Laws and Rules

continued from page 4

what you were supposed to remember (Peacock & Davis, 1972).

An interesting thing about what affects how well we remember is that it creates endless opportunities for class projects. Any self-respecting human factors/ergonomics engineer can program a Pentium™ to present all sorts of challenges to a cranium. The adventurous ones do not need to limit themselves to digits and letters; they can manipulate shapes, sizes, colors, music, faces, pictures, mazes, operational procedures, travel directions, assembly instructions, accident scenarios, English, Spanish, or Chinese. They can even require the user to do things with the information before he or she recalls it. Champion students of working memory puzzles mix modalities, provide pacing and payoff, observe the young and the old and the inebriated, and even don't let their subjects sleep for days. But they usually find that Miller's magical number 7 ± 2 is in the right ballpark (Baddeley, 1990).

Sometimes wrong numbers are useful. A number of years ago, a wrong Swiss bank number alerted investigators to a lead in the Iran-Contra affair. But mostly wrong numbers are a nuisance.

The Design of Codes

So why don't the designers of this information age get it right? People forget, and forgetting leads to all sorts of problems. Therefore, our job as human factors/ergonomics professionals is first to design memory tasks so that people are not likely to forget, and if they do forget, we must design in a mechanism for recovery. We should start with a brief review of combinatorics. If we have three characters (e.g., 1, 2, 3), there are 6 possible orders (permutations or selection without replacement) using all three digits. But if we allow repetition of one or more of the digits (selection with replacement), we have 27 unique combinations. Finally, if we allow the choice of 1, 2, or 3 characters, we have effectively added one or two leading "blank" characters and can stretch the number of unique numbers to 39.

Now, if we allow the use of all 10 digits and select groups of not more than three digits, we have 999 unique combinations. I encourage readers to calculate how many unique combinations of 26 characters we can have if we include both digits (10) and letters (26). But, of course, bureaucrats must allow for growth in their system, such as the number of vehicles that will be registered in the state over the next 10,000 years. So we have Rule #1: "Use only as many characters as necessary." In this regard I would like to mention that many years ago, I learned to communicate at 25 words per minute using only combinations of up to four dots and dashes. Mr. Morse was an efficiency expert.

If you don't like Rule #1, then go to Rule #2: "Make use of the richness of natural (English, Chinese, etc.) language and its redundancies, with due regard to easy-to-remember abbreviations, such as MA, ME, MI, MO, and MN (Rule #2a)." I have had three major employers – in academia (OU), industry (GM), and government (NASA) – and in every case I have had to learn new abbreviations and acronyms: eduspeak, carspeak, and spacespeak. Unfortunately, the use of abbreviations and acronyms guarantees that many of the users will make errors much of the time, in part because of their inability to link a chunk of to-be-remembered information with its reference system. Unfortunately, although Rule #2 is usually very effective, it is not very efficient, and Rule #2a may be efficient but not always effective.

So we have to rely on Rule #3: "Do a human factors/ergonomics evaluation of your system before you foist it on an unsuspecting public." If you select your participants well, you can get away with anything. Even if you select only those with fifth percentile and above brains (memories) and usage conditions, you will satisfy most of the users most of the time. But what about Granddad, or the user who is new to the system or in a hurry or under some other kind of stress? Now we have the real challenge for HF/E: We must not design for average Joe in average conditions. We must evaluate our system with extreme users in extreme conditions, especially when the implication of error is serious – like when my pension check goes to Rochester MN instead of Rochester MI.

Finally, if all else fails, we should use Rule #4: "Pay attention to Miller's magical number 7 ± 2, and you will accommodate most of the people most of the time without the need for a costly and perhaps unreliable usability study." You might add Rule #4a: Break Miller into two or three subgroups – like CA TDO GC OWPI G.

I would be remiss if I did not finish this article where I started – at the science fair. A couple of years ago, I had the good fortune to be a judge at an international high school science fair competition held in Detroit. The projects were outstanding; many students didn't get help from mere parents and teachers but worked with professors at local universities. But they were on their own for the interview with the judges. Among the judges were at least six Nobel prize winners. Unfortunately, the only part of the whole event that came near to HF/E was when a tall Nobel laureate in physics made a comment about the headroom in his car. The message is clear: Shepherd your children, grandchildren, and their friends toward human factors/ergonomics science fair projects, and perhaps one day they will be awarded a Nobel prize for resolving the problem of trade-offs between styling and anthropometric accommodation or preventing errors in information processing.

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PERSPECTIVE

Finally – Some Respect

BY CHRIS BOND

I work in a corporate environment where you can't tell anybody what to do. Not that this is necessarily bad. It's just the way it is. I'm sure there are a lot of usability professionals who work for companies that have autonomous developers or groups of developers who follow their own standards for designing user interfaces. So, over the years I've had to find ways to win friends and influence people. I've attended many a meeting where we were designing by consensus, ignoring what users had to tell us and hearing "that's a training issue" anytime I brought up a usability concern.

Back in the early 1980s I started as a technical writer. It wasn't long before I got tired of documenting poorly designed systems. After attending a number of usability seminars and human/computer interface classes, I was convinced I could make a difference. I remember documenting a system that required 14 screens and 48 keystrokes to establish a single record. I proposed a simpler design that used 8 screens and 23 keystrokes. This seemed like a great way to demonstrate one of the fundamental tenets of good interface design: Reduce the amount of effort required to complete a task. I'm not sure of the exact reason why the change couldn't be made. It may have been something along the lines of, "We don't have time to do it" or "The users like it that way" – it doesn't really matter. The fact is, my proposal was summarily dismissed.

On another occasion, a mainframe programmer was working on her first graphical user interface (GUI). After she had completed it, she asked me to look it over and wanted to know if I had any suggestions for "making the screens pretty." It was her first GUI, and it was painfully obvious that her widget of choice was the push button, because the screens were riddled with them. I sent her a four-page, single-spaced document with detailed recommendations for design improvements. She quickly responded with a one-sentence e-mail saying, "I do not have time to redesign the entire interface." The best I could have hoped for was the outside chance that she'd realize my contribution was a little more than "making the screens pretty."

This seemed like a great way to demonstrate one of the fundamental tenets of good interface design: Reduce the amount of effort required to complete a task.

But I didn't give up. Over the years I've gained a number of allies and usability advocates. This came about by working closely with developers, creating style guides, and conducting usability tests (which provide empirical data to support recommendations). I also brought in some of the top professionals in the field, such as Deborah Mayhew, Joe Dumas, Jeffrey Rubin, and Norman Schwalm, to teach internal seminars or work with us on specific projects. I wrote my own articles, spoke at conferences, and lauded my own successes. And I've been fortunate to work on projects in which I had complete control over the usability activities from start to finish.

I've been at Portland General Electric almost 18 years now, and through sponsorship from upper management I have reached the status of a peer with a discipline that's considered essential to the success of the design. This isn't to say I still don't have the occasional lively discussion (usually with marketers or graphic designers) about the differences between usability and aesthetics.

Not long ago I approached some of our Web developers midconversation. One of them was asking the other, "Why are we doing it *this* way?" to which the other gestured toward me and replied, "Because his Royal Highness said so." I smiled and thought to myself, I can live with that, I've been called a lot worse.

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