

CD ROM TECHNOLOGY
AND
ITS ROLE IN
DESIGN ACTIVITY

Ramamurthy Shastri B.G.

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Industrial Design Centre
I.I.T. Bombay

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by Ramamurthy Shastry B.G.

Guide: Prof. R.K.Joshi

MSR-6

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April, 1989
IDC-IIT, Powai
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RAMAMURTHY SHASTRY B.G.

APPROVAL SHEET

This special project entitled 'CD ROM Technology and its role in design activity' by Ramamurthy Shastry B.G. in partial fulfilment of the requirements for the Masters Degree in Industrial Design.

Guide

Industrial Design Centre

INDIAN INSTITUTE OF TECHNOLOGY

BOMBAY

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INTRODUCTION

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Computers and their applications have been evolved with the evolution of storage media and their capabilities. Every time the storage density increased resulted in new applications with better and better facilities for the users. While the first computers occupied the space of a room with very few arithmetic and logical functions, the latest personal computers with portability (lesser than the size of a brief case) can do better than big minicomputers.

The following table provides a summary of some of the characteristics of personal computer storage media, both currently available and under development. But it is to be noted that no one medium suits all applications, nor one can generalise the suitability of a particular medium to specific environment. Each has its own advantages and limitations.

Storage and/or Distribution Media for Personal Computers

Media	Key Features	Target Applications
Cassette tape	Lowest-cost media, variable capacity (up to 60MB), easy to transport and store, not durable, slow access/serial	Backup of data files, backup of program files
Floppy disk	Relatively low cost (\$1-\$3), easily transportable, difficult to copy-protect, capacity to 1.5MB, more durable than tape	Program distribution, user data storage, limited copy protection, limited backup storage
Hard disk	High cost(\$500-\$1500 per 10MB), medium to large capacity (avg 10-20MB), high-speed access, more reliable and durable than floppy	User data storage (not archival), per program storage, download reference data
CD ROM	Low-cost media in volume (\$2-\$5), low-cost drive(\$500), large capacity (500-600MB), durable, fast data access, current high mastering cost, still-video storage	Reference data distributor (large volume), large program distributor (large volume), interactive training
Writable compact disc	High-cost media(\$250), high-cost drive (\$3000-\$5000), no mastering costs, large capacity (100MB), still-video storage	Reference data distributor, large program distributor, backup storage, download reference data, interactive training
Read-write compact disc	Expected high cost, expected large capacity	To be determined, currently unavailable

Computer industry is excited about the vast potential of this emerging CD ROM technology for a number of reasons. It is quite different from any other media like TV, movie, video, slides, audio, books or personal computers. In fact one might look at the CD ROM as a combination of all these media. In a few years after CD ROM, becomes common, anyone looking back at the information, education or entertainment applications of today will understand the limited appeal they have had.

CD ROM will proliferate in two ways one as peripheral to existing personal computers and second the heart of a new 'viewer' device which will be more similar to the stereo and television than a computer. It is this second way where a designer can contribute, use his creativity to make CD ROM successful. In the same way that the first computers consisted of someone standing in front of a TV camera reading radio reports, initial efforts will not stretch CD ROM to its limits. But one has to put efforts to develop, only then new applications can be created. Maps, catalogs,

reference works, training courses and educational books will not only shift to this new medium but also will acquire a new meaning.

The scope of this project is to understand CD ROM technology from the design point of view. The relation of the CD ROM technology can be better understood by exploring the applications and application areas. Some of these applications can be taken as projects in IDC.

CD ROM FEATURES & SYSTEM

CD ROM : FEATURES AND SYSTEM

COMPACT DISC READ ONLY MEMORY (CD ROM) represents an exciting break through in information storage technology. Even though it is just a computer storage medium which can store the information in the digital form, its capacity to hold the incredible amount of information has made it more than a storage unit. It is a new publishing medium, centre of a genre of computer and an educational tool of unprecedented power.

Each CD ROM disc can carry 550 megabyte of digital data. This is enough to hold

- the text content of 150,000 printed pages (enough to fill 250 big books)
- sharp images of 15,000 big business documents (enough to fill two tall filing cabinets.
- the content of 1200 standard 5.25 inch floppy disks.
- A crisp color picture and 10 second of narration for each

of 3000 segments of an educational or reference program
(almost 8 hrs of content)

- large amounts of anything else which can be represented digitally or any combination, in any proportion and order of any of the above.

Capacity is just the beginning. Since it is storing the information, it can be text, audio, computer graphics or still video frames.

Much of the excitement about CD ROM can be attributed to the compact disc audio the successful new consumer format for the distribution of music. CD ROM is an extension of compact disc audio. All this has come from optical disc technology, which is a great leap forward in the quality, quantity and variety of data that can be stored and what can be done with that recorded information. Compact disc audio was launched in 1982, and CD ROM came in late 1985.

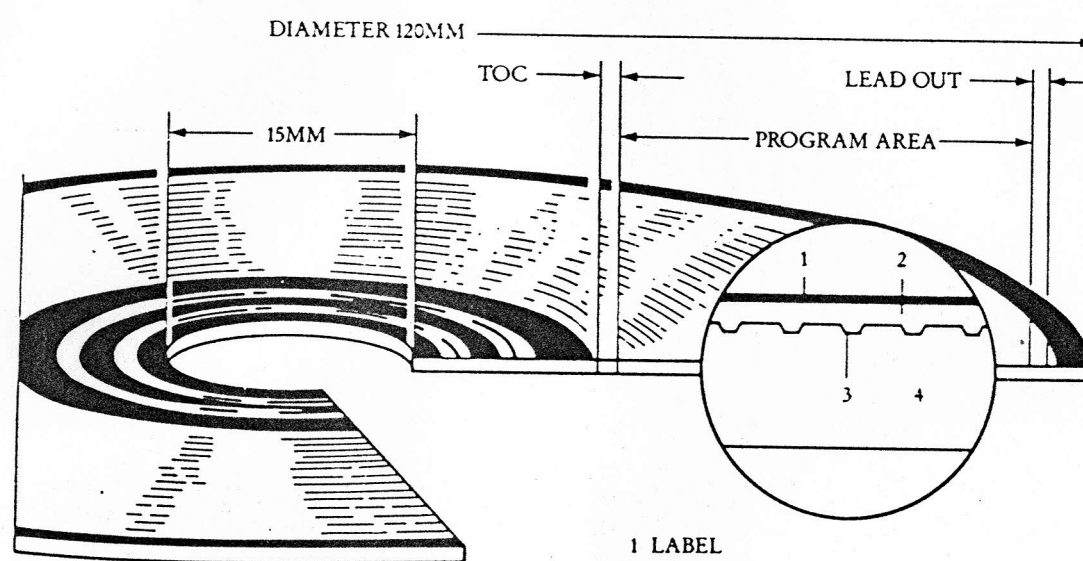
CD ROM Production:

CD ROM is a 120 mm disc in diameter, 1.2 mm thick. The information in the coded form, from a magnetic tape is burnt into a specially coated glass master disc by a powerful laser beam. The beam records digital signals as shallow pits and grooves on a long spiral path, rather like a conventional audio-LP, but much much denser. Metal stampers are created using this master to press copies in a special plastic. A fine film reflective aluminium is laid over this and sealed under a tough, clear plastic topcoat but protects the data from damage. Reading is done by a laser beam reflection. The output of the player itself is compatible with existing audio and video equipment.

