



Ontological Framework for S. R. Ranganathan's Theory of the Origin of Knowledge: Unveiling the Structural Essence of the "Brain Chamber" Concept

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Creating an ontology on any subject is complex and intellectually demanding, requiring great attention to detail. This study attempts to develop an ontology (Brain Chamber Ontology) centred around S. R. Ranganathan's Theory of the Origin of Knowledge and the concept of the Brain Chamber, as given in his seminal book, *Prolegomena to Library Classification*. The METHONTOLOGY approach, a mature ontology development method, was employed to achieve this. The created ontology was subjected to rigorous evaluation to ascertain its efficacy. SPARQL queries were formulated to assess the ontology's performance, gauging its ability to provide meaningful answers. Additionally, the quality of the ontology was measured using the FOCA methodology. The built-in reasoners played a crucial role in verifying the internal consistency of the ontology. Its performance in responding to SPARQL queries suggests a robust representation of Ranganathan's Theory of the Origin of Knowledge. Furthermore, applying the FOCA methodology underscored the ontology's quality and adherence to established standards.

Keywords: Ontology, Semantic Web, S. R. Ranganathan, Theory of Origin of Knowledge

Introduction

The Semantic Web represents the realisation of Tim Berners-Lee's vision¹, wherein he aspired to create a web capable of autonomously processing data with minimal human intervention². Certain prerequisites, such as developing the Resource Description Framework (RDF) and the Web Ontology Language (OWL)³, must be met to achieve this. OWL is a Semantic Web language carefully designed to represent the knowledge imbibed in different domains⁴. The term "ontology," originally a philosophical concept exploring the study of existence, was adopted later in Information Science. According to Gruber⁵, an ontology can be defined as a formal, explicit specification of a shared conceptualisation. Within this formal framework, ontologies encompass various components such as classes, relations, attributes, formal axioms, functions, and instances. Classes serve as representations of both physical and abstract concepts. The essence of an ontology lies in its capacity to provide a structured and standardised means of expressing and sharing knowledge in a domain⁶.

The objective of the present study is to construct an ontology centred on the Theory of knowledge articulated

by Ranganathan⁷ in his seminal book *Prolegomena to Library Classification*. Ranganathan's claims about this theory are well-supported by evidence and show a deep understanding. Here, Ranganathan⁷ formulates two fundamental types of knowledge: *intellection*, denoting intellectual processes applied to sensory data, and *intuition*, representing the direct apprehension of objects in their intrinsic nature⁸. Ranganathan⁷ metaphorically illustrates the complex process of conceiving concepts and formulating ideas as a "Brain Chamber," wherein intuition and intellect interact. Figure 1 captures the visual representation of this interaction between intuition and intellect that Ranganathan⁷ describes in his book *Prolegomena to Library Classification*. This figurative depiction of the "Brain Chamber" is a visual metaphor, portraying the relationship between the faculties of intuition and intellect.

Review of Literature

Sources such as Google Scholar, SCOPUS, and Emerald Insights were employed for a literature review, and two separate keywords were used. They are as follows:

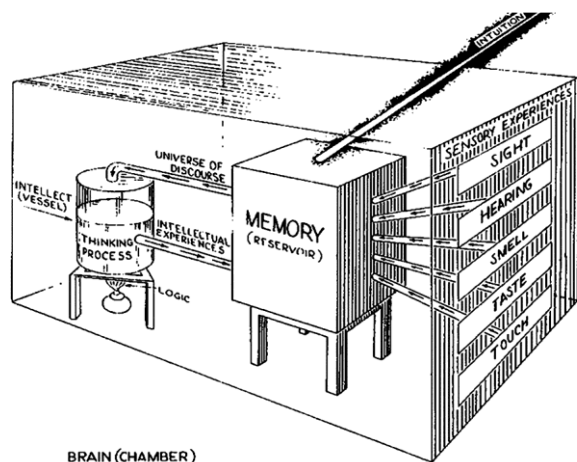


Fig.1 — The concept of the “Brain Chamber” from the book *Prolegomena to Library Classification*

1. ((Ontology) OR (Knowledge Graph)) AND (METHONTOLOGY)
2. (((Ontology) OR (Knowledge Graph)) OR (Semantic Web)) AND (S. R. Ranganathan)

The literature section lists papers that describe different ontology development attempts using the METHONTOLOGY approach. Additionally, the review incorporates papers that use Ranganathan’s concepts within the domains of Ontology and Semantic Web. Among the many papers gathered, the important ones are listed below chronologically.

