

## CHAPTER IV. MANAGEMENT AND ITS REQUIREMENTS

### A. MANAGEMENT DATA

Now that we have discussed the nature of cultural repositories and of collections, the actions taken on objects and the sequences of actions which constitute procedures, it is useful to turn our attention to the concept of management to complete the discussion of a framework for defining requirement of collections management systems for cultural repositories.

Management consists of a cycle of Establishing Objectives, Planning, Allocating, Monitoring, Evaluating, and then Establishing Objectives etc.. The first requirement of a collections management information system, therefore, is that it must record our objectives and information with which we can plan how to manage the collection. The second requirement is that it supply tools with which to use that information to control the future management of collections. It must permit allocation of resources to specific actions and objects in the future and monitor the degree to which planned activity is completed as planned and the degree to which unplanned activity impacts on plans. And it must permit us to evaluate the success of the program as conducted according to criteria derived from the organizations' basic mission. While these appears to be innocent requirements, they are not; when thoroughly analyzed they collectively define the form which information recorded in the system should take and dictate the basic functional capabilities which must be supported.

If we examine the most fundamental level of collections management activities in a cultural repository, we find they are clustered around four missions: "obtain objects", "maintain documentation of objects", "conserve objects", and "provide interpreted access to holdings". But each of these broad missions requires that we set concrete objectives and plan - first what we want to obtain, then what we must document, then what we should conserve and how, and lastly how best to provide access. And to achieve whatever we decide, we will need to allocate our efforts, not just in a general way, but to specific actions on a given collection for a scheduled time, place, cost.

We manage resources to achieve objectives. The entities about which we require information, therefore, are ACTIONS, OBJECTS, PERSONNEL,

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PROPERTY, TIME, SPACE, and FUNDS. Some of the actions we must plan relate to exhibits, educational programs and other events for which we must identify appropriate objects based on terminology used to describe both the object and the proposed contents of the event. The entities about which we require information for administering events are OBJECTS and ACTIONS, AGENTS and EVENTS. The entities required for retrieval, research and interpretation of collections are AUTHORITIES, which govern our use of terminology to describe index or access points such as persons, geographical locations, styles, materials or functions. Thus, our requirement for information with which to manage collections, leads us back to the preliminary definition of the data which must be captured in a system which supports collection management.

Figure 1 is a model of the data in a collection management system first developed in 1984. While more detailed studies have been undertaken since<sup>11</sup>, the model works well to explain why actions play a central role in collections management systems, how resource management systems relate to collections management systems, and why information retrieval can be a separate system, and perhaps ought to be implemented in a loosely coupled fashion.

The central management feature of the model is that entities are related to each other only through ACTIONS or AUTHORITIES, that is either by taking part in a managed activity or by sharing a descriptor assigned in the action of cataloging. Objects do not directly link to exhibits, but to actions which lead them to take part in exhibits. Agents do not do things to objects, but take part in actions involving objects. Funds are expended on actions, not on objects or events directly. In all cases, the unit of analysis is the action, which alone makes management possible, for at the level of actions we have commonalities both within the institution and across organizations.

A second feature of the model, discussed in detail in this chapter, is that the functions required by systems designed specifically to managing resources such as space, finances, and personnel (as discussed in chapter 1)

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<sup>11</sup> Particularly, see the Virginia Museum of Fine Arts & Canadian Heritage Information Network; Virginia Museum of Fine Arts Information Systems Framework, August 1987, and Smithsonian Institution, Office of Information Resource Management, Information Architecture 1987: Executive Summary, October 1987

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are not identical with those needed by a collections management system to view resources through actions.

Our definition of management, makes it evident why a good management system will support three distinct chronological views of the database and provide tools to relate them - e.g., what we desire should be the case (plans), what is the case (present state), and what actions have been taken towards the goals in any stated period of time (progress). Thus we need to be able to define the shape we want the holdings of the repository to take in the future, whether by identifying specific objects for future acquisition or future distributions of objects across conceptual or organizational lines, and we need to be able to assign specific members of the staff or specific units within the organization to tasks aimed at achieving these ends. We need to be able to define an event that will take place five years from now to the system, and reserve for it appropriate space and personnel, specific objects from the collection. We must define these steps as goals for the exhibit to achieve in time. If we imagine the event is an exhibit, these goals may be other records which will be attached to the exhibit record, such as an approved script, or a floor plan, or "holds" on all the objects which will be included. They may also relate to the completeness of records which already exist, for instance, that object records for objects in the exhibit must have completed "exhibit label" fields or verified dimensions. What is important is to be able to schedule the large number of tasks that must take place in the management of collections according to priorities determined in advance and carry them out with existing or planned personnel within budgetary limits established in advance. We must have information available to measure our progress and be informed when boundaries established in planning are exceeded.

