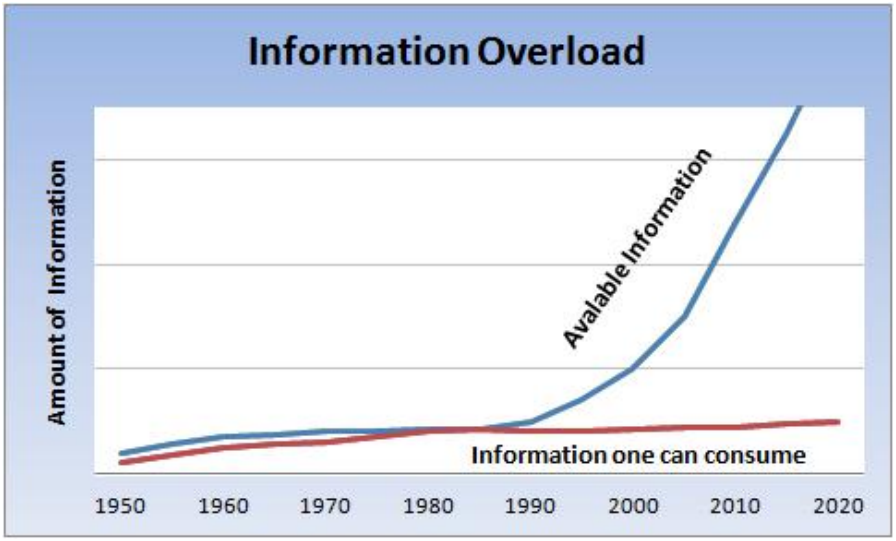
Increasing Operator Effectiveness.

The basics of Papermaking today is very much the same as 25 years ago, technology however has also bought many changes and one of the biggest is how we operate the Paper Machine today. In the past the operator spent most of his time next to the machine, nowadays he spends the larger part sat in front of the many monitors that are full of information. It is a general assumption that if we bring the information to the operator, then he can do more and the process can be run with less hands. To make this work and be sure to not create unsafe conditions and still produce at top performance, it is important to understand how an operator can work the huge amount of data that he or she is confronted with in an effective way.

The global process industry loses approximately $20 billion, or five percent of annual production, due to unscheduled downtime and poor quality. We estimate that almost 80 percent of these losses are preventable and over 40 percent are primarily the result of operator error. With the process becoming more and more automated operating rooms are being equipped larger numbers of monitors. When these operating rooms are manned by one or 2 operators with multiple screens per operator we can understand that things can go wrong.

The reason for the increased automation of the process is also very well known and needed. To maximize profits in a tough market the industry has invested in automation to reduce production costs and increase quality. The dilemma now is how we can keep increasing the level of automation without creating a contra productive situation. We need to provide the operator with an environment that will help him absorb and react to the masses of data provided, minimizing the risks of accidents, eliminating unscheduled downtime and maximizing production and quality.



To get an idea of the challenge we are facing, it may be good to put the information flow we receive today into perspective. Each new day introduces an unrelenting flow of data,TV news, the Internet, e-mail, voicemail, faxes, cell phones, pagers, billboards, junk mail, newspapers, magazines, books, catalogs and nonstop cable news. It never lets up and there's no place to hide. It assaults us at home, at work, even at play. By one estimate, a single issue of the New York Times contains more information than the average 17th-century person would come across in an entire lifetime. Obviously, our ability to gather

and deliver information has increased greatly since the 17th century, but the brain's ability to absorb and process it has not changed since the days of the cave man.

We have a situation very equal to the comparison above when we think of the information we are providing the operators of our processes today and it is becoming more and more important to understand the best way to present the data to ensure that safety and effectiveness can be still be maintained, or even better increased.