The METHONTOLOGY, introduced by Fernández-López et al.⁹, serves as a comprehensive framework for formulating ontologies at the knowledge level, presenting a precise specification of conceptualisations. The authors illustrate its application in constructing a chemical ontology. Building upon this foundation, Corcho et al.¹¹ extended the METHONTOLOGY approach in their paper, detailing the construction of an ontology within the legal domain. The study describes the ontology development process using METHONTOLOGY and utilising the ontology engineering workbench WebODE.

Park, Sung, and Moon¹², in their paper, developed the Graduation Screen Ontology (GSO) based on the guidelines suggested by METHONTOLOGY to analyse the ontology development life cycle suggested in it and to identify the issues related to this approach. To demonstrate the efficacy of applying Ranganathan’s canons to ontology structuring, Campos, de Almeida Campos, & Campos¹³, conducted a comprehensive analysis of the hierarchical organisation of Gene Ontology (GO) within the biomedical domain. Their investigation revealed that the adoption of

Ranganathan’s canons could significantly reduce the inconsistencies prevalent in the hierarchical structure of GO. This study underscores the potential utility of integrating Ranganathan’s principles for enhancing robustness in biomedical ontologies.

Dragoni, Poria, and Cambria¹⁴ introduced OntoSenticNet, a common-sense ontology designed explicitly for sentiment analysis. The ontology was created using the METHONTOLOGY method. Grounded in SenticNet, a semantic network encompassing 100,000 concepts derived from conceptual primitives, OntoSenticNet emerges as a structured framework for comprehending and analysing sentiments. Chouchani and Debbech¹⁵ developed ATMO (Autonomous Train Map Ontology), a modular framework for on-board digital mapping in autonomous trains. Developed via METHONTOLOGY, ATMO models railway infrastructure, line-side signalling, and related structures.

Scholars widely agree that METHONTOLOGY stands out as a top choice for ontology development because it’s thorough, reliable, and backed by solid research. Over time, though, other authors have slightly adjusted the original steps and kept the core elements intact. These modified versions often appear in the field, highlighting METHONTOLOGY’s flexibility and adaptability. On the other hand, ontologies that draw on Ranganathan’s philosophical ideas are still largely unexplored. There haven’t been enough efforts to connect Ranganathan’s significant contributions with the fields of ontology or the Semantic Web. It’s important to look more deeply at how his insights might impact and enrich these areas of study. This gap suggests a real opportunity to investigate how Ranganathan’s ideas could be woven into modern frameworks for developing ontologies.

Objectives

Based on the insights obtained from the literature review, the study’s objectives are formulated as follows:

- Create a detailed ontology that captures the complexities of the “Brain Chamber” concept within S.R. Ranganathan’s Theory of Origin of Knowledge using the METHONTOLOGY methodology.
- Create SPARQL queries based on Competency Questions (CQs) provided by domain experts to test how well the ontology represents and retrieves relevant knowledge.

- Use the built-in Pellet reasoner to check the ontology's internal consistency, ensuring it is coherent and logically sound in representing knowledge.
- Employ the FOCA¹⁶ methodology to conduct a comprehensive quality assessment of the ontology, considering aspects such as clarity, expressiveness, and adherence to best practices in formal ontology construction.

Methodology

The methodology consists of two distinct parts: one describing the methods for ontology development and the other addressing the evaluation of the created ontology. Detailed explanations of both are provided separately below.

Methods for Developing Ontology

The Brain Chamber Ontology, constructed upon Ranganathan's Theory of Knowledge, is formulated utilising the ontology development method, METHONTOLOGY, proposed by Fernández-López *et al.*⁹. This method comprises seven distinct steps, each serving as a foundational framework for the entire development process. It provides a systematic guide for the ontology development process, describing how specific activities should be taken, which techniques are most apt for each activity, and the resultant products of each phase. As given by Dragoni, Poria, and Cambria¹⁴, METHONTOLOGY⁹ establishes a structured methodology for ontology development with its guidelines. In Figure 2, the aforementioned steps are depicted.

Methods for the Evaluation of Ontology

Building reliable and effective ontologies requires careful evaluation. This study presents a thorough, multi-faceted approach to assessing ontology quality from multiple angles. The three-step ontology evaluation process is given below.

