indeed, transferred to an individual's computer work station. It provided a realistic demonstration of the availability and, at times, lack of availability, of many Internet resources during certain hours of the day.

The use of HTML and a World Wide Web browser as instructional tools is all the more important, given the scope for academics to use them to disseminate research and prepare and present teaching programs. It is envisaged that academic staff will use these resources to provide both local and open learning programs.[4]

Comments received in questions three and four of the evaluation questionnaire indicated a need for greater depth of coverage with more hands-on, subject-specific experiences. Such requirements could not be fulfilled in a 1.5 hour general overview, but will be incorporated into the planning of future phases of the program. In particular, problem-based, subject-specific sessions are planned in future phases. Such sessions will be presented by teams of library staff, including both the co-ordinator and assistant as well as subject librarians involved in providing follow-up assistance for participants.

Future phases of the program currently being planned include:

- Phase 2: Internet Overview for Library staff
- Phase 3: Internet Overview for Postgraduate students
- Phase 4 (Concurrent with Phases 2 and 3): Subject specific Internet Training Sessions in, for example, Architecture, Life Sciences etc. It is envisaged that all sessions will use subject focussed HTML/WWW pages listing a range of subject resources from Listservs to Gopher and WWW resources.

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Solving reshelving backlogs in a university library

A case study using an interactive problem-solving technique with a TQM application

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The General Purpose Utility Problem Solving (GPUPS) technique redeveloped at the Manufacturing Management Programme in the School of Management at the University of Technology, Sydney, employs a variant of conventional cluster methods to perform cluster analysis of qualitative data. The nine key steps in problem solving with the GPUPS technique involve: selecting the participants in the process; making a clear and concise statement of the problem; describing work processes; brainstorming to highlight the aspects that contribute to the problem; restructuring the elements identified in the brainstorming session into a cause and effect diagram; developing action statements as the basis for improvement measures; compiling an interaction matrix that describes the effect of each action statement on all the others; creating a dendrogram that illustrates the underlying structure of the problem; and interpreting the results. The final problem tree, or dendrogram provides a plan of action and gives priority to the order in which the solutions are to be addressed. The article describes the application of this technique to the problem experienced by a satellite university campus library where there were periodic backlogs of books to be reshelved, associated with shortages of trolleys, limited floor storage area and minimal staff to deal with the situation

THE Manufacturing Management Programme in the School of Management at the University of Technology, Sydney, has been applying a problem-solving technique developed by its Director, Associate Professor Graeme Sheather, to a wide range of management and organisational learning situations in both public and private sector organisations. The General Purpose Utility Problem Solving (GPUPS) technique employs a variant of conventional cluster methods to

perform cluster analysis of data that are essentially qualitative. GPUPS was developed upon the computational instructions of Sokal and Sneath (1963). It employs an interdependency matrix to record non-quantitative 'judgements of preference' and decomposes this matrix into patterns of underlying 'perceptual structures'. GPUPS has been applied in a variety of disciplines during the last twenty years, but a recent focus has been to develop case study material to support Total Quality Management (TQM) applications in industrial firms and educational institutions.

As part of this development, the technique was recently applied to analysis of a recurring problem in a university library, where there were periodic peaks in book use resulting in too many books for the shelvers to replace. A draft of the results from the case study was shown to a number of librarians who suggested circulating it for comment. Publicised on the Internet, the authors received in excess of 180 requests for further details, and because of this interest, have reworked the paper for academic publication. This article briefly describes the background to the GPUPS problem-solving technique and its application to this specific case study.

Purpose of GPUPS

The General Purpose Utility Problem Solving (GPUPS) technique is designed to remove the fuzziness from problem-solving processes, as they apply to TQM and team building situations. It is extremely easy for participants to become confused with the complexity of problems faced in the implementation of TQM projects. People often ask:

- where do we start?
- what is the next step?
- how will we commence the implementation?

The GPUPS technique helps to make the problem-solving process more objective and systematic, whilst allowing for the subjectivity of decision makers. The technique described here enables teams of participants to:

- jointly state a problem
- describe the work processes
- develop appropriate actions
- examine the interdependences
- design solutions, and
- plan for their implementation.

Participants take part in a group problem solving exercise, where they come to own the solution, and can become multi-skilled in the process.

A dendrogram or 'problem tree' is used to structure the solution to the case study. It is produced through a cluster routine contained in the SPSS statistical package. As the mathematics is complicated, it has been omitted from this report, however, for those interested, reference is made to the literature in the bibliography. Detailed explanations of GPUPS, can be obtained by contacting the authors, or the secretary of the Manufacturing Management Programme (Tel: (02) 330-5262 or email t.nolan@UTS.edu.au).

Background to the GPUPS problem-solving technique

Most solution techniques applied to problem structuring, employ decision trees displaying alternative options as sets binary, where the criterion for 'splitting' is either a risk probability or categorical yes/no status. Decision analysis trees described by Raiffa (1968) are an example of the former, whilst the 'Vroom-Yetton' leadership and decision making model, is an example of the latter (Vroom & Yetton 1973). The basic problem in any data reduction, or simplifying exercise, is how to find structure in multi-dimensional data: that is, a structure which simplifies the basic relationships between variables that make up the multi-variate problem.

An alternative to this statistical approach, is to formulate the problem as a system of basic requirements and their interactions (ie inter-relationships as perceived by role players), and then employ a mathematical procedure to decompose this system into sub-systems. By hierarchically recombining these sub-systems, the specific problem is allowed to generate its own structure based on the internal interaction of the requirements. The theoretical hypothesis of GPUPS is that: the relation structure of the hierarchy in a problem solving procedure is the exact counterpart of the solution strategy.

The interaction matrix that records the pattern of inter-relationships between key variables of the problem, shows the individual differences in judgements of similarity that reflect 'perceptual structures' (Shepard, Romney & Nerlove 1972:15), as well as judgements of preference, and different ways for acting upon and using these perceptual structures to achieve a coherent plan of action. Uni-dimensional scales, such as those used by Likert-type instruments, do not provide an adequate representation of the relationships between responses to multiple-choice questions. However, multi-dimensional scaling, hierarchical clustering, and factor analysis techniques can produce subsets, or relatively discrete types of structures that underlie the data. The resulting taxonomies, or partitions of elements into several subsets, may be mutually exclusive and exhaustive or they may be hierarchically nested, and represented by points in Euclidean space.