Before we are able to determine the best way to present the information it is important to understand how the human mind reacts to the information being presented and how much information the human mind can process. Alvin Toffler sounded the first early warning more than 30 years ago. In his trailblazing book, Future Shock (Random House, 1971), Toffler theorized that the human brain has finite limits on how much information it can absorb and process. Exceed that limit and the brain becomes overloaded, thinking and reasoning become dulled, decision-making flawed and, in some cases, impossible.

We can compare the brain as a giant board with lights, each light represents a concept. When a concept is brought to our attention then the lights in that the area representing that concept light up. With so much information reaching you, many areas are lit up at once. To handle this, your brain uses a controller that focuses attention on the most important area. It also keeps scanning other areas in case they become important. With so much brain activity, keeping your attention focused becomes very difficult and results in wandering attention, inability to stick to one task and frustration at the constant interruptions from new areas being lit up. At night, while you're asleep, the controller is still sorting things out

No matter how much we try to absorb everything that reaches at us via the various media channels, our brain is limited and can only focus on one thing at a time in depth. Much of what we think we're taking in is dissipated before we're able to digest it and at the same time it is using our mental energy. Another mistake we often make is confusing information with knowledge; however as have seen too much information actually confuses and numbs our brain and with that the ability to expand our knowledge.

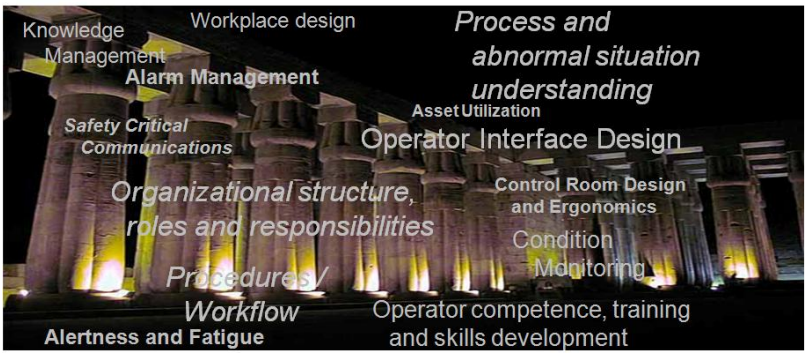
> The role of an operator can be characterized by long periods of inactivity, punctuated with short bursts of highly very stressful action. It is critical for an operator to sustain a high level of alertness and understanding of the progress through the production cycle during the slow times and, at the same time, have real-time access to critical information in context to be able to make correct decisions and take the proper action immediately when circumstances dictate.

The workplace, especially, has become a breeding ground for information overload. A worldwide survey (Reuters, 1996) found that two thirds of managers suffer from increased tension and one-third from ill health because of the huge amounts of information they must cope with. The workplace, in fact, has become our leading source of stress, according to the American Institute of Stress. Just because we have access to all the information in the world doesn't mean

we can process it all." It's easier to screen out information "noise" once we recognize it as such. Our experts agree that the most important building block for a defense against information overload is recognition of its existence.

It is exactly a workplace that we using to inform the operators on the status of the process they are taking care of, process information is very often presented to operators in a continuous mode, for instance a live video of the same part of the process is visualized, hour after hour, day after day and it is not uncommon to put four of these video's on the same screen quadrupling the information. We have to question the value of this kind of presentation, can the human brain really process all this data, is it possible to register critical circumstances out of the huge mass of data being presented. Another well known issue is how the process alarms are handled. When the process goes into a critical situation the workplace or workplaces start producing alarms, very often at such a rate and quantity that the essence or root cause of the alarm is lost in the overflow of information. As mentioned before most of the information provided to the operator is in a continuous mode, the same part of the process is visualized via a process graphic and possibly in a separate video as well. For the largest part of the time this information has limited or no value, showing the operator that all is well, monitoring the process in a steady state hours on end results in loss of attention.

It is not difficult to understand that if we want to use the technical solutions that are available in an effective and safe way we have to move our attention to solving a the fundamental issue of how we can provide the huge masses of data in a form that the operator can handle. We have to combine information of the process by integrating aspects like live video, alarming and other available information from external applications and only present the information when it actually has a value in a way that should help the operators handle the information provided to them.