One of the most time intensive aspect of CD ROM publishing, is data preparation. This is the time 'after', you have all designed the application and acquired data and 'before' the disc is mastered and replicated. For this,

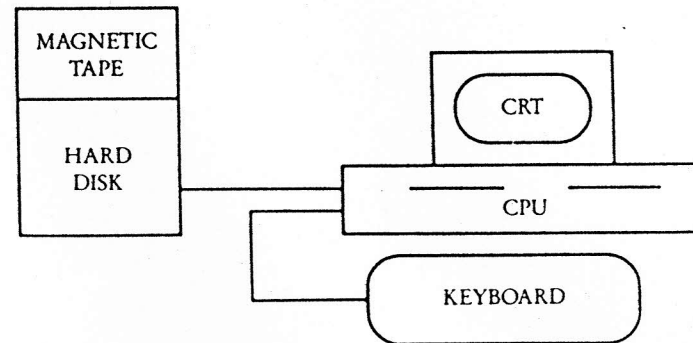
one has to have a data preparation system, which varies with sophistication required. Minimum could be a personal computer with a hard disc and 9 track magnetic tape storage (shoe string system 1 Or it could be enhanced with more hard disk and magnetic tape drive.

Multimedia data preparation system could be a better system for experimental purpose as it provides accessibility to video, audio, and graphics also. But it is possible to start with shoe string system and build up later as one learns more about the needs.



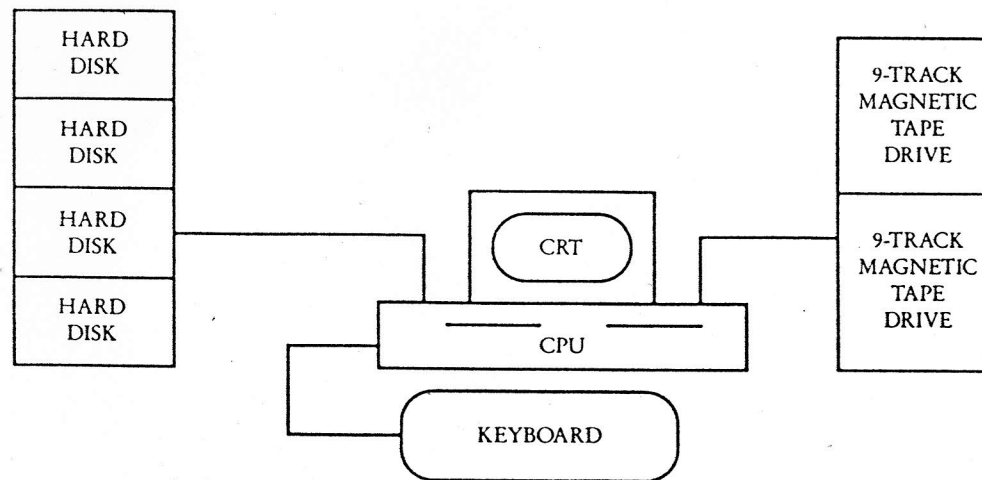
- 1 LABEL
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- 3 REFLECTIVE COATING
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COMPACT DISC