1. Internal Consistency Check with the Pellet Reasoner
2. Query-Based Evaluation with Apache Jena Fuseki: Competency Questions (CQs) are formulated and translated into SPARQL queries to further validate the ontology's functionality.
3. FOCA Methodology¹⁶ for quality assessment

Quality Equation

The quality (μ) of the ontology is quantified using the following equation, as mentioned in FOCA Methodology¹⁶.

$$\mu = \frac{\exp \left\{ \begin{array}{l} -0.44 + 0.03(Cov_s \times Sb)i \\ +0.02(Cov_c \times Co)i + 0.01(Cov_r \times Re)i \\ +0.02(Cov_{cp} \times Cp)i - 0.66LExp_i - 25(0.1 \times NI)i \end{array} \right\}}{1 + \exp \left\{ \begin{array}{l} -0.44 + 0.03(Cov_s \times Sb)i \\ +0.02(Cov_c \times Co)i + 0.01(Cov_r \times Re)i \\ +0.02(Cov_{cp} \times Cp)i - 0.66LExp_i - 25(0.1 \times NI)i \end{array} \right\}}$$

Where μ represents the quality score, the resulting value of μ , ranging from 0 to 1, serves as a reliable indicator of the ontology's overall quality, with values approaching 1 signifying a higher level of quality.

Development of Brain Chamber Ontology

Ontology development is a way to formally represent knowledge within a specific domain, enabling machines to understand and use this information across various platforms¹⁷. The development process is naturally iterative, without a one-size-fits-all method; it depends on the unique features of the field and the type of knowledge being represented. METHONTOLOGY⁹ was chosen as the preferred method for building the ontology, widely regarded as a standard, thorough approach^{18,19,20}. This paper outlines a step-by-step approach to developing the Brain Chamber Ontology. Using METHONTOLOGY⁹ as a structured framework, it guides the complex process of ontology creation and highlights its relevance and fit for this domain. The following sections break down each stage, showing

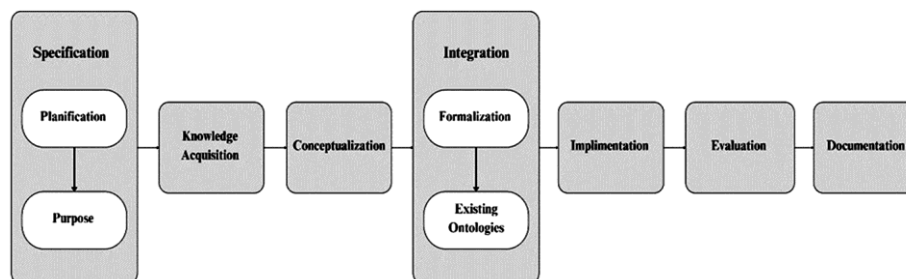


Fig. 2 — Steps in the Methontology Process

how METHONTOLOGY⁹ adapts to capture and formalise the complex knowledge specific to this field.

1 Specification

The primary objective of the specification phase lies in the careful development of a comprehensive document articulated in natural language, explaining the ontology under consideration. Within the internal workings of this phase, two distinct steps unfold: “*Planification*” and “*Purpose*”. These steps carefully outline key details, including the ontology's focus area, when it was created, and how it can be useful. This is an introduction to the ontology creation process, giving readers key details about its basic components and the main people involved²¹. Table 1 encapsulates the formalised details of these aforementioned elements.

2 Knowledge Acquisition

In pursuing knowledge for ontology creation, our focus was primarily on the seminal book, *Prolegomena to Library Classification* by Ranganathan⁷. The information in this text is vast and complex, covering more than any one individual could completely grasp on their own. Consequently, a collective effort involving experts specialising in Library Classification and Ranganathan's Philosophy was essential. The specifics of this expert group will be elaborated upon in the subsequent evaluation step, where their insights will be instrumental in assessing the ontology and formulating Competency Questions (CQs).

The initial phase involved identifying core ideas and their interconnected concepts within the book. Employing a middle-out approach²², we recognised central ideas and their surrounding concepts, constructing a conceptual model that encapsulated these terms. It is imperative to underscore that the entire process of constructing the ontology emerged organically through a dynamic exchange of ideas and

discussions with the expert panel. This collaborative endeavour ensured a comprehensive representation of the subject matter, laying the foundation for the subsequent steps in ontology development.