Existing implementations of collections management within automated environments look different because they have not been designed to fully implement management over time and management of items at various levels of aggregation. If they had taken this generalized approach, they would look very similar. An example familiar to collections managers in archives and museums is the limitations imposed by library circulation systems, which are applications designed to manage changes in physical custody. A fully implemented holdings management capability would permit us to identify any point in time at which any action can be taken with respect to any object (which may be a collectivity) and to identify the nature of a notification which is to be sent at that time to any person or organization

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including but not limited to the temporary custodian. It would also permit us to construct flexible descriptions of temporary custodians based on a variety of types of "borrowers" we serve. Library circulation systems, however, have only recently, and only partially, implemented the "reserve" capability, which schedules the next loan contingent upon the return of the prior loan, and have frequently implemented their "patron" or "borrower" file in such a limited way that a separate subsystem needs to be maintained for "reading room" when reading room is a temporary custodian. Few library circulation systems "see" internal addresses which are temporarily in custody of an object as "patrons", therefore holding shelves and even conservation laboratories may be reflected in the system through separate facilities from those employed for "loans". And even fewer library circulation systems are structured in such a way as to permit me to create a group of objects, as in a travelling exhibit, and treat it as a single loan. No library system known to me permits loans to be partially returned or considers exchanges as a category of loans.

Finally, library circulation systems assume two things which museums and archives cannot accept. First, they assume that objects in the collections may either be loaned or not, without distinction by patron. Little, therefore, needs to be known about a temporary custodian beyond their name and address and, perhaps, loan privilege class. Secondly, they implement a privacy protection under which, once a loan is returned, the record of its having taken place is deleted. Archives and museums on the other hand maintain elaborate records of some temporary custodians, including condition reports on their storage facilities, and use these records in determining whether objects may be loaned. They also maintain quite elaborate systems of describing objects (physical conditions, legal conditions, restrictions on access, restrictions on use, etc.) which can govern whether items may be loaned (and remember, a loan may be a transfer of physical custody within the boundaries of a search room). Archives and museums also take it for granted that any action taken on objects will be recorded and the record will be retained throughout the life of the system. For an archive or museum, the loan of an object to an exhibit is important in understanding the object, just as its prior ownership by a famous person or its creation in

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fulfillment of a commission, or its discovery by a particular scientific expedition, is critical to its cultural meaning.<sup>12</sup>

The following section of this report discusses generalized capabilities which would need to be present in a fully implemented collections management system.

### B. AUTOMATED RESOURCES MANAGEMENT CAPABILITIES

One purpose in taking a generalized view of collections management requirements in this report is to influence the future design of collections management information systems so that they do not unnecessarily restrict their applicability. However, cultural repository staff should recognize that taking a highly generalized view incurs two costs: the system itself has a greater overhead if it must always consider more options before executing a command, and the staffs responsible for implementing a system which includes numerous options will need to address policy and procedures before implementing the system, rather than just turning it on. The first concern, while legitimate, can be minimized by good design. The second, and largest, barrier could be reduced by better documentation and training.

We can view the computer as a machine which moves bits and bytes of data around to various storage locations and compares them or as a collection of much higher level capabilities. The highest level of aggregation we call a system. Immediately below that are the applications and modules described in the previous chapter. Here we will examine a middle levels of computational capabilities, organized around system facilities applying to specific data entities we examined in the data model in exhibit 1. These capabilities lie just below the level of application modules.