A number of structure-seeking methods depend on distances between points in Euclidean space, and use algorithms to search for points whose interpoint distances are small (see Kruskal 1964; Shepard, Romney & Nerlove 1972; Sokal and Sneath 1963 as references; and Can 1993 for some recent literature). Cluster techniques are particularly useful where each element is described by a large number of interrelated variables or attributes, for under these circumstances, subjective grouping 'by eye' becomes difficult.

The GPUPS technique employs a variant of these conventional cluster methods, as it addresses those situations where the value or impact of a variable/program does not fit easily into a metric scale of measurement. Where such measurement techniques do exist, they are laborious and time-consuming, and it may become impossible to quantify inter-relationships of arbitrarily measured variables. GPUPS was designed specifically to perform cluster analysis of data that are essentially qualitative. Observations on each element are recorded on a two-state scale, e.g. attribute present/absent, character positive/negative, etc. Semi-quantitative measurements made on a scale such as significant/present/insignificant/absent may also be used, after coding into a two-state form.

As mentioned, most clustering techniques are most suitable for use with fully quantitative data, where similarity measures have an inverse linear relation to Euclidean distances. However, early work by Shepard, Romney & Nerlove (1972), Kruskal (1964) and others on multi dimensional scaling have suggested that pairwise

similarity measures, placed in rank order, may be used for mathematically sophisticated analyses of this kind, after conversion to Euclidean distances by transformations involving a minimum of distortion. GPUPS employs an interdependency matrix to record non-quantitative 'judgements of preference' and decomposes this matrix into patterns of underlying 'perceptual structures'. The cluster method is more rough and ready, but it is utilitarian and probably most suited for the type of decision-data employed.

Rather than starting with an initial classification, that is later adjusted and that would require a proposition on the part of the decision maker, ungrouped objects are progressively linked, first into pairs, then progressively into larger groups by an iterative process. This method is known as the 'pair-group' method using average linkage, and is fully discussed by Sokal and Sneath (1963). GPUPS was essentially developed upon the computational instructions described by Sokal and Sneath but adds a number of refinements, particularly that of automatically plotting the resulting 'problem tree' as a dendrogram. Application of GPUPS to a wide range of problem specific situations, across a diverse set of disciplinary and functional areas, has proceeded over some twenty years.

The detail steps of the process were followed as a framework for solving a library case study.

The case study

The site

The site chosen for this case study is a satellite campus library of a major metropolitan university. The campus has some 5000 full time and part time students, with 500 academic and support staff. Library patrons are drawn from the local university community, as well as visitors and reciprocal borrowers. The library is a member of the Unilinc Network, and uses a GEAC computer terminal system through a modem connection.

During semester the library's opening hours are:

- Monday to Thursday 8.30 am to 10.00 pm
- Friday 8.30 am to 6.00 pm
- Saturday, Sunday and Public holidays 10.00 am to 5.00 pm.

During non-semester times opening hours are:

- Monday - Friday 9.00 am to 5.00 pm
- closed on weekends and public holidays.

Borrowing conditions are:

- 2 weeks and 10 items for undergraduates
- 4 weeks and 50 items for postgraduates
- 8 weeks and 99 items for staff
- One renewal per item is available for both staff and postgraduates.

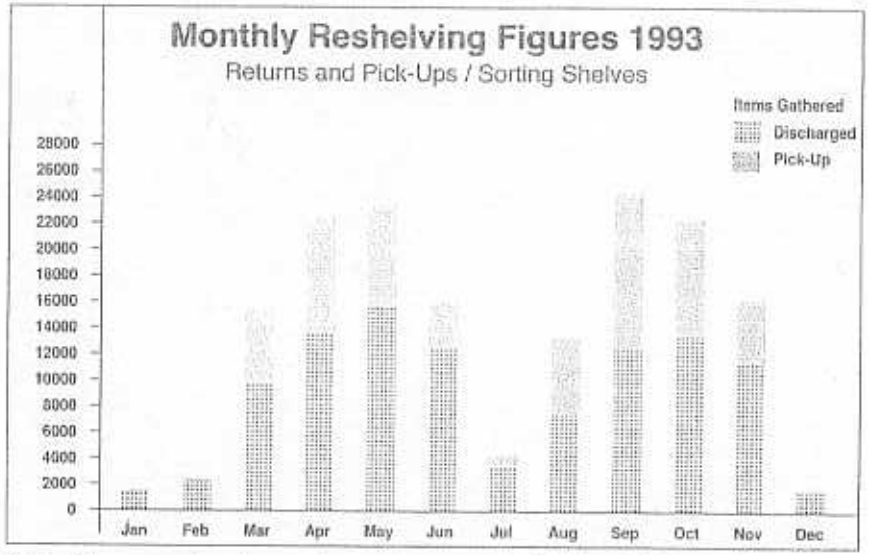
The collection contains about 254,000 items and has a yearly turnover of 110,000 loans. Besides books, the library collection also includes videos, records, films, kits, models and a closed reserve facility.

In 1993 the library had 104,746 (discharges) and 60,684 (internal pick ups) giving a total of 165,430 items that had to be returning to the collection shelves. (Figure 1)

The problem

At least four times a year there is a backlog of books to be reshelved, a shortage of trolleys, limited floor storage area, and minimal staff to cope with the returns demand.

Figure 1. Reshelving figures 1993



The backlog occurs when there are too many books for the shelvers to shelve, and books are stacked on all available trolleys and some tables. This eventually affects the efficient operation of other sections of the library.

Steps in the GPUPS process

The GPUPS process involves following nine steps – including preparation of an interaction matrix and the dendrogram that sets priorities for solutions, which together we call the 'dendromatrix'.

1. Selecting the participants

The process begins by identifying the key stakeholders who have an interest in the problem, or key issue, being addressed. These participants reflect the interests, responsibilities, and areas of accountability, associated with the problem. This requires a 'diagonal' slice across the organisation to ensure managerial levels and those with functional responsibilities are all represented. If all participants are to own the solutions and participate in their implementation, they must be involved from the outset.

Representatives from the areas of shelving, circulation, and library management, were the participants in this case study.

2. Targeting the problem

In this step, participants make a clear and precise statement of the problem. In particular, they elucidate why the issue has become a problem, and reflect upon its history. An important part of this process, is for participants to explore their different interpretations of the causes and effects of the problem.

By 'obliging' participants to commit the problem to paper, a common reference point is created, and this helps clarify others' views of the problem. Four questions must be answered to define this process.