3 Conceptualisation

After the “Specification” and “Knowledge Acquisition” phases, the next step is the “Conceptualisation” phase. In this phase, a conceptual model is created to outline the domain knowledge, explaining the complexities of the problem and its solution using domain-specific vocabulary¹⁰. The ontology being developed is based on Ranganathan's⁷ *Prolegomena to Library Classification*. The terms extracted from this text are represented as sentences in a Subject-Predicate-Object (SPO) structure, with their relationships forming a coherent representation of the knowledge²³. Emphasising the significance of these connections, each term plays a pivotal role in structuring the ontological model. These connections have been carefully identified, and their inter-relationships are graphically represented in Figure 3.

4. Integration

The integration stage encompasses the formalisation of the ontology, with due consideration given to the potential utilisation of existing ontologies within the same domain⁶. It is strongly advocated to use existing ontologies, if available, to fulfil the defined scope, thereby reducing redundancy²⁴. An exhaustive search for similar existing ontologies was conducted by keeping this principle in mind, revealing that no ontologies precisely aligned with the specifications outlined in the Ontology Specification Document. Table 2 lists the ontology libraries that were searched for this purpose, along with their URLs.

4.1. Formalisation

According to Guarino²⁵, formalising an ontology is a crucial step that involves building a conceptual model to represent the domain accurately. This

Table 1 — Ontology Specification Requirement Document

Domain: Library and Information Science

Date: January, 15th 2024

Conceptualized-by: B. Abhijith & K.G. Sudhier

Implemented-by: B. Abhijith & K.G. Sudhier

Purpose: This study aims to construct an ontology centred around the fundamental concepts of S. R. Ranganathan's Theory of the Origin of Knowledge. Additionally, it seeks to extract the structural essence of the “Brain Chamber” concept as described within the same theoretical framework.

Scope: The crafted ontology will provide a conceptual framework depicting S. R. Ranganathan's Theory of the Origin of Knowledge. It can be of significant utility for individuals aiming to construct semantic tools utilising these concepts and those engaged in developing e-learning platforms or personalised e-learning recommendation systems.

Source of Knowledge: Ranganathan S R, *Prolegomena to Library Classification* 3rd ed, (Ess Ess Publication; New Delhi), 2006.

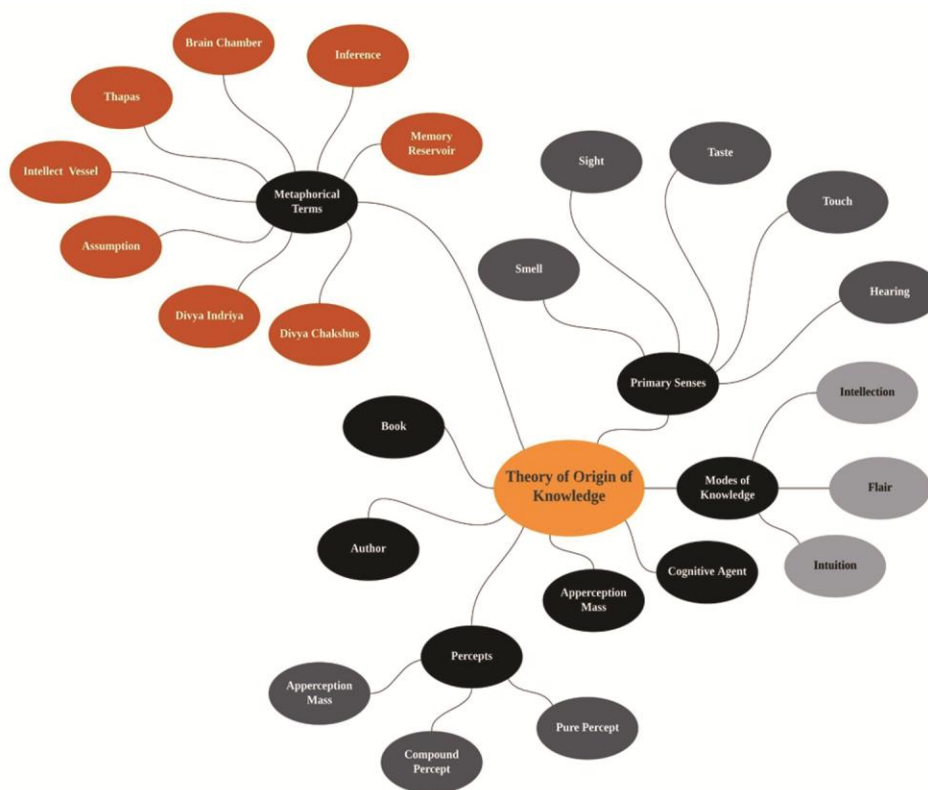


Fig. 3 — Conceptual Map of Theory of Origin Knowledge

Table 2 — Ontology Libraries

Ontology Library	URL
NCBO BioPortal	https://bioportal.bioontology.org/
AgroPortal	https://agroportal.lirmm.fr/
COLORE	https://ontologforum.org/index.php/COLORE
ROMULUS	https://www.thezfiles.co.za/ROMULUS/
OeGOV	http://www.oegov.us/
Swoogle	https://ebiquity.umbc.edu/project/html/id/53/Swoogle
LOV	https://lov.linkeddata.es/dataset/lov/

