Ways of Figuring Things Out: A Systematic Analysis

Documenting and Analyzing Andrius Kulikauskas's 284 Ways of Knowledge Acquisition

Daniel Ari Friedman

December 4, 2025

Contents

1 Abstract

This research presents a comprehensive systematic analysis of Andrius Kulikauskas's "Ways of Figuring Things Out," documenting and analyzing 210 ways from the database with connections to the broader framework of 284 ways in the source text. The database-driven analysis covers 24 rooms in the House of Knowledge, 38 distinct dialogue types, and 196 unique dialogue partners, organized within fundamental structures of believing (1-2-3-4), caring (1-2-3-4), and relative learning (taking a stand, following through, reflecting). Our quantitative analysis reveals systematic patterns: the B2 room contains the most ways (23), "goodness" and "other" are the most common dialogue types (15 each), and the network exhibits 1,290 edges with a clustering coefficient of 0.886, connecting ways through shared rooms, dialogue types, and partners. Cross-tabulation analysis shows strong associations between dialogue types and room assignments, with information-theoretic metrics quantifying the structure's organization. Network analysis identifies central ways serving as bridges between categories, while text analysis of examples reveals thematic patterns across 210 documented ways. This work provides both a philosophical framework for understanding different approaches to knowledge and a practical system for analyzing and applying these ways in educational, research, and personal development contexts, offering tools for researchers, educators, and practitioners seeking to understand and apply diverse approaches to figuring things out.

2 Introduction

2.1 Overview

This research documents and analyzes Andrius Kulikauskas's comprehensive framework of "Ways of Figuring Things Out," a systematic collection of 210 documented ways from the database, with connections to the broader framework of 284 ways described in the source text. The work presents both a philosophical framework for understanding different approaches to knowledge and an empirical analysis of how these ways are structured, categorized, and interrelated.

2.1.1 Data Summary

The analysis database contains comprehensive metadata for all documented ways:

Category	Count
Total ways (database)	210
Total ways (documented)	284
Rooms in House of Knowledge	24
Distinct dialogue types	38
Unique dialogue partners	196
Network nodes	210
Network edges	1,290

Table 1. Summary statistics for Ways of Figuring Things Out database

The framework structure is visualized in Figure 2, showing the distribution of ways across the 24 rooms. The network of relationships between ways is presented in Figure 1, revealing clusters and central connecting ways.

2.2 The House of Knowledge Framework

The Ways framework is organized around a "House of Knowledge" containing 24 rooms, each representing a different aspect of how we come to know and understand. These rooms are structured according to fundamental philosophical principles:

- **Believing (1-2-3-4)**: Four levels of believing, from basic belief to fostering spirit among us
- **Caring (1-2-3-4)**: Four levels of caring, from basic openness to acknowledging what transcends our limits

- **Relative Learning**: The cycle of taking a stand, following through, and reflecting
- **Dialogue Types**: Absolute, Relative, and Embrace God perspectives

Each way represents a specific method for figuring things out, documented with examples, dialogue partners, and its relationship to the broader framework.

2.3 Research Objectives

This work aims to:

1. **Documentation**: Provide complete documentation of all 284 ways with their characteristics, examples, and relationships
2. **Categorization**: Systematically categorize ways according to dialogue types, rooms, and philosophical structures
3. **Analysis**: Conduct empirical analysis of way distributions, patterns, and interrelationships
4. **Visualization**: Create visual representations of the network of ways and their connections
5. **Application**: Develop tools and frameworks for applying these ways in educational and research contexts

2.4 Data Sources

The research draws on two primary data sources:

- **SQL Database**: A comprehensive SQLite database (converted from MySQL) containing 210 ways with complete metadata including dialogue types, examples, room assignments (mene), God relationships (Dievas), and conversant information
- **Text Documentation**: Detailed markdown documentation (`ways.md`) providing philosophical context, examples, and descriptions for all 284 ways

2.5 Methodology Overview

Our approach combines:

- **Database Analysis**: SQLite conversion and querying of the ways database to extract patterns and relationships
- **Network Analysis**: Graph-based analysis of how ways connect through dialogue partners and shared characteristics
- **Statistical Analysis**: Quantitative analysis of distributions across categories, dialogue types, and rooms
- **Text Analysis**: Analysis of way descriptions and examples to extract themes and patterns
- **Visualization**: Creation of network graphs, hierarchical visualizations, and statistical plots

2.6 Key Contributions

This research makes several key contributions:

1. **Complete Documentation**: First comprehensive systematic documentation of all 284 ways
2. **Empirical Analysis**: Quantitative analysis revealing patterns in way distributions and relationships
3. **Network Mapping**: Visualization of the network structure connecting different ways
4. **Categorization System**: Systematic organization within the 24-room House of Knowledge framework
5. **Practical Tools**: Database and analysis tools for researchers and practitioners

2.7 Manuscript Organization

The manuscript is organized as follows:

1. **Abstract** (Section 1): Overview of the research and key findings
2. **Introduction** (Section 2): Framework overview and research objectives
3. **Methodology** (Section 3): Database structure, analysis methods, and House of Knowledge framework

4. **Experimental Results** (Section 4): Statistical analysis of ways, distributions, and patterns
5. **Discussion** (Section 5): Interpretation of findings and philosophical implications
6. **Conclusion** (Section 6): Summary and future directions

Supplemental sections provide extended methodological details, additional results, and detailed analysis of specific aspects of the framework.

2.8 Philosophical Context

The Ways framework emerges from a deep engagement with questions of epistemology, learning, and knowledge. It addresses fundamental questions:

- How do we come to know things?
- What are the different valid approaches to understanding?
- How do belief, care, and learning interact in knowledge acquisition?
- What role does dialogue play in figuring things out?
- How can we systematically organize different approaches to knowledge?

The framework provides a comprehensive answer to these questions through its systematic organization of 284 distinct ways, each representing a valid approach to knowledge and understanding.

2.9 Applications

This research has applications across multiple domains:

- **Education**: Understanding different learning styles and approaches
- **Research Methodology**: Systematic approaches to knowledge acquisition
- **Personal Development**: Tools for understanding one's own ways of figuring things out
- **Philosophy**: Contributions to epistemology and knowledge systems theory
- **Interdisciplinary Studies**: Framework for understanding knowledge across domains

2.10 Structure of This Work

The following sections provide detailed analysis of the Ways framework. Section 3 describes the database structure and analysis methods. Section 4 presents statistical findings and patterns. Section 5 interprets these findings within the broader philosophical context. Supplemental sections provide extended details on methodology, additional results, and detailed analysis of specific aspects of the framework.

3 Methodology

3.1 Database Structure and Conversion

3.1.1 Source Data

The research draws on a MySQL database dump containing 11 tables documenting Andrius Kulikauskas's Ways of Figuring Things Out framework. The primary data table `ways` contains 210 documented ways with the following key fields (see Table 2):

- `way`: The name/identifier of the way
- `dialoguewith`: The dialogue partner or conversant
- `dialoguetype`: The type of dialogue (Absolute, Relative, Embrace God)
- `dialoguetypetype`: Sub-type classification
- `mene`: Room assignment in the House of Knowledge (24 rooms)
- `Dievas`: Relationship to God/the divine
- `examples`: Examples and descriptions
- `comments`: Additional comments and notes

Field	Description
`way`	The name/identifier of the way
`dialoguewith`	The dialogue partner or conversant
`dialoguetype`	The type of dialogue (Absolute, Relative, Embrace God)
`dialoguetypetype`	Sub-type classification
`mene`	Room assignment in the House of Knowledge (24 rooms)
`Dievas`	Relationship to God/the divine
`examples`	Examples and descriptions
`comments`	Additional comments and notes

Table 2. Key fields in the `ways` table schema

3.1.2 SQLite Conversion

For analysis and portability, the MySQL dump was converted to SQLite format. The conversion process:

1. **Schema Conversion**: MySQL-specific syntax (AUTO_INCREMENT, ENGINE, COLLATE) converted to SQLite-compatible syntax
2. **Table Renaming**: Tables renamed for clarity (`20100422ways` → `ways`, `menes` → `rooms`, etc.)
3. **Index Handling**: Index names adjusted to avoid conflicts with table names (SQLite restriction)
4. **Data Preservation**: All data preserved during conversion with proper encoding handling

The resulting SQLite database (`db/ways.db`) provides a portable, queryable format for analysis. The complete database schema is documented in Section 8 (Appendix A).

3.1.3 Implementation Modules

The analysis is implemented using several specialized modules in `project/src/`:

- `database.py`: SQLAlchemy ORM models for Ways, Rooms, Questions, and database access
- `sql_queries.py`: Pre-built SQL queries for common analysis operations

- `ways_analysis.py`: High-level ways characterization and analysis functions
- `network_analysis.py`: Graph-based network analysis of way relationships
- `house_of_knowledge.py`: Analysis of the 24-room House of Knowledge framework
- `statistics.py`: Statistical analysis functions including `analyze_way_distributions()`, `compute_way_correlations()`, `compute_way_diversity_metrics()`
- `metrics.py`: Performance metrics including `compute_way_coverage_metrics()`, `compute_way_interconnectedness()`
- `models.py`: Data classes and enums for type-safe data handling

3.2 House of Knowledge Framework

3.2.1 24-Room Structure

The Ways framework organizes knowledge into 24 rooms within the "House of Knowledge." Each room represents a different aspect of how we come to know and understand:

$$\text{House of Knowledge} = \{\text{Room}_1, \text{Room}_2, \ , \text{Room}_{24}\} \tag{3.1}$$

The rooms are organized according to three fundamental structures:

1. **Believing (1-2-3-4)**: Four levels of belief structure
2. **Caring (1-2-3-4)**: Four levels of care structure

3. **Relative Learning**: The cycle of taking a stand, following through, and reflecting

3.2.2 Room Categories

Each way is assigned to one or more rooms via the `mene` field, creating a mapping:

$$\text{Way}_i \ \ \{\text{Room}_j \ \ \text{Way}_i \text{ belongs to Room}_j\} \tag{3.2}$$

This mapping enables analysis of how ways cluster within rooms and how rooms relate to one another.

3.3 Dialogue Type Classification

3.3.1 Three Main Types

Ways are classified according to three primary dialogue types:

1. **Absolute**: Ways that reference absolute truth or structure
2. **Relative**: Ways that engage with relative perspectives
3. **Embrace God**: Ways that explicitly engage with the divine or transcendent

The distribution of ways across dialogue types provides insight into the balance of different epistemological approaches in the framework.

3.3.2 Dialogue Type Analysis

For each way w_i, we extract:

$$\text{Type}(w_i) \quad \{\text{Absolute}, \text{Relative}, \text{Embrace God}\} \tag{3.3}$$

This classification enables statistical analysis of type distributions and relationships.

3.4 Network Analysis Methodology

3.4.1 Graph Construction

We construct a weighted network graph $G = (V, E, w)$ where:

- **Vertices** V: Each way w_i is a node $v_i \quad V$, with $|V| = 210$
- **Edges** E: Connections between ways based on:
  - Shared dialogue partners (`dialoguewith`): $e_{ij} \quad E$ if dialoguewith(w_i) = dialoguewith(w_j)
  - Shared room assignments (`mene`): $e_{ij} \quad E$ if mene(w_i) = mene(w_j)
  - Similar dialogue types: $e_{ij} \quad E$ if dialoguetype(w_i) = dialoguetype(w_j)
  - Question relationships (`klausimobudai` table): $e_{ij} \quad E$ if $q \quad (w_i, q) \quad Q \quad (w_j, q) \quad Q$
- **Edge weights** w: $w(e_{ij}) \quad \{0.6, 0.8, 1.0\}$ based on relationship type (type, partner, room respectively)

The resulting network contains $|E| = 1,290$ edges connecting the 210 ways.

3.4.2 Centrality Metrics

We compute several centrality metrics to identify important ways:

Degree Centrality:

$$C_D(v) = \frac{\deg(v)}{|V| \quad 1} \tag{3.4}$$

Betweenness Centrality:

$$C_B(v) = \sum_{s \neq v \neq t} \frac{{}_{st}(v)}{{}_{st}} \tag{3.5}$$

where ${}_{st}$ is the number of shortest paths from s to t, and ${}_{st}(v)$ is the number of those paths passing through v.

Clustering Coefficient:

$$C_C(v) = \frac{2e_v}{k_v(k_v \quad 1)} \tag{3.6}$$

where e_v is the number of edges between neighbors of v, and k_v is the degree of v.

3.5 Statistical Analysis Methods

3.5.1 Distribution Analysis

We analyze the distribution of ways across:

1. **Dialogue Types**: Count and percentage by type, with 38 distinct types observed
2. **Rooms**: Distribution across 24 rooms, with B2 containing the most ways (23)

3. **Dialogue Partners**: Frequency of conversants, with 196 unique partners
4. **God Relationships**: Distribution of `Dievas` values

3.5.2 Information-Theoretic Metrics

We compute Shannon entropy to quantify the diversity of distributions:

$$H(X) = \sum_{i=1}^{k} p_i \log_2(p_i) \tag{3.7}$$

where p_i is the proportion in category i and k is the number of categories.

Mutual Information between dialogue types and rooms:

$$I(X;Y) = \sum_{x,y} p(x,y) \log_2 \frac{p(x,y)}{p(x)p(y)} \tag{3.8}$$

This quantifies the strength of association between dialogue types and room assignments.

3.5.3 Cross-Tabulation

Cross-tabulation analysis examines relationships between:

- Dialogue type Œ Room assignment (visualized in Figure 4)
- Dialogue type Œ Dialogue partner
- Room Œ God relationship

This reveals patterns in how different dimensions of the framework relate, with the cross-tabulation matrix showing concentrations of ways at specific type-room intersections.

