

## **THE SOFTWARE IN THE SYSTEM.**

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On 14 April 1912, Edward Smith, the master of the Titanic pressed on at full speed, 22 knots, driving his huge ship through the night. Earlier he had received a warning message through the wireless about icebergs on the route ahead. Ignoring this warning he killed himself and 1400 passengers.

In 1972 a Lockheed 1011 of Eastern Airlines was about to land at Miami Airport. A green light indicating the extension of the nose-wheel did not come on and the chief pilot turned on the autopilot to cruise at 2000 feet. The crew, four persons, began to examine what was the cause of the problem. They did not notice that the aircraft slowly began losing height, nor did they hear the warning from the airtraffic control or the warning in the cockpit indicating low altitude. Nobody saw the trees of Everglades. Trees clearly visible from the cockpit. The disaster cost many lives and seemed quite unnecessary.

The accident in the nuclear plant at Three Mile Island was only partly caused by a failing pump. From this small start the accident grew to become a major threat to the surroundings by the fact that the people in charge refused to believe in and rely on their own warning system.

I have chosen those three examples illustrating the so called human factor. Examples where those in charge failed to act properly in situations where all information about the hazardous events was available. To this we can easily add the majority of accidents at sea over the years.

I would very much like to take the opportunity here to throw some light on possible explanations of accidents like this. As we all know our mental system was designed several thousand years ago and equipped from the start with a coping system aimed at dealing with threats of a quite primitive nature. Today we are dealing with more complex surroundings and considerable threats, not only to ourselves. This calls for more complex forms of behaviour. Designed as we are to deal with stressful events of short duration we now have to face and cope with prolonged tension which seriously affect the function of our nervous system.

In order to cope with any situation, hazardous or not, it is essential that we get a clear picture of the situation. Human beings build their personal view of a situation by interpreting the information given to them through their senses. In this mental process, which as all processes must take some time, every individual is by him self. Relying in his interpretation solely on what he already knows or has experienced before.

When the process of interpretation or understanding has come to an end we become aware of the situation. The process of interpreting the reality is, like most mental processes, unconscious. Only the end product is conscious. Like when You notice a sudden ominous traffic situation. It takes more or less a second to get a clear picture of what is happening. This process of understanding is the same in normal on-going life as well as in sudden events. We have to rely in our ability to interpret and on our senses.

Unless we have a picture of a situation we are not able to act and alter the situation, we are still in the process of understanding. By the time we have reach an understanding of the situation we are able to act or do something and our behaviour is of course determined by our personal view of that situation. If the personal view is good our actions will be good, but if our personal view is poor, we will not realize that and act poorly in the believe that our behaviour is adequate. No one makes a mistake on purpose, mostly we make mistakes in the belief that we are doing the right thing.

But just having a picture of an on-going event does not make us eager to act. We also need an emotional involvement in the reality. Some things we know but don't care for, some things we are very much involved in. We have to have at least some involvement in the situation or experience something that has an influence upon us in order to react.

Thirdly we must make a proper judgement of it all and of our own capacity and hopefully come to the conclusion that we are able to cope with it, i. e. handle the situation in some way or get out of it. If this evaluation is positive some action will be the consequence. No one does anything if he does not have a clear picture of a situation. No one does anything if he or she not is affected and doesn't have the belief that he or she is able to cope with the situation. All three must be positive.

Panic for example is believed to follow if You experience a life-threatening situation. The life threatening quality of the situation is equal to having a high involvement in the situation. If You believe You can alter the situation but don't have a clear picture of how, Your actions will be aimless, forceful and irrelevant, thus panic.

Apathy is the opposite. You experience a life-threatening situation which You (as You see it) not are able to alter. No action will occur and You give up.

As we can see, the process of understanding is vital to the ability to cope.

It is in this process we experience our human shortcomings. The ability to understand the outside reality is linked with our ability to perceive it correctly. I. e. that our senses are reliable and that our ability to interpret is adequate. Unfortunately this is not so.

To begin with we create images of the outside world reflecting what is. Personally coloured images which also reflect our own personality, motivation, level of tension, neurotic aims and the like. Maybe this was the case with the Master of Titanic who presumably had too much belief in his own capacity, or in the ships. Or maybe he was just trying to please the passengers.