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<sup>12</sup> A further example of the difference between library based systems and the levels of generality which are required for collections management, is exemplified in the cataloging sub-systems of automated library systems. The limitation is not the particular data elements employed in library systems, since the screens and data dictionaries can be altered, but rather the assumption that library cataloging is an essentially one time event. Its purpose is to either identify ones holding as the same as that catalogued by another library in a shared system environment or to catalog your own in such a way that others will not have to do it again. This is so different from the incremental, sometimes top-down, cataloging done by archives and museums that different kinds of tools are relevant.

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### **1. Time-based system facilities:**

Management of collections means managing what happens to them, and thus requires a degree of control over time that is difficult to achieve with manual systems. Automated time-based functions are driven by the system clock and are therefore often described as "automatic", that is not human initiated. In effect they are batch processes initiated when a date changes or a time of day change occurs in the internal clock of the computer system. Typically such a change launches a search of the database for records meeting specified criteria and executes a stored program.

Time-based functions are extremely important in management systems because the essence of management is the execution of plans. The ability to establish such plans and have them carried out (if not directly by the system, then by the system alerting responsible individuals and notifying the manager of the status of the task), is central. Nevertheless, few existing collections management systems are designed around time-based functions.

In addition to seeking simply to be able to define particular clock/calendar times for specific actions, we need to design systems to reflect other ways in which time is specified. Time is frequently specified as a contingency sequence - ten days after the occurrence of x. Contingencies may be other system events (in which case support for defining such event times directly would be useful) or external events (in which case the system needs to launch a program after certain data is entered). Time is also frequently defined in recurring intervals - every fiscal year or every November 13, and may, for some needs, be defined in non-technical time ranges such as "spring" or "evening".. It should be possible to set up regular actions as well as non-recurring actions.

Finally, in addition to seeking systems that enable us to establish sequences of actions to be conducted, and to monitor their execution (in effect simply to define another action, notification, which takes place as well) a usable collections management system will require an ability to define sets of such action sequences, rather than requiring that we define such a set each time. We should be able to invoke "loan" and set up an action sequence that includes all the contingent actions we want to have take place. And we should be able to record that the item has been returned, and have the contingent actions established by the loan erased.

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We should note that time-based functions can be implemented on-line or in batch reporting systems with equal effect. As batch output functions, they are often referred to as notification and/or calendaring. As an on-line function they may be referred to as electronic messaging or tickling. In evaluating systems for cultural repository collections management one would want to assess not so much the mode, but whether the capabilities are generalized and if so whether time-based functions can be combined with further computational procedures, such as exception reporting and scheduling.

### a) Scheduling

The most basic time-based capability is the facility to build an imaginary time-line for any object or event and locate future actions on that line, retaining the scheduled action and the actual action for future comparison. A more complex scheduling function might recognize the distinction between proposed actions and authorized actions, permitting management review of schedules before they become effective. Sophisticated scheduling systems may incorporate methods of conflict resolution and priority setting so that actions can be scheduled in relation to other actions and can be tied into resources databases to assure that available resources are not over-committed.

### b) Calendaring

The facility to display or print a calendar of scheduled events or actions, for a given person, unit, organization or space provides a view of the object/action oriented schedules often required by management. Enhancements on this might provide overviews of classes of actions or classes of objects or composite calendars which reflect analysis of schedules by overall time commitments for groups of staff and/or for periods of time.

### c) Timed batch execution

The purpose of scheduling and calendaring is, of course, to enable us to set subsequent events in motion. A facility to identify procedures to be run at specified times in the future, or at specified intervals, goes part-way towards meeting this need, and is often referred to as timed, batch, execution. With such a facility any program can be executed at a fixed time in the future. A library of such programs might be maintained, some of which in turn invoke other programs. Thus, a sophisticated implementation might permit batch

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execution of a job at a specified time following the execution of other procedures.

### d) Automatic notification

The facility to print notices addressed to specific persons or groups, based on analysis of the database state at a specified time, is a specialized timed batch facility. Here we have defined a particular output report, to be addressed to given persons based on the results of the execution of a program (in effect, calling a second program to assess the results and a third to issue a print report). Management of collections involves the "automatic" issuance of many such notices. Sophisticated versions may allow the time to be determined by prior analysis of the database state.

