HOW MODERN IS MODERN LINGUISTICS?

The Medieval Age in Modern (Linguistics) Education, and How to Make it Modern

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PRELIMINARIES

The topic, "How Modern is Modern Linguistics?" was recommended to us, which we accepted readily, for a talk in Deccan College, Pune, as this year's lecture in the series of Ashok Kelkar Memorial Lectures. What follows is an article on the basis of which we plan to design the lecture.

In this article, we shift the focus from Linguistics to Linguistics education, as signalled by our subtitle. We define 'Modern Linguistics Education" as one that is responsive to the current state of affairs in the world, not just as a period of time that includes the present moment. We view the existence of LLMs as an important state of affairs that education in general, linguistics education in particular, must recognise.

We follow NEP 2020 in the choice of developing Higher Order Cognitive Capacities as the primary goal of the curriculum for higher education. Given this mandate, linguistics education has an important role to play, in connecting language, logic, and epistemology. Given the proposal for the five-year integrated Bharat Vidya program at Deccan College, we believe that initiating an ongoing discussion of the issues we raise is timely.

This article is structured as follows. Section 1 outlines the idea of linguistics as the scientific study of language. Section 2 traces the evolution of linguistics as a science, from its beginnings I historical linguistics in the 19th C to its diversity in the current times. Section 3 outlines the other strand of this article, namely, the concept of Higher Order Cognitive Capacities, fleshed out in the NAAC White Paper, "Re-imagining Assesssment and Accreditation in Higher Education in India." It then proceeds to the vision of education in the five-year integrative Bharat Vidya program in Deccan College, and goes on to linguistics education and the issue of curriculum design in what we now call the LLM period. As a response to the challenge of developing a linguistics curriculum in this period, Section 4 makes a case for the need to develop a branch of linguistics that we call 'Epistemic Semantics'. Section 5 considers the practical constraints and challenges in implementing the proposals.

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1 WHAT IS LINGUISTICS?

Most introductions to linguistics begin with the statement that linguistics is the ***scientific study of language***. We accept this description, as long as we agree that by ***scientific***, we mean a form of inquiry in which conclusions are justified on the basis of observations or data. It follows then that:

(1) *Linguistics is the study of language in which conclusions are justified on the basis of observations or data.*

Now, the term ***language*** in this definition may be restricted to ***human languages*** like English, Hindi, Chinese, and German, or it may include the languages of non-human species, such as the language of bacteria and the language of bees. For the purposes of this article, we will restrict ourselves to human language.

(2) Under 'human language', we include:
natural languages like English, Bangla, Chinese, and Yoruba;
formal languages like algebra and propositional calculus; and
diagrammatic languages like Venn Diagrams and tree diagrams.

For the purposes of this talk, we use the term ***linguistics*** to refer to the scientific study of natural languages, and ***semiotics*** to the more general category that includes formal languages and diagrammatic languages.[1]

Something else we need to be clear about is the distinction between *linguistics* and *grammar*. A ***grammar*** is a study of the structure of a systematic enterprise; for instance, the grammar of Bharathanatyam, the grammar of Kathak, the grammar of protein molecules, the grammar of the language of equations, the grammar of English, or the grammar of Hindi.

We also need to distinguish between ***theoretical linguistics*** and ***theoretical grammars*** on the one hand, and ***descriptive linguistics*** and ***descriptive grammars*** on the other.

(3) A **description** of a phenomenon is a set of observational generalisations on the phenomenon.

(4) A ***theory*** is a set of statements
that make a set of predictions
whose truth can be verified by
checking against observational generalisations.

Suppose we use the term *linguistics* to denote:

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[1] As we see it, Ashok Kelkar's book, *Language in a Semiotic Perspective: The Architecture of Marathi Sentence*, is about Semiotics as a scientific study, but not, say, Umberto Eco's *A Theory of Semiotics*, which we do not regard as part of the scientific *Architecture of Marathi Sentence*, is about Semiotics as a scientific study, but not, say, Umberto Eco's *A Theory of Semiotics*, which we do not regard as part of the scientific study of semiotics.

(5) The scientific investigation of what is shared across the grammars of natural languages.

That would be what theoretical linguists call ***Universal Grammar***, UG for short. Equating linguistics with the study of UG will in effect equate it with Chomskian linguistics, not including other research programs in the study of language, like historical linguistics, psycholinguistics, neurolinguistics, sociolinguistics, and educational linguistics.