The most logical place to start working on the solution is most likely the human machine interface design as this is one of the main information providers, the following things should be considered to provide an ergonomic interface:

- High level of HMI consistency in systems delivered by different suppliers such as large screen display, operator systems and critical action panel
- High level of HMI consistency in use of symbols, structure and content, colors and alarms, faceplate and tag descriptors for the VDU based operating systems
- Alarm philosophy and principles consistently applied throughout the different HMI's

But we cannot stop here as there are more information sources in the operators environment and these need to be addressed as well take for instance the control centre layout and that it is well thought out with high focus on preventing unnecessary traffic not to disturb the operators:

- The control centre is spacious and designed to accommodate future increase of operator and system tasks
- Good viewing angles are guaranteed from the operator desks to the large screen display and work permit area.
- Good daylight is guaranteed by large windows while sound absorbing lining on walls and furniture reduces the reflection sounds from the large screen wall promoting further the well being of the operators

ABB has worked together with CGM to achieve the results as described above and reduce the workload and stress in a control centre and make sure that today's operator has the tools to make the right decisions at the right moment, by rethinking and streamlining the information provided. The ABB System 800xA Operations gives operators fast and easy access to the process in an easy way, hiding excess information but making it available when needed, information is accessed fast and effectively via a right click. Large amounts of information can be handled quickly, effectively and correctly. In addition, collaboration with maintenance and process engineers is greatly simplified as all information is accessed via the same system but controlled through access rights.

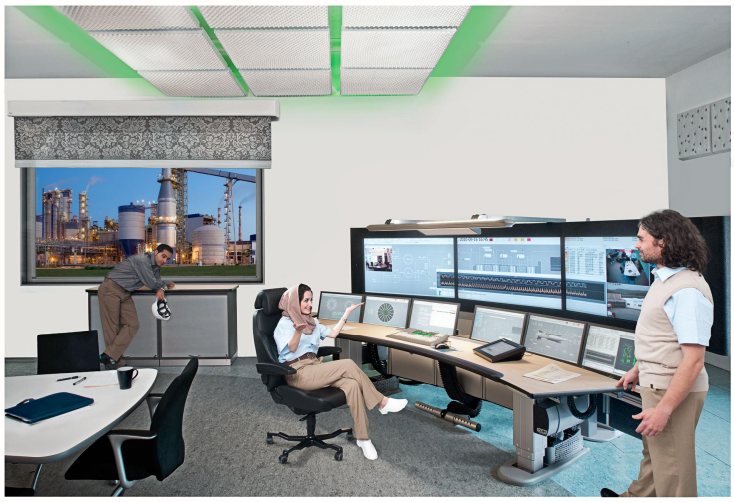
Process alarms can create high stress levels in the control room and it is therefore all the more important to look at how we can handle these effectively. System 800xA Operations prioritizes alarm and event handling so that process operators react quickly and effectively irrespective of whether the reported event appears to be a routine alarm or something more serious. In certain process situation large amounts of known alarms can be created, unexpected alarms can be missed due to the high amount of predictable alarms. This can be reduced to a minimum by suppressing alarms that are not relevant in a particular situation, e.g. low temperatures or flow during a controlled shutdown. 'Alarm hiding' dramatically decreases operator distraction, ensuring that they work productively and remain alert to other situations. The quicker you find information, the faster you can respond in the correct way. It is important to offers operators consistent navigation to and from the alarm list

Information overflow due to alarms can also be controlled by applying filters. Ad-hoc filters enable flexible operator filtering while pre-defined filters short-cut directly to relevant alarms. Operator reaction speed and efficiency increase even further, which is especially valuable in stressful situations. In the event of multiple alarms, automatic identification of the section of the plant with the most acute problems allows operators to know exactly where to concentrate their efforts, which in some cases could help avoid total shutdown. The 'live-value-in-alarm-list' function also gives those responding a very quick assessment of the current status for a measured value in alarm condition. Once again, saving valuable time by instantly handing the operator correct and relevant information.

