities of mass destruction. The medical profession can be helpful in this effort. Physicians do not refer to badly burned or irradiated people as "acceptable losses." Medical doctors understand that terms like "winning" or "surviving," and phrases like "getting back to normal" would have little meaning in the conditions of plague and epidemic that would follow any nuclear war.

Awareness of language is vital if we are to avoid being lulled into thinking of nuclear war as an "acceptable risk."

Of all the words that might be used to clarify thought and guide action, we recommend four in particular: WHAT ABOUT THE CHILDREN?

ORGANIZATIONS

While some of these organizations may appear to be restricted (to physicians, to lawyers, to students, to women, etc.), membership is generally encouraged for all who are interested in joining.

American Committee on East-West Accord
109 11th Street, EE
Washington, D.C. 20003
202 546-1700

Center for Defense Information
Capitol Gallery West, Suite 303
600 Maryland Avenue, SW
Washington, D.C. 20024
202 484-9490

Center for Innovative Diplomacy
644 Emerson, Suite 32
Palo Alto, CA 94301
415 323-0474

Council for a Livable World
20 Park Plaza
Boston MA 02116
617-542-2282

Educators for Social Responsibility
23 Garden Street
Cambridge, MA 02138
617 492-1764

Ground Zero
P.O. Box 19049
Portland, Oregon 97219
503 245-3519

Lawyers Alliance for Nuclear Arms Control
43 Charles Street, Suite 3
Boston, MA 02114
617 227-0118

Mobilization for Survival
853 Broadway, Rm. 418
New York, N.Y. 10003
212 533-0008

Nuclear Free America
2521 Guilford Avenue
Baltimore, MD 21218
301 235-3575

Peace Links
747 8th Street, SE
Washington, D.C. 20003
202 544-0805

Physicians for Social Responsibility
639 Massachusetts Avenue
Cambridge, MA 02139
617 491-2754

PSR is the U.S. affiliate of International Physicians for the Prevention of Nuclear War, the organization awarded the Nobel Peace Prize for 1985.

SANE
711 G Street
Washington, D.C. 20003
202 546-7100

Student/Teacher Organization to Prevent Nuclear War (STOP)
636 Beacon Street, Rm. 203
Boston, MA 02215
617 437-0035

Union of Concerned Scientists
26 Church Street
Cambridge, MA 02138
617 547-5552

Women's International League for Peace and Freedom
1213 Race Street
Philadelphia, PA 19107
215 563-7110

WORLD MILITARY AND SOCIAL EXPENDITURES 1985

RUTH LEGER SIVARD

"The care of human life and happiness, and not their destruction, is the first and only legitimate object of good government."

Thomas Jefferson, US, 1809

WORLD PRIORITIES, Wash DC

Summary

The arms build-up has continued, at painful cost to the world community. The ultimate absurdity is the $3-4,000,000,000,000 (3-4 trillion dollars) spent since World War II to create a nuclear arsenal which, if used, will mean global suicide.

Violence is on the rise. There are more wars and more people killed in them. Four times as many war deaths have occurred in the 40 years since World War II as in the 40 years preceding it. Increasingly the geopolitical designs of the major military powers are being worked out on the soil of other countries and with other peoples' lives.

While national governments compete fiercely for superiority in destructive power, there is no evidence of a competition for first place in social development. In a world spending $800 billion a year for military programs, one adult in three cannot read and write, one person in four is hungry.

Priorities 1985

The megatonnage in the world's stockpile of nuclear weapons is enough to kill 58 billion people, or to kill every person now living 12 times.

In the Third World military spending has increased five-fold since 1960 and the number of countries ruled by military governments has grown from 22 to 57.

Over 1 billion people live in countries controlled by military governments.

The US and USSR, first in military power, rank 14 and 51 among all nations in their infant mortality rates.

The budget of the US Air Force is larger than the total educational budget for 1.2 billion children in Africa, Latin America, and Asia excluding Japan.

The Soviet Union in one year spends more on military defense than the governments of all the developing countries spend for education and health care for 3.6 billion people.

There is one soldier per 43 people in the world, one physician per 1,030 people.

The developed countries on average spend 5.4 percent of their GNP for military purposes, 0.3 percent for development assistance to poorer countries.