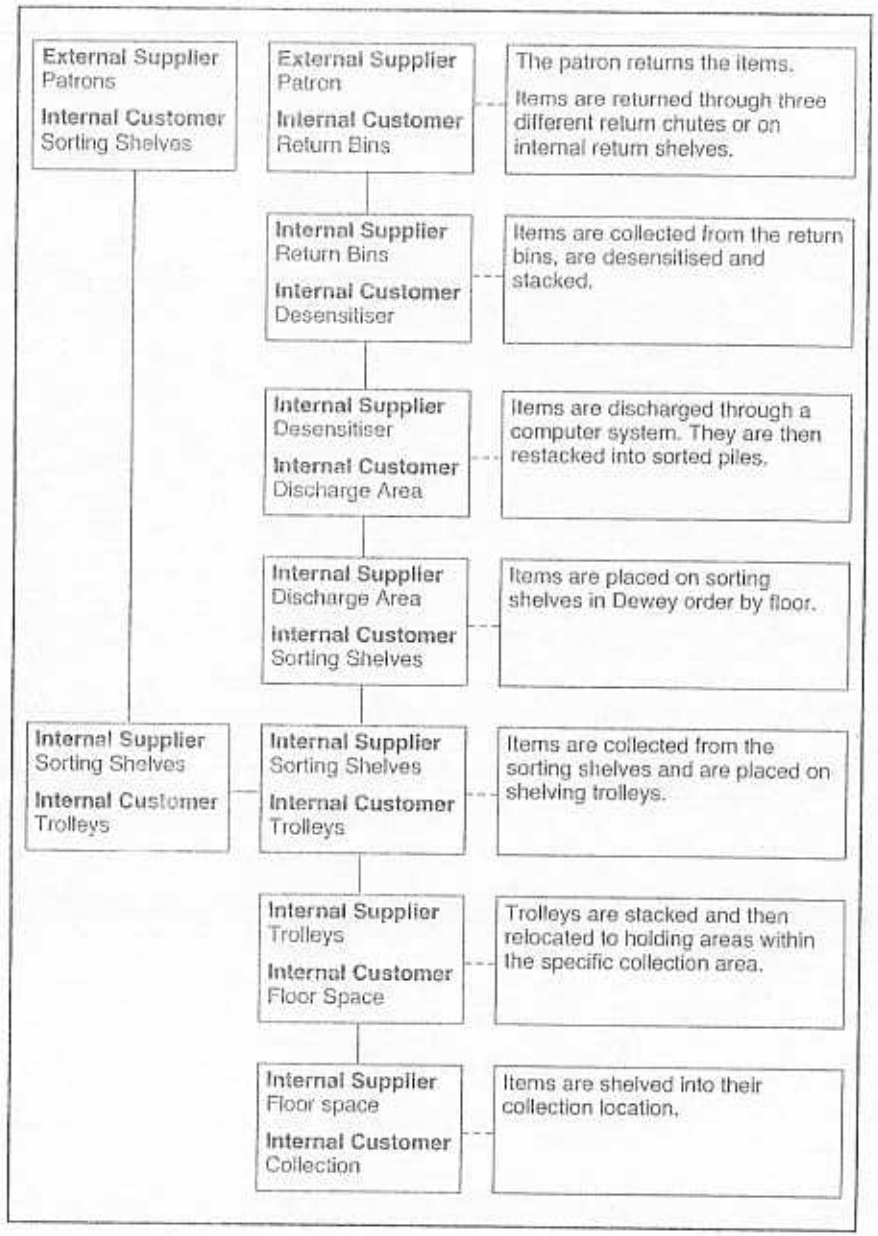


Figure 2. Workflow for reshelving library materials

What is the problem?

- Backlog of books to be shelved.

What causes the problem?

- Too many items being returned with insufficient resources to cope with extreme levels of demand.

Why is it a problem?

- Books and journals are hard to find.
- Piles of books and trolleys often obstruct traffic ways, causing mobility problems.
- Work areas become congested.
- Patrons have to search in three or four areas rather than in a single area.

What is the history of the problem?

- At certain times throughout the year, items are returned in greater numbers, the system is unable to cope, and backlogs occur.
- This occurs about two or three times each six months.

3. Describe the process

In the case study, the problem commences with the return of items to the returns bin, and follows the various processes through to their final shelving. (Figure 2) This work flow comprises a number of sequential steps, all of which involve input from a 'supplier' and output to a following 'customer'. Customers and suppliers may be internal or external to the library's staff. Committing this work flow to paper allows each staff member to convey to their colleagues a full description of their work tasks, and any problems associated with those tasks. Broadening this understanding helps all participants find a mutually acceptable solution.

An important aspect of TQM philosophy is that suppliers and customers are treated as one and the same. This duality provides a clearer understanding of each other's responsibilities.

4. Brainstorming the problem

This step must begin with a clear understanding of the return process described in step 3. Brainstorming aims to highlight the aspects that contribute to the problem of 'Backlog of books to be shelved'. It is important to capture all participants' views, suggestions and experiences in this brainstorming, as it enhances everyone's understanding of the process. It is also essential to capture all dimensions of the problem, if a practical solution is to be found.

The following were found to be key contributors to the problem:

- Patrons lack knowledge of where to return items
- Books are returned to the wrong bins
- Staff use different methods and procedures
- Sorting shelves are incorrectly used
- Computers go down and the manual system is outdated
- Computer equipment is outdated, and breaks down easily
- Trolleys are in poor condition
- Work spaces are too cluttered, and too small
- Equipment needs regular maintenance
- Computers give too many messages
- Desensitiser breaks down
- Library does not keep circulation records
- There are no numerical data entry pads on keyboards
- There are too few trolleys
- Items are left lying around

Define problem effect and target effect.	1. PROBLEM EFFECT Decide what needs to be improved. 2. IMPROVEMENT MEASURE Decide how, and how often, to measure improvement. 3. TARGET EFFECT Set the target to be reached.
Identify possible causes.	4. FACT CARDS Gather and integrate factual information about the cause of the problem.
Test improvement ideas.	5. IMPROVEMENT CARDS Generate ideas, possible solutions, proposals for improvement of the causes. 6. 3 DOT SYSTEM Select, test and adopt improvement ideas.
Stick with those that work.	7. STANDARD CARDS Establish and document new standard procedures. 8. ADHERENCE Maintain adherence to the established standard procedures.

Figure 3: The eight steps of CEDAC (based on Ishikawa 1985).