process includes identifying and defining the key entities and relationships that form the backbone of the ontology. The structure of classes, subclasses, and properties was carefully designed to reflect the domain's specifics. Using OWL as the formal language supports this approach by offering a standardised, widely accepted framework for ontology development²⁶.

Generally, three approaches are considered for formalisation: top-down, bottom-up, and the middle-out approach²². The top-down approach provides precise control over details during ontology development, while the bottom-up approach demands substantial effort²⁷. Among these, METHONTOLOGY⁹ recommends the

middle-out approach as a strategic method for concept identification²⁸. This approach initially facilitates identifying primary concepts, allowing subsequent progression towards specialisation or generalisation.

Constructing the Brain Chamber Ontology necessitates the design of abstract classes and the development of a class hierarchy. The abstraction process aims to achieve high cohesion and low coupling within classes²⁹. Notably, an abstract class, defined as one lacking instance, is best utilised by generating its subclasses instead³⁰. According to Guarino and Welty³¹, these concrete subclasses inherit all attributes from their parent class. In the Brain Chamber ontology, abstract classes dominate, although specific instances are included wherever necessary for clarity and completeness. Figure 4 is the ontology class hierarchy depicted with the help of the OWLViz ontology visualisation plugin in Protégé.

5. Implementation

The "Implementation" phase is a seamless extension of the "Formalisation" phase, wherein the formalised ontology is brought to fruition with dedicated ontology editing software. Several notable ontology editors are



Fig. 4 — Class Hierarchy of Brain Chamber Ontology

available for this purpose, including Protégé, SWOOP, Onto Edit, Altova Semantic Works, and Onto Studio. In this study, Protégé (version 5.6.1), an open-source software widely used by professionals, programmers, and researchers, was selected for its versatility³². Inbuilt reasoner Pellet (Version 2.2.0) ensured a careful validation process, minimising errors and maintaining consistency throughout the developed ontology. The resultant ontology comprises 149 axioms, 85 classes, and 13 object properties. Detailed metrics of the developed Brain Chamber Ontology are given in Table 3.

Figure 5 gives the total object properties created in this ontology. They are “givesInputsTo”, “are IncludedIn”, “areResultOf”, “acquiredKnowledgeThro

Item	Count
Axiom	149
Logical axiom count	85
Declaration axioms count	63
Class count	47
Object property count	13
Data property count	0
Individual count	4
Annotation Property count	1

ugh”, “contains”, “givesOut”, “helpsIn”, “involves”, and “transformsTo”. They connect one class to another, following standard naming conventions.

Figure 6 shows the visualisation of the ontology using OntoGraph, an ontology visualisation plug-in in Protégé software.

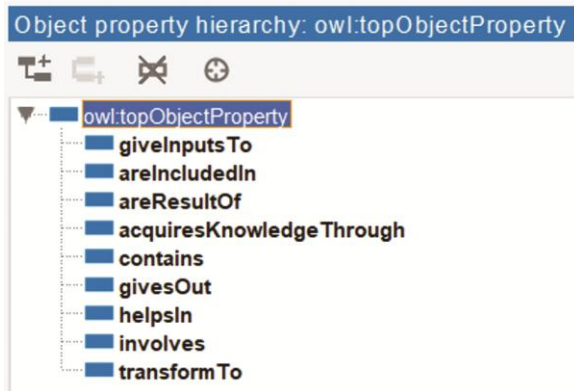


Fig. 5 — Object Properties in the Brain Chamber Ontology

6. Evaluation

In ontology development, the evaluation process involves a thorough technical review of the ontology, its software environment, and documentation within a defined framework³³. This evaluation focuses on *verification* and *validation*³⁴. Validation ensures that the ontology, tools, and documentation align with the intended representation of the system³⁵. Verification, on the other hand, involves technical checks to confirm the ontology's accuracy and correctness⁶. Together, these steps help ensure the ontology faithfully represents the domain it aims to model.