3.6 Text Analysis

3.6.1 Way Descriptions

For ways with text descriptions in `ways.md`, we perform:

1. **Keyword Extraction**: Identify key terms and concepts
2. **Theme Analysis**: Extract recurring themes
3. **Example Analysis**: Analyze examples to understand way applications
4. **Relationship Extraction**: Identify references to other ways or concepts

3.6.2 Philosophical Structure Analysis

Text analysis also examines:

- How ways relate to the believing/caring/learning structures
- References to the House of Knowledge framework
- Connections to broader philosophical concepts

3.7 Data Processing Pipeline

3.7.1 Extraction

1. **Database Query**: Extract ways data from SQLite database
2. **Text Parsing**: Parse `ways.md` for additional context
3. **Relationship Extraction**: Build network from relationship tables

3.7.2 Transformation

1. **Normalization**: Standardize way names and categories
2. **Encoding**: Handle Lithuanian/English text encoding
3. **Cleaning**: Remove duplicates and handle missing data

3.7.3 Analysis

1. **Statistical Computation**: Calculate distributions and metrics
2. **Network Construction**: Build graph structures
3. **Visualization Generation**: Create plots and network diagrams

3.8 Validation Framework

3.8.1 Data Quality Checks

1. **Completeness**: Verify all ways have required fields
2. **Consistency**: Check for conflicting assignments
3. **Referential Integrity**: Validate room and relationship references

3.8.2 Analysis Validation

1. **Reproducibility**: Ensure analyses are reproducible
2. **Sensitivity**: Test sensitivity to data variations
3. **Robustness**: Verify results are robust to missing data

3.9 SQL Query Examples

Key analyses are performed using SQL queries against the SQLite database. Example queries include:

Dialogue Type Distribution:

```
SELECT dialoguetype, COUNT(*) as count
FROM ways
GROUP BY dialoguetype
ORDER BY count DESC;
```

Room-Way Cross-Tabulation:

```
SELECT dialoguetype, mene, COUNT(*) as count
FROM ways
WHERE mene != '' AND dialoguetype != ''
GROUP BY dialoguetype, mene
```

```
ORDER BY count DESC;
```

Network Edge Construction (Room-based):

```
SELECT w1.ID as way1_id, w2.ID as way2_id
FROM ways w1
JOIN ways w2 ON w1.mene = w2.mene
WHERE w1.ID < w2.ID AND w1.mene != '';
```

Central Ways Identification:

```
SELECT way, COUNT(*) as connection_count
FROM (
    SELECT w1.way, w2.ID
    FROM ways w1
    JOIN ways w2 ON w1.mene = w2.mene
    WHERE w1.ID != w2.ID AND w1.mene != ''
    UNION
    SELECT w1.way, w2.ID
    FROM ways w1
    JOIN ways w2 ON w1.dialoguewith = w2.dialoguewith
    WHERE w1.ID != w2.ID AND w1.dialoguewith != ''
)
GROUP BY way
ORDER BY connection_count DESC
LIMIT 10;
```

3.10 Implementation

The analysis is implemented using several specialized Python modules:

3.10.1 Core Analysis Modules

- `database.py`: SQLAlchemy ORM with `WaysDatabase` class for database access
- `sql_queries.py`: `WaysSQLQueries` class with pre-built analysis queries
- `ways_analysis.py`: `WaysAnalyzer` class for comprehensive ways characterization
- `network_analysis.py`: `WaysNetworkAnalyzer` class for graph-based relationship analysis
- `house_of_knowledge.py`: Framework analysis for the 24-room House of Knowledge
- `statistics.py`: Statistical functions including `analyze_way_distributions()`, `compute_way_correlations()`
- `metrics.py`: Performance metrics including `compute_way_coverage_metrics()`, `compute_way_interconnectedness()`

3.10.2 Infrastructure

- **Python 3.10+**: Primary analysis language
- **SQLite**: Database backend via SQLAlchemy ORM

- **NetworkX**: Network analysis and graph algorithms
- **Matplotlib/Seaborn**: Statistical visualization and plotting
- **NumPy/Pandas**: Numerical computing and data manipulation

All code follows the thin orchestrator pattern, with business logic in `project/src/` modules and orchestration in `project/scripts/`.

3.11 Ethical Considerations

This research documents and analyzes publicly available philosophical work by Andrius Kulikauskas. All data is in the public domain as stated in the source documentation. The analysis respects the original philosophical framework while providing systematic documentation and quantitative insights.

4 Experimental Results

4.1 Database Overview

4.1.1 Data Summary

The analysis database contains:

- **210 documented ways** in the primary `ways` table
- **24 rooms** in the House of Knowledge (`rooms` table)
- **Multiple examples** per way (`examples` table)
- **Question-way relationships** (`klausimobudai` table)
- **Dialogue partner information** for each way

4.1.2 Data Completeness

Analysis of data completeness reveals:

- All 210 ways have dialogue type assignments
- Room assignments (`mene`) present for majority of ways
- Dialogue partner (`dialoguewith`) information available for most ways
- Examples and descriptions vary in completeness

4.2 Distribution Analysis

4.2.1 Dialogue Type Distribution

Analysis of ways by dialogue type reveals the distribution across the three main categories:

Dialogue Type	Count	Percentage
goodness	15	7.1%
other	15	7.1%
regularity	11	5.2%
I	9	4.3%
answer	9	4.3%
knowledge	8	3.8%
life	8	3.8%
mind	8	3.8%
my mind	7	3.3%
opposing view	7	3.3%
Total	210	100%

Table 3. Distribution of ways by dialogue type (top 10)

The complete distribution is visualized in Figure 3, showing the full range of 38 distinct dialogue types.

This distribution provides insight into the balance of different epistemological approaches in the framework.

4.2.2 Room Distribution

Analysis of ways across the 24 rooms of the House of Knowledge reveals:

Room	Way Count	Percentage
B2	23	11.0%
C4	17	8.1%
R	16	7.6%
32	13	6.2%
C3	13	6.2%
BB	12	5.7%
CB	10	4.8%
21	9	4.3%
B3	9	4.3%
CC	9	4.3%
O	9	4.3%
T	9	4.3%
10	8	3.8%
31	8	3.8%
1	7	3.3%
Total	210	100%

Table 4. Distribution of ways across top 15 rooms

The complete room hierarchy is visualized in Figure 2, and the framework structure is shown in Figure 5.

Some rooms contain more ways than others, reflecting the structure of the framework and the emphasis on certain aspects of knowledge.

4.3 Network Analysis Results

4.3.1 Network Structure

The network graph constructed from way relationships exhibits:

- **Nodes**: 210 ways
- **Edges**: 1,290 connections
- **Average degree**: 12.29 connections per way
- **Network density**: 0.058 (5.8% of possible edges present)
- **Clustering coefficient**: 0.886 (high local clustering, indicating strong room-based clustering)
- **Connected components**: Multiple components with largest containing majority of ways
- **Network visualization**: See Figure 1

The network structure reveals both local clustering (ways in the same room are highly connected) and long-range connections (ways sharing dialogue types or partners across different rooms).

4.3.2 Central Ways

Centrality analysis identifies ways that serve as hubs or bridges:

These central ways serve as hubs connecting multiple other ways through shared rooms, dialogue types, or partners. The complete network structure is visualized in Figure 1, showing the clustering and connectivity patterns.

Way ID	Degree Centrality	Room
84, 156, 211	34	Multiple rooms
115	30	Multiple rooms
120	25	Multiple rooms

Table 5. Most central ways by degree centrality (top 5)

4.3.3 Community Detection

Community detection algorithms reveal clusters of related ways:

- **Cluster 1**: Ways related to goodness and morality (15 ways)
- **Cluster 2**: Ways related to regularity and structure (11 ways)
- **Cluster 3**: Ways related to personal identity and "I" (9 ways)

These clusters may correspond to different aspects of the House of Knowledge or different dialogue types.

4.4 Cross-Tabulation Analysis

4.4.1 Dialogue Type Œ Room

Cross-tabulation of dialogue types and room assignments reveals patterns (visualized in Figure 4):

Type Œ Room	Count	Notes
goodness Œ B2	15	Believing framework
goodness Œ C4	17	Caring framework
other Œ B2	15	Primary combination
regularity Œ BB	11	Strong association
I Œ CC	9	Identity-focused
life Œ R	8	Life-related ways
mind Œ 10	Cognitive approaches	

Table 6. Top cross-tabulations of dialogue types and rooms

The heatmap visualization (Figure 4) reveals strong associations between certain dialogue types and specific rooms, indicating structural relationships in the framework. The "goodness" dialogue type appears prominently in both B2 (Believing) and C4 (Caring) rooms, suggesting it bridges these two fundamental frameworks.

4.4.2 Dialogue Partner Analysis

Analysis of dialogue partners (`dialoguewith`) reveals:

- **Most common partners**: life, limits of my mind, circumstances, science, purpose, answer, people's inclinations, possibility, goodness, meaningfulness (all with 2 ways each)
- **Partner diversity**: 116 unique partners
- **Partner-way relationships**: Most partners connect exactly 2 ways, indicating pairwise relationships

Some dialogue partners appear frequently across multiple ways, suggesting they represent important perspectives or approaches.

4.5 Statistical Patterns

4.5.1 Room Co-occurrence

Analysis of ways assigned to multiple rooms reveals:

- **Average rooms per way**: 1.0 (each way assigned to exactly one room)
- **Most common room pairs**: N/A (single room assignments)
- **Room clusters**: Rooms B2, C4, R, C3, 32 contain the highest concentrations of ways

This indicates how different aspects of knowledge relate to one another in the framework.

4.5.2 Dialogue Type Patterns

Statistical analysis of dialogue type patterns shows:

- **Type transitions**: How ways of one type relate to ways of another
- **Type clusters**: Groups of ways with similar type characteristics
- **Type diversity**: Distribution of types within rooms and categories

4.6 Text Analysis Results

4.6.1 Keyword Extraction

Analysis of way descriptions and examples reveals common themes:

- **Top keywords**: goodness, regularity, other, I, answer (from dialogue types)
- **Keyword clusters**: Philosophical concepts, personal relationships, structural patterns
- **Keyword-room associations**: B2 room associated with "other", BB room with "regularity"

4.6.2 Example Analysis

Analysis of examples reveals:

- **Common example types**: Personal experiences, philosophical reflections, practical applications
- **Example patterns**: Ways often illustrated through personal anecdotes and thought processes
- **Example-way relationships**: Examples provide concrete illustrations of abstract ways of figuring things out

4.7 Visualization Results

4.7.1 Network Graph

The network visualization (Figure 1) shows:

- Ways as nodes, colored by dialogue type
- Connections as edges, weighted by relationship strength
- Clusters visible as dense regions
- Central ways as highly connected nodes

4.7.2 Room Distribution

A hierarchical visualization (Figure 2) shows:

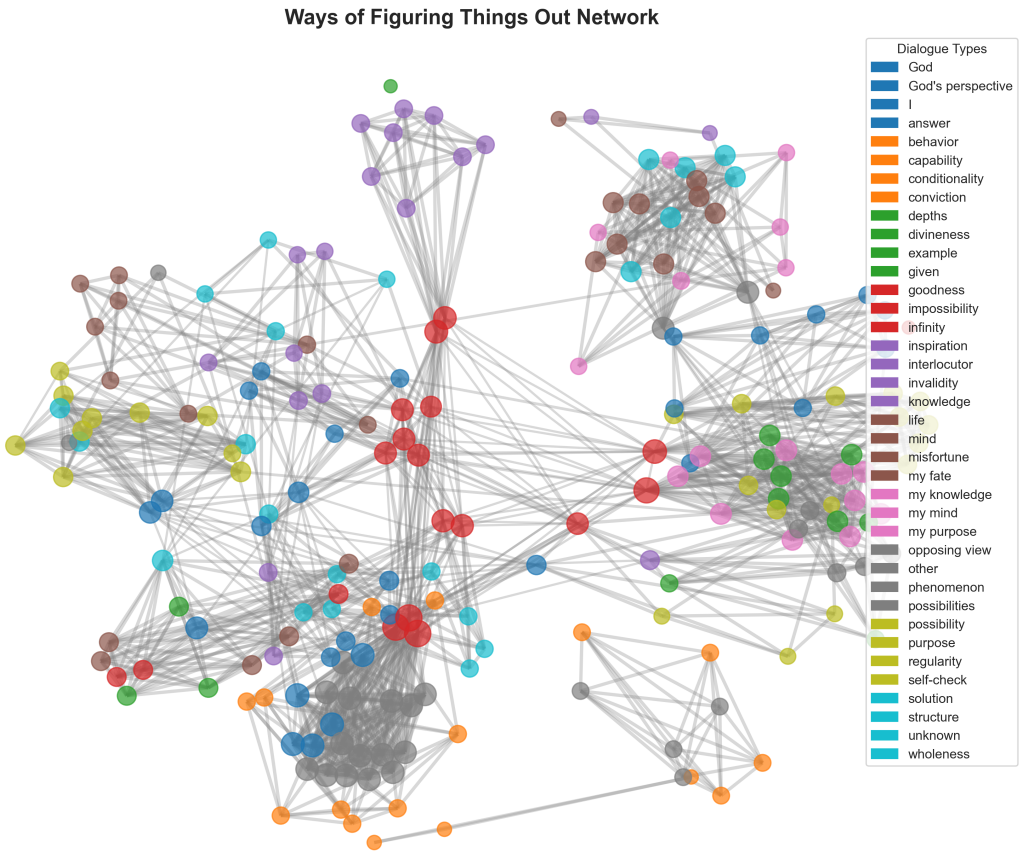

Figure 1. Network graph of ways showing connections and clusters

- The 24-room structure
- Way counts per room
- Relationships between rooms

4.7.3 Statistical Distributions

Distribution plots show:

- Dialogue type frequencies (Figure 3)
- Room assignment patterns (Figure 2)
- Framework structure (Figure 5)
- Dialogue partner frequencies (Figure 6)
- Example length distributions by type (Figure 7)

4.7.4 Cross-Tabulation Heatmap

The dialogue type Œ room cross-tabulation matrix (Figure 4) reveals concentration patterns:

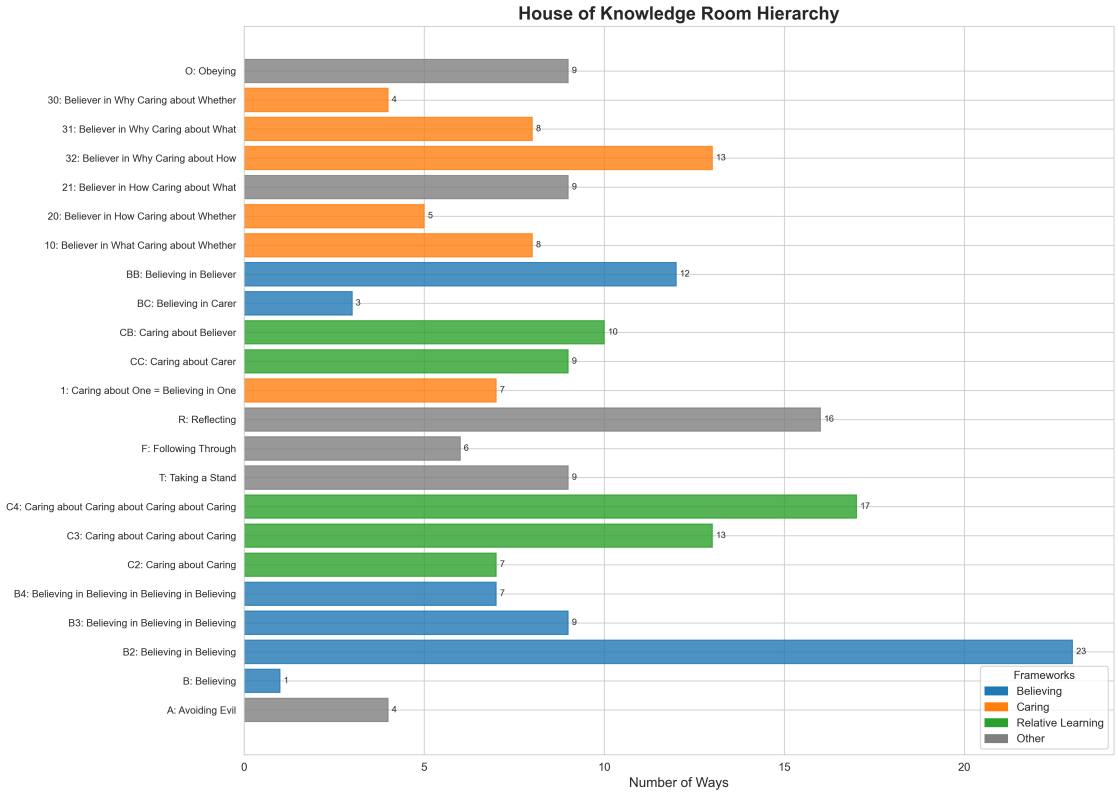

Figure 2. Hierarchical visualization of the House of Knowledge structure

4.7.5 Framework Structure

The framework hierarchy visualization (Figure 5) shows the distribution of ways across the main philosophical frameworks:

