CHAPTER 5 HUMAN ERROR & RISK

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Do Humans Cause Most Accidents?

- A commonly citied statistic is that 85% of work accidents are due to unsafe acts by human rather than unsafe conditions

- More recent studies of various industries from rolling mills, construction, and railroads show that 60 to 80 percent of accidents were the direct result of the operator.

Do Humans Cause Most Accidents?

- *The data from most studies could be proved to be biased and incomplete*
- Most reports are written by supervisors who motives are self-serving so their definition of an human error may be incorrect

- DC-10 plane crash of 1979 into Mount Erebus in Antarctica blamed the crash on the pilot, but through a much more thorough investigation the actual autopilot heading of the airplane were altered before the flight started

Do Humans Cause Most Accidents?

- *Positive actions are usually not recorded*

- One reason why human error reports may be misleading is that human actions are generally reported only if they have a negative effect on safety.

- A positive effect which is usually an operator who brings the system back to normal after failure is usually not reported.

Do Humans Cause Most Accidents?

- *Operators often have to intervene at the limits*

- Some operators are often required to intervene at the limits system of behavior when the consequences of not succeeding are serious

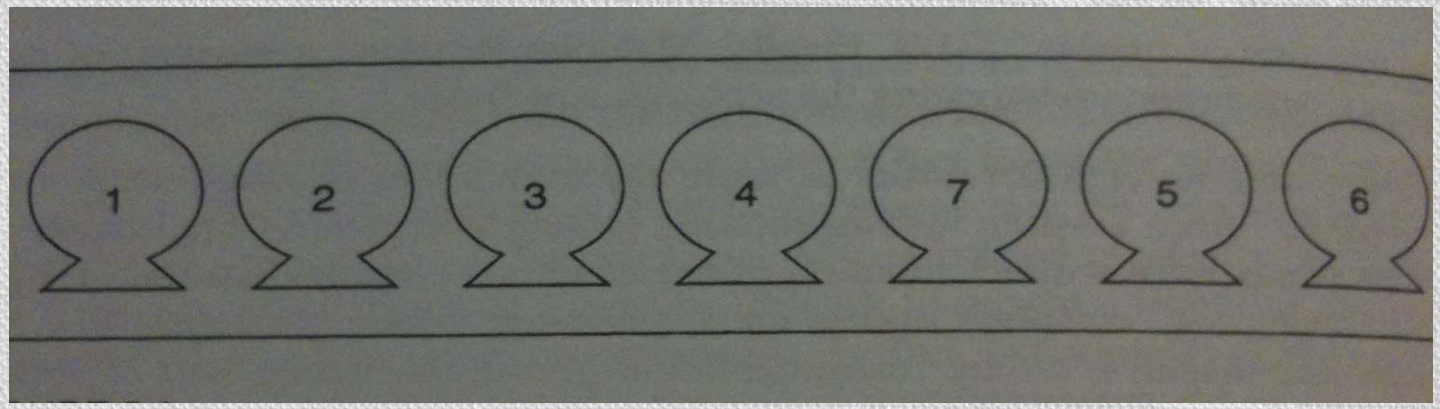
Do Humans Cause Most Accidents?

- *Hindsight is always 20/20*
- Sometimes our judgment on certain situation may not be the best direction to go
- Operators are required to detect a problem, diagnose its cause, and determine the appropriate actions
- *Situation*: 110 alarms sounding, key indicators not reachable, repair tags on warning signs, and data print out on the computer was behind
- *Outcome*: No human error, system design error

Separating Operator Error from Design Error

- Human operators are often at mercy of the system design and operational procedures.
- Poor Designs: The location of critical decimal points is unclear, Critical displays are located on the backside of a panel, and panel meters can not be read from more than several feet away.
- Some companies have used there own ideas as far as understanding their system design with color tape coordination etc.

