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UNIT I: PRELIMINARY OPERATIONS: CHOICE OF SUBJECT

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★ STRUCTURE ★

1.0 LEARNING OBJECTIVES

After reading this unit students will be able to:

- know the preliminary operations-choice of subject.
- understand the preliminary operations - preparation on outlines.
- analyse the analytical operations – external critism.
- write about the analytical operations: internal critism.

1.1 INTRODUCTION

Among the most widely used research tools in the social sciences are group depth interviews, or focus groups. Originally called "focused" interviews (Merton & Kendall, 1946), this technique came into vogue after World War II and has been a part of the social scientist's tool kit ever since. Focus groups emerged in behavioural science research as a distinctive member of the qualitative research family, which also includes individual depth interviewing, ethnographic participant observation, and projective methods, among others. Like its qualitative siblings, the popularity and status of focus groups among behavioural researchers has ebbed and flowed over the years, with distinctive patterns in particular fields. For example, in qualitative marketing studies, the use of focus groups has grown steadily since the 1970s, and today, business expenditures on focus groups are estimated to account for at least 80% of the $1.1 billion spent annually on qualitative marketing studies.

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1.2 PRELIMINARY OPERATIONS – CHOICE OF SUBJECT

Although procedures vary from one field of inquiry to another, identifiable features distinguish scientific inquiry from other methods of obtaining knowledge. Scientific researchers propose hypotheses as explanations of phenomena, and design experimental studies to test these hypotheses via predictions which can be derived from them. These steps must be repeatable, to guard against mistake or confusion in any particular experiment. Theories that encompass wider domains of inquiry may bind many independently derived hypotheses together in a coherent, supportive structure. Theories, in turn, may help form new hypotheses or place groups of hypotheses into context.

Scientific inquiry is generally intended to be as objective as possible, to reduce biased interpretations of results. Another basic expectation is to document, archive and share all data and methodology so they are available for careful scrutiny by other scientists, giving them the opportunity to verify results by attempting to reproduce them.

A scientific inquiry incorporates:

- Features contributions to mathematics, statistics, and computer science that have special relevance to operations research.
- Publishes theoretical and applied papers with substantial mathematical interest in a wide range of areas, from mathematical programming to game theory.
- Includes a special section devoted to review papers on mathematical methods and models in interesting fields of operations research and related optimization theory.

1.2.1 Operations Research

In a nutshell, operations research (O.R.) is the discipline of applying advanced analytical methods to help make better decisions.

By using techniques such as mathematical modeling to analyze complex situations, operations research gives executives the power to make more effective decisions and build more productive systems based on:

- More complete data
- Consideration of all available options
- Careful predictions of outcomes and estimates of risk
- The latest decision tools and techniques

1.2.2 A uniquely powerful approach to decision making

Operations Research (OR) is unique. It's best of breed, employing highly developed methods practised by specially trained professionals. It is powerful, using advanced tools and technologies to provide analytical power that no ordinary software or spreadsheet can deliver out of the box. And it is tailored to you, because an O.R. professional offers you the ability to define your specific challenge in ways that make the most of your data and uncover your most beneficial options.

To achieve these results, O.R. professionals draw upon the latest analytical technologies, including:

- **Simulation** Giving the ability to try out approaches and test ideas for improvement

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- **Optimization** Narrowing the choices to the very best when there are virtually innumerable feasible options and comparing them is difficult
- **Probability and Statistics** Helping one to measure risk, mine data to find valuable connections and insights, test conclusions, and make reliable forecasts

It (also referred to as decision science or management science) is an interdisciplinary mathematical science that focuses on the effective *use* of technology by organizations. In contrast, many other science & engineering disciplines focus on technology giving secondary considerations to its use.

Employing techniques from other mathematical sciences such as mathematical modeling, statistical analysis, and mathematical optimization, operations research arrives at optimal or near-optimal solutions to complex decision-making problems. Because of its emphasis on human-technology interaction and because of its focus on practical applications, operations research has overlaped with other disciplines, notably industrial engineering and management science, and draws on psychology and organization science. Operations Research is often concerned with determining the maximum (of profit, performance, or yield) or minimum (of loss, risk, or cost) of some real-world objective. Originating in military efforts before World War II, its techniques have grown to concern problems in a variety of industries.

1.2.3 Overview

Operational research (OR) encompasses a wide range of problem-solving techniques and methods applied in the pursuit of improved decision-making and efficiency.

Some of the tools used by operational researchers are statistics, optimization, probability theory, theory, game, graph theory, decision analysis, mathematical modeling and simulation. Because of the computational nature of these fields, OR also has strong ties to computer science and analytics. Operational researchers faced with a new problem must determine which of these techniques are most appropriate given the nature of the system, the goals for improvement, and constraints on time and computing power.

Work in operational research and management science may be characterized as one of three categories:

- Fundamental or foundational work takes place in three mathematical disciplines: probability theory, mathematical optimization, and dynamical systems theory.
- Modeling work is concerned with the construction of models, analyzing them mathematically, implementing them on computers, solving them using software tools, and assessing their effectiveness with data. This level is mainly instrumental, and driven mainly by statistics and econometrics.
- Application work in operational research, like other engineering and economics' disciplines, attempts to use models to make a practical impact on real-world problems.

The major sub disciplines in modern operational research, as identified by the journal Operations Research, are:

- Computing and information technologies
- Decision analysis
- Environment, energy, and natural resources

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- Financial engineering
- Manufacturing, service sciences, and supply chain management
- Marketing Engineering
- Policy modeling and public sector work
- Revenue management
- Simulation
- Stochastic models
- Transportation

As a formal discipline, operational research originated in the efforts of military planners during World War II. In the decades after the war, the techniques began to be applied more widely to problems in business, industry and society. Since that time, operational research has expanded into a field widely used in industries ranging from petrochemicals to airlines, finance, logistics, and government, moving to a focus on the development of mathematical models that can be used to analyze and optimize complex systems, and has become an area of active academic and industrial research.

1.2.4 Research on the Basis of Earlier Theory

Many of the problems of exploratory research can be avoided if the researcher can start with a model, developed in earlier studies, which he uses as a "working hypothesis". The model can either consist of cases (holistic model) or of concepts (analytic model). During the analysis, the researcher tries to see whether the collected material conforms to the model or must he correct the model or look for a more suitable one.

Often the study simply proceeds by enlarging an earlier model. A good rule to be followed in such a situation is: Start from what is known. Proceed by enlarging the mapped area, and connect the new intelligence to the known facts. Sometimes all that you need is only an adjustment of a few details in the existing model. This is often the case when the study shall give grounds for a forecast or new product development and the environment of intended application is slightly different from the one of the earlier study.

The existence of a tentative model helps in selecting the logical structure of the entire research project and planning it. The model helps you to decide which material has to be collected, from which cases or specimens and about which attributes or variables of these cases. Even the recording of observations is facilitated because often you will be able to utilize earlier definitions of variables. The same applies to analysis methods: often you can borrow them from earlier works.

In descriptive study the project is often arranged as distinct phases. First you demarcate the population about which you need knowledge, then select a sample, gather the empirical data, analyze them, and finally assess the findings.

1.2.5 Adopting models from earlier treatises involves a risk

It can affect your observations so that you wrongly discard the anomalies or those cases which too much differ from what would be expected on the basis of the old theory. If this happens, you will never discover the weaknesses of the old

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model. In normative study models are used for describing the existing problems and defining the improvements to the object of study. If you can find an existing descriptive model of the object, made in an earlier study, you can often transform it into a normative model by adding an evaluative dimension to it. Methods for analyzing information and evaluations with normative models are discussed in Normative Case Study, Normative Comparison. Normative Classification, Normative Study of Variables and Normative History. Once the target for development has been defined with the help of a normative model, the project often continues as planning the practical operations, perhaps also realizing them and measuring the results. The process, for example, can include such phases as product concept, various drafts of design, a series of prototypes and finally a detailed proposal for the product.

Optimally a normative research project proceeds through successive stages:

- Evaluation of the initial state and defining the need for improvements
- Analysis of relationships and possibilities to change things
- Synthesis: proposal for improvement
- Evaluation of the final state.

It is quite usual to repeat the above sequence several times before one gets an acceptable result. Normative projects often deal with complex practical problems, and when making a theoretical model of the problem, the researcher may wish to make the model more easily manageable by simplifying it, i.e. by leaving out factors that seem nonessential. However, in the final practical test or appraisal it may turn out that an excluded factor is important after all, which makes it necessary to adjust the model and repeat the sequence once more.

Usually the object of study is influenced by various factors besides the independent variable mentioned in the hypothesis. These disturbances, sometimes called "noise", prevent the researcher from clearly seeing the influence of the independent variable. Such factors whose systematic influence is known beforehand can simply be eliminated by making a suitable correction in the measurements. Unknown factors which cause detrimental random variation in the dependent variable are more difficult to handle. The researcher can be prepared for disturbances and for the random variation of the explained object in alternative ways:

- By studying more cases and calculating the average of the data
- By shielding the research object in such a way that the disturbing influences will be eliminated. This usually requires an experiment set up in a laboratory.
- By choosing the variables in the hypothesis in such a way that the influential variables are dealt with as explaining factors and not as random variation.

The method of hypothesis was originally developed for descriptive studies. This type of research aspires to get factual knowledge about the object of study, and the criterion which is used in accepting or rejecting a descriptive hypothesis is factuality or truthfulness. The same criterion is applied to other phases of descriptive project as well as is explained in Assessing Input Data , Assessing Correctness of Analysis and Assessing Theoretical Output.

In normative research a hypothesis is seldom used as such, but it is interesting to note that a normative project often includes a decisive focal point which determines the project's success or failure in much the same way than the test of a hypothesis

does in a descriptive project. This focal point is the final practical testing of the normative proposal. Because the target in normative study is not just to get information but primarily to improve the object of study or other similar objects, the principal criterion when testing normative development proposals is not truth but instead practical value and functional operative ness. This criterion is discussed in Evaluating Normative Proposals.

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Another difference to testing a descriptive hypothesis is that the process of development need not end in the test. If the first proposal must be rejected the normal practice is to prepare and test another proposal. This means that the process of development returns to that of normative research on the basis of earlier model, discussed above.

Tests of normative proposals are habitually carried out when developing a new product. Their procedures are discussed in Presenting the Draft and Prototype and Evaluating a Design Proposal. Similarly, in the development of an activity the project usually includes practical testing of the proposals, as described in Assessing Activity Development.

1.3 PRELIMINARY OPERATIONS - PREPARATION ON OUTLINES

Perhaps the most direct way to plan an outline with any research paper that has a contemporary issue as its centerpiece is to separate the paper into three parts: a past, a present and a future. Another approach is to explain the central issues, describe the problems endemic in the issues, and provide possible solutions.

The outline cannot be formulated until a great amount of research is gathered. If notes are placed on cards, the major divisions and subdivisions should present themselves. The outline at this point will be only in tentative and rough in form, but the thesis statement and the preliminary works cited should serve well to allow fleshing out the organization of the paper. The introduction will be a jumping off point for what you will be presenting in paper; its conclusion will be the culmination of the information presented, including insights gained from the vast array of knowledge acquired. The body sections of the outline should be a breakdown of the various areas, aspects and subjects plan to discuss in the term paper. The preliminary outline will function merely as a general guideline to reading. As reading progresses and gains more information it can revise and extend outline accordingly.

1.3.1 Executive Summary

The executive summary should appear on a separate page in the front matter of the document and be printed on blue paper. The executive summary summarizes the remediation project and associated remedial design (RD) activities so that managers with DOE, EPA, and TDEC will have the essential information required to understand the scope of work addressed in the document. It should include a brief description of the site and the regulatory history of the project. Note in this section if the Land Use Control Implementation Plan (LUCIP) has been appended to this document.

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1.3.2 Project Organization

Provide a list of the names, titles, telephone numbers, and organization affiliations of key personnel associated with this project. Provide an organization chart showing relationships of key personnel and organizations. Include brief descriptions of individual roles, responsibilities, and authorities. Key personnel may include the following: subcontractor technical representative, project manager, lead discipline design engineer, quality assurance specialist, computer-aided design and drafting designer, site health and safety officer, and waste management specialist.

1.3.3 Project Description

Summarize the operational history of the site and the releases or pollutants of concern, referencing support sections of the Remedial Investigation, Feasibility Study, or ROD. Include a summary of previous investigations, remedial actions, or removal actions at the site. Summarize the remedial action objectives from the ROD (e.g., the specific remediation goals and performance criteria for the remedy components).Summarize the remedy components to be designed for this design package. Provide a description of the remedy, preliminary layout, preliminary process diagrams, and the general operation and maintenance or long-term monitoring requirements. List the design work tasks to be completed, the specific work products or deliverables, and design interfaces. Provide a preliminary list of drawings and list of specification sections.

1.3.4 Remedial Design Schedule

A summary level (bar chart) schedule is used to outline the proposed schedule for the completion of all RD activities, including Federal Facility Agreement (FFA) Appendix E milestones. At a minimum, the following items must be presented in the schedule:

- Date of ROD issuance;
- Start and end dates for project integration, construction and post-construction monitoring (if applicable) (e.g., 30%, 60%, and 90% design packages);
- Start and end dates for RD and procurement activities, separated into phases consistent with project plan;
- Due dates and review periods for regulatory deliverables including the RDR/RAWP, and Remedial

Action Report Note that these milestones are subject to change via the FFA negotiation process;

- Informal regulator input opportunities;
- Dates for regulatory meetings and review;
- Schedule for preparation of supporting RD work plans (if required);
- Schedule for performing field sampling in the RD (if required);
- Projected start and end dates for remedial actions; and
- Schedule for design submittals and review periods.

Since both the RDWP and the RDR/RAWP are identified in the FFA as primary documents, the established review cycle protocol for these documents must be reflected in this schedule. To expedite the approval of the Draft 2 (D2) RDWP, the

project team should meet with the FFA representatives before submittal of the Draft 0 (D0) RDWP and establish an agreement on the design objectives, ARARs, and schedule.

1.3.5 Design Criteria, Codes, and Standards

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Identify the specific design criteria; industry codes and standards; and local, state, and central regulatory requirements that must be complied with in the design. Discuss any permits, access, easements, or rights-of-way required. Identify any special technical problems, health and safety requirements, or design data required. Identify the design procedures required to be followed by the design team, including interdisciplinary reviews, engineering calculations, drawings, and specifications.

1.3.6 Applicable or Relevant and Appropriate Requirements

The government agencies are concerned that each ARAR is incorporated into the RD in an appropriate and effective manner as design work progresses. A summary table of ARARs cross walked to the means by which each requirement will be met should be provided in an Appendix. If waivers from or alterations to any ARARs are contemplated during the planning or preparation of the RD, they must be negotiated. DOE is responsible for ensuring that the conditions of the waivers are met.

Project preparation is usually considered to include all those activities short of a final decision to implement. This process includes the following stages:

- Identification of the project. At this stage, the production target based on a marketing study, the species to be cultured and the systems of culture to be adopted, the availability of a large enough drainable and accessible land area free from flooding and having adequate soil conditions as well as adequate water source, must all be investigated and determined.
- Preparation of outline or feasibility plan of the project.
- Preparation of detailed plan of the project.
- Preparation of estimates of the project.
- Preparation of tender documents of the project.

During each stage, a number of activities and analyses must be carried out and the findings used to meet the requirements of the subsequent phase, until the project is finally completed.

1.3.7 Outline or Feasibility Plan

A superior feasibility plan is one that is clear and concise. Length is determined by the plan's expected use. Lengthy plans only confuse, overwhelm and discourage the reader. There is no gain from a lengthy well-prepared plan if the readers won't read it. The authors recommend that a feasibility plan not exceed 15 pages (not including appendices), except for unusual circumstances. The feasibility plan is the framework that the entrepreneur uses to decide whether to pursue the concept and to develop a business plan. When formatting your feasibility plan, using subtitles for each major section of the plan is highly recommended. Subtitles clearly divide the information in each section into similar categories, which makes reading the plan easier and more eye appealing.

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Topic Outline a suggested topical outline for a feasibility plan consists of the following:

- Executive Summary
- Product/Service
- The Market
- Price and Profitability
- Plan for Further Action

1.3.8 Site selection

In aquaculture project operations, site selection is of paramount importance. Success of the project depends to a large extent on the proper selection of the site. There are ecological and technological as well as economic and social considerations involved in site selection.

1.3.9 Collection of maps and data

The following maps and data about the site should be gathered to facilitate the preliminary investigations and calculations:

(*a*) **Maps:** This can be used for the preparation of a project location map, to determine the water catchments area and to serve as a source of information on road connections, etc. land map showing boundaries of properties with different ownerships according to the official register of owners; soil or geological map showing the topsoil or subsoil encountered at the site, water resources development map. This will help in determining the water source of the project by indicating the possibilities of water supply and drainage, as well as by showing the depth of the expected water tables and yield capacities of any aquifers; climatologically map showing the meteorological stations nearest to the site and the monthly mean values of temperature and rainfall, other development map, if any, regarding the proposed site.

(*b*) **Hydrological data:** Data for discharge, yield, floods and water elevations of existing water sources (rivers, irrigation channels, reservoirs, springs, etc.), restriction for water supply to the fish farm (for example, periods of the maintenance works in the irrigation channel).

1.3.10 Outline plan

An outline plan is generally used as a basis for approval and financing of a project. This should prove the technical feasibility of the project. The production calculations concerned as well as the design should be in sufficient detail so that a reliable cost estimate including both the annual operational and production cost can be established.

The principal parts of the outline plan consist of the following;

(i) Report

This should contain the most important information on the project proposal including a description of the site, soil characteristics determined by the reconnaissance soil survey, source of water and the results of the water analysis, meteorological features used for planning, operation plan with the necessary

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production calculations, planning considerations, arrangement of the layout plan for the ponds and the location of the hatchery and the other buildings with the approach road to the project, arrangement for water supply and drainage of the ponds and the hatchery, the pond facilities, abstract of costs for capital, operational and production costs, economic analysis for benefits, and the proposed construction programme. Additionally, all the statements obtained and required for approval and implementation of the project must be presented usually in a list of annexures to the report. (ii) General location map (iii) Plane table map.

This has a scale of 1:2000 to 1:5000 depending the size of the project, showing the boundary lines and the proposed size of the project, the locations of the soil test pits with their elevations, the rough contour lines and water source and drainage possibilities.(iv) Outline layout plan. This plan to a scale of 1:1000 to 1:5000 should include the arrangements of the ponds, the water supply and drainage systems as well as the location of the hatchery and other buildings including the proposed approach road and the power and telephone lines. (v) Outline cross-sections of dikes and channels. All the typical cross-sections of the dikes and channels showing their measurements and slopes required for the cost estimate must be provided. (vi) List of proposed buildings and equipment. A list of the proposed buildings with their plinth areas and the equipment needed for running the project should be given for the cost estimate. (vii) Soil and water test results. Soil test laboratory results of the samples taken from the test pits for engineering and production purposes should be provided in tables which are used for planning dikes, etc. (viii) Cost estimate. Estimates of base (civil works) cost must be calculated using unit rates judged to be applicable for the region of the project site and major quantities of each item shall be calculated from the drawings in just sufficient detail to serve the needs of proper estimating. Building costs should be estimated on plinth area. Earthwork costs are based as far as possible on a balance between cutting and filling. Estimates of cost are given for electricity supply, engineering (design of detailed plan and supervision of construction), equipment, land procurement and physical contingencies.Lastly, the operational costs and the production cost are provided under separate heads. (ix) Implementation schedule. Based on the results of the reconnaissance investigations and quantity calculations a bar-chart for the various activities required to complete the detailed plans and tender documents and procure the land for construction should be prepared.

1.4 ANALYTICAL OPERATIONS – EXTERNAL CRITICISM

Operation and External Criticism aim to objectively and rationally uncover the strengths and weaknesses of the existing business or proposed venture, opportunities and threats as presented by the environment, the resources required to carry through, and ultimately the prospects for success. In its simplest term, the two criteria to judge feasibility are cost required and value to be attained. A business plan is often prepared when:

- Starting a new organization, business venture, or product (service) or
- Expanding, acquiring or improving any of the above.

There are numerous benefits of doing a business plan, including:

- To identify a problems in your plans before you implement those plans.

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- To get the commitment and participation of those who will implement the plans. To establish a roadmap to compare results as the venture proceeds from paper to reality.
- To achieve greater profitability in your organization, products and services —all with less work.
- To obtain financing from investors and funders.
- To minimize your risk of failure.
- To update your plans and operations in a changing world.
- To clarify and synchronize your goals and strategies.

Analytic philosophy is a generic term for a style of philosophy that emphasizes the use of scientific methods to develop and solve philosophical problems. The term "analytic philosophy" can refer to a general philosophical tradition characterized by an emphasis on clarity and argument (often achieved via modern formal logic and analysis of language) and a respect for the natural sciences.

The more specific set of developments of early 20th-century philosophy that were the historical antecedents of the general sense: *e.g.*, the work of Bertrand Russell, Ludwig Wittgenstein, G.E. Moore, Gottlob Frege, and the logical positivists. In this specific sense, analytic philosophy is identified with specific philosophical commitments (many of which are rejected by contemporary analytic philosophers), such as the logical positivist principle that there are not any specifically philosophical truths and that the object of philosophy is the logical clarification of thoughts. This may be contrasted with the traditional foundationless which considers philosophy as a special, elite science which investigates the fundamental reasons and principles of everything. As a result, many analytic philosophers have considered their inquiries as continuous with, or subordinate to, those of the natural sciences. The principle that the logical clarification of thoughts can only be achieved by analysis of the logical form of philosophical propositions. The logical form of a proposition is a way of representing it (often using the formal grammar and symbolism of alogical system) to display its similarity with all other propositions of the same type. However, analytic philosophers disagree widely about the correct logical form of ordinary language.

1.4.1 According to a characteristic paragraph by Bertrand Russell

"Modern analytical empiricism differs from that of Locke, Berkeley, and Hume by its incorporation of mathematics and its development of a powerful logical technique. It is thus able, in regard to certain problems, to achieve definite answers, which have the quality of science rather than of philosophy. It has the advantage, as compared with the philosophies of the system-builders, of being able to tackle its problems one at a time, instead of having to invent at one stroke a block theory of the whole universe. Its methods, in this respect, resemble those of science. I have no doubt that, in so far as philosophical knowledge is possible, it is by such methods that it must be sought; I have also no doubt that, by these methods, many ancient problems are completely soluble."

- If the sources all agree about an event, historians can consider the event proved.
- However, majority does not rule; even if most sources relate events in one way, that version will not prevail unless it passes the test of critical textual analysis.

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- The source whose account can be confirmed by reference to outside authorities in some of its parts can be trusted in its entirety if it is impossible similarly to confirm the entire text.
- When two sources disagree on a particular point, the historian will prefer the source with most "authority"—that is the source created by the expert or by the eyewitness.
- Eyewitnesses are, in general, to be preferred especially in circumstances where the ordinary observer could have accurately reported what transpired and, more specifically, when they deal with facts known by most contemporaries.
- If two independently created sources agree on a matter, the reliability of each is measurably enhanced.
- When two sources disagree and there is no other means of evaluation, then historians take the source which seems to accord best with common sense.

1.4.2 Nature of the Work

Operations research analysts formulate and apply mathematical modeling methods to develop and interpret information that assists management with policy formulation and other managerial functions. Using analytical techniques, operations research analysts help managers to make better decisions and solve problems. The procedures of operations research were first formalized by the military. They have been used in wartime to effectively deploy radar, search for enemy submarines, and get supplies to where they are most needed. In peacetime and in private enterprises, operations research is used in planning business ventures and analyzing options by using statistical analysis, data mining, simulation, computer modeling, linear programming, and other mathematical techniques.

In addition to the military, operations research analysts today are employed in almost every industry, as companies and organizations must effectively manage money, materials, equipment, people, and time. Operations research analysts reduce the complexity of these elements by applying analytical methods from mathematics, science, and engineering, to help companies make better decisions and improve efficiency. Using sophisticated software tools, operations research analysts are largely responsible for solving complex problems, such as setting up schedules for sports leagues or determining how to organize products in supermarkets. Presenting the pros and cons of each possible scenario, analysts present solutions to managers, who use the information to make decisions.

Analysts are often involved in top-level strategizing, planning, and forecasting. They help to allocate resources, measure performance, schedule, design production facilities and systems, manage the supply chain, set prices, coordinate transportation and distribution, or analyze large databases.

The duties of operations research analysts vary according to the structure and management of the organizations they are assisting. Some firms centralize operations research in one department; others use operations research in each division. Many analysts work with management consulting companies that perform contract work for other firms. Analysts working in these positions often have areas of specialization, such as transportation or finance. Because problems are very complex and often require expertise from many disciplines, most analysts work in teams.

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Teams of analysts usually start projects by listening to managers describe problems. Analysts ask questions and search for data that may help to formally define a problem. For example, an operations research team for an auto manufacturer may be asked to determine the best inventory level for each of the parts needed on a production line and to determine the optimal number of windshields to be kept in stock. Too many windshields would be wasteful and expensive, whereas too few could halt production.

Analysts study the problem, breaking it into its components. Then they gather information from a variety of sources. To determine the optimal inventory, operations research analysts might talk with engineers about production levels, discuss purchasing arrangements with buyers, and examine storage-cost data provided by the accounting department. They might also find data on past inventory levels or other statistics that may help them to project their needs.

Relevant information in hand, the team determines the most appropriate analytical technique. Techniques used may include Monte Carlo simulations, linear and nonlinear programming, dynamic programming, queuing and other stochastic-process models, Markov decision processes, econometric methods, data envelopment analysis, neural networks, expert systems, decision analysis, and the analytic hierarchy process. Nearly all of these techniques involve the construction of mathematical models that attempt to describe the system. The problem of the windshields, for example, would be described as a set of equations that represent real-world conditions.

Using these models, the team can explicitly describe the different components and clarify the relationships among them. The model's inputs can then be altered to examine what might happen to the system under different circumstances. In most cases, a computer program is used to numerically evaluate the model.

A team will often run the model with a variety of different inputs to determine the results of each change. A model for airline flight scheduling, for example, might stipulate such things as connecting cities, the amount of fuel required to fly the routes, projected levels of passenger demand, varying ticket and fuel prices, pilot scheduling, and maintenance costs. Analysts may also use optimization techniques to determine the most cost effective or profit-maximizing solution for the airline.

Based on the results of the analysis, the operations research team presents recommendations to managers. Managers may ask analysts to modify and rerun the model with different inputs or change some aspect of the model before making their decisions. Once a manager reaches a final decision, the team usually works with others in the organization to ensure the plan's successful implementation.

1.4.3 Work environment

Operations research analysts generally work 40 hours a week; some, however, work longer. While most of their work is done in an office environment, they may spend time in the field, analyzing processes through direct observation. Because they work on projects that are of immediate interest to top managers, operations research analysts often are under pressure to meet deadlines.

1. **Training, other qualification and advancement:** Some entry-level positions are available to those with a bachelor's degree in operations research, management science, or a related field, but higher degrees are required for many

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positions. Strong quantitative and computer skills are essential. Employers prefer workers who have completed advanced math courses.

2. **Education and training:** A bachelor's degree coupled with extensive coursework in mathematics and other quantitative subjects usually is the minimum education requirement. Many employers, however, prefer applicants with a master's degree in operations research, management science, or a closely related field such as computer science, engineering, business, applied mathematics, or information systems. Dual graduate degrees in operations research and computer science are especially attractive to employers. There are numerous degree programs in operations research and closely related fields in colleges and universities across the United States. Continuing education is important for operations research analysts. Keeping up to date with technological advances, software tools, and improvements in analytical methods is vital for maintaining their problem-solving skills.
3. **Other qualifications:** Those considering careers as operations research analysts should be able to pay attention to detail because much time is spent on data analysis. Candidates should also have strong computer and quantitative skills and be able to perform complex research. Employers prefer analysts who understand how to use advanced operations research software and statistical packages. Although not always required, having programming skills can be very helpful.

   Since operations research is a multi-disciplinary field, a background in political science, economics, statistics, engineering, accounting, and management can also be useful. Operations research analysts must be able to think logically, work well with people, and write and speak well.

   Advancement beginning analysts usually perform routine computational work under the supervision of more experienced analysts. As novices gain knowledge and experience, they are assigned more complex tasks and are given greater autonomy to design models and solve problems.

   Operations research analysts can advance by becoming technical specialists or project team leaders. Analysts also gain valuable insights into the industry where they work and may assume higher level managerial or administrative positions. Operations research analysts with significant experience or expertise may become independent consultants. Others may move into corporate management, where they eventually may become chief operating officers.
4. **Employment:** Operations research analysts held about 63,000 jobs in 2008. Major employers include computer systems design firms; insurance carriers and other financial institutions; management; telecommunications companies; and scientific, and technical consulting.
5. **Employment change:** Employment of operations research analysts is expected to grow 22 per cent over the 2008-18 periods, much faster than the average for all occupations. As technology advances and companies further emphasize efficiency, demand for operations research analysis should continue to grow. Technological advancements have extended the availability of data access and storage, making information more readily available. Advancements in computing capabilities and analytical software have made it cheaper and faster for analysts to solve problems. As problem solving becomes cheaper and faster with technological advances, more firms will have the ability to employ or consult with analysts. Additionally, organizations increasingly will be faced with the pressure of growing domestic and inter-

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national competition and must work to maximize organizational efficiency. As a result, businesses increasingly will rely on operations research analysts to optimize profits by improving productivity and reducing costs. As new technologies are introduced into the marketplace, operations research analysts will be needed to determine how to best use those new technologies.

6. **Job prospects:** Jobs for operations research analysts exist in almost every industry because of the diversity of applications for their work. As businesses and government agencies continue to contract out jobs to cut costs, opportunities for operations research analysts will be best in management, scientific, and technical consulting firms. The relatively small pool of qualified candidates will result in excellent opportunities for those with a master's or Ph.D. degree in operations research or management science. Operations research is not a particularly well-known field, which means there are fewer applicants competing for each job.

1.5 ANALYTICAL OPERATIONS: INTERNAL CRITICISM

Qualitative research is a system of inquiry which seeks to build a holistic, largely Description to inform the researcher's understanding of a social or cultural Phenomenon. Qualitative research takes place in natural settings employing a combination of observations, interviews, and document reviews. It is essential to review the qualitative research process, and then six qualitative research strategies: case study, focus group, and the ethnographic, phenomenological, grounded theory, and historical research perspectives.

1.5.1 Qualitative Research Internal critics

(A) The "General" Qualitative Research Process

- **McMillan and Schumacher** defined qualitative research as, "primarily an inductive process of organizing data into categories and identifying patterns (relationships) among categories." This definition implies that data and meaning emerge "organically" from the research context.
- **Common Assumptions**: Qualitative research, as a strategy, is predicated on underlying assumptions and perspectives. Wiersma summarized these as:
  - (*a*) Phenomena are viewed in its entirety or holistically. It is not possible to reduce complex phenomena into a few interdependent or independent factors.
  - (*b*) Investigators research in "nature." Researchers do not impose their assumptions, limitations, and delimitations or definitions, or research designs upon emerging data. The researcher's role is to record what he observes and/or collects from subjects' in their natural environment.
  - (*c*) "Reality" exists as the subjects see it. The researcher is to record, fully, accurately and unbiasedly, that reality as seen through the eyes of subjects.
  - (*d*) Post hoc conclusions emerge from the data. A priori conclusions are avoided.