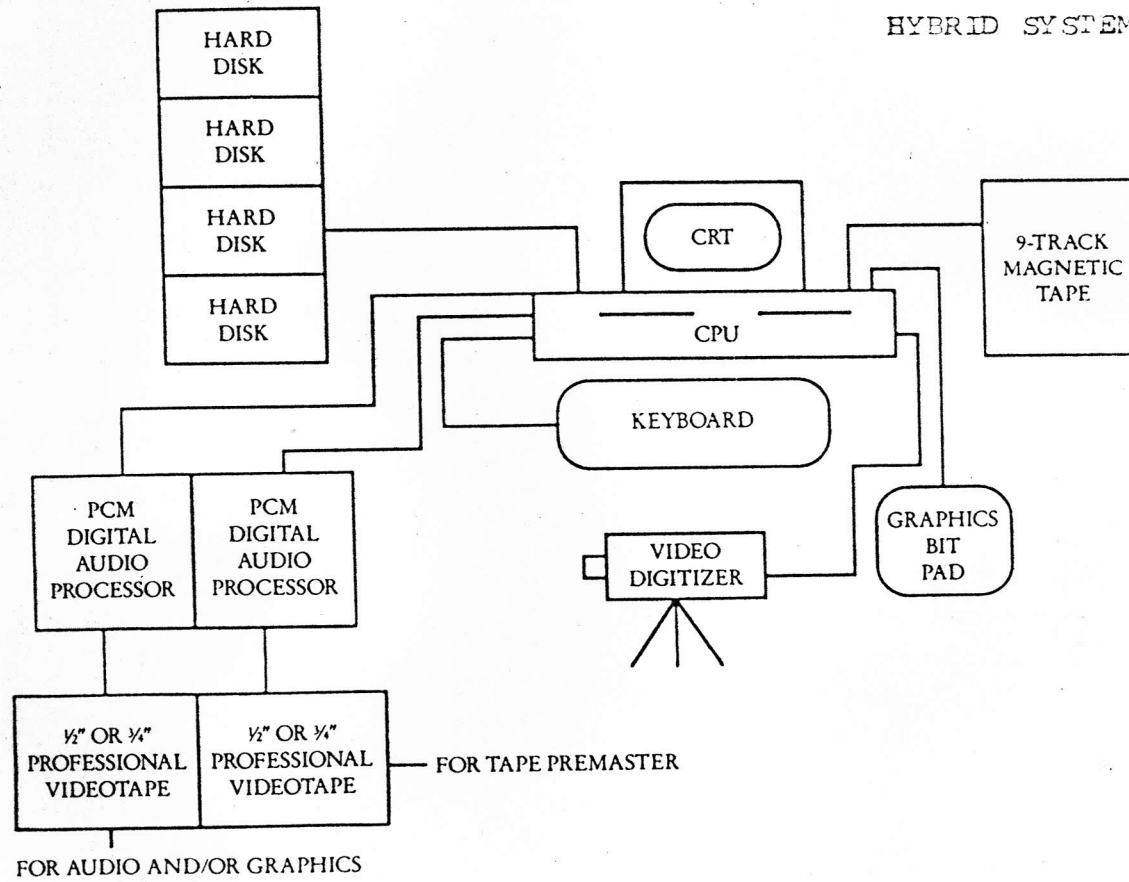


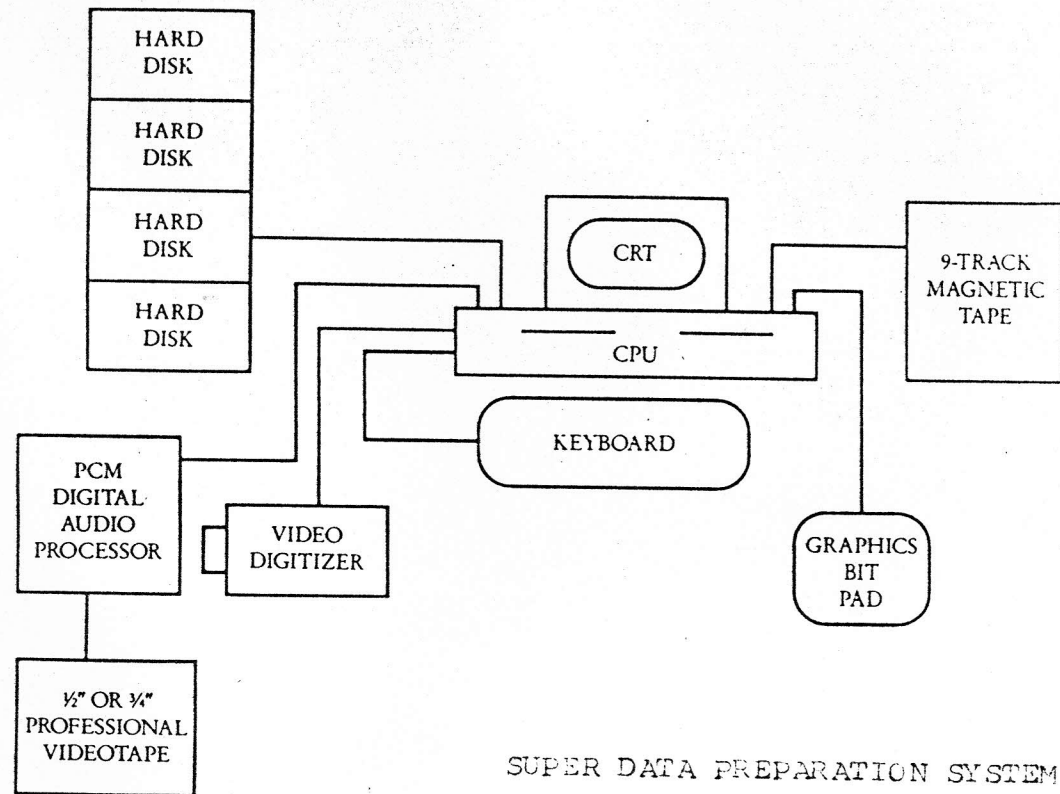
SHOE STRING SYSTEM

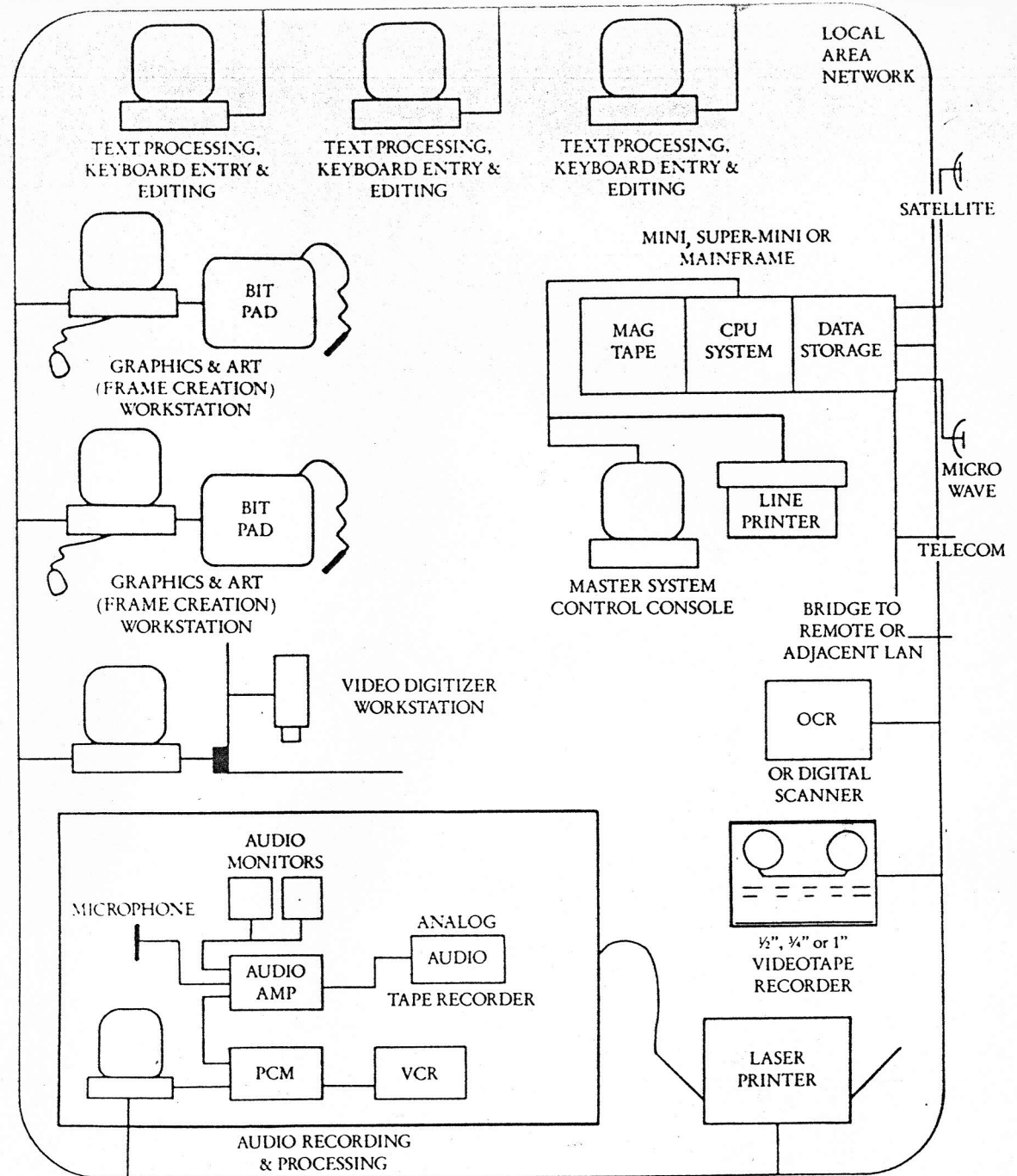
ENHANCED SYSTEM



HYBRID SYSTEM







MULTIMEDIA DATA PREPARATION SYSTEM

ELEMENTS OF DESIGN

ELEMENTS OF DESIGN

1. Multimedia:

In computer terms multimedia is reviewed as a blending of media types, text, audio, visual, and computer data in one convenient delivery medium. Information sources such as books, periodicals, films, television, LPs computer etc are viewed as separate and distinct media. The development of compact disc technology enable us to mix information from variety of media or sources. It is a challenge for the designer to select the best creative concepts from each media and combine them to evolve a new concept for compact disc.

