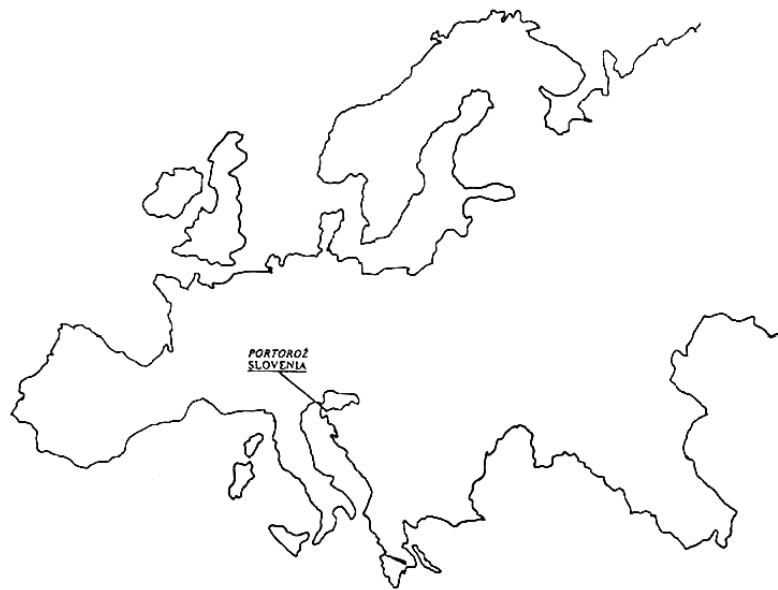


W O R K S H O P
**ENGINEERING
IN
KARST**



**Portorož, Slovenia
September 7 - 9, 1996**

During the IMWA 1996 Workshop, fourteen national and international colleagues presented their experience about engineering and mining in karstic regions. The papers presented were not published in a proceedings volume, but handed out to the delegates as paper copies.

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HUMAN AND SOCIAL CONSTRAINTS OF ENVIRONMENTAL MANAGEMENT IN KARST

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According to Encyclopaedia Britannica (1995) approximately 15 percent of the Earth's land surface is **karst**, terrain usually characterized by barren, rocky ground, caves, sinkholes, underground rivers, etc. Because of its very nature, karst regions are extremely sensitive to human interventions. Many of them have consequences that are not immediately visible, and therefore people become conscious of them only when their cumulative effects are evident. In this paper I shall try to direct your attention to certain mechanism of human thinking and decision making that are responsible for irresponsible human behavior toward nature. These are general ways of thinking and acting, and not something specific for attitude toward karst. They are subsumed under Simon's concept of **bounded rationality**, connected with **behavioral** and **social traps**, and a consequence of general attitude of western culture toward nature.

General attitude toward nature

More and more authors (Veitch & Arkkelin, 1995; McAndrew, 1993) find the roots of human attitudes toward nature in prevailing Judeo-Christian tradition that has shaped the growth of Western civilization. According to White (1967) "*What people do about their ecology depends on what they think about themselves in relation to other things around them. Human ecology is deeply conditioned by beliefs about our nature and destiny - that is, by religion.*" As is explicitly stated in the Book of Genesis (1:28) the nature exists to to be at our disposal to serve our needs and it is God's will that it be used however people see fit: "*...and have dominion over the fish of the sea and the birds of the air and over every living thing that moves upon the Earth.*" It is evident, that we have here an antienvironmental ethic, that is characterized by three assumptions (Veitch & Arkkelin, 1995):

- Humans view the environment as an unlimited supply of resources,
- we see ourselves as separate from, rather than a part of, the environment, and
- nature is seen as something to be overcome.