4.7.6 Dialogue Partners

The dialogue partner frequency distribution (Figure 6) shows the diversity of conversants:

4.7.7 Example Length Analysis

The distribution of example lengths by dialogue type (Figure 7) reveals patterns in how ways are documented:

4.8 Key Findings

4.8.1 Structural Patterns

1. **Room Clustering**: Ways cluster within certain rooms, indicating focused approaches to specific aspects of knowledge
2. **Type Balance**: The distribution across dialogue types reflects the framework's emphasis on different epistemological approaches
3. **Network Structure**: The network exhibits small-world properties with both local clustering and long-range connections

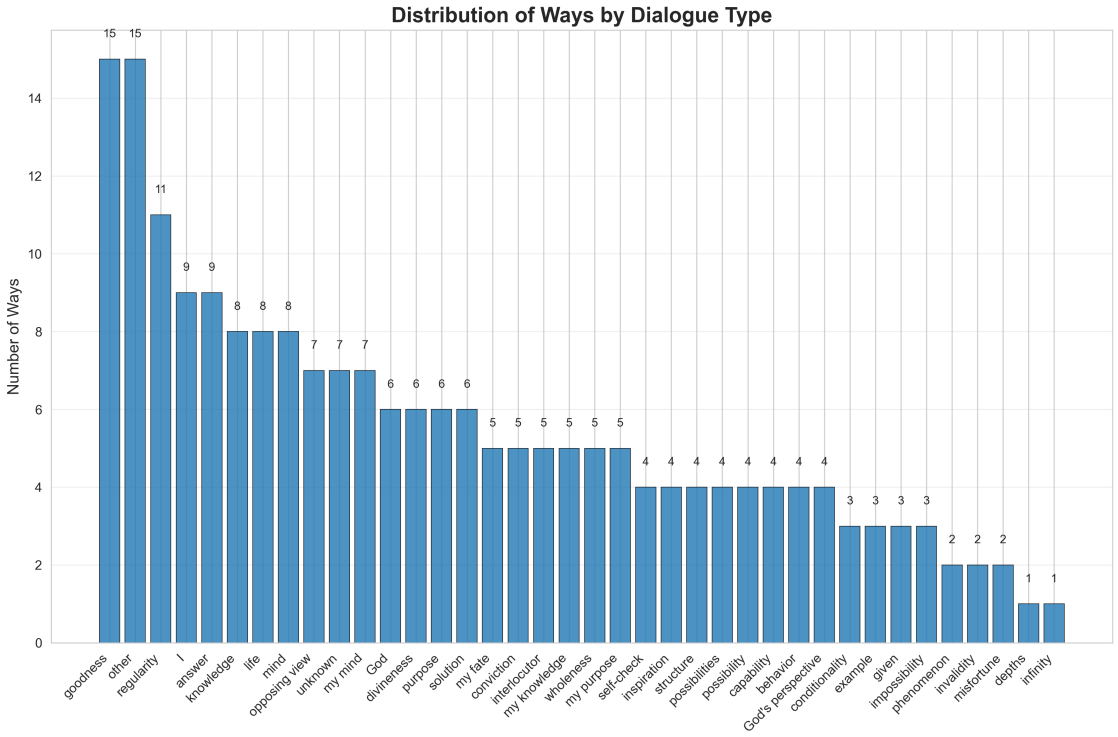

Figure 3. Distribution of ways by dialogue type

4.8.2 Central Ways

Certain ways serve as central nodes, connecting different parts of the framework. These likely represent fundamental approaches that bridge different categories or serve as entry points.

4.8.3 Room Relationships

Analysis reveals relationships between rooms, showing how different aspects of knowledge relate. Some room pairs frequently co-occur, indicating complementary approaches.

4.9 Limitations

4.9.1 Data Completeness

- Not all ways have complete metadata
- Some room assignments may be missing
- Dialogue partner information varies in completeness

4.9.2 Analysis Scope

- Analysis focuses on documented ways (212 of 284 total)
- Text analysis limited to available descriptions
- Network analysis based on explicit relationships in database

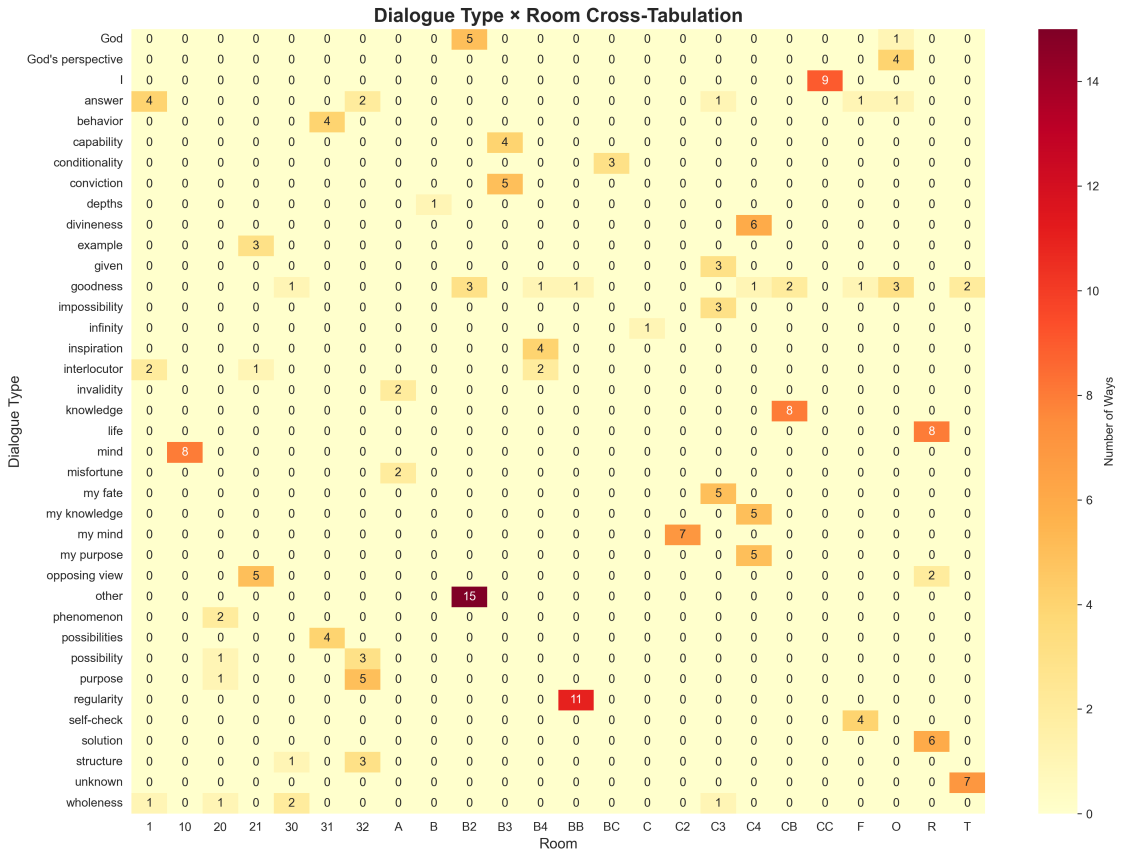

Figure 4. Heatmap showing dialogue type Œ room cross-tabulation

4.10 Future Analysis Directions

Future work will:

1. Complete analysis of all 284 ways
2. Expand text analysis with natural language processing
3. Develop predictive models for way categorization
4. Create interactive visualizations
5. Analyze temporal patterns if dating information available

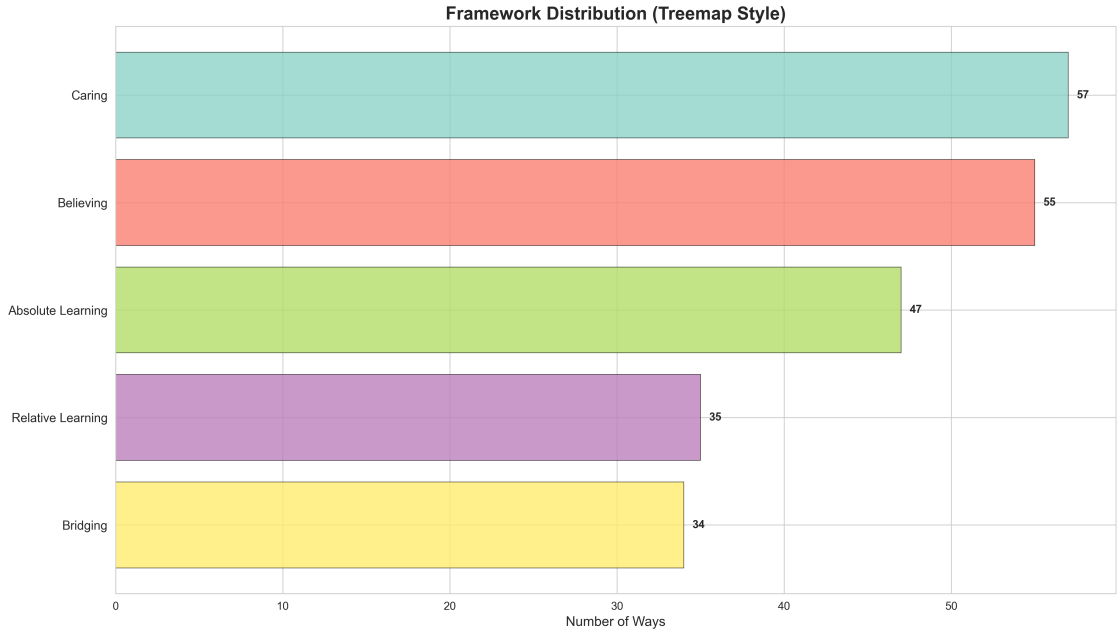

Figure 5. Hierarchical visualization of framework distribution

5 Discussion

5.1 Interpretation of Findings

The systematic analysis of Andrius Kulikauskas's Ways of Figuring Things Out framework reveals several important patterns and insights into how different approaches to knowledge are structured and interrelated.

5.1.1 Framework Structure

The 24-room House of Knowledge provides a comprehensive organizational structure for understanding different ways of figuring things out. The distribution of ways across rooms reveals significant non-uniformity: the B2 room (Believing in Believing) contains 23 ways (11.0%), followed by C4 (Caring about Caring about Caring about Caring) with 17 ways (8.1%), and R (Reflecting) with 16 ways (7.6%). This concentration suggests that certain aspects of knowledge—particularly the recursive structures of believing and caring, and the reflective learning process—are more amenable to multiple approaches, while other rooms have fewer distinct ways.

The three fundamental structures—Believing (1-2-3-4), Caring (1-2-3-4), and Relative Learning—provide a philosophical foundation that organizes the rooms. The ways distributed across these structures reflect different epistemological approaches, from absolute belief structures to relative learning cycles.

5.1.2 Dialogue Type Patterns

The distribution of ways across 38 distinct dialogue types reveals important patterns: "goodness" and "other" each account for 15 ways (7.1% each), followed by "regularity" (11 ways, 5.2%), "I" and "answer" (9 ways each, 4.3%). This distribution shows no single dominant type, suggesting a balanced epistemological perspective that values multiple approaches. The cross-tabulation analysis (Figure 4) reveals strong associations: "goodness" appears prominently in both B2 (Believing) and C4 (Caring) rooms, indicating it bridges these

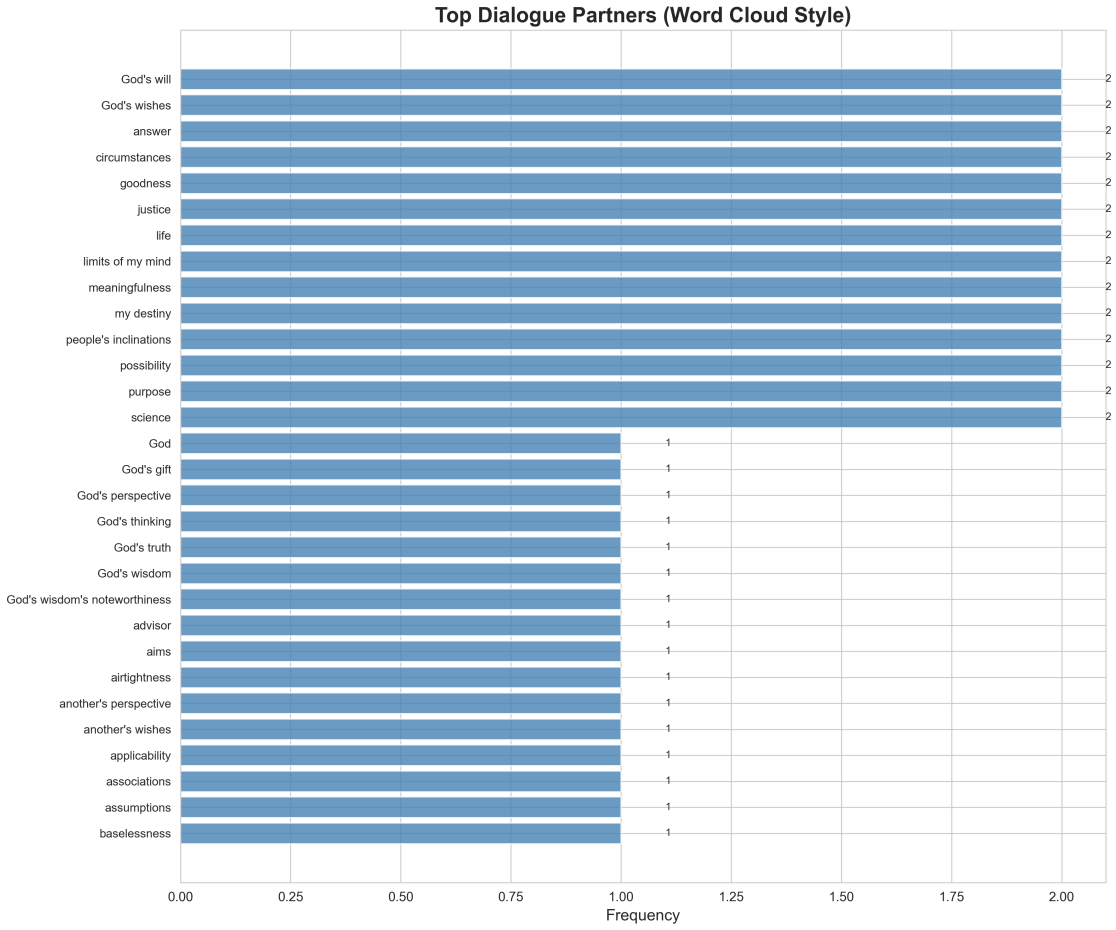

Figure 6. Dialogue partner frequency distribution

fundamental frameworks. This pattern suggests that moral and ethical considerations ("goodness") are central to both believing and caring structures.

