

Communications as a Design Consideration in Developing a Computerized Nursery Management Environment¹

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Abstract: The transition from a manual to a computerized is successful only if the designers consider three levels of communications in the social and technical environments. In order of importance, these levels include communications among the staff members, communications between the staff and the computer, and communications between computers.

INTRODUCTION

The purpose of this paper is to examine how three levels of communications have played an important part in the development of the nursery management tool for Oklahoma. The three levels are:

- communications between members of staff,
- communications between the staff and the computer,
- communications between the various computers in the operation.

Consideration of the levels of communication has developed from the observation that the office environment is often viewed by management as being split between social and technical considerations. The author contends that, if the manager of a nursery wants to successfully convert from a manual to an automated operation, all three levels of communication must be considered.

COMMUNICATIONS BETWEEN STAFF MEMBERS

The 'traditional' manner of software development has been for the software designers to meet with the managers and supervisors of a particular operation and decide among themselves what software is needed to automate an office. The staff workers are not brought into the

picture until after the development process has been completed. Their first view of the system is when hardware and software are installed in the office. The group at the Forest Regeneration Center in Norman, Oklahoma have taken a quite different approach to the development of their system. From the first moment of development to the present time, the staff has been deeply involved in the definition of system specifications, design of the work flow in the system, and preliminary testing.

The most important role that the staff has played has been that of an information filter. The first meeting with the Oklahoma staff revealed the vast amount of paper work that an integrated nursery system would replace. In an ideal system, one of the goals of the development team is to filter the large amount of information for superfluous and redundant data (fig. 1). The members of the Oklahoma nursery have played that role of information filter.

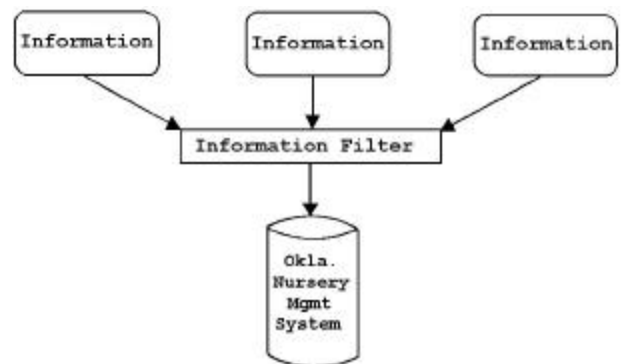


Figure 1 -- The Nursery staff acts as the filter which determines what information will be included in the automated system.

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In addition to aiding in the design of the system, previewing the information proposed for inclusion in the automated operation has allowed the staff to review the data that they have been

collecting in the past. This whole process of bringing the staff into the design process has had ramifications which should last long after the automation process is complete.

Promotes a Spirit of Ownership

Bringing the staff into the development process promotes a spirit of ownership in the final product. This is important during the conversion process.

In a typical conversion process, the manual system runs parallel with the automated system. This means that the nursery staff will have to maintain both systems together for some specified length of time. The period is trying at best, but the path is much smoother when the staff feels that they have had a significant impact on the development of the product.

Provides a Creative Outlet

In the same light, including the staff in the development process allows these individuals to exercise their creative talents. It must be remembered that these are the individuals who have been performing the day-to-day tasks. Many have 'ideas' as to how the data should be collected, displayed, and reported. Involvement in system development provides a job enrichment unlike any normally available to the staff.

Lowers Resistance to Change

For long-term employees it may be difficult to accept a new way of collecting and reporting data, if an automated system is simply installed without their input. In some cases, change is a process that some staff members cannot accept; however, involvement in this type of a project at least gives the manager or supervisor an opportunity to whittle away at the resistance. Input from these long-term employees is important to the project. There may be a reason why the manual process should not be automated and this reason needs to be heard.

Reduces Training Time

A great deal of resources in the form of time and personnel may be needed to train individuals in the operation of the automated system. If these same individuals are part of the design process, they receive their training in an evolutionary manner as the project progresses. When they finish testing the final process, management will find that very little additional training will be necessary.

It is often seen that employees don't fear the changing process as much they fear the new technology. They are literally uncomfortable

when they sit in front of a computer for the first time. Given incremental doses of involvement with the computer helps to lessen the apprehension these individuals feel.

COMMUNICATION BETWEEN STAFF AND COMPUTER

The Integrated Environment

The Oklahoma Nursery Management System has been designed as an integrated environment. Though it does not encompass every function encountered in the management of a nursery operation, its operation does include most of the major data-generating activities (fig. 2).