We will not make that move. Instead, we will try to get a birds'-eye view of the evolution of what we see as the scientific study of language.

2 THE EVOLUTION OF LINGUISTICS

2.1 The Origin of Modern Linguistics

The term ***modern*** refers to a period. It implies that there was a period that we would recognise as *pre-modern*. Scholars of human history use the terms *ancient*, *medieval*, and *modern* as in (6):

6) Ancient: From the start of human civilization (around 6000 BCE) to around 500–700 CE.[2]

Medieval: From around 500 CE to 1850 CE, depending on the region.

Modern: From the end of the medieval period to the present.

We must ask: did the scientific study of language exist during the Ancient Period? There is general agreement among linguists — at least among Chomskian linguists — that Paanini's *AStaadhyaayi* (a grammar of Sanskrit) was the first work in the scientific study of a language. Paanini's research program did not include the grammars of languages other than Sanskrit, and so it would not be legitimate to give him the title: *The Father of Linguistics*. If we exclude Paanini, then we will have to conclude that linguistics became an academic pursuit only in the 19th C.

Within that pursuit, when did linguistics become modern? If we grant the title 'modern' to the 19th C pursuit of historical linguistics, by linguists like Friedrich von Schlegel, Rasmus Rask, and Jacob Grimm who studied the laws of sound change, the term 'modern linguistics' would become synonymous with 'linguistics'. We have two other options:

Option 2: Modern Linguistics originated in early 20th C, with stalwarts like Ferdinand de Saussure, Roman Jakobson, Nikolai Trubetzkoy, Louis Hjelmslev, Leonard Bloomfield, Franz Boas, Edward Sapir, Benjamin Lee Whorf, Zellig Harris, and Charles Hockett.

[2] Received wisdom says that Homo Sapiens came to exist at least 300,000 years ago. Yet, the term 'ancient' in Ancient Indian philosophy is assumed to cover the time period from 1500 BCE to 500 CE.

Option 3: Modern Linguistics originated with Noam Chomsky in 1965 with the setting up of the lineage of Generative Linguistics.

The choice between these three options depends on which lineage of linguistics one belongs to. Even though we, the authors of this article belong to the Chomskian lineage, we choose Option 1.

2.2 Linguistics from the 20th C to the 21st C

The question, "How Modern is Modern Linguistics?" presupposes multiple periods of modernity within modern linguistics. For the purposes of illustration, we may identify the following landmarks in the evolutionary history of modern linguistics.

(7) A. *The concepts of langage, langue and parole, synchronic and diachronic,* as proposed by Ferdinand de Saussure.

B. *Pre-Chomskian modern linguistics* from Roman Jakobson to Zellig Harris.

C. *The concepts of competence and performance, grammars and universal grammar, rules, representations, and modularity,* as proposed by Noam Chomsky and Morris Halle, yielding theories of language structure (phonology, morphology, syntax, semantics).[3]

D. *Non-Chomskian lineages in modern linguistics:* Systemic Functional Grammar, Stratificational Grammar, Tagmemics, and so on.

E. *Sociolinguistics, variation, and communication*, as triggered by the ideas of William Labov and Dell Hymes, and so on.

F. *Departures from Chomsky*: Generative Semantics, Case Grammar, Relational Grammar, Lexical Functional Grammar, Generalised Phrase Structure Grammar, Head-driven Phrase Structure Grammar, Dependency Grammar, Construction Grammar, Optimality Theory, Cognitive Linguistics, and so on.

G. *Technology-assisted linguistics*: sound spectrography, X-rays and other scanning devices such as fMRI, corpus linguistics, culminating in the birth of Generative AI and LLMs as part of AI-linguistics.

[3] We believe that this research program drew upon Leonard Euler's work on graph theory, Alan Turing's work on automata/machines, and Alonzo Church's work on first order logic. We are also tempted to believe that this program is what resulted in computational linguistics and mathematical linguistics.

The inventory given above can form the basis for a course on the Evolution of Modern Linguistics in a Master's program.[4]

If we examine the diversity of research programs inhabiting the terrain of linguistics today, from the point of view of graduate students asking themselves which community of linguistics they wish to be members of, we may identify some of the variables that distinguish the different research programs as follows:

Variable I. **Object of Inquiry**: What is the entity that we wish to understand? Here are some of the possibilities:

Option (Ia): Language as a mental entity
The Chomskian communities of Generative Linguistics pursue this research program, treating Generative Linguistics as a branch of cognitive science, which in turn becomes a branch of Biology (called Biolinguistics).