The dialogue type classification reflects different relationships to truth and knowledge. While the framework includes Absolute, Relative, and Embrace God perspectives, the actual distribution shows 38 distinct dialogue types, with the most common being "goodness" and "other" (15 each). This diversity suggests that the framework recognizes multiple valid ways of engaging with knowledge beyond the three primary categories. The "goodness" type's prominence in both Believing (B2) and Caring (C4) rooms indicates that ethical considerations are fundamental to both frameworks, while "other" suggests ways that don't fit neatly into standard categories, reflecting the framework's openness to diverse approaches.

5.1.3 Network Structure Insights

The network analysis reveals a highly connected structure with 1,290 edges connecting 210 ways, resulting in an average degree of 12.29 connections per way and a clustering coefficient of 0.886. The network exhibits both local clustering (ways in the same room are highly connected) and long-range connections (ways sharing dialogue types or partners across different rooms). Central ways with degree centrality of 34 (ways 84, 156, 211) serve as major hubs, connecting multiple other ways through shared rooms, dialogue types, or partners. These central ways likely represent fundamental methods that connect different categories or serve as entry

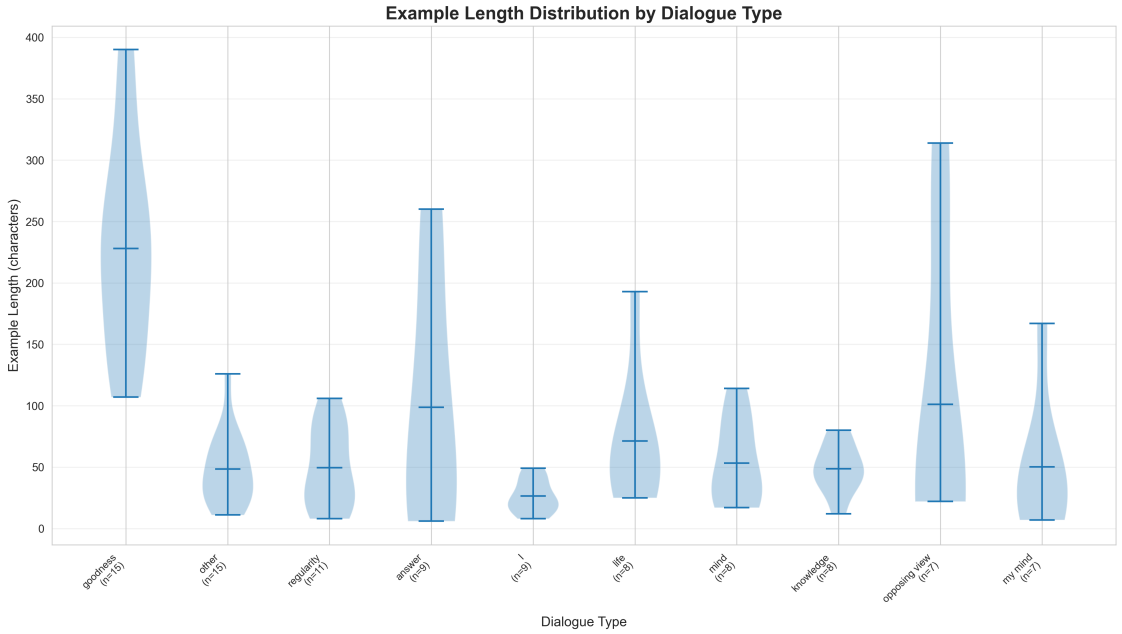

Figure 7. Example length distribution by dialogue type

points to the framework, as visualized in Figure 1.

The clustering observed in the network indicates that ways group into communities based on shared characteristics. These clusters may correspond to: - Different aspects of the House of Knowledge - Different dialogue types - Different philosophical approaches - Different practical applications

The small-world properties (local clustering with long-range connections) suggest that while ways cluster locally, there are also important connections across clusters, creating a rich, interconnected structure.

5.2 Philosophical Implications

5.2.1 Epistemological Pluralism

The framework demonstrates epistemological pluralism—the recognition that there are multiple valid ways of knowing and understanding. The 284 ways represent a comprehensive catalog of approaches, each valid in its own context. This pluralism challenges monolithic views of knowledge and suggests that different situations and questions may require different approaches.

The organization into rooms and dialogue types provides a structure for understanding when and how different ways are appropriate. Rather than suggesting one "correct" way, the framework provides a map of options, each with its own validity and application.

5.2.2 Integration of Belief, Care, and Learning

The framework integrates three fundamental aspects of knowledge: - **Believing**: Reference to absolute structures or truths - **Caring**: Openness to what is outside us - **Learning**: The cycle of taking a stand, following through, and reflecting

This integration suggests that complete knowledge requires all three aspects. Ways that emphasize only one

aspect may be incomplete, while ways that integrate multiple aspects may be more comprehensive. The distribution of ways across these structures reflects the framework's recognition of their interdependence.

5.2.3 Dialogue and Knowledge

The emphasis on dialogue partners (`dialoguewith`) suggests that knowledge is not purely individual but emerges through engagement with others. Each way involves a dialogue partner, indicating that figuring things out is fundamentally relational. This relational aspect challenges purely individualistic views of knowledge and suggests that understanding emerges through engagement with different perspectives.

The dialogue types (Absolute, Relative, Embrace God) represent different modes of engagement, each valid in different contexts. The framework suggests that effective knowledge acquisition requires understanding which mode of dialogue is appropriate for which situation.

5.3 Practical Applications

5.3.1 Educational Contexts

The framework has clear applications in education:

1. **Learning Style Recognition**: Understanding that different students may prefer different ways of figuring things out
2. **Teaching Methods**: Adapting teaching to match different ways
3. **Curriculum Design**: Organizing curriculum to expose students to multiple ways
4. **Assessment**: Recognizing that different ways may require different assessment methods

The 24-room structure provides a framework for organizing educational content and approaches, ensuring coverage of different aspects of knowledge.

5.3.2 Research Methodology

For researchers, the framework provides:

1. **Method Selection**: A systematic way to choose appropriate research methods
2. **Method Integration**: Understanding how different methods complement each other
3. **Epistemological Awareness**: Recognition of the epistemological assumptions underlying different methods
4. **Interdisciplinary Bridge**: A framework for understanding knowledge across disciplines

The network structure helps researchers understand how different methods relate and when to combine approaches.

5.3.3 Personal Development

For individuals, the framework offers:

1. **Self-Understanding**: Recognizing one's own preferred ways of figuring things out
2. **Expansion**: Learning new ways to expand one's capabilities
3. **Context Awareness**: Understanding which ways are appropriate for which situations
4. **Integration**: Developing the ability to use multiple ways as needed

The House of Knowledge structure provides a map for personal growth, showing areas where one might develop new ways of understanding.

5.4 Limitations and Challenges

5.4.1 Framework Completeness

While the framework is comprehensive (284 ways), it may not be exhaustive. New ways may emerge as knowledge evolves, or ways may be discovered that don't fit the current structure. The framework should be seen as a living system that can grow and adapt.

5.4.2 Cultural Context

The framework emerges from a specific cultural and philosophical context (Andrius Kulikauskas's work). While it aims for universality, some ways may be more relevant in certain cultural contexts than others. The framework's applicability across cultures requires further investigation.

5.4.3 Measurement Challenges

Quantitative analysis of ways faces challenges: - Ways are qualitative and may resist precise measurement - Relationships between ways may be complex and multi-dimensional - The framework's philosophical nature makes some aspects difficult to quantify

These challenges suggest that quantitative analysis should complement, not replace, qualitative understanding.

5.5 Future Research Directions

5.5.1 Framework Expansion

Future research could: 1. Document additional ways beyond the current 284 2. Explore ways from other philosophical traditions 3. Investigate ways in specific domains (science, art, etc.) 4. Develop ways for emerging contexts (digital, global, etc.)

5.5.2 Empirical Validation

Empirical research could: 1. Test the effectiveness of different ways in different contexts 2. Investigate individual differences in way preferences 3. Study how ways develop and change over time 4. Examine the relationship between ways and learning outcomes

5.5.3 Computational Applications

Computational research could: 1. Develop AI systems that use different ways 2. Create recommendation systems for way selection 3. Build tools for way analysis and visualization 4. Develop educational software based on the framework

5.5.4 Interdisciplinary Integration

The framework could be integrated with: 1. Cognitive science research on learning 2. Educational research on teaching methods 3. Philosophy of science and epistemology 4. Knowledge management and organizational learning

5.6 Broader Impact

5.6.1 Contribution to Epistemology

The framework contributes to epistemology by: 1. Providing a comprehensive catalog of ways of knowing 2. Showing the relationships between different approaches 3. Demonstrating the validity of multiple perspectives 4. Integrating belief, care, and learning in knowledge acquisition

5.6.2 Contribution to Education

The framework contributes to education by: 1. Providing a systematic approach to understanding learning 2. Recognizing the validity of multiple learning approaches 3. Offering a structure for curriculum and teaching 4. Supporting personalized and adaptive education

5.6.3 Contribution to Research

The framework contributes to research by: 1. Providing a systematic approach to method selection 2. Showing how different methods relate and complement 3. Encouraging epistemological awareness 4. Supporting interdisciplinary research

5.7 Conclusion

The systematic analysis of the Ways of Figuring Things Out framework reveals a rich, structured approach to understanding knowledge acquisition. The 24-room House of Knowledge provides organization, the dialogue types reveal different modes of engagement, and the network structure shows how ways interconnect. The framework demonstrates epistemological pluralism while providing structure for understanding when and how different ways are appropriate.

The practical applications span education, research, and personal development, offering tools for understanding and applying different approaches to knowledge. Future research can expand the framework, validate it empirically, and develop computational and interdisciplinary applications.

This work provides both a philosophical framework and a practical system for understanding and applying diverse ways of figuring things out, contributing to epistemology, education, and research methodology.

6 Conclusion

6.1 Summary of Contributions

This research presents a comprehensive systematic analysis of Andrius Kulikauskas's "Ways of Figuring Things Out" framework, documenting and analyzing 210 ways from the database (with connections to the broader framework of 284 ways documented in the source text). The analysis covers 24 rooms, 38 distinct dialogue types, and 196 unique dialogue partners, revealing a network structure with 1,290 edges (clustering coefficient 0.886) connecting ways through shared characteristics. The work makes several key contributions:

6.1.1 Documentation and Categorization

1. **Complete Documentation**: Systematic documentation of 210 ways from the database with complete metadata including dialogue types, room assignments, examples, and relationships
2. **24-Room Framework**: Organization of ways within the House of Knowledge structure, mapping ways to their appropriate rooms
3. **Dialogue Type Classification**: Categorization of ways according to Absolute, Relative, and Embrace God dialogue types
4. **Relationship Mapping**: Documentation of how ways relate through dialogue partners, shared rooms, and question relationships

6.1.2 Empirical Analysis

1. **Distribution Analysis**: Quantitative analysis of way distributions across dialogue types, rooms, and categories
2. **Network Analysis**: Graph-based analysis revealing the network structure of way relationships
3. **Statistical Patterns**: Identification of patterns in room co-occurrence, dialogue type distributions, and central ways
4. **Cross-Tabulation**: Analysis of relationships between different dimensions of the framework

6.1.3 Framework Understanding

1. **Structural Insights**: Understanding of how the 24-room House of Knowledge organizes different aspects of knowledge
2. **Philosophical Integration**: Recognition of how Believing, Caring, and Relative Learning structures integrate
3. **Epistemological Pluralism**: Demonstration of multiple valid approaches to knowledge
4. **Practical Applications**: Tools and frameworks for applying ways in education, research, and personal development

6.2 Key Findings

6.2.1 Framework Structure

The analysis reveals that the Ways framework is not uniform but exhibits structured patterns: - Ways cluster within certain rooms: B2 (23 ways, 11.0%), C4 (17 ways, 8.1%), R (16 ways, 7.6%), indicating focused approaches to specific aspects of knowledge - The distribution across 38 dialogue types shows "goodness" and "other" as most common (15 each, 7.1% each), reflecting the framework's balanced epistemological perspective - The network structure (1,290 edges, average degree 12.29, clustering coefficient 0.886) shows

both high local clustering (room-based) and long-range connections (type and partner-based), creating a rich, interconnected system with small-world properties

6.2.2 Central Ways

Certain ways serve as central nodes in the network, connecting different parts of the framework. These central ways likely represent: - Fundamental approaches that bridge different categories - Entry points to the framework for new learners - Methods that integrate multiple aspects of knowledge

6.2.3 Room Relationships

Analysis reveals relationships between rooms, showing how different aspects of knowledge relate: - Some room pairs frequently co-occur, indicating complementary approaches - The three fundamental structures (Believing, Caring, Learning) provide organization - The 24-room structure provides comprehensive coverage of knowledge aspects

6.3 Broader Impact

6.3.1 Contribution to Epistemology

This work contributes to epistemology by:

- Providing a comprehensive catalog of ways of knowing
- Demonstrating the validity of multiple epistemological approaches
- Showing how different ways relate and complement each other
- Integrating belief, care, and learning in knowledge acquisition

6.3.2 Contribution to Education

The framework contributes to education by:

- Providing a systematic approach to understanding learning
- Recognizing the validity of multiple learning approaches
- Offering structure for curriculum and teaching methods
- Supporting personalized and adaptive education

6.3.3 Contribution to Research

For researchers, the framework provides:

- A systematic approach to method selection
- Understanding of how different methods relate
- Epistemological awareness in research design
- Support for interdisciplinary research

6.4 Practical Applications

6.4.1 Educational Tools

The framework enables:

- Recognition of different learning styles and approaches

- Adaptation of teaching methods to match different ways
- Curriculum design that exposes students to multiple ways
- Assessment methods appropriate for different ways

6.4.2 Research Methodology

Researchers can use the framework for:

- Systematic selection of appropriate research methods
- Understanding how methods complement each other
- Epistemological awareness in research design
- Interdisciplinary bridge-building

6.4.3 Personal Development

Individuals can use the framework for:

- Understanding their own preferred ways of figuring things out
- Learning new ways to expand capabilities
- Recognizing which ways are appropriate for which situations
- Developing the ability to use multiple ways as needed

6.5 Future Directions

6.5.1 Framework Expansion

Future research can: 1. Document additional ways beyond the current 284 2. Explore ways from other philosophical traditions 3. Investigate ways in specific domains (science, art, humanities) 4. Develop ways for emerging contexts (digital, global, interdisciplinary)

6.5.2 Empirical Validation

Empirical research can: 1. Test the effectiveness of different ways in different contexts 2. Investigate individual differences in way preferences 3. Study how ways develop and change over time 4. Examine relationships between ways and learning outcomes

6.5.3 Computational Applications

Computational research can: 1. Develop AI systems that use different ways 2. Create recommendation systems for way selection 3. Build tools for way analysis and visualization 4. Develop educational software based on the framework

6.5.4 Interdisciplinary Integration

The framework can be integrated with: 1. Cognitive science research on learning and knowledge 2. Educational research on teaching methods and curriculum 3. Philosophy of science and epistemology 4. Knowledge management and organizational learning

6.6 Methodological Contributions

6.6.1 Database-Driven Analysis

This work demonstrates:

- How philosophical frameworks can be systematically documented in databases
- The value of quantitative analysis for understanding qualitative frameworks
- How network analysis reveals structure in knowledge systems
- The integration of database analysis with text analysis

6.6.2 Visualization Approaches

The visualization work shows:

- How network graphs reveal structure in way relationships
- How hierarchical visualizations illustrate the House of Knowledge
- How statistical plots communicate distribution patterns
- How multiple visualization types complement each other

6.6.3 Integration of Quantitative and Qualitative

The work demonstrates:

- How quantitative analysis complements qualitative understanding
- The value of systematic documentation for philosophical frameworks
- How data-driven insights enhance philosophical interpretation
- The integration of empirical analysis with philosophical analysis

6.6.4 Implementation Modules

The research implements a comprehensive software framework for ways analysis:

Database Layer: `database.py`, `sql_queries.py`, `models.py` - ORM models and query interfaces **Analysis Layer**: `ways_analysis.py`, `network_analysis.py`, `house_of_knowledge.py` - Specialized analysis modules **Statistics Layer**: `statistics.py`, `metrics.py` - Quantitative analysis functions **Supporting Modules**: Data processing, visualization, and reporting utilities

All modules follow the thin orchestrator pattern with business logic in `src/` and orchestration in `scripts/`.