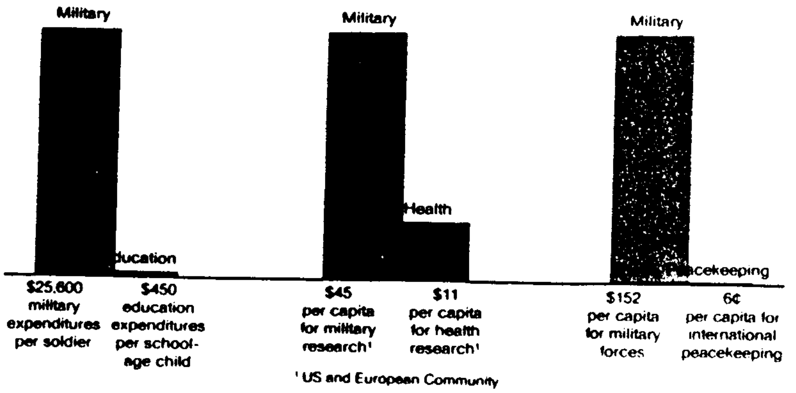
If the price of an automobile had gone up as much since World War II as the price of sophisticated weapons, the average car today would cost $300,000.

Only one citizen in four in developing countries has an unrestricted right to vote.

It costs $590,000 a day to operate one aircraft carrier and every day in Africa alone 14,000 children die of hunger or hunger-related causes.

CHART 2

World Budgetary Priorities, 1983



Public budgets, reflecting government priorities, show a decided preference for military power, whether in comparison with social programs or with peaceful approaches to conflict resolution.

The radical transformation in the art of warfare that these vast sums have produced is illustrated by the long ascending lines in *chart 1* opposite. Spending for military research has been larger by far than any other research effort financed by public funds. The results are reflected in spectacular advances in military technology, in the lethality, speed, and range of modern weapons, and in the immeasurably greater danger to human life that they represent. As compared with the arms of World War II, increases of 200 times in the "quality" or effectiveness of today's weapons are not uncommon.

By comparison, the qualitative change in global living conditions has advanced at a snail's pace. Several of the indicators shown on *chart 1* reflect an improved quality of life for the average individual; others reflect growth related to larger populations; none, however, adequately portrays the millions of lives for whom there has been no improvement whatsoever. In the Third World, the average per capita GNP is estimated to have doubled, but crushing poverty is still pervasive. The number of literate adults in the world has greatly increased, but in 1985 there are still over 600 million people who cannot read and write. School enrollment has almost quadrupled but an estimated 700 million children in the school ages are not enrolled in school. Life expectancy on average has increased but in the very poorest countries the average life span is no more than 40 years, or 37 years less than in some of the richest.

Forty years after nations joined together to ensure that all people could live out their lives in freedom from fear and want, one-quarter to one-third of the world's population remains ill-housed, ill-clad, ill-nourished.

> ***"Usually we speak of violence only when it has reached an extreme. But it is also violence when children are dying of malnutrition, when there is no freedom of unions, when there is not enough housing, not enough health care."***
>
> ***Adolfo Perez Esquivel***
> ***Argentina, 1984***

Justice

Two principles of justice and equality are specifically addressed by the Charter: rights of people and rights of nations large and small. Without question the latter has made dramatic progress, when measured by a tripling of the number of politically independent states. The postwar period marks a major transition from colonialism to self-government. In 1945 approximately one-quarter of the global population lived in political dependencies. In 1985 the proportion is under 3 percent.

The successful movement to independence owes a great deal to actions taken jointly by the member states of the UN. A carefully-monitored trusteeship system was set up. Missions were sent to assist colonies to self-government. Annual reports responding to 247 specific questions on economic-social policies were required of the powers administering dependencies. Discussions in the UN General Assembly helped to focus public awareness and to reveal changing world attitudes toward colonialism.

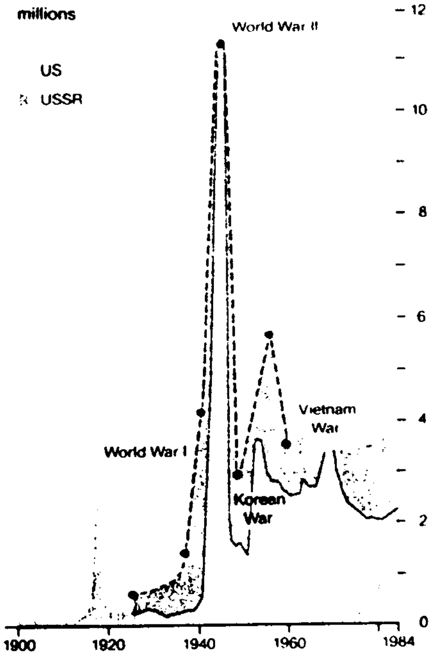
Between 1945 and 1985, 93 new nations were created. Over one billion people gained the right to rule themselves. Some of the new countries are very small; others, like India, among the largest in the world. Overall the range in population, resources, and power is extremely broad. But all countries in the world community have, at least in the formal sense, full legal equality.