*Opti*on (Ib): Language as a social entity
The communities of Sociolinguistics and Historical Linguistics pursue this research program.

Option (Ic): Language as spoken or written text
Corpus linguistics takes this research program.

Option (Id): Language as a form of communication
This research program explores how we use natural language for real-life interpersonal communication and social interaction.

Option (Ie): Language as a formal object
Mathematical Linguistics and Computational Linguistics see language this way, using concepts like regular languages, context-free languages, context-sensitive languages, recursively enumerable languages, and so on.[5] If this terminology sounds opaque, watch the ten-minute YouTube video, "Discrete Mathematics/Formal Languages" at
https://www.youtube.com/watch?v=7MBpk4gJRkk

Variable II: **Purpose of Inquiry**. Why do you wish to study linguistics? The options here are:

Option (IIa): Understanding-Oriented Linguistics
If you ask theoretical linguists why they study linguistics, you will get the answer that they do so because they wish to understand Nature, and Natural languages are a part of Nature.

[4] Such a course is analogous to a course on the Evolution of Modern Physics in a Master's program in Physics. Even though the title of the book, *Evolution of Physics* by Einstein and Infeld (1935) does not specify modern physics, its focus is the evolution from classical mechanics to relativity mechanics and quantum mechanics, so that the book can be used as the primary resource for a parallel course on the evolution of Modern Physics.

[5] We may note that Chomsky's PhD thesis was the starting point of the study of formal languages.

Option (IIb): Usefulness-Oriented Linguistics
If you ask people who work in language pathology or educational linguistics the same question, the answer would be: because what we discover has useful practical applications.

Variable III: **Theory vs. Description**

Option (IIIa): Those who see themselves as theoreticians, who seek to predict and explain observational generalisations.

Option (IIIb): A great deal of the work on Aboriginal (*aadivaasi*) languages in various parts of the world comes under the category of descriptive linguistics that seeks to document observational generalisations in those languages.

Variable IV: **Formal vs. Non-formal linguistics**

Option (IVa): Formal linguistics expresses the propositions of theories in terms of the symbols and formulae of a formal language. This includes the language of graph theory (e.g., tree diagrams, autosegmental representations, and so on) and a host of formalisms for the expression of laws /rules /constraints /principles /conventions, and so on.

Option (IVb): Non-formal linguistics expresses the propositions of theories in terms of the words and sentences of a natural language.

Formalism is not the same as theory. Euclid's *Elements* employs Greek to express the postulates (definitions and axioms) and theorems of the theory of Euclidian geometry. It was only when analytic geometry emerged that geometry became formalised. Newton's second law can be stated in English as: "Force is equal to mass multiplied by acceleration," or in the formal language of equations as F = ma.

(For more on this, see "Linguistics: Theories and Formalisms," in *Parallelism, Interconnection, and Complementary Distribution: Papers in Honor of Miriam Butt and Tracy Holloway King* at https://omp.kim.uni-konstanz.de/main/index.php/publikon/en/catalog/book/3)

What we have sketched above is a set of parameters that distinguish the different communities of linguists. Some of these communities often ignore or dismiss one another, and use community-internal terminologies that are incomprehensible to members of other communities. Imagine a conference attended by hard-core theoretical linguists and hard-core sociolinguists!

3 LINGUISTICS EDUCATION

3.1 Higher Order Cognitive Capacities

Implicit in the question, "How Modern is Modern Linguistics?" is the assumption that the answer to that question would serve as the basis for

the design of a university curriculum for Bachelor's, Master's and PhD programs in linguistics. Now, designing curricula for any program is not done in a vacuum. In any university, the curriculum for any subject must be integrated vertically with the curricula for school education, and horizontally with the curricula for other subjects in the university.