(B) Common Reference Points: Virtually all qualitative research is done in "natural" settings, variables are not manipulated. While there are several qualitative research strategies and subspecialties, they are based on a number of common reference points.

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(*a*) Working Design: A preliminary plan is drawn, but is intended to be flexible. Here the field sites are selected through purposeful sampling, given the study's purpose. The time duration of fieldwork is determined and other relevant operational issues are addressed.

(*b*) Working Hypotheses: Using an inductive mode of inquiry, qualitative researchers, refrain from positing firm hypotheses or any hypotheses at all. General research questions are typically posed and as data collection and analysis proceed, more specific questions usually emerge. These more specific questions and/or hypotheses may be extended, deleted, or reframed as data collection and analysis continues. The objective of this process is the emergence of a comprehensive, accurate description of the phenomena being investigated from the perspective of those who experience it.

(*c*) Data Collection: The chief data collection devices are observation, interview, artifact, oral histories, and specimen records (behaviour recorded through observation). Qualitative research data records are typically quite massive. Also, the qualitative researcher is advised to keep fairly detailed records of his or her thoughts, feelings, and behaviours while data are collected. It is important to determine whether or not the researcher is himself or herself a source of bias. These notes also contain changes in the work design and research questions or hypotheses.

(*d*) Data Analysis and Interpretation: Data analysis and collection are iterative. Data must be organized and reduced (data classification and reduction). Data are organized by coding. Descriptions of behaviour, statements, feelings, thoughts, etc. are identified and coded.

Wireman identifies three types of codes

(*i*) **Setting or context codes:** These codes describe the setting or context descriptors of the phenomenon under study. Given that copious field notes are taken, codes for specific or regularly occurring characteristics contribute to efficient and effective field note production.

(*ii*) **Perception codes:** These codes are used to accurately record subjects' reported perception, understanding, etc. about relevant people, circumstances, or things.

(*iii*) **Process codes:** It is a given in qualitative research that naturally occurring systems change. These codes are used to note event or process evolution and factors which cause or contribute to said evolution. These codes need not be mutually exclusively and rarely are. The specific coding system employed by a researcher usually emerges as the iterative data analysis and interpretative process unfolds. The coding system employed by the qualitative researcher should be comprehensive and tailored to his or her needs, accurate in recording what is being observed or reported, and useful in describing and enabling.

(*iv*) *Perspectives for Designing the Qualitative Study*

(*a*) Funnel Approach: In the working design phase, the researcher has a very general research question or hypothesis which is used to select the initial research site, subjects, data to be collected, etc. Based on results generated from the earlier initiative, the research question or hypothesis becomes increasingly focused. This process is repeated until data collection, analysis, and interpretation focus exclusively on the phenomena under study and produces "solid" conclusions.

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(*b*) Modified Analytic Induction Approach: According to Wiersma, (1995, p. 219) in this approach, the researcher starts with specific research question(s); identifies virtually all instances (or cases) of the phenomenon under investigation; and investigates each case, employing an iterative process where the research question or phenomenon explanation is revised until he or she arrives at a suitable comprehensive, descriptively rich narrative.

(*v*) **Establishing a Qualitative Study's Validity:** Internal validity relies on logical analysis; it is virtually impossible to control variables in "natural" settings. Thus, it is essential that full descriptions of the research site and subjects, data collection devices and procedures, etc. be presented. Two strategies for arguing for internal validity include interpretive validity and trustworthiness.

(*a*) Interpretive validity is the degree to which data interpretation and conclusions are considered accurate so as to be reflective of the subjects' or phenomenon's "reality." There are four dimensions to interpretive validity; the greater the degree of acceptance by other researchers, the more valid the original researcher's interpretation is perceived

(*b*) Usefulness: Usefulness is determined by the extent the report informs and stimulates further research.

(*c*) Contextual Completeness: This refers to the fullness and richness of the description of the report.

(*d*) Research Positioning: Qualitative researchers have been referred to as data collection devises, given the centrality of the researcher in qualitative strategies. Thus, the researcher must document his, her, or their direct and indirect effects on the research site(s), participants, etc.

(*e*) Reporting Style: This refers to the extent the research report authors' description is perceived as authentic.

A study's "trustworthiness" is increased when data analysis and Conclusions are triangulated; subjects' perceptions are verified in a systematic manner; and the project's data chain of evidence is established.

Triangulation: The use of multiple data collection devices, sources, analysts, etc. to establish the validity of findings.

Member Checking: Research participants should review findings for accuracy and representative ness.

Chain of Evidence: The logical relationship between researches questions, research procedures, raw data, and results should be such that a reasonably prudent person would arrive at the same or similar conclusions. Five strategies for establishing the data's chain of evidence are:

- Outline Analysis: Highly dissimilar cases should be examined and differences explained. This will contribute to strengthening the findings' integrity.
- Pattern Matching: This is similar to the goal attainment methods for evaluating a project. Here, the perceived benefits of an intervention are matched against those found. If such are matched, then the argument for "trustworthiness" is enhanced.
- Representativeness Check: This strategy is akin to monitoring used in survey research. An interview or artifact is reviewed to assess its representativeness as compared to other similar Interviews or artifacts.
- Long-term Involvement: This is similar to trend analysis. If data are collected over the long-term, then situation specific influences are "canceled" out.

- Coding Check: Here, multiple researchers code the data and check for differences. Those differences are then resolved. A high level of agreement between coders is very desirable.

Qualitative Reliability and Generalizability

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Where possible, it is wise to use multiple observers and "run" inter-rater reliability coefficients, if standard rating forms were used. Establish fully developed procedures for resolving disagreements among raters. Document that present findings are consistent with those of other investigators, conducting similar research. Draw on the procedures for establishing a study's trustworthiness. Combined, these strategies strengthen reliability arguments.

The qualitative researcher does not share the same level of concern for generalizability as does the quantitative researcher. Qualitative external validity concerns itself with comparability (i.e., the ability of other researchers to extend knowledge based on the "richness and depth" of the description) and translatability (i.e., the extent to which other researchers understand the results given the theory and procedures underlying the study.)

Qualitative Research Design Strategies

Case Study: In a case study, a single person, program, event, process, institution, organization, social group or phenomenon is investigated within a specified time frame, using a combination of appropriate data collection devices. Case studies are routinely employed in business, medicine and law.

Ethnography: Rooted in anthropology, ethnography involves the study of an intact group, logically defined, in its natural context for a sustained time interval. The researcher is typically an observer or a participant observer

Phenomenology: The researcher develops an understanding of a subject's or subjects' "reality" however he, she, or they so perceive (Leedy, 1997, p. 161). In essence, this approach investigates an individual's or group's perception of reality as he or she constructs it. These realities may be expressed as an event, program, relationship, emotion, etc. Phenomenology is rooted in philosophy.

Grounded Theory: Grounded theory is a general research methodology used in building naturalistic theory and is rooted in sociology (Strauss and Corbin).

Focus Groups: Focus groups are panels, facilitated by a moderator, who meet for a specified time period to exchange perspectives, knowledge, and/or opinions on a particular topic. Groups are rarely more than a dozen members.

Historical Research: Historical research relies on records, diaries, oral histories, photographs, and other artifacts to describe, analyze, and explain past events, philosophies, etc. The artifacts and records used are driven by the particular study and its research question(s). Historical research relies significantly on inductive, logical reasoning.

Qualitative Research Strategies

- **Case Study**

Purpose: Case studies are constructed to richly describe, explain, or assess and evaluate a phenomenon

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Process: The "case" is studied onsite within its natural context. The data gathering process is often interactive as the researcher or researchers associate with persons involved in the "case" under study.

Data Collection: Data is collected primarily by fieldwork, but secondary data collection is usually employed as well. It is important that the researcher(s) understand the phenomenon from the perspective of the participants.

Data Analysis: Gall et al outlined three approaches to case data analysis. Interpretational Analysis: When employing this strategy, the researcher is looking for patterns within the data to explain the phenomenon.

Structural Analysis: Investigating patterns which may be found in conversations, text, activities, etc., with little or no explication as to pattern meaning.

Reflective Analysis: The description and evaluation of the studied phenomenon based on judgment and intuition by a highly qualified expert.

Communicating Findings

- The case narrative richly and fully reports the subject's perceptions about the phenomenon being investigated.
- According to Leedy, researchers using the reflective analysis strategy try to draw their readers into the participants' experiences by using emotive writings, poems, etc.
- Leedy goes onto point out that researchers using the other two analysis approaches tend to use an objective writing style and effectively use tables, figures, matrices, etc.

Ethnographic Research Strategy

- Purpose: Goetz and LeCompte (1984, pp. 2-3) describe ethnography as, "analytical description of social scenes and groups that recreate for the reader the shared beliefs, practices, artifacts, folk knowledge, and behaviours of those people." Great emphasis is given to the relationship between culture and behavour.
- Process: Ethnographic research is very labour and time intensive, involving extensive fieldwork in a natural setting. Usually a general research question(s) is (are) identified. Once entry is gained and rapport (or trust) is established, the research questions are continually refined becoming more focused. It is not uncommon for the larger research question(s) to be segmented into more numerous, focused ones.
- Data Collection: Ethnographic researchers use multiple data collection devices so that interpretations maybe grounded and triangulated. Leedy, outlines three specific data collection devices:
- Participant Observation: Here the researcher may participate in the phenomenon under study to varying degrees. Observation runs a continuum from detached observer to complete participant observer. The researcher must take great care to be as objective as possible. He or she is the single greatest source of bias within this strategy. The researcher will usually record his or her thoughts, feelings, etc. when developing field notes so as to guard against bias when interpreting the collected data.
- Ethnographic Interviews: These types of interviews are usually purposeful, employing open-ended items so that the subject's reality and perceptions can be documented, understood, and interpreted.

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- Artifact Collection: This is a secondary data collection strategy which typically includes unofficial document, official documents, objects, etc. which provide insight into the lives, experiences, and perceptions of subjects.
- Data Analysis: Data analysis within ethnographic research occurs as data are collected. The researcher codes and classifies data (e.g., events, observations, quotes, etc.) into a meaningful taxonomy. New data are compared and contrasted to old so as to note patterns, etc. This iterative process continues until the researcher is able to make "assertions" which describe the participants' "reality" and perspectives.
- Communicating Findings: Findings are reported in the form of research based assertions supported by analytical vignettes, interview quotes, and interpretative observations, all intended to present a holistic, rich description of the experiences and perceptions of participants.

Phenomenological research

- Purpose: Phenomenology seeks to understand a person's or persons' perspectives as he, she, or they experience and understand an event, relationship, programme, emotion, etc. The researcher often has a significant personal interest in the phenomenon under study as well.
- Process: Once a phenomenon is selected, the researcher engages in much the same process as used in ethnographic study.
- Data Collection: Phenomenologist may study one subject, but typically 6-10, who is or are purposefully selected. These researchers rely on semi-structured in-depth interviews. The researcher and subject(s) must work rather closely together to collect data.
- Data Analysis: The researcher(s) must search interview transcripts to locate "meaningful units" which are small bits of text which are independently able to convey meaning. Phenomenologists search for themes and patterns, not categories by logically linking these "meaningful units."
- Communicating Findings: Phenomenologists communicate findings through detailed narratives exploring themes and patterns which emerged from data analysis and reduction. These themes and patterns are then placed within the context of virtually all instances of the phenomenon under study.

Grounded Theory Research Strategy

- Purpose: Using naturalistic iterative data collection and relationship analysis processes, researchers derive, from the data, a theory. The theory is the expected outcome of the inquiry.
- Process: Using the iterative processes of data collection and analysis, relationships between concepts are continually identified and refined so as to enable theory development.
- Data Collection: Grounded theorists employ the same data collection devices as do other qualitative researchers. The process is iterative with early data being compared and contrasted with "newer" data to refine, discard, generate, or extend questions, hypotheses, or conclusions.
- Data Analysis: Using the iterative process between data collection and analysis within grounded theory, the researcher seeks to identify patterns of interaction between and among subjects (not necessarily individuals) by logically liking two or more data categories (i.e., similar topics sharing the same mean-

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ing). Strauss and Corbin (1990) explained the three major data coding strategies used in grounded theory research:

- Open Coding: As the initial coding effort, data are deconstructed into the simplest form possible, examined for commonalities, and sorted into categories.
- Axial Coding: As the intermediate step, data are reassembled based on logical connections between categories.
- Selective Coding: At this third stage of coding, the "core" category is determined and the relationships between it and secondary categories are posited. Core and secondary category relationships are later validated. Categories needing further refinement or development are completed. Two or more related categories (or concepts) give rise to a theory (McMillan & Schumacher, 1993), which is referred to as a proposition. Since several conceptual relationships are required to define a theory, such theories are said to be conceptually dense.
- Communicating Findings: Strauss and Corbin (1990) write that to achieve "integration", the core category (or concept) is presented as a story line which becomes the lens through which all other categories are examined. The relationships are compared to the data for validation, refinement, or discard.

Focus Groups

Purpose: Focus groups are panels, facilitated by a moderator, who meet for a specified time period to exchange perspectives, knowledge, and/or opinions on a particular topic. Groups are rarely more than a dozen members. Focus groups are often sponsored by research, marketing, corporate, or political organizations.

Focus groups

- Can quickly and cheaply identify core issues of a topic.
- Can observe reactions to a research question or product in an open forum.
- Can explore new or unexpected information or reactions in subsequent focus groups.
- Enable subjects to respond in their own words and their emotional intensity can be measured.

Focus group disadvantages are

- The failure to use probability sampling seriously limits generalizability.
- The convenience sampling strategy commonly used in focus groups may introduce bias into the research process. To counteract, ensure that group membership is representative of the population of interest.

CHECK YOUR PROGRESS

1. What is operation research?

_____

_____

2. Write a short note on RAE.

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3. Define Multidiscipline.

4. What is meant by ARARs?

5. What is Submarine?

6. What are the duties of operations research analysts?

SUMMARY

The method of hypothesis was originally developed for descriptive studies. This type of research aspires to get factual knowledge about the object of study, and the criterion which is used in accepting or rejecting a descriptive hypothesis is factuality or truthfulness. The same criterion is applied to other phases of descriptive project as well as is explained in Assessing Input Data , Assessing Correctness of Analysis and Output. This section should be written like a letter and addressed to the reader(s) of the plan. This section is a brief overview of the key points appearing in each section of the plan. Many times this is the only section a potential investor, lender, future employee or strategic partner will read, so it is of great importance. The length of the letter should be no more than one-and-a-half to two pages long. Although this section is first in the order of the feasibility plan, it is the last section to be written. As you develop the feasibility plan, it will uncover additional information that will alter your original business concept. : Virtually all qualitative research is done in "natural" settings, variables are not manipulated. While there are several qualitative research strategies and subspecialties, they are based on a number of common reference points.

KEY WORDS

- **LUCIP** : Land Use Control Implementation Plan
- **RDR** : Remedial Design Report
- **RAWP** : Remedial Action Work Plan
- **AORG** : Army Operational Research Group
- **MOS** : Ministry of Supply

ANSWER TO CHECK YOUR PROGRESS

1. Operations research (O.R.) is the discipline of applying advanced analytical methods to help make better decisions
2. RAE is Royal Aircraft Establishment.They set up a team known as the "Circus" which helped to reduce the number of anti-aircraft artillery rounds.

3. Multidisciplinarity is a non-integrative mixture of disciplines where each discipline retains its methodologies and assumptions without change or development from other disciplines within the multidisciplinary relationship.
4. Any special project-applicable or relevant for appropriate requirements (ARARs) or project-level plans
5. A submarine is a watercraft capable of independent operation below the surface of the water
6. The duties of operations research analysts vary according to the structure and management of the organizations they are assisting. Some firms centralize operations research in one department

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TERMINAL QUESTIONS

1. Write on the preliminary operation Research.
2. Write in detail about the Historical origins of operation research.
3. Write about the Research work based on earlier Theory.
4. Write a paragraph on preliminary operation in preparation of outlines.
5. Write a note on Project Description.

FURTHER READINGS

- Altheide, D. L. & Johnson, J. M. Criteria for assessing interpretive validity in Qualitative research. In N. K. Denzin & Y. S. Lincoln , Handbook of Qualitative research. Thousand Oaks, CA: Sage.
- Creswell, J. W. Research designs: Qualitative and quantitative approaches. Thousand Oaks, CA: Sage.
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- Gall, M. D., Borg, W. R., & Gall, J. P. Educational research: An introduction.
- Goetz, J. P. & LeCompte, M. D. Ethnology and qualitative design in educational research.
- Lexington, MA: D. C. Heath. Leedy, P. D. Practical research:
- River, NJ: Prentice-Hall, Inc. McMillan, J. H. & Schumacher, S. Research in education: A conceptual understanding. New York: HarperCollins. Patton, M.
- A. & Corbin, J. Basics of qualitative research:

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UNIT II: SYNTHETIC OPERATIONS: DETERMINING PARTICULAR FACTS

★ STRUCTURE ★

2.0 LEARNING OBJECTIVES

After reading this unit students will be able to:

- know the synthetic operations – determining particular facts.
- understand the synthetic operations –groping of facts.
- analyses the synthetic operations – constructive reasoning.
- write about the concluding operations – valid generalization.
- discuss the Multiresolution modeling from data and partial specifications.

2.1 INTRODUCTION

Currently, wire rope is used universally in timber harvesting for skylines, winch lines, support lines, truck wrappers, chokers, and running lines. It has advanced cable logging and it is employed around the world in millions of miles annually. However, wire rope is heavy, corrodes, and is difficult and time-consuming to splice. Additionally, used wire ropes develop jaggers that puncture the hands of woods workers.

The opportunity exists to replace steel wire rope with ultra-high molecular weight polyethylene (UHMW-PE). The braided rope has the strength of steel, lower weight, low stretch, and high flexibility. UHMW-PE rope has a higher breaking strength to weight ratio than steel wire rope by a factor of ten for breaking strengths

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when compared diameter by diameter for steel wire rope. Synthetic rope does not kink, corrode, or absorb chemicals and water. UHMW-PE braided rope has proven itself in the offshore drilling, mooring, tug line, and power line industries. The US Navy (Flory et al., 1992) and Canadian Coastguard (Fisheries and Oceans Canada and the Canadian Coast Guard Search and Rescue, 2000) have approved it for use within their maritime operations and deep-sea salvage.

One of the major difficulties with synthetic rope is using it with existing harvesting systems and adapting it to current end connections. Because of the low coefficient of friction, standard wire rope clamps, fist grips, etc. that would yield 90%+ breaking strength with steel wire rope, only yield 50-60% breaking strength with synthetic rope (Garland, et al., 2002). Synthetic rope has a much lower critical temperature compared to steel rope and is thus intolerant of heated connections. Finally, the low coefficient of friction makes pressed connections difficult. Essentially, the rope's physical, chemical, and mechanical properties make it an excellent substitute for wire rope in timber harvesting, but these same characteristics make it difficult to couple with existing cable systems.

Although some steel wire rope end connections are not suitable in their traditional form, the concepts may be modified for synthetic rope. Wire rope clamps and pressed nubbins are two examples of adapted technology. Splicing an eye is one of the most common end connectors for wire rope. However, splicing steel wire rope is tiring, cumbersome work. Synthetic rope manufacturers have developed quick splicing techniques that yield nearly 100% of the rope's ultimate breaking strength. New end connections were developed to meet requirements unfulfilled by splices or modified wire rope hardware.

The OSU research was the first extensive study on end connections specifically designed for synthetic rope. The objective was to determine suitable end connections and terminations for use with synthetic rope in logging. This study assesses the strength of the synthetic rope end connections under cycled loading at ambient temperature. Without proper end connections and terminations, synthetic rope's advantages over steel wire rope cannot be fully appreciated in the woods.

2.2.1 Methods

The pilot study determined which concepts are suitable for use in timber harvesting. The study design required rope samples of the diameter classes common to many logging applications: 3/8", 9/16", and 5/8" diameters were tested. However, only the 9/16" and 5/8" Amsteel®-Blue1 diameter classes will be discussed in this paper.

The rope manufacturer identifies the buried eye splice as retaining the highest breaking strength when the rope is modified. It is a simple splice to construct and is used in all diameter classes, but specifically for the 9/16", and 5/8" nominal diameters. Figure 2.1(a) shows the eye of a completed buried eye splice. In this project, the buried eye splice was the control treatment, or benchmark to compare all end connector concepts and represents the ultimate breaking strength of the rope.

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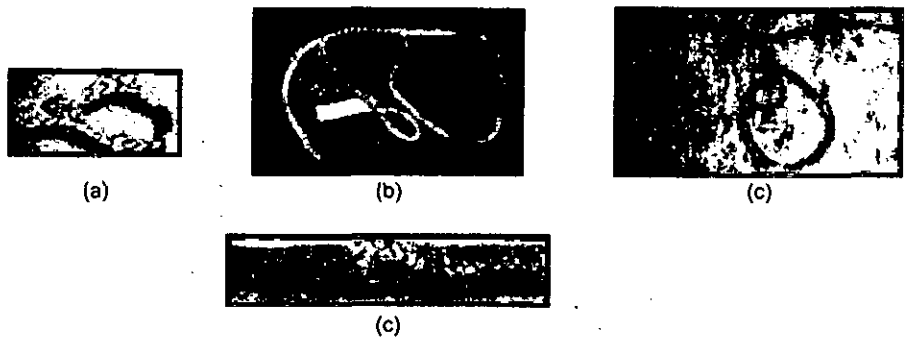

Fig. 2.1 Spiced end connections: (a) Buried eye splice (b) Long splice (c) Whoopie Sling

All test specimens were prepared in accordance with Cordage Institute Standards CI 1500-99 §6 (Cordage Institute, 1999) and tested with the synthetic rope manufacturer's Test Methods for Fiber Rope (SRT Test Method-001-02) in the Knudsen Structural Laboratory in Richardson Hall at Oregon State University. The procedure was standardized for all end connector tests to reduce variability.

The following end connections were evaluated, buried eye splice, long splice, Whoopie Sling, Y-splice, pinned nubbin, knuckle link, and pressed nubbin. Figures show these end connections. The buried eye splice, long splice, whoopie sling, and Y-splice were existing splicing techniques developed by the rope manufacturer. The knuckle link and pinned nubbin were designed by the researcher and fabricated specifically for this pilot study. The pressed nubbin was a straightforward adaptation of steel end termination techniques.

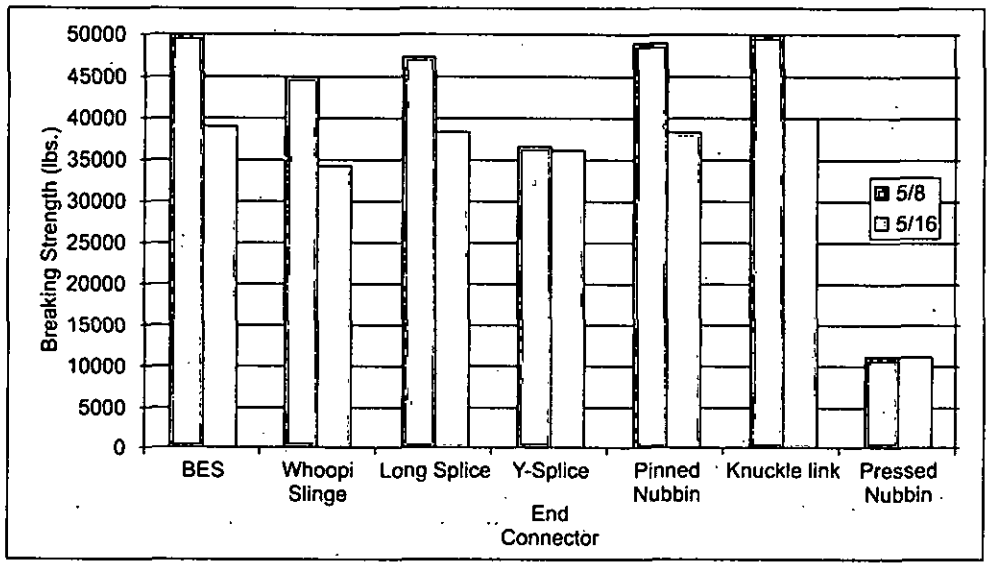

Fig. 2.2 Mean end connection breaking strength

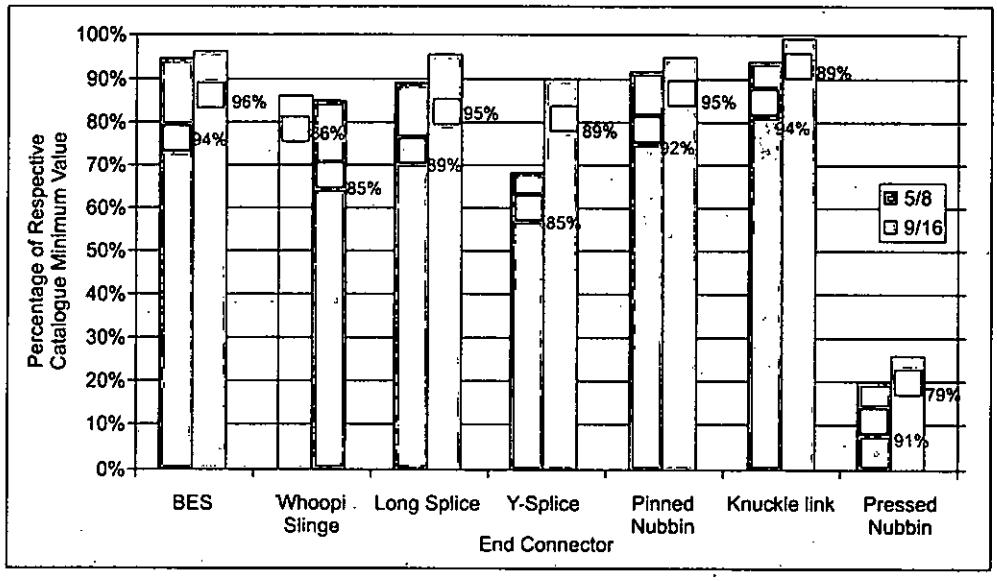

Fig. 2.3 Mean breaking strength as a percent of catalogue minimum value (CMV).

In addition to the four spliced end connections, three end connections with hardware were tested. The knuckle link had the highest breaking strength in the 9/16" diameter class at 39,944 pounds and 99% of the CMV. The pinned nubbin had a mean breaking strength of 48,868 pounds for the 5/8" diameter and 38,067 pounds for the 9/16" diameter, representing 92% and 95% of the CMV respectively. Both the pinned nubbin and knuckle link concepts performed consistently with low variability among the samples.

The knuckle link and pinned nubbin were designed to attach to the synthetic rope using an eye splice and for use with static and running line applications. For the knuckle link, as the rope is spliced, it is first passed up through one hole, over the bar, and passed back down through the other hole. When the rope is pulled, the strands of the rope are highly stressed, and the top of the eye becomes one of the common failure modes. The second failure mode common to the knuckle link and pinned nubbin is at the end of the splice taper.

Finally, the pressed nubbin concept was derived directly from steel wire rope applications where a hydraulic press compresses the steel nubbin onto the wire rope. A similar procedure was used to compress the steel nubbin on to the synthetic rope. The pressed nubbin for both diameter classes performed consistently to within a 5% standard deviation. Although consistent and a potentially useful end connection for use with breakaway drum connections, it only achieved 21% (11,066 pounds) and 27% (10,724 pounds) of the CMV for the 5/8" and 9/16" diameters respectively.

2.2.2 Discussion

Six of the seven end connections show promise for use with timber harvesting systems. Other end connection concepts were developed and tested, but none consistently achieved more than 60% for both diameter classes. Other concepts tested were wire rope clamps and nubbins with adhesives. The adhesives were weak and inconsistent in breaking strengths. The wire rope clamps provided 57% of the CMV for the 9/16" and 65% of the CMV for the 5/8" diameters.

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It is tested in different end connection and termination concepts suitable for timber harvesting. Not all end connection concepts tested achieved acceptable breaking strengths. Instead, the variability among end connections was substantial. Sometimes, the end connection that has the highest breaking strength may not be the most suitable for an operation. The pressed nubbin may be an option to attach the synthetic rope to tractor winch drums. For example, if a load suddenly began to roll down over a cliff, the end connection on the drum should break before the skidder is upset.

Further research and development needs to be conducted on end connector concepts. This research has identified some suitable end connections for synthetic rope. Not all forest operations require maximum breaking strength for certain rope applications. End connections have been tested that break at lower strengths, but can be used in such systems. Some end connectors attain nearly 100% breaking strength of synthetic rope.

End connections and termination concepts from this pilot study have been developed through controlled laboratory testing and engineering analysis. Materials selected and fabricated for the hardware are not only essential to the strength of the end connection, but also to the safety of the workers. Furthermore, when fabricating hardware, one should know the material properties and the effects of welding and heat-treating. It is not advisable to simply use any material available, weld a bolt on, and put it into use in the field. Such actions jeopardize the safety of the entire crew. The rope manufacturer's splicing directions should be carefully implemented. In all cases, the appropriate safety rules should be followed.

2.3 SYNTHETIC OPERATIONS: GROUPING OF FACTS

Most of the biological applications of chemically synthesized oligonucleotides require molecules with free 3'-hydroxyl functions and thus the solid supports commonly used for oligonucleotide synthesis match these requirements due to 3'-0-acyl linkage cleaved during final deportations. However, in some cases like chemical legation (1), introduction of modified intemucleotidic bonds (2) and structural studies (3), oligonucleotides with terminal 3'-phosphates are necessary.

Methods of obtaining oligonucleotides with terminal 3'-phosphates were already described either for solution (4) or solid supported synthesis.

The solid supports allowing the synthesis of oligonucleotide 3'-phosphates are based on polyacrylamide (6), Teflon (7), polystyrene (8, 9) or silica gel (10). Among these supports only Teflon and silica gel based supports can be used with the phosphoramidite method. However, the oxidation of the cis-diol system of the 'anchor' ribose moiety of the Teflon support was found (3) to be accompanied by partial 5'-Odimethoxytrityl group cleavage. This fact might disturb the purification of synthetic oligonucleotides by the reverse phase HPLC. Silica gel supports give less efficient couplings and have a worse homogeneity compared to CPG (11).

In this paper, we report the methods of preparation of glass supports compatible with the established phosphoramidite chemistry of internucleotide bond formation that give rise to oligonucleotide 3'-phosphates during final deportations.

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2.3.1 A multipole-motivated Hierarchical Model for Inference in Large-scale GMRFs

The main focus is to develop efficient methods to estimate approximate means and error variances in large-scale Gauss-Markov random fields (GMRFs). This problem arises in a variety of applications, but it is challenging when the number of variables is large and measurements are noisy and sparse. The multi scale tree models, developed at SSG, introduce auxiliary variables which represent the field of interest at coarser resolutions and compute the estimates by passing messages between parent-child pairs, which is highly efficient but results in blocky artifacts in the estimation results.

The inference algorithm on the model is motivated by the multipole method, which uses interactions between particle clusters to evaluate far-field potentials rapidly. Unlike many existing hierarchical models (e.g. multigrid methods), the pyramidal graph forms an MRF, so various techniques developed for efficient inference in graphical models can be applied.