How different are the attitudes of so called primitive people, e.g., North American Indians, who perceive themselves as part of the natural world, and treat nature respectfully. Or in the words of Young Chief of the Cayuses Indians (1855): "*The Great Spirit, in placing men on the earth, desired them to take good care of the ground, to do each other no harm.*", and Chief Seattle, leader of the Suquamish tribe in his now famous speech: "*Every part of the earth is sacred to my people. Every shining pine needle, every sandy shore, every mist in the dark woods, every clearing, and humming insect is holy in the memory and experience of my people...The rivers are our brothers, they quench our thirst. The rivers carry our canoes, and feed our children.... The air is precious to the red man, for all things share the same breath...*" and so on and so on. Will we, our so called civilization, be ever able for such an attitude, though this is the matter of our survival. Things are changing, and certain optimism is still possible though not sure.

Time perspective

Where are we in the time? Old people are usually thinking about the past as the best part of their life. Modern men are looking only into close future that is on the grasp of their hands. The necessary condition for the solutions of environmental problems and prevention of the new ones is the orientation into the far future. Only then we could be completely aware of what could be and what we must do concerning our only earth.

Behavioral and social traps

Quite often people are engaged in behavior that looks promising, but later appeared as harmful, but they somehow could not stop with it. We are talking about **behavioral traps**, that occur when we take potentially harmful courses of action. There exists also **countertraps** (sins of omission), when we avoid potentially beneficial behavior (Plous, 1993). Several types of traps are known, each with corresponding countertrap (Cross-Guyer, 1980):

- **Time delay traps**, occur when current gratification clashes with long-term consequences (countertrap means avoidance of what is momentarily unpleasant);
- **Ignorance traps**, occur when negative consequences of behavior are not foreseen at the start of an action;
- **Investment traps**, occur when prior expenditures of time, money, or other resources lead people to make choices they would not otherwise make;
- **Deterioration traps**, occur when initially rewarding action gradually become punishing;
- **Collective traps, commons dilemmas or social dilemmas** involve more than one party and they appeared when the pursuit of individual self-interest results in adverse consequences for the collective. It usually refers to the overuse of natural resources such as land, water, etc. as a result of conflict between individual and group interests. We are thus speaking about commons as a desirable resource held jointly by a group of individuals. Some of the resources are renewable, at least slowly, some are not renewable at all. To preserve the later, society must agree, through laws and regulations, to severely limit individual freedom to exploit the commons. Known examples of these traps are Hardin's "the tragedy of commons" and so called Prisoner's Dilemma. The question is always whether to act in self interest or in public interest.

It must be mention that the elements of different traps often combine into a hybrid trap.

Will the trap appear and how it would be solved depend on characteristics of the resource, characteristics of the participants, and rules of the "game" (Gifford, 1987). So, as the value of the resource increases, the rate of cooperation decreases. The participants cooperated significantly more in the half-degraded situation, when we have partly polluted environment. Dividing the commons into individual territories improved management. Cooperation declines both as the number of commons members rises and as the number of groups within a commons of a constant total membership rises. The ability

to work together toward sound management of the commons increases with age. If the reward for cooperation is high enough, the social dilemma is no longer a dilemma at all. Varying individual gain, affected cooperation much more than varying the common gain.

There are a number of theories that try to explain social dilemmas:

- **Tragic Choice Theory** states that inequality and the resulting scarcity and suffering are natural and nearly impossible to change. Some widely held ideals are simply incompatible (e.g. , freedom and equality). Self interest cannot be overcome except by the creation of a very strong central authority.
- **Game Theory** tries to make sense of the choices we make by reducing that choice to the simplest one possible. This is not really the theory, but more an approach assuming that simulation place individuals in real dilemmas. Nevertheless this approach clearly lay out the many complex dimensions of social dilemmas, and investigate their effects.
- **Social Trap Theory** examines the reinforcement structure of the social dilemma. It suggests that better management of the commons would follow from a restructuring of reinforcement timing. Again, centralized authority is necessary.
- **Equity Theory** maintains that individuals compare their own ratio of rewards to investments with the ratios of others. Equity or justice is present when the ratios are equal. Because equity or justice is the ratio of net rewards to investment, they are possible without equality of resources.
- **Limited Processing Theory** states that individuals in many situations do not behave in a rational way. They act selfishly, not because they are evil, but because the dangers of defection simply do not occur to them. There are two basic modes of nonrationality. Sometimes we just do not pay much attention to what we are doing, and sometimes we may act nonrationally even while possessing a general understanding of social dilemmas and an awareness that we are making a choice. This later happens when the structure of the social dilemma is too complex for us to

understand or when no one has explained that a particular behavior happens to be a defection.