2. Interactivity:

For the question what is interactivity there are probably as many answers as there are applications. Even though the basic concepts of interactivity from computer point of view is answering the question posed (telling

yes or no almost) by the computer, the level of interactivity with the user varies with the type of application and its complexity. The designers role is to balance the objectives of the application with the degree of interactive control that is to be provided to the user. This balance must be struck all the times while a video game might require a continuous interaction from the user, an instructional program would require an occasional starting and stopping.

If you want to write an interactive document you must write what amounts to a script to be acted in an interactive medium. Consider how a programmed text book works. First it presents a situation or concept on page 3, then it asks the reader a question about the presentation. If answer is correct it says turn to 4 otherwise 5. This can go on but is too cumbersome.

CD ROM devices with high density access offer the greatest potential for interaction today. But it is

always limited by the system in which the user uses the program. Whatever is the limitations of the media learning to write interactively provide benefits such as the following:

- . Natural give and take between the application and the user.
- . Multiple choices including the consequences of those choices.
- . Different levels of details, difficulty, or security depending on user needs.
- . Access to the full potential of the medium.

3. Page to Screen:

When the information source jumps from page to screen, it creates problems to both designers and users. Problems lie primarily in two areas, design of surface and interface. Surface design involves making decisions about typography, layout, use of graphics, illustrations in the

text. Interface design is related to way finding problem - helping users navigate through parts of the text, move from one level of information to another, retrace, find help retrieve some other parts etc. Here there is no physical feeling of the book is not there. So he should be able to just browse through the text, keep a mark, or able to refer to two pages simultaneously etc. Thus there is a lot of difference and scope between page design and electronic text design. CD ROM offers a greater challenge to the designers.

4. Audio Visual:

Even though CD ROM can not provide moving pictures, it offers a high potential for audio-visual itself. Audio visuals has its own strength as compared moving pictures. There is a lot of possibilities for building relational sequences, by juxtapost. Taking and using a simple still image is far more easier and cheaper than moving pictures. It can make use of large quantities of average material.

Using computer graphics and text material if enhances the power of audio visual. By clever use of pictures it is possible to give a bit of motion effect also which would become a special effect.

5. Team Approach:

Optical disc technology has been a boon for interactive program designers. Although designers might like to work individually, as the technology continues to develop, the team approach for programme development makes more and more sense, both from programmatic and creative point of view.

There are five major tasks in the production of optical disc programme:

- . Analysis and design of application
- . Script and story boarding
- . Production and disc mastering

. Programming and integration

. Evaluation and revision.

1. Analysis and Design: Project brief is prepared through analysis and the overall outline of the work involved is designed to distribute the work into teams.

2. Script Writing and Story Boarding: Script and story board are prepared deciding the portion of text, graphics etc.

3. Production: This includes all activities of program information preparation of different media. It is converted into digital format and stored in magnetic tape through data preparation system. The master is prepared using the tape and copies of discs are printed.

4. Programming: Control software is developed for interactive programming.

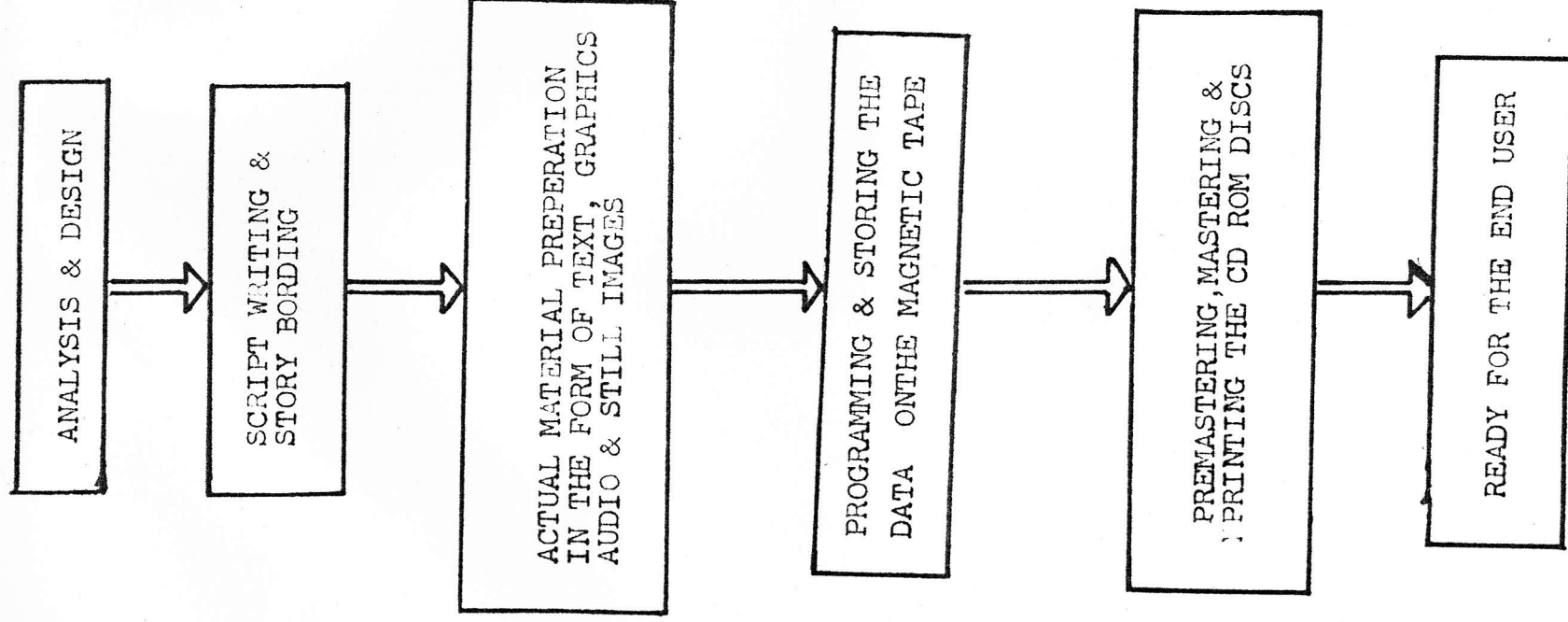
5. Evaluation: Evaluation of the project should be conducted in parallel with the production by all team members to make sure that the program works as intended, since the

information will be in 3-4 medium. Formal evaluation at the user end would help for the next disc production.

Depending upon the projects a team may be consisting of different experts for each of the task. However a typical team might be

- a project manager who will co-ordinate the activity and progress
- a project director who will exercise the creative control and ensure all materials are correctly integrated
- an author who writes the script and text screens
- a designer of audio-visual material
- a graphic designer to originate imager and to design user interface screens.
- a programmer to write the software required.

The significance of team approach is that the expertise of widely differing people can be focused towards a common goal.



