

Knowledge Extraction and Synthesis

- Five levels of analysis
 - Element (concepts, constructs and processes)
 - Element relationship
 - Model
 - Theory
 - Theme

Analysis Method Map

	Cypher query	NLP/Text mining	Cluster analysis	Social network analysis	DAG theory	Graph theory
Element	X	X	X				
Element relationship	X			X			
Model	X	X		X	X	X	
Theory	X			X		X	
Theme	X		X			X	

Elements (Concepts, Constructs, and Processes)

Tasks	Descriptions	Suggested Possible Methods
Information Retrieval	Retrieval of information about an element, such as its definitions, associated publications, authors, research models, or theories.	Cypher queries
Element Semantic Similarity	The similarity between two elements based on their element labels or definitions.	Bidirectional Encoder Representations from Transformers (BERT) (Devlin et al. 2018)
Jingle and Jangle Fallacies	The jingle fallacy occurs when two concepts have identical or similar labels but reference different real-world phenomena (Thorndike 1913). The jangle fallacy occurs when two concepts reference identical or similar phenomena but are labeled differently (Kelley 1927).	NLP-based similarity matrix using BERT for all definitions
Theme Identification	Identification of research themes based on concepts.	K-means clustering, or NLP, organize concepts or definitions as vectors and use K-means clustering for grouping.

Example 1: Semantic Similarity of Concepts (based on concept label)

Concept 1	Concept 2	String-based Measure	Corpus-based Measure	Knowledge-based Measure
Internet privacy concerns	User privacy concerns	0.667	0.999	1
Information privacy concerns	Privacy concern	0.408	0.998	1
Risks	Costs	0	0.998	0.167
Trust	Work overload	0	0	0.133
Costs	Benefits	0	0.615	0.308

Example 2: Definitions and Defining Publications for Trust

	Definition	Publication
1	We define trust as the subjective assessment of one party that another party will perform a particular transaction according to his or her confident expectations, in an environment characterized by uncertainty.	Ba, S., & Pavlou, P. A. (2002). Evidence of the Effect of Trust Building Technology in Electronic Markets: Price Premiums and Buyer Behavior. <i>MIS Quarterly</i> , 26(3), 243.
2	Trust is argued to be rooted in perceptions of teammates' ability, benevolence, and integrity (Jarvenpaa et al. 1998). Ability refers to the aptitude and skills that enable an individual to be perceived as competent by teammates (Jarvenpaa et al. 1998; Mayer et al. 1995). Benevolence refers to the extent to which an individual is believed to be willing to help teammates beyond personal motives or individual gain. 1995). Integrity refers to the extent to which an individual is believed to adhere to a set of principles thought to make her dependable and reliable.	Piccoli, & Ives. (2003). Trust and the Unintended Effects of Behavior Control in Virtual Teams. <i>MIS Quarterly</i> , 27(3), 365.
3	Trust is defined as the buyer's intentions to accept vulnerability based on her beliefs that the transaction will meet her confident expectations.	Pavlou, Liang, & Xue. (2007). Understanding and Mitigating Uncertainty in Online Exchange Relationships: A Principal-Agent Perspective. <i>MIS Quarterly</i> , 31(1), 105.
4	The user beliefs in the recommendation agents' competence, benevolence, and integrity. The beliefs that 1) the recommendation agent has the ability, skills, and expertise to perform effectively 2) the recommendation agent cares about the user and acts in the user's interest 3) the recommendation agent adheres to a set of principles (e.g., honesty and promise keeping) that the user finds acceptable,	Xiao, & Benbasat. (2007). E-Commerce Product Recommendation Agents: Use, Characteristics, and Impact. <i>MIS Quarterly</i> , 31(1), 137.
5	Trust reflects one party's belief that its requirements will be fulfilled through future actions undertaken by the other party.	Goo, Kishore, Rao, & Nam. (2009). The Role of Service Level Agreements in Relational Management of Information Technology Outsourcing: An Empirical Study. <i>MIS Quarterly</i> , 33(1), 119.
6	Trust is conceptualized as a single variable and refers to general confidence in the website.	Cyr, Head, Larios, & Pan. (2009). Exploring Human Images in Website Design: A Multi-Method Approach. <i>MIS Quarterly</i> , 33(3), 539.
7	The extent to which a buyer perceives in a seller's ability (i.e., skills, competencies, and characteristics in seller his/her products online), integrity (adhering to a set of principles that the buyer finds acceptable), and benevolence (i.e., doing good toward the buyer).	Ou, C. X., Pavlou, P. A., & Davison, R. M. (2014). Swift Guanxi in Online Marketplaces: The Role of Computer-Mediated Communication Technologies. <i>MIS Quarterly</i> , 38(1), 209–230.

