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Testing Electronic Forms

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A little bit of history

Forms have been with us ever since Gutenberg printed forms for the granting of indulgences in 1454. Gutenberg's form, preprinted with spaces for entering variable data, was driven by the technology of the day, a factor that has changed little in over 500 years. Most form design is still driven by the printing industry and the producers of technology, with the added arty approach of the graphic design world. Many think of forms as simply drawings, and since we learn drawing in kindergarten, forms must be easy to design. Yet, if you talk to the form fillers, you will find the assumed simplicity overshadowed by frustration, inefficiency and a vast array of human error.

The 19th Century industrial revolution brought a great desire for increased productivity and the industrial engineering concepts of the factory were soon being applied to office workers. Today, the emphasis is still on treating people as machines. If they can fill out forms faster then increased productivity must follow. This concept was to become the driving force behind much of the use of computers in the 1950's to 1970's. But by the mid 1970's it was obvious to many in the business systems world that something was disastrously wrong. Writers such as Keith London in his excellent book, *The People Side of Systems*, were talking about the need to think about people in systems development. He likened the business system to an iceberg stating that: *"The bulk of the iceberg in systems terms is the people, their jobs and their attitudes."*

In a letter to the President Carter, Frank Horton made this telling statement:

"Many people feel, and the Commission agrees, that a multi-billion dollar wall of paperwork has been erected between the government and the people. Countless reporting and recordkeeping requirements and other heavy-handed investigation and monitoring schemes have been instituted based on what we view as a faulty premise that people will not obey laws and rules unless they are checked, monitored and rechecked."

"This situation and this assumption must be reversed if we are to restore efficiency within Government and confidence in Government by the people."

Yet this concept failed dismally to solve forms problems. The concentration on physical processing, while ignoring the way people think about and understand forms, just made matters worse.

Now we come to the era of electronic forms and if we aren't careful, we'll make the same mistakes—forms that are epitome of technical perfection but incomprehensible to the users.

Electronic forms need testing even more than paper forms because, in addition to the comprehension needs already mentioned, it IS essential to test the technical aspects thoroughly. While similar to testing computer systems, electronic forms have some unique components that are not generally part of mainframe systems.

Areas to test

There are three overall aspects that need testing, although these can be broken down into more specific components.

1. Does the form's electronic intelligence actually work?
2. Does the electronic form carry out ALL the user needs?
3. Do the users understand how to use the forms and what the questions mean?

The first two aspects need very thorough checking by the designer as well as by some typical users.

Testing data field intelligence

This is the key to REAL savings by reducing data entry errors. The extent of work in this area will depend on the software you are using. Some programs such as Shana's Informed Designer® have extensive built-in field calculation capabilities while others, such as FormFlow® rely more on scripting and macros. Still others rely almost entirely on scripting. Whatever method you use, you need to thoroughly test the calculations and scripts. In doing these checks, there are three important questions to ask:

1. Does it actually work?

It's no use just entering a formula in a calculation field or macro and just hoping for the best. Just because the program accepts your calculation is no guarantee that it will do the job. No matter how confident you are or how many times you have used the formula in the past, you still need to check it to ensure that it really does work. It's better to spend a little extra time during development than send out a form with a mistake that reflects on you later.

2. Does the intelligence apply to ALL situations?

I haven't found this to be a common problem, but it could be an issue where you have a number of different users, possibly in very different working environments. It's a potentially difficult matter with public-use electronic forms where you often don't know the situation of all the form fillers. It's really a matter of doing your homework and thinking through all the possible form-filling scenarios to reduce the risk of problems.

3. Does it have side effects?

This is an unlikely event, but you need to be aware of its possibilities. For example, your software may enable you to set a field to be mandatory so that it cannot be saved,

printed or e-mailed unless it is filled correctly. This seems like a good idea till you have a very long form and the form filler has to stop work part way through to deal with an emergency. Maybe they've spent an hour or two collecting data and filling in the form. Now the emergency arises, the person has to stop work for the rest of the day and does the normal thing—tries to save the data. But the form won't let the person save it because a mandatory field isn't complete. What do they do? Leave the computer running, hoping that the power doesn't go off, or just close down and start all over again the next day? The solution is to make the field optional and to deal with the mandatory entry in some other way.

Field formatting

This includes both the type of field and any mask that is applied. Again, what you check will depend on the type of software you are using, but the principles are the same.

For example, below are some typical field formats. These are from older versions of software but they illustrate the issues. Note that most of these have sub-formats that are not shown here. Also, some functions may be handled in different ways. For example, buttons in FormFlow[®] are a field type whereas with Informed[®] they are treated separately to fields using the *Button* tool. JetForm[®] treats *radio buttons* and *check boxes* as separate field types, whereas with Informed[®], these are subsets of *Boolean*. This doesn't imply that one is better than the other, just that they are different and that you need to fully understand the difference before you test.