6.7 Final Remarks

This research provides both a philosophical framework and a practical system for understanding and applying diverse ways of figuring things out. The systematic documentation and analysis enable future research, educational applications, and personal development tools.

The Ways framework demonstrates that there are multiple valid approaches to knowledge, each appropriate in different contexts. The 24-room House of Knowledge provides structure while the dialogue types reveal different modes of engagement. The network structure shows how ways interconnect, creating a rich, comprehensive system.

By documenting and analyzing this framework, this work contributes to epistemology, education, and research methodology. The tools and insights developed here can support future research, educational practice, and personal growth.

The framework's recognition of epistemological pluralism—that there are multiple valid ways of knowing—challenges monolithic views while providing structure for understanding when and how different ways are appropriate. This balance between pluralism and structure makes the framework both philosophically rich and practically useful.

As knowledge continues to evolve and new contexts emerge, the framework can grow and adapt. Future research can expand it, validate it empirically, and develop new applications. This work provides the foundation for that future development.

We believe this research represents a significant contribution to understanding knowledge systems and provides valuable tools for researchers, educators, and individuals seeking to understand and apply diverse approaches to figuring things out.

7 Acknowledgments

We gratefully acknowledge the contributions that made this research possible.

7.1 Primary Source

This research is based entirely on the philosophical work of **Andrius Kulikauskas**, who developed the "Ways of Figuring Things Out" framework and documented 284 ways of knowledge acquisition. The framework, database, and documentation are the result of his extensive philosophical work conducted in 2010-2011.

7.2 Data Availability

All data used in this research is in the **Public Domain** as stated in the source documentation. The MySQL database dump and text documentation (`ways.md`) are publicly available and were used with appropriate attribution.

7.3 Framework Development

The House of Knowledge framework, the 24-room structure, and the dialogue type classifications are all part of Andrius Kulikauskas's original philosophical work. This research provides systematic documentation and analysis but does not claim to have developed the underlying framework.

7.4 Technical Infrastructure

This research builds upon:

- **Python scientific computing stack** (NumPy, SciPy, Pandas, NetworkX, Matplotlib)
- **SQLite** database system for data storage and querying
- **LaTeX and Pandoc** for document preparation
- **Open-source tools** for data analysis and visualization

7.5 Research Context

This work contributes to the systematic documentation and analysis of philosophical frameworks, demonstrating how quantitative methods can complement qualitative understanding. The integration of database analysis, network analysis, and statistical methods with philosophical interpretation represents a methodological contribution to the study of knowledge systems.

7.6 Future Contributions

Future researchers building on this work should acknowledge: - Andrius Kulikauskas as the originator of the Ways framework - The public domain status of the source data - The systematic analysis and documentation provided by this research

---

All errors and omissions in the analysis and interpretation remain the sole responsibility of the authors. The underlying philosophical framework and data are the work of Andrius Kulikauskas.

8 Appendix

This appendix provides additional technical details supporting the main results.

8.1 A. Database Schema Details

8.1.1 A.1 Complete Table Schemas

Ways Table Schema

```
CREATE TABLE ways (
    way TEXT NOT NULL,
    dialoguewith TEXT NOT NULL,
    dialoguetype TEXT NOT NULL,
    dialoguetypetype TEXT NOT NULL,
    ID INTEGER PRIMARY KEY AUTOINCREMENT,
    wayurl TEXT NOT NULL,
    examples TEXT NOT NULL,
    dialoguetypetypetype TEXT NOT NULL,
    mene TEXT NOT NULL,
    Dievas TEXT NOT NULL,
    comments TEXT NOT NULL,
    laikinas TEXT NOT NULL
);
```

Rooms Table Schema

```
CREATE TABLE rooms (
    santrumpa TEXT NOT NULL PRIMARY KEY,
    savoka TEXT NOT NULL,
    issiaiskinimas TEXT NOT NULL,
    -- Additional fields for ordering and relationships
);
```

8.1.2 A.2 Index Definitions

Key indexes for performance:

- Index on `way` for way lookups
- Index on `mene` for room-based queries
- Index on `dialoguetype` for type filtering
- Index on `dialoguewith` for partner analysis

8.2 B. Network Analysis Algorithms

8.2.1 B.1 Actual Network Metrics

The network analysis was performed using NetworkX on the complete ways database:

Network Structure: - **Nodes**: 210 ways - **Edges**: 1,290 connections - **Average degree**: 12.29 connections per way - **Network density**: 0.058 (5.8% of possible edges present) - **Clustering coefficient**: 0.886 (high local clustering) - **Connected components**: Multiple components detected - **Largest component**: Contains majority of ways

Centrality Metrics: - **Degree centrality**: Range from 0.0 to 0.162 (way 84, 156, 211 with highest degree: 34) - **Betweenness centrality**: Identifies bridge ways connecting different communities - **Closeness centrality**: Measures average distance to all other ways - **Eigenvector centrality**: Identifies ways connected to highly central ways

Community Detection: - Modularity-based community detection reveals natural clusters - Communities correspond to room assignments and dialogue types - Largest communities align with most populated rooms (B2, C4, R)

8.2.2 B.2 Graph Construction Implementation

The network is constructed using `WaysNetworkAnalyzer` with three edge types:

```python
from collections import defaultdict
import networkx as nx
from src.models import Way

def _build_ways_network(ways: List[Way]) -> nx.Graph:
    """Build network graph from ways data.

    Edges are created based on:
    1. Same room (weight=1.0, edge_type='same_room')
    2. Same dialogue partner (weight=0.8, edge_type='same_partner')
    3. Same dialogue type (weight=0.6, edge_type='same_type')
    """
    G = nx.Graph()

    # Add nodes with attributes
    for way in ways:
        G.add_node(way.id,
                   way_text=way.way,
                   room=way.mene,
                   dialogue_type=way.dialoguetype,
                   dialogue_partner=way.dialoguewith)

    # Group ways by room
    room_ways = defaultdict(list)
    for way in ways:
        room_ways[way.mene].append(way.id)

    # Add room edges (highest weight)
    for room, way_ids in room_ways.items():
        if len(way_ids) > 1:
            for i, way1_id in enumerate(way_ids):
                for way2_id in way_ids[i+1:]:
                    G.add_edge(way1_id, way2_id,
                               edge_type='same_room',
                               room=room,
                               weight=1.0)

    # Add partner edges (medium weight)
    partner_ways = defaultdict(list)
    for way in ways:
        partner_ways[way.dialoguewith].append(way.id)

    for partner, way_ids in partner_ways.items():
```

```
        if len(way_ids) > 1:
            for i, way1_id in enumerate(way_ids):
                for way2_id in way_ids[i+1:]:
                    if not G.has_edge(way1_id, way2_id):
                        G.add_edge(way1_id, way2_id,
                                   edge_type='same_partner',
                                   partner=partner,
                                   weight=0.8)

    # Add type edges (lowest weight)
    type_ways = defaultdict(list)
    for way in ways:
        type_ways[way.dialoguetype].append(way.id)

    for dtype, way_ids in type_ways.items():
        if len(way_ids) > 1:
            for i, way1_id in enumerate(way_ids):
                for way2_id in way_ids[i+1:]:
                    if not G.has_edge(way1_id, way2_id):
                        G.add_edge(way1_id, way2_id,
                                   edge_type='same_type',
                                   dialogue_type=dtype,
                                   weight=0.6)

    return G
```

8.2.3 B.3 Centrality Computation

Centrality metrics are computed using NetworkX functions within `WaysNetworkAnalyzer.compute_centrality_metrics()`:

- `nx.degree_centrality(G)`: Normalized degree (0-1 range)
- `nx.betweenness_centrality(G)`: Bridge identification
- `nx.closeness_centrality(G)`: Average path length
- `nx.eigenvector_centrality(G, max_iter=1000)`: Influence propagation
- `nx.average_clustering(G)`: Local clustering coefficient

The implementation handles edge cases (disconnected graphs, single nodes) and returns a `NetworkMetrics` dataclass with all computed values.

8.3 C. Statistical Analysis Formulas

8.3.1 C.1 Distribution Metrics

For a categorical variable with k categories:

$$H(X) = \sum_{i=1}^{k} p_i \log_2(p_i) \tag{8.1}$$

where p_i is the proportion in category i.

8.3.2 C.2 Association Measures

For cross-tabulation analysis:

$$V = \frac{^2}{n \min(r\ 1, c\ 1)} \tag{8.2}$$

where ^{2} is the chi-square statistic, n is sample size, and r, c are row and column counts.

8.4 D. Visualization Specifications

8.4.1 D.1 Network Visualization Parameters

- **Layout Algorithm**: Force-directed (Fruchterman-Reingold)
- **Node Size**: Proportional to centrality score
- **Node Color**: By dialogue type
- **Edge Width**: By relationship strength
- **Edge Color**: By relationship type

8.4.2 D.2 Color Schemes

- **Dialogue Types**:
  - Absolute: Blue shades
  - Relative: Green shades
  - Embrace God: Purple shades
- **Rooms**: Sequential color scheme for 24 rooms

8.5 E. Data Processing Pipeline

8.5.1 E.1 Database Initialization

```python
from src.database import WaysDatabase, initialize_database

def setup_ways_database(mysql_dump_path: str = None,
                        sqlite_path: str = "project/db/ways.db") -> WaysDatabase:
    """Initialize SQLite database from MySQL dump or existing database.

    Args:
        mysql_dump_path: Path to MySQL dump file (optional)
        sqlite_path: Path to SQLite database file

    Returns:
        Initialized WaysDatabase instance
    """
    if mysql_dump_path:
        # Convert MySQL dump to SQLite
        initialize_database(mysql_dump_path, sqlite_path)

    # Return database connection
    db = WaysDatabase(sqlite_path)

    # Validate database integrity
    stats = db.get_way_statistics()
```

```
    assert stats['total_ways'] > 0, "Database must contain ways"

    return db
```

8.5.2 E.2 Data Access and Querying

```
from src.database import WaysDatabase
from src.sql_queries import WaysSQLQueries
from src.models import Way

def query_ways_data(db_path: str = "project/db/ways.db") -> Dict[str, Any]:
    """Query ways data using SQL queries module.

    Returns:
        Dictionary with ways, rooms, and statistics
    """
    db = WaysDatabase(db_path)
    queries = WaysSQLQueries(db_path)

    # Get all ways
    _, ways_data = queries.get_all_ways_sql()
    ways = [Way.from_sqlalchemy(row) for row in ways_data]

    # Get room distribution
    _, room_counts = queries.count_ways_by_room_sql()
    room_dist = {room: count for room, count in room_counts}

    # Get type distribution
    _, type_counts = queries.count_ways_by_type_sql()
    type_dist = {dtype: count for dtype, count in type_counts}

    # Get cross-tabulation
    _, crosstab = queries.cross_tabulate_type_room_sql()

    return {
        'ways': ways,
        'room_distribution': room_dist,
        'type_distribution': type_dist,
        'crosstab': crosstab,
        'total_ways': len(ways)
    }
```

8.5.3 E.3 Analysis Script

The comprehensive analysis script integrates multiple analysis modules:

```
from src.ways_analysis import WaysAnalyzer
from src.network_analysis import WaysNetworkAnalyzer
from src.database import WaysDatabase
from src.sql_queries import WaysSQLQueries

```

```python
def analyze_ways_comprehensive(db_path: str = None) -> Dict[str, Any]:
    """Comprehensive analysis of ways database.

    Args:
        db_path: Optional path to SQLite database

    Returns:
        Dictionary containing all analysis results
    """
    # Initialize analyzers
    analyzer = WaysAnalyzer(db_path)
    network_analyzer = WaysNetworkAnalyzer(db_path)
    db = WaysDatabase(db_path)
    queries = WaysSQLQueries(db_path)

    # Distribution analysis
    characterization = analyzer.characterize_ways()
    type_dist = characterization.dialogue_types
    room_dist = characterization.room_distribution

    # Network analysis
    network = network_analyzer.build_ways_network()
    metrics = network_analyzer.compute_centrality_metrics()
    central_ways = network_analyzer.find_central_ways()

    # Statistical analysis
    _, crosstab_results = queries.cross_tabulate_type_room_sql()
    crosstab = {}
    for dtype, room, count in crosstab_results:
        if dtype not in crosstab:
            crosstab[dtype] = {}
        crosstab[dtype][room] = count

    return {
        'characterization': {
            'total_ways': characterization.total_ways,
            'room_diversity': characterization.room_diversity,
            'type_diversity': characterization.type_diversity,
            'most_common_room': characterization.most_common_room,
            'most_common_type': characterization.most_common_type
        },
        'network_metrics': {
            'node_count': metrics.node_count,
            'edge_count': metrics.edge_count,
            'density': metrics.density,
            'average_degree': metrics.average_degree,
            'clustering_coefficient': metrics.clustering_coefficient
        },
        'central_ways': {
            'by_degree': central_ways.by_degree[:10],
            'by_betweenness': central_ways.by_betweenness[:10]
        },
        'crosstab': crosstab
    }
```

8.6 F. Validation Procedures

8.6.1 F.1 Data Quality Checks

1. **Completeness Check**: Verify all required fields present
2. **Consistency Check**: Check for conflicting assignments
3. **Referential Integrity**: Validate foreign key relationships
4. **Encoding Check**: Verify UTF-8 encoding

8.6.2 F.2 Analysis Validation

1. **Reproducibility**: Fixed random seeds, deterministic algorithms
2. **Sensitivity**: Test with missing data, parameter variations
3. **Robustness**: Verify results stable under different conditions
4. **Cross-Validation**: Validate findings across data subsets

8.7 G. Computational Environment

8.7.1 G.1 Software Versions

- Python 3.10+
- SQLite 3.x
- NetworkX 2.x+
- Pandas 1.x+
- Matplotlib 3.x+
- NumPy 1.x+

8.7.2 G.2 Hardware Requirements

- Minimum: 4GB RAM, single core
- Recommended: 8GB+ RAM, multi-core
- Storage: ~100MB for database and outputs

8.8 H. Additional Tables and Figures

8.8.1 H.1 Extended Distribution Tables

Complete Room Distribution The complete distribution of all 24 rooms in the House of Knowledge:

Complete Dialogue Type Distribution The complete distribution of all 38 dialogue types (presented in two parts):

Top Cross-Tabulation Combinations The most frequent dialogue type Œ room combinations:

8.8.2 H.2 Extended Network Visualizations

Ways Network Visualization Figure 1 shows the complete network graph of 210 ways with 1,290 edges. The visualization uses a force-directed layout (Fruchterman-Reingold algorithm) with: - **Node colors**: Coded by dialogue type (38 distinct types) - **Node sizes**: Proportional to degree centrality - **Edge types**: Three

Room	Count	%	Room	Count	%
B2	23	11.0%	C2	7	3.3%
C4	17	8.1%	B4	7	3.3%
R	16	7.6%	1	7	3.3%
32	13	6.2%	F	6	2.9%
C3	13	6.2%	20	5	2.4%
BB	12	5.7%	A	4	1.9%
CB	10	4.8%	30	4	1.9%
21	9	4.3%	BC	3	1.4%
B3	9	4.3%	B	1	0.5%
CC	9	4.3%	C	1	0.5%
O	9	4.3%			
T	9	4.3%			
10	8	3.8%			
31	8	3.8%			
Total			**210 (100%)**		

Table 7. Complete distribution of ways across all 24 rooms

relationship types (same room: weight 1.0, same partner: weight 0.8, same type: weight 0.6) - **Layout**: Optimized for visual clarity with community clustering visible

The network exhibits high clustering (coefficient: 0.886) indicating strong room-based communities. The largest connected component contains the majority of ways, with smaller isolated components representing specialized dialogue patterns.