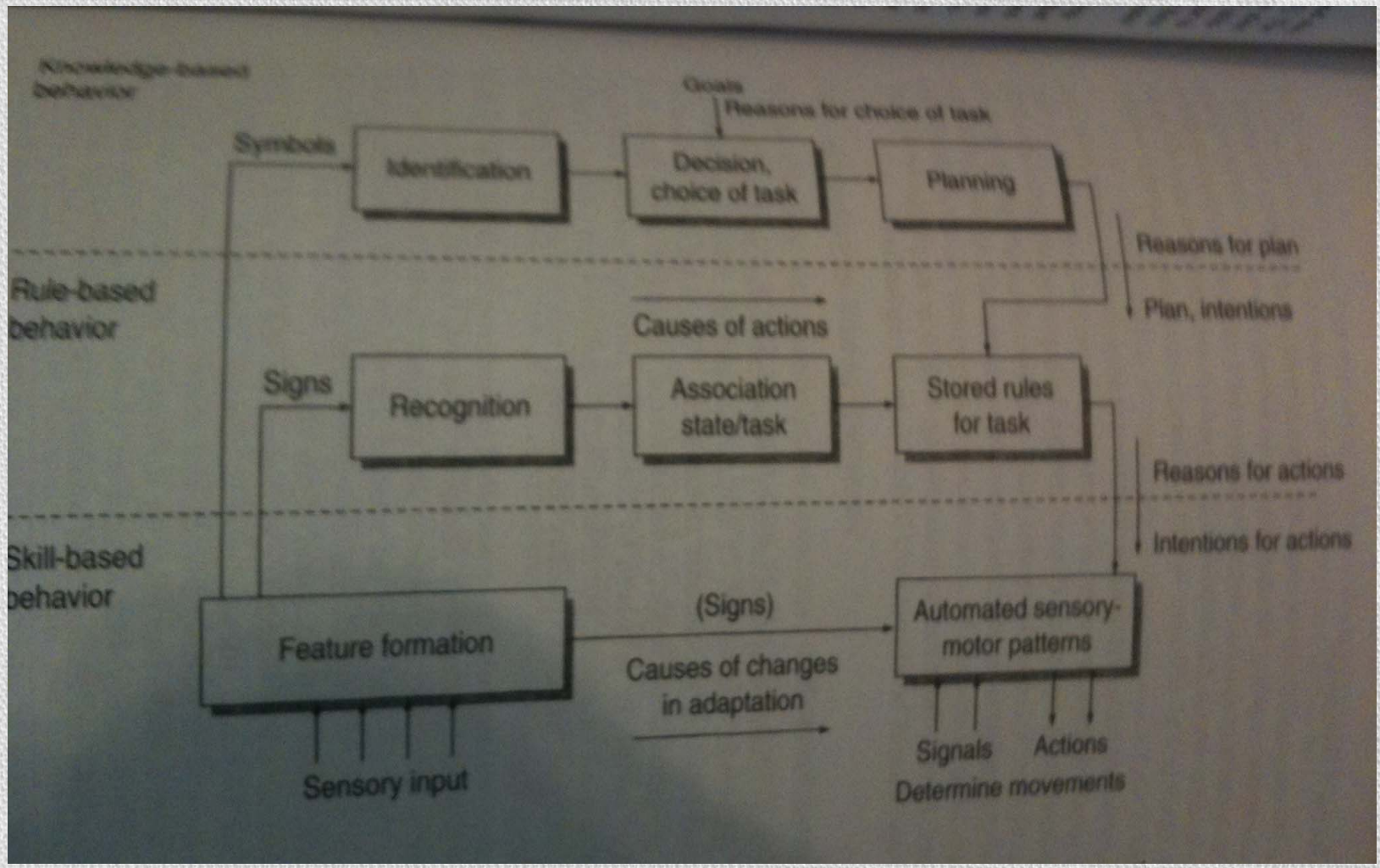
- Rows of hot oil pumps in a chemical plant. Hot oil came out of pumps 5 and 6 when they were dismantled can anyone tell me why?