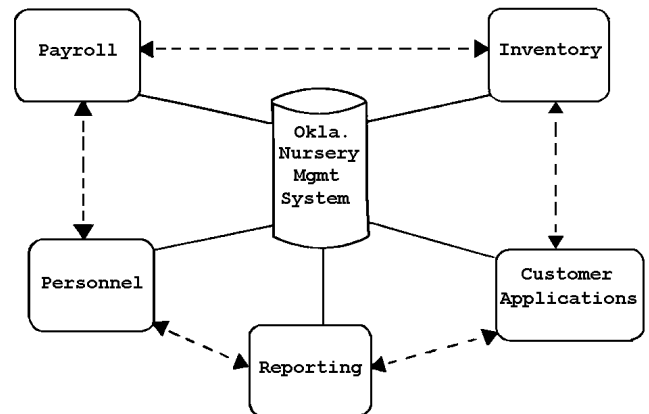


Figure 2 -- The automated environment showing the communication between the various submodules and the main environment.

As Figure 2 implies, the integrated environment was designed not only to bring all of the data activities under 'one program', but more importantly this type of configuration allows each submodule to 'talk' to those submodules which store data needed to complete a calculation. This environment is not one program but rather a number of programs linked together through a number of programming techniques. To the user, the nursery staff member, the movement from one submodule to the next is virtually transparent.

Figure 3 illustrates the concept of one submodule talking to another. In this case, the Payroll module (which, as one of its functions, collects information on cultural practices by hours for each particular specie) needs the names of the species which the nursery is currently growing. So it 'asks' the Inventory module which species are currently being grown. On the other hand the Inventory module needs to calculate the cost of growing a particular species of seedling, so it 'asks' the Payroll module how many hours and in what cultural

practices time was spent on a particular species. Again, this transfer of information is totally transparent to the user, but is maintained by separate programs in the system.

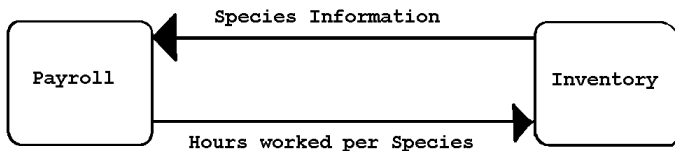


Figure 3 -- Transfer of information between two modules in the integrated environment.

A Dynamic Dialogue

Communications between the human staff member and the computer is a dynamic process. Interaction between the two entities changes from one day to the next. The problem that faces the system designer is that, once the program is installed, the program is, in a sense, in a static state. The process of moving from one part of the program to another does not change simply because it's Monday instead of Thursday. But the data and the database are dynamic. They are in a constant state of change.

Menus are the standard means of moving from one point in a program to the next (fig. 4). From the designers standpoint, menus are simple to Program and they present no particular difficulty in error-checking. From the user's standpoint, menus are simple to use, self-documenting (to a point), and, in most cases, quite boring after the first few times through a program.

It seems to be a step backwards to involve your staff in the development of a computer system (where you are trying to unleash their creative talents), and then to saddle them with a system driven by one of the least creative selection mechanisms. The Oklahoma system only uses menus to move from one major program segment to the next.

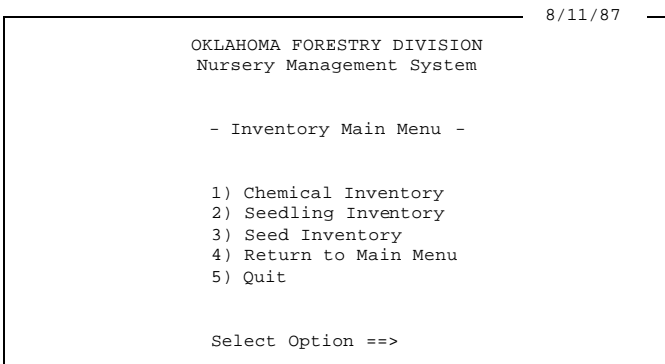


Figure 4 -- Menus are used only for movement from one major program module to another.

Data selection and data manipulation use one of two mechanisms. In a database environment, data records are selected by keys embedded in the data. In some cases a key may be an employee's name or social security number. In another case, a key may be a particular species or species code. In many cases, the key is a logical representation of the character string which actually retrieves the data. So the program must prompt the human for the information it needs to build the physical key. Figures 5 and 6 show two methods that the Oklahoma system uses to prompt the staff member for the necessary information to build a key.