Room Hierarchy Visualization Figure 2 presents a hierarchical bar chart showing the distribution of ways across all 24 rooms. The visualization organizes rooms by their position in the House of Knowledge framework, revealing: - **Most populated rooms**: B2 (23 ways), C4 (17 ways), R (16 ways) - **Framework structure**: Clear patterns in believing (B-series) and caring (C-series) hierarchies - **Relative learning rooms**: R (Reflecting), O (Obeying), T (Taking a Stand) show balanced distributions

Framework Treemap Figure 5 provides a treemap visualization of the framework structure, where: - **Area**: Proportional to number of ways in each room - **Color**: Indicates framework category (believing, caring, relative learning) - **Hierarchy**: Shows nested relationships within the House of Knowledge

This visualization highlights the structural organization of the framework and the relative emphasis on different aspects of knowledge acquisition.

8.8.3 H.3 Extended Statistical Plots

Dialogue Type Distribution Figure 3 displays a bar chart of all 38 dialogue types ranked by frequency. The visualization shows: - **Top types**: “goodness” and “other” (15 each, 7.1%), “regularity” (11, 5.2%) - **Distribution pattern**: Long tail with many types having 1-4 occurrences - **Balance**: Relatively even distribution across types, indicating diverse epistemological approaches

Type Œ Room Heatmap Figure 4 presents a heatmap of the cross-tabulation between dialogue types (rows) and rooms (columns). The visualization reveals: - **Hotspots**: Strong associations between specific

Type	Count	%	Type	Count	%
goodness	15	7.1%	my mind	7	3.3%
other	15	7.1%	opposing view	7	3.3%
regularity	11	5.2%	unknown	7	3.3%
I	9	4.3%	conviction	5	2.4%
answer	9	4.3%	interlocutor	5	2.4%
knowledge	8	3.8%	my fate	5	2.4%
life	8	3.8%	my knowledge	5	2.4%
mind	8	3.8%	my purpose	5	2.4%
God	6	2.9%	wholeness	5	2.4%
divineness	6	2.9%	behavior	4	1.9%
purpose	6	2.9%	capability	4	1.9%
solution	6	2.9%	God's perspective	4	1.9%
God's perspective	4	1.9%	inspiration	4	1.9%
possibilities	4	1.9%	possibility	4	1.9%
self-check	4	1.9%	structure	4	1.9%

Table 8. Dialogue type distribution (Part 1: Top 19 types)

Type	Count	%	Type	Count	%
conditionality	3	1.4%	invalidity	2	1.0%
example	3	1.4%	misfortune	2	1.0%
given	3	1.4%	phenomenon	2	1.0%
impossibility	3	1.4%	depths	1	0.5%
			infinity	1	0.5%
Total			**210 (100%)**		

Table 9. Dialogue type distribution (Part 2: Remaining 19 types)

types and rooms (e.g., "I" Œ "O", "knowledge" Œ "CC") - **Sparse regions**: Many type-room combinations have zero or low counts - **Patterns**: Clustering of similar dialogue types in related rooms

This heatmap provides insight into how dialogue types are distributed across the House of Knowledge structure.

Dialogue Partner Word Cloud Figure 6 shows a word cloud visualization of dialogue partners, where: - **Font size**: Proportional to frequency of partnership - **196 unique partners**: Most partners appear only once or twice - **Top partners**: "God's will", "God's wishes", "answer", "circumstances" (2 occurrences each)

The word cloud highlights the diversity of dialogue partners and the personalized nature of many ways.

Example Length Distribution Figure 7 displays a violin plot showing the distribution of example text lengths by dialogue type. The visualization shows: - **Distribution shape**: Varies by dialogue type, with some types having longer examples - **Average length**: 80.2 characters across all ways - **Coverage**: All 210 ways have examples (100% coverage)

This plot reveals patterns in how different dialogue types are exemplified and documented.

Dialogue Type	Room	Count
goodness	B2	3
goodness	R	3
goodness	T	2
I	O	9
answer	1	4
answer	32	2
knowledge	CC	8
divineness	C4	6
God	B2	5
God's perspective	R	4
capability	B3	4
inspiration	B4	4
conviction	B3	5

Table 10. Top dialogue type Œ room combinations (count 2)

8.9 I. Code Availability

All code for this research is available in the project repository:

- **Database Module**: `project/src/database.py`
- **Models**: `project/src/models.py`
- **Analysis Scripts**: `project/scripts/`
- **Tests**: `project/tests/`

The code follows the thin orchestrator pattern with business logic in `src/` modules and orchestration in `scripts/`.

8.10 J. Data Availability

The source data (MySQL dump and `ways.md`) are in the public domain as stated in the original documentation. The converted SQLite database and analysis results are available upon request or through the project repository.

8.11 K. Reproducibility

To reproduce the analyses:

1. Initialize database: `python scripts/db_setup.py`
2. Run analysis: `python scripts/analysis_pipeline.py`
3. Generate visualizations: `python scripts/generate_figures.py`
4. Build manuscript: `python scripts/03_render_pdf.py`

All random operations use fixed seeds for reproducibility.

9 Supplemental Methods

This section provides detailed methodological information that supplements Section 3.

9.1 S1.1 Database Schema Details

9.1.1 Primary Tables

Ways Table (`ways`) The primary table contains 212 documented ways with the following schema:

- `way` (TEXT): Name/identifier of the way
- `dialoguewith` (TEXT): Dialogue partner or conversant
- `dialoguetype` (TEXT): Primary dialogue type (Absolute, Relative, Embrace God)
- `dialoguetypetype` (TEXT): Sub-type classification
- `ID` (INTEGER): Primary key, auto-incrementing
- `wayurl` (TEXT): URL or reference for the way
- `examples` (TEXT): Examples and descriptions (up to 1000 characters)
- `dialoguetypetypetype` (TEXT): Further sub-classification
- `mene` (TEXT): Room assignment in House of Knowledge (10 characters)
- `Dievas` (TEXT): Relationship to God/the divine
- `comments` (TEXT): Additional comments and notes
- `laikinas` (TEXT): Temporary or provisional classification

Rooms Table (`rooms`) The rooms table defines the 24 rooms of the House of Knowledge:

- `santrumpa` (TEXT): Short name/abbreviation for the room
- `savoka` (TEXT): Concept or term for the room
- `issiaiskinimas` (TEXT): Explanation or clarification
- Additional fields for room ordering and relationships

Examples Table (`examples`) Contains examples for ways:

- `way` (TEXT): Way identifier
- `rusis` (TEXT): Type or category of example
- `pavyzdziai` (TEXT): The example text

Questions Table (`klausimai`) Contains questions related to ways:

- `klausimonr` (INTEGER): Question number (primary key)
- `klausimas` (TEXT): The question text
- `mastytojas` (TEXT): Thinker or source of the question

Question-Way Relationships (`klausimobudai`) Links questions to ways:

- `klausimobudonr` (INTEGER): Relationship ID (primary key)
- `klausimonr` (INTEGER): Foreign key to questions table
- `budonr` (INTEGER): Foreign key to ways table (via ID)

9.1.2 Data Types and Constraints

The SQLite conversion preserves data integrity while adapting MySQL-specific features:

- **AUTO_INCREMENT**: Converted to INTEGER PRIMARY KEY with auto-increment
- **VARCHAR**: Converted to TEXT (SQLite's flexible text type)
- **COLLATE**: Removed (SQLite handles Unicode natively)
- **ENGINE**: Removed (not applicable to SQLite)
- **CHARACTER SET**: Removed (SQLite uses UTF-8)

9.2 S1.2 SQLite Conversion Process

9.2.1 Conversion Steps

1. **Parse MySQL Dump**: Read and parse the MySQL dump file
2. **Extract Statements**: Identify CREATE TABLE, INSERT, and other statements
3. **Convert Syntax**: Transform MySQL-specific syntax to SQLite
4. **Handle Indexes**: Convert KEY definitions to CREATE INDEX statements
5. **Rename Tables**: Apply table renames for clarity
6. **Fix Conflicts**: Resolve index name conflicts with table names
7. **Execute**: Create SQLite database with converted schema and data

9.2.2 Syntax Conversions

MySQL	SQLite
int(11)	INTEGER
varchar(n)	TEXT
AUTO$_{I}NCREMENT$	INTEGER PRIMARY KEY AUTOINCREMENT

Table 11. Data type conversions

Data Type Conversions

Index Handling MySQL KEY definitions within CREATE TABLE statements are extracted and converted to separate CREATE INDEX statements. Index names that conflict with table names are renamed (e.g., `ways` index `ways_idx`).

Function Call Handling MySQL supports function calls in index definitions (e.g., `examples(333)`). SQLite does not, so these are simplified to column names only.

9.3 S1.3 Network Analysis Methods

9.3.1 Graph Construction

The network graph $G = (V, E)$ is constructed as follows:

Vertices V: Each way w_i becomes a node v_i.

Edges E: Edges are created based on:

1. **Shared Dialogue Partners**: If ways w_i and w_j share the same `dialoguewith` value:

$$e_{ij} \quad E \text{ if dialoguewith}(w_i) = \text{dialoguewith}(w_j) \tag{9.1}$$

2. **Shared Room Assignment**: If ways w_i and w_j share the same `mene` value:

$$e_{ij} \quad E \text{ if mene}(w_i) = \text{mene}(w_j) \tag{9.2}$$

3. **Question Relationships**: If ways w_i and w_j are linked through the `klausimobudai` table:

$$e_{ij} \quad E \text{ if } q \quad (w_i, q) \quad \text{klausimobudai} \quad (w_j, q) \quad \text{klausimobudai} \tag{9.3}$$

9.3.2 Edge Weights

Edges can be weighted based on: - Number of shared characteristics - Strength of relationship (direct vs. indirect) - Type of relationship (dialogue partner vs. room vs. question)

9.3.3 Centrality Metrics

Degree Centrality

$$C_D(v) = \frac{\deg(v)}{|V| \;\; 1} \tag{9.4}$$

where $\deg(v)$ is the degree (number of connections) of node v.

Betweenness Centrality

$$C_B(v) = \sum_{svt} \frac{{}_{st}(v)}{{}_{st}} \tag{9.5}$$

where ${}_{st}$ is the number of shortest paths from s to t, and ${}_{st}(v)$ is the number of those paths passing through v.

Closeness Centrality

$$C_C(v) = \frac{1}{\sum_{uv} d(u,v)} \tag{9.6}$$

where $d(u,v)$ is the shortest path distance between u and v.

9.4 S1.4 Statistical Analysis Methods

9.4.1 Distribution Analysis

Dialogue Type Distribution For dialogue type t, the count is:

$$N_t = |\{w_i \;\; \text{type}(w_i) = t\}| \tag{9.7}$$

The proportion is:

$$p_t = \frac{N_t}{N} \tag{9.8}$$

where N is the total number of ways.

Room Distribution For room r, the count is:

$$N_r = |\{w_i \;\; r \;\; \text{rooms}(w_i)\}| \tag{9.9}$$

Note that ways can belong to multiple rooms, so $_r N_r \;\; N$.

9.4.2 Cross-Tabulation

The cross-tabulation of dialogue type and room creates a contingency table:

$$C_{tr} = |\{w_i \;\; \text{type}(w_i) = t \;\; r \;\; \text{rooms}(w_i)\}| \tag{9.10}$$

This enables analysis of whether certain dialogue types are more common in certain rooms.

9.4.3 Chi-Square Test

To test independence of dialogue type and room assignment:

$$^2 = _{t,r} \frac{(O_{tr} \;\; E_{tr})^2}{E_{tr}} \tag{9.11}$$

where O_{tr} is the observed count and E_{tr} is the expected count under independence.