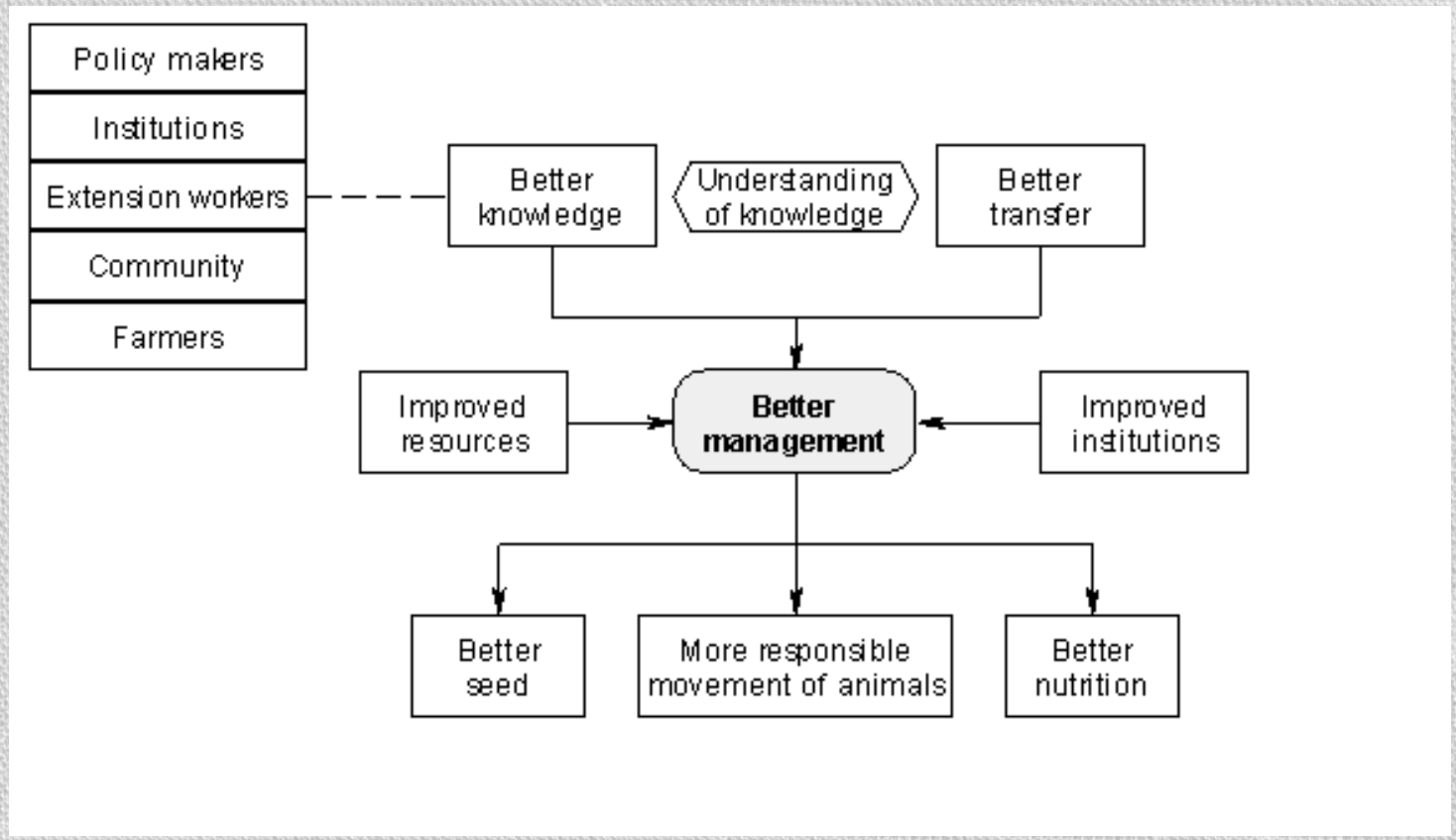
Human Error as Human-Task Mismatch

- Human error is not a useful term and should be human-task mismatch.
- Human error implies that something can be done to humans in order to improve the state of affairs
- In other words a human who has experience, knowledge, and clear guidelines of certain procedures that could cut down on a lot of human errors

