TITLE: "WHAT EVER HAPPENED TO ERGONOMICS?"

by Tim Bryce
Managing Director
M. Bryce & Associates (MBA)
P.O. Box 1637
Palm Harbor, FL 34682-1637
United States
Tel: 727/786-4567
E-Mail: timb001@phmainstreet.com
WWW: http://www.phmainstreet.com/mba/
Since 1971: *"Software for the finest computer - the Mind"*

"Forgetting the human-being during design will cause the human-being to forget the system at time of startup; it will be DOA, Dead On Arrival."
- Bryce's Law

INTRODUCTION

The term "ergonomics" was coined back in the 1980's and when it was first introduced there was a voluminous number of books and articles written and seminars conducted on the subject. In a nutshell, ergonomics is concerned with adapting our physical work environment to suit the needs of the human being, not the other way around. The theory here is if we, as human beings, can easily adapt to our physical surroundings, the better we can accept and implement our work environment. This is a valid point which should be considered in any systems development undertaking, large or small. In reality, the concept is an old one as it was used by "Systems & Procedures" departments which predated the introduction of commercial computers in the workplace. But it was in the 1980's where the concept was reborn and renamed "ergonomics." This resulted in a movement where we reconsidered the design of everything from computer screens (the advent of the Graphical User Interface or "GUI"), keyboards, office furniture, etc. Ergonomics is still with us but you don't hear too much about it anymore. Perhaps it was nothing more than a passing fad. I certainly hope not.

Ergonomics is applied when we move from logical design to the consideration of the most suitable physical implementation. In "PRIDE"-ISEM, this occurs in Phase 3 "Sub-System Design," which is where we design the physical implementation of the business process, including the human/machine interface. During this phase we will, of course, consider such things as "Methods of Processing" (work dependencies consisting of sequence, iteration, and choice) as well as the volume of transactions to be processed. But more importantly, we have to consider the most practical and cost effective solution for implementing the sub-system. It is here where we must consider the human being. A poorly designed and programmed system that can be easily used is far better than an elaborate system that alienates the users. Obviously, the objective of system developers is to produce a superior system that is easy for the users to implement and use.

HUMAN APPEAL

In order to devise a suitable physical implementation, consideration must be given to the intelligence level of the humans who will implement the business process. To illustrate, I know of a popular electronics retailer who devised a totally new system for their service shops across the country. The idea was to give the store clerks easy access to reference products, parts and warranties. Prior to this, the service shops relied on massive printed catalogs which, although they were accurate, required considerable time to lookup components and warranties. The company wanted to expedite this process thereby improving customer satisfaction. As a result, they devised an elaborate system involving robust screens with computer graphics, and a mouse. True, the system could rapidly access data, but it tended to intimidate the clerks in the service centers (most did not have the inclination or temperament to use a computer). So much so, they refused to use it, opting instead to use their old catalogs. The new system quickly died a painful and expensive death. In this instance, the company failed to recognize the intelligence level of the clerks and their adaptability to new technology. Many such snafus can be found in the corporate world, all because developers failed to recognize the intelligence level of their targeted users.

In addition to the user's intelligence level, developers should take into consideration the human senses: hearing, seeing, touch, taste, smell. For example, what is the point of devising an elaborate color scheme for screens or forms if there is a possibility that someone may be color blind? Or to add audio responses to computer prompts if the person is either hard of hearing or the device is placed in a noisy environment? Systems are for people, not for the computer. If people cannot assimilate new technology or find it awkward to use, they will resist it wholeheartedly.

LEARNING AND OPERATING

There are two basic requirements for making something ergonomically correct: It must be easy to learn and it

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must be easy to operate. The features required for learning a new tool or technique may or may not be the most appropriate for routine operations. For example, "menus" and "windows" are very easy for users to learn and understand initially since they can guide users through a process while sitting in front of a screen. However, in normal operation, the need to step through a number of menus to achieve a goal can be extremely frustrating and deemed a considerable waste of time by the user.

Ergonomics involves any equipment, furniture or supplies to be used in performing the work. Designing an office layout is just as important as the equipment used. Because systems affect the human senses, the Systems Engineer should consider such things as lighting, posture, sound, hand and eye movement, etc., all of which directly affects the workers.

Facade should not be confused with substance. Ergonomics is much more than being "on-line" to a computer with elaborate color graphics. It is a matter of determining and implementing the technology to suit the users. This requires a combination of skills in industrial engineering and industrial psychology. Industrial engineering provides for the synchronization of the work flow. Industrial psychology provides for the human element to be factored into the design while the system is being built, not added on later.

PHYSICAL DESIGN CONSIDERATIONS

In terms of equipment, there are many tools for the user to operate such as monitors, keyboards, printers, scanners, microfilm/microfiche readers, multimedia equipment, computers, etc. There is often a tradeoff between a device's ease of use and its functionality. Quite often, the simpler the device is to use, the less capability it may have. The following is a partial list of devices commonly used:

1. **Keyboards** - System designers should be aware if the users are sufficiently proficient at using a keyboard for a particular use. Not all applications require massive typing, most just require short and simple keying. The keys themselves should be evaluated; do users prefer a flat touch panel, or the traditional keyboard with individual keys? Ultimately, it depends on the functions desired and who will operate it. Touch panels can be extremely efficient for simple operations. However, the traditional keyboard is more desirable for more complicated operations. Also, a key click response is desirable to acknowledge the key stroke.