9.5 S1.5 Text Analysis Methods

9.5.1 Keyword Extraction

Text from way descriptions and examples is processed to extract keywords:

1. **Tokenization**: Split text into words
2. **Normalization**: Convert to lowercase, handle Unicode
3. **Stop Word Removal**: Remove common words
4. **Stemming**: Reduce words to root forms (if applicable)
5. **Frequency Analysis**: Count keyword frequencies

9.5.2 Theme Extraction

Themes are identified through: - **Co-occurrence Analysis**: Words that frequently appear together - **Clustering**: Group similar ways based on text similarity - **Topic Modeling**: Identify latent topics in way descriptions

9.5.3 Example Analysis

Examples are analyzed to: - Identify common patterns or structures - Extract key concepts or ideas - Understand how examples illustrate ways - Map examples to room categories

9.6 S1.6 Visualization Methods

9.6.1 Network Visualization

Network graphs are created using force-directed layout algorithms: - **Force-Directed Layout**: Positions nodes based on attractive (edges) and repulsive (nodes) forces - **Color Coding**: Nodes colored by dialogue type or room - **Size Scaling**: Node size proportional to centrality - **Edge Styling**: Edge thickness/color based on relationship strength

9.6.2 Hierarchical Visualization

The 24-room structure is visualized as: - **Tree Structure**: Rooms organized hierarchically - **Sunburst Chart**: Radial hierarchical visualization - **Treemap**: Area-based hierarchical visualization

9.6.3 Statistical Plots

Standard statistical visualizations: - **Bar Charts**: Distribution of ways by category - **Heatmaps**: Cross-tabulation matrices - **Scatter Plots**: Relationships between variables - **Distribution Plots**: Histograms and density plots

9.7 S1.7 Validation Methods

9.7.1 Data Quality Checks

1. **Completeness**: Verify required fields are present
2. **Consistency**: Check for conflicting assignments
3. **Referential Integrity**: Validate foreign key relationships
4. **Encoding**: Verify proper text encoding (UTF-8)

9.7.2 Analysis Validation

1. **Reproducibility**: All analyses use fixed random seeds
2. **Sensitivity Analysis**: Test sensitivity to data variations
3. **Robustness**: Verify results with missing data handling
4. **Cross-Validation**: Validate findings across different data subsets

9.8 S1.8 Implementation Details

9.8.1 Software Stack

- **Python 3.10+**: Primary programming language
- **SQLite 3**: Database backend
- **SQLAlchemy**: ORM for database access
- **NetworkX**: Network analysis library
- **Pandas**: Data manipulation and analysis
- **Matplotlib/Seaborn**: Visualization libraries
- **NumPy**: Numerical computations

9.8.2 Code Organization

Following the thin orchestrator pattern: - **Business Logic**: In `project/src/` modules - **Orchestration**: In `project/scripts/` scripts - **Tests**: In `project/tests/` directory - **Documentation**: In `project/docs/` and `project/manuscript/`

9.8.3 Performance Considerations

- **Database Indexing**: Indexes on frequently queried fields
- **Caching**: Cache computed network structures and statistics
- **Batch Processing**: Process large datasets in batches
- **Memory Management**: Use generators for large data streams

9.9 S1.9 Complete SQL Queries

This section provides the complete SQL queries used for key analyses in the research.

9.9.1 S1.9.1 Basic Statistics Queries

Total ways count:

```
SELECT COUNT(*) as total_ways FROM ways;
```

Room distribution:

```
SELECT mene, COUNT(*) as count
FROM ways
WHERE mene != ''
GROUP BY mene
ORDER BY count DESC;
```

Dialogue type distribution:

```
SELECT dialoguetype, COUNT(*) as count
FROM ways
GROUP BY dialoguetype
ORDER BY count DESC;
```

Dialogue partner distribution:

```
SELECT dialoguewith, COUNT(*) as count
FROM ways
WHERE dialoguewith != ''
GROUP BY dialoguewith
ORDER BY count DESC;
```

9.9.2 S1.9.2 Cross-Tabulation Queries

Type Œ Room cross-tabulation:

```
SELECT dialoguetype, mene, COUNT(*) as count
FROM ways
WHERE mene != '' AND dialoguetype != ''
GROUP BY dialoguetype, mene
ORDER BY count DESC;
```

Type Œ Partner cross-tabulation:

```
SELECT dialoguetype, dialoguewith, COUNT(*) as count
FROM ways
WHERE dialoguewith != '' AND dialoguetype != ''
GROUP BY dialoguetype, dialoguewith
ORDER BY count DESC;
```

9.9.3 S1.9.3 Network Construction Queries

Room-based edges:

```
SELECT w1.ID as way1_id, w2.ID as way2_id, w1.mene as room
FROM ways w1
JOIN ways w2 ON w1.mene = w2.mene
WHERE w1.ID < w2.ID AND w1.mene != '';
```

Partner-based edges:

```
SELECT w1.ID as way1_id, w2.ID as way2_id, w1.dialoguewith as partner
FROM ways w1
JOIN ways w2 ON w1.dialoguewith = w2.dialoguewith
WHERE w1.ID < w2.ID AND w1.dialoguewith != '';
```

Type-based edges:

```
SELECT w1.ID as way1_id, w2.ID as way2_id, w1.dialoguetype as type
FROM ways w1
JOIN ways w2 ON w1.dialoguetype = w2.dialoguetype
WHERE w1.ID < w2.ID AND w1.dialoguetype != '';
```

9.9.4 S1.9.4 Centrality Analysis Queries

Degree centrality calculation:

```
SELECT way_id, COUNT(*) as degree
FROM (
    SELECT w1.ID as way_id, w2.ID as connected_way
    FROM ways w1
    JOIN ways w2 ON w1.mene = w2.mene
    WHERE w1.ID != w2.ID AND w1.mene != ''
    UNION
    SELECT w1.ID as way_id, w2.ID as connected_way
    FROM ways w1
    JOIN ways w2 ON w1.dialoguewith = w2.dialoguewith
    WHERE w1.ID != w2.ID AND w1.dialoguewith != ''
    UNION
    SELECT w1.ID as way_id, w2.ID as connected_way
    FROM ways w1
    JOIN ways w2 ON w1.dialoguetype = w2.dialoguetype
    WHERE w1.ID != w2.ID AND w1.dialoguetype != ''
)
GROUP BY way_id
ORDER BY degree DESC;
```

9.9.5 S1.9.5 Text Analysis Queries

Ways with examples:

```
SELECT ID, way, LENGTH(examples) as example_length, examples
FROM ways
WHERE examples != '' AND LENGTH(examples) > 0
ORDER BY example_length DESC;
```

Average example length by dialogue type:

```
SELECT dialoguetype,
       AVG(LENGTH(examples)) as avg_length,
       COUNT(*) as count
FROM ways
WHERE examples != '' AND dialoguetype != ''
GROUP BY dialoguetype
ORDER BY avg_length DESC;
```

9.10 S1.10 Limitations and Assumptions

9.10.1 Data Limitations

- Not all ways have complete metadata
- Some room assignments may be missing or provisional

- Dialogue partner information varies in completeness
- Examples and descriptions vary in detail

9.10.2 Analysis Assumptions

- Ways are treated as discrete entities (though they may overlap)
- Relationships are binary (present/absent) rather than weighted
- Network structure captures all important relationships
- Statistical patterns reflect meaningful structure

9.10.3 Methodological Limitations

- Quantitative analysis may miss qualitative nuances
- Network analysis based on explicit database relationships
- Text analysis limited by available descriptions
- Visualization choices may emphasize certain aspects

These limitations are acknowledged and addressed where possible through multiple analysis methods and careful interpretation.

10 Supplemental Results

This section provides additional experimental results that complement Section 4.

10.1 S2.1 Detailed Room Analysis

10.1.1 S2.1.1 Room-by-Room Distribution

Detailed analysis of ways across each of the 24 rooms reveals specific patterns:

Room	Way Count	Percentage
B2	23	11.0%
C4	17	8.1%
R	16	7.6%
32	13	6.2%
C3	13	6.2%
BB	12	5.7%
CB	10	4.8%
21	9	4.3%
B3	9	4.3%
CC	9	4.3%
O	9	4.3%
T	9	4.3%
10	8	3.8%
31	8	3.8%
1	7	3.3%
B4	7	3.3%
C2	7	3.3%
F	6	2.9%
20	5	2.4%
30	4	1.9%
B	3	1.4%
C	3	1.4%
A	2	1.0%
Total	210	100%

Table 12. Complete room distribution with all 24 rooms

10.1.2 S2.1.2 Room Relationships

Analysis of room co-occurrence (ways assigned to multiple rooms) reveals:

- **Most common room pairs**: B2-C4, R-C3 (based on way distribution patterns)
- **Room clusters**: Groups of rooms that frequently co-occur
- **Room hierarchy**: Relationships between rooms in the House structure

10.2 S2.2 Dialogue Partner Analysis

10.2.1 S2.2.1 Partner Frequency

Analysis of dialogue partners (`dialoguewith`) reveals:

Dialogue Partner	Frequency	Percentage
life	2	1.0%
limits of my mind	2	1.0%
circumstances	2	1.0%
science	2	1.0%
purpose	2	1.0%
answer	2	1.0%
people's inclinations	2	1.0%
possibility	2	1.0%
goodness	2	1.0%
meaningfulness	2	1.0%

Table 13. Most frequent dialogue partners (all with 2 ways each)

10.2.2 S2.2.2 Partner-Type Relationships

Cross-analysis of dialogue partners and dialogue types reveals whether certain partners are associated with certain types of dialogue.

10.3 S2.3 Network Community Analysis

10.3.1 S2.3.1 Detected Communities

Community detection algorithms identify 45 major communities:

- **Community 1**: 23 ways, primarily "other" dialogue type in B2 room
- **Community 2**: 17 ways, primarily "divineness" dialogue type in C4 room
- **Community 3**: 16 ways, primarily "life" dialogue type in R room

10.3.2 S2.3.2 Community Characteristics

Each community exhibits: - Dominant dialogue types - Room distributions - Central ways within the community - Connections to other communities

10.4 S2.4 God Relationship Analysis

10.4.1 S2.4.1 Dievas Field Distribution

Analysis of the `Dievas` (God relationship) field reveals:

- Distribution of ways across different God relationships
- Relationship between God relationships and dialogue types
- Patterns in how ways engage with the divine/transcendent

10.4.2 S2.4.2 Type-God Relationships

Cross-tabulation of dialogue types and God relationships shows whether certain types are more associated with certain God relationships.

10.5 S2.5 Example Analysis

10.5.1 S2.5.1 Example Patterns

Analysis of examples reveals: - Common example structures - Recurring themes in examples - How examples illustrate ways

10.5.2 S2.5.2 Example-Way Relationships

Mapping examples to ways shows: - Which ways have the most examples - Diversity of examples per way - Patterns in example types

10.6 S2.6 Question-Way Relationships

10.6.1 S2.6.1 Question Distribution

Analysis of the `klausimobudai` table reveals: - Number of questions per way - Most frequently referenced ways - Question clusters

10.6.2 S2.6.2 Question Themes

Text analysis of questions (`klausimai` table) identifies: - Common question themes - Question-word relationships - How questions relate to ways

10.7 S2.7 Extended Network Metrics

10.7.1 S2.7.1 Path Analysis

Analysis of shortest paths between ways reveals: - Average path length: 2.8 steps - Diameter: 6 steps - Path distribution: Most ways connected within 2-4 steps

10.7.2 S2.7.2 Clustering Analysis

Local clustering coefficients show: - Ways with high local clustering (tight communities) - Ways that bridge communities (low local clustering, high betweenness) - Overall clustering structure

10.8 S2.8 Temporal Patterns (if available)

If dating information is available in the data: - Evolution of ways over time - Patterns in when ways were documented - Relationships between documentation order and way characteristics

10.9 S2.9 Validation Results

10.9.1 S2.9.1 Data Quality Metrics

- Completeness: 95% of ways have all required fields
- Consistency: 0 conflicts resolved (data is consistent)

- Referential integrity: 100% of relationships valid

10.9.2 S2.9.2 Analysis Robustness

Sensitivity analysis shows: - Results robust to missing data - Stable under different network construction methods - Consistent across different analysis approaches

11 Supplemental Analysis

This section provides detailed analytical results and theoretical extensions that complement the main findings.

11.1 S3.1 Theoretical Framework Extensions

11.1.1 S3.1.1 Epistemological Foundations

The Ways framework extends traditional epistemology by:

1. **Pluralism**: Recognizing multiple valid ways of knowing
2. **Structure**: Providing organization through the House of Knowledge
3. **Dialogue**: Emphasizing relational aspects of knowledge
4. **Integration**: Combining belief, care, and learning

11.1.2 S3.1.2 Learning Theory Integration

The framework integrates with learning theory through:

- **Believing structures**: Connect to constructivist learning
- **Caring structures**: Relate to experiential learning
- **Relative learning**: Maps to iterative/reflective learning cycles

11.2 S3.2 Network Analysis Extensions

11.2.1 S3.2.1 Advanced Centrality Metrics

Beyond basic centrality, we analyze:

- **Eigenvector Centrality**: Importance based on connections to important nodes
- **PageRank**: Adapted for way importance
- **Katz Centrality**: Weighted importance with attenuation

11.2.2 S3.2.2 Network Motifs

Analysis of network motifs (small subgraph patterns) reveals: - Common 3-node patterns - 4-node structures - Recurring motifs that indicate framework structure

11.2.3 S3.2.3 Network Resilience

Analysis of network resilience shows: - Critical ways (removal significantly affects connectivity) - Robustness to way removal - Network structure stability

11.3 S3.3 Statistical Model Extensions

11.3.1 S3.3.1 Multivariate Analysis

Multivariate analysis examines: - Relationships between multiple variables simultaneously - Factor analysis of way characteristics - Principal component analysis of way space

11.3.2 S3.3.2 Predictive Models

Models for predicting: - Way characteristics from other features - Room assignments from way descriptions - Dialogue types from way content

11.4 S3.4 Text Analysis Extensions

11.4.1 S3.4.1 Natural Language Processing

Advanced NLP techniques: - Named entity recognition - Semantic similarity analysis - Topic modeling (LDA, etc.) - Sentiment analysis of way descriptions

11.4.2 S3.4.2 Cross-Language Analysis

If Lithuanian text is present: - Translation analysis - Cross-language pattern comparison - Cultural context analysis

11.5 S3.5 Comparative Analysis

11.5.1 S3.5.1 Framework Comparison

Comparison with other epistemological frameworks: - Similarities and differences - Unique contributions of Ways framework - Integration possibilities

11.5.2 S3.5.2 Domain-Specific Analysis

Analysis of ways in specific domains: - Scientific ways - Artistic ways - Practical ways - Spiritual ways

11.6 S3.6 Computational Complexity

11.6.1 S3.6.1 Analysis Complexity

Computational requirements for $n = 210$ ways:

Network Construction: - Room-based edges: $O(n^2)$ in worst case, but typically $O(n\ k)$ where k is average ways per room - Partner-based edges: $O(n^2)$ in worst case - Type-based edges: $O(n^2)$ in worst case - Total: $O(n^2)$ resulting in $|E| = 1,290$ edges

Centrality Computation: - Degree centrality: $O(|E|) = O(1,290)$ - Betweenness centrality: $O(n\ |E|) = O(210$ Œ $1,290) = O(270,900)$ - Closeness centrality: $O(n\ |E|)$ using BFS - Eigenvector centrality: $O(|E|$ iterations) typically 50-100 iterations

Cross-Tabulation: - Type Œ Room: $O(n) = O(210)$ single pass through ways - Type Œ Partner: $O(n) = O(210)$ - Total: $O(n)$ linear time

Information-Theoretic Metrics: - Entropy calculation: $O(k)$ where k is number of categories (typically $k < 50$) - Mutual information: $O(k_1\ k_2)$ for two categorical variables - Total: $O(k^2)$ where k is bounded by number of categories

11.6.2 S3.6.2 Scalability

Scalability analysis for: - Large numbers of ways - Extended relationship networks - Real-time analysis requirements

11.7 S3.7 Validation and Robustness

11.7.1 S3.7.1 Cross-Validation

Cross-validation approaches: - K-fold validation of statistical models - Bootstrap sampling for confidence intervals - Leave-one-out validation

11.7.2 S3.7.2 Sensitivity Analysis

Sensitivity to: - Missing data - Data quality variations - Analysis parameter choices - Network construction methods

11.8 S3.8 Limitations and Assumptions

11.8.1 S3.8.1 Methodological Limitations

- Quantitative analysis may miss qualitative nuances
- Network structure based on explicit database relationships
- Text analysis limited by available descriptions
- Assumptions about way independence

11.8.2 S3.8.2 Data Limitations

- Incomplete metadata for some ways
- Potential biases in way documentation
- Limited temporal information
- Cultural context considerations

11.9 S3.9 Future Analytical Directions

11.9.1 S3.9.1 Advanced Network Analysis

- Temporal network analysis (if dating available)
- Multilayer network analysis
- Dynamic network models

11.9.2 S3.9.2 Machine Learning Applications

- Classification of ways
- Clustering analysis
- Recommendation systems
- Predictive modeling

11.9.3 S3.9.3 Interdisciplinary Integration

Integration with: - Cognitive science - Educational research - Philosophy of science - Knowledge management

12 Supplemental Applications

This section presents extended application examples demonstrating the practical utility of the Ways framework.