Equality has been slower to come to all members of the human family. A recent survey by World Priorities of women's status, for example, found that in no country of the world do women yet enjoy full equality with men. In general

CHART 3

US and USSR Armed Forces

millions



● Stated by Premier Khrushchev, Jan 1960

Arms and armies, like wars *(chart 4)*, are in a strong growth pattern. Throughout the world, military expenditures have increased more than manpower, as sophisticated technology has swollen costs and raised the killpower of the individual soldier. Yet armies too have grown, even among the nuclear-armed countries. The armed forces of the US and USSR are four times as large as in the years before World War II.

terms remarkable progress has been made in laws and covenants defining human rights, setting standards without distinction of sex, race, or religion, and promoting their acceptance worldwide. Yet in practice discrimination and repression remain in many forms. The evidence summarized here on two aspects of human rights (pages 24-25) presents a bleak picture of the present.

Restrictions on the right to vote are particularly widespread. Suffrage is among the basic rights laid out by the Universal Declaration of Human Rights and subsequent international covenants. It ensures that "the will of the people shall be the basis of the authority of government". Yet a review of voting practices in the Third World shows an astonishingly large number limiting or denying that right. While most of the countries do have constitutional provisions for suffrage, four out of five have voting restrictions in some form, ranging from limitations on choice of candidates under one-party control to suspension of elections and bans on all political activity.

Repression in more extreme forms—as government-directed violence against the person— is also common among the countries studied. A review of reports by human rights organizations suggests that as many as half the governments in the Third World have made frequent use of torture, brutality, disappearances, and/or political killings.

The incidence of official violence and of the denial of suffrage is especially high among governments under military control. They are twice as likely as other governments to use violent forms of oppression, twice as likely to deny the right of citizens to vote to change their governments. The growing militarization of political power therefore must be seen as a climate increasingly unfavorable to the protection of basic human rights.

Peace

Peace too has proved to be elusive, despite collective actions taken to protect it—and despite the very considerable efforts by national governments to develop an impregnable military defense or, among the nuclear-endowed, a "balance" in the power to destroy planet earth.

In the postwar period the United Nations has dealt with more than 70 cases involving a threat to peace and has tried in a variety of ways to mediate and defuse conflicts. In the interest of collective security, many member countries have provided personnel and equipment under the command of the UN for international peacekeeping operations. These peace forces have been used in the Congo, Cyprus, Dominican Republic, Egypt, India, Israel, Lebanon, Pakistan, Palestine, West Irian, and Yemen. The scope of their authority is limited. They are not empowered or equipped to prevent aggression or impose solutions; that is, they do not have the power of enforcement as envisaged in article 42 of the Charter. Furthermore, they are stationed only with the consent of the parties concerned, and can be effective only with their support.

Nevertheless, peacekeeping forces have served to protect armistice lines, restore order, and insulate conflicts from superpower confrontation. As the "symbol of the international community on patrol for peace", these forces have demonstrated the value of an impartial, stabilizing influence in conflict situations. Used more often, they would undoubtedly have saved many lives, but any mission they undertake is dependent on decisions of the Security Council of the UN, which is not always unanimously in favor of intervention. Governments which in general are supporters of UN peacekeeping are often opposed to its operating in situations which they consider national preserves.

Wars, as the three pages following illustrate, are therefore much more numerous than peacekeeping actions. They have also shown a decided upward trend since World War II, increasing sharply both in frequency and in associated deaths. No single measure can define the cost of war, nor what peacekeeping can save in lives and material assets. Peacekeeping expenditures are on record, however, and in comparison with military expenditures, these costs—both cash and in kind—are so minute as to be barely visible on *chart 2*. The relative height of the two bars says a great deal about progress on the primary goal of a Charter to which virtually all nations have subscribed.

A closer look at the arms race, and at some of the factors propelling it, may help to explain why the military drive has flourished while development and peacekeeping languish.

(continued, page 12)

Gaps and Gaffes

In the age of nuclear-speak the numbers game has always been the biggest game in town. No one wants to lose the "nuclear edge" to the opponent. The Russians are more close-mouthed about this, as they are about everything else. The Americans talk more freely about the gaps that haunt their nightmares. There is a season of the year, called budget-time, when gaposis is especially virulent. Here [illegible] case histories.

In the 1950's it was the "Bomber Gap."

The fear was that the Russians would have 600-700 long-range bombers by 1960.

What they actually had by then was 190. Throughout the life of the gap, the US apparently always had a superiority of at least 300 bombers.