FormFlow 2.15	Shana Informed	JetForm
<i>General</i>	<i>Text</i>	<i>Action Button</i>
<i>Fixed decimal</i>	<i>Character</i>	<i>Check Box</i>
<i>Percentage</i>	<i>Number</i>	<i>Database lookup</i>
<i>Currency</i>	<i>Name</i>	<i>Numeric</i>
<i>Floating decimal</i>	<i>Date</i>	<i>OLE</i>
<i>Page number</i>	<i>Time</i>	<i>Radio Button</i>
<i>Serial number</i>	<i>Boolean</i>	<i>Signature</i>
<i>Check mark</i>	<i>Picture</i>	<i>Text</i>
<i>Time</i>	<i>Signature</i>	
<i>Date</i>		
<i>Graphic</i>		
<i>Bar code</i>		
<i>Signature</i>		
<i>Button</i>		

Masks are where you apply a particular character format to a field such as (##) #### #### for an Australian telephone number. If you needed to enter a mobile (cell phone) number, this mask wouldn't work as the Australian format is ##### ### ###—same number of digits but a different format. You need to be sure that your mask applies in all situations.

This is an important issue for multinational organisations. Each country has different phone number formats and different address formats. For example, I frequently find that US-designed forms assume that a State code will always be 2 characters, whereas in

Australia, with only a small number of states, here is no fixed format and no fixed codes. By convention, some states have a 2 digit code and some 3 digits. The problem with the US-designed forms is that 2 digits don't allow me to enter my State code, ACT.

Field calculations and macros

Some field calculations are very basic, being nothing more than simple additions, yet they still need to be checked. In other cases, field calculations can be very complex and based on a number of variable conditions. In other words, if a field is completed with certain data then a certain calculation applies. If a different set of data is entered, then a different calculation applies. These are the most difficult to test and you will need to be sure that you test ALL possible variations. The safest way is to have a copy of the calculation or macro in front of you and write out a list of all possible conditions that need to be tested. Then test each condition as thoroughly as you can.

Edit checks and field validation

These are usually similar to field calculations and enable the form to check the data for accuracy. They could be simple validations such as ensuring that an entry is under \$1000, or more complex checks based on what has been entered in other fields.

With the checking goes the appropriate reporting of errors. If you want the form filler to know that there's an error, then you need to work out an appropriate response. It isn't much use telling the user they've made a mistake and not letting them know the reason why. The language of this will need to be tested to ensure that typical users understand it and can carry out appropriate action.

Be aware of a trap that can occur in a large organisation where some users may have special circumstances. For example, I've seen forms that are filled in the same way except in one State that had local legislation that required different data entry conditions. If you weren't aware of such a condition, you might build in a field validation that is inappropriate for that one State.

Ballot boxes

These are commonly used on forms and on electronic forms can be a great asset for collecting correct information and routing the person through the form. But ballot boxes on electronic forms are different to paper forms. It has become a convention to use tick (check) boxes for questions where the user can select one or more of a series and to use radio buttons where the user selects one only. See the following illustration. The left hand example shows tick boxes while the right hand example shows radio buttons.

<p>Which of the following do you have? Select all that apply.</p> <p>Refrigerator <input checked="" type="checkbox"/></p> <p>Freezer <input checked="" type="checkbox"/></p> <p>Blender <input type="checkbox"/></p> <p>Breadmaker <input checked="" type="checkbox"/></p> <p>Electric Frypan <input checked="" type="checkbox"/></p>	<p>What is your annual income? Select the range that applies to you.</p> <p>Under \$20,000 <input type="radio"/></p> <p>\$20,000 — \$40,000 <input type="radio"/></p> <p>\$40,001 — \$60,000 <input checked="" type="radio"/></p> <p>\$60,001 — \$80,000 <input type="radio"/></p> <p>Over \$80,000 <input type="radio"/></p>
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The first thing you have to test is whether each "fill group" or "cluster" is behaving as you'd expect. If you select a radio button and then change your mind and select another, does the first choice become deselected? Further, once you've made your radio button choice and touched the tab key, does the cursor move right out of the group to the next field?

You might even find in testing that radio buttons or check boxes are not appropriate. Another method of displaying the choices is with solid filled boxes as shown below. These don't look as attractive and aren't conventional, but they stand out much more clearly on screen.

Which of the following do you have?
Select all that apply.

Refrigerator Freezer Blender Breadmaker Electric Frypan

Tabbing (including conditional tabbing)

As a form is developed it is common for fields to be added, deleted or moved and this can lead to changes in the tabbing sequence. So you need to go through the form carefully, making sure that tabbing works as required and is consistent with user and system needs.

If there are tables, does the tabbing need to go across the rows or down the columns? When should the tabbing to leave the table entirely—as soon as a whole row is blank or as soon as the user tabs out of the first column without entering anything? You may find in testing that the users don't actually use the forms the way you expected?

Even more critical is conditional tabbing. That is, a tabbing sequence that depends on what has been entered into a field. For example, Field 10 could be set up so that if an amount is entered over \$1000, the tabbing goes to field 20, whereas if it is \$1000 or less, tabbing just takes the person to field 11.