5. Cause and effect

The elements identified during the brainstorming session are restructured into a cause and effect diagram. The seven tools of TQM employ CEDAC (Cause and Effect Diagram And Cards) and fishbone diagrams, both of which originated from Ishikawa's model of cause and effect (Ishikawa 1985), and generally follow the eight steps outlined in Figure 3.

Applying this technique identified five major dimensions of the reshelving problem, namely:

- people
- equipment
- demand
- floor space
- operator software interface

These became the key improvement measures. Each of the contributing elements from the brainstorming session was allocated to one of the five headings. (Figure 4) The CEDAC procedure provides a logic for searching for possible solutions, where these ideas are tagged via cards to the various spines of the 'fishbone' diagram. This solution process encourages lateral and creative thinking on behalf of all participants.

A limitation of traditional CEDAC diagrams is that the suggested solutions become too many, their interrelationships are unclear, and there is no obvious point of commencement. One of the benefits of the 'dendromatrix' technique is that it solves these interrelationships, and provides a logical plan of action.

6. Action statements.

Elements of any cause and effect diagram are problematic, and as such are naturally recorded as negative statements. In order to become 'improvement measures'

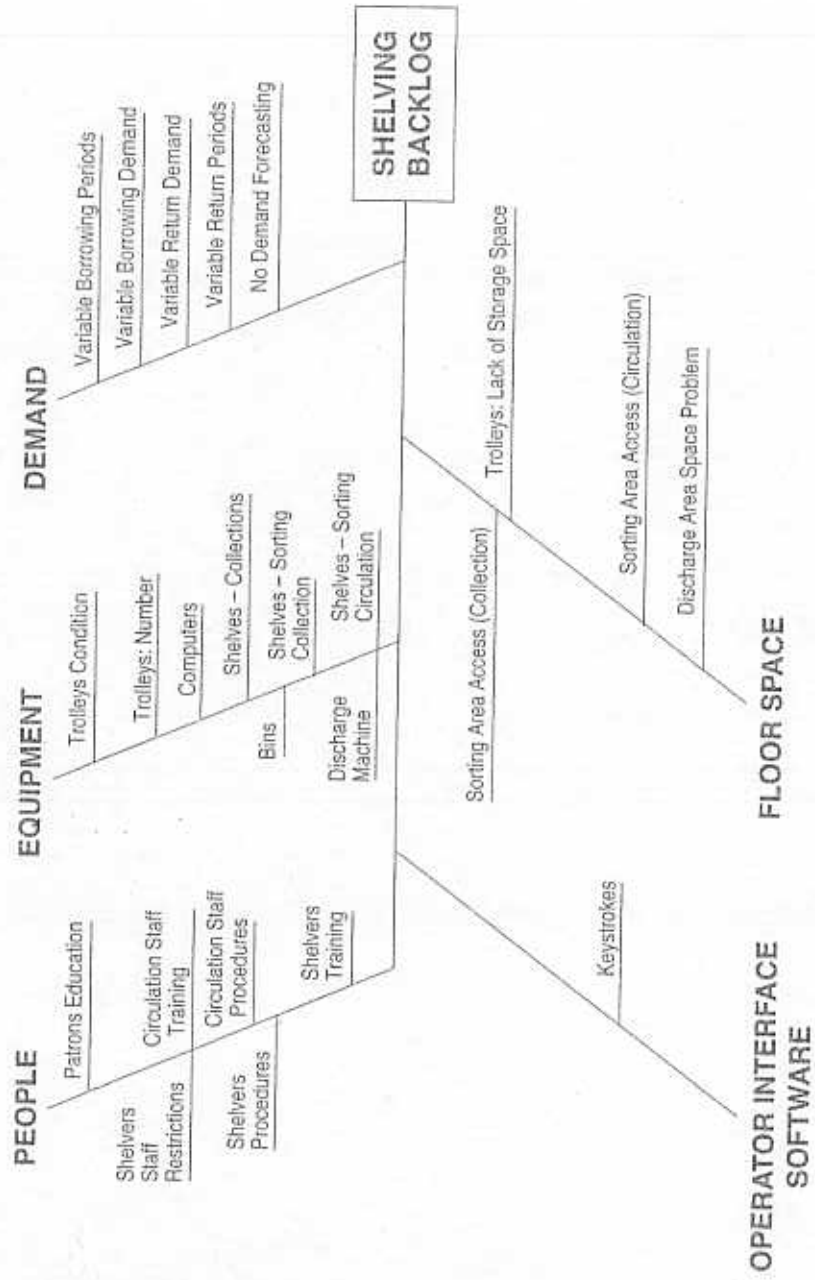


Figure 4. Cause and effect diagram

they must be converted into the positive actions required to correct the problem. For example, 'trolleys in poor condition' would be converted into 'improve trolley condition'. These action statements do not imply the means of addressing or correcting the problems. This is articulated during application of the 'dendromatrix' technique in steps 7 and 8. Action statements should be depersonalised, have a clear purpose and direction, avoid duplication and redundancy, and be of comparable scale or level of detail. The final set of action statements for the case study is shown in Figure 5.

Figure 5. Action statements to address the problem: Backlog of reshelving.

Demand	Provide demand forecasting
Operator/software interface	Reduce keystrokes
Floor space	Provide adequate trolley space Provide adequate floor space
Equipment	Improve trolley condition Provide suitable trolley system Improve computer reliability Provide suitable computer equipment Provide suitable shelving Improve desensitiser reliability
People	Improve customer awareness Provide suitable shelving labour Provide suitable training Improve procedures

7. The interaction matrix.

This step is the first component of the 'dendromatrix'. Each of the action statements is arrayed in a square matrix. The interrelationship between these action statements is explored by participants: the impact of one element on another being expressed according to a five-point scale: negative, negative unsure, no relationship, positive unsure, and positive. Commencing with the top row of the matrix (i.e. action statement No. 1), the question is asked 'Does this have an effect on action statement No. 2?'; the response being recorded according to the five-point scale. The result is listed in the matching cell of the matrix. The subsequent question would be, 'Does action statement No. 1 have an effect on action statement No. 3?' Sample questions from the case study are shown in Figure 6.