Section 2 of the NAAC white paper "Re-imagining assessment and accreditation in higher education in India," formulates the ***ultimate purpose of education*** as

> "…the well-being of individuals, society, nation, the human species, and the planet with all its creatures"
> (https://www.thinq.education/post/re-imagining-assessment-and-accreditation-in-higher-education-in-india)

Such ***well-being*** has "…multiple dimensions: physical, pragmatic, societal, emotional, ethical, intellectual, aesthetic, and spiritual." To achieve the ultimate purpose of education, we need to accept the concept of ***educatedness*** as

> "…the shared learning outcomes that all HIEs (Higher Education Institutions) must aspire to, regardless of the specialisation and career paths of the learners. Central to educatedness is what NEP 2020 calls Higher Order Cognitive Capacities, which can be viewed as the strands of the intellectual dimension of well-being"

For the purposes of university education, we can take ***Higher Order Cognitive Capacities*** (HOCC) as the ***educational goals*** (the ***learning outcomes*** it aims at), demanding that the curricula for particular programs like linguistics, archeology, Sanskrit, English literature, philosophy, and physics have their educational goals aligned to the goals of university education.

From the perspective of HOCC, the current institutionalized system of education is a form of ***medievalism***, where:

- ~ belief systems of those who design the curricula are presented as knowledge:
- ~ assertions are made without rational justification: and
- ~ learners imbibe the results of indoctrination with total certainty, without doubting and questioning.

Current mainstream curricula aim at transmission of information, without the goal of helping learners to think and reason.

3.2 Trans-disciplinarity and HOCC in Bharat Vidya

The preamble to the Curriculum Framework for the Five Year Integrative Program in Bharat Vidya articulates its vision of education as follows:

> "Education in Bharat was always liberal, open ended, and trans-disciplinary. The 14 Vidyas and 64 Kalas constituted a comprehensive framework of knowledge encompassing philosophy, science, language, governance, mathematics, arts, and creative practice. Universities such as Takshashila,

> Nalanda, and Vikramashila, and Gurukuls such as that of Sandipani and Bharadwaj, taught across these domains as an integrated whole for centuries. This tradition produced scholars of extraordinary breadth and depth who contributed to societal change. It was a creative education system with enjoyable learning long before the modern university took shape elsewhere. The Five Year Integrated Programme in Transdisciplinary Studies restores this genius in education, built for contemporary relevance and aligned with national priorities and challenges. The programme is expected to produce a young cadre of change makers."

The section on Guiding Questions of Bharat Vidya presents the vision of Higher Order Cognitive Capacities as follows:

> "Any programme of higher education ought to help learners become truly educated. Educatedness may be defined as the capacity to strive for wellbeing, one's own as well as that of all life forms on earth including all humans, along the physical, emotional, intellectual, ethical, societal, economic, aesthetic, and spiritual dimensions. Within this vision, the programme is committed to the goal that the National Education Policy 2020 calls Higher Order Cognition: the capacity to think like an academic, including thinking like a sociologist, historian, anthropologist, linguist, experimental scientist, theoretical scientist, philosopher, and so on. Central to this is rational inquiry into questions of truth, ethical judgment and action, and practical action, with a focus on intellectual wellbeing."

Given that the specialisations in Bharat Vidya include archaeology, history, languages, philosophy, and culture, but not mathematics, the physical sciences, engineering, and so on, we may describe it as a programme in Human Studies. (See "Advocacy for an Institute of Human Studies," at https://www.thinq.education/post/joint-work-on-policy-matters)

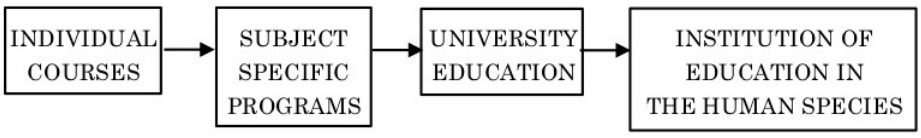
3.3 The Linguistics Curriculum in Bharat Vidya

Given sections 3.1 and 3.2, we may say that the central question for curriculum design for a Linguistics program would be:

> How well do the learning outcomes of the individual courses contribute to the learning outcomes of the degree program as a whole, which in turn need to be aligned to the learning outcomes that the university aims at?

The picture of educational goals we have sketched above can be expressed in a diagrammatic form as follows:

(8) Hierarchy of Educational Goals



Educational goals of the institutions of education have been evolving over time. In the context of linguistics in Deccan College, the question, How modern is modern linguistics? becomes:

> Is the Linguistics curriculum sufficiently 'modern'? Does it implement the educational goals of Higher Order Cognitive Capacities needed in the world today, or do the educational goals remain unchanged from the traditional ones?

Traditional linguistics education follows the practice of providing information content available in the Linguistics literature. This is a function that LLMs can serve much better. In the age of AI, LLMs can answer traditional examination questions better than human students, and write research theses that are successful in getting awarded Master's or PhD degrees. Given this situation, our question is particularly pertinent. The continued use of the traditional information-oriented practice can be detrimental to the culture of learning and research in modern times.