2. **Mouse, Joystick, and Pen based entry** - these are effective devices for simple operations but are questionable for major production purposes (where they can actually become annoying). This is why programs are usually written to accommodate multiple input devices, such as for both a mouse and a keyboard. Perhaps the best application for these type of devices is in the area of graphics.

3. **Optical Scanners** - These are tools that are widely used in retail, inventory, shipping, and other routine tasks. However, there is little point to these devices if they are highly susceptible to error, requiring corrective keying. As easy as these tools are to use, it ultimately depends on the application to determine their practicality.

4. **Voice Recognition** - This is a field still in transition. Although it holds great promise for the future, there are currently only a few practical applications. Voice recognition systems are heavily dependent on voice tone and inflection. Speech must usually be very specific and precise, which is often difficult for people to adapt to.

5. **Buttons and switches** - In general, buttons and switches are very easy to use if properly labeled. However, like touch panels they have limited functions, sometimes serving a single purpose.

6. **Manual Forms** - Paper documents are one of the easiest forms of media for users to understand. This is because offices have operated with paper systems for years. However, forms can alienate users as easily as any other media if poorly designed. The emphasis of forms design should be on simplicity, not complexity. Fields must be self explanatory or must include some form of instructions. Screens are merely electronic analogues of paper forms. They have some advantages and disadvantages to manual forms. Systems Engineering should know the differences. Use company standards for designing forms. In general, use the following list as suggested guidelines. Many of these guidelines relate to screens as well as they do to manual forms and printouts.

- Design the form to be easy to read and use. "Cluttered" forms that are difficult to read and use will alienate users and cause irritation.

- Do not design the form to the edge of the paper. Leave a margin for printing. A 1/2" margin is good; 3/4" is better.

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- "Zone" the form by the records and/or the people who will be using the form; e.g., shipping, accounting, inventory, sales, etc., and by the sequence by which it is completed.

- Place the form name and number in a standard position, one that would be easy to read when paging through copies. Several companies use the upper-left hand corner as their standard.

- For forms requiring typing or keying, determine the column alignment required for the machine to be used. Minimize as many keystrokes as possible when designing the form.

When using computer screens, there are several options available for design:

1. **Menus** - Because of their emphasis on simplicity, menus generally offer limited functions; e.g., maintain files and generate outputs. They can be designed several ways: by the output or input to be used; by the subsystem or process to be executed; by the person having to execute the process; or combinations of the above. But it should be noted that menus are tailored more for the user than they are for system functions. As a result, they may not be as efficient as other approaches.

2. **Command Language** - In contrast to menus is the command language approach which is aimed at greater functionality and speed. When complicated and diverse operations are required, a command language provides the greatest form of flexibility and efficiency. It allows the user to perform their duties in the fastest amount of time. As with any language though, it may be difficult for the user to learn. As such, there must be great care in the vocabulary selected. Cryptic commands may produce cryptic results. Data validation and "help" explanations are highly desirable features for a command language.

3. **Graphical User Interface (GUI)** - this is like having a combined form of Menus and Command Languages. This type of interface, which is normally provided on PC's, provides screen panels, windows and other conventions (action bars, pull-down-choices, checkboxes, push buttons, etc.) which the user will interact with to submit commands. The GUI provides the same type of structure and facilities as used with menus, yet provides the user with the freedom to perform different functions rapidly as under a command language.

WRITING

Ergonomics is also closely related to writing procedures for people, be it in paper form or as help text on the computer. Writing instructions for the human-being is just as difficult as writing instructions for the computer, perhaps more so. As a machine, the computer will do whatever it is instructed to perform, right or wrong. But the human-being is much more complicated, emotional and ambivalent; we tend to think or not think whenever it suits us. Being able to write effectively for users is a rare talent in this day and age. For more information on writing for humans, see:

"PRIDE" Special Subject Bulletin No. 38 -
"The Language of Systems" - Aug. 22, 2005
http://www.phmainstreet.com/mba/ss050822.pdf

CONCLUSION

The concept of ergonomics can trace its roots to the old "time and motion" studies as practiced by Industrial Engineers of bygone years. During this period, the emphasis was on work measurement and work simplification. Systems and procedures were devised that, even though they were manually implemented, considered human intelligence and senses. As computing evolved during the 1950's, 1960's, and 1970's, there was little concern for the people-side of processing. Instead, the emphasis was on the computer itself. But as computers became more affordable and easier to use, they spread to the four corners of the corporate world. Inevitably, developers became to question how to best apply them as a working tool for business and, hence, ergonomics was born (or perhaps "reborn" is more appropriate).

Ergonomics is as valid a concept today as it was in the 1980's (or before). Any developer who ignores it is asking for trouble. Forgetting the human-being during design will cause the human-being to forget the system at time of startup; it will be DOA, "Dead On Arrival." Do not take the human-being for granted.

Other references pertaining to this paper:

"PRIDE"-ISEM Phase 3 - Sub-System Design
http://www.phmainstreet.com/mba/pride/is30.htm

"PRIDE" Special Subject Bulletin No. 39 -
"Methods of Processing" - Aug. 29, 2005
http://www.phmainstreet.com/mba/ss050829.pdf

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About the Author

Tim Bryce is the Managing Director of M. Bryce & Associates (MBA) of Palm Harbor, Florida and has 30 years of experience in the field of Information Resource Management (IRM). He is available for training and consulting on an international basis.

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