Rasmussen's Model of Control



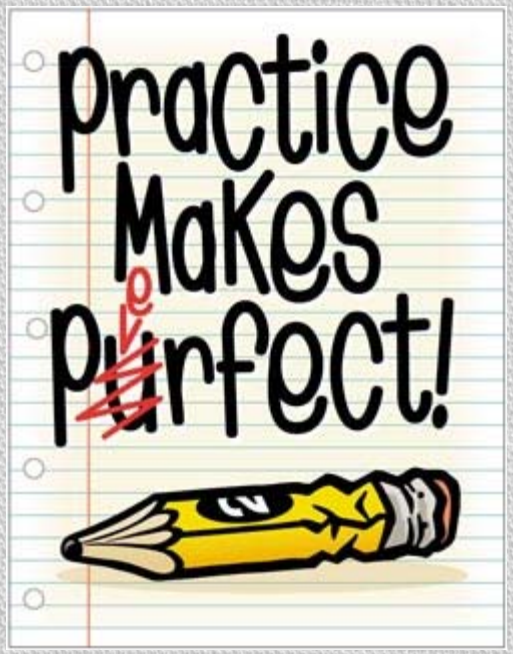
Rasmussen's Model of Control (My Version)



Skill-Based Behavior

- Skill-Base Behavior constitutes unconscious performance of routine task such as driving a car

- The more you practice what you the know the better efficient you will be



Rule-Based Behavior

- Knowing the rules of certain procedures by training or experience can allow the operator to interact efficiently with a complex system.

- Having the knowledge to use certain rules at given time is also a way of cutting down on human error

Knowledge-Based Behavior

- When there isn't a rule that can help you get out of certain situation based on your experience and knowledge you can easily handle a situation.

- Example: They never teach you in driving school how to change a tire, but due to your mother making you change the tire every time there is a flat gave you knowledge and experience of what needs to be done

Conclusion

- In the industry we must make sure that everyone is equip with knowledge, and experience. Without having the proper training will result in more human error than system error. Learn to look past the limits not just the limit in itself.

- Use every lesson as a learning experience and apply it to similar situations

CHAPTER 6
THE ROLE OF HUMANS IN AUTOMATED SYSTEMS

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Roles of Humans

- Human tasks are being taken over by machines more and more every day.
- That reason is because mostly operator error accounts for majority of accidents.
- Designers these days create to eliminate humans from systems. They make the operators job more complex and accident prone. Leading to having an increased interest in human factors and the human-machine interface
- Automation usually does not eliminate humans but instead raises their task to new level of complexity.

Roles of Human

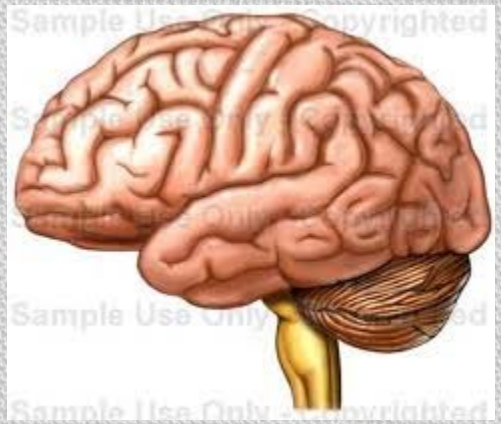
- Human factors play important roles in certain fields as far as engineering is concerned. The human factors in engineer designs may have been inhibited due to cultural clash between human factor researchers.
- Human factor researchers usually have a background in psychology, and design engineers have little to none education resources in this error.

- So how can a psychologist design engineer systems?