Figure 6. Sample questions and answers used in compiling the interaction matrix

Question	If you *Provide demand forecasting*, what effect does this have on *Reduce key strokes*?
Scale	Negative. Unsure Negative. No Relation. Unsure Positive. Positive.
Answer	For this question, participants thought that there was no relationship between *providing demand forecasting* and *reducing key strokes*.
Question	If you *Provide demand forecasting*, what effect does this have on *Provide adequate trolley space*?
Scale	Negative. Unsure Negative. No Relation. Unsure Positive. Positive.
Answer	For this question, participatants were unsure if *providing demand forecasting* had an effect on *providing adequate trolley space*, but if it did have an effect, it would most likely be a positive effect.
Question	If you *Provide demand forecasting*, what effect does it have on *Provide suitable shelving labour*?
Scale	Negative. Unsure Negative. No Relation. Unsure Positive. Positive.
Answer	For this question, participants thought that *providing demand forecasting* had a positive effect on *providing suitable shelving labour*.

The likely effect of each action statement on all the others is plotted on the matrix. When an action statement is compared against itself, it is recorded as a positive response. The measure 'unsure' is used when the group cannot be certain of the positive or negative direction of the impact. The process continues until the entire set of action statement interrelationships is recorded. (Figure 7)

In exploring the cross-impact of the action statements, the group must arrive at a consensus as to the magnitude and direction of that impact. This process obliges participants to make public their assumptions and understandings of the problem and its causes. It is important to note that the direction of the impact between any two action statements may not be identical. That is, action statement No. X may not effect action statement No. Y, in a reciprocal manner.

8. Creating the dendrogram.

This step is the second component of the 'dendromatrix' and simplifies the obvious complexity contained in the interaction matrix. The logic of information theory, numerical taxonomy and graph theory as it applies to the GPUPS problem-solving technique, searches for patterns of interrelationship between action statements, and groups these statements into sets according to the degree of similarity of impact. A number of clustering routines are available which can be used to sort this matrix and identify these patterns (Sneath & Sokal 1973). We have used routines from the SPSS package to complete this step of the analysis. The resulting dendrogram or 'problem tree' is similar to the conventual decision tree common in operations management and probability analysis (Vroom & Yetton 1973; Churchman et al. 1957). Down the left hand side of the diagram are listed the

Figure 7. The interaction matrix.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Provide demand forecasting	+	0	?+	0	0	?+	0	0	0	0	?+	+	+	+
2 Reduce keystrokes	0	+	0	0	0	0	0	0	0	0	?+	0	0	+
3 Provide adequate trolley space	0	0	+	+	+	+	0	0	+	0	?+	+	+	+
4 Provide adequate floor space	0	0	+	+	0	+	0	0	+	+	?+	+	+	+
5 Improve trolley condition	0	0	0	?+	+	+	0	0	?+	0	0	+	0	0
6 Improve trolley system	0	0	+	+	+	+	0	0	+	0	0	+	0	+
7 Improve computer reliability	0	+	0	+	0	0	+	+	+	0	+	+	+	+
8 Provide suitable computer equip.	0	+	0	+	0	−	+	+	?-	0	+	+	+	+
9 Provide suitable shelving	0	0	0	+	0	+	0	0	+	0	+	+	+	+
10 Improve desensitiser reliability	0	0	0	+	0	0	0	0	0	+	0	0	0	0
11 Improve customer awareness	0	+	+	+	0	+	0	0	+	0	+	+	0	0
12 Provide suitable shelving labour	0	0	0	+	0	+	0	0	+	0	0	+	0	0
13 Provide suitable training	+	+	0	+	0	+	0	0	+	0	+	+	+	+
14 Improve procedures	0	+	0	+	0	+	0	0	+	0	+	+	+	+

Scale: − Negative, ?- Unsure Negative, 0 No Relation, +? Unsure Positive, + Positive

action statements, grouped into clusters according to the degree of similarity of their impact across all action statements. Each action statement is given a code E (number) as it represents an element in the problem tree. It is important to note, that these element numbers no longer correspond to the action statement numbers in the initial interaction matrix. This is because the clustering routine sorts and reorders these action statements. (Figure 8)

9a. Interpreting the Results

The dendrogram illustrates the underlying structure of the problem of 'Backlog of books to be shelved' as interpreted by the major participants working in the returns process. It has grouped together those action statements for which simultaneous solutions must be found. It is clear from the 'problem tree' that there are sets of action statements that progressively combine into larger sets of elements that ultimately make up the total solution.

Commencing from the basic element numbers at the base of the tree, one proceeds to the right combining those paired elements, and searching for solutions to the dual action statements or solution points. The logic behind this pairing, is that any two elements can be worked on independently of either another single element, or set of elements. Management and staff participants can proceed to search for solutions to each set, confident that they are not cutting across any key relationships defined in the interaction matrix. The problem tree provides a plan of action, and gives priority to the order in which the solutions are to be addressed. Management can allocate resources, time and staff to each of these sub-problems, knowing that ultimately the most effective use of these resources has been applied to solve the problem.

Applying the dendrogram to solving the 'backlog problem', one commences with solution point S1. This first cluster deals with the 'basic operation' of the trolleys. It then combines with S2, which concerns the 'condition of the trolleys' and 'shelving labour'. S3 and S4, deal with the 'trolley system' and the 'education of the customer'. This whole cluster focuses on the 'pickup and transport' of the items to be shelved.

S5 deals with 'improving procedures' and the 'training of staff'. S6 and S7, deal with the 'storage and work areas'. S8 addresses the issue of 'user demand', enabling management to 'forecast' the best way to plan the work spaces. Solution points S5 to S8 deal with 'work area and operational procedures', so the focus of this cluster is 'work processing'.

S9 and S10 comprise the 'equipment cluster': which equipment items need to be examined and modified?

S11, S12 and S13 comprise the 'management and evaluation clusters'. At these solution points the system should be reviewed, to see if actions taken at the earlier solution points are working, or require adjustment.