2.3.2 Tractable Methods for Inference and Learning in Graphical Models

(*a*) **Approximate Inference by Recursive Cavity Modeling:** Recursive cavity modeling (RCM) is an approximate inference method for MRFs that blends exact recursive inference with variation methods that minimize relative entropy. The key idea is to build cavity models of subfields. Each cavity model provides a tractable, approximate model for statistics on the boundary of a subfield that is useful for inference outside of the subfield. Using a nested dissection procedure, these cavity models and a complementary set of blanket models can be built up recursively. Ultimately, this leads to approximate computation of the marginal distribution of each variable in the MRF.

Model thinning plays an important role in this approach. This involves selecting a tractable approximation to a given MRF based on a sub-graph of the MRF (e.g., a cavity or blanket model in RCM), which requires both selection of a sub-graph and parameter optimization to minimize relative entropy over the class of MRFs defined on this sub-graph (an information projection). An efficient information projection method was developed using chordal graph embedding and exploiting certain tractable representations of Fisher information for MRFs defined on chordal graphs.

(*b*) **Maximum-Entroy Relaxation for Learning Graphical Structure:** Maximum entropy relaxation (MER) is a convex optimization approach for thinning MRF models that was originally formulated as a method to select cavity models in the context of Jason's RCM algorithm. The usual approach to model thinning is to select a tractable approximation to a given MRF, based on a sub-graph of the original MRF, which involves both selection of a sub-graph and parameter optimization in the class of MRFs defined on that sub-graph to minimize relative entropy. Because sub-graph selection is combinatorial, the MER approach was formulated as a tractable alternative that simultaneously selects both the sub-graph and corresponding parameters through solution of a convex optimization problem. Formally, we seek to maximize entropy subject to a relaxed set of marginal constraints, which require that the marginals of the relaxed distribution are close to the corresponding marginals in the orginal distribution in the sense of relative entropy.

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In joint work with Venkat, this idea was formalized in an exponential family representation for Gaussian and Boltzmann models. An approach was developed to solve these problems using a modified primal-dual interior point method, which exploits sparsity of Fisher information in chordal MRFs, and an incremental method for identifying the active set of constraints in the MER problem.

(*c*) **Lagrangian Relaxation for Intractable Graphical Models:** Lagrangian relaxation (LR) is an approximate method to estimate the most probable configuration of an intractable MRF. LR is formulated with respect to an augmented graphical model, which includes replicas of the nodes and edges of the original graph. By dualizing the constraint that replicated variables (and, more generally, replicated features) must be equal in any valid assignment, we obtain a relaxed, convex "dual" problem, which is tractable to solve provided the augmented graph has a low tree width. In particular, if the augmented graph is chosen to correspond to a set of spanning trees of the original graph, then we recover essentially the same formalism as in the tree-reweighed max-product approach developed by Martin Wainwright. More generally, these extensions can lead to reduced duality gaps and faster convergence in the iterative methods used to solve the dual problem.

(*d*) **Walk-Sum Analysis for Gaussian Graphical Models:** An interesting spin-off of Jason's work in GMRFs has been the novel walk-sum interpretation of inference in Gaussian graphical models. In a technical report, Jason introduced the class of walk-assumable models; characterized some important, easily identified sub-classes of these models and provided a walk-sum analysis of certain iterative estimation algorithms, namely, the Gauss-Jacobi iteration, the (stationary) embedded-tree (ET) algorithm and a special-case of the cyclic, two-tree ET iteration. Later on, in joint work with Dmitry Malioutov, this picture was further refined and applied to give a new interpretation of Gaussian belief propagation, which was therefore shown to converge in walk-assumable models. Later still, Venkat and Jason generalized the walk-sum interpretation of ET to a much broader class of algorithms, including iterations based on arbitrary (non-cyclic) sequences of tractable sub-graphs.

2.3.3 Anisotropy Characterization in Wide-Angle SAR Imaging Using Sparse Signal Approximation.

Imagery formed from wide-angle synthetic aperture radar (SAR) measurements has fine cross-range resolution in principle. However, conventional SAR image formation techniques assume isotropic scattering, which is not valid with wide-angle apertures. Also, the spatial location of scattering centers may migrate as a function of viewing angle across the aperture. The problem of jointly forming images and characterizing anisotropy as well as characterizing scattering center migration in wide-angle SAR is considered in the research. The approach not only compensates for anisotropy and migration in the image formation process, but gives much more information, useful for scene interpretation, than a simple image would.

A method based on a sparse representation of anisotropic scattering with an over complete dictionary composed of atoms with varying levels of angular persistence is presented. Solved as an inverse problem, the result is a complex-valued, aspect-dependent response for each scatterer in a scene. The non-parametric approach jointly considers all scatterers within one system of equations. The choice of the

over complete dictionary incorporates prior knowledge of anisotropy, but the method is flexible enough to admit solutions that may not match a family of parametric functions. Sparsity is enforced through regularization based on the l_p quasi-norm, p<1, leading to a non-convex minimization problem. A quasi-Newton method is applied to the problem and a novel graph-structured algorithm is developed and also applied. Results are demonstrated on synthetic examples and realistic examples with XPatch data, including the backhoe public release dataset.

2.3.4 Multi resolution modeling from Data and Partial Specifications.

In this research, we study a recently developed class of models, called multi scale models, which is well-suited to represent a wide variety of random processes. The advantage of this type of model is in providing an extremely efficient estimation algorithm which is a generalization of the traditional Kalman filter and Rauch-Tung-Striebel smoother. Multi scale models and the associated estimation algorithm have been shown to be useful in a number of applications including image processing, remote sensing, and geophysics.

In particular, previous research in this area has provided an algorithm which builds a multi scale model to match the covariance of a given process of interest. However, this approach requires complete knowledge of the covariance and the capability to store it and for problems of even moderate size, this type of complete characterization is an overwhelmingly large data storage problem.

2.3.5 Sensor Arrays and Information Theoretic Fusion

Large arrays of sensors with overlapping regions of influence and multiple sensing modalities pose new problems in data fusion. Complex relationships between the sensor observations, including reflections and nonlinear effects, make it difficult to determine such quantities as number, location, and characteristics of sources, and even the sensor array configuration. This is related to such problems as ICA (independent component analysis), sensor fusion, and more standard array processing problems like finding direction of arrival.

2.3.6 Image Segmentation and Deblurring Using Curve Evolution

Image segmentation has been an important problem in image processing and computer vision. One of the problems we are working on is to perform segmentation and deblurring of a given image, which is obtained by blurring an unknown original image with a known blurring operation and by adding white Gaussian noise to the blurred image. The segmentation and deblurring is performed simultaneously by minimizing the Mumford-Shah functional, which is designed to get a piecewise smooth deblurred image and its edges. Minimizing the Mumford-Shah functional corresponds to evolving a curve to the boundaries of piecewise smooth regions and the curve evolution is implemented using Level Set method, which automatically handles topological changes of the image boundaries.

Other relevant problems include development of information theoretic approach to image segmentation using nonparametric statistics, segmentation of textured images, and development of a mathematically sound shape prior.

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2.3.7 Modeling and Estimation of Gaussian Processes on Graphs with Cycles, Erik Sudderth

Statistical models of two-dimensional fields play an important role in a variety of application areas, from oceanography to image processing. Markov random fields, perhaps the most common means of representing a two-dimensional random process, have an intuitively appealing structure, but they generally lead to computationally intensive estimation algorithms. The multistage tree models previously introduced by the Stochastic Systems Group provide highly efficient estimation procedures. The fundamental source of the efficiency of tree-based algorithms is that there is a single unique path between any two points in the tree -in other words, there are no loops. Unfortunately, the tree structure also tends to lead to blocky artifacts in the final estimation results. My research involves the investigation of model structures that lie in between densely connected.

Markov random fields and singly connected multistage trees. We have developed a novel estimation algorithm which computes the exact means and error covariance's for Gaussian estimation problems on arbitrary cyclic graphs. It works by exploiting the presence of tree-like structures in more densely connected graphs. Current work focuses on obtaining a deeper understanding of this algorithm's dynamics, and on determining efficient procedures for constructing models on graphs with cycles.

2.3.8 Krylov Subspace Estimation

Computing the linear least-squares estimate of a high-dimensional random quantity given noisy data requires solving a large system of linear equations. In many situations, one can solve this system efficiently using the conjugate gradient (CG) algorithm. Computing the estimation error variances is a more intricate task. It is difficult because the error variances are the diagonal elements of a complicated matrix. This research is focused on developing a method for using the conjugate search directions generated by the CG algorithm to obtain a converging approximation to the estimation error variances. The algorithm for computing the error variances falls out naturally from a novel estimation-theoretic interpretation of the CG algorithm. Preliminary results indicate that the algorithm is effective for many problems requiring the estimation of processes evolving in space or time.

2.3.9 Statistical Methods and Curve Evolution Theory for Image Segmentation, A. Tsai

Image segmentation—the process of grouping image data into meaningful regions—is a fundamental and challenging problem in early vision with important applications to medical diagnosis, remote sensing, product quality inspection, motion analysis and tracking, autonomous vehicle navigation, and so forth. Generally, image segmentation is the first and most difficult task of any automated image understanding process. During image segmentation, each meaningful region formed can be set apart from the rest based on some defining features that are unique to that particular region. The defining features of each region manifest themselves in a variety of ways including, but not limited to, intensity, color, surface luminance, and texture. In recent years, segmentation algorithms based on either curve evolution techniques or statistical methods have received considerable attention. Curve evolution techniques for image segmentation involve the evolution of curves according to prescribed partial differential equations (PDEs)

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whereas statistical methods for image segmentation entail stochastic models and estimation-theoretic techniques. The statistical methods we focus on include multi scale models and estimators, the EM algorithm, and approximation schemes derived from mean field theory. The broad objective is to develop novel image segmentation algorithms for a variety of different applications (e.g. prostate segmentation for MRI-guided prostate brachytherapy or laser radar range profiling, anomaly suppression, and target detection) based on statistical methods and curve evolution techniques.

2.3.10 Target Model Generation from Synthetic Aperture Radar Imagery

Automatic target recognition (ATR) systems are often designed to be used in conjunction with synthetic aperture radar (SAR) imaging systems to detect and classify targets of interest. A prerequisite for the operation of a model-based ATR system is the existence of a database containing models of targets that might be encountered in SAR imagery. Unfortunately, the generation of models to populate the ATR database is typically a tedious and difficult task, often requiring detailed descriptions of targets in the form of blueprints or CAD models. Recently, efforts to generate models from a single 1-D radar range profile or a single 2-D SAR image have met with some success. However, the models generated from these data sets are of limited use to most ATR systems because they are not three-dimensional. The goal of my research is twofold: to develop a method for generating or updating 3-D target models directly from multiple SAR images, and more generally, to understand and to characterize the context in which this model generation takes place, in terms of the operability and robustness of the elemental components that form the target models.

2.4 SYNTHETIC OPERATIONS: CONSTRUCTIVE REASONING

Designing research is often considered as an important part of research within Engineering, Computer Science and Information Systems. It involves the analysis of the use and performance of designed artifacts (constructs) in order to understand, explain and improve designed systems. The outputs of Design Research are construction, models, methods, theories, instantiations, algorithms, human-computer interfaces, system design methodologies, languages and other artifacts,

Designing Research as constructive research presents a bridge between natural and human spheres as it produces artifacts which are both natural and intentional. That implies understanding both of the workings of basic mechanisms (as found in sciences) and the role which a given construct may play in the broader context (societal aspects).

Constructivist epistemology emphasizes the fact that scientific knowledge is constructed by scientists with help of cognitive tools. It is the opposite of the positivist epistemology which sees scientific knowledge as discovered in the world. For a classical positivist, scientific facts are discovered and the connection between the world and the fact is unique. On the other hand constructivism entails that there is no single valid methodology for construction of scientific knowledge, so no unique prescription to establish "the facts" or provide the data, and no guarantee for a consensus. One can say that constructivism is more interested in the mechanisms of theory building while positivism describes the steady state of theory where one dominant framework has been established among competing approaches.

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Often mentioned is also the alleged opposition between Constructivism and Realism. Both come in two flavors – ontological and epistemological. The confusion among varieties of claims is vast. In short, constructivist approaches are primarily applied in the process of discovery where many possibilities are still open, in the sense of ontological choices, dur- ing concepts formation and in the sense of epistemological approaches. In the new research, the reality appears as malleable and negotiable as an uncharted territory. Similar to the process of reinforcement learning in the brain, learning in the network of agents causes that those paths that are taken repeatedly get reinforced, and those that are not followed fade out – so finally in a long time perspective some approaches win and some get forgotten. That is a territory of steady state in which it can appear as if there is only one clear-cut approach to the phenomenon or a solution to the problem. As already mentioned, a received view in sciences and engineering is ontological realism in conjunction with epistemological constructivism.

2.4.1 Parallelism for the Physically Constrained Iterative Deconvolution (PCID) Algorithm

The imaging mission of the Air Force Maui Optical & Supercomputing Site (AMOS) requires high resolution imagery. Linear image processing algorithms, like bispectrum, used to reduce the observatory data are fast, easily parallelized, and produce a recovery in seconds. Bispectrum cannot recover the very high spatial frequency data we seek due to the direct calculations making up the heart of the algorithm. The high performance computing assets at Maui High Performance Computing Center (MHPCC) make possible the integration of non-linear iterative algorithms as data reduction tools which can recover the very high spatial frequency information. The physically constrained iterative de-convolution (PCID) algorithm, selected as the next generation image processing tool for observatory data, can take minutes to hours to complete a recovery.

PCID is capable of handling one or many frames to form a recovery. Initial versions of parallel PCID spread the frames in the ensemble across multiple processors working together. As shown in the following flowchart, worker processors under control of the master processor are given entire frames within the ensemble. In this scenario, no more workers than number of frames in the ensemble can be used to reduce the data. With the advent of newer, faster, and more processors available for data reduction, we want to split the data frames across multiple workers to decrease execution time.

New PCID paradigm to operate on the architectures of today and scale well for the architectures of tomorrow. This means PCID must work on shared memory processors (SMP) as well as distributed memory processors (DMP) and processors working together on a recovery may be a combination of SMP and DMP.

Background

PCID uses ensembles of short exposure imagery containing one or more frames. Each frame corrupted with turbulence from the atmospheric layer of the earth (Figure 1). The algorithm iteratively solves for the common object in each frame, thereby removing the atmospheric corruption. During the processing, the cost function and the gradient function subroutines within PCID are executed many times making heavy use of Fast Fourier Transforms (FFT).

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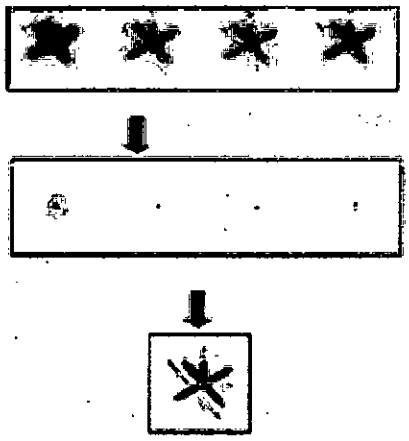

Fig. 2.4 Top row, raw data frames, middle row, PSF bottom row, recovered object.

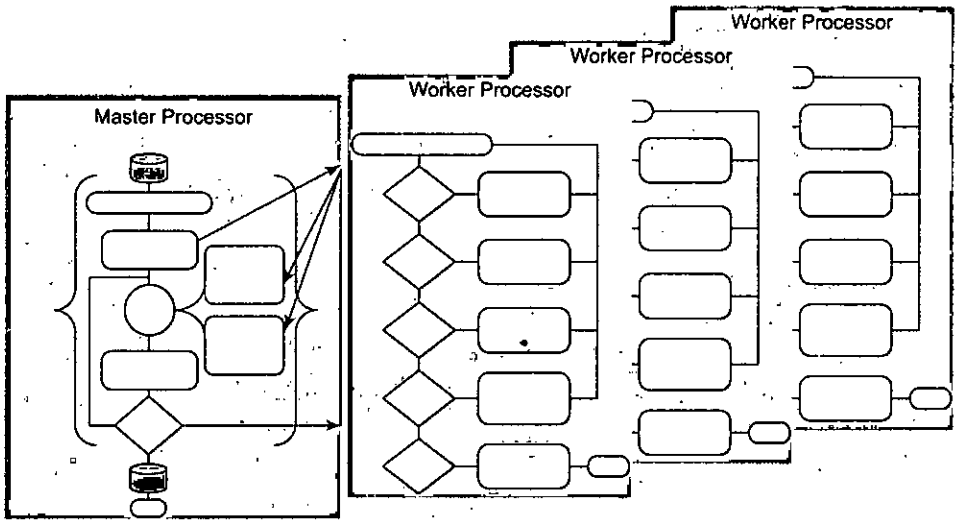

Fig. 2.5 Parallel DMP PCIC flowchart-frame solk scroes worker processore

The cost function and gradient routines require convolutions that are pixel by pixel operations in the Fourier domain. Pixel by pixel operations lends themselves ideally to splitting a frame of data across multiple workers requiring no inter-process communication. FFT operations do require inter-process communication but library functions exist to take care of this process for us. On the IBM Tempest system, the Parallel Engineering and Scientific Subroutine Library (pESSL) math library contains FFT routines to accommodate data across multiple processors. Basic Linear Algebra Communication Subroutines (BLACS) contains routines to setup the worker processors so they can be used together for the FFT. BLACS and pESSL work transparently with SMP and DMP processors. BLACS is portable and, in general, each new system has its own parallel optimized math library comparable to p ESSL.

The first step was to understand and control the parallel FFT routines. A stand-alone program was written (outside of PCID) to test the FFT and get some timing stats, which we hoped would indicate the level of performance improvement we could gain with single frame, multi-processor PCID. Our initial results from the stand-alone FFT test routine indicated a speedup that correlates with the number of added worker processors. The second step was to modify PCID to utilize multiple worker processors for a single frame of data. Processors working together on a single frame of data are known as a processing set and are shown in the flowchart here.

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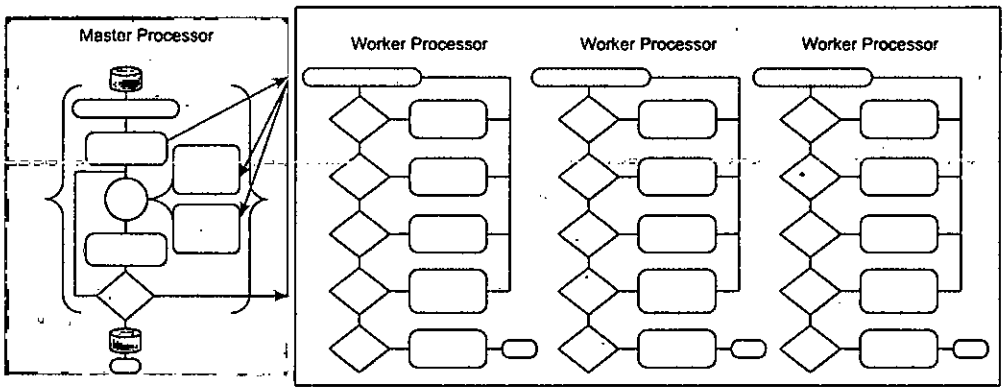

Fig. 2.6 Parallel DMP PCIC Flowchart: Frame solt scross worker processor
Each worker handles a portion of a frame.

- Each process set handles a complete frame.
- We see in this plot that in the multi-worker, single frame case, we are achieving our expected speedup correlating with the number of added worker processors.

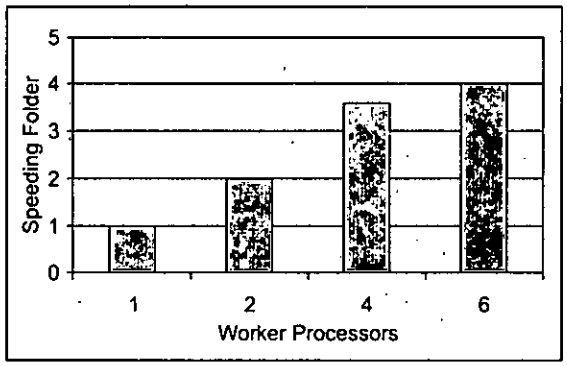

Fig. 2.7 Multi-processor single frame PCID

2.4.2 High Performance Computing Software Applications Institute for Space Situation (HSAI SSA)

Background: The DOD High Performance Computing Modernization Office (HPCMO) originally devised the strategy for the HSAI in 2003 and issued a call for DOD organizations proposals late that year. After initial vetting stages by each of the military services, 12 organizations were ultimately invited to submit proposals to the HPCMO. HPCMO made and announced its final selection of five organizations on 20 August 2004 to stand-up Software Application Institutes (SAIs), as shown in Figure 1. One of the five institutes that were selected by the Deputy Under Secretary of Defense (Science and Technology) for activation was an HSAI for Space Situational Awareness (HSAI SSA), which was awarded to the Air Force Research Laboratory's Directed Energy directorate (AFRL/DE). The HPCMP Kick-Off Meeting for the five institutes occurred in October and initial partial funding was made available in December 2004. The first specific meeting of the HSAI SSA with the HPCMO's Board of Directors occurred in February 2005. At that time, the HSAI SSA briefed its approach to structuring and staffing of the HSAI SSA and strategic goals and technology thrust areas, with particular emphasis on activities to be performed during the first year of the program. The HSAI SSA continued further program initiation work during March 2005.

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Methodology: The mission of the HSAI SSA is to support the Space Situational Awareness needs of stakeholders by developing high performance computing (HPC) software applications for SSA. SSA encompasses the Space Support and Mission Support foundation tiers of United States military space power. The Institute will apply the power of high performance computing and innovative algorithms to enable the war fighter to better perform space control missions by providing a more accurate, more detailed, and timelier characterization of space objects, and by developing a data management architecture that can be utilized by the stakeholders. Early HSAI work incorporated program planning and control activities including the establishment of the organization and partnering and supporting organizations, and initial programmatic and technical liaison.

The Air Force established a Task Order (TO) on the existing AFRL MHPCC Contract to support all necessary Institute initial requirements. This avoided the need for establishing a separate contract and enabled more rapid securing of personnel resources for early software management and development work, and it arranged for the securing of office space and provision of communications and other infrastructure.

HSAI SSA has refined its original planning and has chosen two Strategic Goals and technical thrust areas to begin its work in. These items are Strategic Goal 1: ASTRO-dynamics for the Characterization of Space Objects, and Strategic Goal 2: Image Enhancement.

The major objective of the ASTRO-dynamics thrust is to develop advanced orbit prediction and metric extraction capabilities. This involves:

- Development of HPC Application Software to Aid Space Surveillance Network (SSN) Architecture, Systems and
- Sensors Developments, and Operational Decision-Making Processes
- Expansion of Spacetrack Test Bed Architecture for Air Force Space Surveillance System (AFSSS) Fence Radar
- Developments, Architecture, and Operational Decision-Making Processes
- Development of a Parallelized Scalable Satellite Orbit Propagation Tool (Parallel Catalog Propagation - PCP) for
- Higher Accuracy Orbit Calculations

The major objective of the Image Enhancement area is to derive enhanced utility from electro-optical sensors by applying various image processing algorithms currently in development for SSA solutions and enhancing them further to better meet customer requirements. Efforts here are focused toward investigating and resolving the issues with the implementation of the current and new algorithms in the HPC environment. The HSAI SSA team has begun the process of developing a prototype that will form the foundation for an operational product. Customer and stakeholder organizations for these items include the U.S. Strategic Command (STRATCOM), Air Force Space Command (AFSPC), and Air Force Maui Optical & Supercomputing Site (AMOS).

This involves:

- Expansion and Implementation of New Advanced Image Processing Software and Data Management Tools in the HPC Environment
- Enhancement of the Fidelity of Image Products and Development of Scalable High-Speed Parallel Versions Using

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HPC Assets to Decrease Computational Times

- Employment of the Physically Constrained Iterative De-convolution (PCID) Software and Multiple Instruction Multiple Data (MIMD) and Multiple Process Multiple Data (MPMD) Computational Methods to Efficiently Yield Consistent, High Resolution Images.

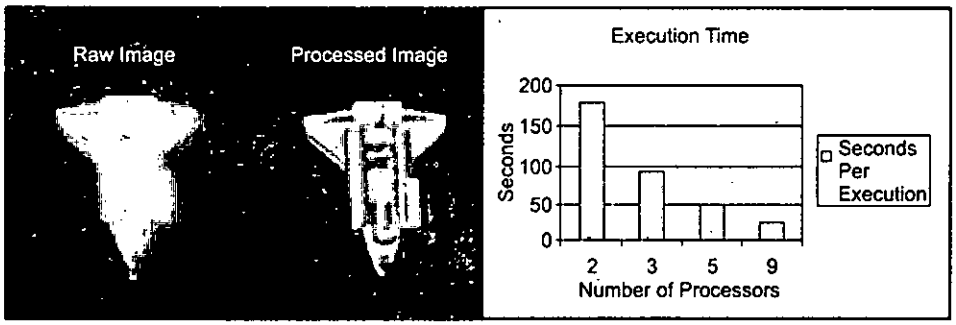

Fig. 2.8

Similarly, additional work was also performed on SSNAM software to evaluate scalability, timing, sizing, and differences in running this code on different platforms. Initial work was performed completing porting and integration of more than 560,000 SLOC and setting up for evaluation runs under the IBM AIX P3/P4 MHPCC Tempest environment, employing a 64-Bit implementation. The validation and initial evaluation timing runs were as anticipated, demonstrating good scalability, throughput, and showing that a factor of two speedup is attainable. The HSAI SSA team next ported and integrated the executable to the JFCOM J9 *Koa* Linux Networx Evolocity II platform at MHPCC. The team executed the software on a single *Koa* 2.4 GHz Xeon processor. The timing results and evaluation from this activity demonstrated that a factor of eight speedup was achieved against a test case run on a SSNAM technical support contractor's Laptop PC. The results also showed that a factor of three is achievable for the test case run on a single CPU of the SSNAM technical support contractor's SSNAM Laboratory PC (see Figure 2.9). These results were very encouraging, as follow-on HPC development work will be able to run with significantly more processors than the eighteen that are available in the current SSNAM PC lab. It is estimated that a speedup of five-fold, or greater, is very likely to be realized in the near future.

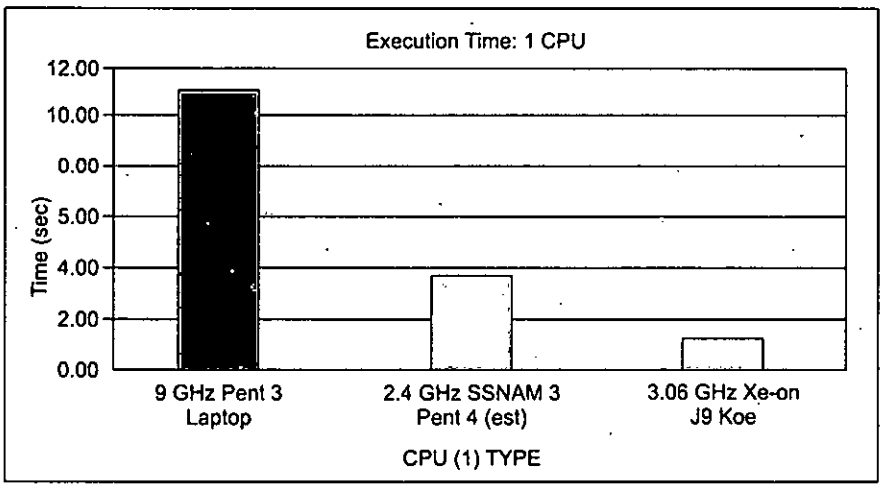

Fig. 2.9 HPC SSNAM Provides Higher speed runs of analyze the space Survaillance Nestwork of Sensors

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Significance: The HSAI mission and resulting efforts will expand DOD Service / Agency efforts in providing robust production level software for modeling, simulation, and computation in HPC application areas of the highest impact to DOD. The goals and focus areas of the HSAI SSA have direct applicability to customer requirements and ongoing activities to increase DOD space surveillance and exploitation capabilities that are important to the defense of the nation. The increasing number of satellites (with decreasing structural sizes) and the increased capabilities of space surveillance sensors will necessitate advanced software applications that utilize high performance computing assets. HSAI SSA will exploit technical resources to develop, apply, and support the transition of DOD HPC software applications. This will help lower cost and accelerate electronic systems design, development, testing, and procurement while capitalizing on modeling and simulation where applicable, and provide for a greater usability and robustness of applications software across a wide user base.

2.5 CONCLUDING OPERATIONS: VALID GENERALIZATION

2.5.1 Validity Generalizations.

A generalization is a specific kind of conclusion. All generalizations are conclusions, but not all conclusions are generalizations. A generalization is a broad statement that applies to many examples. A generalization is formed from a number of examples or facts and what they have in common. All animals that have feathers are birds.

Readers recognize and evaluate generalizations made by an author. Readers make and support their own generalizations based on reading a selection. Clue words that support instruction for generalizations: all, none, most, many, always, everyone, never, sometimes, some, usually, seldom, few, generally, in general, and overall. Generalizations are statements that may include or imply ideas. The climate in Mexico is generally warmer than that of the northern United States. Thoughtful readers are able to recognize generalizations. They are able to evaluate if a generalization is adequately supported by specific facts. Instruction for this strategy may include helping students evaluate, make judgments and form opinions A judgment is an opinion about the value of an action, a character, a situation, an author's assertions, elements of the text, etc. Thoughtful readers use their own experiences and details from the text to make judgments, form opinions, evaluate, or generalize.

2.5.2 Reliability

Definition: Reliability is the consistency of your measurement, or the degree to which an instrument measures the same way each time it is used under the same condition with the same subjects. In short, it is the repeatability of your measurement. A measure is considered reliable if a person's score on the same test given twice is similar. It is important to remember that reliability is not measured, it is estimated.

There are two ways that reliability is usually estimated: test/retest and internal consistency.

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Test/Retest: Test/retest is the more conservative method to estimate reliability. Simply put, the idea behind test/retest is that you should get the same score on test 1 as you do on test 2. The three main components of this method are as follows:

- Implement your measurement instrument at two separate times for each subject;
- Compute the correlation between the two separate measurements; and
- Assume there is no change in the underlying condition (or trait you are trying to measure) between test 1 and test 2.

Internal Consistency: Internal consistency estimates reliability by grouping questions in a questionnaire that measure the same concept. For example, you could write two sets of three questions that measure the same concept (say class participation) and after collecting the responses, run a correlation between those two groups of three questions to determine if your instrument is reliably measuring that concept.

The primary difference between test/retest and internal consistency estimates of reliability is that test/retest involves two administrations of the measurement instrument, whereas the internal consistency method involves only one administration of that instrument.

2.5.3 Validity

Definition: Validity is the strength of our conclusions, inferences or propositions. More formally, Cook and Campbell (1979) define it as the "best available approximation to the truth or falsity of a given inference, proposition or conclusion." In short, were we right? Let's look at a simple example. Say we are studying the effect of strict attendance policies on class participation. In our case, we saw that class participation did increase after the policy was established. Each type of validity would highlight a different aspect of the relationship between our treatment (strict attendance policy) and our observed outcome (increased class participation).

Types of Validity: There are four types of validity commonly examined in social research.