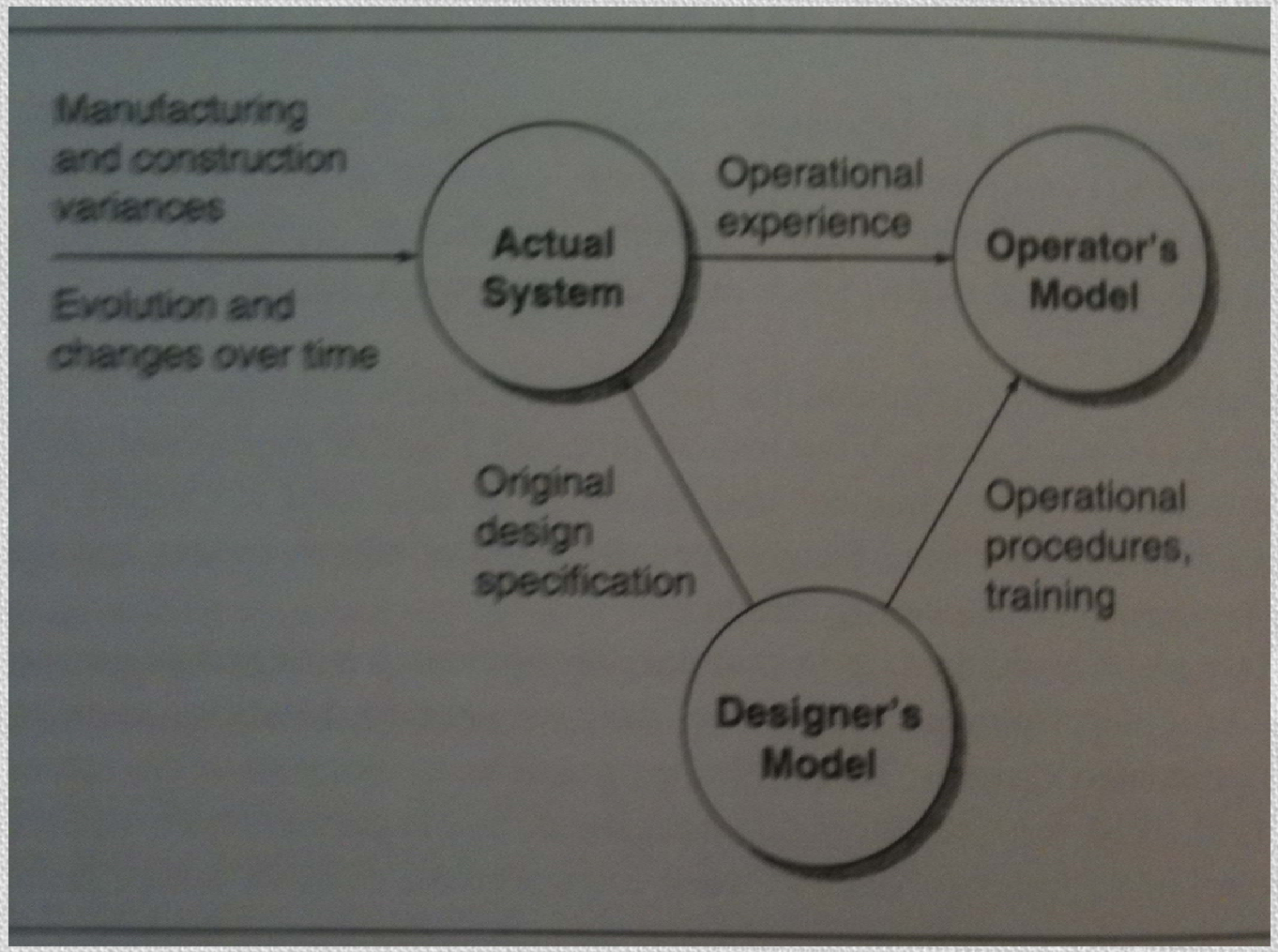
Mental Models

- Dealing with complexity, abstraction is one of our most powerful tools. It allows us to concentrate on the relevant aspects of a problem while ignoring the irrelevant.

- Mental models contain the most relevant aspects of an individual's interaction with a system. Some mental models maybe very simple while others are very elaborate.



The Relationship Between Mental Models Diagram



Relationship Between Mental Models

- The operators model will be based partly on formal training and experience. The operator must cope with the system as it is constructed and not as it may be envisioned.