In the first case (fig. 5), the staff member is using the Payroll submodule and is about to add hours (specified by cultural practice) to an employee's record. The individual entering the data is using the employee's social security number to pull up the employee's work history. The social security number may have been the only means the staff member had of identifying the employee, or the staff member may have felt that using the social security number was a faster means of getting to a particular employee's record. The point should be made that using either the name or the social security number of the employee would have led to the same record. In this case, name and social security number are alternative keys for a particular employee's record.

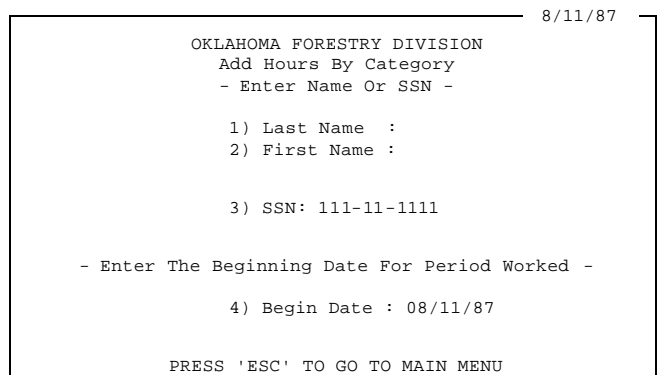


Figure 5 -- Data selection through alternative keys. The computer prompts the user for the information needed to locate an employee's record.

Though figure 5 appears somewhat like the menus that were slandered above for their inherent lack of creativity, the difference between the two is that in using a key screen, like that in figure 5, the staff member needs to make decisions. The first decision is what key to use. If an employee is not located using that key, the user needs to decide what alternative key to use to perform the search.

Figure 6 illustrates another mechanism which the Oklahoma system uses for gathering

information it needs for generating a key. The user is in the Inventory module and wants to add Ponderosa Pine to the species inventory. Rather than flipping to a separate screen to ask for the species name or species code, a window automatically pops up on the screen indicating to the user that the computer needs some information before it can continue its processing. The message in the bottom of the pop-up window indicates that the user used the species name as a key to the species' records. Since no species record existed for Ponderosa Pine, the computer indicates this fact and asks the user for the species code in order to complete the initial construction of the species record.

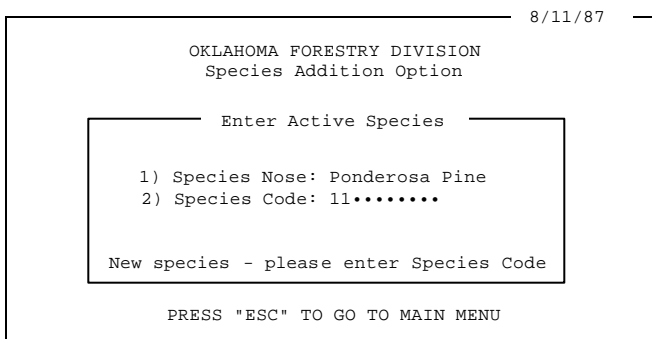


Figure 6 -- A pop-up window which prompts the user for information needed to construct the key for new species record.

The final method the Oklahoma Nursery Management system uses for obtaining a key to a specific record is shown in figure 7. Again, the pop-up window mechanism is used. In addition to alerting the user to the fact that the computer needs some piece of information, the pop-up windows eliminate a number of screens and, in some cases, a number of menus.

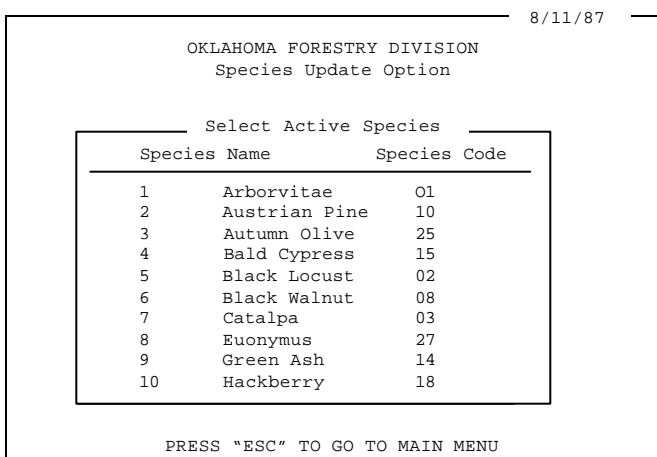


Figure 7 -- A pop-up window which allows the user to select a given species from the list of active species.