### e) Tickling

The facility to alert a particular user or class of users to a database state, when that database state is defined as a field in which a date resides, is called tickling. When any date field can be definable as a tickling field, management is able to employ scheduling and automatic notification. Depending upon the sophistication of the underlying notification modules, tickling may define alternative users to be notified or may establish secondary actions to be executed depending on the value of another field on the specified date.

### f) Automatic exception reporting

The facility to compare the planned or desired state of the database with its actual state along any dimension and report on a user scheduled basis when expectations are not being met is an important management capability. The most complete definition of a time-based function, automatic exception reporting, utilizes all the previous capabilities. (I will assume in this discussion that we are not dealing with object-oriented systems where this facility is implemented differently). What we would want in automatic exception reporting is to be able to define a relatively complex condition (anything we can express in a Boolean query) which is tested for at specified times and which, if satisfied, returns a specified notice to specified persons. Sophisticated versions may permit definition of percentages of variation permitted for each variable or require conditions to be satisfied more than once.

## 2. Space-based system facilities

Space-based functions enable management to control the utilization of space, which in cultural repositories is a critical resource heavily impacted by past commitments. Unlike most organizations, in which space is largely occupied by staff and normal working environmental conditions and equipment can be assumed, cultural repositories devote the largest part of their space to the storage or display of their holdings, and the management of holdings is dependent not only on being able to locate them at all times, but on assigning them to appropriate storage and display spaces.

Space-based functions, like time-based functions, are difficult to manage in manual systems. While they depend on representation of objects in visual models (three-dimensional representation of available spaces and their potential fillers) the number of objects and their variety impedes manual model making except in the development of exhibits where the numbers of objects are small and the implication of space assignment decisions are critical.

### a) Space planning

The facility to identify a space to meet a space requirement, such as storing an object or locating an exhibit cabinet is the first requirement for a space-based system. Matching of definitions of existing spaces and the space needs of objects, while relatively simple from a computational perspective, involves careful definition of the spatial requirements (including environmental requirements, angles of viewing, etc.) of objects in the collections. Sophisticated versions might return a number of options based on other criteria.

### b) Space allocation and assignment

A large number of variables come into play in assigning a cultural object to storage or exhibit space, as discussed above. These factors will have different weight in different organizations and will need to be considered by a system in identifying spaces for objects. People, however, actually allocate the space for objects, order objects moved, move them and report on the movements. Ideally a system would assist in making determinations about spaces (ranking available spaces), would notify appropriate persons about new space assignments, activating them to make the required movements, and would report on actual movements and on new locations. Two methods of "automatic" spatial reporting are often employed in collections management systems and should be considered: bar-codes and remote

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sensing. Bar-codes, familiar to consumers from the grocery store if not elsewhere, are markings read by a light "wand" or "eye" which can be a very small, lightweight and portable device. By bar-coding objects and spaces the two can be "wanded" to indicate an object movement. Remote sensing, while more expensive as a space planning mechanism, may be cost-effective when seen as a security mechanism as well. These involve weight sensitive shelving and in situ image recognition.

### c) Itinerary management

Ideally space management systems would be constructed so that objects could be scheduled to move from space to space, thereby accommodating the management of itineraries for travelling exhibits, waiting lists for loans, and internal study and educational uses of objects. Setting up itineraries involves defining spaces and times, but its automated support could involve scheduling of appropriate shippers or movers, defining a checklist of paperwork to be completed by a given number of days prior to a move, and support for viewing where in transit objects are, rather than simply by the time of scheduled actions.

### d) Space utilization reporting

To plan or allocate space, data about spaces available must be given to the system, but to provide space utilization reporting the data must be provided to a facility which can display a visual model of actual utilization of space in storage or exhibit areas suited to human decision making. Because space utilization functions are used in planning moves, it must be possible to define new spaces and target destinations as well as existing spaces and actual locations. Sophisticated versions of storage utilization reporting can indicate the levels of movement activity associated with each space.

### **3. Personnel-based system facilities**

Personnel-based management for cultural repositories is no different from that for other service organizations; the important issues are matching skills with needs and managing the assignment of tasks so that the overall schedules are achieved by the product of the work of a large number of persons. The measurement of output tends to be less rigorous than in production environments but it can be important in establishing realistic baselines for future planning.