- Conclusion validity asks is there a relationship between the programme and the observed outcome? Or, in our example, is there a connection between the attendance policy and the increased participation we saw.
- Internal Validity asks if there is a relationship between the programme and the outcome we saw, is it a causal relationship? For example, did the attendance policy cause class participation to increase.
- Construct validity is the hardest to understand in my opinion. It asks if there is there a relationship between how I operationalized my concepts in this study to the actual causal relationship I'm trying to study. Or in our example, did our treatment (attendance policy) reflect the construct of attendance, and did our measured outcome - increased class participation-reflect the construct of participation? Overall, we are trying to generalize our conceptualized treatment and outcomes to broader constructs of the same concepts.
- External validity refers to our ability to generalize the results of our study to other settings. In our example, could we generalize our results to other classrooms

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2.5.4 Threats to Internal Validity

There are three main types of threats to internal validity - single group, multiple group and social interaction threats.

- **Single Group Threats** apply to a single group receiving a programme or treatment. Thus, all of these threats can be greatly reduced by adding a control group.
- **A History Threat** occurs when an historical event affects the programme group such that it causes the outcome which is observed (rather than your treatment being the cause). This would mean that the stricter attendance policy did not cause an increase in class participation, but rather, the expulsion of several students due to low participation from school impacted your programme group such that they increased their participation as a result.
- **A Maturation Threat** to internal validity occurs when standard events over the course of time cause the outcome. For example, if by chance, the students who participated in your study on class participation all "grew up" naturally and realized that class participation increased their learning that could be the cause of your increased participation, not the stricter attendance policy.
- **A Testing Threat** to internal validity is simply when the act of taking a pretest affects how that group does on the post-test. For example, if in your study of class participation, you measured class participation prior to implementing your new attendance policy, and students became forewarned that there was about to be an emphasis on participation, they may increase it simply as a result of involvement in the pretest measure - and thus, your outcome could be a result of a testing threat - not your treatment.
- **An Instrumentation Threat** to internal validity could occur if the effect of increased participation could be due to the way in which that pretest was implemented.
- **A Mortality Threat** to internal validity occurs when subjects drop out of your study, and this leads to an inflated measure of your effect. For example, if as a result of a stricter attendance policy, most students drop out of a class, leaving only those more serious students in the class (those who would participate at a high level naturally) - this could mean your effect is overestimated and suffering from a mortality threat.

The last single group threat to internal validity is a Regression Threat. This is the most intimating of them all (just its name alone makes one panic). Don't panic. Simply put, a regression threat means that there is a tendency for the sample (those students you study for example) to score close to the average (or mean) of a larger population from the pretest to the post test. This is a common occurrence, and will happen between almost any two variables that you take two measures of. Because it is common, it is easily remedied through either the inclusion of a control group or through a carefully designed research plan (this is discussed later).

CHECK YOUR PROGRESS

1. Write short note on UHMW-PE.

_____

_____

2. What is meant by ATR?

3. What is meant by AMOS?

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4. What are the types of threats to internal validity?

SUMMARY

The opportunity exists to replace steel wire rope with ultra-high molecular weight polyethylene (UHMW-PE). The braided rope has the strength of steel, lower weight, low stretch, and high flexibility. UHMW-PE rope has a higher breaking strength to weight ratio than steel wire rope by a factor of ten for breaking strengths when compared diameter by diameter for steel wire rope. Synthetic rope does not kink, corrode, or absorb chemicals and water. UHMW-PE braided rope has proven itself in the offshore drilling, mooring, tug line, and power line industries. The knuckle link and pinned nubbin were designed to attach to the synthetic rope using an eye splice and for use with static and running line applications. For the knuckle link, as the rope is spliced, it is first passed up through one hole, over the bar, and passed back down through the other hole. When the rope is pulled, the strands of the rope are highly stressed, and the top of the eye becomes one of the common failure modes. The focus of our work is on the development of efficient algorithms for signal and image processing problems. More specifically, we address real-world problems with large dimensionality for which computationally efficient data analysis is a primary concern.

KEY WORDS

- **Purification** - The act or an instance of cleansing or purifying.
- **Multistage** - Relating to or composed of two or more propulsion units.

ANSWER TO CHECK YOUR PROGRESS

1. UMWP means Ultra-high molecular weight polyethylene.
2. ATR means Automatic target recognition.
3. AMOS mean Air Force Maui Optical & Supercomputing Site.
4. There are three main types of threats to internal validity - single group, multiple group and social interaction threats.

TERMINAL QUESTIONS

1. What are the methods of synthetic operations?
2. Write down the determining of particular facts.
3. Explain synthetic operations groping of facts.

4. What is GMRFs?
5. Write a paragraph on Tractable Methods Inference and Learning in Graphical Models.

FURTHER READINGS

NOTES

- C. West Churchman, Russell L. Ackoff & E. L. Arnoff, Introduction to Operations Research, New York: J. Wiley and Sons.
- Joseph G. Ecker & Michael Kupferschmid, Introduction to Operations Research, Krieger Publishing Co.
- Frederick S. Hillier & Gerald J. Lieberman, Introduction to Operations Research, McGraw-Hill.
- Michael Pidd, Tools for Thinking: Modelling in Management Science, J. Wiley & Sons Ltd., Chichester.
- Hamdy A. Taha, Operations Research: An Introduction, Prentice Hall.
- Wayne Winston, Operations Research: Applications and Algorithms, Duxbury Press.
- Kenneth R. Baker, Dean H. Kropp . An Introduction to the Use of Decision Models.

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UNIT III: CONCLUDING OPERATIONS: EXPOSITION

★ STRUCTURE ★

3.0 LEARNING OBJECTIVES

After reading this unit students will be able to:

- know the concluding operations - exposition.
- understand the concluding operations – footnotes.
- analyse the concluding operations – bibliography.
- write about the construction and representations of india's past.
- discuss the Light Rail and the Safety of Drivers and Pedestrians– State of the Art.

3.1 INTRODUCTION

Exposition is one of four rhetorical modes of discourse, along with argumentation, description, and narration. It is also used for speeches. The purpose of exposition is to provide some background and inform the readers about the plot, character, setting, and theme of the essay/story or motion picture. Exposition is divided into two methods: Analytical Exposition, Hortatory Exposition.

3.2 CONCLUDING OPERATIONS: EXPOSITION

3.2.1 Analytical Exposition

An analytical exposition is a type of spoken or written text that is intended to persuade the listeners or readers that something is the case. To make the persuasion

stronger, the speaker or writer gives some arguments as the fundamental reasons why something is the case. This type of text can be found in scientific books, journals, magazines, newspaper articles, academic speech or lectures, research report etc. Analytical expositions are popular among science, academic community and educated people. The generic structure of analytical exposition usually has three components: (1) Thesis, (2) Arguments and (3) Reiteration or conclusion.

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(A) Generic Structure of Analytical Exposition

- Thesis: Introduces the topic and shows speaker or writer's position; Outlines of the arguments are presented.
- Arguments: It consists about Point and Elaboration Point, states the main argument. Elaboration, develops and supports each point of argument
- Conclusion: Reiteration (restatement), restates speaker or writer's position

(B) Generic Features

An analytical exposition focuses on generic human and non human participants. It uses mental processes. It is used to state what the writer or speaker thinks or feels about something. For example: realize, feel etc. It uses emotive and evaluative words. It often needs material processes. It is used to state what happens, *e.g.* ....has polluted... etc. It usually uses Simple Present Tense and Present Perfect Tense. Enumeration is sometimes necessary to show the list of given arguments: Firstly, secondly ..., finally, etc.

3.2.2 Definition of Hortatory Exposition

- Hortatory exposition is a text which represents the attempt of the writer to have the addressee do something or act in certain way.
- Generic Structure of Hortatory Exposition
  - Thesis
  - Arguments
  - Recommendation
- Language Feature of Hortatory Exposition
  - Focusing on the writer
  - Using abstract noun; policy, advantage, etc
  - Using action verb
  - Using thinking verb
  - Using modal adverb; certainly, surely, etc
  - Using temporal connective; firstly, secondly, etc
  - Using evaluative words; important, valuable, trustworthy, etc
  - Using passive voice
  - Using simple present tense

3.2.3 Example of Hortatory Exposition

Television becomes one of the most important devices which take place in almost houses. It can unite all members of the family as well as separate them. However,

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is it important to know what your kids are watching? The answer is, of course, absolutely "Yes" and that should be done by all parents. Television can expose things you have tried to protect the children from, especially violence, pornography, consumerism and so on.

Recently, a study demonstrated that spending too much time on watching TV during the day or at bedtime often causes bed-time disruption, stress, and short sleep duration.

Another research found that there is a significant relationship between the amount of time spent for watching television during adolescence and early adulthood, and the possibility of being aggressive. Meanwhile, many studies have identified a relationship between kids who watch TV a lot and being inactive and overweight. Considering some facts mentioning above, protect your children with the following tips:

- Limit television viewing to one-two hours each day
- Do not allow your children to have a TV set in their own bedrooms
- Review the rating of TV shows which your children watch
- Watch television with your children and discuss what is happening in the show

3.2.4 Exposition in fiction

(*a*) **Exposition as a fiction-writing mode:** Within the context of fiction, exposition is the fiction-writing mode for conveying information. According to Robert Kernen, "Exposition can be one of the most effective ways of creating and increasing the drama in your story. It can also be the quickest way to kill a plot's momentum and get your story bogged down in detail. Too much exposition, or too much at one time, can seriously derail a story and be frustrating to the reader or viewer eager for a story to either get moving or move on."

Exposition in fiction may be delivered through various means. As noted by Ansen Dibell, the simplest way is to just place the information between scenes as the all-seeing, all-knowing (but impersonal and invisible) narrator.) Jessica Page Morrell has observed that various devices, such as trial transcriptions, newspaper clippings, letters, and diaries may be used to convey information. Another means of delivering information is through a character, either as dialogue or through the character's thoughts.

(*b*) **Information dump:** When the presentation of information in fiction becomes wordy, it is sometimes referred to as an "information dump," "exposition dump," or "plot dump." Information dumps expressed by characters in dialogue or monologue are sometimes referred to as "idiot lectures."

Information dumps are sometimes placed at the beginning of stories as a means of establishing the premise of the plot. In serial television dramas, exposition in individual episodes often appears as a brief montage of scenes from earlier episodes, prefaced with the phrase "Previously on [name of series]." *Villain speech* is a specific form of exposition in which the villain describes his sinister plans to a helpless hero, often prefacing his exposition with the comment that it can't hurt to divulge the plan, since the hero will be dead soon anyway (or the plan will be impossible to stop in the short time available). The villain's motivation sometimes includes his desire to have his cleverness admired by the character most capable of appreciating it.

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Examples include Comic book supervillains and villains in James Bond movies.

In television, information dumps are common in sit-coms with the introduction of non-recurring characters which drive the comedic plot of a particular episode. An example would be the use of the narrator in *Arrested Development* to sum up the revelations and inner thoughts of characters in order to keep the viewer tuned to the plot.

In television sketch comedy, which borrows from the tradition of vaudeville comedy, exposition in the most exaggerated sense is used for outrageous comedic effect.

Stories which are concerned with the unearthing of a secret past sometimes include lengthy exposition sequences. These may include large quantities of exposition, complete with theorizing about the implications of the information. Examples include:

- Dan Brown's The Da Vinci Code
- Neal Stephenson's Snow Crash
- Umberto Eco's Foucault's Pendulum
- HBO's Rome (TV series)

(*c*) **Parodies of information dump:** The Austin Powers film series has a character named Basil Exposition whose job was to repeatedly plot dump as a parody of the process in movies with serious plots. The series Mystery Science Theater 3000 always mocked movies that made blatant use of this practice. For example, in Parts: The Clonus Horror, there is a scene where a character views a videotape that explains the organization's origins and purpose in painstaking detail, basically providing all of the necessary exposition in one fell swoop. Tom Servo quips, "Good thing he wandered into the Department of Backstory!" At the beginning of another MST3k movie, Riding with Death, an extra consults a computer file containing information about the movie's protagonist for completely unexplained reasons (other than providing exposition). Once again, Servo notes this by referring to the computer as the "Backstory Database".

Plot dumps are parodied in the movie Spaceballs when Colonel Sandurz explains a plan to Dark Helmet, though Dark Helmet should have already known the plan. Dark Helmet then faces the camera and, breaking the fourth wall, asks the audience "Everybody got that?" to parody the true purpose of the plot dump.

The "villain speech" is criticized in the film Last Action Hero, where the police traitor, John Practice, reveals his evil plan to Jack Slater and Danny, to which the latter retorts that it is a classic mistake made by villains. Also, in The Incredibles, several characters negatively denote "monologuing" as a villain's speech that goes on for too long and distracts him from realizing the superhero is escaping.

Several villains in the Nickelodeon series Danny Phantom have been prone to plot dumping, especially the recurring technology ghost, Nicolai Technus. This is made into a running gag in the episode "Identity Crisis." In that episode, Technus claims to have upgraded himself, one of the advantages of the upgrade being that he would no longer shout his nefarious plot into the sky. He was able to maintain this for most of the episode (at one point even criticizing Danny for shouting something into the air himself), but eventually dictates his plot to himself near victory, immediately afterwards saying, "Nobody heard that, right?"

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In the stage musical Urine town, the first song is in fact titled "Too Much Exposition" during which the Narrator and Little Sally explain about the drought that caused the water shortage, and in turn, the end of private bathrooms. While discussing the issue Officer Lock stock finally stops Little Sally before she reveals too much because "nothing can kill a show like too much exposition." Really! ("What about bad subject matter?" she argues. "Or a bad title? That can kill a show pretty good.")

(d) **In cluing:** *In cluing is a technique of world building, in which the reader is* gradually exposed to background information about the world in which a story is set. The idea is to clue the readers into the world the author is building, without them being aware of it. This in opposition to info dumping, where a concentrated amount of background material is given all at once in the story, often in the form of a conversation between two characters, both of whom should already know the material under discussion. (The so-called As you know, Bobconversation.)

Both in cluing and infodumping are forms of exposition and are frequently used in science fiction and fantasy, genres where the author has the task to make the reader believe in a world that does not exist. Writers in other genres have less use for these techniques, as they can often depend on the reader's familiarity with the "real world".

In cluing can be done in a number of ways: through conversation between characters, through background details or by establishing scenes where a character is followed through daily life.

The word in cluing is attributed to fantasy and science fiction author Jo Walton. She defined it as "the process of scattering information seamlessly through the text, as opposed to stopping the story to impart the information."

3.3 CONCLUDING OPERATIONS: FOOTNOTES

A footnote is a notation at the bottom of the page in a printed document. Footnotes are usually presented in smaller print than the dominant text, and they are used for a variety of purposes. The "foot" in "footnote" refers to the fact that the notation is located in the "footer" or "bottom" of the document. A similar concept is the endnote, a note which is provided at the end of a document, rather than at the bottom of a specific page. When a text has footnotes, they are indicated with various symbols or superscript numbers.

The asterisk symbol, *, is a common symbol for footnotes, but a variety of symbols including daggers, †, may be used. In a text with a lot of footnotes, numbers are usually used to indicate footnotes, so that the reader can keep track of what is going on. Endnotes are typically indicated with numbers, to make it easier for people to look them up.

Different style manuals have different rules about using footnotes, and it is important to follow style guidelines when submitting material for publication. Because footnoting can get very complicated, most style guidelines devote at least a few pages to the footnote. Some people avoid using footnotes at all, while others relish footnotes, because footnotes provide a great degree of freedom when they are used well.

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One common reason for footnoting is to provide citations. Whenever an author quotes someone else or discusses someone else's ideas, he or she is expected to provide a citation, both to provide credit and to allow readers to examine the source for themselves. Some style guidelines like citations inline in the text, as in "(Myers, 2006)", while others prefer to see citations footnoted. Footnoting citations allows readers to focus on the text, consulting the citation whenever they feel like it, rather than being forced to read it.

Footnotes really flourish in the sense of additional commentary. Authors may use a footnote to provide comments or extra information, especially if that information digresses. Academics in particular cannot resist sharing interesting tidbits with their readers, but these tidbits may not be strictly relevant to the text at hand. Using a footnote allows authors to talk about matters which may be of interest without detracting from the primary focus of the text. Sometimes, the footnotes take up more room on the page than the actual text.

It is not uncommon to see footnotes used to make humorous asides. For people who enjoy academic jokes, footnotes are often a great source for amusing comments and side notes which would not be appropriate in the central text. Footnotes may also be used to recount anecdotes or to provide a subtle commentary on the source or topic being discussed.

Writing an academic report or a research paper requires the author to pay careful attention to footnote formatting requirements. Some industries and institutions have their own specific formatting and may either provide their own style guide or follow a more standard one. The standard footnote formatting styles include those of the American Psychological Association (APA) and the Modern Language Association (MLA). APA style footnotes focus on the exact research source and its date, and are used for psychological and scientific papers, articles, and journals. Documents in language and literature disciplines tend to stress MLA style, which focuses more on the author than details on the source.

In contrast to endnotes that go at the end of a document, footnotes are placed at the bottom of the page where a reference appears. Footnotes are used to cite quotes from books or articles, sources of statistics, and concepts derived from the ideas of another author's argument. Information that is used to describe and define concepts in detail can also be cited with its appropriate source. How this information is structured depends on the footnote formatting used.

Footnote formatting for technical and scientific information follows APA guidelines. The research source is emphasized because similar articles published by the same author may reflect out of date information. Details that are crucial to the ideas expressed in the paper can be referenced using citations within the text. The references can otherwise be highlighted by a superscripted number or asterisk that corresponds to the specific footnote.

In APA-style footnotes, the last and first name of the author appear at the beginning, followed by the article title or website in italics. It is optional to add the date, in brackets or parentheses, on which the information was retrieved. The website address, if appropriate, must be placed at the end of the footnote.

Another major style of footnote formatting is MLA. This format focuses on the author, but if the author's name is not known, the website can be mentioned in

italics first. The author's name goes first in other cases, followed by the date the information was found in month, day, and year format. Information on the source title or website address follows this information. This kind of footnote formatting, like other aspects of MLA, is designed to provide concise and brief citations in the text, and is tailored to the needs of scholastic disciplines.

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A note is a string of text placed at the bottom of a page in a book or document or at the end of a text. The note can provide an author's comments on the main text or citations of a reference work in support of the text, or both. A footnote is normally flagged by a superscripted number immediately following that portion of the text the note is in reference to.

The first idea for the first footnote on the page, the second idea for the second footnote, and so on. Occasionally a number between brackets or parentheses is used instead, thus: Typographical devices such as the asterisk (*) or dagger (†) may also be used to point to footnotes; the traditional order of these symbols is *, †, ‡, §, ,¶. In documents like timetables, many different symbols, as well as letters and numbers, may be used to refer the reader to particular notes.

Footnotes are notes at the foot of the page while endnotes are collected under a separate heading at the end of a chapter in a book or a document. Unlike footnotes, endnotes have the advantage of not affecting the image of the main text, but may cause inconvenience to readers who have to move back and forth between the main text and the endnotes.

The U.S. Government Printing Office Style Manual devotes over two pages to the topic of footnotes. NASA has guidance for footnote usage in its historical documents.

Notes are most often used as an alternative to long explanatory notes that can be distracting to readers. Most literary style guidelines (including the Modern Language Association and the American Psychological Association) recommend limited use of foot and endnotes. However, publishers often encourage note references in lieu of parenthetical references. Aside from use as a bibliographic element, notes are used for additional information or explanatory notes that might be too digressive for the main text.

The MLA (Modern Language Association) requires the superscript numbers in the main text to be placed following the punctuation in the phrase or clause the note is in reference to. The exception to this rule occurs when you have a hyphen in a sentence, in which case the superscript would appear before.

Aside from their technical use, authors use notes for a variety of reasons:

- As signposts to direct the reader to information the author has provided or where further useful information is pertaining to the subject in the main text.
- To attribute to a quote or viewpoint.
- As an alternative to parenthetical references; it is a simpler way to acknowledge information gained from another source.
- To escape the limitations imposed on the word count of various academic and legal texts which do not take into account notes. Aggressive use of this strategy can lead the text to be seen as affected by what some people call "foot and note disease."

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HTML

HTML, the predominant markup language for web pages, has no mechanism for marking up notes. Despite a number of different proposals over the years, and repeated pleas from the user base, the working group has been unable to reach a consensus on it. Because of this, Media Wiki, for example, has had to introduce its own <ref></ref> tag for citing references in notes, an idea which has since also been implemented for generic use by the Nelson HTML preprocessor.

It might be argued that the hyperlink partially eliminates the need for notes, being the web's way to refer to another document. However, it does not allow citing to offline sources and if the destination of the link changes, the link can become dead or irrelevant.

Wikipedia footnotes serve two purposes: to add explanatory material, particularly if the added information would be distracting if written out in the main article; or, to present citations to reliable sources that support assertions in the main article.[1] As explained at Wikipedia: Citing sources, footnoting is one of several acceptable ways to present inline citations.

Wikipedia has several mechanisms for creating footnotes that contain reciprocal hyperlinks, so that clicking on a number or symbol found in the main text brings readers to the corresponding footnote, and vice versa. Thus, as described below, two different types of footnote mark up may be used to distinguish explanatory footnotes from citation footnotes. See, for example, the Jane Austen article.

The prevailing system for adding footnotes to an article is Cite. php, which involves the <ref> tag. This system has several advantages, including automatic sequential numbering of the footnotes and provisions for multiple references to the same footnote. To add such a footnote to an article, the editor includes the text of the footnote between two HTML-style tags (e.g., <ref>Text of footnote goes here.</ref>). Different classes of footnotes can be defined within an article using the group parameter inside the ref tag, as described below.

Editors may also use the older system of template-based footnotes, such as {{ref label}} and {{note label}}. These have the disadvantage that they are not numbered automatically; the editor has to choose a specific label. It is generally expected that footnotes will be labeled in the order in which they occur in the text. Therefore, if an editor adds such a template-based footnote in the middle of an article, the editor should also renumber/increment all the subsequent footnotes of the same type, by hand.

How to use

A simplified explanation is given at Help: Footnotes

- Place a <ref> ... </ref> opening and closing tag where you want a footnote reference number to appear in an article—type the text of the note between the ref tags.
- Place the <references /> tag or {{Reflist}} tag in either a "Notes" or "References" section as explained in the Guide to Layout — the list of notes will be generated in that section.

This page itself uses footnotes, such as the one at the end of this sentence. If you view the Wiki code of this page by clicking "Edit this page", you can see a working example of footnotes.

Listing footnotes at the end of the article: using <references /> or {{Reflist}}: If creating a new article or editing an article that does not have footnotes already

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and you wish to add footnotes to the article, it must create a new section towards the end of the article (usually titled "Notes" or "References", see Layout) and place one of these in it: <references /> or {{Reflist}}.

{{Reflist}} displays the footnotes in a smaller font in the old mono book skin.

{{Reflist|2}} is used to split long listings into a specific number of columns. Three-column lists (and larger) are inaccessible to users with smaller/laptop monitors and should be avoided unless they are supporting shortened footnotes.

To prevent display problems with multi-column formats on smaller monitors, the "colwidth" parameter can be used with {{Reflist}} to specify a fixed column width. The number of columns displayed will then automatically adjust to match the size of the user's browser window. For example, {{Reflist|colwidth=20em}} will display as many columns with a minimum width of 20 cms as will fit in the browser window.

Multi-column lists are not currently supported by Internet Explorer or Safari.

Two of the above options are included in the "markup" below the edit box; if you click on this, it will add it to the page. Once you save your edit, footnotes will be automatically generated in the new references section.

Reference name (naming a ref tag so it can be used more than once): To give a footnote a unique identifier, use <ref name="Whatevernameyoupick"> ... </ref> rather than just <ref> ... </ref>. You can then refer to the same source, in a new footnote, simply by using a ref tag with the name you chose, which looks like this <ref name="Whatevernameyoupick" />. The name cannot be a number, or the extension will return an error. The ref name need not be placed within quotes unless it contains a space, certain punctuation marks, or non-ASCII characters (the wiki parser converts single word quoteless attribute values into validly quoted XHTML). Note that any quotation marks placed around the ref name must be straight quotes (") rather than curly quotes ("or"). Curly quotes are standard for word processing programs and can show up when drafts are cut and pasted from word processing programs.

Named references are used when there are several cases of repetition of exactly the same reference, including the page number for books; they should not normally be used to cite different pages in the same book. However, in the case of a source that must be cited many, many times, at numerous different pages, the template {{rp}} can be used. This allows a page number to be appended directly to each use of the named reference although the page cannot be linked directly. Named references in wikitext serve a purpose similar to loc. cit., ibid., Id. or supra in printed media. See also cautions in Style below.

Only the first occurrence of text in a named ref will be used, although that occurrence may be located anywhere in the article. You can either copy the whole footnote, or you can use a terminated empty ref tag that looks like this: <ref name="name" />. Such forward-slash-terminated named tags may precede the definition of the named reference.

When using named references, many editors prefer <ref name="name" /> for the later instances of the named footnote, rather than copying the whole footnote again, making it easier and less tedious to follow the flow of readable text when editing. However, some editors prefer to repeat the entire footnote, to prevent inadvertent removal of the only full copy of the reference, although this approach requires that updates to the footnote be made to all the footnote instances if all the instances are to reflect the current displayed text.

A third alternative is to use only empty references in the body of the article, keeping the text of all references within the reflist template at the end of the article, although this requires manual editing of the reflist template when a reference is added or completely removed. (See List-defined references below.)

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In the following example, the same source is cited three times: This is an example of multiple references to the same footnote.<ref name="multiple" /> Such references are particularly useful when citing sources where different statements come from the same source.<ref name="multiple">Author, A. (2007). "How to cite references", New York: McGraw-Hill.</ref> A concise way to make multiple references is to use empty ref tags, which have a slash at the end.<ref name="multiple">This text is superfluous, and won't show up anywhere. We may as well just use an empty tag.</ref>== Notes ={{reflist}}

The edit text above gives the following result in the article: This is an example of multiple references to the same footnote. Such references are particularly useful when citing sources where different statements come from the same source. A concise way to make multiple references is to use empty ref tags, which have a slash at the end.^ [a] [b] [c] Author, A. (2007). "How to cite references", New York: McGraw-Hill.

One should be particularly careful when deleting a named reference with text content, because the footnote text will be deleted unless it is copied to another ref tag with the same name.

Citation templates: Text placed between <ref> and </ref> may be short notes or full bibliographic references, and may be formatted either by hand or with the assistance of templates. Instructions on available templates to help format bibliographic references may be found at Wikipedia: Citation templates. Use of such templates is neither encouraged nor discouraged; see WP:CITE

Notes and references not normally visible: Edit a Single Section on a long page, the Notes or References section will not be visible preview edits unless use the editor gadget wikEd. Thus ordinarily cannot see the footnotes (text place between <ref> and </ref> tags) will later appear save the edits.

Workaround for notes and references: A simple workaround is to temporarily insert a <references /> or {{Reflist}} tag at the bottom of the edit box of the section you are editing (wikEd does this automatically). footnotes will appear at the bottom of your section so you can preview them. When you are satisfied with your edits to the section, delete your temporary <references />or {{Reflist}} tag, and save your edits. Now, your footnotes should appear in the "Notes" or "References" section along with other footnotes on the page.

While preview the footnotes in a section this way, the first footnote in the section will temporarily have a number of one (1), because the preview will not show footnotes from elsewhere on the page. The footnotes will renumber properly across the entire article after save the edited section.

Re-use of reference(s) from another section: Another complication is that you will not be able to preview the effect of citing a footnote from another section merely by citing its name (for example: <ref name="multiple" />). If the section you want to edit reuses footnotes from elsewhere on the page, a simple solution is to edit the whole page at once in order to preview the footnotes accurately.

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The footnotes will appear at the bottom of the section so it can preview them. Delete the temporary full reference code and save the edits. Now, the footnotes should appear in the "Notes" or "References" section along with other footnotes on the page.

New line after closing ref tag: Reading inline <ref> tags can be difficult in edit mode, particularly where ref tags contain large amounts of reference text, such that simply discerning where the reference ends and the article text begins can be time-consuming.

As a convenience, it may be helpful to carriage return (newline) the article text that comes just after the closing </ref> tag, such as:

Article text text <ref name="refname"> Reference text... </ref> {return}'!continuing text text text..

This allows editors to see clearly where the ref tag body ends and the article text begins, and it doesn't alter the way the text appears in the output view mode—text sections need to be separated by two newline/carriage returns to be formatted as separate paragraphs.

Ref tags, spacing and punctuation: Material may be referenced mid-sentence (particularly if one portion of the sentence is supported by one source, and another portion by another source) or at the end of a sentence or paragraph. Reference tags should immediately follow the text to which they refer, with no space before the tag. When a reference tag coincides with punctuation, the tag is placed immediately after the punctuation. Multiple tags should have no space between them. Flightless birds have a reduced keel and smaller wing bones than flying birds of similar size.

Punctuation exceptions: There are two exceptions, as recommended by the Chicago Manual of Style and other style guides: reference tags are placed before, not after, dashes; and where a reference applies only to material within a parenthetical phrase, the tag may be placed within the closing parenthesis if appropriate. Paris is not the capital city of England—the capital of which is London but of France, and is widely known as a beautiful city. Kim Jong-un (Korean: @®È@Ç, Hanjais the third and youngest son of Kim Jong-il with his late consort Ko Young-hee.

Style recommendations: Do not use ibid., Id., or similar abbreviations in footnotes. Other editors who add new references to the article may not take the time to correct Ibid references broken by their addition (op. cit. is less problematic in that it should refer explicitly to a citation contained in the article; however, not all readers are familiar with the meaning of the terms). If a reference is reused in more than one footnote, it is preferable to use the format "Smith, Short Title, 182" rather than "Ibid, 182", so as to avoid these problems, or use named references if appropriate.

Consider maintaining a separate bibliography/references section that gives full publication details for frequently cited sources, then you only need to cite the author, short title or year of publication, and page number in specific notes, following shortened footnotes. For examples of this usage, see Johannes Kepler and Rabindranath Tagore.

The decision on whether to use quotes in footnotes is primarily a decision of style and may vary from article to article. Some citation templates include parameters for quotes, and quoted text can also be added inside a footnote either preceding or

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following a template-produced citation. Quoting text can be useful for the verifiability of material in an article. Footnoted quotes are acceptable if they are brief, relevant to the article text that is being footnoted, compliant to copyright (including fair use where applicable), of use or interest to the reader, and not used as an evasion of other guidance (most notably: content policy). Where there is disagreement on the use of quotations in footnotes on a particular article, consensus should be sought on the talk page for that article.

Separating reference lists and explanatory notes: It may be desirable for an article to list sources separately from explanatory notes. When this is done the sources may appear in an alphabetized list unlinked to the article (e.g., Starship Troopers) or in a list that is linked to specific text in the article by footnotes (e.g., Jane Austen). A separate section containing references is usually given the title "References", while the explanatory notes section retains the "Notes" title.

One way to generate a linked list of sources involves the group= option of the <ref> tag, which is analogous to thename= option described above. In this approach, narrative references are given their own "group" namespace. The group identifier is specified inside explanatory note <ref> tags and its final <references /> tag. The closing tag </ref> does not change.