The difference in the case of figure 7 is that the choices presented to the user are fed to the pop-up window straight from the species database. The user selects the species to update by moving a cursor to the left of the number corresponding to the species of interest. By pressing the enter key, the selected species is brought into active memory and is available to the user for update.

Data Entry - A Model of Simplicity

Next to manipulating the data (producing statistics and reports), the most important function of any data processing system is incorporating data into the database, i.e. data entry. Many designers disagree on the level of sophistication of a data entry screen; but, there is no disagreement on the fact that data validation is a primary concern of the system designer. The integrity of the database is protected only to the extent that the designers provide for error checking when designing the screens. There are two basic data entry screens being used by the Oklahoma Nursery Management System. A conventional screen (fig. 8) is used for gathering most of the raw data for the database records.

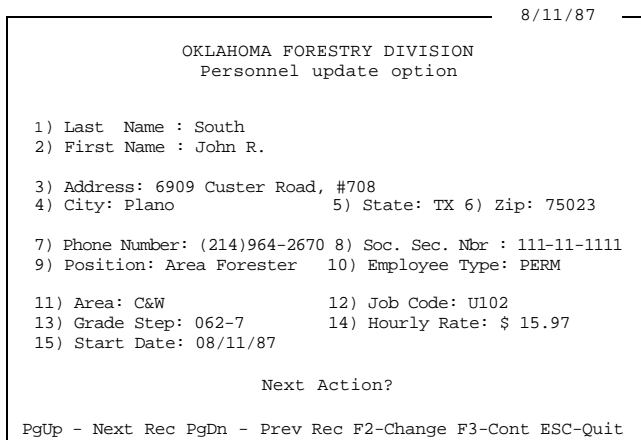


Figure 8 -- A data entry used to enter personnel information. Each field is validated for type of data, length of the data field, and the range of the data.

Not all the information shown in figure 8 typed in by the user. The Oklahoma system is designed to put information on the screen for the user once it has enough data to perform this operation. For instance, in figure 8 the user would type in the employee type (PERM), area (C&W), and the job code (U102). The system determines that this data corresponds to an Area Forester of Grade 62. The user then entered the step (7) and the computer responded with the hourly rate (\$15.97).

Figure 8 also illustrates one of the primary design features of the Oklahoma Nursery

Management System. At the bottom of the window is a key selection menu. If the user were to press the PgUp key, the system would bring the next personnel record up on the screen. Pressing PgDn would bring up the previous record. This one key operation is designed throughout the system and allows the user to move through the database and to select particular operations without having to go another menu or another screen.

In some cases, a large amount of numeric data needs to be entered into the database. The Oklahoma system handles this by providing a matrix-like screen system (fig. 9). The upper part of the screen indicates the data record the user is working with; the bottom part of the screen is used for the data entry. Since not every field will be used for storing data, the user can move the cursor to the proper fields (not unlike a popular spreadsheet package).

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OKLAHOMA FORESTRY DIVISION      8/11/87
      Add Hours By Category
Name:  South, John R.           SSN : 111-11-1111
Address : 6909 Custer Road, #708   Job Code: U102
          Plano, TX 75023          Area:   C&W
Position: Area Forester           Type:   PERM

Enter Time Spent On The Following Categories For: 08/11/87

1) Chemicals >...   10) Seed Inven.>   19) Count/Tie >
2) Hand Chem. >    11) Equipment >    20) Topcut >
3) Weeding >      12) Grounds >      21) Seed Harv. >
4) Fertilizer >   13) Seed. Rec. >   22) Seed Proc. >
5) Soil Amend.>  14) Training >    23) Planting >
6) Irrigation >  15) Admin. >      24) Cult. Pact.>
7) Site Prep. >  16) Shipping >    25) Misc. 1 >
8) Cover Crop >  17) Ship. Admn.>  26) Misc. 2 >
9) Research >    18) Mach. Harv.>  27) Misc. 3 >