The dendrogram shows that staff indicate the first area needing attention is the 'delivery / transport' phase. The next step is the 'work area / procedures' phase. Finally, the issue of 'equipment' to be used is addressed. The full set of alternative solution points are presented as an appendix. These solution sets record which elements are appropriate to the respective solutions, and the headings under which they were originally listed in the cause and effect diagram. The original reason each element was identified as a problem, is also listed. At each solution point, participants examine the previous solution steps and determine

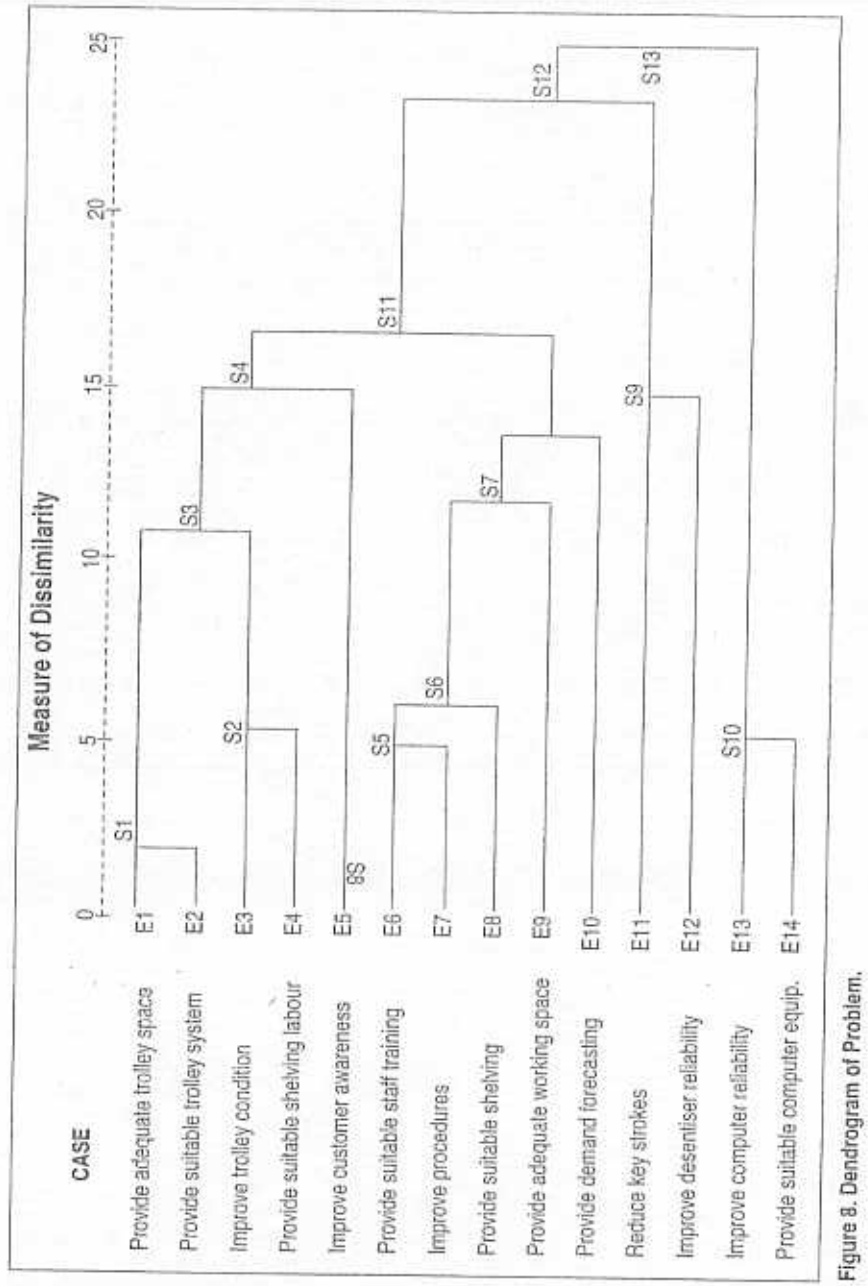
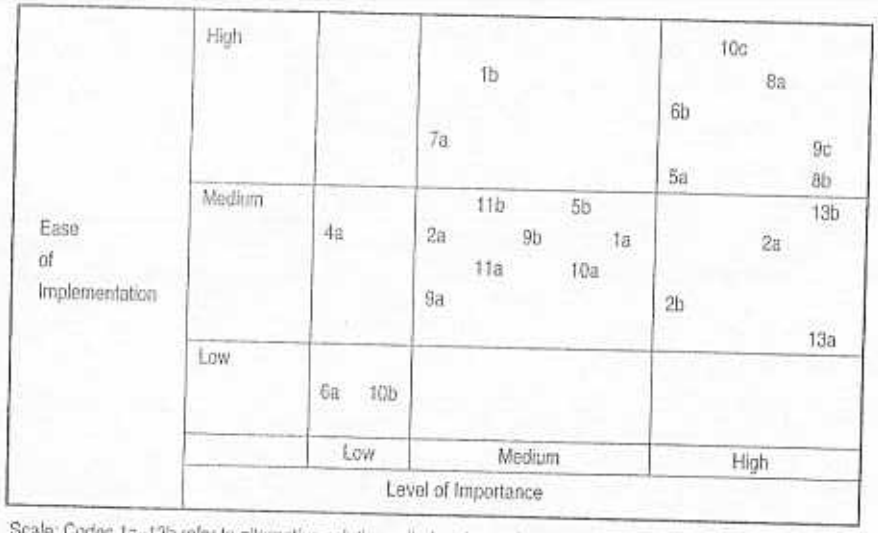


Figure 8. Dendrogram of Problem.

Figure 9. Relationship Between Ease and Level of Importance.



Scale: Codes 1a–13b refer to alternative solutions cited under each solution point

whether the recommended actions have been effective.

9b. Setting priorities for the working solutions.

To provide management with a guide as to which groups of solutions to concentrate on, a schema relating 'ease of implementation' to the 'level of importance' is constructed. (Figure 9) Each of the axes is graded in terms of low, medium and high level of impact. By plotting each of the possible options for each solution point (S1 to S13) on these two scales, management can target the priority it wishes to give the respective solution.

This is the final step, and is designed to provide a coherent plan of action for solving the problem. Not all the solution points will be practical and cost effective, or able to be implemented immediately. Each solution will require budgeting and planning, and the purpose of this diagram is to order management's response to the problem.

Those options in the top right hand quadrant, such as keeping statistics, identifying busy times, starting a computer maintenance program, and a general maintenance program, colouring the internal return shelves, and defining new procedures, are all low cost and easy to implement, but of considerable level of importance in alleviating the problem.

Conclusion

GPUPS has a long history of application to policy, management and strategic planning problem situations. It has illustrated the benefit of prioritising solutions and action plans, through improved involvement of people and a sense of ownership. Linking the process into TQM programs of continuous improvement has given these programs an added capacity for achieving realistic plans for implementation. A major advantage for organisational change is that the process helps answer the question of how to address priorities and at the same time ensure commitment from all levels of the organisation.

The case study has demonstrated that it is essential to involve the major players in problem identification, exploring and weighing up interrelationships, jointly devising solutions, and then planning the operational and resource steps for implemention. And, as the results of this exercise show, the outcomes are eminently sensible and practical.