### a) Resource availability and skill matching

The most basic requirement in managing the work of people within organizations is frequently overlooked by personnel management systems (which are oriented towards hiring and paying employees rather than supporting the management of their activity once they are employed). Fortunately for cultural repositories, however, the requirements of volunteer management, where remuneration and hiring are not issues, are those of time and skill matching, and systems are being developed to match schedules of available volunteers and their known skills with schedules of tasks needing to be accomplished and the skills required to achieve them.

### b) Task assignment

Once matching of skills and schedules has taken place, the system must assign tasks to particular individuals, thus removing the task from the pool of tasks to be assigned and maintaining a task list by person and by client organizational unit. Normally, completed tasks must be retired from the task assignment list and the database must be updated to show that the task was completed as assigned, or to permit the release of a task back to the matching pool if the task cannot be completed as assigned. Management should be able to review both tasks and personnel. Sophisticated task assignment capabilities will automatically reserve the anticipated amount of time based on algorithms derived from previous experience.

### c) Productivity reporting

In order to plan effectively, we must know how much resource a given task requires, whether that resource is time, space or funding. In order to manage effectively we must also know how productive individuals are and what the important variables to productivity are. Productivity reporting should permit the manager to examine classes of actions and report on the time each requires when controlling for a variety of variables about the task, the person assigned and the objects.

## 4. Fund-based system facilities

Controlling the expenditure or commitment of funds is a management function which is essentially identical in cultural repositories and other organizations. In either situation, management must budget the resource, account for its expenditure and use experience to make better predictions and plans in the future. The only significant difference is that collections managers are most often concerned with variables in expenditure based on characteristics of their holdings, so the accounting system must either record

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considerable data about precisely what cost money or be tightly integrated with the object and action management applications.

### a) Budgetting

Perhaps because cultural repositories expend the largest part of their financial resource on personnel (thus the importance of skill and time management), they desperately need to control their expenditures through budgetting. But budgetting for collections management is made significantly more difficult by the uniqueness of each project and each collection. Establishing budget categories that provide management with needed data is therefore, especially challenging. Software that supports interactive experience reporting and detailed budgetting would be ideal.

### b) Accounting

Accurate reporting on expenses is, of course, essential to any organization. Cultural repositories need, in addition, to be able to manage many separate (often hundreds of) funds, each usually with its own peculiar restrictions. Ideally, because taking on holdings is such a long-term commitment, accrual accounting systems that permit reporting of multi-year obligations would best meet the needs of collection managers. Sophisticated accounts receivable systems are rarely needed in collection management, although they might have their place elsewhere in archives or museums.

### c) Experience reporting/prediction

To realize the benefit of accounting and budgetting systems within collections management requires that these systems be able to report accurately on past experiences with the sophistication to control for any variables that might be important. Support for a semi-automatic multi-variate analysis to determine which variables are affecting costs for particular experiences would be exceptionally helpful. Automatic use of ratios established by the analysis in subsequent budgetting (unless overridden), would also be a valuable feature for collections managers, similar to the use of macros in Lotus 1-2-3.

## 5. Object-based system facilities

While it should go without saying that object based functions will play a critical role in collections management systems, few implementations of automated collections management distinguish effectively between objective and intrinsic descriptors of objects and subjective and extrinsic links. These

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features achieve efficiencies by making it possible to manage large numbers of items with a single action because they are recognized by the system as common along some extrinsic dimension to which the object is linked. (Obviously the system must also be able to identify items which have commonalities in some intrinsic attribute if the description provided is uniform.)

### a) Provenance and association - the context links

Before they were part of the collection of a cultural repository, objects in the collection had a history. This history is the reason they were collected in the first place. Some items were originally acquired because of their provenance; perhaps they were created by an exceptional natural process or an important institution, they were discovered by a great explorer or as the result of a significant international effort. In this case it is not incidental that an plow handle was among the exhibits at the World Columbian Exposition in 1893; it is the reason this plow handle is in the collection. Likewise, if we find two lava samples are in the collection from Vesuvius and Mt. St. Helena it is not because these were easier to get or were better samples but because a cultural repository, even a "scientific" one, has a popularizing cultural mission. Similarly, many items are in the collections because they were associated with events or persons of cultural interest. The axe that belonged to the Mount Vernon estate is otherwise unremarkable, indeed it might from time to time be used to illustrate the state of everyday consumer goods in Virginia in the 1760's. On the other hand, it is likely that this axe will also be considered in planning an exhibit on George Washington who is in no way intrinsically connected to the axe.