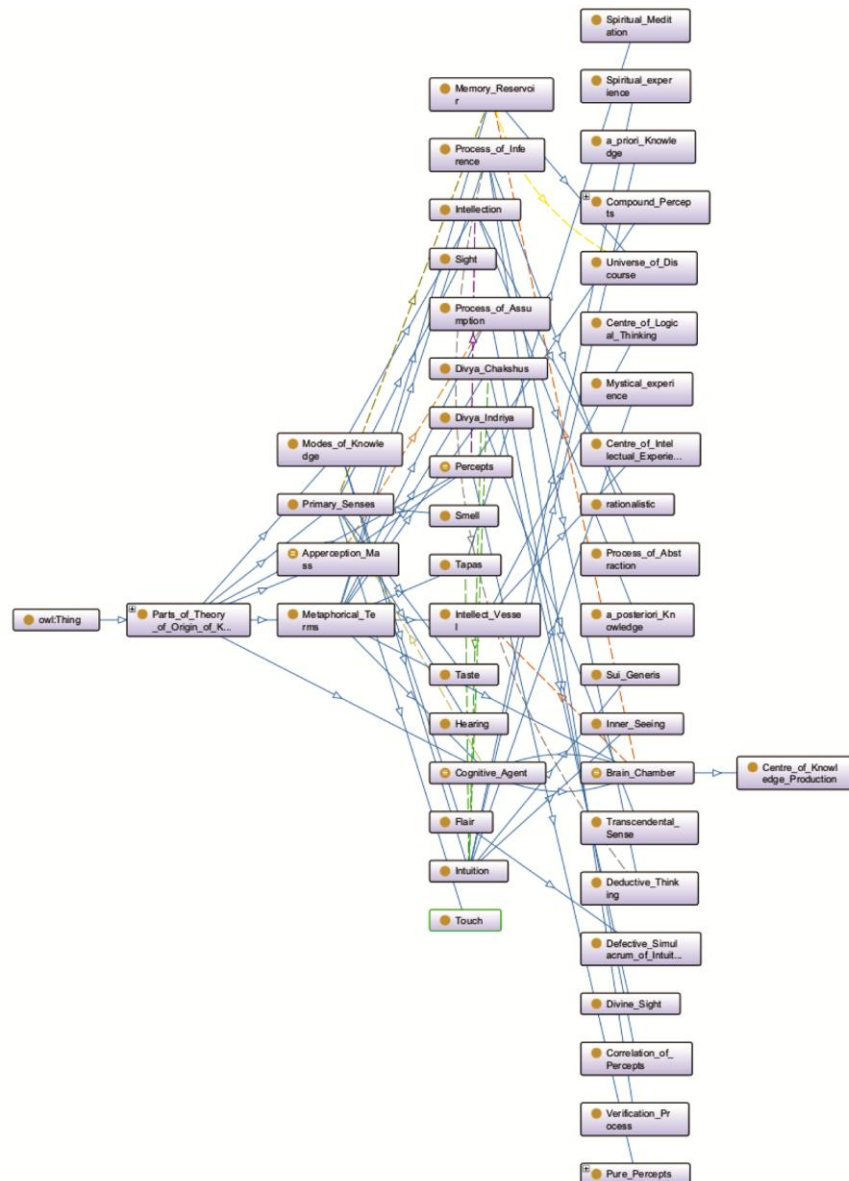


Fig.6 — Brain Chamber Ontology Visualisation Using Ontograph Plug-in

Table 4 — Final List of Competency Questions (CQs)

CQ Number	Competency Questions (CQs)
CQ1	What are the various modes of knowledge that S. R. Ranganathan describes in his Theory of the Origin of Knowledge?
CQ2	What metaphorical terms are used by S. R. Ranganathan in his Origin of the Theory of Knowledge?
CQ3	Which type of knowledge is inner-seeing a part of, according to S. R. Ranganathan?
CQ4	According to Ranganathan, mystical experiences are formed due to which type of knowledge?
CQ5	Which type of knowledge is “a-priori knowledge”, according to S. R. Ranganathan?
CQ6	Where is the “Centre of logical thinking” in the Brain Chamber Model of S. R. Ranganathan?
CQ7	What are the different types of percepts, according to S. R. Ranganathan?
CQ8	What are the different types of sensory experiences given by S. R. Ranganathan in his Theory of the Origin of Knowledge?
CQ9	Who wrote the book <i>Prolegomena to Library Classification</i> ?
CQ10	What are the “Brain Chamber” components in the proposed Theory of the Origin of Knowledge by S. R. Ranganathan?