APPLICATION DEVELOPEMENT
& DESIGN

DATA PREPERATION ON
THE DATA PREPERATION
SYSTEM

DISC CUTTING IN THE
FACTORY

PROCESS OF CD ROM PRODUCTION

APPLICATIONS

APPLICATIONS

The term application development takes on new meaning as we move into CD ROM. Application development requires an understanding of the market, use and potential of emerging technology. It needs highly creative people to develop new applications. The specialists who can work on this are designers, educationists, entertainers, information technologists. To start with one could use the present applications itself.

1. Multilingual Dictionary

An application like multilingual dictionary which needs a large amount of storage can make use of the compact disk technology. It is possible to organise meanings of the words in different languages, their pronunciation script etc together. Such a dictionary would help translations, linguistic work etc. There is already a multilingual dictionary existing which can be taken as the source material. A designer would be involved in developing typography, layout, interface, organisation of the dictionary.

2. Catalog of Terms and Terminologies in Design Field

One could develop a catalogue of terms and terminologies used by designers. They carry special meanings more than ordinary usage. Such a catalogue can be more than just a dictionary containing lot of visual references. It is like a databank. The word should give the works and material related to it, along with the meaning, definition etc. For example take a word symmetry. It can provide meaning in the text and visual form, the related work done on it, the persons worked, references of books, journals, products etc. This can be developed in IDC and put into CD ROM for ready reference.

Ofcourse this can be extended to other disciplines also.

3. Product Catalogue for the Industries:

There are so many products coming out every day. But it is very difficult to get details of the products, price, ads etc. If a publication like periodical can be easily brought out through CD ROM. This ofcourse would be similar to key word dictionary discussed above.

4. Educational Material Through Audio Visual for Schools/ITI

So for computer in education is mainly used for higher education specialised instructions. It is basically because of the cost and the interaction of the student with the computer. That is to develop something after acquiring the sufficient basic knowledge through other media. This is the case in India even though data banks are there abroad. When we talk of the higher secondary education, there is a lot of information to be provided, to increase the knowledge of the student. That means there is a requirement for an informative media. Interactivity is also required, but the question is should it be through computer? As we know it is not possible to provide one computer to one student, the students won't even be able to share. That may not be feasible. A specialised system of CD ROM is a solution for such an application, which can be used as a media giving a large amount of information for a group of students. Here it is just a media providing information without any direct interaction. It gives an opportunity

for the teacher to be involved in the program, which otherwise may not be possible when the computer is used as a self learning tool. Even the teacher may be given an option to program the lesson.

For such an application the product at the user end has to be developed. This consists of a CD ROM drive, a projector (let us call it a CD ROM project) a micro-computer monitor with a control terminal for programming. The picture is projected on a screen, so that the whole class can observe.

The possibility producing in different languages is an added advantage as the material prepared would be same for all. Also the teachers may have to be well trained for such a use.

The whole process would become a big project involving computer engineers, companies, educationalists, designers etc. At an experimental state developing educational material can be taken as a team assignment.

5. Book Design

A book on the CD ROM will definitely not be the same as printed on the paper. The way of 'writing' the book itself has to change as it offers different tools. Like the story printed on a book takes different dimension through movie, what can happen on CD ROM? What makes the difference is the elements text, graphics, audio, and pictures can be woven together to create interest.

The reader can be given an option to interrupt the story. He could select the names, choose the colors, dress the pictures according to his taste.

This could be the part of a 'magazine' a monthly publication or a story 'book' itself. For such an application it might be a good idea to have a hand held terminals.

6. Course Material For IDC

1. Printing techniques for VC
2. Materials and processes for PD

Courses like the above are more of an exposure type. It is important for the student to get familiarised with the techniques and processes. This could be better made through visuals, as also the processes not available in the dept can be studied through computer. Course material can be best developed for CD ROM.

EPILOGUE

These projects will give an opportunity for the designers to contribute their share to the emerging technology, which can be taken up in IDC. It opens up a new field for the designers to work in. Once the CD ROM is proved successful, computer will become one of the powerful tools for design activity.