This technique augments the various tools available to TQM practitioners. Application to a university library environment has confirmed its utility, both as a problem-solving methodology and as a process for team building and cultural change. Any technique that dares to make explicit the underlying 'perceptual structures', and judgement preferences, and that publicises the value sets of organisational members, must necessarily encounter difficulties. Getting participants to present their ideas, doubts and preferences publicly, and also listen constructively to others' viewpoints, is never easy. The process of moving back and forth between the interaction matrix and the 'problem tree', enables players to explore their differences in a non-threatening way. When an agreed position is reached, it becomes one that everyone owns and is bound into willingly and publicly. Response to the solutions reached have been positive and engendered a solid team spirit. Applications of the GPUPS process and its supporting software to other operational settings, are currently being developed by the Manufacturing Management Programme.

Appendix

Alternative solution points and options identified by the dendrogram

ALTERNATIVE SOLUTION POINT S1. = E1. + E2.

E1 Provide adequate trolley space.
Heading: Floor space.
Problem: No set locations to keep trolleys in, either empty or full.

E2 Provide suitable trolley system.
Heading: Equipment.
Problem: Not enough trolleys for peak periods.

S1 **OPTION A:** Make space to store trolleys in.
Note: Not much room to increase storage area, perhaps a slight change to floor layout.

OPTION B: Buy more trolleys.
Note: Can increase the number of trolleys, but also may increase the problem of storage of trolleys.

OPTION C: Pack trolleys better.
Note: Packing trolleys in a better order, saves time and makes the work practice easier on the shelvers.

ALTERNATIVE SOLUTION POINT S2. = E3. + E4.

E1 Improve trolley condition.
Heading: Equipment.
Problem: Some trolleys are in need of repair.

E2 Provide suitable shelving labour.
Heading: People.
Problem: Not enough shelvers for peak periods.

S2 **OPTION A:** Provide a regular maintenance program.
Note: Check the trolleys every 3 months.

OPTION B: Redistribute shelves, resources.
Note: Better distribution of books on shelves. Make shelves less cramped, and more accessible.

OPTION C: Flying squad.
Note: Ready teams of people who can shelve fast, and are very accurate. They can be called in for problem times.

OPTION D: Speciality areas.
Note: Have people who can handle the real problem areas. These shelvers know the little quirks of the area, and have the experience and knowledge to fix it quickly.

Option E: Different colour sorting shelves.
Note: Sorting shelves more highly visible. People would then know that they can return items there. The sorting shelves would stand out better, and help to remind people about returning items there and not return boxes (which duplicates work and increases unnecessary throughput by about 15-20%).

Alternative Solution Point S3. = S2. + S1.

S1 Solution to trolley system and trolley space.
Headings: Floor Space, Equipment.
Problem: Is there now sufficient more space for all the trolleys?

S2 Solution to trolley condition and shelving labour.
Headings: Equipment, People.
Problem: Are the trolleys now in better condition and are there enough shelvers?

S3 **Option A:** Keep records of trolleys.
Note: Keep track of the trolley usage and repair, which helps keep a better track of what is available.

Option B: Keep records of shelving loads.
Note: Help to improve knowledge of future staff and equipment requirements.

Alternative Solution Point S4. = S3. + E5.

S3 Solution to trolley systems and shelving labour.
Headings: Floor space, Equipment, People.
Problem: Are the trolleys and shelving systems coping with the work load?

E5 Improve customer awareness.
Heading: People.
Problem: Patrons often return the wrong items to the return bins. This creates more work which is unnecessary.

S4 **Option A:** Teach people how books are returned.
Note: Use the library tours to instruct people on what is the best way to return books.

Option B: Survey and feedback.
Note: To find out if the library has improved customer's awareness.

Alternative Solution Point S5. = E6. + E7.

E6 Provide suitable staff training.
Heading: People.
Problem: Staff are being training by several members of staff, which may be confusing. Each staff member has their own ideas and methods.

E7 Improve Procedures.
Heading: People.
Problem: Bad practises can be taught. Crisis problems may lead to more confusion. Night staff and weekend staff don't always have the correct information or knowledge.

S5 **Option A:** Define and set procedures.
Note: To have a set method or procedure helps in the change over of shifts.

Option B: Train staff.
Note: Have set people do set training. Train people in a proactive time table, rather than reactively to solve a crisis.

Alternative Solution Point S6. = S5. + E8.

S5 Solution to staff training and improving procedures.
Heading: People.
Problem: How are staff training and improved procedures working?

E8 Provide suitable shelving.
Heading: Equipment.
Problems: The shelves are over stocked and too cluttered. No room for expansion.

S6 **Option A:** More shelf space in the general collection.
Note: Redistribute the collection. Create stacks or 'weed' the collection.

Option B. Colour and increase collection return shelves in the collection area.
Note: Make internal return/sorting shelves a different colour to stand out better. This will reduce the number of items that need to go through circulation.

Option C: Collect loose items while shelving.
Note: It's better to collect missed shelved items and items left lying around by patrons and return them to the sorting shelves. It is better not to deal with them on the spot, because it allows a faster trolley turn around time.

Alternative Solution Point S7. = S6. + E9.

S6 Solution to training, procedures & suitable shelving.
Headings: People, Equipment.
Problems: Are the procedures working? Is there any more space on the shelves?

E9 Provide Adequate Working Space.
Heading: Floor space.
Problems: Working areas are too crowded. Problems with storing and transfer areas being too small.

S7 **Option A:** Redesign work areas, with easier access.
Note: By having a set defined but flexible area, allows greater productivity, better movement, less cramped environment and better working and psychological conditions.

Alternative Solution Point S8. = S7. + E10.

S7 Solution to training, procedures, shelving & work space
Headings: People, Equipment, Floor space.
Problem: Are these systems now working to the best that they can?

E10 Provide demand forecasting
Heading: Demand.
Problem: Peak demand periods are felt rather than known.

S8 **Option A:** Keep turnover statistics
Note: Keep records on all loans, returns, shelving statistics.

Option B: Identify busy times with advanced warning for library staff.
Note: Plot peak periods with statistics. Survey staff concerning what they feel are the peak times. Get advanced information on when assignments are due.

Alternative Solution Point S9. = E11. + E12.

E11 Reduce key strokes.
Heading: Operator interface software.
Problem: Computer warnings slow down throughput. Don't need to acknowledge book not on loan.

E12 Improve desensitiser reliability.
Heading: Equipment.
Problem: Desensitiser breaks down and creates backlog.