Database lookups

This is a very critical area to check. If your form looks up remote databases for checking or bringing in data, you will need to make sure that ALL your users can successfully complete the form. Do they even have access to the relevant databases? I've seen personnel systems where access is severely limited to retain the confidentiality of the information about the employees. It may not be feasible for all users to have access.

In a very large organisation, especially a national or multinational organisation, you might have to check whether different users have different databases or even different database software?

Testing help messages

This is where electronic forms surpass paper forms. Most software has the facility to produce pop-up help messages for every field. There are many ways in which this can be done, so I don't propose to explain them all here, but there are basic aspects that should be checked.

Are they present where necessary?

Some designers place help messages in every field. This is generally a waste of effort and an unnecessary expense. For example, if you have a field that is headed "Date of Birth", there isn't much point in creating a help message that says, "In this field, enter the date on which you were born." On the other hand, a field asking for the name of a person's spouse might need a help message if (as is the case with some Australian government forms), "spouse" includes "de facto" or anyone the person is living with on a permanent basis, irrespective of gender.

Are messages free of typing errors?

This may seem a minor point, but incorrect messages can cause irritation and when you are installing electronic forms for the first time, may reflect on your credibility.

Are they of a manageable size?

This is a common mistake for the novice forms designer. I like the approach taken by Microsoft that generally limits the size of help messages but includes hypertext links that take the reader to additional information if required. Much depends on whether or not your software provides the facility to apply graphic enhancements such as larger or bold type, and whether you can use such formatting devices as hanging indents and bulleted paragraphs. If you can only include plain text, the smaller the message, the easier it will be to read.

Are the help messages correct for all users?

This particularly applies in very large organisations where there is a wide diversity of operations. Take, for example, a form used in the Defence Department. It might be used by Army, Navy and Air Force yet because of the different nature of each Service, the messages might need to change. You might even need three versions of the form.

Do they apply in all circumstances?

Would they be confusing for some people? Where a form is widely used, you need to test it in as wide a range of circumstances as possible to make sure that the messages apply to everyone.

Do they provide the help that people need—and WANT?

This is closely related to the next item. Whereas the next deals with comprehension, this item deals with needs. It's all very well to write clear and precise messages, but what do typical users actually need when filling out the form? What are the things the *form fillers* want to know about rather than what *you* think they should have?

Do people understand them?

This is probably the most important item with help messages. After all, they are supposed to HELP people. Yet, so often I've seen on-screen "help" that doesn't help at all—just leaves me as confused as ever. Even if the message is needed and wanted by the users, do they read it and understand what it says? This will be covered in more detail later.

Testing choice lists

Choice lists can be a great help in reducing form-filler errors and there are a number of matters that need to be tested.

What is the best method?

If there are different methods for making them appear, what is the most appropriate in each case? In some cases, a pop-up window will be best while in others a drop down list might be more appropriate. Often you will only find this out with testing and observational studies.

Are they correct and comprehensive?

First, you need to make sure that you provide all the choices that all the users need. Just like their paper cousins, they can be confusing if the choice the person needs isn't there. Then you need to ensure that the choices are correctly worded. Programs such as Shana's Informed and FormFlow allow the user to select an item from a list and then have the form automatically place a code or acronym (or other text) in the field in the form. This can be a great space saver, but you need to make sure that the codes are correct.

A related matter is that of conditional or "dynamic" choices. If your software allows for this, it means that the choices provided in a list are dependant on what was entered in another field. For example, if a person selects a leave code of "military" then the next field might show military-related options. If the person selected "sick leave" then the choices might change for the next field.

Are they appropriate for all users?

This often won't be an issue since you will know what choices the person should be given. But in other cases—particularly with public-use forms—you might need to check that the lists are correct. Testing will help you to ensure that you have covered all possible alternatives.

Do choices need to be in any particular sequence?

Some programs put choice items in alphabetical order, but this may not be the way people look for information. If the list is very short it probably won't be a problem, but with longer lists it might be difficult for people to find what they want. It might even be better to have choice lists that vary depending on what people have entered in other fields. This would reduce the number of choices, but adds more to the complexity and the need for thorough testing.

Testing graphics

Are fonts compatible for all users?

This can be a frequent compatibility problem with electronic forms. The most common occurrence is with forms that are used on both Windows and Apple Macintosh systems. The former generally uses TrueType fonts while Macintosh users tend to use PostScript fonts. While the characters might have the same shape, variations in letter spacing can cause

sentences and text blocks to wrap in different places. I've even encountered variations in TrueType fonts used on PC's with older fonts on one machine behaving differently to newer fonts.

A more common issue is the availability of the fonts to all users. It's all very well to select a font that you think looks good on your forms, but do all users have it on their systems? We've found the best typeface for forms to be Helvetica or one of its modern derivatives such as HelveticaNeue Condensed. But Helvetica is rarely found on PC's. Most PC users only have Arial, but they are not aware that their computer is set to print Helvetica in its place as a default. The result is that most PC users don't even know the difference. However, once again, the character spacing is different as is the positioning of the type base line. A form designed with Helvetica might just not work well on a PC that only has Arial installed.