3.4 CONCLUDING OPERATIONS: BIBLIOGRAPHY

Bibliography (from Greek bibliographia, literally "book writing"), as a practice, is the academic study of books as physical, cultural objects; in this sense, it is also known as bibliology (from Greek -ëïãßá, -logia). On the whole, bibliography is not concerned with the literary content of books, but rather the sources of books – how they were designed, edited, printed, circulated, reprinted and collected. A bibliography, the product of the practice of bibliography, is a systematic list of books and other works such as journal articles. Bibliographies range from "works cited" lists at the end of books and articles to complete, independent publications. As separate works, they may be in bound volumes, or computerized bibliographic databases. A library catalogue, while not referred to as a "bibliography," is bibliographic in nature. Bibliographical works are almost always considered to be tertiary sources.

Bibliographic works differ in the amount of detail depending on the purpose, and can be generally divided into two categories: enumerative bibliography (also called compilative, reference or systematic), which results in an overview of publications in a particular category, and analytical, or critical, bibliography, which studies the production of books

Definition of bibliography

- A complete or selective list of works compiled upon some common principle, as authorship, subject, place of publication, or printer.
- A list of source materials that are used or consulted in the preparation of a work or that are referred to in the text.
- A branch of library science dealing with the history, physical description, comparison, and classification of books and other works.

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3.4.1 Etymology

The word bibliographia was used by Greek writers in the first three centuries AD to mean the copying of books by hand. In the 12th century, the word started being used for "the intellectual activity of composing books". The 17th century then saw the emergence of the modern meaning, that of description of books.

3.4.2 Enumerative bibliography

A bibliography is a list of writings that share a common factor: this may be a topic, a language, a period, or some other theme. The list may be comprehensive or selective. One particular instance of this is the list of sources used or considered in preparing a work, sometimes called a reference list.

Citation formats vary, but an entry for a book in a bibliography usually contains the following information:

- author(s)
- title
- publisher
- date of publication

An entry for a journal or periodical article usually contains:

- author(s)
- article title
- journal title
- volume
- pages
- date of publication

A bibliography may be arranged by author, topic, or some other scheme. Annotated bibliographies give descriptions about how each source is useful to an author in constructing a paper or argument. These descriptions, usually a few sentences long, provide a summary of the source and describe its relevance. Reference management software may be used to keep track of references and generate bibliographies as required.

Bibliographies differ from library catalogues by including only relevant items rather than all items present in a particular library. However, the catalogues of some national libraries effectively serve as national bibliographies, as the national libraries own almost all their countries' publications.

3.4.3 Analytical bibliography

The critical study of bibliography can be subdivided into descriptive (or physical), historical, and textual bibliography. Descriptive bibliography is the close examination of a book as a physical object, recording its size, format, binding, and so on, while historical bibliography takes a broader view of the context in which a book is produced, in particular, printing, publishing and bookselling. Textual bibliography is another name for textual criticism.

Non-book material

Systematic lists of media other than books can be referred to with terms formed analogously to bibliography:

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- Discography – recorded music
- Filmography – films

Webography (or webliography) – websites (the first use of the word "webliography" recorded in the Oxford English Dictionary dates from June 1995) Arachniography is a term coined by NASA research historian Andrew J. Butrica, which means a reference list of URLs about a particular subject. It is equivalent to a bibliography in a book. The name derives from arachne in reference to a spider and its web.

Broadly, a **citation** is a reference to a published or unpublished source (not always the original source). More precisely, a citation is an abbreviated alphanumeric expression (e.g. [Newell84]) embedded in the body of an intellectual work that denotes an entry in the bibliographic references section of the work for the purpose of acknowledging the relevance of the works of others to the topic of discussion at the spot where the citation appears. Generally the combination of both the in-body citation and the bibliographic entry constitutes what is commonly thought of as a citation (whereas bibliographic entries by themselves are not).

A prime purpose of a citation is intellectual honesty: to attribute prior or unoriginal work and ideas to the correct sources, and to allow the reader to determine independently whether the referenced material supports the author's argument in the claimed way.

The forms of citations generally subscribe to one of the generally accepted citations systems, such as the Oxford, Harvard, MLA, American Sociological Association (ASA), American Psychological Association (APA), and other citations systems, as their syntactic conventions are widely known and easily interpreted by readers. Each of these citation systems has its respective advantages and disadvantages relative to the trade-offs of being informative (but not too disruptive) and thus should be chosen relative to the needs of the type of publication being crafted. Editors will often specify the citation system to use.

Bibliographies, and other list-like compilations of references, are generally not considered citations because they do not fulfill the true spirit of the term: deliberate acknowledgment by other authors of the priority of one's ideas.

Concepts

A bibliographic citation is a reference to a book, article, web page, or other published item. Citations should supply sufficient detail to identify the item uniquely. Different citation systems and styles are used in citation, legal, prior art, and the arts and the humanities.

Citation content

Citation content can vary depending on the type of source and may include:

1. Book: author(s), book title, publisher, date of publication, and page number(s) if appropriate.
2. Journal: author(s), article title, journal title, date of publication, and page number(s).
3. Newspaper: author(s), article title, name of newspaper, section title and page number(s) if desired, date of publication.

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4. Web site: author(s), article and publication title where appropriate, as well as a URL, and a date when the site was accessed.
5. Play: inline citations offer part, scene, and line numbers, the latter separated by periods: 4.452 refer to scene 4, line 452. For example, "In Eugene Onegin, Onegin rejects Tanya when she is free to be his, and only decides he wants her when she is already married" (Pushkin 4.452-53).

Poem: spaced slashes are normally used to indicate separate lines of a poem, and parenthetical citations usually include the line number(s). For example: "For I must love because I live / And life in me is what you give." (Brennan, lines 15–16).

Unique identifiers

Along with information such as author(s), date of publication, title and page numbers, citations may also include unique identifiers depending on the type of work being referred to.

Citations of books may include an International Standard Book Number (ISBN).

Specific volumes, articles or other identifiable parts of a periodical, may have an associated Serial Item and Contribution Identifier (SICI). Electronic documents may have a digital object identifier (DOI). Biomedical research articles may have a PubMed Identifier (PMID). A citation number, used in some citation systems, is a number or symbol added inline and usually in superscript, to refer readers to a footnote or endnote that cites the source. In other citation systems, an inline parenthetical reference is used rather than a citation number, with limited information such as the author's last name, year of publication, and page number referenced; a full identification of the source will then appear in an appended bibliography.

3.4.4 Citation systems

Note systems: Note systems involve the use of sequential numbers in the text which refer to either footnotes (notes at the end of the page) or endnotes (a note on a separate page at the end of the paper) which gives the source detail. The notes system may or may not require a full bibliography, depending on whether the writer has used a full note form or a shortened note form. For example, an excerpt from the text of a paper using a notes system without a full bibliography could look like this:

"The five stages of grief are denial, anger, bargaining, depression, and acceptance. "The note, located either at the foot of the page (footnote) or at the end of the paper (endnote) would look like this:

Elisabeth Kübler-Ross, On Death and Dying (New York: Macmillan, 1969) 45–60.In a paper which contains a full bibliography, the shortened note could look like this:

Kübler-Ross, On Death and Dying 45–60 and the bibliography entry, which would be required with a shortened note, would look like this: Kübler-Ross, Elisabeth. On Death and Dying. New York: Macmillan, 1969.

In the humanities, many authors use footnotes or endnotes to supply anecdotal information. In this way, what looks like a citation is actually supplementary material, or suggestions for further reading.

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Parenthetical referencing

In parenthetical referencing also known as Harvard referencing full or partial, in-text citations are enclosed within parentheses and embedded in the paragraph, as opposed to the footnote style.

Depending on the choice of style, fully cited parenthetical references may require no end section. Alternately a list of the citations with complete bibliographical references may be included in an end section sorted alphabetically by author's last name.

This section may be known as:

- References
- Bibliography
- Works cited
- Works consulted

3.4.5 Law

The Bluebook is a citation system traditionally used in American academic legal writing, and the Bluebook (or similar systems derived from it) is used by many courts. At present, academic legal articles are always footnoted, but motions submitted to courts and court opinions traditionally use inline citations which are either separate sentences or separate clauses.

The legal citation style used almost universally in Canada is based on the Canadian Guide to Uniform Legal Citation (aka McGill Guide), published by McGill Law Journal. British legal citation almost universally follows the Oxford Standard for Citation of Legal Authorities (OSCOLA)

Sciences, mathematics, engineering, physiology, and medicine

The American Chemical Society style, or ACS style, is often used in chemistry and other physical sciences. In ACS style references are numbered in the text and in the reference list, and numbers are repeated throughout the text as needed.

In the style of the American Institute of Physics (AIP style), references are also numbered in the text and in the reference list, with numbers repeated throughout the text as needed. Styles developed for the American Mathematical Society (AMS), or AMS styles, such as AMS-LaTeX, are typically implemented using the BibTeX tool in the LaTeX typesetting environment. Brackets with author's initials and year are inserted in the text and at the beginning of the reference. Typical citations are listed in-line with alphabetic-label format, e.g. [AB90]. This type of style is also called a "Authorship trigraph."

The Vancouver system, recommended by the Council of Science Editors (CSE), is used in medical and scientific papers and research.

In one major variant that is used by the American Society of Mechanical Engineers (ASME), citation numbers are included in the text in square brackets rather than as superscripts. All bibliographical information is exclusively included in the list of references at the end of the document, next to the respective citation number.

The International Committee of Medical Journal Editors (ICMJE) is reportedly the original kernel of this biomedical style which evolved from the Vancouver 1978 editors' meeting. The MEDLINE/ PubMed database uses this citation style

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and the National Library of Medicine provides "ICMJE Uniform Requirements for Manuscripts Submitted to Biomedical Journals — Sample References".

The style of the Institute of Electrical and Electronics Engineers (IEEE), or IEEE style, encloses citation numbers within square brackets and numbers them consecutively, with numbers repeated throughout the text as needed.

Pechenik Citation Style is a style described in A Short Guide to Writing about Biology, 6th ed. (2007), by Jan A. Pechenik. In 2006, Eugene Garfield proposed a bibliographic system for scientific literature, to consolidate the integrity of scientific publications.

3.4.6 Social sciences

The style of the American Psychological Association, or APA style, published in the Publication Manual of the American Psychological Association, is most often used in social sciences. APA style uses Harvard referencing within the text, listing the author's name and year of publication, keyed to an alphabetical list of sources at the end of the paper on a References page.

The American Political Science Association publishes both a style manual and a style guide for publications in this field. The style is close to the CMOS. The American Anthropological Association utilizes a modified form of the Chicago Style laid out in their Publishing Style Guide. The ASA style of American Sociological Association is one of the main styles used in sociological publications. In the case of direct citations, the boundaries of a citation are apparent from the quotation marks. However, the boundaries of indirect citations are usually unknown. In order to clarify these boundaries, citation marks can be used.

3.5 CONSTRUCTION AND REPRESENTATION OF INDIA'S PAST BY VARIOUS SCHOOL OF HISTORIOGRAPHY:

3.5.1 Defining historiography

Furay and Salevouris (1988) define historiography as "the study of the way history has been and is written — the history of historical writing... When you study 'historiography' you do not study the events of the past directly, but the changing interpretations of those events in the works of individual historians.

Indian historiography of today owes much to the nationalist schools of history that developed before Independence. The prefix "nationalist" by no means disqualifies them from being counted as unbiased or scientific historians. On the contrary, many to whom we apply this adjective were "nationalist" mainly because they rejected the view, current among not a few British historians, that the history of the "natives" could not be studied as one would study the history of any European people. "Native" sources were untrustworthy, their evidence no better than that of courtiers or religious fanatics, their very natures different from those of their masters, so that they did not have any history other than political or religious worth talking about. An Indian historian who on the other hand, held that Indian sources were susceptible to the same kind of critical examination as those of other peoples, that India too had its economic, social or cultural history became by this very statement a nationalist. Such a historian did not thereby

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glorify India's past, but simply asked that it be studied with an open mind. I may recall two historians of this tradition: Tara Chand, author of the Influence of Islam on Indian Culture (first pub., 1922), and Mohammad Habib, author of Mahmud of Ghazni (pub., 1924), did not by any means gave an unqualified endorsement to either the culture or the character described; yet their texts were treated as important works of the nationalist schools. In other words, then, we have inherited from our nationalist precursors an admonition to use the scientific and critical approach to our past, which we ought to cherish.

Secondly, the nationalist historians did not accept the "White Man's burden" view of modern Indian history. The model was set by R.C. Dutt's splendid two volume Economic History of India under British Rule (first ed. 1902 & 1904). While by no means entirely denigrating British rule, Dutt was unsparing in his description of the rapacity of conquerors, oppressive Settlements, the Tribute realization and de-industrialization. There is much that is still valid in Dutt's work, despite the obvious low opinion which American authors like Furber or Mc Alpin appear to have of him.

It was a part of the nationalist tradition again to study regional history under the impulse of bringing it closer to people. One may recall S. Krishnawswamy Aiyangar's reconstruction of South Indian history. Of a different trend was Tapan Raychaudhuri's Multi-faceted study, Bengal under Akbar and Jahangir, though it appeared after Independence.

It is not my purpose to be uncritical about nationalist endeavours. In order to prove that the British ruined India, there was a tendency to picture pre-British India in rosier colours than was warranted. This may be seen, for example, in Radhakamal Mukherji's Economic History of India, 1600-1800, in many ways a significant work, but undoubtedly with a case to argue. Or, to show that we had the same genius as our masters, it seemed proper to speak of our local self-government and guilds or of our colonies, Radhakumud Mookerji wrote reputed tomes Local Government in Ancient India, (1920) and Indian Shipping — a History of the Sea-borne Trade and Maritime Activities of the Indians from the Earliest Times, (1912). The information in these works is not out-of-date, but their approach is. And there is no doubt that one must exercise caution in respect of this part of the nationalist heritage.

Within nationalist historiography, there developed in time the Marxist trend. Its early products were R.P. Dutt, India Today (1940), and Shevlankar's Problem of India (1940), both dealing with India under British rule. Marxist influences are perceptible in Jawaharlal Nehru's Autobiography as well. But full scale Marxist writing came only later. D.D. Kosambi's Introduction to the Study of Indian History (1956) was essentially a Marxist interpretation of ancient India, while Mohammad Habib in his long introduction to a reprint of Elliot and Dowson's History of India, & c., Vol.II, essayed an interpretation of the Delhi Sultanate. In the second line came R.S. Sharma, with his many papers persuing Marxist analysis of ancient social phenomena, culminating in two major works Sudras in Ancient India (1958) and Indian Feudalism, (1965). Irfan Habib's principal Marxist-oriented work Agrarian System of Mughal India (1963) was followed by a spate of papers, a selection being now published as Essays in Indian History, towards a Marxist Perception (1965). The body of Marxist writing in India is now a large one, including among others D.N. Jha, Suvira Jaiswal, Iqtidar A.Khan and A. Bagchi.

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One can see from their work that Marxist writing has become increasingly sophisticated, using sources critically and carefully, and disdaining the early strait jacket of the fixed 'modes of production'. There has been much pioneering work on the history of ideas (e.g. Debiprasad Chattopadhyaya) and of technology (e.g. Irfan Habib), which has lent richness to Marxist analysis.

There is no doubt that Marxist work has added considerable dimensions to our study of economic and social history. By concerning itself especially with mode of exploitation and the struggles of the oppressed, it has helped the historian to identify with the mass of the people, who have been regarded more as the objects rather than the subjects of history. Mainly under Marxist influence one has learnt to look more closely than ever at the sweat strained ploughman or the oppressed woman slave, and set in their place the throne and the pulpit.

A branch of historiography grew, essentially hostile to mainstream nationalism, which has come to be described as communal. Soon after Independence the Hindu and Muslim Communal schools found their standard statements in two series on either side of the border of the Partitioned subcontinent. The technically better edited and produced History and Culture of the Indian People ed. R.C. Majumdar and published by the Bhartiya Vidya Bhavan, and the Freedom Struggle of the Muslims in the Indo-Pakistan Sub-continent, ed. I.H. Qureshi. Both these works believe in the Two-Nation theory, the former implicitly, the latter avowedly, since they assume an irreconcilable hostility between Hindus and Muslims from the very point that Islam arrived in India. The Bhartiya Vidya Bhavan volumes added chauvinism in high doses as well.

These schools, by essentially denying what Rabindranath Tagore had thought to be the central theme of Indian history the formation of India's composite culture, both stand in direct confrontation with nationalist historiography. But the major points they raise for a historian go beyond the themes of their debate with the nationalists. It is the technical problem of historical method: the partisan reading of sources, the selectivity in presentation of facts, the projection of present day identities into the past, etc. The free invocation of religious beliefs that are supposedly beyond the historians' province is particularly marked. It was a common statement not long ago that "crores of Hindus" could not be wrong about matters like the Mahabharta or Rama's birth place. Similarly, I.H. Qureshi and his fellow contributors found it enough justification for any course of conduct, if it could be shown to follow a Quranic injunction, however unfair or offensive that conduct might otherwise appear to us. One always needs to remind oneself, when reading these books, that a historian cannot see himself either as a lawyer appearing for a religion, or as a judge who takes it as his duty to enforce either the dharmasastra or the shari`a. Religion may have played an important role in History; but for that very reason it must become, and remain, subject to historical criticism.

During the early years of our Independence, a historical school began to win over increasing number of votaries in England: it was associated with the name of Sir Lewis Namier, who had done much to unravel the individual interests and motives behind individual parliamentarians in 18th century England. His method of reading private interests behind public postures began to be applied to modern India by John Gallagher and his pupil A. Seal, who established themselves at Cambridge. Seal's interpretation of the Indian National Movement, mainly given in the Emergence of Indian Nationalism, was published in 1968. Seal's major

effort was to argue that the Indian nationalist leaders had their community and caste constituencies to care for, and their 'nationalism' resulted from maladjustments of interests of this sort under British rule rather than any genuine national grievances: much of the agitation of the National Movement was thus of an illusory character. It was not the mass base of the nationalists that forced the British to bring forth constitutional legislation, but it was the latter which forced the elite nationalist leadership to seek mass support. We have similar interpretations made, within the Namierite framework, of Gandhi by Judith Brown and Jinnah by Ayesha Jalal.

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Bayly extended the range of interpretation to the 18th century by discerning a continuity of "corporate groups" from late Mughal into early British regimes in his Rulers, Townsmen and Bazars, 1770-1870 (1983). If the national movement was largely an illusion to Seal, the British conquest became to Bayly a mere elaboration of processes already at work in India.

Since most of these publications appeared from Cambridge, it has become conventional to describe it as the Cambridge School. Its influence on Indian historical writing has been considerable, despite sundry protests at its immense selectivity in source -treatment. One of those schools, who, despite theological differences, have obviously been deeply influenced by the Cambridge critiques of the nationalist *elite* has been the group known as Subalterns.

The "Subaltern" historians started as the Indian variant of the History from Below and made use of some of Gramsci's terminology notably the term "subaltern" itself, to which Ranjit Guha in his initial essay is Subaltern Studies gave a definition Gramsci would not have thought of. The "Subaltern" historians by insisting on researches in the conditions of life and thought of the ordinary people were continuing, some times with much fruitful result, the Marxist tradition. But the Marxist imbilical cord has long been cut, there is an increasing mystification about subaltern conciousness, a rejection of the "nation" (a la' Partha Chaterjee) and, therefore, of "national" grievances against the British. The elite Vs. Subalterns becomes a dominant motif from them, rather than the class analysis derived from the Marxist method. Their perception of the nationalist elite is, then, practically identical with that of their Cambridge friends. In more recent days, therefore, the Subalterns have found regionalism and communalism to be more authentic expressions of subaltern conciousness than the dangerous phenomenon of nationalism. It becomes a matter of wonder how India at all exists, and how people (including "Subalterns") still identify themselves as "Indians"!

A third trend, which has begun to influence Indian historiography, has emerged from France. Before World War II the Annales School, associated with Marc Bloch, had established itself as the proponent of a comprehensive and comparative history, in which conventional, Marxist and innovative trends all came together. After World War II, Braudel in his well-known article Long Duree, seemed to belittle political revolutions and give crucial importance to long-range changes in social habits, psychological outlook and economic phenomena. Concern with 'mentality', marginal classes, and environmental change became the hall-mark of the Annales school, especially in works of Ladurie who has seemed to shift from work in the Marc Bloch tradition to 'best sellers' of impeccable scholarship. There has been much accolade showered on the new Annales approach in India by Harbans Mukhia. S. Settar's recent work (Inviting Death & Pursuing Death) perhaps, belongs to this genre, although there is no explicit declaration of such allegiance. There is no doubt that the new Annales approach, as shown by Settar's work, could expose elements of belief that were not previously analysed or given

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attention to. Similarly, use of historical anthropology to explore small communities that had a natural or social environment of their own cannot but add to the richness of historical information. The desire to regard political formations as of inferior significance is clearly manifested in Romila Thapar's Mauryas Revisited (1987). Such an attitude meshes well with the increasing depreciation of the effectiveness of political regimes in South Asia stressed by B. Stein, F. Perlin and A. Wink. It seems to me that here too a large amount of historical evidence is not admitted to the historians' consideration, when dealing with political history. I need not here do more than refer to the points brought out in the current debate on Burton Stein's application of the theory of segmentary state to South India.

During the last two decades a new trend of thought has developed in the West, which has designated itself "Post-modernism". The very name implies a self-concious departure from modernity, which is held to be assemblage of values and objectives which have been the special hall-mark of modern civilization: a belief in reason, in large logical frameworks, rational solutions to social ills, a common range of values summed up in the French Revolutionary watch words, "Liberty, Equality, and Fraternity". To Post-modernists all such firm assertions are open to question: the capitalist market place is extended to the intellectual sphere, where not strength of argument but appeal to consumer is the test of worth, with the media being the true shopping centre. Inevitably post-modernism has the potential of accommodating all the disparate, conflicting ideologies of ethnic chauvinism, and religious revivalism and fundamentalism under its umbrella. If it has not happened yet with western post-modernists today, it can happen tomorrow.

Extended to history, Post-modernism visualises many modern institutions and structures as mere imagined realities (compare Benedict Anderson, Imagined Communities, 1983). It will at once be seen that Post-modernism, therefore, holds considerable attraction for the Indian votaries of the Namierite, the Subaltern and the New Annales School who too have been questioning precisely the roles of the state and the nation in our history. In due time the propagations of the revivalist and communal view-point also could obtain sustenance from the Post-modernist fashion. By refusing to accept the plane on which conventional social science proceeds, Post-modernism is able to claim triumph without an encounter, and this too must be especially welcome to the latter-day critics of or migrants from the nationalist and Marxist historiography.

The purpose is to attempt to classify the new entrants of the Indian historical world is not to assert that Indian historiography has nothing worthwhile to learn from the outside world. On the contrary since neither Post-modernism nor the other trends discussed above, constitute together a significant part of western historiography in its home ground should like to reaffirm the central thesis of the nationalist historians: Indian history can be studied in the same way as the history of other countries. Reason and criticism must occupy central place in our historiography, and one should not be afraid of being called "modernist", if this is the price of holding true to these basic pillars of the historical method.

CHECK YOUR PROGRESS

1. Define Hortatory Exposition

_____

_____

2. What is a footnote?

3. Write a short note on bibliography

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SUMMARY

The "Subaltern" historians started as the Indian variant of the History from Below and made use of some of Gramsci's terminology notably the term "subaltern" itself, to which Ranjit Guha in his initial essay Subaltern Studies gave a definition Gramsci would not have thought of. The "Subaltern" historians by insisting on researches in the conditions of life and thought of the ordinary people were continuing, some times with much fruitful result, the Marxist tradition. But the Marxist imbilical cord has long been cut, there is an increasing mystification about subaltern conciousness, a rejection of the "nation" (a la' Partha Chaterjee) and, therefore, of "national" grievances against the British. The elite Vs. Subalterns becomes a dominant motif for them, rather than the class analysis derived from the Marxist method. Their perception of the nationalist elite is, then, practically identical with that of their Cambridge friends.

KEY WORDS

- **Intellectual** - Rational rather than emotional.
- **Historiography** - The principles, theories, or methodology of scholarly historical research and presentation.
- **Conventional** - Based on or in accordance with general agreement.

ANSWERS TO CHECK YOUR PROGRESS

1. Hortatory exposition is a text which represents the attempt of the writer to have the addressee do something or act in certain way.
2. A footnote is a notation at the bottom of the page in a printed document. Footnotes are usually presented in smaller print than the dominant text, and they are used for a variety of purposes.
3. Bibliography is a list of source materials that are used or consulted in the preparation of a work or that are referred to in the text.

TERMINAL QUESTIONS

1. Write a short note on exposition.
2. Write on Generic Structure of Analytical Exposition
3. Define Hortatory Exposition
4. What is footnote
5. Write a paragraph on Citation templates
6. Write on the etymology of bibliography.
7. Describe Enumerative bibliography

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FURTHER READINGS

- E.Sreetharan, A Manual of Historical Research Methodology, CSIS.
- K.N. Chitris, Research Methodology in History, Atlantic publishers.
- Satish K. Bajaj, Research Methodology in History, Anmol publications.
- Predip Jaiswal, Research Methodology in History, Omega publications.

UNIT IV: INDIAN CONCEPT OF HISTORY

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★ STRUCTURE ★

4.0 LEARNING OBJECTIVES

After reading this unit students will be able to:

- know the recent developments about myths in historical understanding.
- understand the recent developments about memory in historical understanding.
- analyse the recent developments about folklore in historical understanding.
- write about the historical overview.

4.1 INTRODUCTION

The Indians have a sense of history is pretty much the received wisdom even today in major sections of the academia, media and the rest. The roots of this received wisdom are branded. Before looking at a "sense of history" or "historical sense, history is defined as:

- A study of the human past.
- A field of research which uses a narrative to examine and analyse the sequence of events, and... attempts to investigate objectively the patterns of cause and effect that determine events.
- Historians debate the nature of history and its usefulness. This includes discussing the study of the discipline as an end in itself and as a way of providing "perspective" on the problems of the present.
- Digging a little deeper, we find the following information related to how history is commonly understood today:
- The stories common to a particular culture, but not supported by external sources....are usually classified as cultural heritage rather than the "disinterested investigation" needed by the discipline of history.
- Events of the past prior to written record are considered prehistory.

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Based on these, we can arrive at these:

- The advent of writing plays a major role in our definition of history.
- The oral tradition, however authentic, however well-preserved is kept beyond the definition of history.
- All oral traditions occurring even after the advent of writing aren't considered as historical evidence.
- History and/or history-writing are essentially a disinterested, academic discipline.

This conception of history is laudable for its scientific approach to studying the past destinies of civilizations, nations, and indeed, the whole world. And this conception is a product of a mind that has a linear view of time. Thus, today's newspaper is tomorrow's history, which fifteen years later, finds its way into textbooks. History then is a little more than a diary without a last page, populated with names, dates, and places and how the three play out with one another. While this precise, factual approach to history has yielded us worthy insights it has made history largely a boring subject. It is the one subject uniformly hated by most starting from primary school up to educated adults who dismiss history in terms of "who wants to know what Julius Caesar did in 62 BC?" it is undeniable that reading this sort of chronicle is boring however factual it may be. But then the same people who despise reading history enjoy reading historical fiction, which continues to command a great deal of popularity.

The reason isn't difficult to fathom: entertainment naturally appeals to the human psyche. And people, when they buy historical fiction, are motivated primarily by the fiction element in it. Julius Caesar becomes a character in a novel first; that he was a powerful Roman emperor who actually existed is secondary. In the end, what the novel accomplishes–like most good literature–is that it entertains the reader, who without his knowledge has also learnt a lot of history about Julius Caesar, the Roman Empire, the geography of 1st Century BC Europe, military equipment, battle styles, and architecture among others.

4.1.1 Defined concept of history

- A usually chronological record of events, as of the life or development of a people or institution, often including an explanation of or commentary on those events: a history of the Vikings.
- A formal written account of related natural phenomena: a history of volcanoes.
- A record of a patient's medical background.
- An established record or pattern of behaviour: an inmate with a history of substance abuse.

The branch of knowledge that records and analyzes past events: "History has a long-range perspective" (Elizabeth Gurley Flynn).

- The past events relating to a particular thing: The history of their rivalry is full of intrigue.
- The aggregate of past events or human affairs: basic tools used throughout history.
- An interesting past: a house with history.
- Something that belongs to the past: Their troubles are history now.
- Slang. One that is no longer worth consideration: Why should we worry about him? He's history!

4.2 THE INDIAN CONCEPTION OF HISTORY

4.2.1 The Notion of Time in India

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The Indian conception of time is very different from what the Western mind regards as intuitively obvious. In Indian thought, time, like other phenomena, is conceived statically rather than dynamically. It is, of course, recognized that the things of this world are always moving and changing. But the substance of things is seen as basically unchanging, it's underlying reality unaffected by the ceaseless flux. The Indian does not concede that we never step into the same river twice; he directs our attention not to the flow of water but to the river itself, the unchanging universal. Indian thought places a high value on universality, and the connection between this, and the static conception of phenomena, is of course not accidental. "The one remains, the many change and flee."

This static conception of time permeates Indian thought. It could hardly fail to do so, for it is present in the very forms of language itself, conditioning all philosophical thinking. In the classical Indian languages, there are no words which corresponded to the concept "to become." The verb formed from the root bhu can be translated as both "to become" and "to exist." These two aspects of perceived reality, conceived as antithetical by the Western mind, are not even distinguished. "To become" is merely an aspect of "to exist." The noun bhava, formed from the same root, can mean either "being born" or "existing" (1); in other words, to become is to be born. To express the idea of change at all, Indians had to make shift with the words anyatha bhavati or anyathabhava-"being otherwise." Becoming is expressed in terms of being, dynamic is seen as a phase of static.

The point of view permeates the language. The noun, which expresses the more stable and unchanging aspects of a thing, is in Sanskrit more likely to be used than the verb, and correspondingly adjectives are more frequent than adverbs. In classical Sanskrit,(2) indeed, especially in prose writings, it became usual to employ verbal nouns or participles instead of finite verbs. For example, the sentence "Because of the rain, the food appears" is expressed in classical Sanskrit as "Because of the rain, appearance of the food (is possible)." It has been the practice since ancient times to use the participial form instead of the finite verb to express the past tense, and it became a common expression in colloquialism of the later periods.(3) Sanskrit will also use an adjective.

It is static in feeling, to express an idea which might take a verb in the languages of the West. The classic Western expression of the sense of flux uses a vivid and specific verb. "All things flow" (panta rei [in Greek, the phrase attributed to Heraclitus]), The corresponding idea is expressed in Sanskrit as sarvam anityam, "all existences are impermanent."

It is the same habit of mind conditioning the use of periphrastic forms. The periphrastic perfect, though seldom found in the Vedas, appears frequently in the literature after the Brahmanas. "He went" becomes gamayam cakara (literally, "he did going"). Again, the periphrastic future may be used to express future action.(4) For example, the word gantasi (you are the one who goes) is used to express the meaning "you will go," thus directing the attention away from the action to the stable state of the actor.

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The primacy of the noun is illustrated in the Sanskrit denominative, a category of verb not found in the classical grammar of the West. For example, the denominative putrlyati is formed from the noun putra (son) and means "to desire to have a son," and svamlyati, from the noun svamin (master) means "to regard as a master." Generally speaking, the denominative connotes the meaning of "to be...," "to work as...," "to regard as...," "to desire...," but the real emphasis of the word is on the noun.

Similarly, the meaning "to be able to," expressed in Western languages by verbs or auxiliary verbs, is expressed in Sanskrit by an adjective, sakya, or an indeclinable, sakyam. For example, na devasuraih sarvaifh sakyah prasahitum yudhi (Ramayana II, 86, 11) = non potest proelio superari a cunctis dis daemonibusque(5) (he cannot be conquered in battle by all the gods and spirits).