And pollution is a social dilemma par excellence. We could trace a surprising amount of pollution to decisions and acts of individuals. That is why it is also a psychological problem. Entrapment is reduced or eliminated when the costs of participation are made salient up. Unfortunately quite often they are not, and this is a matter of time perspective, and conflicts between different needs.

Some general Psychological Mechanisms

There is an old proverb "*out of sight, out of mind.*" Human concern about the environment is often of this kind. People become anxious about pollution, landscape devastation or depletion of natural resources when the problems are publicly visible. When the outward appearances of a problem disappear, so does also the concern for the problem. This is a kind of a **crisis effect**, appearing during and immediately after disasters. Very soon nobody remembers the disaster, and people return to old habits. Psychological basis of this process is clear. We tend to think about and act on stimuli that we are readily aware of. Significance is attributed to stimuli that are salient and attention getting. Unfortunately, environmental harm is often very hard to see, and quite often we are not aware that our personal behavior is also contributing to it. Zimbardo and Leippe (1991) mentioned the fact, that when pollutants are spewed into a lake for decades, 95 percent of the damage is already done before it is apparent to untrained eyes that the lake is dying. We may imagine how all this is much worst in the karst regions, because much of the damage happens somewhere down, out of sight.

Nevertheless our environmental related behavior is not only the matter of our awareness but also of our motivation. Pro-environmental motives must compete with stronger needs and desires. A number of these needs are tangible, salient, and immediate in comparison with small, delayed contribution to preventing or cleaning up a large-scale environmental problem we can not even see.

As Zimbardo and Leippe stated, *"because people do not often see the consequences of environmentally destructive behavior or realize which of their current behaviors has a destructive delayed effect, three factors are missing that contribute to a strong attitude-behavior relationship:*

- knowledge,
- clarity, and
- direct experience with the attitude object.

Pressures of time and the counterinfluence of other energy-wasteful people may override pro-environment inclinations. Our values may lead to good behavioral intentions, but not to meaningful actions.

How can we change this? Evidently, pro-environmental acts must be made either more rewarding or less costly, the motivation to perform them should become a stronger psychic force against competing concerns involving time, money, effort, and convenience. Informative and vivid feedback about our efforts can serve as powerful reinforcer with lasting effects. Feedback is effective if:

- it provides a rewarding sense of achievement,
- this rewarding sense comes from within, thus helping to generate the attribution that one conserves because it is personally satisfying to do so,
- when regularly used, feedback informs one about how specific behavior relate to outcomes, and
- externally charting the daily fluctuations in the target outcome.

The environment offers few vivid, mind-catching reminders about itself, as it is usually the background. To change antienvirnomental attitudes and behaviors we must make it a figure, pushed it into the foreground. Reminders, signs, or cues about how to behave are called **prompts**. They are generally influencing behavior, though not all equally. To be effective, they must attract attention. The absence of a pollution is itself a prompt. Nonpolluted environments tell to people that they must not pollute there, its heighten the salience of proenvironmental norms. We must be aware that dry statistical information has less effect than vivid and concrete examples.