In the 1960's, the "Missile Gap."

The USSR was expected to have 500-1,000 intercontinental ballistic missiles by 1961.

Later it developed that what they actually had then was 10.

And the "ABM Gap."

The USSR was expected to have by the early 1960's 10,000 interceptors in a nationwide anti-ballistic missile (ABM) system.

The actual count proved to be 64 interceptors and essentially a defense against bombers rather than missiles.

In the 1970's, the "Hard-Target-Kill Gap."

New Soviet missiles, the SS-19 in particular, were judged accurate enough to destroy all US land-based missiles.

Assessments in the 1980's found this unrealistic for several reasons; among them, the SS-19 was found to be less accurate than originally gauged by more than one-third.

In the 1980's, the "Spending Gap."

An unrestrained growth in Soviet military spending, plus the presumed danger to the ICBM's, had opened a "window of vulnerability" in US defenses.

A CIA re-assessment in 1983 showed that Soviet procurement had levelled off during 1977-81 and that the increase in overall spending was half earlier projections.

REFERENCES AND FURTHER READING

Read these, damn it!

Azzaretto, John F. (1985). The shift in OD from process to product. Group and Organization Studies, 10(3), 229-241.

The classic conception of OD was to facilitate change. Azzaretto says many consultants are now directing the change, but the directing ought to be left to the client. Let's return to the classic view.

Bois, J. Samuel (1973). The art of awareness (2nd ed.). Dubuque IA: Wm. C. Brown.

Distinguishing the word from the thing. Based on Korzybski.

Bolman, Lee G. and Terrence E. Deal (1984). Modern approaches to understanding and managing organizations. San Francisco: Jossey-Bass.

Viewing the organization through four "frames": structural, human resources, political, and symbolic. How to integrate them.

Brown, L. David (1983). Managing conflict at organizational interfaces. Reading MA: Addison-Wesley.

Just what the title says. Good stuff. Easy to read. This one and Filley are the best books I know on conflict.

Derber, Charles (1979). The pursuit of attention: Power and individualism in everyday life. Oxford: Oxford University Press.

How to get attention or avoid giving it. Excellent chapter on males and females, and another on control of attention through power.

Drucker, Peter F. (1974). Management: Tasks, responsibilities, practices. New York: Harper and Row.

The BIG book of everything you might want to know about managing. Organized by tasks of managing. Full of useful ideas and good advice. Four excellent chapters (among 61) on the service institution, which includes schools.

Festinger, Leon (1983). The human legacy. New York: Columbia University Press.

How we shape our actions and beliefs through our technologies and social arrangements. Among other things, how agriculture led us into slavery, hierarchy, and war.

Filley, Alan C. (1975). Interpersonal conflict resolution. Glenview IL: Scott, Foresman.

Just what the title says. Includes intergroup. Good stuff.

Hackman, J. Richard (1985). Doing research that makes a difference. In E.E. Lawler III and Associates. Doing research that is useful for theory and practice. San Francisco: Jossey-Bass, pp. 126-155.

Gives what I think is the best way to conceive "effectiveness." Gives five assertions and explanations of what it takes to bring about effectiveness.

Hart, Leslie A. (1983). Human brain and human learning. New York: Longman.

Maybe especially interesting to those of us working in schools, but humans in other organizations use brains, too. How to get out of the way and let the brain do its wondrous work.

Korzybski, Alfred (1948). Science and sanity (3rd ed.). Lakeville CT: International Non-Aristotelian Library.

The original book on general semantics. Maddeningly hard to read. Unless you want to get scholarly, read Bois instead.

Mouton, Jane Srygley and Robert R. Blake (1984). Synergogy: A new strategy for education, training, and development. San Francisco: Jossey-Bass.

How to teach people how to teach themselves.

Naisbitt, John and Patricia Aburdene (1985). Re-inventing the corporation. New York: Warner.

Full of stories of new ways of organizing in public and private organizations. Includes a chapter on changes in education. Has lots of useful statistics on demographic changes that will spur innovations in organizing.

Powers, William T. (1973). Behavior: The control of perception. New York: Aldine.

We act to control input, not output. How most of us, including psychologists, look for the wrong signs of what people want. How individual needs must be answered in group and organization.

Schmuck, Richard A. and Philip J. Runkel (1985). Handbook of organization development in schools (3rd ed.). Palo Alto CA: Mayfield.

What the title says.

Weisbord, Marvin R. (1984). Participative work design: A personal odyssey. Organizational Dynamics, 13(4), 5-19.

A story of how a group of employees found their way into a new design for arranging their duties that reduced conflict, increased satisfaction and commitment, and increased productivity.