Ontology Validation

The initial phase of ontology validation involves a careful examination of its content. In this study, the Pellet reasoner plug-in (version 2.2.0) was employed to check the internal consistency, revealing no inconsistency. Subsequently, the validation process assessed the created ontology’s efficacy in responding to SPARQL queries. Competency Questions (CQs) were devised to formulate these queries by a panel of ten Library and Information Science experts, each contributing to describing the research focus. The group comprises six females (60%) and four males (40%). The composition encompassed two individuals (20%) from the teaching profession, five (50%) engaged in research, and three (30%) pursuing master’s degrees. We conducted an initial interview to gauge participants’ familiarity with the concept under investigation. It was discovered that all individuals had a fundamental understanding of Ranganath’s Theory of the Origin of Knowledge, a significant aspect of the study’s scope. The panel crafted fifteen Competency Questions (CQs) pertaining to the topic. Recognising redundancy, five overlapping questions were integrated into the main set, aligning with similar inquiries. This process yielded a streamlined final set of ten CQs.

The translation of these questions into SPARQL format facilitated their interrogation of the ontology, employing the Apache Jena Fusuki platform. It was found that the developed ontology could answer the CQs well.

Ontology Verification

The verification process for this ontology used the FOCA methodology, as outlined by Bandeira et al.¹⁶ This method, based on a statistical model, is a powerful tool for assessing ontology quality¹⁶. FOCA evaluates the ontology against five key roles in Knowledge Representation⁵⁶: Substitute (ensuring the ontology reflects the real world accurately), Ontological Commitments, Intelligent Reasoning, Efficient Computation, and Human Expression. The FOCA Methodology¹⁶ integrates Vrandečić’s³⁷ main quality criteria, aligning them with the five roles of Knowledge Representation using the GQM (Goal Quality Metrics) approach. The roles of knowledge representation are regarded as GOALS, the quality criteria serve as METRICS, and the questions related to the metrics are treated as QUESTIONS in the GQM approach. Table 5 lists metrics, corresponding questions, and justifications for their use.

To quantify the aggregate quality verification, which ranges from 0 to 1, a beta regression model was employed, as outlined by Ferrari and Cribari-Neto³⁸. The closer the value gets to 1, the higher the quality. The resulting outcomes of this verification process are presented in Table 6, describing the mean grade for each of the five knowledge representation positions. Calculation of Quality Value (μ)

Table 7 presents the derived values of various variables in the Quality Equation, which can be extracted from Table 6. Below are the steps involved in calculating the Quality Value (μ).

Apart from these values, other variables are $S_b = 1$, $Co = 1$, $Re = 1$, and $C_p = 1$ (since all goals are considered). From these values, μ is calculated as:

$$\mu = \frac{\exp \left\{ \begin{array}{c} -0.44 + 0.03(Cov_s \times Sb)i \\ +0.02(Cov_c \times Co)i \\ +0.01(Cov_r \times Re)i + 0.02(Cov_{cp} \times Cp)i \\ -0.66LExp_i - 25(0.1 \times Nl)i \end{array} \right\}}{1 + \exp \left\{ \begin{array}{c} -0.44 + 0.03(Cov_s \times Sb)i \\ +0.02(Cov_c \times Co)i \\ +0.01(Cov_r \times Re)i + 0.02(Cov_{cp} \times Cp)i \\ -0.66LExp_i - 25(0.1 \times Nl)i \end{array} \right\}}$$

Table 5 — GQM and Justifications for the Corresponding Questions used in FOCA Methodology

Correspondent Role	Question	Justification
Substitute	Q1	This question is about the document that includes the ontology's important questions, key terms, and goals.
Substitute	Q2	This question ensures that the document with the ontology's important questions, key terms, and goals aligns well with the actual model.
Substitute	Q3	This question is about using already-existing ideas to represent things in the real world.
Ontological Commitments	Q4	This question concerns picking the most suitable way to show things in a particular area.
Ontological Commitments	Q5	This question is about picking the best way to show things in a more general or theoretical field.
Ontological Commitments	Q6	This question is about making sure things in our model match up with how things are in the real world.
Intelligent Reasoning	Q7	This question checks if the ontology makes sense and follows the right reasoning.
Intelligent Reasoning	Q8	Same as Q7
Efficient Computation	Q9	This question is about ensuring the ontology works well and performs efficiently when using computers (succeeding).
Efficient Computation	Q10	This question is about ensuring that the ontology works quickly and efficiently on computers.
Human Expression	Q11	This question is about making sure that the way things are modelled is easy for people to understand.
Human Expression	Q12	Same as Q11
Human Expression	Q13	Same as Q11