S9 **Option A:** Remove some warnings like 'Item not on loan'.
Note: Remove some messages or make them a non keystroke response.

Option B: Get a replacement desensitiser.
Note: Get a backup machine for either sensitise or desensitise.

Option C: Maintenance program.
Note: Have a 3 monthly maintenance program.

Alternative Solution Point S10. = E13. + E14.

E13 Improve computer reliability.
Heading: Equipment.
Problem: Computers often break down or slow down. Sometimes attachments don't work consistently, eg barcode wands.

E14 Provide suitable computer equipment.
Heading: Equipment.
Problem: There is no numerical keypad, so after the system has been down, it takes more time to re-enter the data from the manual backup sheets.

S10 **Option A:** Backup software.
Note. Get some computer software, that works on site for when the general system is down.

Option B: Numerical keypad.
Note: Get new keyboards, with numberpads.

Option C: Computer maintenance program.
Note: Have a 3 month maintenance program.

Alternative Solution Point S11. = S4. + S8.

S4 Solution to trolley systems, shelving labour & customer awareness.
Headings: Floor Space, Equipment & People.
Problem: Are these solutions working? Are there less unnecessary items going through the circulation system?

S8 Solution to training, procedures, shelving, work space & demand forecasting.
Headings: People, Equipment, Floor space, Demand.
Problem: Are people's work practices becoming more standardised? Are the procedures working?

S11 **Option A:** Access trolley system with shelving roster review.
Note: Is the trolley system now coping with the demand in peak periods? Do any more adjustments need to be made?

Option B. Check shelf capacity
Note. Are the shelves now easier to store items on? Are the items easier to access and read the numbers?

ALTERNATIVE SOLUTION POINT S12. = S11. + S9.

S11 Solution to trolley systems, shelving labour, customer awareness, training, procedures, shelving, work space & demand forecasting.
Headings: Floor space, People, Equipment, Demand.
Problem: Is the library work flow now efficient within reason?

S9 Solution to reduce key strokes & improve desensitiser reliability.
Headings: Operator/software interface, Equipment.
Problem: Are the computer keystrokes reduced and is there less trouble with the desensitiser?

S12 **OPTION A:** Check throughput of each area.
Note: Check solutions and changes for each area. Are there any small adjustments needed to be made for each area?

ALTERNATIVE SOLUTION POINT S13. = S12. + S10.

S12 Solution to trolley systems, shelving labour, customer awareness, training, procedures, shelving, work space, demand forecasting, reduce key strokes & improve desensitiser reliability.
Headings: Floor space, People, Equipment, Demand.
Problem: Are there still any major backlogs?

S10 Solution to improve computer reliability & provide suitable computer equipment.
Heading: Equipment.
Problem: Is the computer system now in a better condition?

S13 **OPTION A:** Review overall system.
Note: How is the total system working?
OPTION B: Check backlog.
Note: Is there now any backlog, that the adjustments to the system failed to cover?

Acknowledgement and disclaimer

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From the desk of Augustus Slope

My dear Ifould,

Having passed through the honeymoon stage I am starting to take a little interest in the outside world.

The Institute here is in a rotten condition. No interest taken in its proceedings, and it is in debt.

There is a movement in the town to resurrect the affair, & so far I have been spokesman.

One of the difficulties is that the Institute is vested in the Corporation, which is entitled to proportionate representation on the Committee & really controls matters. Unfortunately it takes no interest in the Institute & consequently the thing languishes.

Two courses seem open to us; either to get rid of the Corporation or to found a rival institute. It is no use trying to move under present conditions: there is a dog-in-the-manger policy about the present officers which spoils everything.

It seems presumptuous to talk about founding a rival institute. However, if we can have a free hand, or decide to act on our own initiative we hope to get over 400 members from the Smelting Works – so that you see we stand for something.

I don't know how to act, being ignorant of the law. Is there anything in the Act of 1886 to allow us to get rid of the Corporation; or, if we found a separate institute may we receive a Government Grant?

Any information you can give us will be gratefully received.

Please keep this letter private as we do not want to show our hand.

With kindest regards,

Yours faithfully,

W.L. Raws.

If a man called Richardson calls on you don't tell him anything about this letter. He's a delegate from the Institute Committee & 'agin'us. WLR.

W.L. Raws, Wallaroo to W.H. Ifould. Public Library, Museum and Art Gallery of South Australia, 13 September 1905, State Records, GRG19/1 Wallaroo.

Self-help v state intervention

The 1850 Public Libraries Act as a reflection of mid-Victorian doctrine

• Sarah Charing •

The Metcalfe Medallion

John Metcalfe was responsible for establishing the basis of the profession of librarianship in Australia and was the dominating influence in the profession in this country until his retirement in the 1960s. John Metcalfe and his contribution to librarianship and library education are commemorated by the Australian Library and Information Association through the Metcalfe Medallion.

The award is for the most outstanding essay or other piece of work on a topic of interest to library and information services and consists of a medallion and a year's membership of the Association. Students are invited to submit entries for this award.

To meet the criteria for this award entries for the ALIA Metcalfe Medallion should:

- be submitted in triplicate by a student undertaking a first award course in library and information science;
- be an essay or other piece of work of up to 5000 words in length of interest to library and information science;
- be written in a form or style appropriate for publishing in an ALIA journal or as an ALIA Press publication;
- indicate competence in the analysis, evaluation or synthesis of data, information or previously published material;
- include a declaration stating that the entry is the student's own work.

Sarah Charing was the 1995 winner.

Sarah Charing completed the Graduate Diploma in Library and Information Studies at Monash University in 1994. Her first degree is a BA (Hons) in History, also from Monash. She is currently employed at the State Library of Victoria on a serials identificati\on project.

Manuscript received February 1995

The passage of the Public Libraries Act 1850 (UK) reflected social and political attitudes prevalent at the time. The principles of laissez-faire and utilitarianism were both influential in the period preceding 1850. Taken together these contributed to an age that embodied negative attitudes to government intervention, but tolerance for ameliorative social legislation. The Act itself, and reactions to it, are examined as encompassing these juxtaposed notions, and reflecting the concerns of the increasingly influential middle class.

THE Public Libraries Act 1850 and the reactions to it, both before and during its passage into law, embodied many of the predominant political and social philosophies of mid-Victorian England. The pioneers of the Act, though motivated by utilitarian concerns, betrayed notions of social control in their arguments for legislation. In turn, opposition to the Act comprised elements of the