3.4 Linguistics Curricula in the 'LLM Period'

LLMs came into existence in the second decade of the 21st C. By the 'LLM period', we mean the stretch of time from the birth of LLMs to the present day. The design of Linguistics Curricula in the LLM period offers important opportunities as well as challenges. These are analogous to the opportunities and challenges that pocket calculators present to the primary school curriculum.

A pocket calculator performs the arithmetic operations of addition, subtraction, multiplication, and division, using a language consisting of the digits 0-9, and the symbols +, – , x, and ÷. It cannot use count the number of apples in a basket, or solve word problems. But it can make correct calculations of the product of, say, eight-digit numbers so fast that even mathematicians cannot compete with it.

It is important for children to exploit this opportunity and learn how to use pocket calculators. But it is equally important that they acquire the skills of making arithmetic calculations without relying on machines. If they outsource that skill to pocket calculators, they will not be able to answer questions like: "What do you get when you multiply two thousand seven hundred fifty three by three thousand eight?"

Unlike pocket calculators, smart phones with searh engines with a built-in LLM can answer that question instantly. They can also answer questions like: "Which store closest to me sells broccoli?"

LLMs offer extraordinary help to students in the expression of their ideas in grammatical academic writing with clarity, extending to structure as well. They also provide extensive help in literature search, and in writing literature reviews. Meanwhile, we need to also be wary of students outsourcing their creativity, thinking, reasoning, and rigour to machines.

How do we achieve the difficult balance between opportunities and dangers?

Since LLMs (as a branch of Generative AI) interact with us through ***text***, it follows that:

> *we as linguists should help the young develop* ***the capacity for critical reading,*** *to decide whether they should judge propositions expressed by texts (even AI ones) as true or false, or set them aside for further* scrutiny.

Watch the 16-minute YouTube Video, "AI & Education: Generative AI & the Future of Critical Thinking" at
https://www.youtube.com/watch?v=k7PvscqGD24&t=27s

This responsibility calls for a new branch of linguistics that we call ***epistemic semantics***, taking linguistics as a branch of semiotics.

4 EPISTEMIC SEMANTICS

Epistemology is the study or theory of knowledge. The knowledge of a cogniser (knower) X is a body of propositions that X believes to be true, beyond reasonable doubt. In academic knowledge, the criterion that separates knowledge from belief is the requirement that knowledge claims must be rationally justified, to the satisfaction of one's community of fellow inquirers.

Propositions are expressed in a language. To extract the propositions expressed in sentences of a natural language, we need natural language semantics. And to determine whether a proposition is true or false, we need to employ reasoning, studied under logic. In this section, we go beyond the existing literature on epistemology, natural language semantics, and logic, to illustrate the value of what we call epistemic semantics in a curriculum that aims at Higher Order Cognitive Capacities.

4.1 Epistemology, Language, and Logic

Suppose you are taking a course in human biology. In one of the examinations in this course, you see the following question:

Q1: Consider the claim that most members of the human species have exactly four fingers on each of their hands. How would establish the truth or falsity of the claim?

Suppose you give the following proof in support of your claim:

A1: Nearly 100% of humans have five fingers on their right hand, meaning that the percentage with exactly four fingers is close to zero. Therefore, the claim that most humans have exactly four fingers on each of their hands is false.

You get zero marks for your answer. When you approach the instructor of the course to find out why, she writes down the following claims on the whiteboard:

Claim 1: Most members of the human species have exactly four fingers on each hand.

Claim 2: Most members of the human species have exactly five fingers on each hand.

Q2: The exam question demands that you prove or disprove Claim 1. All that you have done is assume the truth of Claim 2, and argue that if Claim 2 is true, then Claim 1 is false. For your proof to be sound, you have to establish that Claim 2 is true. How would you do that?

You think about that problem for some time, and give the following answer:

A2: I would take a randomised sample of about 1000 members of the human species, and count the number of fingers on each of their hands. If every human in the sample has five fingers on each hand, it is legitimate, until we find evidence to the contrary, to generalise, and to claim that:

> Every member of the population of the human species has five fingers on each hand. If that turns out to be the case, then claim 1 is false.

The instructor raises her right hand and says, "How many fingers do I have on my right hand?"

