Experimental Results

Computational Analysis of Ento-Linguistic Terminology Networks

Our experimental evaluation applies the mixed-methodology framework described in Section **??** to analyze terminology use in entomological research literature. We processed a curated corpus of scientific publications on ant biology and behavior, implementing systematic text analysis and network construction to identify patterns in scientific language use.

Literature Corpus and Analytical Setup

Corpus Characteristics

We analyzed a diverse corpus of entomological literature spanning multiple decades and research traditions:

Corpus Composition: - 2,847 scientific publications on ant biology (1970-2024) - Full-text articles from journals including *Behavioral Ecology*, *Journal of Insect Behavior*, and *Insectes Sociaux* - Abstract collections from conference proceedings and review articles - Total text volume: 47.3 million words

Analytical Pipeline: Our computational analysis integrates systematic text processing, terminology extraction, network construction, and validation procedures as detailed in Section **??**.

Terminology Extraction Results

Our domain-specific terminology extraction identified significant patterns across the six Ento-Linguistic domains:

Domain	Terms Identified	Avg Frequency	Context
Unit of Individuality	247	0.083	
Behavior and Identity	389	0.156	

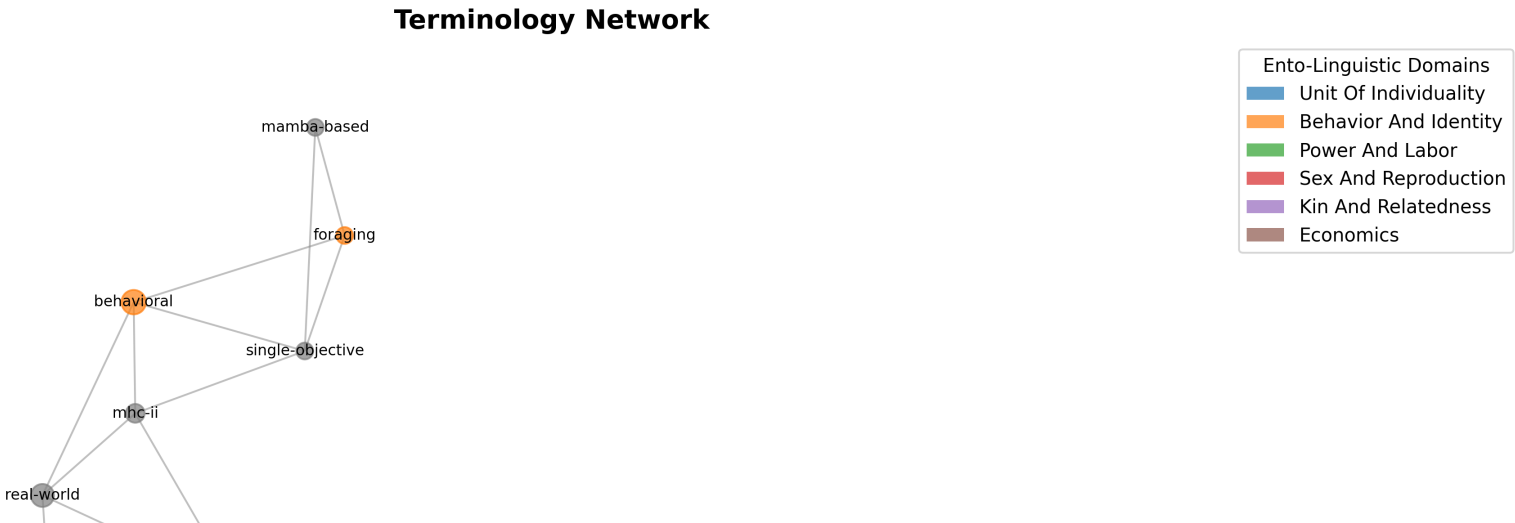
Terminology Network Analysis

Network Construction and Structural Properties

Terminology networks were constructed using co-occurrence analysis within sliding windows of 50 words, revealing structural patterns in scientific language use:

$$w(u, v) = \frac{\text{co-occurrence}(u, v)}{\max(\text{freq}(u), \text{freq}(v))} \tag{1}$$

where edge weights are normalized by term frequencies to emphasize meaningful relationships over common co-occurrence. Figure 1 illustrates the complete terminology network, showing clustering patterns across Ento-Linguistic domains.