- The designers' model are less accurate than the operators model

The Human Monitor

- With automation of control systems, the operator's role changes from active control to monitoring. Which means the human becomes responsible for detecting problems and providing repair capabilities.

- A human monitoring the progress of a certain system has become ideal due to the fact that it takes the attention off of doing operational task and devoting all attention to the monitoring task

- From experience and studies done within human monitoring, it shows that humans make very poor monitors of automatic systems

The Human as Monitor

- There are many explanations as to why humans are poor monitors

- *The task may be impossible.* Some of the automated control systems can provide a better job than a human. Thus showing that the human must have accurate knowledge of the system at hand and know the proper procedures

- Also if a problem arise the computer could make a quicker and more efficient decision than a human can make

The Human as Monitor

- The operator is dependent on the information provided; it is easy to provide too much or too little information.
- Running a system can sometimes be overwhelming with the massive need to know information. Humans respond accurately with less information known to correct issues
- This brings in the irrelevant and relevant information provided

The Human as Monitor

- *The information is more indirect with automated systems, which may make it harder for the operator to obtain a clear picture of the state of the system*

- If the designer lacks the understanding of the mental models used by operators it limits the monitors decision making ability
- The information received from the system through instrumentation is not reality but merely a representation of reality

The Human as Monitor

- *Failures may be silent or masked*

- Automatic control systems *are designed to cope with the immediate effects in the process. An operator will be aware of such problems only if adequate information to detect issues were provided*
- *Such information is not always provided*
- *Sometimes feedback from the system may be masked or delayed due to the fact that where the trouble first appeared may not be the place where the failures have occurred. Its all about design*

The Human as Monitor

- *Tasks that require little active operator behavior may result in lowered alertness and vigilance and can be lead to complacency and overreliance on automated systems*
- *Attention spans of an adult to maintain an effective alertness is for about half hour. So if a system has been operating smoothing for sometime it makes it hard for a monitor to keep up with the progress.*
- *The higher the reliability of the system the more likely the monitor will become more alert which means a longer attention to detail span*

The Human as Backup

- A second role that an operator may be required to perform is an automated system back up in the event of an emergency.
- But due to poorly designed automation this role may be difficult for the operator

- A poorly designed human-machine interface may leave operators with lowered proficiency and increased reluctance to intervene.

Bad System Designs

The Human as Backup

- *Fault-intolerant systems may lead to even larger errors*

- Designers are sometimes so sure that their systems are self-regulating that they do not include appropriate means for human intervention.

- But the system mail fail in ways that the designer did not anticipate, and unless the designer provided appropriate means for the operator it could cause serious problems

The Human as Partner

- A third role that humans can partake in is the human and automated system may both be assigned control tasks.

- This has to be carefully planned or else operator will end up having a job the designer can't explain how to automate.

Downfalls of Partnership

- The operator may be assigned a task that the designer cannot figure out how to automate

- By taking away the easy parts of the operator's job, automation may make the more difficult parts even harder. Because eliminating some tasks makes it more difficult or impossible for the operator to receive the necessary feedback to maintain an accurate system.

Doubts About Partnership in Corporations

- Issues of automation of functions currently performed by humans are exemplified by the automation of air traffic control.
- FAA is researching the possibility of eliminating human control over minute to minute traffic decisions by replacing it with computer interaction and having a human act as a manager.
- Which means the human would take care of other task not to be handled by a computer and the computer would take care of the regular routine commands to aircraft

Doubts About Partnership in Corporations

- The doubts that come into play is that the design of the system would not allow human backup in case the computer failed to handle a given situation correctly.
- The volume of traffic handled by each control station would be about doubled that handled today so the controller would not have time to check the computers accuracy with possible conflicts
- If controllers had the time to handle conflicts their role in the system would over time would become unreliable monitors. They would lose skills in dealing with traffic.

Conclusion

- The goals of human-machine interface design should be to preserve the human capability to intervene positively while making harmful intervention difficult as possible.
- The risk to human operators may not be that they will cause accidents but that they may not succeed in preventing them.

- But the main factor is that the operator is not considered during the main process of designing a system

Questions or Comments