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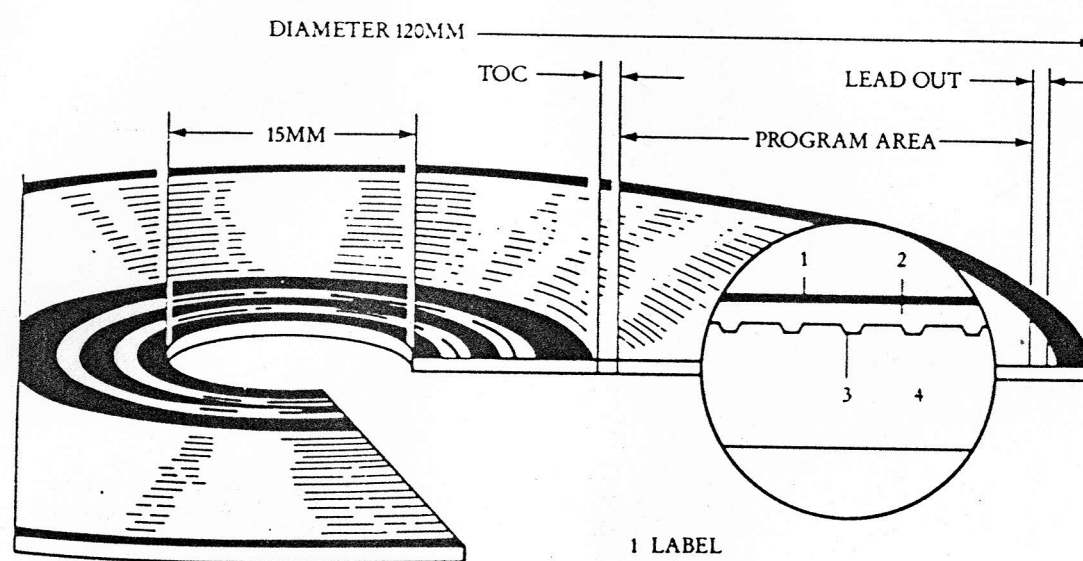
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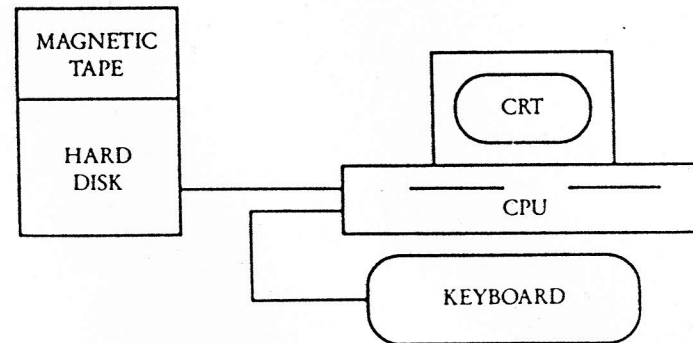
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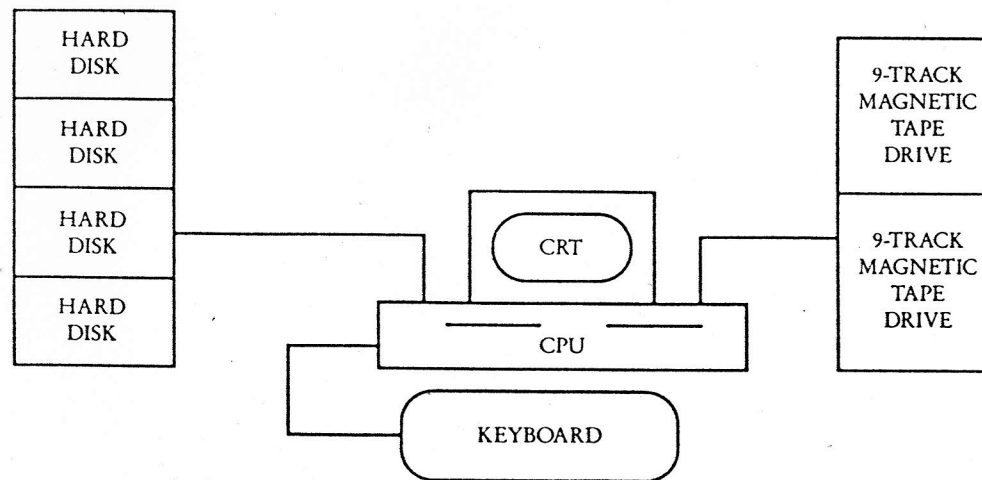
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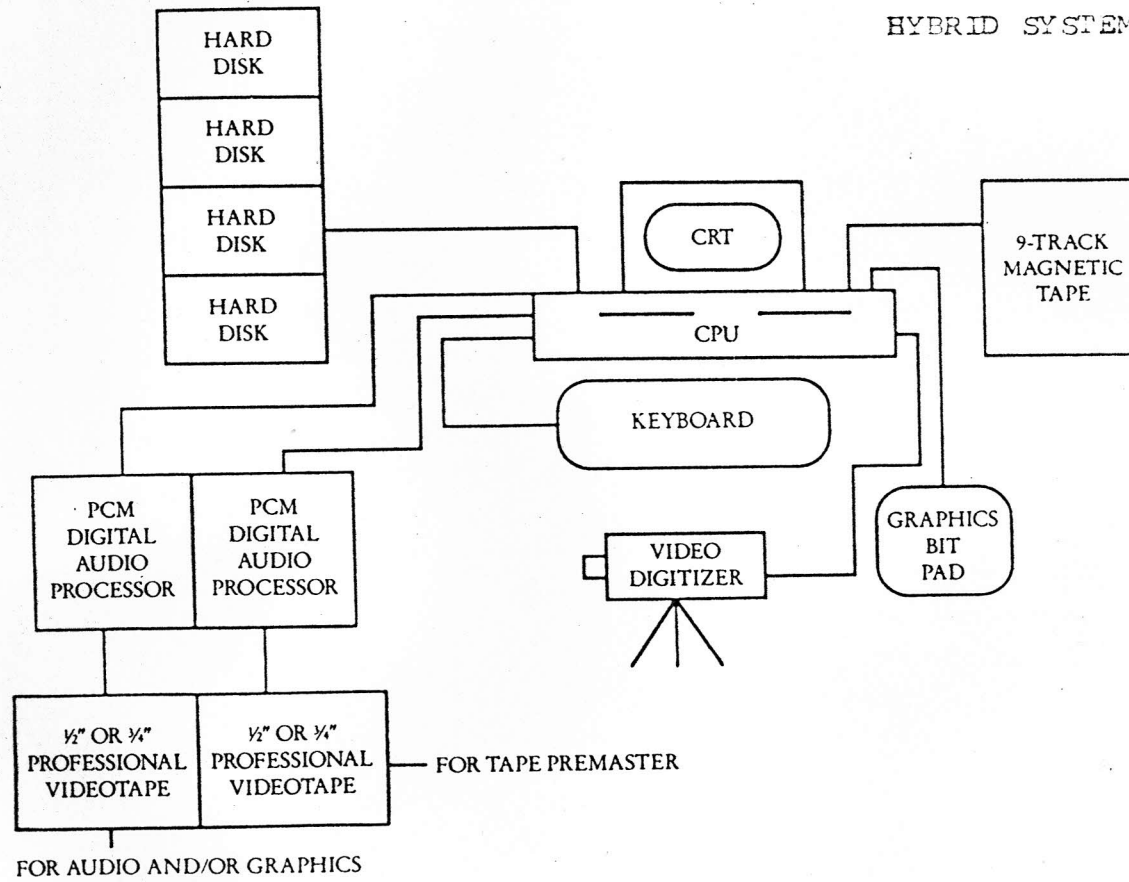