Another key component in optimizing and providing information is consistency. The data must be provided by the system in a consistent yet easy-to-adapt format; this reduces the stress levels but allows

enough flexibility to handle all situations. ABB has developed a solution that minimizes the need to move and resize windows and eliminates 'window-overload'. A new trend display will, for example, always open in the same window as the previous. You know in advance where to look, which minimizes stress and saves considerable time.

In many control centre's information from different systems is provided via multiple monitors, creating many sources of constant and less valuable information. Again this information should be combined; information that is not required at that moment should not be displayed. Different display formats should be handled in a mixed environment of standard monitors and large displays. Once again, operators should focus on the task in hand without having to spend time creating a workable viewing environment. For instance they can also decide that alarm lists are never covered by other views, or view all displays related to a given object, i.e. a trend display or an alarm list. Another way to control information is to combine different data in one window, thus creating group displays for large screens from existing normal displays. As an example live video information is easy to integrate. This saves time, money, space and distraction by eliminating the need for separate ceiling-mounted CCTV monitors.



Live videos play an increasingly significant role in today's plant operations and a modern facility may have hundreds of cameras in use simultaneously. The opportunities are many live video aspects on process objects, video history with recording to hard-disk, snapshot images, etc. However it is often a e problem to find the right camera. Again this dilemma can be solved the same way as many others. Intelligent navigation by right-clicking on the camera's object brings up the video required. You don't need to know which camera to call up or where it is physically placed, and you don't have to run through long lists to find out. Another method is to place embedded camera views in process displays, create group displays, and control any camera (or several) directly from the screen in front of you.

Not only the way that the data is presented to the operators contributes to the effectiveness but also the control room itself has influence. The control room is the most important room in your facility, the room where corporate goals of operational excellence and plant Return-on-Assets are fulfilled. A total control-room environment focused on operator performance, health and job satisfaction

The Extended Control Room (ECR) for 800xA comprises of the operator interface as well as the physical environment in the control room, ECR gives operators:

- The right tools for the job, correct information served up on time for fast and correct decision-making
- A rewarding and attractive environment, full of ingenious solutions that make operators more aware and more effective

The ECR helps operators perform more effectively by handing them the information they must have to act quickly and take correct decisions. For instance viewing ergonomics have to be taken into account. Operators need to enjoy a superior close overview plus full integration at the same time, instead of having to twist their necks to view a distant non-interactive panel. Close-up overviews also prove invaluable when several operators need to see and discuss process events together.

The ECR recognizes and acts on human factors such as ergonomics, good health and job satisfaction. It rewards operators for the vital work they perform. It is a proven fact that plants performs smarter, safer and better and at substantial cost-savings. Operators enjoy a place of work that finally mirrors their own perceptions of the vital task they perform. Skilled and motivated personal are sometimes hard to find, ECR makes it easier to recruit younger operators with modern control skills. These operators, highly qualified for running today's complex, multi-layered manufacturing plants, put a high value on the job they perform and on their working conditions.

Close attention needs to be taken to working height, viewing angle, sit comfort and legroom as well as ambient lighting, noise and heating levels keeps operators alert and ready to act quickly whatever situation arises. Should a certain type of alarm be detected, for example, subtle changes in working

position, speaker system and micro-ventilation occur automatically so that the operators in question can focus all their attention on solving the problem.

When skilled and enthusiastic process operators look forward to a new day of work, you can be sure that the control of your plant is in very competent hands.

About the author

Born in the UK Paul moved to the Netherlands early in life and completed his training with a Bsc degree in Measurement and Control. Paul started his career with ABB in 1989 as a Quality Control Systems Service Engineer for the Pulp & Paper Industry, assisting customers with system and process issues. After 7 years in service and project Paul continued his career in sales first in the Netherlands, then the Benelux and now in Europe.

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