In Sanskrit, then, finite verbs are seldom used; the verb appears mainly as a verbal noun, and the nominal sentence is more often used than the verbal sentence. Usage of the infinitive of the verb is also limited; it is never used as subject(6) or as object. When it seems necessary to use the infinitive as an object, an abstract noun formed from the root of the verb is used instead, thus directing attention from the changing aspect of the action to the unchanging universal: "to appear" does not equal "appearance."

The centrality of the noun is further illustrated by the absence in Sanskrit of the adverbial suffix which is common to all Western languages. Adjectives are converted into adverbs by adding (w=s) in Greek, -ment in French, -ly and - lich in English and German. In Sanskrit, however, the accusative case of the adjective is used if it is necessary to modify the verb. Ablative and locative cases of adjectives may also be used adverbially. The adverb itself is not even.

Acknowledged as a part of speech in Sanskrit

There are other curious illustrations of this tendency to comprehend things through their static aspects. To connect two ideas, Western languages use such conjunctions as, and or then; sanskrit, in contrast, will express the same idea by adding the demonstrative pronoun sa to the subject of the sentence, as if "John runs and jumps" were to be expressed as "John running he jumping." The conjunction emphasizes the separateness of events; the demonstrative focuses on the subject, unchanging through time.

On the whole, then, Western people comprehend action through its changing aspects, while Indians tend to comprehend it attributively. In particular, many Indians consider that action is an unchanging aspect, even an attribute, of existence. Westerners tend to regard action as an active phenomenon while Indians tend to look upon it statically. In the sentence sabbe sankhara anicca (all things are impermanent), a basic idea of Indian Buddhism, anicca, is an adjective. For an Indian, even the statement that "all things of this world are changing and moving" is not, as it was for Heraclitus, the expression of the changing aspects of existences, but the expression of a static and unchanging state.

In Indian philosophy the Absolute is generally explained as a Being beyond all temporal appearances. These exist and change in time; the Absolute, in contrast, is essentially static. In the Upanisads, the Absolute is repeatedly expressed as "Imperishable."(7) "Atman is imperishable for it cannot be destroyed.... It is

unfettered, it does not suffer, it is not injured."(8) "This is that great unborn Self who is imperishable, incorruptible, eternal, fearless, Brahman."(9) Early Buddhism does not lay emphasis on a metaphysical Absolute as such, but the same habit of mind is found in the principle of pratltyasamutpada, later developed in Mahayana Buddhism, which states that nothing can disappear or arise. In Indian thought, as in the Sanskrit language, it is the idea of Being which receives central consideration.

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Indian philosophers in general replace the concept of Becoming by three aspects of temporal existence: Appearance, Extinction, and Continuance. All three states are clearly conceived as static. They are referred to early in the Upanisads and are generally accepted by the orthodox schools of Brahmanism and Jainism. Buddhism also designates these as the three aspects of the conditioned or phenomenal being.(l0) Other words which are considered equivalent to "becoming" (vikara, vikriya,parinama, viparinama, etc.) in fact express the specialization of the simple into the complex and should be understood as meaning "evolution" or "development," rather than "becoming."Indian philosophy contains a number of variations on the three basic states, and the Sarvastivada school, the most eminent of Abhidharma Buddhist schools, added a fourth, namely jara or "decaying," which was interpreted as "changing to the other" (anyathabhava, anyathatva).(ll) This might seem to come close to "becoming"; the theory, however, was not accepted by all Buddhist schools, and Decay is no real analogue of Becoming as the idea appears in Western philosophy.

There are evident similarities here to ancient Greek thought, at least in its Platonic and Parmenidean aspects. Plato formulated the antithesis between Being and Becoming; he saw the true essence of reality as consisting of changeless, timeless 'forms.' Geometry, as an investigation of the fixed forms of material bodies in space, was the typical pattern of science in ancient times, and in the physical sciences only static's was developed. Interest in the changing world of phenomena, however, was also an important element in Greek thought; "all things flow" is after all as Greek as Plato's ideal forms. Modern thought has concerned itself increasingly (though not exclusively) with Becoming; kinetics has replaced static's in the center of the physicist's attention, and mathematics has turned to analytics and algebra, in which variable quantities are examined. Modern thought is described as "progressive," "dynamic"; the unique contribution of Indian thought, in contrast, can be a kind of rest and joyfulness which may be very welcome to those who are tired of the frantic movement of their culture.

The persistent Indian conception of a transcendent reality is more important than the phenomenal world it underlies and sustains results in a kind of paralysis of the individual's sensitivity to time, if we understand "time" to mean the passage and flow of specific events in our experience. This paralysis manifests itself in a characteristic lack of time concepts which non-Indians regard as common sense. (Indian thought may show an intense preoccupation with other, more metaphysical senses of time; in the Vedic period time was seen as the fundamental principle of the universe, "Time, the steed, [who] runs with seven reins, thousand-eyed, ageless, rich in seed. The seers, thinking holy thoughts, mount him, all the worlds are his wheels.... With seven wheels does this Time ride, seven navels has he, immortality is his axle.... Time, the first god, now hastens onward" (l2) But this is hardly the time in which human beings carry on their common concerns.

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Language, as usual, is where this lack of common-sense concepts is most clearly seen: the Indian people did not have a clear awareness of the discrimination of tense. Although in Sanskrit, as in Greek, there are five kinds of tenses, they are not sharply discriminated in meaning. To indicate past time, the imperfect, perfect, past participle active, aorist and historical present are used almost indiscriminately, and the frequency with which a given tense is used varies not according to meaning but according to historical period.

The aorist is often used in the sixth century B.C., for instance, but in classical Sanskrit is no longer common. The discrimination between absolute past and relative past is not clearly made in the ancient Indian language. In modern Hindustani as well, we find similar linguistic phenomena. The adverb kal means both "yesterday" and "tomorrow." Parson means "the day after tomorrow" as well as "the day before yesterday"; atarson means equally "three days ago" or "three days from now." The meaning of these terms can be determined only through context.

Since the lack of common-sense time concepts is built into the languages of India, both ancient and modern, it is not surprising to find it manifested in Indian religion and historiography. The Buddha was born under a tree in the park at Lumbini, attained Enlightenment under a tree at Gaya, and entered Nirvana under a tree at Kusinagara. These three events, according to common-sense notions, must have taken place on different dates, yet they are all celebrated by Indians and South Asiatics on the same Wesak day in May. Indians have not exerted themselves to grasp the concept of time quantitatively, and have never written historical books with accurate dates. According to the Indian world view, the universe, world, and social order are eternal; personal life, however, is only one sample of a succession of lives existing repeatedly in limitless time. If one's life is conceived as infinitely repeated, it becomes meaningless. The idea of the transmigration of souls, the perpetual self- revolution of rebirth, has appeared only occasionally in the West, but in India it is a basic assumption of the common people as well as of philosophers. Passing phenomena, whether the events of the individual life or of more generalized history, have no real significance. It is natural enough that no importance is given to providing them with accurate dates.

We should thus be prepared to find the Indian conception of history very different from our own. Indian books of history are few in number, and these few are tinged with a fantastic and legendary color. They are not products of historical science but rather works of art. Usually they are written in verse. Indians are not satisfied with the simple description of facts in the language of daily use. They beautify the past and try to idealize it. They ignore precise figures, exact sequences of events, and other details of time and place. Far from exerting themselves to give exact sizes of armies, say, or expenditures, they exaggerate astronomically with magnificent and brilliant hyperbole.

As an example, consider the Mahavamsa, the most reliable work of history produced in ancient Ceylon. Even this book, though highly informative from the modern historian's point of view, is saturated with a mysterious and legendary atmosphere. For instance, though Mahanaman, the author of the Mahavamsa, lived in the fifth century A.D., in an age not too distant from the time of King Dutthagamani, his descriptions of this greatest of Ceylon's rulers are already full of fantastic elements, and the reader must make a careful distinction between myth and that which is historically true. The histories or "chronicles" of medieval

European monks and the biographies of eminent Buddhist monks in China and Japan have a similar style, but the Mahavamsa stretches historical truth to an incomparably greater degree.

Another example is Kalhana's Rajatarangini, the chronicle of a Kashmiri dynasty and one of the best historical works ever written by an Indian. In it Kalhana details the social situation of his time and the activities of the various personages in it with an accuracy that no other Indian book of history has attained. Yet Oldenberg can still describe it in these terms:

If one removes all the poetic elements from Kalhana's story, and compares it with events of the time, he will find that the account is in essence on a level no higher than that of a more or less accurate article in a newspaper or a cartoon in a political comic paper. The process of formation that this story has undergone is not that of historical thinking but that of poetry- poetry in the Indian sense with its brilliant quality and also with its weakness. And Kalhana himself has a very distinct idea on this point; he feels himself as a poet and he is a poet. It is worth pointing out that Kalhana scarcely pays heed to causal sequence when considering historical events. His dates are inaccurate and sometimes clearly the products of pure imagination.

The Indians themselves have attached little significance to their books of history; most Indians have been much more interested in religion and poetry than in historical documentation. For the Indians, a minor error in the recitation of the Vedas has been a serious matter. But they have been thoroughly indifferent to the erroneous recording of dates or facts in their books of history.(16) This lack of historical consciousness is distinctly observable in the Buddhist attitude to the rules of their order. In the period after the death of the Buddha, Buddhists had to establish new precepts in order to meet changing social conditions. As some of the new rules were not compatible with the older ones, they hesitated to include them in the traditional books of ordination (patimokkhas), and instead attached them to the patimokkhas as supplements. Although they would not alter the traditional books, however, they were not afraid to claim the authority of the Buddha's own teaching even for these supplementary precepts of their own creation, completely ignoring the historical facts. Their concern for the proper observance of the precepts was far stronger than their regard for historical accuracy.

This lack of interest in history is very different from what we find in China. The Chinese derive their rules of social conduct from the examples of their ancestors as set down in their books of history. The Indians, on the other hand, gain their principles of behavior from their religious books, and at the same time fables and parables such as the Panchatantra and Hitopades'a contribute toward the diffusion of practical morals into daily life. These books, embodiments of the enduring spirit of folk-tale, present for contemplation eternal paradigms of human experience - paradigms which are by their nature timeless and in that sense, outside history.

The concentration on the universality behind and beyond the variety of concrete phenomena of our experience is in its essence contemplative. Language again provides a key to thought; the meditative character of Indian thought is forcibly illustrated in the concept of causal relations as expressed in the forms of Sanskrit itself. To indicate the causal relation between two notions, Sanskrit forms a compound which suggests that the natural order of thought is to begin with the effect and trace it back to the cause. Accordingly, the expression "effect and cause"

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(phalahetu) occurs instead of the familiar "cause and effect." The contemplative attitude thus erases time: one can only speak of "effect and cause" if the effect is already known and both effect and cause present to the contemplative mind sub specie aeternitatis.

Although the Latin phrase suggests that this habit of thinking is not wholly foreign to the West, the natural order of Western thought is clear: it is to proceed temporally from cause to effect. Even though the relationship is seen, it is seen in time. In Sanskrit, in contrast, many expressions emphasize this meditative view in which progressive phenomena are seen as already complete. Karyakaranabhava means, not "the relation of cause and effect," but of "effect and cause." What would in Western languages appear as the "relation of the knower and the knowable" is in Sanskrit "the relation of the knowable and the knower (gamyagamakabhava)." We find similar reversals of Western order in the "relation of the generated and the generative (janyajanakabhava)"; "the relation of the proved and the prover (sadhyasadhakabhava)"; "the relation of the established and the establishing (vyayasthapyavyavasthapakabhava)"; "the relation of the activated and the activator (pravartyapravartayitrtva)." Each of these expressions appears reversed to Western minds, and even to other Orientals. Accordingly, when scholars translated the original texts into Chinese they changed the word order. Tibetan scholars also understood the causal relationship differently from the Indian; they translated phalahetu ("effect and cause") into rgyu dan hbras-bu ("cause and effect"). This way of thinking, in which the notion of effect is formed first and that of the cause inferred and stated afterward, is retrospective, and is basically different from the approach which starts from the cause. The retrospective, contemplative attitude is in further contrast to the thinking processes of natural science, through which, with the help of inductive and deductive reasoning, the cause of an effect is investigated and ascertained by functional correlation without giving primacy either to cause or effect.

Even when Indians do investigate the relation of two phenomena from cause to effect, they generally do not take the view that a single effect is caused by a single active movement, but prefer to consider that effects are produced by the combination of various causes. Therefore, most Indian thinkers do not employ the term which corresponds to the Aristotelian notion of efficient cause. While nimitta-karana is linguistically the equivalent of causa efficiens, it is also used to express the Western notion of causa occasionalis. The Sanskrit expression in fact describes a final cause or aim, that is, a teleological relation. And such relations, East and West, are traditional subjects of contemplation.

It would be incorrect to infer from the foregoing that the Indian people have no concept of abstract time. On the contrary, the view of the uncertainty and transiency of life which is at the center of both Buddhism and Jainism demonstrates that they understand from their heartfelt experience the changing phases of the world. Buddhism from the outset emphasized the transience and impermanence of human existence. All things pass away. On account of our fragility we are subject to disease and death. From transience comes suffering. The Buddha asked his disciples: "That which is transient, O monks, is it painful or pleasant?". "Painful O Master!"(20) Our dreams, our hopes, our wishes- all of them will be forgotten as if they had never been. This is a universal principle. "Whatever is subject to origination is subject also to destruction."(21) Necessary and inexorable is the death of all that is born. The difference is only in the degree of duration. Some

things may last for years, others for a brief while only. But all must vanish. For the ignoble craving for worldly things must be substituted the noble aspiration for the "incomparable security of Nirvana free from corruption":

- Transient are our life's experience!
- Their nature 'tis to rise and pass away
- They happen in our ken, they cease to be.
- Well for us when they are sunk to rest!

There is no substance which abides forever. All matter is force; all substance is motion. The state of every individual is unstable, sure to pass away. In later days the sentiment of impermanence became more peculiarly Indian than Buddhist. Suffering is seen as one with transience. Craving causes suffering since the impermanence of what we crave causes disappointment and sorrow. The Buddhist beatitude lies in our realization that all things are transient and we should not cling to them.

4.3 RECENT DEVELOPMENT: MYTHS IN HISTORICAL UNDERSTANDING

Hindu religious literature is the large body of traditional narratives related to Hinduism, notably as contained in Sanskrit literature, such as the Sanskrit epics and the Puranas. As such, it is a subset of Indian culture. Rather than one consistent, monolithic structure, it is a range of diverse traditions, developed by different sects, people and philosophical schools, in different regions and at different times, which are not necessarily held by all Hindus to be literal accounts of historical events, but are taken to have deeper, often symbolic, meaning, and which have been given a complex range of interpretations.

4.3.1 Sources

The four Vedas, notably the hymns of the Rigveda, contained allusions to many themes (seeRigvedic deities, Rigvedic rivers). In the period of Classical Sanskrit, much material is preserved in the Sanskrit epics, the Ramayana and the Mahabharata. Besides theology proper, the voluminous epics also provide a plethora of information about ancient Indian society, philosophy, culture, religion and ways of life.

The Puranas deal with stories that are old and do not appear (or fleetingly appear) in the epics (Puratana is Sanskrit for "ancient", the derivative noun purana means "old story" – "history" to be precise). Puranic texts as preserved, however, mostly post-date the epics, dating to the Early Middle Ages.

The epics themselves are set in different Yugas (epochs) or periods of time. The Ramayana, written by the poet Valmiki, describes the life and times of Lord Rama (the seventh avatar of Lord Vishnu) and occurs in the treta yuga, while the Mahabharatha that describes the life and times of the Pandavas, occurs in the Dwapara yuga, a period associated with Lord Krishna (the eighth avatar of Lord Vishnu). In total, there are 4 Yugas. These are the Satya Yuga (or Krita Yuga), the Treta Yuga, the Dvapara Yuga and finally the Kali Yuga.the other 2 are lost to history. The avatara concept, however, belongs to the puranic times well after the two great epics, though they often refer to pre-epic yugas. The Bhagavata Purana

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is probably the most read and popular of the puranas. It chronicles the story of the god Vishnu and his incarnations (Avatars) on earth.

4.3.2 Vedic mythology

The roots of theology that evolved from classical Hinduism come from the times of the Vedic civilization, from the ancient Vedic religion. The characters, theology, philosophy and stories that make up ancient Vedic myths are indelibly linked with Hindu beliefs. The Vedas are said to be four in number, namely RigVeda, YajurVeda, SamaVeda, and the AtharvaVeda. Some of these texts mention mythological concepts and machines very much similar to modern day scientific theories and machines.

4.3.3 Epics

The two great Hindu Epics, the Ramayana and the Mahabharata tell the story of two specific incarnations of Vishnu (Rama and Krishna). These two works are known as Itihasa. The epics are divided into chapters and contain various short stories and moral situations, where the character takes a certain course of action in accordance with Hindu laws and codes of righteousness. The most famous of these chapters is the Bhagavad Gita(Sanskrit: The Lord's Song) in the Mahabharata, in which Lord Krishna explains the concepts of duty and righteousness to the hero Arjuna before the climactic battle. These stories are deeply embedded in Hindu philosophy and serve as parables and sources of devotion for Hindus. The Mahabharata is the world's longest epic in verse, running to more than 30,000 lines.

Cosmogony

Hinduism presents a number of accounts pertaining to cosmology, and several explanations have been given as regards the origin of the universe. The most popular belief is that the universe was created by Brahma, the creator manifestation of the supreme soul. In the beginning, there was only Avyactha, or 'The in expressible' . In this emptiness, Lord Vishnu, the preserver appeared in the form of a child, lying on the leaf of a banyan tree. As soon as he appeared in this form, his mind was filled with doubts about his identity. Then his questions were answered by an unmanned voice- the voice of the supreme soul, which is his true form. It asked him to meditate upon his soul, which he did. A thousand petaled lotus emerged from his navel, in which Brahma appeared. It was Brahma who created the entire universe and all that is in it. Lord Siva (also known as Maheshwara) the destroyer God is also depicted to have come through Brahma, (When Brahma was born from the Naval of Lord Vishnu he was confused of his origin so he traveled through the Lotus stem to find his creator,when we could not find the other end of the lotus lord Vishnu appeared and told him the truth. However Brahma disagreed, then Supreme Lord explained about their origin and in return Brahma wished the Supreme Lord to be born as his son, later Lord Shiva was born as Brahmas mental son (who is born from the mental power), though he is not considered as a creation of Brahma, but as an equal of Lord Vishnu and Brahma. The trio are popularly referred to as Brahma-Vishnu-Maheshwara. Brahma is considered as a mere medium for Siva's appearance in physical form. It is to be noted that these three, considered as the supreme Trimurti

in Hinduism, are not three separate Gods, but three manifestations of the same Supreme soul, Brahman.

4.3.4 The weapons

An iconographic representation of the Sudarshana Chakra may be seen revolving above the index finger of the right hand of Vishnu herewith. Apart from the traditional human weapons like swords, daggers, spears, clubs, shields, bows, arrows and maces, and the weapons used by the gods (such as Indra's thunderbolt Vajrayudha), the texts mention the utilization of various divine weapons by various heroes, each associated with a certain god or deity. These weapons are most often gifted to semi-divine beings, human beings or the rakshasas by the gods, sometimes as a result of penance.

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There are several weapons which were believed to be used by the gods of the Hindu theology, some of which are Agneyastra, Brahmastra, Chakram, Garudastra, Kaumodaki, Narayanastra, Pashupata, Shiva Dhanush, Sugarcane Chakra, Trishul, Vaishnavastra, Varunastra, and Vayavastra. Some of these weapons are explicitly classified (for example, the Shiva Dhanush is a bow, the Sudharshan Chakra is a discus and the Trishul is a trident), but many other weapons appear to be weapons specially blessed by the gods. For example, the Brahmastra, Agneyastra (Sanskrit: Astra =weapon, especially, one thrown at an opponent) and the other astras appear to be single use weapons requiring an intricate knowledge of use, often depicted in art, literature and adapted filmography as divinely blessed arrows.

Sometimes the astra is descriptive of the function, or of the force of nature which it invokes. The Mahabharata cites instances when the Nagastra (Sanskrit: Nag=snake) was used, and thousands of snakes came pouring down from the skies on unsuspecting enemies. Similarly, the Agneyastra (Agni) is used for setting the enemy ablaze, as the Varunastra (Varuna) is used for extinguishing flames, or for invoking floods. Some weapons like the Brahmastra can only be used (lethally) against a single individual.

Apart from the astras, other instances of divine or mythological weaponry include armor (Kavacha), crowns and helmets, staffs and jewellery (Kundala).

4.3.5 The Deluge

The story of a great flood is mentioned in ancient Hindu texts, particularly the Satapatha Brahmana. It is compared to the accounts of the Deluge found in several religions and cultures. Manu was informed of the impending flood and was protected by the Matsya Avatar of Lord Vishnu, who had manifested himself in this form to rid the world of morally depraved human beings and protect the pious, as also all animals and plants. After the flood the Lord inspires the Manusmriti, largely based upon theVedas, which details the moral code of conduct, of living and the division of society according to the caste system.

4.3.6 The people of the epics

Hindu theology is not only about Gods and men, but classifies a host of different kinds of spiritual, celestial, ethereal and earthly beings. Most of the names mentioned in the Hindu mythology are from Sanskrit language, which are based on personal

attributes of the character. There are several such examples in the Hindu mythology. So the names may vary in different references and might bear more than one meanings or references.

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4.3.7 Sapta Rishis

Lord Brahma, out of his thought, creates seven sages, or Sapta Rishis, to help him in his act of creation. Sapta Rishis(sapta means seven and rishis mean sages in Sanskrit). They are Bhrigu, Angira, Atri, Gautama, Kashyapa, Vashista, and Agastya. The other meaning of Saptarishis is constellation of Great Bear (Ursa Major). The Pitara, or fathers, were the first humans. The word 'Pitara' comes from the word Pitri or Pita(In Hindi and Sanskrit) meaning Father. So it is about paternity and paternal relations, and ancestors.

4.3.8 Worlds

The Creation of the Cosmic Ocean and the Elements, folio from the Shiva Purana, c. 1828. Hindu theology defines fourteen worlds (not to be confused with planets) – seven higher worlds (heavens) and seven lower ones (underworlds). (The earth is considered the lowest of the seven higher worlds.) The higher worlds are the seven vyahrtis, viz. bhu,bhuvas, svar, mahas, janas, tapas, and satya (the world that is ruled by Brahma); and the lower ones (the "seven underworlds" or paatalas) are atala, vitala, sutala, rasaataala, talatala, mahaatala,paatala.

All the worlds except the earth are used as temporary places of stay as follows: upon one's death on earth, the god of death (officially called 'Yama Dharma Raajaa' – Yama, the lord of justice) tallies the person's good/bad deeds while on earth and decides if the soul goes to a heaven and/or a hell, for how long, and in what capacity. Some versions of the theology state that good and bad deeds neutralize each other and the soul therefore is born in either a heaven or a hell, but not both, whereas according to another school of thought, the good and bad deeds don't cancel out each other. In either case, the soul acquires a body as appropriate to the worlds it enters. At the end of the soul's time in those worlds, it returns to the earth (is reborn as a life form on the earth). It is considered that only from the earth, and only after a human life, can the soul reach supreme salvation, the state free from the cycle of birth and death, a state of absolute and eternal bliss.

4.3.9 Deities

An illustration of the family of Shiva, consisting of Shiva, Parvati, Ganeshaand Murugan, there are many deities in Hinduism. At the top is Adi parashakti then come the Trimurti: Brahma (the creator), Vishnu (the protector) and Shiva (the destroyer), and their wives (goddesses in their own right): Saraswati the goddess of learning, Lakshmi the goddess of all forms of wealth, and Parvati (also known as Durga, Shakti, Ambika) the goddess of courage and power. The children of the Trimurti are also devas, such as Ganeshaand Skanda (or Kartikeya).

Brahma is considered the ruler of the highest of the heavens (the world called Sathya), so in one sense, Brahma is not beyond the fourteen worlds as Shiva and Vishnu are.

Some gods are associated with specific elements or functions: Indra (the king of gods, the god of thunder and lightning; he also rules the world of Swarga),

Varuna (the god of the oceans), Agni (the god of fire), Kubera(the treasurer of the gods), Surya (the sun god), Vayu (the god of wind), and Soma (the moon god).

Swarga also has a set of famous heavenly dancers: Urvasi, Menaka,Rambha, and Tilottama (all female), whose job is to entertain the heavenly court, and upon orders from the heavenly kings, to distract people on the earth from accumulating too much good deeds so as to become a threat to the heavenly kings. Other notable inhabitants of the heavens include the celestial sages, and Narada the messenger of the gods.

Yama (the god of death and justice) is said to live in Kailash along with his master Shiva. He rules the lower world of Naraka with a band of emissaries called the Yama doota (messengers of Yama), who bring the souls of dead persons to Yama for evaluation. Chitragupta is one of those lower level celestial beings who functions as the karmic accountant of all the actions of the human beings on earth.

4.3.10 Incarnations

The ten avatars of Vishnu, Matsya, Kurma, Varaha,Vamana, Krishna, Kalki, Buddha, Parshurama,Rama and Narasimha, Krishna, several gods are believed to have had incarnations (Avatars). As the protector of life, one of the duties of Vishnu is to appear on the earth whenever a firm hand is required to set things right. The epic Bhagavatha Purana is the chronology of Vishnu's ten major incarnations (there are in total twenty six incarnations): Matsya (fish),Kurma (turtle), Varaha (boar), Narasimha (lion-faced human),Vamana (an ascetic in the form of a midget), Parasurama (a militant Brahmin), Rama, Krishna, Gautam Buddha(later buddhists separated themselves from Hindus), Kalki (a predicted warrior on a white horse who would come in this yuga) whose appearance also signals the beginning of the end of the epoch.

4.4 RECENT DEVELOPMENTS: MEMORY IN HISTORICAL UNDERSTANDING

As part of the general trend toward interdisciplinary research in recent years, a growing number of investigators have come to consider both cognitive and neuron scientific perspectives when theorizing about memory. Although such cognitive neuroscience analyses are a relatively recent development, the approach has precedents in earlier scientific thinking about memory. In this article we present historical review of three major issues in memory research-consolidation processes, the nature of memory representations, and multiple memory systems. The nature of the relation between cognitive, and neuroscience is a fundamentally interdisciplinary pursuit that draws on the methodological tools and theoretical frameworks of both of its constituent disciplines. In doing so, it promises to provide a more complete understanding of mnemonic processes than could be achieved by either discipline alone. During the past few decades, the cognitive neuroscience approach has become increasingly prominent in the analysis of memory. A growing number of cognitive scientists have made use of findings and ideas about brain function (e.g.,Schacter, 1985a; McClelland and Rumelhart, 1986a,1986b; Shimamura, 1989), and similarly an increasing number of neuro-

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scientists have drawn on cognitive theories and paradigms (e.g., Kean & Nadel, 1982; Mishkin & Petri, 1984; Squire, 1987). Although still in its infancy, this approach has already begun to yield important insights into various aspects of memory, and there is every reason to believe that it will become even more prominent in the future.

Although the emergence of widespread interest in cognitive neuroscience analyses of memory is a relatively recent phenomenon, the approach itself is not entirely without precedent in the history of scientific thinking about memory. Thus, for example, investigators such as Ribot (1882), Burnham (1903), Semon (1904-1921) and neuroscientific approaches to each of these issues with respect to the distinction between collateral, complementary, and convergent relations (Schacter, 1986). Although some early investigators offered analyses that linked psychological and physiological perspectives, there is little historical evidence of systematic or sustained interdisciplinary research. However, more recent work, especially with respect to hypotheses about memory systems, suggests progress toward establishing programmatic interdisciplinary research.

4.4.1 Consolidation

The notion that memories become permanently fixed, or consolidated, only some time after registration of a stimulus or event, is a familiar construct in memory research. Although a consolidation stage is a generally, though not universally, accepted part of the memory formation process, exactly what is meant by the term consolidation remains largely unspecified after nearly 100 years of research-so much so that Crowder (1989) recently referred to the term as "bankrupt."For example, consolidation can be used in a physiological sense to refer to neural activation or reverberation following presentation of a stimulus (*e.g.*, Muller & Pilzecker, 1900; Burnham, 1903; Decamp, 1915; Hebb, 1949), or in a psychological sense to refer to more abstract processes occurring during the same, or a more extended, period of time (*e.g.*, Burnham, 1903; Bartlett, 1932; Squire,Cohen, & Nadel, 1984). At another level, confusion exists over whether consolidation is better viewed as an active or a passive process: in both cases the result is the formation of a potentially permanent memory, yet there are important differences between models of consolidation that depict it as resulting from automatic mechanisms and those that depict it as requiring effort and organization. Yet another area of debate concerns the duration of the consolidation process. Estimations of the time required for consolidation to conclude have varied from several seconds to years. These issues have framed the nature of consolidation research for the past 100 years, and serve as the focus for the present review.

4.4.2 Historical Overview

Although analogies for memory have been around at least since the ancient Greeks (e.g., Plato's notion of in a tablet of wax), the explicit identification of the notion that it might take time for a process to create permanent memories is relatively new. Quintillion, in his treatise Institution Oratorio (On the Education of the Orator), seems to be the first person to make reference to such a process of fixation or consolidation. In reflecting on how the interval of one night can greatly increase the strength of memory, he referred to "a process of ripening and maturing" (Herrmann & Chaffin, 1988, p. 103). Other than this passing mention of the

possibility that the strength of a memory can increase over time, we have been unable to find evidence that the concept of consolidation was considered until the late nineteenth century.

4.4.3 Early Psychological Investigations and Physiological Speculations

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Muller and Pilzecker (1900) are usually cited as the primary reference to consolidation. Although they may have been the first to use the term "consolidation," hypotheses about such a concept based on clinical evidence predate their work by about 20 years. Ribot (1882, 1892), for instance, invoked the notion of consolidation to explain brief periods of retrograde amnesia, finding that when recovering from unconsciousness, a patient "lost not only the recollection of the accident...but also the recollection of a more or less long period of his life before the accident" . He cited 26 cases of retrograde amnesia that were first reported by Dr. Frank Hamilton. In these early anecdotal accounts, the amnesia was thought to be very short, affecting memory for events in the minutes preceding the trauma. Ribot concluded that" in order that a recollection may organize and fix it self, a certain time is necessary, which in consequence of the cerebral excitement [in the case of trauma] does not suffice. Muller and Pilzecker (1900) extended the notion of consolidation beyond previous anecdotal and clinical ac-counts by conducting a series of experiments in which they manipulated subjects' activity between study and test. They observed that memory performance was related to the nature of interpolated activity. For example, a task of describing a landscape picture between studying nonsense syllables and a subsequent memory test produced poorer memory performance than a condition with no intervening task. Based on these results, they concluded that a "physiological activity persists for some minutes in the nervous tracts concerned, and that this increases the fixity of the associations" (cited inMcDougall, 1901, p. 393). McDougall saw the connection between this finding and Ribot's work, suggesting that it"throws light upon, we might almost say explains, certain recorded cases in which a severe blow on the head has wiped out completely the memory of immediately pre-ceding events. It throws light too on the fact, noted by some persons, that what is learnt immediately before falling asleep is often remembered with exceptional accuracy" (p. 393). A return, it appears, to Quintillion so regional example. It is interesting to note that this very hypothesis became the subject of direct experimental investigation aimed at distinguishing between theories of decay and interference in explaining forgetting (*e.g.*,Jenkins & Dallenbach, 1924).

