

MINOTAUR - A VICTIM OF ITS OWN SUCCESS? ACCOMMODATING EVOLVING AND CONFLICTING SOFTWARE REQUIREMENTS

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A major difficulty in software development is identifying and accommodating continually evolving, and often contrasting, client and end user requirements. User requirements tend to expand during system development and following roll out to the workplace, particularly where a new computerised system replaces an existing manual tool. It is argued that this effect is largely a result of users failing to grasp the full potential benefits of the new system. Accommodating evolving requirements to the satisfaction of both the client and end users can be problematic due to conflict between client and user priorities for system functionality. This paper discusses these issues with reference to 'Minotaur', an automated labelling system developed for the Post Office, and offers some recommendations for system specification and project management.

Introduction

RM Consulting's ergonomics group supplies consultancy throughout the Post Office. Work is project based, with clients agreeing specified deliverables, time-scales and budgets. In this context it is essential that solutions are developed cost effectively to prevent clients seeking alternative suppliers. Solutions must meet the requirements of both the customer and the end users to ensure adoption and success.

New technology in the postal industry is resulting in increasing volumes of mail being processed automatically. However, delivery staff are still required to manually sequence mail in preparation for delivery. Although delivery offices are traditionally manual work areas, computer based systems have recently been introduced into these areas. The development of software applications in this environment has highlighted a number of issues relating to the ongoing satisfaction of clients and end users. This paper reviews the success of a sorting frame labelling application, 'Minotaur', to illustrate some of these issues.

Mail Preparation

Prior to delivery, all mail items are manually sorted and sequenced on a sorting frame to ensure that the mail for each address is accessible at each delivery point in turn. A delivery walk may cover up to 800 different addresses, and there may be up to 2,000 items for delivery on any single day. Given that there are 80,000 delivery routes across the UK, mail preparation is not a trivial task for the Post Office.

The most commonly used mail preparation equipment is the 'RM2000', a modern slot sorting frame. Each address on a delivery walk is allocated a whole or half slot on the frame in which the relevant mail items are deposited. The width of the slots, and the size of the frame itself, are configured to match the mail profile of each delivery walk.

The introduction of the modular and efficient RM2000 highlighted the need for an up to date frame labelling system. The labels on a sorting frame identify the address or addresses associated with each slot and are therefore critical to the speed and accuracy of mail preparation. Previous methods for frame label production, which included hand written labels, stencils, standard labelling machines and simple spreadsheet based computer applications, were time consuming and generated poor quality labels. None of these systems were adequate for labelling the RM2000, as none were able to display the information clearly, while matching it to the size and location of the slot allocated.

The RM Consulting ergonomics group were sponsored to develop a frame labelling system for the RM2000.

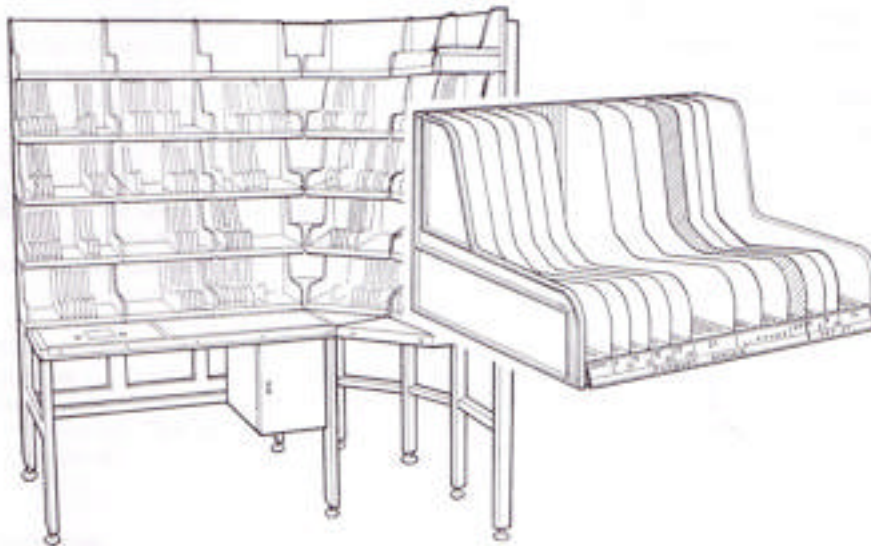


Figure 1. RM2000 sorting frame, showing detail of variable slot size and label information requirements

Minotaur

System specification

The key constraints for the development of the labelling system included the sorting task, the RM 2000 frame characteristics, existing Post Office IT systems, and the delivery office environment, as well as the end user requirements.

The specific dimensions for the RM2000 frame labels, and the complex series of algorithms which determine slot size and location were determined as the minimum performance requirements for the system.

A computer based solution was selected due to the significant operational benefits offered, such as speed of label preparation and production. In particular, label files could be saved, so that if delivery details changed (for example due to a commercial property changing hands and therefore its name) the label information could be retrieved, edited and reprinted quickly, easily and cheaply. Desktop computers had recently been introduced into delivery offices, used in conjunction with dot matrix printers. Although of relatively low specification, this hardware was available for use with the label system at no cost, and so was the client's preferred platform. Detailed user requirements were identified through the involvement of delivery staff, managers, IT experts and delivery office planners. It was established that a significant proportion of the potential users of the system had little or no experience working with computers. A user working group was established and was involved throughout the development and implementation program. The documented system specification, which was agreed and signed off by the client, was used to set the minimum requirements for the application.