Cultural repositories depend upon the linkages created by provenance and association to make connections between otherwise unlike things. Because association and provenance can involve extensive records, each object having numerous owners and users over many decades or centuries, and because many objects can have the same association or provenance at some point in their life prior to coming to the repository, efficient collections management systems will not confuse extrinsic characteristics with the object itself, but will, nevertheless, provide means to manage the latter by characteristics of the former.

### b) Structural links and inheritance hierarchies

A potentially more powerful link for collection management purposes is created by the repository when items are accessioned into administrative

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groups of its holdings. This structural identification ("assigned to the Costume Division, as part of the Smith collection") is, again, not an intrinsic attribute of the objects. Other structural links (Aleut 3 excavation, 170 ft, level, in the kitchen area") are similarly extrinsic. The potential for collections management of establishing these structural linkages is that a large number of properties of objects "inherit" down these structural links and it is therefore not necessary to record certain data at the object (or component or piece) level, which can be recorded once at a higher level in the hierarchy, if the information system supports inheritance of attributes! One function that should be examined in collection management systems, therefore, is the facility with they distribute inherited information.

### c) Content links and authority incorporation

Some attributes of objects are assigned based on the actual content of the object itself, but are, nonetheless, subjective. If we state that a tool is paleozoic, the time periods of that era and associated information about how to properly identify paleozoic artifacts, can be made part of a secondary reference file, or "authority" and be incorporated into every object assigned the value of paleozoic. Likewise, if we state that a tool was manufactured by Black & Decker, we can associate this with a record which contains the corporate history of Black and Decker and its places of manufacture. Not only does this reduce the amount of information which must be redundantly keyed into the system (for other tools with the same manufacturer), it facilitates management of the collection when there is a need to gather all the items made by one manufacturer. It makes possible certain other kinds of searches that would be nearly impossible without it (all the handtools made in the 1930's by manufacturers founded in the 1850's).

## C. OTHER APPLICATION VIEWS OF RESOURCE BASED CAPABILITIES

While it is evident that collections management systems manage resources, the language of cultural repositories provides other ways to speak about resources management from the same data model discussed above. The administrative structures of cultural repositories reveal that other special conjunctions of time, space, personnel, property and funds with objects have an applied significance. These other application views of resources include the conjunction of time, space and objects which we call events; the

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conjunction of personnel, funds, time and objects we call actions; and the view of the internal attributes of objects, agents and events which we call authorities. Other, more limited, application views are subsets of events oriented, action oriented or authority oriented views. Exhibition history is a special event view, provenance a particular action view, and style is an authority concept combining attributes of the object and of the cultural context of the agents of its creation. While this report deals only with collections management systems, it is useful to introduce these other application views briefly both to illustrate that they arise from the same data model discussed in the prior sections.

### **1. Event-based system facilities**

#### **a. Constructing the Database**

Cultural repositories manage a wide range of events. Systems to support the management of event information must be designed to accommodate both what is common to all events (titles, dates, places, sponsors, etc) and what is unique to particular kinds of events. The common information permits us to manage all the events scheduled for particular places (rooms, buildings, institutions, cities or even nations) at particular times, while the unique information permits us to assign seats in theatres, berths on cruises, age groups for puppet shows and pages for publications.

Cultural repositories draw numerous different distinctions among types of events, usually based on organizational lines of responsibility, but for purposes of considering their information requirements, it is not very useful, for instance, to distinguish between lectures which take place in-house, in conjunction with an exhibit, and those which comprise part of what is often called outreach activity. All lectures involve one or more speakers who must be present at the lecture, take place in a facility with seats which may or may not be reserved but are limited, and require that we mail a follow-up letter to the speaker(s), possible including remuneration. All tours require transportation (and might need to consider requiring a deposit to cover its cost), and tours which extend across any normal meal times or bedtimes need to make arrangements for such meals and sleeping facilities but need not arrange for more than one hotel nor more than four (at the most) meals, per day. Thus the parameters of particular kinds of events can be defined in general terms, and the kinds of support which an information system should provide to the management of an event can be identified for each category of events.