Are fonts consistent for similar functions?

This is a basic form design principle, but it should still be checked.

Do scroll bars function as required?

If a field needs a scroll bar, you should make sure that it is present and that it does work once the visible space is filled.

Variable length text fields

The issue here is what happens when the text field reaches it's maximum capacity? Does it get cropped when the form is printed? Does the bottom of the text disappear off screen?

Testing network usage—first time installation

This might seem an odd item at this point, but it has the potential to cause you major headaches if you don't test it well in advance and your forms (or software) just don't work on the network

Installation instructions

Are they correct? The best way to check this is to give them to someone who is unfamiliar with the software and have them follow the instructions while you watch. It should be an easy matter to find out if the installation took place as expected.

Comprehension

This is related to the above point. Not only must the instructions be correct, but they must be easy to follow for all people likely to use them.

Does the software install correctly?

This might look like the first point under this heading, but there is a difference. Your instructions might be essentially correct, but there might be a problem on a particular network configuration.

Do all the functions work?

Even if the software appears to install correctly, you should make sure that all its functions perform as expected.

Testing overall form intelligence

Testing individual fields is only one aspect of form intelligence. You will also need to look at the form as a whole and those aspects of electronic forms that are not tied to individual fields. This will include at least the following items.

Database updating

This can be a critical component of electronic forms. People fill out forms and just expect that database updates will work.

Does it work as it is supposed to and does it work for ALL users on all computers and all networks?

Buttons

Buttons can be great time savers, but are they appropriate and do they work? I've seen some forms that have so many buttons (either on the form itself or in Windows button bars) that there is little space left for the form itself. Do users find the buttons helpful or do they get in the way?

E-mail and routing

Is pre-planned routing correct for ALL situations? What does a user do if the pre-planned routing isn't appropriate?

Macros

Do they work?

Custom menus

Do they cover ALL user needs and is the language clear? Menu names are usually cryptic abbreviations, so you need to make sure that they are appropriate for all users. And if you have cross-platform (eg Windows/Mac) forms, do your menus and menu items have names that are consistent with the way people normally work. This can be a problem in some cases due to the different standards—e.g. "Exit" on PC and "Quit" on Macintosh. Even standard keyboard shortcuts can vary so you need to work out ahead of time how you will handle these matters and find out if users have any difficulty with your choices.

Form tracking

Is it correctly configured, does it work and does it provide the information users need?

Printing—a problematic component

I've found printing to be one of the most difficult aspects of electronic forms installation. Macintosh users will most likely wonder what I'm talking about, but PC users will be able to relate very readily to that IBM advertisement where users are all complaining that "it won't print".

Our experience has been that many PC users just don't know how to configure their printers and this can be a major problem. However, there are a number of other design-related areas that also need attention.

Print area

Does the form's print area match all the printers your users have? The margins vary for each printer and if you design your forms around the printers you use in the form design section, you might find that other users can't print all document because their margins are larger than you expected. This is quite likely to be a problem if some of your users have ink jet printers.

Does form print on all printers?

The hardest forms to test are those used by people outside your organisation and there probably won't be much you can do till the form is running live. However, with the current state of electronic forms technology, you should be able to print on most, if not all, desktop printers.

Non-print objects

This is a design issue that will apply to some forms. Electronic forms often make use of buttons and other objects that are to appear on screen but are not expected to print. The simplest approach is to print a copy of your form and make sure that all these objects are invisible.

Printable objects

This is related to the previous item. Do ALL printable objects actually print as required? This could include objects that are hidden on the screen.

Testing overall performance

Here are as few additional matters that need to be tested before your form goes live.

Computer models

Has your form been tested on ALL computer models on which it will be used and with all operating systems?

Identification

Has the form been correctly identified and named?

Locking

If you have locked the form or protected it in some other way, does it actually work? Don't just assume that because you have used an electronic signature or other method to prevent users tampering with the form, that your locking actually works. Test it! And while you're on the locking business, make sure that you don't prevent even yourself from coming back and making changes. With some electronic forms software, once a form is locked it can't be unlocked and you can't amend it later. If this is the way your software works, then make sure you keep an unlocked copy.

Version number

Does your form have the correct version number?

Passwords

If you've set up a password protection system, does it work?

Testing user needs

Each form is part of a business process and since electronic forms severely restrict the freedom of users, it is important to ensure that the form DOES fulfil the business needs of ALL the users. Forms have always been a key element in productivity and electronic forms are no exception. They need to suit the way people work and the use of new technology will change that work practice. This in turn leads to conflict and especially fear of change. You will often find that with paper forms, work practice and workflow varies from person to person. Electronic forms often stabilise these elements, and introduce uniformity, but this might not be best for the business. Maybe the different workers SHOULD do things differently for maximum productivity. All of this has to be taken into account in the design stage and checked thoroughly during testing to make sure that what you have created does what the organisation needs.