You look at the hand, and say, "Five."

"No," she says, "I have exactly four fingers on this hand." And she proceeds to count, from the little finger to the forefinger: "One, two, three, four. See?"

"Ah, but you didn't count the thumb. If you include that, it becomes five."

"But the thumb is not a finger. A hand has five digits, but only four of them are fingers."

When you consult a dictionary or do an Internet search, you find that the word 'finger' is ambiguous. It can mean, "All the digits on the hand," or "All the digits on the hand except the thumb." Under the first meaning, your answer is correct. But the instructor is right under the second meaning.

The moral of this story is this:

> To judge whether or not a proposition expressed by a declarative sentence is true, you need to clarify the crucial terms in the sentence by defining them.

This example illustrates the relation between language, epistemology, and logic in epistemic semantics.

Let us take this a step further. Claim 2 does not say that ***all*** members of the human species have exactly five fingers on each hand. All that it says is that ***most*** members of the human species have exactly five fingers on each hand. Suppose you find that one percent of humans have six fingers.

If so, the proposition expressed by the sentence with *all* is false, while that with *most* would still be true.

Here, we are concerned with the meaning of the probabilistic quantifier *most*. What exactly does it mean?

99%? 90%? 60%? 51%?

To test the truth of the claim, the intended meaning of the quantifier must be expressed in quantitative terms.

We need to do an empirical study of what speakers of English mean when they say *most* and *almost all*, to establish the following claims:

When speakers of English say *most*, they mean at least *m*%.

When speakers of English say *almost all*, they mean at least *n*%.

This is where research in epistemic semantics becomes relevant for rational inquiry, critical thinking, and research.

The scenario we have presented above is an illustration of how the epistemology of *academic knowledge, linguistics,* and *logic* come together as ***epistemic semantics.***

We have now discussed the need to define the concepts denoted by words like *finger* and *most*. Moving from *most* to *all*, consider Claim 3:

Claim 3: All members of the human species have exactly five fingers on each hand.

How do we test this claim, and establish it as true or false? Suppose we say:

If *all* the members in our sample have five fingers,
until we find evidence to the contrary,
we are justified in concluding that
all the members of the population have five fingers.

As we increase our sample size, and come across at lest one member who has either four or six fingers, we have to concluse that claim 3 as false.

The phrase, *until we find evidence to the contrary*, is an important part of conclusions in ***defeasible reasoning*** in the construction of scientific arguments.

The general principles of epistemology and logic illustrated here are widespread in academic knowledge. The need for a thorough grounding in epistemic semantics in biology becomes relevant when:

we state an observational generalisation such as:

Insects have *compound eyes*,

and argue that given the definition of *insects* as:

Insects are creatures with *six legs*,

spiders are not insects because they have eight legs, and
hence the fact that:

Spiders do not have compound eyes,

is not a counterexample to the claim that insects have compound eyes.

It becomes relevant in physics when we ask:

Both ***force*** and ***energy*** cause entities to move.
What is the distinction between these two concepts?
Why do we need both?
Why don't we have a theory that uses only one of these concepts?

4.2 Structure of Proofs

A ***proof*** is a *rational argument* to establish the ***credibility of a knowledge claim***. The *rational justification* for an observational generalisation employs *inductive reasoning* from sample to population, a mode of reasoning that is crucial in experimental science. Proofs of theoretical postulates in scientific inquiry, and proofs of conjectures in mathematics do not appeal to samples and populations. Mathematical proofs use *classical deductive reasoning*. Arguments for theoretical postulates in science employ what is called *speculative deductive reasoning*, and arguments for interpretations within a theory use what is called *abductive reasoning*. A study of the different modes of reasoning used in different kinds of proofs is central to the epistemology of academic inquiry.

Reasoning has a tripartite structure: *Premises*, *Conclusions*, and *the Derivation* from premises to conclusions: what we call the ***PDC-structure*** for short. The reasoning is expressed either in a natural language (such as English or Greek or Hindi), or a formal language such as algebra or formal logic.

And that is precisely where epistemic semantics plays a significant role, in unearthing the concepts and propositions from words, phrases, and sentences.