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Specific events can be defined from the template for their type. Each option in the event can be identified (and associated with a range of costs) so that the event can be appropriately advertised, and, if desired, specific places can be reserved, at specific prices, by individuals or groups. Part of the support the systems provides for the event is that it keeps track of enrollments or subscriptions or reservations.

The structure of the events database must recognize that events can be comprised of other events. "Members' Day" may include a puppet show, film, cocktail party and sit down dinner; a course is a series of lectures; a tour includes tickets to other events along the way, etc. By using a building block concept, the templates for a small number of types of events can be used to schedule even the most complex of week-long extravaganzas.

The structure of the events database must acknowledge that there are two sides to an event: the public side and behind the scenes. Performers' names need to be known up-front and in back, but their addresses and social security numbers are only relevant to pay them and notify the taxing authorities. Unnumbered tickets to exhibits or cocktail parties are fine since there are no seats, but the system should limit tickets to the fire marshall's limits for the room, adjusted for average time of stay and numbers of no-shows.

### **2. Action-based system facilities**

The concept of actions is pervasive in collections management systems. Cultural repositories are not, however, typical "transaction processing" organizations, largely because as repositories of information considered to be of enduring value, they typically regard information about past actions as critical to retain, and they employ data derived from past actions in the process of planning future actions. Unlike data processing systems aimed at supporting "transaction processing" in finance, airlines, insurance and other high volume industries, the capabilities needed in cultural repositories have less to do with through-put

#### a) Action history

Many actions are performed with the collection daily. Each action is of a particular type. Thus many actions of each type are performed daily, weekly, monthly and annually. But many different actions are also performed on or with the same object. Each object has an action history, just

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as each action has an object history. Although we occasionally use the object histories of actions in administrative procedures, as in verifying the items insured in a shipment or the objects displayed in an exhibit, we frequently refer to, and use, the action history of an object. This action history includes its discovery or creation, its provenance, its acquisition and accessioning, its display and interpretation, and all other actions which are performed in its day-to-day management. A facility common to all collections management systems is to compile action histories or create pointers which permit them to be readily compiled.

### b) Status reporting

Most aspects of the action history are relevant only to the study of actions, but the "status" data element, which records the consequence of an action, informs potential users of the current disposition of an object with respect to any action. We don't have to acquire an item if it is "owned"; we can shelve an object known to have been infested when it is "fumigated"; and we can't study an item right away if it is "on loan".

Status reporting is not only a view of the action system from every other application (documentation, information retrieval, information analysis, etc.), it is the condition for many conditional actions, and therefore it is the glue which binds together the components of a procedure. Recall that one of the major functions of the collections management system is the ability to plan future actions and schedule them. But we know that most actions cannot be scheduled to occur at a specific time, but rather must occur, according to procedures, as a consequence of other actions. Therefore, in defining the data which characterize an action we provided for three varieties of time statements: absolute (a specific date or time), interval (recurring approximate times), and conditional (times which are based on the time of occurrence of another action, whether internal to the system or reported to it).

### c) Action accounting

Good management of cultural repositories depends on having and being able to use a knowledge of the variables in handling their collections. Our present information systems provide little knowledge of even the crudest measures of performance, such as the average amount of time involved in identifying, retrieving, conserving, reporting, and shelving an item requiring conservation intervention. But we need to know not just this, but the time, cost and levels of manpower required for objects in different stages of

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documentation, composed of different materials and having different sizes, being treated in a number of specific ways, and based on where in the storage areas they are located. How else can we allocate appropriate amounts of resource to the tasks we need to perform?

Accounting facilities, structured around actions, will provide us not only with simple "resource balances" for different actions, but also with data with which to analyze the sources of differences between averages for different materials, personnel, and specific actions. It isn't essential for the facility to actually execute such multivariate analysis, only to generate data which can interface to systems which can.

### 3. Authority-based system facilities

Significantly complex functions must be present in facilities required to support authority control over vocabularies recorded in cultural repository information systems. Unlike databases in more structured environments, nearly every field describing objects within a collections information system may require authority control, and a large number of distinct authority files will therefore need to be created, maintained and made available for searching.