I like to get users involved in the development of forms at an early stage—whether they are paper or electronic. Getting them involved in the testing also helps them to become familiar with the software and with the form itself.

One phenomenon that I've encountered a great deal is that as users gain experience with a form, they often think of better ways to work. So be prepared for testing to change the way they view the form's usage and for them to come up with new ideas that they might not have given you to begin with. I used to get upset when this happened, criticising the users for not knowing what they wanted, but I've come to see that this iterative approach to form development actually produces better results.

Testing user comprehension

This is one of the most critical items to test and has a great bearing on the success of the form. We have found from extensive work with paper forms over the past 15 years that the best testing method is to use observational useability studies.

While the observational study methods that are used for paper forms will work

effectively for electronic forms, they need some variation. The major difference is that you can't observe a person filling in a screen form while sitting opposite them. You have to sit in a position where you can see the screen and the person, yet not be behind them. Most form fillers become very uncomfortable when someone is sitting behind them, so I suggest sitting to one side.

One of the key matters of importance is that form filler behaviour when filling electronic forms is very different to filling out paper forms. While we now know a great deal about what people do when using paper forms, very little is known at this stage about their electronic counterparts. We do know some things—for example, many users ignore the request to tab through a form and insist on using the mouse, thereby placing severe restrictions on any controls you might build in for automatic or conditional tabbing. This is only one issue—there are many more that we'll all learn in coming months and years. So it is very important to thoroughly test what people actually DO when using the form to test their understanding of instructions as well as testing their understanding of the questions.

The failure of traditional testing methods

Traditional systems methodology places its emphasis on physical movement but virtually ignores the human mind.

One of my systems books talks about finding bad data in the system. It takes a simplistic view of how to deal with it—if people make mistakes, retrain them. Instructions may be easy to change—but to what? Communication is not just putting words on paper in the right sequence. This thinking is frequently transferred by the developers of computer programs to the development of business systems. It's bad enough that it frequently fails with computer systems, but it creates a shambles when applied to the highly variable nature of human communication and business forms. It is human communication that is generally neglected with an almost total concentration on the physical matters such as effort, paper flow, aesthetics, equipment efficiency, movement and other aspects of ergonomics. Even when we come to language, traditional document testing methods include such things as grammatical correction, legal or technical examination and clearance, proofreading, opinion surveys and work study. But recent research is showing that many of these methods are often unsuccessful and are far from cost effective.

I have come across many so-called forms review procedures that involve nothing more than sending the form out to known users and asking them to comment on whether they would like to change anything. Such approaches rarely give any indication of the success of the form in collecting accurate data or in providing relevant information, yet this is the preferred method in many organisations.

Apply the same principles to electronic forms and you have even more problems. Many computer people think that all you have to do is carry out the tests I've discussed earlier in this paper and all will be well. The emphasis is on the electronic manipulation of data and the way it moves over the network (often mislabelled "work flow" rather than "data flow") but little, if any, thought given to what *people* do and the way *people* think.

What about quantitative methods?

Some organisations use so-called scientific quantitative methods such as readability scores and controlled laboratory testing of users—or even worse, measuring machine performance of computer systems. As has been explained by various researchers, applying readability scores to technical documents is generally a waste of time. While they may be a help in some circumstances in showing up bad text, they are not suitable for forms and instructions^{1 & 2}. Experiments can play an important part in the development of our knowledge but to apply the results of laboratory experiments to other work situations in a different context is totally inappropriate. Some of these approaches have their place when used wisely, but even then, no single procedure supplies all the answers.

Large scale test runs

Another approach is to engage in large-scale test runs, often referred to in the business world as "pilot studies". These studies are frequently expensive to conduct and tend to be superficial. Pilot studies help us with the physical processing and may even provide useful information for data sampling, but they don't tell us much about people's understanding of the form filling process.

Opinion surveys

When I began learning about office efficiency some 30 years ago, I was told never to believe opinions and I soon learned how valid this was. People's recollection of the past is unreliable and their predictions about future behaviour of themselves or others is even more so. I soon learned that if a user claimed to have a "serious" problem with a procedure or document—and that it "happens all the time", then it most likely happened during the past couple of weeks. If it happened more than a few weeks ago—even frequently—then they "don't have a problem at all".

Our problem is that many market research people don't understand the issues, believing that the survey results show how successful the form has been—or will be once implemented. But asking opinions about a form gives only vague information about its performance and is often grossly misleading.

A particularly outstanding example was the redesign of the Midwest Bell Telephone Bill^{3&4}. The techniques for testing the bill came largely from market research—questionnaires eliciting preferences and focus groups. While there were substantial differences among the various revisions when preferences were analysed, the test results revealed few significant differences on measures of comprehension. However, the primary goal of the redesign process had been to increase customer satisfaction; whether customers actually understood a new version better was secondary. The bill may have 'seemed' better, users may have been 'satisfied', but if they didn't really understand it was it a quality document?