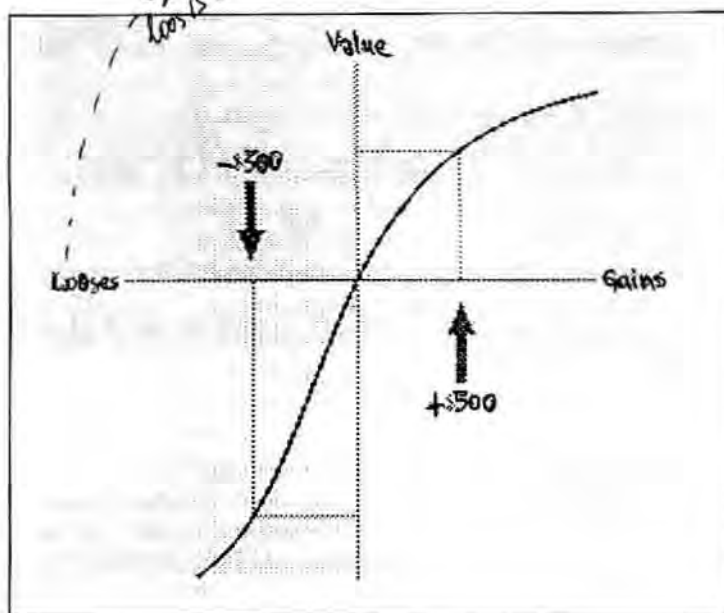


Figure 1: A hypothetical value function in prospect theory (after Plous, 1993)

According to the **prospect theory** reminders must emphasize lost instead of gain. Namely, most people are "loss averse", the loss of equal size is psychologically more important than the gain of that size. Therefore, we must tell people how much they will lose if not taking the protective action. Also the positive image of the environmentally conscious citizen must be promoted.

The problem of our environment is not only the problem of few polluting individuals but also the problem of the global economic system causing environmentally destructive behavior. Just these big problems are so often out of sight. Zimbardo and Leippe saw the solution to global environmental crisis in nurture of proenvironmental attitudes and beliefs throughout the culture. We must start with this task from the very beginning. Children must directly experience nature under the guidance of teachers who can reveal its beauties and teach the consequences of environmental abuse in enough vivid detail to create a sharp contrast with this beauty.

Solutions

Gardner and Stern (1996) stated that over the centuries, there have been only a few basic methods for promoting prosocial behavior:

- use of laws, regulations, and incentives to encourage prosocial behavior
- programs of education, which attempt to encourage prosocial behavior by giving people information and trying to change their attitudes

- the encouragement of prosocial behavior via certain informal social processes that operate in small social groups and communities, and
- the use of moral, religious, and/or ethical appeals to encourage prosocial behavior.

It is not the purpose of this paper to describe in detail all these processes. Perhaps we could end with the causal model of resource-consumption behavior.

LEVEL OF CAUSALITY	TYPE OF VARIABLE
7	Household background
6	External incentives and constraints
5	Values and worldviews
4	Attitudes and beliefs
3	Knowledge
2	Attention, behavioral commitment, etc.
1	Resource-using or resource-saving behavior

Figure 2: Causal model of resource-consumption behavior (Gardner & Stern, 1996).

There are two main types of barriers that can keep people from acting on proenvironmental attitudes:

- break in the chain between attitudes (4) and behavior (1), e.g., absence of appropriate knowledge (3) or of attention or commitment (2), can keep proenvironmental attitudes from generating action. Such barriers exist **within** individuals.
- there are also **external** barriers which appear at levels 7 and 6 (socioeconomic background, available technology, social and political institutions, etc.) that prevent proenvironmental behavior.

Only certain general overview of factors responsible for human behavior toward environment is given here. Emphasize was on those factors that have negative, undesirable consequences and not so on positive ones. Perhaps, the reason lies in the fact that our environment is degraded more and more, and voices that promote its improvement are not yet strong enough. If we look again at the scheme in figure two it is evident that part of the solution lies in the cooperation of different sciences, and between them and politics. Knowledge and technology how to behave toward or in our environment, and knowledge and technology of changing people, of changing ourselves, must go hand in hand to be successful.

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