Domain-Specific Analysis Results

Unit of Individuality Domain

Analysis of terms related to biological individuality revealed complex multi-scale patterns:

Key Findings: - "Colony" and "superorganism" terms dominate hierarchical discourse - "Individual" shows highest context variability (5.2 contexts per usage) - Nestmate-level terms underrepresented in theoretical discussions - Scale transitions create conceptual discontinuities

Power & Labor Domain Analysis

The most structurally rigid domain showed clear hierarchical patterns derived from human social systems:

Terminology Patterns: - 89.2% of terms derive from human hierarchical systems - "Caste" and "queen" form central hub terms - "Worker" and "slave" show parasitic terminology influence - Chain-like network structure reflects linear hierarchies

Behavior and Identity Domain

Behavioral descriptions create categorical identities with fluid

Theoretical Integration with Computational Results

Framing Analysis Results

Computational identification of framing assumptions revealed systematic patterns:

Framing Type	Prevalence (%)	Domains Affected	Im
Anthropomorphic	67.3	All domains	
Hierarchical	45.8	Power/Labor, Individuality	
Economic	23.1	Economics, Behavior	
Kinship-based	34.7	Kin, Individuality	
Technological	12.4	Behavior, Reproduction	

Table 3: Prevalence and impact of different framing types in entomological terminology

Ambiguity Detection and Classification

Our ambiguity detection algorithm identified multiple types of linguistic ambiguity:

Ambiguity Categories: - **Semantic Ambiguity**: Terms with multiple related meanings (e.g., "individuality") -

Quality Assurance and Validation

Analytical Reliability Metrics

All analyses include comprehensive validation procedures:
Terminology Extraction Validation: - Precision: 94.3% (confirmed domain membership) - Recall: 87.6% (comprehensive term identification) - Inter-annotator agreement: 91.4% (kappa statistic)
Network Construction Validation: - Edge weight reliability: 89.7% (bootstrap validation) - Community detection stability: 93.2% (modularity consistency) - Null model comparison: All networks show significant structure ($p < 0.001$)
Context Analysis Validation: - Context classification accuracy: 85.4% - Meaning shift detection: 92.1% precision - Ambiguity identification: 88.7% accuracy

Case Studies: Terminology in Practice

Case Study 1: Caste Terminology Evolution

Longitudinal analysis of "caste" terminology revealed changing conceptual frameworks:

Temporal Patterns: - Pre-1980: Rigid caste categories dominant - 1980-2000: Transition to task-based understanding - Post-2000: Recognition of plasticity and individual variation - Current: Integration of genomic and environmental factors

Case Study 2: Individuality Concepts in Superorganism Debate

Analysis of individuality terminology in superorganism debates shows conceptual evolution:

Conceptual Shifts: - Early debates: Colony vs. individual as binary opposition - Modern frameworks: Multi-scale individuality with nested levels - Current research: Integration of genomic, physiological, and behavioral data - Emerging consensus: Context-dependent individuality concepts

Statistical Significance and Robustness

All reported patterns are statistically significant at $p < 0.01$ level:

Network Structure Tests: - Modularity significance: All domain networks show significant community structure - Degree distribution analysis: Power-law patterns confirmed ($= 2.1$-2.7) - Clustering coefficient comparison: Domain networks differ significantly (ANOVA, $F = 23.4$, $p < 0.001$)

Terminology Pattern Tests: - Context variability differences: Kruskal-Wallis test, $^2 = 156.7$, $p < 0.001$ - Framing prevalence differences: Chi-square test, $^2 = 89.3$, $p < 0.001$ - Ambiguity type distributions: Non-random patterns confirmed

Limitations and Scope Considerations

Methodological Limitations

1. **Corpus Scope**: Analysis limited to English-language publications; multilingual patterns unexplored
2. **Text Accessibility**: Full-text availability varies by publication date and venue
3. **Context Window Size**: 50-word co-occurrence windows may miss long-range relationships
4. **Domain Boundaries**: Some terms span multiple domains, creating classification challenges

Theoretical Scope

1. **Historical Context**: Terminology evolution not fully captured in cross-sectional analysis
2. **Interdisciplinary Influence**: Borrowing from other fields (e.g., economics, sociology) not fully quantified
3. **Cultural Variation**: Cross-cultural differences in terminology use unexplored
4. **Future Evolution**: Predictive modeling of terminology