4.4.4 Early Studies

This dormant period persisted for only about 10 years, until Zubin and Barrera (1941) presented the first experimental studies of the impact of brain stimulation on consolidation. They observed the effect of electroconvulsive shock (ECS) on paired associate learning, and reported that the impact of ECS depended on the interval between learning and the disruptive brain stimulation. More specifically, the briefer the interval between learning and ECS the more adverse its effect on memory performance. This finding paralleled that observed in naturally occurring retrograde amnesia. Therefore, the ECS procedure seemed to provide an experimental method that could interrupt the consolidation process in a controlled fashion.

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4.4.5 The Nature of Memory Representations

A fundamental issue throughout the history of memory research concerns the psychological and physiological properties of changes in the mind that preserves information over time-that is, the nature of the "memory trace" or "engram." We refer to this issue as the problem of memory representation. Whereas studies of consolidation focus on the temporal properties of memory storage, research and theorizing about memory representations attempt to specify the manner in which information is stored. As we shall see, for more than 100 years, the problem of memory representation has been intimately intertwined with the question of whether memories are represented in a localized or distributed fashion. Although the problem of memory representation involves issues other than localized vs. distributed storage, and issues pertaining to localization involve processes other than memory, the two problems show a high degree of historical overlap. The main question and concerns the nature of the relation between psychological and physiological approaches to the general problem of memory representation, which has most frequently taken the form of a debate about localized Vs distributed storage.

The issue of localized vs. distributed representations in memory has been debated at two levels. First, there is the macro level of analysis, which is concerned with where memories are represented. There are two general possibilities here: either one or several regions of the brain are responsible for storing all sorts of memories, or memories are scattered throughout the brain. The second level of analysis is the micro level, which is concerned with how each memory is represented, regardless of where memories (as a group) are stored. Once again there are two possibilities: either there are one-to-one mappings of memories to one or a few nerve cells, or memories are distributed in networks throughout the brain (or region of the brain responsible for memory). Although the focus of the present section will be the micro-level question of how individual memories are represented, we begin with a discussion of the precursors to this debate in the form of the macro-level issue of where memory is represented.

4.4.6 Historical Overview

(i) **Early Physiological Speculations** The idea that the storage of memory might be confined to a specific area of the brain can be traced to phrenology and its attempts to localize cerebral function in general. Gall (1835) and Spurzheim (1834) argued that different areas of the brain are responsible for different mental faculties (*e.g.* memory), and that the contours of the skull reflect the relative strengths of these various faculties in an individual. Although this extrapolation from the shape of the skull to underlying mental strengths and weakness was wildly inaccurate, the basic idea of cerebral localization of function has survived as an essential part of modern day neuro psychology. Most nineteenth century researchers, including Broca (1861), Wernicke (1874), and Munk (1881), favoured a localizations perspective on cerebral functions, including memory.

4.4.7 Memory Systems

It is noted that how specific memories are stored, early investigators also offered macro-level hypotheses concerning where memory processes are localized. Such

hypotheses led naturally to the suggestion that different forms or types of memory might be localized in different parts of the brain (e.g., Gall, 1835). More recent discussions of this issue have taken the form of debates about whether memory is more usefully viewed as a single, monolithic system or as a collection of multiple interacting systems. Although this debate has been at the forefront of the cognitive, neuropsychological, and neurobiological literatures for the past decade, the roots of the discussion are to be found in nineteenth-century philosophical and medical writings. We shall consider first these early writings, and then turn our attention to contemporary discussions.

4.4.8 Historical Overview Philosophy

One problem that can arise when considering early writings that are relevant to the issue of memory systems is that it is frequently difficult to ascertain whether an author was distinguishing between two or more systems. Because it is all too easy to read current conceptions into past formulations, we will attribute a "multiple memory systems hypothesis" to an author only if an explicit statement arguing for a fundamental difference between types of memories is provided. Consider, for example, the views of the medieval philosopher St. Augustine, presented in a fifth-century treatise. Augustine implied a distinction between memories and habits when he suggested that animals "could not even form their habits except by their memories" (cited in Hermann & Chafin, 1988, p. 118). However, he did not provide any reason to assume that memories and habits reflect the operations of different underlying systems; his statement would be equally compatible with the view that there is a single system in which habits are simply overlearned memories.

A similar sort of issue arises when considering the following statement by the thirteenth-century philosopher and theologian Thomas Aquinas: "Pastness can be considered either in relation to the thing known or in relation to the act of knowledge" (cited in Hermman & Chafin, 1988, p . 147). It is tempting to suggest that "the thing known" refers to an explicit form of memory, and that "the act of knowledge" refers to an implicit form of memory. However, such an inference probably reflects more of our own familiarity with this recently developed distinction than of an explicit hypothesis about multiple memory systems on the part of Aquinas. To our knowledge, the first clear delineation of a distinction among types of memory in the philosophical literature (or elsewhere) was provided by the French philosopher Maine de Biran (1804), who proposed three types of memory: mechanical, representative, and sensitive (see Schacter, 1987). In Maine de Biran's scheme mechanical memory refers to the acquisition of motor habits, representative memory refers to memory for facts and events, and sensitive memory refers to memory for emotions and feelings. Maine de Biran discussed at great length the properties and functions of these three types of memory, and there can be little doubt that viewed them as distinct. On the other hand, he was also aware of the difficulties in drawing sharp distinctions among hypothetical mental entities, noting that "The gradation which separates mechanical memory from sensitive memory is, in certain cases, rather difficult to grasp.

4.4.9 History and its representation

In a sense, this question is best answered on the basis of a careful reading of some good historians. But it will be useful to offer several simple answers to this

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foundational question as a sort of conceptual map of the nature of historical knowing. First, historians are interested in providing conceptualizations and factual descriptions of events and circumstances in the past. This effort is an answer to questions like these: "What happened? What was it like? What were some of the circumstances and happenings that took place during this period in the past?" Sometimes this means simply reconstructing a complicated story from scattered historical sources[special-character: mdash for example, in constructing a narrative of the Spanish Civil War or attempting to sort out the series of events that culminated in the Detroit race riot / uprising of 1967. But sometimes it means engaging in substantial conceptual work in order to arrive at a vocabulary in terms of which to characterize "what happened." Concerning the disorders of 1967 in Detroit: was this a riot or an uprising?

Second, historians often want to answer "why" questions: "Why did this event occur? What were the conditions and forces that brought it about?" This body of questions invites the historian to provide an explanation of the event or pattern he or she describes: the rise of fascism in Spain, the collapse of the Ottoman Empire, the great global financial crisis of 2008. And providing an explanation requires, most basically, an account of the causal mechanisms, background circumstances, and human choices that brought the outcome about. We explain a historical outcome when we identify the social causes, forces, and actions that brought it about, or made it more likely.

Third, and related to the previous point, historians are sometimes interested in answering a "how" question: "How did this outcome come to pass? What were the processes through which the outcome occurred?" How did the Prussian Army succeed in defeating the superior French Army in 1870? How did Truman manage to defeat Dewey in the 1948 US election? Here the pragmatic interest of the historian's account derives from the antecedent unlikelihood of the event in question: how was this outcome possible? This too is an explanation; but it is an answer to a "how possible" question rather than a "why necessary" question.

Fourth, often historians are interested in piecing together the human meanings and intentions that underlie a given complex series of historical actions. They want to help the reader make sense of the historical events and actions, in terms of the thoughts, motives, and states of mind of the participants. For example: Why did Napoleon III carelessly provoke Prussia into war in 1870? Why has the Burmese junta dictatorship been so intransigent in its treatment of democracy activist Aung San Suu Kyi? Why did northern cities in the United States develop such profound patterns of racial segregation after World War II? Answers to questions like these require interpretation of actions, meanings, and intentions—of individual actors and of cultures that characterize whole populations. This aspect of historical thinking is "hermeneutic," interpretive, and ethnographic.

(a) Scale in history

Doing history forces us to make choices about the scale of the history with which we are concerned. Suppose we are interested in Asian history. Are we concerned with Asia as a continent, or China, or Shandong Province? Or in historical terms, are we concerned with the whole of the Chinese Revolution, the base area of Yenan, or the specific experience of a handful of villages in Shandong during the 1940s? And given the fundamental heterogeneity of social life, the choice of scale makes a big difference to the findings.

Historians differ fundamentally around the decisions they make about scale. William Hinton provides what is almost a month-to-month description of the Chinese Revolution in Fanshen village—a collection of a few hundred families (Hinton, 1966). The book covers a few years and the events of a few hundred people. Likewise, Emmanuel Le Roy Ladurie offers a deep treatment of the villagers of Montaillou; once again, a single village and a limited time (Le Roy Ladurie, 1979). William Cronon provides a focused and detailed account of the development of Chicago as a metropolis for the middle of the United States (Cronon, 1991). These histories are limited in time and space, and they can appropriately be called "micro-history."

At the other end of the scale spectrum, William McNeill provides a history of the world's diseases (McNeill, 1976); Massimo Livi-Bacci offers a history of the world's population (Livi-Bacci, 2007); and De Vries and Goudsblom provide an environmental history of the world (De Vries and Goudsblom, 2002). In each of these cases, the historian has chosen a scale that encompasses virtually the whole of the globe, over millennia of time. These histories can certainly be called "macro-history."

Both micro- and macro-histories have important shortcomings. Micro-history leaves us with the question, "how does this particular village shed light on anything larger?". And macro-history leaves us with the question, "how do these large assertions about causality really work out in the context of Canada or Sichuan?". The first threatens to be so particular as to lose all interest, whereas the second threatens to be so general as to lose all empirical relevance to real historical processes.

There is a third choice available to the historian that addresses both points. This is to choose a scale that encompasses enough time and space to be genuinely interesting and important, but not so much as to defy valid analysis. This level of scale might be regional-for example, G. William Skinner's analysis of the macro-regions of China (Skinner, 1977). It might be national—for example, a social and political history of Indonesia. And it might be supra-national—for example, an economic history of Western Europe or comparative treatment of Eurasian history. The key point is that historians in this middle range are free to choose the scale of analysis that seems to permit the best level of conceptualization of history, given the evidence that is available and the social processes that appear to be at work. And this mid-level scale permits the historian to make substantive judgments about the "reach" of social processes that are likely to play a causal role in the story that needs telling. This level of analysis can be referred to as "meso-history," and it appears to offer an ideal mix of specificity and generality.

4.4.10 Continental philosophy of history

The topic of history has been treated frequently in modern European philosophy. A long, largely German, tradition of thought looks at history as a total and comprehensible process of events, structures, and processes, for which the philosophy of history can serve as an interpretive tool. This approach, speculative and meta-historical, aims to discern large, embracing patterns and directions in the unfolding of human history, persistent notwithstanding the erratic back-and-forth of particular historical developments. Modern philosophers raising this set of questions about the large direction and meaning of history include Vico,

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Herder, and Hegel. A somewhat different line of thought in the continental tradition that has been very relevant to the philosophy of history is the hermeneutic tradition of the human sciences. Through their emphasis on the "hermeneutic circle" through which humans undertake to understand the meanings created by other humans—in texts, symbols, and actions—hermeneutic philosophers such as Schleiermacher (1838), Dilthey (1860–1903), and Ricoeur (2000) offer philosophical arguments for emphasizing the importance of narrative interpretation within our understanding of history.

(a) **Universal or historical human nature:** Human beings make history; but what is the fundamental nature of the human being? Is there one fundamental "human nature," or are the most basic features of humanity historically conditioned (Mandelbaum 1971)? Can the study of history shed light on this question? When we study different historical epochs, do we learn something about unchanging human beings—or do we learn about fundamental differences of motivation, reasoning, desire, and collectivity? Is humanity a historical product?Giambattista Vico's *New Science* (1725) offered an interpretation of history that turned on the idea of a universal human nature and a universal history (1725); (see (Berlin 2000) for commentary). Vico's interpretation of the history of civilization offers the view that there is an underlying uniformity in human nature across historical settings that permits explanation of historical actions and processes. The common features of human nature give rise to a fixed series of stages of development of civil society, law, commerce, and government: universal human beings, faced with recurring civilizational challenges, produce the same set of responses over time. Two things are worth noting about this perspective on history: first, that it simplifies the task of interpreting and explaining history (because we can take it as given that we can understand the actors of the past based on our own experiences and nature); and second, it has an intellectual heir in twentieth-century social science theory in the form of rational choice theory as a basis for comprehensive social explanation.

Johann Gottfried Herder offers a strikingly different view about human nature and human ideas and motivations. Herder argues for the historical contextuality of human nature in his work, *Ideas for the Philosophy of History of Humanity* (1791). He offers a historicized understanding of human nature, advocating the idea that human nature is itself a historical product and that human beings act differently in different periods of historical development (1800–1877, 1791). Herder's views set the stage for the historicist philosophy of human nature later found in such nineteenth century figures as Hegel and Nietzsche. His perspective too prefigures an important current of thought about the social world in the late twentieth century, the idea of the "social construction" of human nature and social identities (Anderson 1983; Hacking 1999; Foucault 1971).

(b) **Does history possess directionality:** Philosophers have raised questions about the meaning and structure of the totality of human history. Some philosophers have sought to discover a large organizing theme, meaning, or direction in human history. This may take the form of an effort to demonstrate how history enacts a divine order, or reveals a large pattern (cyclical, teleological, progressive), or plays out an important theme (for example, Hegel's conception of history as the unfolding of human freedom discussed below). The ambition in each case is to demonstrate that the apparent contingency and arbitrariness of historical events can be related to a more fundamental underlying purpose or order.

This approach to history may be described as hermeneutic; but it is focused on interpretation of large historical features rather than the interpretation of individual meanings and actions. In effect, it treats the sweep of history as a complicated, tangled text, in which the interpreter assigns meanings to some elements of the story in order to fit these elements into the larger themes and motifs of the story. (Ranke makes this point explicitly (1881).)

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A recurring current in this approach to the philosophy of history falls in the area of theodicy or eschatology: religiously inspired attempts to find meaning and structure in history by relating the past and present to some specific, divinely ordained plan. Theologians and religious thinkers have attempted to find meaning in historical events as expressions of divine will. One reason for theological interest in this question is the problem of evil; thus Leibniz's *Theodicy* attempts to provide a logical interpretation of history that makes the tragedies of history compatible with a benevolent God's will (1709). In the twentieth century, theologians such as Maritain (1957), Rust (1947), and Dawson (1929) offered systematic efforts to provide Christian interpretations of history.

Enlightenment thinkers rejected the religious interpretation of history but brought in their own teleology, the idea of progress—the idea that humanity is moving in the direction of better and more perfect civilization, and that this progression can be witnessed through study of the history of civilization (Condorcet 1795; Montesquieu 1748). Vico's philosophy of history seeks to identify a foundational series of stages of human civilization. Different civilizations go through the same stages, because human nature is constant across history (Pompa 1990). Rousseau (1762a; 1762b) and Kant (1784–5; 1784–6) brought some of these assumptions about rationality and progress into their political philosophies, and Adam Smith embodies some of this optimism about the progressive effects of rationality in his account of the unfolding of the modern European economic system (1776). This effort to derive a fixed series of stages as a tool of interpretation of the history of civilization is repeated throughout the eighteenth and nineteenth centuries; it finds expression in Hegel's philosophy (discussed below), as well as Marx's materialist theory of the development of economic modes of production (Marx and Engels 1845–49; Marx and Engels 1848).

The effort to find directionality or stages in history found a new expression in the early twentieth century, in the hands of several "meta-historians" who sought to provide a macro-interpretation that brought order to world history: Spengler (1934), Toynbee (1934), Wittfogel (1935), and Lattimore (1932). These authors offered a reading of world history in terms of the rise and fall of civilizations, races, or cultures. Their writings were not primarily inspired by philosophical or theological theories, but they were also not works of primary historical scholarship. Spengler and Toynbee portrayed human history as a coherent process in which civilizations pass through specific stages of youth, maturity, and senescence. Wittfogel and Lattimore interpreted Asian civilizations in terms of large determining factors. Wittfogel contrasts China's history with that of Europe by characterizing China's civilization as one of "hydraulic despotism", with the attendant consequence that China's history was cyclical rather than directional. Lattimore applies the key of geographic and ecological determinism to the development of Asian civilization (Rowe 2007).

A legitimate criticism of many efforts to offer an interpretation of the sweep

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of history is the view that it looks for meaning where none can exist. Interpretation of individual actions and life histories is intelligible, because we can ground our attributions of meaning in a theory of the individual person as possessing and creating meanings. But there is no super-agent lying behind historical events—for example, the French Revolution—and so it is a category mistake to attempt to find the meaning of the features of the event (e.g., the Terror). The theological approach purports to evade this criticism by attributing agency to God as the author of history, but the assumption that there is a divine author of history takes the making of history out of the hands of humanity.

Efforts to discern large stages in history such as those of Vico, Spengler, or Toynbee are vulnerable to a different criticism based on their mono-causal interpretations of the full complexity of human history. These authors single out one factor that is thought to drive history: a universal human nature (Vico), or a common set of civilizational challenges (Spengler, Toynbee). But their hypotheses need to be evaluated on the basis of concrete historical evidence. And the evidence concerning the large features of historical change over the past three millennia offers little support for the idea of one fixed process of civilizational development. Instead, human history, at virtually every scale, appears to embody a large degree of contingency and multiple pathways of development. This is not to say that there are no credible "large historical" interpretations available for human history and society. For example, Michael Mann's sociology of early agrarian civilizations (1986), De Vries and Goudsblom's efforts at global environmental history (2002), and Jared Diamond's treatment of disease and warfare (1997) offer examples of scholars who attempt to explain some large features of human history on the basis of a few common human circumstances: the efforts of states to collect revenues, the need of human communities to exploit resources, or the global transmission of disease. The challenge for macro-history is to preserve the discipline of empirical evaluation for the large hypotheses that are put forward.

(c) **Hegel's philosophy of history:** Hegel's philosophy of history is perhaps the most fully developed philosophical theory of history that attempts to discover meaning or direction in history (1824a, 1824b, 1857). Hegel regards history as an intelligible process moving towards a specific condition—the realization of human freedom. "The question at issue is therefore the ultimate end of mankind, the end which the spirit sets itself in the world" (1857: 63). Hegel incorporates a deeper historicism into his philosophical theories than his predecessors or successors. He regards the relationship between "objective" history and the subjective development of the individual consciousness ("spirit") as an intimate one; this is a central thesis in his *Phenomenology of Spirit* (1807). And he views it to be a central task for philosophy to comprehend its place in the unfolding of history. "History is the process whereby the spirit discovers itself and its own concept" (1857: 62). Hegel constructs world history into a narrative of stages of human freedom, from the public freedom of the polis and the citizenship of the Roman Republic, to the individual freedom of the Protestant Reformation, to the civic freedom of the modern state. He attempts to incorporate the civilizations of India and China into his understanding of world history, though he regards those civilizations as static and therefore pre-historical (O'Brien 1975). He constructs specific moments as "world-historical" events that were in the pro-

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cess of bringing about the final, full stage of history and human freedom. For example, Napoleon's conquest of much of Europe is portrayed as a world-historical event doing history's work by establishing the terms of the rational bureaucratic state. Hegel finds reason in history; but it is a latent reason, and one that can only be comprehended when the fullness of history's work is finished: "When philosophy paints its grey on grey, then has a shape of life grown old. ... The owl of Minerva spreads its wings only with the falling of the dusk" ((Hegel 1821: 13). (See O'Brien (1975), Taylor (1975), and Kojève (1969) for treatments of Hegel's philosophy of history.)

It is worth observing that Hegel's philosophy of history is not the indefensible exercise of speculative philosophical reasoning that analytic philosophers sometimes paint it. His philosophical approach is not based solely on foundational apriori reasoning, and many of his interpretations of concrete historical developments are quite insightful. Instead he proposes an "immanent" encounter between philosophical reason and the historical given. His prescription is that the philosopher should seek to discover the rational within the real—not to impose the rational upon the real. "To comprehend what is, this is the task of philosophy, because what is, is reason" (1821: 11). His approach is neither purely philosophical nor purely empirical; instead, he undertakes to discover within the best historical knowledge of his time, an underlying rational principle that can be philosophically articulated (Avineri 1972).

(d) **Hermeneutic approaches to history:** Another important strand of continental philosophy of history proposes to apply hermeneutics to problems of historical interpretation. This approach focuses on the meaning of the actions and intentions of historical individuals rather than historical wholes. This tradition derives from the tradition of scholarly Biblical interpretation. Hermeneutic scholars emphasized the linguistic and symbolic core of human interactions and maintained that the techniques that had been developed for the purpose of interpreting texts could also be employed to interpret symbolic human actions and products. Wilhelm Dilthey maintained that the human sciences were inherently distinct from the natural sciences in that the former depend on the understanding of meaningful human actions, while the latter depend on causal explanation of non-intentional events (1883, 1860-1903, 1910). Human life is structured and carried out through meaningful action and symbolic expressions. Dilthey maintains that the intellectual tools of hermeneutics—the interpretation of meaningful texts—are suited to the interpretation of human action and history. The method of *verstehen* (understanding) makes a methodology of this approach; it invites the thinker to engage in an active construction of the meanings and intentions of the actors from their point of view (Outhwaite 1975). This line of interpretation of human history found expression in the twentieth-century philosophical writings of Heidegger, Gadamer, Ricoeur, and Foucault. This tradition approaches the philosophy of history from the perspective of meaning and language. It argues that historical knowledge depends upon interpretation of meaningful human actions and practices. Historians should probe historical events and actions in order to discover the interconnections of meaning and symbolic interaction that human actions have created (Sherratt 2006).

The hermeneutic tradition took an important new turn in the mid-twentieth century, as philosophers attempted to make sense of modern historical

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developments including war, ethnic and national hatred, and holocaust. Narratives of progress were no longer compelling, following the terrible events of the first half of the twentieth century. The focus of this approach might be labeled "history as remembrance." Contributors to this strand of thought emerged from twentieth-century European philosophy, including existentialism and Marxism, and were influenced by the search for meaning in the Holocaust. Paul Ricoeur draws out the parallels between personal memory, cultural memory, and history (2000). Dominick LaCapra brings the tools of interpretation theory and critical theory to bear on his treatment of the representation of the trauma of the Holocaust (1994, 1998). Others emphasize the role that folk histories play in the construction and interpretation of "our" past. This is a theme that has been taken up by contemporary historians, for example, by Michael Kammen in his treatment of public remembrance of the American Civil War (1991). Memory and the representation of the past play a key role in the formation of racial and national identities; numerous twentieth-century philosophers have noted the degree of subjectivity and construction that are inherent in the national memories represented in a group's telling of its history.

Although not himself falling within the continental lineage, R. G. Collingwood's philosophy of history falls within the general framework of hermeneutic philosophy of history (1946). Collingwood focuses on the question of how to specify the content of history. He argues that history is constituted by human actions. Actions are the result of intentional deliberation and choice; so historians are able to explain historical processes "from within" as a reconstruction of the thought processes of the agents who bring them about.

4.4.11 General laws in history

The philosopher of science Carl Hempel stimulated analytic philosophers' interest in historical knowledge in his essay, "The Function of General Laws in History" (1942). Hempel's general theory of scientific explanation held that all scientific explanations require subsumption under general laws. Hempel considered historical explanation as an apparent exception to the covering-law model and attempted to show the suitability of the covering-law model even to this special case. He argued that valid historical explanations too must invoke general laws. The covering-law approach to historical explanation was supported by other analytical philosophers of science, including Ernest Nagel (1961). Hempel's essay provoked a prolonged controversy between supporters who cited generalizations about human behavior as the relevant general laws, and critics who argued that historical explanations are more akin to explanations of individual behavior, based on interpretation that makes the outcome comprehensible. Especially important discussions were offered by William Dray (1957), Michael Scriven (1962), and Alan Donagan (1966). Donagan and others pointed out the difficulty that many social explanations depend on probabilistic regularities rather than universal laws. Others, including Scriven, pointed out the pragmatic features of explanation, suggesting that arguments that fall far short of deductive validity are nonetheless sufficient to "explain" a given historical event in a given context of belief. The most fundamental objections, however, are these: first, that there are virtually no good examples of universal laws in history, whether of human behaviour or of historical event succession (Donagan 1966: 143–45); and second, that there are other compelling schemata through which we can understand historical actions

and outcomes that do not involve subsumption under general laws (Elster 1989). These include the processes of reasoning through which we understand individual actions—analogous to the methods of *verstehen* and the interpretation of rational behaviour mentioned above (Dray 1966: 131–37); and the processes through which we can trace out chains of causation and specific causal mechanisms without invoking universal laws.

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A careful re-reading of these debates over the covering-law model in history suggests that the debate took place largely because of the erroneous assumption of the unity of science and the postulation of the regulative logical similarity of all areas of scientific reasoning to a few clear examples of explanation in a few natural sciences. This approach was a deeply impoverished one, and handicapped from the start in its ability to pose genuinely important questions about the nature of history and historical knowledge. Explanation of human actions and outcomes should not be understood along the lines of an explanation of why radiators burst when the temperature falls below zero degrees centigrade. As Donagan concludes, "It is harmful to overlook the fundamental identity of the social sciences with history, and to mutilate research into human affairs by remodeling the social sciences into deformed likenesses of physics" (1966: 157). The insistence on naturalistic models for social and historical research leads easily to a presumption in favour of the covering-law model of explanation, but this presumption is misleading.

(*i*) **Historical objectivity:** Another issue that provoked significant attention among analytic philosophers of history is the issue of "objectivity." Is it possible for historical knowledge to objectively represent the past? Or are forms of bias, omission, selection, and interpretation such as to make all historical representations dependent on the perspective of the individual historian? Does the fact that human actions are value-laden make it impossible for the historian to provide a non-value-laden account of those actions?

This topic divides into several different problems, as noted by John Passmore (1966: 76). The most studied of these within the analytic tradition is that of the value-ladenness of social action. Second is the possibility that the historian's interpretations are themselves value-laden—raising the question of the capacity for objectivity or neutrality of the historian herself. Does the intellectual have the ability to investigate the world without regard to the biases that are built into her political or ethical beliefs, her ideology, or her commitments to a class or a social group? And third is the question of the objectivity of the historical circumstances themselves. Is there a fixed historical reality, independent from later representations of the facts? Or is history intrinsically "constructed," with no objective reality independent from the ways in which it is constructed? Is there a reality corresponding to the phrase, "the French Revolution," or is there simply an accumulation of written versions of the French Revolution?

There are solutions to each of these problems that are highly consonant with the philosophical assumptions of the analytic tradition. First, concerning values: There is no fundamental difficulty in reconciling the idea of a researcher with one set of religious values, who nonetheless carefully traces out the religious values of a historical actor possessing radically different values. This research can be done badly, of course; but there is no inherent epistemic barrier that makes it impossible for the researcher to examine the

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body of statements, behaviours, and contemporary cultural institutions corresponding to the other, and to come to a justified representation of the other. One need not share the values or worldview of a *sans-culotte*, in order to arrive at a justified appraisal of those values and worldview. This leads us to a resolution of the second issue as well—the possibility of neutrality on the part of the researcher. The set of epistemic values that we impart to scientists and historians include the value of intellectual discipline and a willingness to subject their hypotheses to the test of uncomfortable facts. Once again, review of the history of science and historical writing makes it apparent that this intellectual value has effect. There are plentiful examples of scientists and historians whose conclusions are guided by their interrogation of the evidence rather than their ideological presuppositions. Objectivity in pursuit of truth is itself a value, and one that can be followed.

Finally, on the question of the objectivity of the past: Is there a basis for saying that events or circumstances in the past have objective, fixed characteristics that are independent from our representation of those events? Is there a representation-independent reality underlying the large historical structures to which historians commonly refer (the Roman Empire, the Great Wall of China, the imperial administration of the Qianlong Emperor)? We can work our way carefully through this issue, by recognizing a distinction between the objectivity of past events, actions and circumstances, the objectivity of the contemporary facts that resulted from these past events, and the objectivity and fixity of large historical entities. The past occurred in precisely the way that it did—agents acted, droughts occurred, armies were defeated, new technologies were invented. These occurrences left traces of varying degrees of information richness; and these traces give us a rational basis for arriving at beliefs about the occurrences of the past. So we can offer a non-controversial interpretation of the "objectivity of the past." However, this objectivity of events and occurrences does not extend very far upward as we consider more abstract historical events: the creation of the Greek city-state, the invention of Enlightenment rationality, the Taiping Rebellion. In each of these instances the noun's referent is an interpretive construction by historical actors and historians, and one that may be undone by future historians. To refer to the "Taiping Rebellion" requires an act of synthesis of a large number of historical facts, along with an interpretive story that draws these facts together in this way rather than that way. The underlying facts of behavior, and their historical traces, remain; but the knitting-together of these facts into a large historical event does not constitute an objective historical entity. Consider research in the past twenty years that questions the existence of the "Industrial Revolution." In this debate, the same set of historical facts were first constructed into an abrupt episode of qualitative change in technology and output in Western Europe; under the more recent interpretation, these changes were more gradual and less correctly characterized as a "revolution" (O'Brien and Keyder 1978). Or consider Arthur Waldron's sustained and detailed argument to the effect that there was no "Great Wall of China," as that structure is usually conceptualized (1990).

(*ii*) **Causation in history:** A third important set of issues that received attention from analytic philosophers concerned the role of causal ascriptions in historical explanations. What is involved in saying that "The American Civil War was caused by economic conflict between the North and the South"?

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Does causal ascription require identifying an underlying causal regularity—for example, "periods of rapid inflation cause political instability"? Is causation established by discovering a set of necessary and sufficient conditions? Can we identify causal connections among historical events by tracing a series of causal mechanisms linking one to the next? This topic raises the related problem of determinism in history: are certain events inevitable in the circumstances? Was the fall of the Roman Empire inevitable, given the configuration of military and material circumstances prior to the crucial events?

Analytic philosophers of history most commonly approached these issues on the basis of a theory of causation drawn from positivist philosophy of science. This theory is ultimately grounded in Humean assumptions about causation: that causation is nothing but constant conjunction. So analytic philosophers were drawn to the covering-law model of explanation, because it appeared to provide a basis for asserting historical causation. As noted above, this approach to causal explanation is fatally flawed in the social sciences, because universal causal regularities among social phenomena are unavailable. So it is necessary either to arrive at other interpretations of causality or to abandon the language of causality. A second approach was to define causes in terms of a set of causally relevant conditions for the occurrence of the event—for example, necessary and/or sufficient conditions, or a set of conditions that enhance or reduce the likelihood of the event. This approach found support in "ordinary language" philosophy and in analysis of the use of causal language in such contexts as the courtroom (Hart and Honoré 1959). Counterfactual reasoning is an important element of discovery of a set of necessary and/or sufficient conditions; to say that Cwas necessary for the occurrence of E requires that we provide evidence that E would not have occurred if C were not present (Mackie 1965, 1974). And it is evident that there are causal circumstances in which no single factor is necessary for the occurrence of the effect; the outcome may be over determined by multiple independent factors.