Blaming the worker—the myth of functional illiteracy

Problems with forms are often blamed on the public itself. When management acknowledges that there is a problem, they frequently don't see the real cause—they blame the form-fillers, claiming they are either incompetent or 'functionally illiterate'. The

December 1989 issue of Business Forms & Systems carried the following item in its Newline column under the heading 'Verbiage':

"It doesn't matter how good your form is if someone can't read it. According to conservative estimates, one out of four adults in America is functionally illiterate. Taking this into consideration, verbiage should especially be eliminated from the design of forms to be used by public agencies"

If we define 'functionally illiterate' as the lack of literacy capability to perform a required function, then we need to look at where the real problem lies. Perhaps 25% of the American public appear to be functionally illiterate because the functions themselves are poorly designed.

Can we accuse the public of being functionally illiterate if the form designers don't know how to communicate effectively with their public?

What is meant by functional illiteracy?

Are form-fillers to blame when they make mistakes?

Is the education system to blame for not teaching them how to fill in forms?

Much of the answer comes from analysing the methods used to determine the extent of the problem. For example, consider the following statements from a billboard promoting the International Literacy Year:

"Two in ten people can't read a telephone book."

"One in ten people can't fill in a medical claim form."

"Four in ten people can't write out a job application form."

If the telephone directory is badly designed, uses poor typography, and is cluttered with visually distracting advertisements, where is the real problem—with the public or the directory designer? If a form is confusing and people get it wrong, where is the real problem—with the form filler or the administrator who doesn't know how to design effective forms?

We're lucky the 'experts' didn't use the Capita life insurance proposal forms for their study. When the form was redesigned, the error rate dropped dramatically from 100% to 15%⁵. Does this mean that the users of Capita's forms suddenly gained their long lost literacy? I don't think so!

What we're learning now

Because of their high profile and frustrating nature, forms have played a major role in communication research since the late 1970's and a great deal has been learned about the way people work with them.

In form design the most important and frequent reason for failure is the inability of designers to see forms from the user's point of view. This was one of the major findings of a review of administrative forms in British Government Departments⁶

We hear a lot about the need for designers to have empathy for the users—to put themselves in the shoes of the users—but designers and users don't necessarily think the same way. It is impossible to know how everyone else thinks. We each come from our different backgrounds, different families, different schools, different generations and a whole host of other variables. Even if designers could have empathy for all the users, there are so many different ways of thinking that it is impossible to arrive at questions on forms

that will be understood by everyone in the same way.

Many people look on communication as simply the process of transferring knowledge or messages from one person to another. The emphasis is on the transfer process and the method of sending the message: so we have the common expression "getting your message across". But if communication was this simple—if we were all born with identical built-in coding and decoding devices—if we all spoke the same language and all understood every word in exactly the same way—we wouldn't have the problems that exist. If communication is so simple, why do we have so many misunderstandings?

What people do with forms

Modern procedures have revealed many interesting insights into the way people behave when using forms. A good example is the report by David Frohlich⁷ in which he outlines 7 question principles for form design.

1. *Principle of linear progression*: work through the questions in the order they appear on the form.
2. *Principle of least reading effort*: only read what seems to be necessary to maintain form-filling progress.
3. *Principle of question routing*: jump directly to a new question if the form tells you to.
4. *Principle of question omission*: miss out questions which don't seem to apply to you.
5. *Principle of question preview*: if in doubt about the meaning of a current question, read the subsequent question.
6. *Principle of question review*: if in doubt about your interpretation of the previous question, review that question and the answer provided.
7. *Principle of topic scan*: if in doubt about the relevance of the current question topic, scan the local topic context.

My experience in testing has consistently shown these principles to be true and some long-held traditions of document designers don't necessarily hold up. We've also found that the same principles apply to electronic forms, often with a unique twist. It's one thing to turn a page in a paper form, but go to another screen in an electronic form and you may forget where you came from. What you need is a method whereby you can find out WHY people are going wrong.

What does all this mean?

It is all very well to know where forms go wrong and that traditional methods tend to fail, but what does this leave us with? Before we look at the solution, here is a summary of the key points.

Good design rules alone do not lead to good forms

Quality is often seen as conformity to rules and accepted practice but does this measure successful performance and understanding? Does the use of 'plain language', traditional typographic principles and appropriate rules of layout mean that a form will work? Are the traditional methods of forms testing and evaluation really successful, or do we just blindly follow them and hope that nobody asks too many probing questions?

Many researchers and form designers have a blind, almost religious-like 'faith' in the traditional methods. Yet the empirical evidence shows that these methods are usually inappropriate and based on a primitive understanding of the realities of human communication. 'Plain language', appropriate typography, good layout and screen design may be very necessary for a form to succeed, but these characteristics alone are not sufficient to guarantee that it will work. If you were to analyse the errors on any major public-use form, my prediction is that you will find a high proportion of the forms incorrectly filled in. It wouldn't be unusual to find an error rate as high as 90% or even 100%. There is no evidence at all to indicate that electronic forms are any better unless they are well designed and tested. They may look good, they may follow all the 'rules', but they don't carry out the task for which they were designed.