Table 6 — Ontology quality verification using FOCA methodology

Goal	Question	Metric	Grade	Mean
1. Check if the ontology complies with Substitute	Q1. Were the competency questions defined?	1. Completeness	100	66.67
	Q2. Were the competency questions answered?	1. Completeness	100	
	Q3. Did the ontology reuse other ontologies?	2. Adaptability	0	
2. Check if the ontology complies with Ontological Commitments.	Q4. Did the ontology impose a minimal ontological commitment?	3. Conciseness		50
	Q5. Did the ontology impose a maximum ontological commitment?	3. Conciseness	75	
	Q6. Are the ontology properties coherent with the domain?	4. Consistency	75	
3. Check if the ontology complies with Intelligent Reasoning	Q7. Are there contradictory axioms?	4. Consistency	100	100
	Q8. Are there redundant axioms?	3. Conciseness	100	
4. Check if the ontology complies with Efficient Computation	Q9. Did the reasoner bring modelling errors?	5. Computational efficiency	100	100
	Q10. Did the reasoner perform quickly?	5. Computational efficiency	100	
5. Check if the ontology complies with Human Expression.	Q11. Is the documentation consistent with the modelling?	6. Clarity.	0	50
	Q12. Were the concepts well written?	6. Clarity.	75	
	Q13. Are there annotations in the ontology that show the definitions of the concepts?	6. Clarity.	75	

$$\mu = \frac{\exp\left\{\frac{-0.44 + 0.03(66.67 \times 1) + 0.02(50 \times 1) + 0.01(100 \times 1)}{+0.02(100 \times 1) - 0.66 - 25(0.1 \times 0)}\right\}}{1 + \exp\left\{\frac{-0.44 + 0.03(66.67 \times 1) + 0.02(50 \times 1) + 0.01(100 \times 1)}{+0.02(100 \times 1) - 0.66 - 25(0.1 \times 0)}\right\}}$$

$$\mu = \frac{\exp\{-0.44 + 2.001 + 1 + 1 + 2 - 0.66\}}{1 + \exp\{-0.44 + 2.001 + 1 + 1 + 2 - 0.66\}}$$

$$\mu = \frac{134.3032}{1 + 134.3032} = 0.9926$$

Here, the μ value is 0.9926, which is very close to 1. It shows that the quality of the Brain Chamber Ontology is very high.

7 Documentation

Ontology documentation lacks a standardised format, often resulting in the ontology being represented only in code³⁹. However, providing a clear, natural language description detailing each step taken during development is essential. The METHONTOLOGY methodology strongly supports thorough documentation of this process, recommending that developers carefully record the stages and decisions involved. The developed ontology file is available in the GitHub repository (<https://github.com/Abhijith-Balaraman/Brain-Chamber-Ontology>).

Table 7 — Values of each Variable in the Quality Equation

Variable	Which is Equal to	Value
Cov _S	Mean of the Grades from Goal 1	66.67
Cov _C	Mean of the Grades from Goal 2	50
Cov _R	Mean of the Grades from Goal 3	100
Cov _{Cp}	Mean of the Grades from Goal 4	100
LExp	Variable for evaluator experience (with “1” being very experienced and “0” being not experienced at all)	1
NI	Is 1, if a goal is not possible to evaluate (or 0 if any question could not be evaluated)	

Conclusion

This article introduces a novel ontology centred around the metaphorical usage of “Brain Chamber”, as described by Ranganathan in his seminal book, *Prolegomena to Library Classification*. Additionally, a broader ontological representation of Ranganathan’s Theory of Knowledge, as presented in the same, is seamlessly incorporated. The ontology construction follows the METHONTOLOGY method, and its efficacy is evaluated through SPARQL queries, with quality verification conducted using the FOCA methodology. Apache Jena Fuseki is the querying tool, demonstrating the ontology’s capability to address all posed SPARQL queries effectively. The results from the FOCA method affirm a high level of quality, indicating a well-structured ontology with a comprehensive and informative concept representation. This ontology is a valuable resource for researchers and practitioners interested in the “Brain Chamber” concept and S. R. Ranganathan’s insightful “Theory of the Origin of Knowledge.” Designed as a comprehensive and versatile knowledge framework, it encourages deeper exploration and application across various research and practical fields.

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