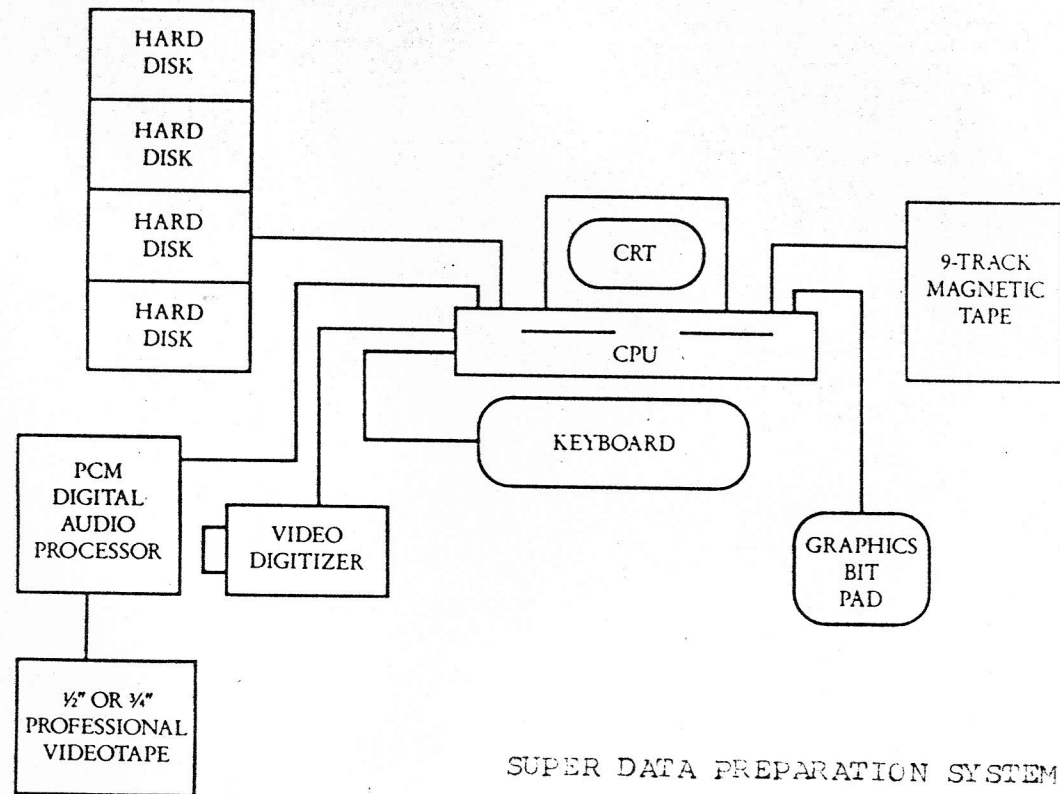
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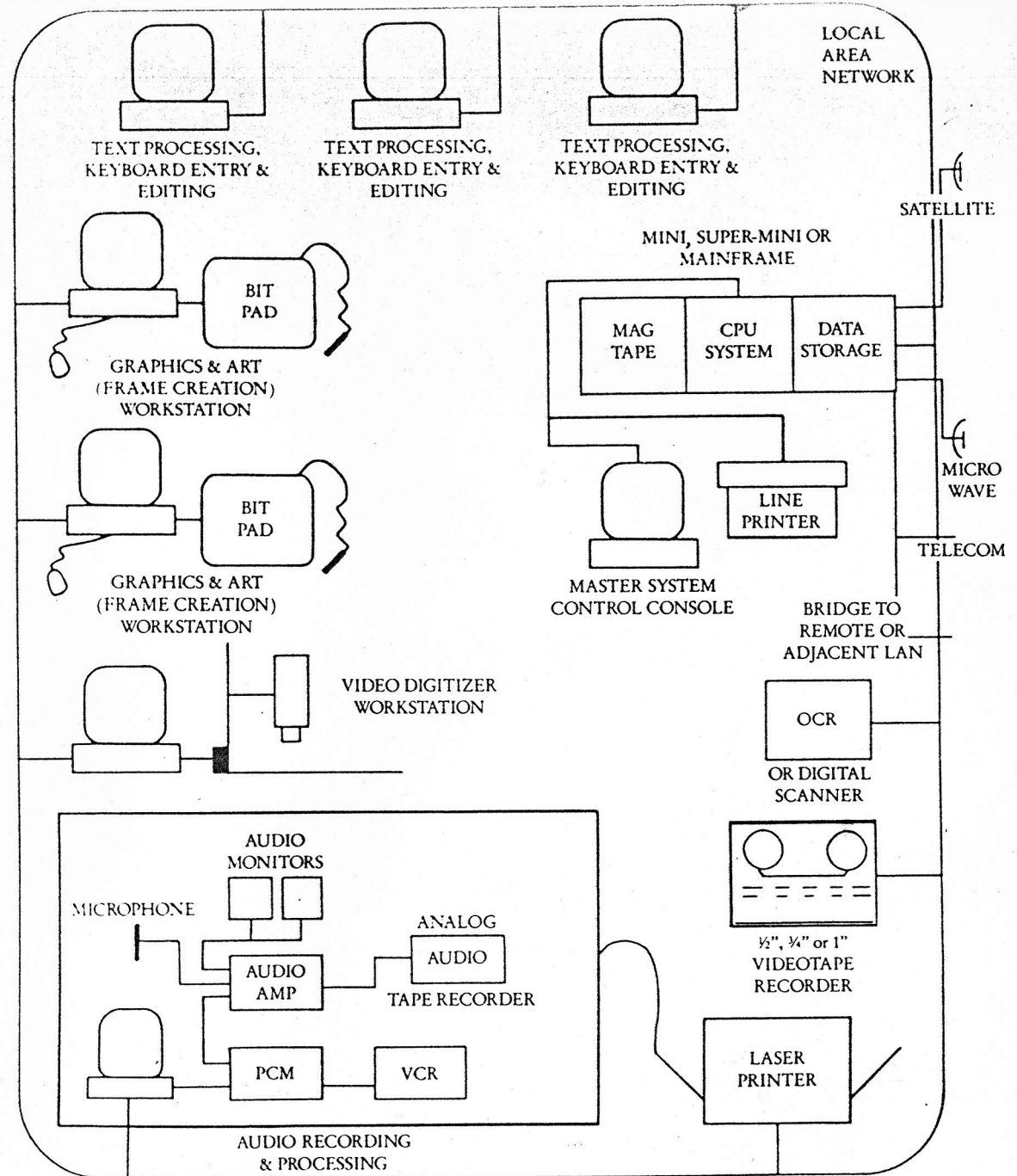
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3. Page to Screen:

When the information source jumps from page to screen, it creates problems to both designers and users. Problems lie primarily in two areas, design of surface and interface. Surface design involves making decisions about typography, layout, use of graphics, illustrations in the

text. Interface design is related to way finding problem - helping users navigate through parts of the text, move from one level of information to another, retrace, find help retrieve some other parts etc. Here there is no physical feeling of the book is not there. So he should be able to just browse through the text, keep a mark, or able to refer to two pages simultaneously etc. Thus there is a lot of difference and scope between page design and electronic text design. CD ROM offers a greater challenge to the designers.

4. Audio Visual:

Even though CD ROM can not provide moving pictures, it offers a high potential for audio-visual itself. Audio visuals has its own strength as compared moving pictures. There is a lot of possibilities for building relational sequences, by juxtapost. Taking and using a simple still image is far more easier and cheaper than moving pictures. It can make use of large quantities of average material.

Using computer graphics and text material if enhances the power of audio visual. By clever use of pictures it is possible to give a bit of motion effect also which would become a special effect.

5. Team Approach:

Optical disc technology has been a boon for interactive program designers. Although designers might like to work individually, as the technology continues to develop, the team approach for programme development makes more and more sense, both from programmatic and creative point of view.

There are five major tasks in the production of optical disc programme:

- . Analysis and design of application
- . Script and story boarding
- . Production and disc mastering

. Programming and integration

. Evaluation and revision.

1. Analysis and Design: Project brief is prepared through analysis and the overall outline of the work involved is designed to distribute the work into teams.

2. Script Writing and Story Boarding: Script and story board are prepared deciding the portion of text, graphics etc.

3. Production: This includes all activities of program information preparation of different media. It is converted into digital format and stored in magnetic tape through data preparation system. The master is prepared using the tape and copies of discs are printed.