Our senses are not able to reflect more than parts of the outside world and we also have limits to our attentiveness. As in the case with the Lockheed aircraft when the crew were narrowed in their attention by a minor problem thereby neglecting a bigger one.

Furthermore we have the problem with our psychic defence mechanisms which sometimes seriously alter our perception and more or less every time in favour of calming ourselves in difficult or stressful situations. Those mechanisms intervene in both the process of perceiving and in the process of interpretation. They act as a kind of shock absorbers between us and the reality very often serving us well but sometimes, and in some individuals guilty of severe distortion in the conscious perception. This is true specially in stressful events where each and everyone of us have to rely in our basic personal set up.

The defence mechanisms are consequences of earlier stressful events or periods in our life. A sort of mental scars from long ago but still unconsciously affecting us as parts of our personal experience. Hence influencing our mental processes of interpreting the outside world in the direction of altered, wishful and false experience. The disbelief shown by the persons in charge of the nuclear plant at Three Mile Island could very well be as a result of such mechanisms.

In the case of a sailor I will also mention the capacity of our mind to feed itself and to close circuits without contact with the outside world. I am talking of plain boredom and daydreaming where a person loses contact with outer reality and is mentally occupied with the inner.

To make all this even worse: it is quite clear that the capacity and function of our nervous system is severely affected by stress, prolonged tension and fatigue.

To make a brief list of our human shortcomings I would point at the following:

**Distortions by the mechanisms of defence.**

**Our personal neurotic aims.**

**Various compensatory aims and actions.**

**Inner conflicts.**

**Influence of stress and fatigue.**

**The narrowing of consciousness when the mind is occupied.**

**The limited capacity of perception and consciousness.**

**The limited capacity to cope with ambiguous perception.**

**The minds capacity for boredom, daydreaming and wishful thinking.**

**The minds concentration on what is, rather than what is not.**

**The influence of strong emotions on behaviour and perception**

In all this we differ as individuals. We all have our limits and especially we differ in our ability to cope with the environment under stress and fatigue. Some have the ability to cope with and master threatening situations and to function adequately under heavy pressure, others lose quickly their capability even under moderate tension.

A couple of years ago there was a full speed collision between two trains here in Sweden. In one of the engines there was a crew of two people. One of them jumped a few meters before the collision taking a smaller risk and avoiding a greater thus saving himself. The other pulled the string and blew the horn all the way to the end.

This tragic accident illuminates in my mind the differences in coping between two individuals experiencing exactly the same situation and with almost the same skill and training. At the same time the end result points to the fact that there is a difference between individuals in their ability to grasp and react rationally in life threatening or stressful situations. The differences lies within the personality or in other words the adequacy in perception and the unconscious process of interpretation. This can be revealed, studied and evaluated by means of special psychological techniques. I will tell You more about that later.

One way of improving standards of officers in charge of ships is of course to as carefully as possible select those who have the best capability of mastering difficult situations and, on the other hand, to identify those with poorer capacity. Another way is to improve the ability overall by improving a sailors ability to perceive and to react properly. A third way is to encourage the staffs involvement in safety issues, especially the Master himself.

This can be done, and is already done in several different ways.

Other ways of improving the standards of behaviour in a crew is of course by training, proper education and exchange of experiences between seamen. By doing this You penetrate in a positive way the process of understanding different situations, i. e. the main level in the coping-scheme (see fig. 1). By exchanging information, knowledge and the like You actively supply a structure or a blueprint for the understanding of similar events in the future. You make the various situations somewhat familiar, faster and easier to comprehend.

By training in real like situations You also create schemes for effective actions in different situations so as to help the trained to evaluate situations and to evaluate different possible actions. I. e. through the help of earlier experiences You can both evaluate and increase the individuals capacity in the situation. By training You also penetrate the third level, the evaluation of ones own capacity to cope.

Furthermore, by clarifying the borders of responsibility between the actors You are able to strengthen the involvement in different safety issues. Clear responsibility sharpens the individuals commitment and emotional involvement in the situation and support the individual to overcome disturbing inner affects and tensions. Every element of responsibility in sea traffic should have its owner. In this case You penetrate the second level.