The real cost of forms is very high

Management spends a great deal of time making decisions based on the data it receives and much of this comes from forms. Management time is costly and forms should be designed to reduce labour content as much as possible. Yet forms cost far more than most people realise.

Managers frequently see only the printing cost (or in the case of electronic forms, the design cost) and because they haven't been trained in the value of good form design and the cost effectiveness of sound forms management, they just don't understand the real issues.

Types of errors people make

Before we examine how to deal with them, it will be useful to consider the types of errors that occur on forms.

Missing data

These errors occur when the form filler fails to answer a question. This may happen for a number of reasons such as not noticing the question, deliberately avoiding it, or not understanding it. This is a difficult form of error to diagnose when examining the completed form because there often is no indication of the reason. On paper forms, it will often be detected during an error analysis study, but such a study will not tell you why the data is missing. You will need to use other analysis methods such as observational studies or user interviews to find out the reason.

Unnecessary data

These errors occur when the form filler gives information that was not requested. This may happen for such reasons as misunderstanding the language, making wrong assumptions about the intent of the question or not understanding the question at all, but assuming that it must be answered and giving fictitious data just to keep the form processors happy.

These errors are often easy to notice and sometimes you will be able to guess the reason. But you should be cautious in making assumptions. Just looking at the completed forms will not directly tell you why the data is missing. You will need to use other analysis

methods such as observational studies or user interviews to find out the reason.

In most cases, when people give unnecessary information the result is not as expensive to deal with as missing data or mistakes.

Wrong data

These errors occur when the form filler answers a question that was meant to be answered, but gives wrong information. The reasons include those for giving unnecessary data but also cover reading and other problems. Not all wrong data is noticeable. For example, if the form asks someone to state their income and they give the net when the gross was needed, the error may go unnoticed unless there is an independent check. Like most errors, you will need to use other analysis methods such as observational studies or user interviews to find out the reason.

Transcription errors

These errors occur when the form filler transcribes data from one document to another. The two common reasons are misreading words in the original document—for example, reading the word "accident" when the document says "incident"—and transposing digits in numeric data.

This is one area where electronic forms can be a great help since they allow you to collect data at the source rather than having it transcribed by a data entry operator.

Guessing

This is a category that cuts across all others but is worth special mention. These errors occur when the form filler doesn't have access to the correct data or doesn't look for it. This could be caused by not having the original document, not wanting to look for the document—perhaps just laziness or document storage in a difficult location—or not having the capability to carry out mathematical calculations.

Observational studies

Observational studies are a method whereby you can find out not just where errors are being made, but WHY—where you can highlight specific user problems and fine tune the design to get rid of them.

This is a bigger subject that can be covered in a short paper. What follows here is a brief summary of some of the more important issues. You will find a more detailed analysis of the background and methods in my book *Forms For People*.

Finding out what people do

Dr Walter Shewhart of Bell Telephone Laboratories was looking into these same issues as far back as the 1920's and he proposed the idea that the way to improve quality in the workplace was to use an iterative style of useability testing: plan a change what you believe will be an improvement, test it on a small sample, observe the results, and finally, study the results and decide what you've learned from the change. Then, in an iterative manner,

repeat the cycle a number of times, each time incorporating the improvements. The methods we use today are similar, though more refined, and are proving extremely valuable in reducing errors, often to insignificant levels. Using structured observational studies, we watch users filling in or using the forms and, with appropriate questions, we can learn why they make mistakes.

This helps us eliminate the problems on subsequent rounds of testing to give us the confidence that we are on the right track with our design.

If you want a form improved, how do you know it is better if you don't know how bad it was before you started? This is why you need to measure the old form's performance before you start on the new design. It is common practice in the Information Systems field for analysts to totally ignore the old (possibly manual) procedures and documents when designing a replacement system. The system and procedures may be different; the new forms may have dropped some of the old data and they may be collecting new data; but if it is a change, statistics about the success or otherwise of the old form could be very valuable. In some cases, I have also found it a great advantage to conduct observational studies of the old form as well. They help you to find out where some of the language problems may be before you start on the new design.

When you are converting a paper form to electronic format, such studies of the old version can be invaluable in helping you to decide what edit checks to include and what to put in help messages.

With repeated application, these methods have never failed to dramatically improve the performance of a form. They allow you to measure changes in behaviour, to actually see the form improving through the testing stages and to obtain documentary proof for management—an important step in dealing with the seemingly endless problem of forms politics.

They also provide a great amount of fine detail and yet they are relatively inexpensive. While each round of testing uses only a few people—perhaps 6 to 10—over the course of the study these can add up to a large group.

However, they do have limitations. While they show problem areas and why people go wrong, they will not provide you with detailed statistics to enable you to make precise predictions or to calculate the percentage of forms in error at any question. Only a large-scale study will do that and this is rarely needed for forms.