4. Programming: Control software is developed for interactive programming.

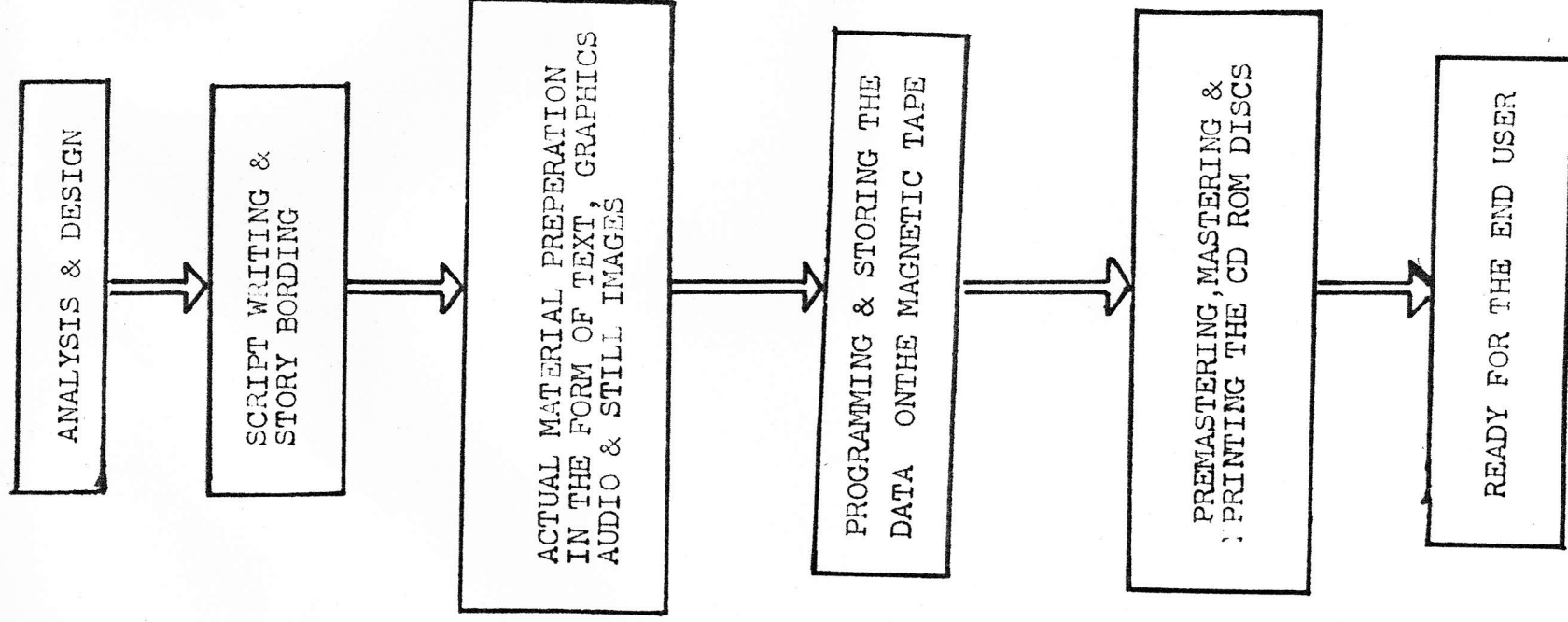
5. Evaluation: Evaluation of the project should be conducted in parallel with the production by all team members to make sure that the program works as intended, since the

information will be in 3-4 medium. Formal evaluation at the user end would help for the next disc production.

Depending upon the projects a team may be consisting of different experts for each of the task. However a typical team might be

- a project manager who will co-ordinate the activity and progress
- a project director who will exercise the creative control and ensure all materials are correctly integrated
- an author who writes the script and text screens
- a designer of audio-visual material
- a graphic designer to originate imager and to design user interface screens.
- a programmer to write the software required.

The significance of team approach is that the expertise of widely differing people can be focused towards a common goal.



APPLICATION DEVELOPEMENT
& DESIGN

DATA PREPERATION ON
THE DATA PREPERATION
SYSTEM

DISC CUTTING IN THE
FACTORY

PROCESS OF CD ROM PRODUCTION

APPLICATIONS

APPLICATIONS

The term application development takes on new meaning as we move into CD ROM. Application development requires an understanding of the market, use and potential of emerging technology. It needs highly creative people to develop new applications. The specialists who can work on this are designers, educationists, entertainers, information technologists. To start with one could use the present applications itself.

1. Multilingual Dictionary

An application like multilingual dictionary which needs a large amount of storage can make use of the compact disk technology. It is possible to organise meanings of the words in different languages, their pronunciation script etc together. Such a dictionary would help translations, linguistic work etc. There is already a multilingual dictionary existing which can be taken as the source material. A designer would be involved in developing typography, layout, interface, organisation of the dictionary.

2. Catalog of Terms and Terminologies in Design Field

One could develop a catalogue of terms and terminologies used by designers. They carry special meanings more than ordinary usage. Such a catalogue can be more than just a dictionary containing lot of visual references. It is like a databank. The word should give the works and material related to it, along with the meaning, definition etc. For example take a word symmetry. It can provide meaning in the text and visual form, the related work done on it, the persons worked, references of books, journals, products etc. This can be developed in IDC and put into CD ROM for ready reference.

Ofcourse this can be extended to other disciplines also.

3. Product Catalogue for the Industries:

There are so many products coming out every day. But it is very difficult to get details of the products, price, ads etc. If a publication like periodical can be easily brought out through CD ROM. This ofcourse would be similar to key word dictionary discussed above.

4. Educational Material Through Audio Visual for Schools/ITI

So for computer in education is mainly used for higher education specialised instructions. It is basically because of the cost and the interaction of the student with the computer. That is to develop something after acquiring the sufficient basic knowledge through other media. This is the case in India even though data banks are there abroad. When we talk of the higher secondary education, there is a lot of information to be provided, to increase the knowledge of the student. That means there is a requirement for an informative media. Interactivity is also required, but the question is should it be through computer? As we know it is not possible to provide one computer to one student, the students won't even be able to share. That may not be feasible. A specialised system of CD ROM is a solution for such an application, which can be used as a media giving a large amount of information for a group of students. Here it is just a media providing information without any direct interaction. It gives an opportunity

for the teacher to be involved in the program, which otherwise may not be possible when the computer is used as a self learning tool. Even the teacher may be given an option to program the lesson.

For such an application the product at the user end has to be developed. This consists of a CD ROM drive, a projector (let us call it a CD ROM project) a micro-computer monitor with a control terminal for programming. The picture is projected on a screen, so that the whole class can observe.

The possibility producing in different languages is an added advantage as the material prepared would be same for all. Also the teachers may have to be well trained for such a use.

The whole process would become a big project involving computer engineers, companies, educationalists, designers etc. At an experimental state developing educational material can be taken as a team assignment.

5. Book Design

A book on the CD ROM will definitely not be the same as printed on the paper. The way of 'writing' the book itself has to change as it offers different tools. Like the story printed on a book takes different dimension through movie, what can happen on CD ROM? What makes the difference is the elements text, graphics, audio, and pictures can be woven together to create interest.

The reader can be given an option to interrupt the story. He could select the names, choose the colors, dress the pictures according to his taste.

This could be the part of a 'magazine' a monthly publication or a story 'book' itself. For such an application it might be a good idea to have a hand held terminals.

6. Course Material For IDC

1. Printing techniques for VC
2. Materials and processes for PD

Courses like the above are more of an exposure type. It is important for the student to get familiarised with the techniques and processes. This could be better made through visuals, as also the processes not available in the dept can be studied through computer. Course material can be best developed for CD ROM.

EPILOGUE

These projects will give an opportunity for the designers to contribute their share to the emerging technology, which can be taken up in IDC. It opens up a new field for the designers to work in. Once the CD ROM is proved successful, computer will become one of the powerful tools for design activity.

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