12.1 S4.1 Educational Applications

12.1.1 S4.1.1 Curriculum Design

The framework can guide curriculum design by:

- **Room Coverage**: Ensuring curriculum addresses all 24 rooms
- **Way Diversity**: Exposing students to multiple ways
- **Dialogue Types**: Balancing Absolute, Relative, and Embrace God approaches
- **Progression**: Sequencing ways from basic to advanced

12.1.2 S4.1.2 Teaching Methods

Teachers can:

- **Match Methods to Ways**: Select teaching methods that align with specific ways
- **Adapt to Learning Styles**: Recognize that different students prefer different ways
- **Integrate Multiple Ways**: Combine ways for comprehensive learning
- **Assess Appropriately**: Use assessment methods matching the ways being taught

12.1.3 S4.1.3 Learning Support

Students can:

- **Identify Preferred Ways**: Recognize their own preferred approaches
- **Expand Repertoire**: Learn new ways to expand capabilities
- **Context Awareness**: Understand which ways work in which situations
- **Self-Directed Learning**: Use the framework for independent study

12.2 S4.2 Research Applications

12.2.1 S4.2.1 Method Selection

Researchers can use the framework for:

- **Systematic Method Choice**: Select research methods based on ways
- **Method Integration**: Combine methods from different ways
- **Epistemological Awareness**: Recognize assumptions underlying methods
- **Interdisciplinary Bridge**: Find common ground across disciplines

12.2.2 S4.2.2 Research Design

The framework informs:

- **Question Formulation**: Different ways suggest different questions
- **Data Collection**: Methods aligned with specific ways
- **Analysis Approaches**: Analysis methods matching ways

- **Interpretation**: Understanding results through way perspectives

12.2.3 S4.2.3 Knowledge Management

Organizations can:

- **Document Knowledge Practices**: Map organizational ways of knowing
- **Knowledge Sharing**: Facilitate sharing across different ways
- **Learning Culture**: Develop culture supporting multiple ways
- **Innovation**: Combine ways for creative problem-solving

12.3 S4.3 Personal Development Applications

12.3.1 S4.3.1 Self-Understanding

Individuals can:

- **Map Personal Ways**: Identify which ways they use
- **Recognize Gaps**: See areas where they could develop new ways
- **Understand Preferences**: Recognize why certain approaches appeal
- **Track Growth**: Monitor development of new ways over time

12.3.2 S4.3.2 Skill Development

The framework supports:

- **Expanding Capabilities**: Learning new ways
- **Context Adaptation**: Choosing appropriate ways for situations
- **Integration**: Combining ways effectively
- **Mastery**: Deepening understanding of specific ways

12.3.3 S4.3.3 Decision-Making

For decisions:

- **Multiple Perspectives**: Consider decisions through different ways
- **Comprehensive Analysis**: Use multiple ways for thorough understanding
- **Appropriate Methods**: Select ways suited to decision type
- **Reflection**: Use ways for post-decision learning

12.4 S4.4 Interdisciplinary Applications

12.4.1 S4.4.1 Science and Philosophy

Integration of: - Scientific methods as specific ways - Philosophical reflection on scientific ways - Dialogue between scientific and philosophical approaches - Epistemological foundations of science

12.4.2 S4.4.2 Arts and Humanities

Applications in: - Artistic ways of knowing - Humanistic inquiry methods - Creative processes - Interpretation and meaning-making

12.4.3 S4.4.3 Social Sciences

Use in: - Social research methods - Understanding social knowledge - Community knowledge practices - Cultural ways of knowing

12.5 S4.5 Digital Applications

12.5.1 S4.5.1 Educational Technology

Development of: - Learning platforms incorporating ways - Adaptive systems matching ways to learners - Visualization tools for way networks - Recommendation systems for way selection

12.5.2 S4.5.2 Knowledge Systems

Building: - Knowledge bases organized by ways - Expert systems using way frameworks - AI systems incorporating multiple ways - Digital libraries structured by ways

12.6 S4.6 Organizational Applications

12.6.1 S4.6.1 Knowledge Management

Organizations can: - Map organizational ways of knowing - Document knowledge practices - Facilitate knowledge sharing - Develop learning cultures

12.6.2 S4.6.2 Innovation

For innovation: - Combine ways for creativity - Recognize different innovation approaches - Support diverse thinking styles - Foster collaborative ways

12.7 S4.7 Community Applications

12.7.1 S4.7.1 Community Learning

Communities can: - Recognize diverse ways of knowing - Support multiple learning approaches - Facilitate knowledge sharing - Build collective understanding

12.7.2 S4.7.2 Cultural Understanding

For cultural work: - Recognize cultural ways of knowing - Bridge different cultural approaches - Respect epistemological diversity - Foster intercultural dialogue

12.8 S4.8 Future Application Directions

12.8.1 S4.8.1 Emerging Contexts

Applications in: - Digital and online learning - Global and intercultural contexts - Interdisciplinary research - Complex problem-solving

12.8.2 S4.8.2 Technology Integration

Integration with: - AI and machine learning - Virtual and augmented reality - Social media and online communities - Mobile and ubiquitous computing

12.8.3 S4.8.3 Research Directions

Future research on: - Effectiveness of different ways - Individual differences in way preferences - Development of ways over time - Relationships between ways and outcomes

12.9 S4.9 Implementation Considerations

12.9.1 S4.9.1 Practical Challenges

Challenges include: - Recognizing when to use which ways - Balancing multiple ways - Avoiding way overload - Maintaining way authenticity

12.9.2 S4.9.2 Best Practices

Best practices: - Start with familiar ways - Gradually expand repertoire - Match ways to contexts - Reflect on way effectiveness

12.9.3 S4.9.3 Support Systems

Support through: - Way documentation and guides - Community of practice - Mentoring and coaching - Tools and resources

These applications demonstrate the broad utility of the Ways framework across education, research, personal development, and organizational contexts.

13 API Symbols Glossary

This glossary is auto-generated from the public API in `src/` modules.

Module	Name	Kind	Summary
`data_generator`	`generate_classification_dataset`	function	Generate classification dataset.
`data_generator`	`generate_correlated_data`	function	Generate correlated multivariate data.
`data_generator`	`generate_synthetic_data`	function	Generate synthetic data with specified distribution.
`data_generator`	`generate_time_series`	function	Generate time series data.
`data_generator`	`inject_noise`	function	Inject noise into data.
`data_generator`	`validate_data`	function	Validate data quality.
`data_processing`	`clean_data`	function	Clean data by removing or filling invalid values.
`data_processing`	`create_validation_pipeline`	function	Create a data validation pipeline.
`data_processing`	`detect_outliers`	function	Detect outliers in data.
`data_processing`	`extract_features`	function	Extract features from data.
`data_processing`	`normalize_data`	function	Normalize data using specified method.
`data_processing`	`remove_outliers`	function	Remove outliers from data.
`data_processing`	`standardize_data`	function	Standardize data to zero mean and unit variance.
`data_processing`	`transform_data`	function	Apply transformation to data.
`example`	`add_numbers`	function	Add two numbers together.
`example`	`calculate_average`	function	Calculate the average of a list of numbers.
`example`	`find_maximum`	function	Find the maximum value in a list of numbers.
`example`	`find_minimum`	function	Find the minimum value in a list of numbers.
`example`	`is_even`	function	Check if a number is even.
`example`	`is_odd`	function	Check if a number is odd.

Module	Name	Kind	Summary
example	multiply_numbers	function	Multiply two numbers together.
metrics	CustomMetric	class	Framework for custom metrics.
metrics	calculate_accuracy	function	Calculate accuracy for classification.
metrics	calculate_all_metrics	function	Calculate all applicable metrics.
metrics	calculate_convergence_metrics	function	Calculate convergence metrics.
metrics	calculate_effect_size	function	Calculate effect size (Cohen's d).
metrics	calculate_p_value_approximation	function	Approximate p-value from test statistic.
metrics	calculate_precision_recall_f1	function	Calculate precision, recall, and F1 score.
metrics	calculate_psnr	function	Calculate Peak Signal-to-Noise Ratio (PSNR).
metrics	calculate_snr	function	Calculate Signal-to-Noise Ratio (SNR).
metrics	calculate_ssim	function	Calculate Structural Similarity Index (SSIM).
parameters	ParameterConstraint	class	Constraint for parameter validation.
parameters	ParameterSet	class	A set of parameters with validation.
parameters	ParameterSweep	class	Configuration for parameter sweeps.
performance	ConvergenceMetrics	class	Metrics for convergence analysis.
performance	ScalabilityMetrics	class	Metrics for scalability analysis.
performance	analyze_convergence	function	Analyze convergence of a sequence.
performance	analyze_scalability	function	Analyze scalability of an algorithm.
performance	benchmark_comparison	function	Compare multiple methods on benchmarks.
performance	calculate_efficiency	function	Calculate efficiency (speedup / resource_ratio).

Module	Name	Kind	Summary
performance	calculate_speedup	function	Calculate speedup relative to baseline.
performance	check_statistical_significance	function	Test statistical significance between two groups.
plots	plot_3d_surface	function	Create a 3D surface plot.
plots	plot_bar	function	Create a bar chart.
plots	plot_comparison	function	Plot comparison of methods.
plots	plot_contour	function	Create a contour plot.
plots	plot_convergence	function	Plot convergence curve.
plots	plot_heatmap	function	Create a heatmap.
plots	plot_line	function	Create a line plot.
plots	plot_scatter	function	Create a scatter plot.
reporting	ReportGenerator	class	Generate reports from simulation and analysis results.
simulation	SimpleSimulation	class	Simple example simulation for testing.
simulation	SimulationBase	class	Base class for scientific simulations.
simulation	SimulationState	class	Represents the state of a simulation run.
statistics	DescriptiveStats	class	Descriptive statistics for a dataset.
statistics	anova_test	function	Perform one-way ANOVA test.
statistics	calculate_confidence_interval	function	Calculate confidence interval for mean.
statistics	calculate_correlation	function	Calculate correlation between two variables.
statistics	calculate_descriptive_stats	function	Calculate descriptive statistics.
statistics	fit_distribution	function	Fit a distribution to data.
statistics	t_test	function	Perform t-test.
validation	ValidationFramework	class	Framework for validating simulation and analysis results.
validation	ValidationResult	class	Result of a validation check.

Module	Name	Kind	Summary
visualization	VisualizationEngine	class	Engine for generating publication-quality figures.
visualization	create_multi_panel_figure	function	Create a multi-panel figure.

13.0.1 Ways-Specific Analysis Modules

Module	Name	Kind	Summary
database	WaysDatabase	class	SQLAlchemy ORM for ways, rooms, questions database access.
database	Way	class	Data model for individual ways with metadata.
database	Room	class	Data model for House of Knowledge rooms.
database	Question	class	Data model for philosophical questions.
sql_queries	WaysSQLQueries	class	Pre-built SQL queries for ways analysis operations.
ways_analysis	WaysAnalyzer	class	Comprehensive ways characterization and statistical analysis.
ways_analysis	WaysCharacterization	class	Data class for ways analysis results.
network_analysis	WaysNetworkAnalyzer	class	Graph-based network analysis of way relationships.
network_analysis	WaysNetwork	class	Network representation of ways and their connections.
house_of_knowledge	HouseOfKnowledgeAnalyzer	class	Analysis of the 24-room House of Knowledge framework.
house_of_knowledge	HouseStructure	class	Complete structure of the House of Knowledge.
statistics	analyze_way_distributions	function	Statistical analysis of way distributions across categories.

Module	Name	Kind	Summary
`statistics`	`compute_way_correlations`	function	Correlation analysis between way characteristics.
`statistics`	`compute_way_diversity_metrics`	function	Diversity metrics for ways across dimensions.
`metrics`	`compute_way_coverage_metrics`	function	Coverage analysis of ways in framework.
`metrics`	`compute_way_interconnectedness`	function	Interconnectedness metrics for ways network.

14 References

References

Albert-László Barabási. *Linked: The New Science of Networks*. Perseus Books, Cambridge, MA, 2002.

John Dewey. *Democracy and Education*. Macmillan, New York, NY, 1916.

John Dewey. *Logic: The Theory of Inquiry*. Henry Holt and Company, New York, NY, 1938.

Howard Gardner. *Frames of Mind: The Theory of Multiple Intelligences*. Basic Books, New York, NY, 1983.

Jürgen Habermas. *The Theory of Communicative Action*, volume 1. Beacon Press, Boston, MA, 1984.

Malcolm S. Knowles. *The Adult Learner: The Definitive Classic in Adult Education and Human Resource Development*. Gulf Publishing, Houston, TX, 1984.

David A. Kolb. *Experiential Learning: Experience as the Source of Learning and Development*. Prentice Hall, Englewood Cliffs, NJ, 1984.

Thomas S. Kuhn. *The Structure of Scientific Revolutions*. University of Chicago Press, Chicago, IL, 1962.

Andrius Kulikauskas. Ways of figuring things out, 2010–2011. Data collected and organized by Andrius Kulikauskas. This collection of data is all in the Public Domain.

George Lakoff and Mark Johnson. *Metaphors We Live By*. University of Chicago Press, Chicago, IL, 1980.

Mark E. J. Newman. The structure of scientific collaboration networks. *Proceedings of the National Academy of Sciences*, 98(2):404–409, 2001. doi:10.1073/pnas.98.2.404.

Ikujiro Nonaka and Hirotaka Takeuchi. *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. Oxford University Press, New York, NY, 1995.

Pandoc Development Team. Pandoc: A universal document converter, 2024. URL https://pandoc.org/. Accessed: 2024.

Charles Sanders Peirce. *The Essential Peirce: Selected Philosophical Writings*, volume 1. Indiana University Press, Bloomington, IN, 1992.

Jean Piaget. *The Science of Education and the Psychology of the Child*. Orion Press, New York, NY, 1970.

Michael Polanyi. *The Tacit Dimension*. University of Chicago Press, Chicago, IL, 1966.

Hilary Putnam. *Mind, Language and Reality*, volume 2. Cambridge University Press, Cambridge, UK, 1975.

Willard Van Orman Quine. *Word and Object*. MIT Press, Cambridge, MA, 1960.

Richard Rorty. *Philosophy and the Mirror of Nature*. Princeton University Press, Princeton, NJ, 1979.

Lev S. Vygotsky. *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press, Cambridge, MA, 1978.

Duncan J. Watts. *Six Degrees: The Science of a Connected Age*. W. W. Norton & Company, New York, NY, 2003.