The specification documented a range of system requirements including:

- label design issues, e.g. label dimensions and minimum font size
- software functionality, e.g. provision of editing controls to support the addition or deletion of delivery addresses
- screen layouts, e.g. design of the data entry screen to ensure compatibility with the paper based data capture forms.

Post implementation development

When it was rolled out, Minotaur was an immediate success. The time taken to produce labels was halved in many offices. The quality of labels produced was high, and feedback from the delivery staff using the frames was positive. The client was satisfied that the project deliverables had been met.

In the months following Minotaur's initial roll out, a series of enhancements were requested and version 2 was released a year later. The enhanced functionality included support for additional sorting frames and printers. Even after the release of version 2, requests for additional functionality continued. Extra requirements included the facility to produce colour labels, to link Minotaur to new systems which also used address information, to produce labels for other equipment within the delivery office and to run the system on new desktop computers with up to date operating systems.

Some of the feedback was directed at the original client in very demanding language, to present a strong case for further enhancing the system. For example, users reported that Minotaur "doesn't work" or that it "has a bug" when they were unable to print coloured labels on a new colour printer (this functionality was not included in the original system specification). The client considered that the project was completed when the original system was delivered. This ongoing feedback raised concerns that the solution provided was inappropriate.

Discussion

The success of any ergonomics consultancy group depends on its reputation with both clients and end users. The customer's key requirement in this instance was to implement

an efficient labelling tool as quickly as possible, so as to realise the operational benefits of the RM2000, in the shortest time-frame, for the largest number of users. Although the operational benefits delivered by Minotaur met the client's requirements, and despite the positive initial feedback, users were soon dissatisfied with the functionality provided. There was increasing pressure for further development, and the client was no longer confident that the solution developed was effective. The additional requirements were not identified during the original system analysis for a number of reasons, reviewed below.

Obsolescence

The operating environment is changing rapidly, in terms of the hardware and software available in delivery offices. Systems are increasingly inter-linked and sophisticated, and user expectations rise accordingly. As the operating environment changes, an application will become out-dated if it is not upgraded to be compatible with the latest systems. At the time of the initial system specification such developments would have been impossible to predict.

Incremental enhancements to accommodate these requirements may be acceptable but adding functionality and complexity to the original system specification will eventually compromise its usability and reliability. There will be a point at which the best approach is to start again and specify a solution which matches the expanded set of requirements. In this case the client wanted to make use of existing, low specification hardware, to minimise the cost of the project. This constrained the system design, making it more difficult to accommodate state of the art hardware and software when it became available.

Starting the development process again obviously requires investment, but this must be traded off against the potential benefits. It is important that the client understands the limitations of the products they commission. Their expectations must be managed, and the pay-back period for a business case justifying the initial development must be realistic. Development costs should be recouped over as short a time frame as possible, to reduce the risk that the system becomes obsolete before it realises the benefits anticipated.

User expectations

There are apparent differences between users' perceptions of, and expectations for, software and hardware products. Users expect the very latest software developments to be available immediately to provide them with faster, more effective performance. In general, Minotaur users have a poor understanding of how software works, but perceive new developments as simple upgrades, as nothing about the tools used physically changes. Consequently, they demand the most up to date performance immediately. It actually reflects positively on the Post Office business culture that the staff feel empowered to request improvements to tools to increase their effectiveness.

Transferring from hardware to software based solutions

A variety of ergonomics tools and techniques were employed to identify the functional and user requirements for the Minotaur system, including work observation, extant system analysis, workshops, user groups, and iterative system testing and development.

The initial success of Minotaur suggested that this exercise was largely successful. However, many of the functional enhancements identified after system roll out could potentially have been identified during the original requirements analysis process, if the potential benefits had been realised at that time. It may not have been possible to accommodate them all on the low specification hardware identified, but early identification would have allowed the client to choose between functionality and cost, and be aware of the implications. Of course, there will always be an element of hindsight in the development of any complex tool. However, it seems that this may be exacerbated in the development of software tools, particularly for first generation applications, used to replace non computer based tools. Users' abilities to predict their requirements are constrained by the limitations of their current tools, and a limited understanding of the power of computer based systems inevitably limits their horizons. When the software tool is initially introduced impressions are very favourable, as the obvious benefits are realised. Over time, as use of the system becomes embedded, additional potential functionality is identified. Innovative and predictive methods for identifying this functionality earlier during development could extend the duration of user satisfaction with the system.

Recommendations

General

- Encourage quick and iterative development to ensure that system benefits are realised at the earliest opportunity.
- Anticipate that additional requirements will be identified following roll out of software applications.
- Develop measures for the success of the application so that the benefits realised since implementation can be identified.
- Communication with the client
- Ensure the client understands the potentially limited life-cycle of a software product, taking account of the rapid developments in available technology.
- Advise that the business case covers a realistic time frame to ensure that clients are not relying on protracted use of the system without ongoing investment.

Communication with users

- Include activities such as role playing and "what if...?" scenarios in the requirements capture process, to identify 'future' user requirements.
- Provide mechanisms for users to record comments and suggestions following roll out, to identify potential system enhancements.
- Investigate how the system is actually being used, for example 6 months following roll out. Where discrepancies are identified from expected use, determine whether this is due to a requirement for additional functionality.

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