Day's Comments:
          F2-Enter Comments   F3-End   Total Hours:
          PRESS "ESC" TO GO TO MAIN
  
```

Figure 9 -- Numeric data is entered into the database through a matrix-like screen.

In the case of figure 9, the user is entering the hours that a particular employee has spent working on the listed cultural practices. Since the hours spent on some cultural practices (for instance, weeding) need to be broken down to the species which were worked, the Oklahoma Nursery Management System alerts the user to this fact by generating a pop-up window which allows the user to enter the appropriate data (fig. 10).

COMMUNICATIONS BETWEEN COMPUTERS

Communications between computers is an area which is beginning to receive a great deal of coverage in the computer press. This media coverage is doing more for the sales of expensive communications hardware and software than it is for generating legitimate development ideas in operations converting from manual to automated processes. There is no doubt that many operations will eventually evolve into systems which can effectively take advantage of concepts such as local area networking, distributed

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OKLAHOMA FORESTRY DIVISION      8/11/87
      Add Hours By Category
Name:  South, John R.           SSN : 111-11-1111
Address : 6909 Custer Road, #708   Job Code: U102
                                          C&W
                                          PERM

      Hours By Species
Please Breakdown 2.00 Hours Over Species Worked On: 08/11/87

Arborvitae >      Aust. Pine >
Cypress >         Aust. Pine C>
Black Locust>     Pond. Pine >
Black Walnut>    Scotch Pine >
Euonymus >       Shtleaf Pine>
Green Ash >      Virg. Pine >
Hackberry >      Imp.Lob.Pine> 1.00
Lacebark Elm>    Cottonwood >
Mulberry >       Baldcypress >
Osage Orange>   Bur Oak >
Pecan > 1.00     Catalpa >
Red Cedar >     M. Rose >
Russ. Olive >   Redbud >
Autumm Olive>   Sand Plus >

Total Hours:
                2.00
  
```

Figure 10 -- A pop-up window which prompts the user for the hours by species for a particular cultural practice.

processing, and mainframe links. From what the author has seen over the past few years, some system designers get caught up in the technology and overlook the true purpose of the system. In fact, in some cases, they go so far as to purchase the hardware and then try to make the system fit the hardware.

WRONG!

The conceptual design of data acquisition and database manipulation needs to be considered first. Granted, the specifics of a particular system may necessitate a hardware intensive design, but that decision should not be made until the database design is well thought out.

In the case of Oklahoma, the nursery system is designed to be a stand-alone system. But it is also designed in such a way that, should the Forestry Division decide to expand into a different configuration, the software can be modified relatively easily to meet the changing environment.

The current system is designed to use rudimentary data communications techniques as illustrated in figure 11. The communication techniques are rudimentary in that the data files are transmitted from one node to the next manually. For instance, the Area Forester can transmit a set of data files to his Supervisor in the capital. In another case, the author's firm can transmit the latest version of a particular report schema to both the capital's computer and to the computer at the Forest Regeneration Center. The point to be made is that this is all the high tech communications the operation needs at this point in time. Some day the nursery in Norman may operate as a node in a distributed processing environment with the capital, but that day is still a ways off. The managers in that operation have made the decision to concentrate on their software environment and to develop the overall system (hardware) as an incremental process.

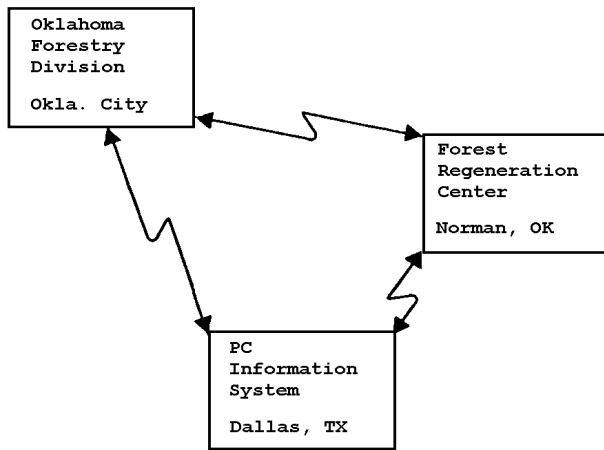


Figure 11 -- Communications between the computers involved in the Oklahoma Nursery Management System.

FINAL COMMENTS

Of the three levels of communications which

the system designers need to consider when converting a manual operation to a computerized environment, the most important area of communications (from the standpoint of the nursery) is the communication among the members of the staff. This level of communications has the most far-reaching impact and will have the greatest long-range effect on the individuals in the operation.

It is inherent that the system designers stress simplicity when they develop a particular automated environment. This will lead to less resources being devoted to training and will alleviate the frustrations that the non-professional computer user feels when working with a system that is not self-documenting.

Finally, it is important that the system designers understand how hardware, software, and the evolutionary stage of the development process all relate to each other. Though it would be nice to incorporate all the neat, sophisticated hardware available, in most cases, during the manual-to-computer conversion, these high tech gadgets are inappropriate.