#### a) Authority record maintenance

All of the facilities envisioned for the documentation sub-system are equally applicable in authority record maintenance. Each authority file is a peer file to the object file itself, with all the internal complexity and administrative problems (including the need to find and research the information), which the object file has. Among other implications, this means that one authority file (say geopolitical entities) can be an authority to data in another authority file (say personal names).<sup>13</sup> A substantially more complex aspect of authority files is that the records have non-arbitrary relationships which must be recorded and displayed. The best known of

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<sup>13</sup> Bearman, David & Szary, Richard, "Beyond Authority Headings: Authorities as Reference Files in a Multi-Disciplinary Setting, in Muller, Karen ed., Authority Control Symposium, Occasional Papers #6, Tucson, AZ, Art Libraries Association of North America, 1987, p.69-78. also, Bearman, David; "Buildings as Structures, as Art and as Dwellings: Data Exchange issues in an Architectural Information Network", Proceedings of the International Conference on Databases in the Humanities & Social Sciences, to be published by Paradigm Press, 1988

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these is the hierarchical (Broader Term/ Narrower Term) relationship, but other relationships, such as generational, causal, or ecological, can equally well be required.

### b) Authority search

If authority files are peer databases, the methods used to support information retrieval in the system should be available to search them as well. This would include, minimally, the ability to browse an authority file in an alphabetical or syndetic display. The syndetic display, which shows related terms in proximity and represents their relationships, is a major computational capability, especially if a variety of relationships are to be supported.

### c) Update from Authority records

Ideally, when a change is made in an authority heading, all the records which have that term assigned to them will reflect the update. This may take place physically, by overwriting the original term in each record, or simply by changing the value of the authority record to which a pointer in the host record leads.

### d) Authority-based search

The primary reason to control vocabularies is to assure that records will be retrieved together with other records indexed according to the same idea. Thus if the curator/cataloger identifies a cooking pot as having been made in Rhodesia, it will be retrieved together with other pots from Nyasaland and Zimbabwe, since these three geopolitical terms refer at various times to the same geographical place. This facility can be implemented in a number of ways, including by replacing the terms Rhodesia and Nyasaland by the term Zimbabwe as is frequently done in present-oriented library systems, but to most curators in cultural repositories, this creates an intolerable error in the database. More acceptable approaches leave the (accurate) attribution of the objects in place, but link them in the search process. This process will provide a user requesting any of the three terms with access to the authority file in which the scope notes will explain the relationship among the terms. The system will then seek all three terms or any combination. The same interface is used in exploded authority searches in which the user is given a syndetic display of the authority file and is permitted to identify all

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branches of the term relationships which should be searched, and how high or deep in the structure to search them.

### e) Term substitution/linkage and synonymy

From the above discussion, it should be evident that terms in authority files may substitute for each other along some linkages and maintain their independence (while working together in exploded searches) in other linkages. Authority control systems however must also maintain separate structures for various uses of a term which in particular contexts are synonymous. Arches are architectural forms, bone structures, and geomorphological features, each of which could be represented in the authority files of a cultural and natural history museum, however a user interested in searching the database on the term "arches" does not want all three. The synonymy linkages between authority files must be displayed in such cases to permit the user to first identify the sense of the term desired, and then to search the authority.

### f) Authorities as reference files

If authority files are peer databases to object files, then they are in themselves reference files. The geopolitical authority file described earlier provides a history of the political entities of the world and their relationships. An "artist" or "inventor" subset of a person authority file is a biographical dictionary when it is not simply the source of a name in an object record. Given the immense intellectual effort required to maintain authority files, it is a good thing they do have this added value. The appropriate experts to add this value, to create "authorities", are scholars in each field: geographers for geopolitical and geomorphological authority files, biologists for taxonomic authorities, art historians for subject files for some other queries. Databases of such authority data have, in many cases, already been created by these expert communities and are often already linked to bibliographic databases and other secondary references. One of the facilities desirable in any authority control system, therefore, is the ability to import such pre-existing databases as the foundations for internal authority records. Whenever it is possible to leverage greater connectivity by adopting a pre-existing vocabulary wholesale, collections managers should seriously consider doing so, both for their own immediate benefit and for the benefit of future research use.