The aims

One aim of an observational study is to collect information about the behaviour of people when using a form or other document. For our purposes, behaviour includes:

- The way in which the person carries out the task.
- The physical things the person does such as tabbing, using the mouse, moving around the form, etc. With electronic forms, this is particularly important as they are often structured to make maximum use of tabbing to get the form filler past sections that don't have to be completed. But many form fillers like to use the mouse instead and could bypass the built-in tabbing intelligence.
- Facial expression and other mannerisms that might indicate problems, frustration, lack of understanding, confusion, etc.
- What the person says.

- Finding out as much as possible about how the person understands the form. What is the cause of any misunderstanding? Do they give answers to form questions that the processors correctly understand? Do they carry out instructions or do what is expected with the information given?

The overall approach

In an observational study, you observe the document in action, in an environment as close as possible to the real world. You cannot fully simulate the real world. For example, in the real world you would not be there. Some observers endeavour to simulate the real world by observing secretly with video cameras or one way glass, but this raises ethical issues of invasion of privacy.

The size of the study

They are conducted in short rounds, usually with five to 20 people in each, depending on the nature of the form, availability of respondents, time frame and what you already know about the form.

The first round is often small and used to establish the pattern and questioning approach for the remainder of the study. It will most likely reveal problems with the form but may not show the reasons, so you will need to make changes and run the test again. It is common for the second round to reveal different problems, possibly introduced by any changes you make. This necessitates at least a third round of testing. The extent to which you continue testing will be determined by the nature of any problems found, the time and cost constraints under which you are working and the seriousness of the problems encountered.

Problems you may encounter

The people being tested know they are being observed and this will usually affect their behaviour to some extent. But many of the negative effects can be countered by your approach and manner.

When people are being watched one or more of the following may happen:

- Those who have an axe to grind against management may use the study to express their opinions or force issues with a 'secret' agenda.
- Some will have an axe to grind on behalf of management.
- They may see you as an ally in resolving some grievance.
- They may see the tester as an enemy, a representative of management. They may even sabotage the results.

Giving opinions

Some people want to give opinions rather than get on with the task of reading the document or filling in the form. While opinions may be of some value—and you certainly should make note of them—they are not the primary task of an observational study. I have found this a particular problem when internal staff are being used. They often like to think

they have a say in the development of the form.

Insecurity

Many people who have trouble blame their own incompetence. This can lead to insecurity and a great deal of tension. While this might help if you were trying to test a form being filled in under pressure, it is generally far from reality. Overcome this by stressing at the outset that you are testing the form, not the person.

Be particularly aware of the "fear of computers" syndrome. Many people are afraid of technology and blame themselves when they don't understand something, not realising that it is often the instructions that are badly designed. This could be a particular problem when you are introducing electronic forms for the first time.

Leading the respondent

Some testers try to inject their own ideas into the study. It doesn't matter what you believe is right or should be done. You are there to test the form and to observe the actual behaviour of the respondent—not the way you would like them to respond. Don't ask leading questions: for example: "That's a confusing question, isn't it?" It would be better to say, "What did that question mean to you?" and let the person volunteer the information that they do or do not find it confusing. They may not understand it, but they may not know that they don't know and therefore don't feel "confused".

Lack of data

Respondent will not have access to all the data when being tested. You may be able to supply some of it in the form of a handout, or perhaps ask the person to make a realistic guess, or even to leave such questions blank. Perhaps they could tell you where they would get help in real life.

Choice questions

Forms with questions involving choice mean that you may not be able to test every question with every respondent. You may need to set up different scenarios to properly test each question and this will generally mean a larger number of respondents.

At the end of the study you may be able to ask the person how they would have answered the question if their choice had been different. But this may not be as reliable since the question is out of context and isn't approached in the normal course of form filling.

Talkative respondents

You will encounter some people who want to spend more time talking about side issues than doing the job at hand. Don't get sidetracked—but don't be rude. Gently draw the person back to the main task.

If the person fails to cooperate you might have to terminate the test. But this should very rarely be necessary.

Validity of results

An important point about observational studies is that the results only hold true as long as the form filling and processing environment remains unchanged. I have come across numerous examples of management changing documents after testing in the blind belief that the changes will not affect the way people use the forms. ANY CHANGE will impact the way a form works and if you want to be sure of the form's quality, you will need to retest it. With form changes go changes in personnel and, with a new form, increased competency as people gain experience in using it. The results of many testing studies highlight a further important, and usually overlooked, aspect of forms work. The lessons learned from one form cannot be applied universally to similar forms. They certainly can provide valid guidelines, but without further testing in the new environment they cannot guarantee the quality of the new form.

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Recommended additional reading

Joseph S. Dumas and Janice C. Redish, *A Practical Guide to Usability Testing*, Intellect Books, Exeter, 1999; ISBN 1 84150 020 8

JoAnn T. Hackos and Janice C. Redish, *User and Task Analysis for Interface Design*, John Wiley & Sons, inc., New York, 1998; ISBN 0 471 17831 4

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