> To find out more about the types of reasoning across domains of academic knowledge, take a look at:
> Chapter 9: Introduction to Reasoning and Logic, and
> Chapter 10: Types of Reasoning
> in our book, *Introduction to Research* freely downloadable at
> at https://www.thinq.education/itr

4.3 Sentences and Propositions

In this section, we explore the many-to-many relation between ***words, phrases***, and ***sentences*** on the one hand, and the ideas they express, namely the ***concepts*** and ***propositions*** on the other. We will then examine the problem of evaluating the truth/credibility of propositions, as this calls for the examination of the ***logical relations*** between propositions in the terrain of ***logic and language***.

The term ***proposition*** refers to the statements (meanings) expressed by declarative sentences. The English sentences in (9), and the equations in (10), express the same proposition:

(**9**) *Five times four is twenty.*
Four times five is twenty

(**10**) 5 x 4 = 20.
4 x 5 = 20

Consider the propositions expressed by the English sentences in (11) and the corresponding Malayalam sentences in (12):

(**11**) English
a. Aman's height is five feet six inches.
b. Aman's daughter is taller than his son.
c. Men are taller than women.

(**12**) Malayalam
a. *amante uyaram ancaTi aarincaaNə.*
Aman's height five feet six inches is
Aman is five feet six inches tall.
b. amante makaLkkə awante makaneekkaaL uyaramuNTə.
Aman's daughter-D his son-more than height-has
Aman's daughter is taller than his son.
c. puruSanmaarkkə striikaleekkaaL uyaramuNTə.
Men-D women-more than height-have
Men are taller than women.

Knowledge is a body of propositions that we believe to be true beyond reasonable doubt. How do we find out whether a proposition asserted by a declarative sentence is true?

Take the proposition expressed by (11a) and (12a). If we were to measure Raman's height with a measuring tape, and show that the numerical value of his height is 5' 6", then the proposition expressed by (11a) and (12a) would be ***true***. But if the value is 5' 3" or 5' 10", the proposition would be ***false***.

If we find that the numerical value for Raman's daughter's height is greater than that for Raman's son, the proposition expressed by (11b) and (12b) is true. But if the value for Raman's son's height is the same as or greater than that of his daughter, the proposition is false.

Establishing the truth of the proposition expressed by (11c) and (12c) is more complex, because the proposition is not about individual humans, but categories of humans: adult human males and adult human females.

To find out if this proposition is true, we take large randomized samples of men and women, measure their heights, calculate the mean heights of each sample. If we find that the mean height of men is significantly greater than the mean height of women, the proposition is true. Otherwise it is false.

This discussion illustrates:
~ the relation between sentences and propositions, which comes under epistemic semantics, and
~ evaluating the truth of the propositions, which comes under the epistemology of academic knowledge and inquiry.

4.4 Language Structure and Meaning

In the preceding sections, we illustrated epistemic semantics using particular lexical items and phrases. We now turn to the meanings embedded in syntactic structure, illustrating a form of inquiry that only those trained in linguists are capable of. For this, we will choose Malayalam for our terrain. There are two reasons for doing this:

The data that we present are largely not known to linguistics students.

Using these examples, we will illustrate the kinds of constructions that are characteristic of Indian languages relevant for a theory of epistemic semantics, but without spelling out the theory itself. In doing so, we hope to inspire graduate students to engage in theory construction in epistemic semantics.

Consider the semantic contrast between (13) and (14):

(13) *aman* *hariye* *aTiccatə* *s'ariyalla.*
Aman-N Hari-A hit-PAST-it right-is not
Aman's beating Hari was not right.
(Aman's action of hitting Hari was morally wrong.)

(14) *aman* *hariye* *aTiccuwennatə* s'ariyalla.
Aman-N Hari-A hit-PAST-that-it true-is not
It is not true that Aman hit Hari.
(The proposition that Raman hit Hari is not true.)[6]

The morphological composition of *s'ariyalla* is:

(15) *s'ari* 'true/right'
alla 'no/is not'

The difference between (13) and (14) lies in their verb forms:

(16) a. *aTiccatə* vs. (b) *aTiccuwennatə*
aTiccu + atə aTiccu + ennə +atə
hit-PAST-it hit-PAST-that-it

The semantic contrast between (16a) and (16b) is located in the contrast between the two morpho-syntactic ***constructions***:

(17) a. V-TENSE-NOM vs. (b) V-TENSE-COMP-NOM
[NOM: Nominaliser COMP: Complementiser]

The nominaliser *atə* 'it' in (16a) refers to an action, while that in (16b) refers to a proposition. This contrast is central to the critical evaluation of the truth of the propositions asserted by (13) and (14). Hence the need for epistemic semantics in the strand of the curriculum that aims at HOCC.