Especially significant in this respect is to clarify the boundaries of different responsibilities between the management, the owner and the Master of the ship. This should, in my opinion, be made very clear to each and everyone who operates vessels and should have nationally or internationally valid rules.

Although we are able to strengthen the coping processes of those who operate ships the main issue of my talk is still to come. That is that we must carefully select the persons to whom we give responsibility for the safety of passengers, ships, cargo and our environment. We can train and educate people but we must also get qualified individuals, suited for the job at the start.

We have to choose individuals who are able to combine training and knowledge with the ability of perceiving the reality with a minimum of personal distortions.

This can be done by introducing a psychological test procedure which is designed to reveal the individuals capacity to take in and process information from the outside reality, to evaluate the information and to act upon that information. The test procedure is constructed so as to give us a picture of how good or poor an individual is at understanding what is happening. By doing the test we can understand how an individual unconsciously is perceiving and processing information and the amount of personal influence or distortions there is in that process in terms of various defence mechanisms.

This will give us very vital information of an individuals capability to cope in especially stressful events because stressful events bear in them emotionally loaded information which will trigger off various defensive strategies in us all. Those strategies can be good or poor. Good when an individual is capable of delaying or not take in for example the personal threat in what is happening. Poor when a person is so influenced with the threatening aspect that he cant make proper judgements or when, in a crisis, the process is so slowed that a person fails to act in time.

Individuals with a good capacity to comprehend an on-going situation will evidently have the base in themselves to make good judgements and by means of that avoid dangerous situations. When a dangerous situation occurs, they will have the capacity to grasp it correctly and to take proper actions.

On the other hand individuals with poorer internal processing will fail in the judgement and more often expose themselves to difficult situations which they also are incapable of grasping and handling in an effective way. As we all know there are often some misjudgements prior to an accident. On the one hand we have the problem of foreseeing and avoiding hazardous situations, on the other hand of the problem of coping with them if they come about. Two different abilities which often live close together within the same individual.

In order to illustrate what this kind of psychological evaluation can do I would like to show You some figures from the Swedish Air force where, in 1969, the selection of pilots was improved by introducing The Defence Mechanism Test, known as the DMT.

Prior to that there was a period when pilots and student pilots were tested with the DMT but the results of the test were not used in the selecting process. Instead the pilots were tested and divided into five different groups, of course without their knowledge. In group five were the pilots with the best DMT scores and in group one the pilots with the poorest. It was believed that the pilots in group 1 - 2 would have the poorest coping ability and accuracy in perception and that the pilots in group 3 - 5 would have differences between the different groups but be suited enough for the work and have suitable personality traits with good judgement and coping ability.

The DMT as a method of evaluating different important personality traits is now well established and the test is used in the selection of both military and civil pilots, here in Sweden and in several other countries.

In other areas DMT has also shown its ability to differentiate and to give us some picture of accident prone individuals. For example it is shown among car drivers that the third of a tested group with the poorest DMT results were involved in 71% of the accidents of the total group while the best third only was involved in 6% of the accidents.

It is my belief that a similar procedure, adapted for the selection of officers on board ships, could spare us some accidents and loss of live as in the case of flyers. We now have reliable instruments by which we are able to unfold some of the hidden aspects of human functioning and by using it in areas were individuals face difficult tasks we are able to improve the overall standards of operation.

I have, like in the scheme for coping just presented to You, done my best to give You some details which hopefully can add something to Your view or picture of the problem with safety at sea. Hopefully too, we will today start a process which could lead to even greater concern over this kind of issues, or in the language of its coping scheme: involvement. Lastly I have tried to point to some ways of handling the problem by selecting, training and making boundaries between responsibilities clearer. Here we have the coping part. The next and last level of coping is action!

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## References

- Neuman, T. (1978). *Dimensionering och validering av perceptgenesens försvarsmekanismer. En hierarkisk analys mot pilotens stressbeteende*. FOA Rapport nr C 55020-H6
- Neuman, T. (1986) *En studie av DMT och det stegvisa flygarurvalets funktion under perioden 1977 - 81, samt en utredning om DMT-X-Aspects*. London. Stencil.
- Trygg, L. (1982). *Personlighet och förarutbildning*. Stockholm, Transportdelegationen.