The convergence of reasons and causes in historical processes is helpful in this context, because historical causes are frequently the effect of deliberate human action (Davidson 1963). So specifying the reason for the action is simultaneously identifying a part of the cause of the consequences of the action. It is often justifiable to identify a concrete action as the cause of a particular event (a circumstance that was sufficient in the existing circumstances to bring about the outcome), and it is feasible to provide a convincing interpretation of the reasons that led the actor to carry out the action.

What analytic philosophers of the 1960s did not come to, but what is crucial for current understanding of historical causality, is the feasibility of tracing causal mechanisms through a complex series of events (causal realism). Historical narratives often take the form of an account of a series of events, each of which was a causal condition or trigger for later events. Subsequent research in the philosophy of the social sciences has provided substantial support for historical explanations that depend on tracing a series of causal mechanisms (Hedström and Swedberg 1998).

(*iii*) **Recent topics in the philosophy of history:** English-speaking philosophy of history shifted significantly in the 1970s, beginning with the publication of Hayden White's*Metahistory* (1973) and Louis Mink's writings of the same period (1966; Mink et al. 1987). The so-called "linguistic turn" that marked

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many areas of philosophy and literature also influenced the philosophy of history. Whereas analytic philosophy of history had emphasized scientific analogies for historical knowledge and advanced the goals of verifiability and generalizability in historical knowledge, English-speaking philosophers in the 1970s and 1980s were increasingly influenced by hermeneutic philosophy, post-modernism, and French literary theory (Rorty 1979). These philosophers emphasized the rhetoric of historical writing, the non-reducibility of historical narrative to a sequence of "facts", and the degree of construction that is involved in historical representation. Affinities with literature and anthropology came to eclipse examples from the natural sciences as guides for representing historical knowledge and historical understanding. The richness and texture of the historical narrative came in for greater attention than the attempt to provide causal explanations of historical outcomes. Frank Ankersmit captured many of these themes in his treatment of historical narrative (1995; Ankersmit and Kellner 1995); see also Berkhofer (1995). Another important strand of thinking within analytic philosophy has focused attention on historical ontology (Hacking 2002).

This "new" philosophy of history is distinguished from analytic philosophy of history in several important respects. It emphasizes historical narrative rather than historical causation. It is intellectually closer to the hermeneutic tradition than to the positivism that underlay the analytic philosophy of history of the 1960s. It highlights features of subjectivity and multiple interpretation over those of objectivity, truth, and correspondence to the facts. Another important strand in this approach to the philosophy of history is a clear theoretical preference for the historicist rather than the universalist position on the status of human nature—Herder rather than Vico. The prevalent perspective holds that human consciousness is itself a historical product, and that it is an important part of the historian's work to piece together the mentality and assumptions of actors in the past (Pompa 1990). Significantly, contemporary historians such as Robert Darnton have turned to the tools of ethnography to permit this sort of discovery (1984).

4.5 RECENT DEVELOPMENTS–FOLKLORE IN HISTORICAL UNDERSTANDING

National Folklore Support Centre (NFSC) is a non-governmental, non-profit organization, registered in Chennai, dedicated to the promotion of Indian folklore research, education, training, networking, and publications. The aim of the Centre is to integrate scholarship with activism, aesthetic appreciation with community development, comparative folklore studies with cultural diversities and identities, dissemination of information with multi-disciplinary dialogues, folklore fieldwork with developmental issues, folklore advocacy with public programming events and digital technology with applications to voice the cultures of the marginalized and historically disadvantaged communities. Folklore is a tradition based on any expressive behaviour that brings a group together, creates a convention and commits it to cultural memory. NFSC aims to achieve its goals through cooperative and experimental activities at various levels. NFSC is supported by grants from the Ford Foundation and Tata Education Trust.

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4.5.1 From Antiquity to Modern

Folklore study has come a long way from the days of antiquity and has emerged as a discipline in its own right. Not so long ago, it was only an appendage to subjects like history, anthropology, philology and archaeology. Geography too plays an important role in tracing the evolutions of folktales and identifying actual locations from legends and myths. The ramifications of folklore study can now be heard in political discourse and ethnic assertions. Further, folklore or/ and cultural studies have now become an integral component of comparative literature in many universities. Oral tradition, the source of all folklore is now being hailed as the chronicle of human history by providing evidence to the origin of people and their subsequent migrations to their final destinations. Jan Vansina, in his book, Oral Tradition as History (1985) says that the 'rules of historical evidence as they apply to oral traditions form a body, a logical train of thought' (from the Preface, p.xiii). The paper on the Origin Myth of the Aos seems to exemplify this in authenticating certain elements of the traditional myth and at the same time placing that particular culture in a more or less accurate historical-geographical framework. The other Origin Myth (Mao) addresses the philosophical aspect of mythmaking while the short tale of the transformation of a girl into a bird highlights the magical as well as the etiological elements of folktales.

4.5.2 Kongliang Otsü: An Ao Naga Folk Tale

A long time ago, in the age of dreams and magical times, when the gods and humans resided side by side, there lived a family with two daughters. One day, the parents went to their jhum field, leaving the two girls at home. The time of year is understood to be around end July to early August. "Tenü (younger sister), today mother and father have gone to the fields, so today I will clean the rice and prepare the pigs' feed. You go to fetch the water and firewood," the older sister told her younger sister. The younger sister readily agreed and went to collect firewood. She came laden with the wood and dumping the load on the ground said to her sister, "Oya (elder sister), I am hungry, give me something to eat!" But the older sister, ignoring her plea, sent her to fetch water three more times. When the younger sister filled all the pots and containers with water, it was time to cook food for the evening meal and the older sister set the pot of rice on the fire.

4.5.3 Re-interpreting the Myth of Longterok

There are two phratries among the Ao Nagas who are identified by the dialect they speak. One phratry known as 'Mongsen-ür' speaks the Mongsen dialect and the other that speaks the Chongli dialect is known as Chongli-ür. The Ao Naga myth of origin says that their ancestors "sprang up or originated" (Poktet) from six stones at a place called Longterok which is located in Chungliyimti village, Tuensang District, presently inhabited by the Sangtam tribe. In probably one of the earliest documented descriptions of Longterok, Hutton (1986:45) during one of his visit to Longterok in November 1923 observed that only three of the stones were standing and the largest stone identified as the female stone and a small phallus near it was knocked down by a Christian evangelist and the sixth one was seen leaning on a nearby tree. In January 2008, it was found that five roughly shaped megaliths in a slightly leaning position were located about 3 m

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away from the female stone lying on the ground. Beneath the 'female' stone was an elongated boulder identified as the sixth stone. This myth is so central to the Ao world-view that in Ao folklore, songs, narratives and all other customary practices are traced to Longterok and the ancestral village called Chungliyimti which was established by the first people there.

4.5.4 Archaeological evidence from Chungliyimti

Archaeological excavations carried out for three seasons at Chungliyimti appear to point to a settlement that was inhabited from ancient up to modern times. This observation is borne out by the evidence where cultural artefacts, both early and modern were retrieved from Locality-1 and 2 from different cultural layers. But the lack of convincing evidence of a sterile layer at both Localities suggests continuous settlement without any break. Traces of charcoal and ash at different soil layers (5) to (7) are also indicative of periodic burning of houses which conform to the oral historical sources on frequent village raids and military operations. Archaeological excavation brought to light seven house plans out of which House 1 was reconstructed to its approximate size. Since all the evidence came from the same bedrock level and layer, it is uncertain whether these structures fall within the same complex or different cultural periods. Although a taxing and expensive affair, along with the cultural materials from a stratified context, comparison of radiocarbon dates from each of these individual houses will help determine the temporality of the residential structures. All the houses excavated were seen to face east with three distinct plans having interior divisions indicating the typical traditional house plan of the Aos, Changs, Phoms and Sangtams. As observed by J. P. Mills (1926), in the Ao tradition of house architecture, it is likely that houses with a semi-circular apse/ plan may denote individuals ascribed with high status. If this holds true for Chungliyimti, it would mean that variation in house plans and building adornments were principally based on social status.

4.5.5 Reinterpretation of the myth of Longterok

The narration of Ao tradition typically follows "having originated at Longterok." onsequently, the term 'poktet'(origin) is interpreted in a literal manner and for generations the Aos claimed that they originated from these stones. Nevertheless, following the concept of myth as a symbolic representation of the past, a reinterpretation of the term 'origin/poktet' as given in the myth of Longterok needs to be subjected to a logical analysis. Another Ao tradition says that after living in Chungliyimti for many generations, they crossed the river Tzüla by making a cane suspension bridge over it. This is further validated by the following statement: "In the oral tradition of Chungliyimti and the Sangtam tribe, it is said that the six stones were erected by the ancestors in memory of the six clans who migrated from this village." As Imchen (1990: 35) points out, 'the oral narratives of the Ao Mongsen group say that in the village of Chungliyimti, there were six ancestral grand fathers–Chongli ancestors: Tongpok, Longpok, and Longjakrüp and the Mongsen ancestors Tsüngremchang, Longchenti, and Longmetang. From these ancestors were descended the Ao tribe.' Imchen further mentions that in Chungliyimti village were six Unger and six Tir, each set (one Unger and one Tir) representing one of the six clans. Thereby, in the village of Chungliyimti was raised the Longterok (six stones) in memory of them.

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4.5.6 Oral Tradition in contemporary resolution

In the ancient pre-literate world of tribal societies, oral tradition played the dominant role as the chronicles of history, source of knowledge and wisdom which guided and influenced the people in all aspects of their lives. Naga culture and oral history flourished without any written script of their own. Yet they had an effective medium of communication and records that have been preserved for many centuries through the oral tradition based on deep-rooted and time-tested foundations. Any oral narrative of traditional history, origin and migration of the people (tribe, clan, individual, etc.), formation of the village, events of war, peace, festivals and so on are transmitted by word of mouth from one generation to another through songs, poetry, ballads, prayers, sayings, stories and tales or as public oration when the situation demands. Through such means youngsters were trained not only to learn but to master them. This tradition is so vital for the Nagas that it goes much beyond their culture. Indeed, the very history of the Naga people, their religion and entire social life is shaped by their oral tradition. In the socio-cultural and political life of the Nagas, oral narration was, and still is, a powerful weapon to prove or disprove, substantiate and support any dispute/ claims or for resolving any dispute or conflict. It is instrumental in peace negotiation or to conduct truce in times of war or confrontation. Pledges and promises made between two conflicting parties ensuing after peaceful negotiations were highly respected and honoured. Any violation of such pledges was considered not only as an insult and offence but cowardly, invoking wrath for vengeance and invariably resulting in more conflict.

India's languages, religions, dance, music, architecture, food and customs differ from place to place within the country, but nevertheless possess a commonality. India is the only country in the world to have so many religions and beliefs. The **culture of India** is an amalgamation of these diverse sub-cultures spread all over the Indian subcontinent and traditions that are several millennia old.

Regarded by many historians as the "oldest living civilization of Earth", the Indian tradition dates back to 8000 BC and has a continuous recorded history since the time of the Vedas, believed variously to be 3,000 to over 5,500 years ago. Several elements of India's diverse culture — such as Indian religions, yoga and Indian cuisine — have had a profound impact across the world.

4.5.7 Religions and spirituality

India is the birth place of Hinduism, Buddhism, Jainism and Sikhism, collectively known as Indian religions. Indian religions, also known as Dharmic religions are a major form of world religions along with Abrahamic ones. Today, Hinduism and Buddhism are the world's third- and fourth-largest religions respectively, with over 2 billion follower's altogether, and possibly as many as 2.5 or 2.6 billion followers. India is also the birthplace for the Lingayat and Ahmadiyya faiths.

India is one of the most religiously diverse nations in the world, with some of the most deeply religious societies and cultures. Religion still plays a central and definitive role in the life of many of its people.

The religion of 80% of the people is Hinduism. Islam is practised by around 13% of all Indians. Sikhism, Jainism and especially Buddhism are influential not only in India but across the world. Christianity, Zoroastrianism, Judaism and the

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Bahá'í Faith are also influential but their numbers are smaller. Despite the strong role of religion in Indian life, atheism and agnostics also have visible influence along with a self-ascribed tolerance to other people.

According to Eugene M. Makar, a respected industry consultant, traditional Indian culture is defined by a relatively strict social hierarchy. He also mentions that from an early age, children are reminded of their roles and places in society. This is reinforced by the fact that many believe gods and spirits have an integral and functional role in determining their life. Several differences such as religion divide the culture. However, a far more powerful division is the traditional Hindu bifurcation into non-polluting and polluting occupations. Strict social taboos have governed these groups for thousands of years. In recent years, particularly in cities, some of these lines have blurred and sometimes even disappeared. Important family relations extend as far as gotra, the mainly patrilinear lineage or clan assigned to a Hindu at birth. In rural areas & sometimes in urban areas as well, it is common that three or four generations of the family live under the same roof. The patriarch often resolves family issues.

(*a*) **Family:** Family plays a significant role in the Indian culture. For generations, India has had a prevailing tradition of the joint family system. It is a system under which extended members of a family – parents, children, the children's spouses and their offspring, etc. – live together. Usually, the eldest male member is the head in the joint Indian family system. He makes all important decisions and rules, and other family members abide by them.

(*b*) **Marriage:** For centuries, arranged marriages have been the tradition in Indian society though men and women have always had the choice of who they want to marry. Even today, the vast majority of Indians have their marriages planned by their parents and other respected family-members, with the consent of the bride and groom. Arranged matches are made after taking into account factors such as age, height, personal values and tastes, the backgrounds of their families (wealth, social standing), their castes and the astrological compatibility of the couples' horoscopes. Generally this is done to reduce culture shock for the bride and groom as most families are extended families.

In most marriages the bride's family provides a dowry to the bride to safeguard herself and her children in the event of her husband passing prematurely. In most families the inheritance of family estates pass down the male line.

In India, the marriage is thought to be for life, and the divorce rate is extremely low — 1.1% compared with about 50% in the United States. The arranged marriages generally have a much lower divorce rate, although divorce rates have risen significantly in recent years for love marriage. The divorce rates of marriage is increasing nowadays (3.5%) "Opinion is divided over what the phenomenon means: for traditionalists the rising numbers portend the breakdown of society while, for some modernists, they speak of a healthy new empowerment for women."

(*c*) **Namaste:** Namaste, namaskar or Namaskara or Namaskaram, Vanakkam (Tamil), Nomoshkaar (Bengali), or Sat Shri Akal (Punjabi) is a common spoken greeting or salutation in the Indian subcontinent. Namaskar is considered a slightly more formal version than Namaste but both express deep respect. It is commonly used in India and Nepal by Hindus, Jains, Buddhists and Sikhs, and many continue to use this outside the Indian subcontinent. In Indian and Nepali culture, the word is spoken at the beginning of

written or verbal communication. However, the same hands folded gesture is made usually wordlessly upon departure. Taken literally, it means "I bow to you". The word is derived from Sanskrit (namah): to bow, obeisance, reverential salutation, and respect, and (te): "to you". As explained by an Indian scholar, in literal terms Namaste refers to 'That which is of God in me bows to that which is of God in you'. Also in orthodox families, youngster are taught to seek the blessing of their elders by reverentially bowing to their elders.

(*d*) **Festivals:** India, being a multi-cultural and multi-religious society, celebrates holidays and festivals of various religions. The four national holidays in India, the Independence Day, the Republic Day, the Gandhi Jayanti, and 1st May are celebrated with zeal and enthusiasm across India. In addition, many states and regions have local festivals depending on prevalent religious and linguistic demographics. Popular religious festivals include the Hindu festivals of Navratri, Diwali, Ganesh Chaturthi, Durga puja, Holi, Rakshabandhan and Dussehra. Several harvest festivals, such as Sankranthi, Pongal, Raja sankaranti swinging fesival, and Onam,"Nuakhai" are also fairly popular.

Certain festivals in India are celebrated by multiple religions. Notable examples include Diwali, which is celebrated by Hindus, Sikhs and Jains, and Buddh Purnima, celebrated by Buddhists and Hindus. Islamic festivals, such Eid ul-Fitr, Eid al-Adha and Ramadan, are celebrated by Muslims across India. Sikh Festivals, such as Guru Nanak Jayanti, Baisakhi are celebrated with full fanfare by Sikhs and Hindus. Adding colors to the culture of India, the Dree Festival is one of the tribal festivals of India celebrated by the Apatanis of the Ziro valley of Arunachal Pradesh, which is the easternmost state of India.

(*e*) **Clothing:** Traditional clothing in India greatly varies across different parts of the country and is influenced immensely by local culture, geography and climate. Popular styles of dress include draped garments such as sari for women and dhoti or lungi for men; in addition, stitched clothes such as churidar for women and kurta-pyjama and European-style trousers and shirts for men, are also popular.

In India, a person's social status is perceived to be symbolized by his or her attire. Indian dress etiquette discourages exposure of skin and wearing transparent or tight clothes. Most Indian clothes are made from cotton which is ideal for the region's hot weather. Since India's weather is mostly hot and rainy, majority of Indians wear sandals.

Worn by women on their forehead, the bindi is considered to be a highly auspicious mark in Hindu religion. Traditionally, the red bindi (or sindoor) was worn only by the married Hindu women, but now it has become a part of women's fashion. Some Indian traditions consider the bindi to be representative of the third eye.

India's clothing styles have continuously evolved over the course of the country's history. Ancient Vedic texts mention clothes made from barks and leaves (known as phataka). The 11th century BC Rig-veda mentions dyed and embroidered garments (known as paridhan and pesas respectively) and thus highlights the development of sophisticated garment manufacturing techniques during the Vedic age. In 5th century BC, Greek historian Herodotus describes the richness of the quality of Indian cotton clothes. By 2nd century AD, muslins manufactured in

southern India were imported by the Roman Empire and silk cloth was one of the major exports of ancient India along with Indian spices. Stitched clothing in India was developed before 10th century AD and was further popularized in 15th century by Muslim empires in India. Draped clothing styles remained popular with India's Hindu population while the Muslims increasingly adopted tailored garments.

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During the British Raj, India's large clothing and handicrafts industry was left paralyzed so as to make place for British industrial cloth. Consequently, Indian independence movement leader Mahatma Gandhi successfully advocated for what he termed as khadi clothing — light colored hand-woven clothes — so as to decrease reliance of the Indian people on British industrial goods. The 1980s was marked by a widespread modification to Indian clothing fashions which was characterized by a large-scale growth of fashion schools in India, increasing involvement of women in the fashion industry and changing Indian attitudes towards multiculturalism. These developments played a pivotal role in the fusion of Indian and Western clothing styles.

4.5.8 Languages and literature

Time is always referred as Kaala Chakra in India. In Ancient India the time was divided in four yugas. The calendar which most Indians follow goes in accordance to this. There by, measuring the dates of Vedas came in later days. With its oldest core dating back to as early as 1500 BC, the Rigvedic Sanskrit is one of the oldest attestations of any Indo-Iranian language, and one of the earliest attested members of the Indo-European language family, the family which includes English and most European languages. Sanskrit has had a profound impact on the languages and literature of India. Hindi, India's most spoken language, is a "Sanskritized register" of the Khariboli dialect. In addition, all modern Indo-Aryan languages, Munda languages and Dravidian languages, have borrowed many words either directly from Sanskrit (tatsama words), or indirectly via middle Indo-Aryan languages (tadbhava words). Words originating in Sanskrit are estimated to constitute roughly fifty percent of the vocabulary of modern Indo-Aryan languages, and the literary forms of (Dravidian) Telugu,Malayalam and Kannada. Part of the Eastern Indo-Aryan languages, the Bengali language arose from the eastern Middle Indic languages and its roots are traced to the 5th century BC Ardhamagadhi language.

Tamil, one of India's major classical languages, descends from Proto-Dravidian languages spoken around the third millennium BC in peninsular India. Tamil literature has existed for over two thousand years and the earliest epigraphic records found date from around the third century BC. Another major Dravidian language, Kannada is attested epigraphically from the mid-1st millennium AD, and literary Old Kannada flourished in the 9th to 10th century Rashtrakuta Dynasty. Pre-old Kannada (or Purava HaleGannada) was the language of Banavasi in the early Common Era, the Satavahana and Kadamba periods and hence has a history of over 2000 years. The Ashoka rock edict found at Brahmagiri (dated to 230 BC) has been suggested to contain a word in identifiable Kannada.

According to 2001 India census, Hindi is the most spoken language in India, followed by Bengali, Telugu, Marathi and Tamil. In contemporary Indian literature, there are two major literary awards; these are the Sahitya Akademi Fellowship

and the Jnanpith Award. Seven Jnanpith awards have been awarded in Kannada, six in Hindi, five in Bengali, four in Malayalam, three each in Marathi, Gujarati, Urdu and Oriya and two each in Telugu and Tamil,.

(*a*) **Epics:** The Râmâyana and the Mahâbhârata are the oldest preserved and well-known epics of India. Versions have been adopted as the epics of South-east Asian countries like Thailand, Malaysia and Indonesia. The Ramayana consists of 24,000 verses in seven books (kâgas) and 500 cantos (sargas), and tells the story of Rama (an incarnation or Avatar of the Hindu preserver-god Vishnu), whose wife Sita is abducted by the demon king of Lanka, Ravana. This epic played a pivotal role in establishing the role of dhárma as a principal ideal guiding force for Hindu way of life. The earliest parts of the Mahabharata text date to 400 BC and is estimated to have reached its final form by the early Gupta period (ca. 4th c. AD). Other regional variations of these, as well as unrelated epics include the Tamil Ramavataram, Kannada Pampa Bharata, Hindi Ramacharitamanasa, and Malayalam Adhyath maramayanam. In addition to these two great Indian epics, there are five major epics in the classical Tamil language — Silappatikaram, Manimekalai, Civaka-cintamani, and Valayapathi and Kundalakesi.

(*b*) **Performing arts:** Indian Dance too has diverse folk and classical forms. Among the well-known folk dances are the bhangra of the Punjab, the bihu of Assam, the chhau of Jharkhand, the Odishi of Odisha, the ghoomar of Rajasthan, the dandiya and garba of Gujarat, the Yakshagana of Karnataka and lavani of Maharashtra and Dekhnni of Goa. Eight dance forms, many with narrative forms and mythological elements, have been accordedclassical dance status by India's National Academy of Music, Dance, and Drama. These are:bharatanatyam of the state of Tamil Nadu, kathak of Uttar Pradesh, kathakali and mohiniattam of Kerala,kuchipudi of AndhraPradesh, manipuri of Manipur, odissi of the state of Odisha and the sattriya of Assam.

(*c*) **Drama and theatre:** Indian drama and theatre has a long history alongside its music and dance. Kalidasa's plays like Shakuntala and Meghadoota are some of the older dramas, following those of Bhasa. One of the oldest surviving theatre traditions of the world is the 2,000 year old Kutiyattam of Kerala. It strictly follows theNatya Shastra. Nâtyâchârya Mâni Mâdhava Châkyâr is credited for reviving the age old drama tradition from extinction. He was known for mastery of Rasa Abhinaya. He started to perform the Kalidasa plays like Abhijñânaúâkuntala, Vikramorvaúîya and Mâlavikâ gnimitra;

(*d*) **Music:** The music of India includes multiple varieties of religious, classical, folk, popular and pop music. The oldest preserved examples of Indian music are the melodies of the Samaveda (1000 BC) that are still sung in certain Vedic sacrifices; this is the earliest account of Indian musical hymns. It proposed a tonal structure consisting of seven notes, which were named, in descending order, as Krusht, Pratham, Dwitiya, Tritiya, Chaturth, Mandra and Atiswâr. These refer to the notes of a flute, which was the only fixed frequency instrument. The Samaveda, and other Hindu texts, heavily influenced India's classical music tradition, which is known today in two distinct styles: Carnatic and Hindustani music. Both the Carnatic music and Hindustani music systems are based on the melodic mode (known as Râga), sung to a rhythmic cycle (known as Tâla); these principles were refined in the nâtyaúâstra (200 BC) and the dattilam (300 AD).

Prominent contemporary Indian musical forms include filmi and Indipop. Filmi refers to the wide range of music written and performed for mainstream Indian

cinema, primarily Bollywood, and accounts for more than 70 percent of all music sales in the country. Indipop is one of the most popular contemporary styles of Indian music which is either a fusion of Indian folk, classical or Sufi music with Western musical traditions.

4.5.9 Visual arts

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(*a*) **Painting:** The earliest Indian paintings were the rock paintings of pre-historic times, the petroglyphst; it was common for households to paint their doorways or indoor rooms where guests resided.

Cave paintings from Ajanta, Bagh, Ellora and Sittanavasal and temple paintings testify to a love of naturalism. Most early and medieval art in India is Hindu, Buddhist or Jain. A freshly made coloured flour design (Rangoli) is still a common sight outside the doorstep of many (mostly South Indian) Indian homes. Raja Ravi Varma is one the classical painters.

Madhubani painting, Mysore painting, Rajput painting, Tanjore painting, Mughal painting are some notable genres of Indian Art; while Nandalal Bose, M. F. Husain, S. H. Raza, Geeta Vadhera,Jamini Roy and B.Venkatappa are some modern painters. Among the present day artists, Atúl Dodiya, Bose Krishnamacnahri, Devajyoti Ray and Shibu Natesan represent a new era of Indian art where global art shows direct amalgamation with Indian classical styles. These recent artists have acquired international recognition. Jehangir Art Gallery, Mumbai, Mysore Palace has on display a few good Indian paintings.

(*b*) **Sculpture:** The first sculptures in India date back to the Indus Valley civilization, where stone and bronze figures have been discovered. Later, as Hinduism, Buddhism, and Jainism developed further, India produced some extremely intricate bronzes as well as temple carvings. Some huge shrines, such as the one at Ellora were not constructed by using blocks but carved out of solid rock.

Sculptures produced in the northwest, in stucco, schist, or clay, display a very strong blend of Indian and Classical Hellenistic or possibly even Greco-Roman influence. The pink sandstone sculptures of Mathura evolved almost simultaneously. During the Gupta period (4th to 6th century) sculpture reached a very high standard in execution and delicacy in modeling. These styles and others elsewhere in India evolved leading to classical Indian art that contributed to Buddhist and Hindu sculpture throughout Southeast Central and East Asia.

(*c*) **Architecture:** Indian architecture encompasses a multitude of expressions over space and time, constantly absorbing new ideas. The result is an evolving range of architectural production that nonetheless retains a certain amount of continuity across history. Some of its earliest production are found in the Indus Valley Civilization (2600–1900 BC) which is characterised by well planned cities and houses. Religion and kingship do not seem to have played an important role in the planning and layout of these towns.

During the period of the Mauryan and Gupta empires and their successors, several Buddhist architectural complexes, such as the caves of Ajanta and Ellora and the monumental SanchiStupa were built. Later on, South India produced several Hindu temples like Chennakesava Temple at Belur, the Hoysaleswara Temple at Halebidu, and the Kesava Temple at Somanathapura,Brihadeeswara Temple, Thanjavur, the Sun Temple, Konark, Sri Ranganathaswamy Temple at Srirangam, and the Buddha stupa (Chinna Lanja dibba and Vikramarka kota dibba) at Bhattiprolu.Angkor Wat, Borobudur and other Buddhist and Hindu temples

indicate strong Indian influence on South East Asian architecture, as they are built in styles almost identical to traditional Indian religious buildings.

The traditional system of Vaastu Shastra serves as India's version of Feng Shui, influencing town planning, architecture, and ergonomics. It is unclear which system is older, but they contain certain similarities. Feng Shui is more commonly used throughout the world. Though Vastu is conceptually similar to Feng Shui in that it also tries to harmonize the flow of energy, (also called life-force or Prana in Sanskrit and Chi/Ki in Chinese/Japanese) through the house, it differs in the details, such as the exact directions in which various objects, rooms, materials, etc. are to be placed.

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With the advent of Islamic influence from the west, Indian architecture was adapted to allow the traditions of the new religion. Fatehpur Sikri, Taj Mahal, Gol Gumbaz, Qutub Minar, Red Fort of Delhi are creations of this era, and are often used as the stereotypical symbols of India. The colonial rule of the British Empire saw the development of Indo-Saracenic style, and mixing of several other styles, such as European Gothic. The Victoria Memorial or the Chhatrapati Shivaji Terminus are notable examples.

Indian architecture has influenced eastern and southeastern Asia, due to the spread of Buddhism. A number of Indian architectural features such as the temple mound or stupa, temple spire or sikhara, temple tower or pagoda and temple gate or torana, have become famous symbols of Asian culture, used extensively in East Asia and South East Asia. The central spire is also sometimes called a vimanam. The southern temple gate, or gopuram is noted for its intricacy and majesty. Con temporary Indian architecture is more cosmopolitan. Cities are extremely compact and densely populated. Mumbai's Nariman Point is famous for its Art Deco buildings. Recent creations such as the Lotus Temple, and the various modern urban developments of India like Chandigarh, are notable.

CHECK YOUR PROGRESS

1. Define a concept of history.

2. What is meant by ECS?

3. Write a short note on Oral Tradition in contemporary resolution.

SUMMARY

The Constitution of India prohibits discrimination against members of a particular religion, race, caste, sex or place of birth. The word secular was inserted into the preamble by the Forty-second Amendment (1976) It implies equality of all religions and religious tolerance. India therefore does not have an official state religion. Every person has the right to preach, practice and propagate any religion he chooses. The government must not favour or discriminate against any religion. It must treat all religions with equal respect. All citizens, irrespective of their religious beliefs are equal

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in the eyes of law. No religious instruction is imparted in government or government-aided schools. Nevertheless, general information about all established world religions is imparted as part of the course in Sociology, without giving any importance to any one religion or the others. The content presents the basic/fundamental information with regards to the fundamental beliefs, social values and main practices and festivals of each established world religions. The Indian National Congress at the time of independence from British Raj adopted secularism, not as a worldly philosophy but more as a political arrangement. As power-sharing arrangement could not be satisfactorily worked out between the Hindu and Muslim elite the country was divided into two independent states of India and Pakistan, Muslim majority areas of North-West going to Pakistan. After independence and partition a large body of Muslims were left in India and hence the leaders like Gandhi and Nehru preferred to keep India secular in the sense that Indian state will have no religion though people of India will be free both in individual and corporate sense to follow any religion of their birth or adoption. Thus India remained politically secular but otherwise its people continue to be deeply religious.

KEY WORDS

- **Substance** - A material of a particular kind or constitution.
- **Secularism** - Not specifically relating to religion or to a religious body.
- **Communalism** - Belief in or practice of communal ownership, as of goods and property.

ANSWER TO CHECK YOUR PROGRESS

1. History is usually chronological record of events, as of the life or development of a people or institution, often including an explanation of or commentary on those events.
2. ECS means electroconvulsive shock.
3. In the ancient pre-literate world of tribal societies, oral tradition played the dominant role as the chronicler of history, source of knowledge and wisdom which guided and influenced the people in all aspects of their lives.

TERMINAL QUESTIONS

1. Write a short note on Areas of study.
2. Write on Geographical locations.
3. Write in detail about Indian concept of history.
4. Write briefly the History of Eighteenth and Nineteenth Centuries.
5. What are the intellectual tasks that define the historian's work?
6. How did participants and contemporaries think about it?

FURTHER READINGS

- **A History of India:** "Dietmar Rothermund and Hermann Kulke, Manohar, 2008
- **A History of India:** Burton Stein, Oxford University Press, 2001
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- **A History of India:** Peter Robb, Palgrave / Macmillan, 2003