To turn to another example, compare (18a) and (18b):

[6] Note that the word *s'ari* has different meanings in (13) and (14): it translates as *right* or *true*. A counterpart of *s'ariaaN∂* in Malayalam is *Thiik hai* in Hindi, which also is ambiguous between *right* and *true*.

(18) a. *amante* *makkaL* *puunayil aaNə*
Aman-poss children Pune-in is/are
Aman's children are in Pune.

b. *amante* *ellaa* *makkaLum* *puunayil aaNə*
Aman-poss all children-and Pune-in is/are
All of Aman's children are in Pune.

The combination of negation and quantifiers is even more interesting:

(19) a. *amante* *orə* *kuTTi* *puunayil* ***aaNə***
Aman-poss one child Pune-in is
One of Aman's children is in Pune.

b. *amante* *orə* *kuTTi* *puunayil* ***alla***
Aman-poss one child Pune-in is not
One of Aman's children is not in Pune.

c. *amante* *orə* *kuTTiyum* *puunayil* ***alla***
Aman-poss one child-and Pune-in is not.
None of Aman's children is in Mumbai.

d. *amante* *orə* *kuTTiyum* *puunayil* ***aaNə***
Aman-poss one children-and Pune-in is.
One of Aman's children is in Pune too.

The examples discussed above are intended only as an illustration of the kinds of questions that epistemic semantics seeks to investigate. They can be thought of as pointers for graduate students in theoretical linguistics, such that the design of curricula aiming at HOCC can draw upon the outcomes of their research.

5 From Vision and Goals to Implementation

5.1 Assessment Tasks

In order to implement the vision of education outlined in the previous sections, we need to change the nature of assessment — entrance tests, aptitude tests, and examination questions — because that is what guides students in what to learn, in order to perform well. This situation is compounded by the existence of LLMs that students can outsource their work to: they can submit a Honours/Master's/PhD thesis written by an LLM, and get a degree with no learning. Given this situation, the highest priority in improving the quality of education in any program of higher education must be to work backwards to figure out what the questions seek to assess, and work forward to decide what they ought to, or what we would like them to, assess.

The first step in this direction would be to replace all the closed-book tests and exams with Open Book Exams (OBE), such that students would not be able to do well simply by memorising and regurgitating. It is important then that faculty learn to design questions appropriate for OBEs.

The second step would be to set up computer gradable Enhanced-MCQs that test higher order cognition in a way that independently of the faculty, students would learn what is of value to them in their life after they graduate. (On E-MCQs, see: "Isn't this a 'NEET' solution to address the poor design of exam and test questions in India?" https://www.newindianexpress.com/web-only/2024/Jul/09/isnt-this-a-neet-solution-to-address-the-poor-design-of-exam-and-test-questions-in-india)

5.2 A Five–Year Plan

It is unwise to change the nature of the assessment tasks without changing the nature of the rest of the curriculum: class sessions, learning resources, syllabus, ... Therefore, we would suggest the following strategy:

A) Create a question bank for entrance tests, aptitude tests, and final exams. This would provise a guideline for the faculty to get a fair idea of what they need to learn, such that they can help their students learn those forms of understanding, abilities, and capacities that come under HOCC.

B) Select faculty with the potential to function in HOCC, and take them through faculty development programs to help them:
   (1) acquire trans-disciplinary HOCC, and
   (2) help their students acquire trans-disciplinary HOCC.

C) Set up a foundation program for the first two years of Bharat Vidya, with courses on reasoning and logic, epistemic semantics, inquiry and critical thinking, trans-disciplinary thinking, and Indian Knowledge Systems.

D) Implement computer-gradable Enhanced-MCQs that probe into HOCC.

E) Conduct field trials of (C) and (D) and fine tune them.

F) Convert as many courses of (D) as possible into online courses, such that students in other universities can also learn from them.

G) Revise the curricula for specialisations such that they aim at HOCC, going beyond the understanding of content knowledge.

As indicated in the subtitle of this article, the culture of institutionalized mainstream education is that of the medieval age. It is our hope that the ideas and strategies of implementation outlined in this article would result in a thorough rethinking of the design of not only the linguistics curricula, but also university curricula in general, in India and abroad. The successful implementation in Deccan college, Pune, would also transform the college into a leading flagship institution, worthy of being a descendant of the College during Ashok Kelkar's time.