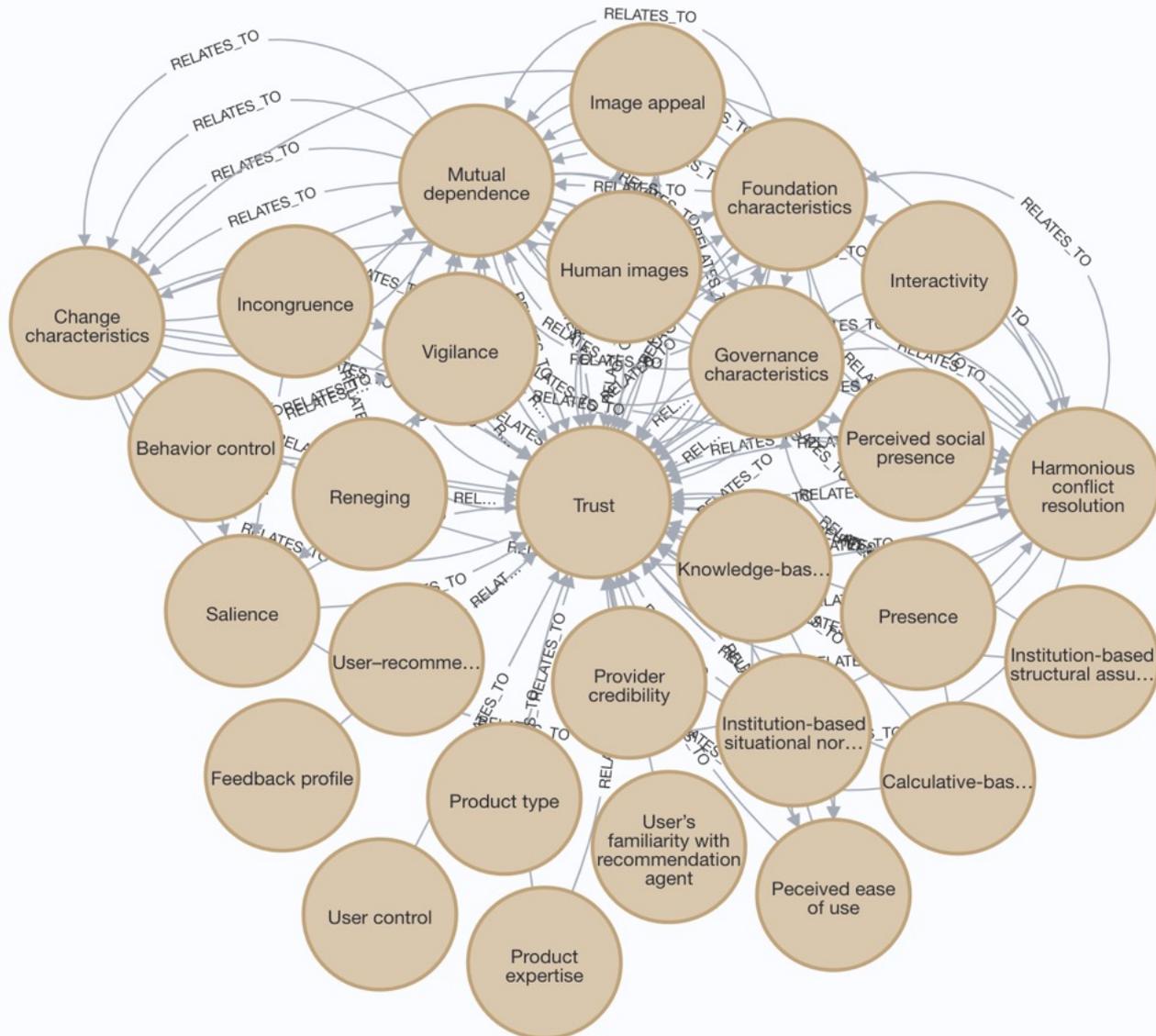
Example 3: Concept Similarity for Trust Definitions (based on concept definitions)

Definition	1	2	3	4	5	6	7
1	—	—	—	—	—	—	—
2	0.60	—	—	—	—	—	—
3	0.80	0.63	—	—	—	—	—
4	0.57	0.76	0.63	—	—	—	—
5	0.81	0.61	0.77	0.57	—	—	—
6	0.59	0.50	0.57	0.49	0.46	—	—
7	0.38	0.57	0.52	0.76	0.38	0.45	—
Means	0.62	0.61	0.66	0.63	0.60	0.51	0.58

Element Relationships

Tasks	Descriptions	Suggested Possible Methods
Information Retrieval	Retrieval of elements related to an element, such as its antecedents, consequents, all paths starting or ending with it, or between two elements.	Cypher queries to retrieve connected elements. Graph theory methods such as shortest path analysis.
Network Importance	The importance of an element in a knowledge network	Social network analysis measures, such as degree, betweenness, and closeness centralities.

Example 4: Antecedents of Trust



Example 5: Causal Paths Starting or Ending with Trust

Trust → Perceived information asymmetry → Perceived uncertainty → Purchase intentions → Actual purchases

Trust → Information security concerns → Perceived uncertainty → Purchase intentions → Actual purchases

Effective use of feedback system → Presence → Trust

Effective use of instant messenger → Interactivity → Trust

Satisfaction ← User control → Trust

Behavior control → Vigilance → Trust

Incongruence → Salience → Trust

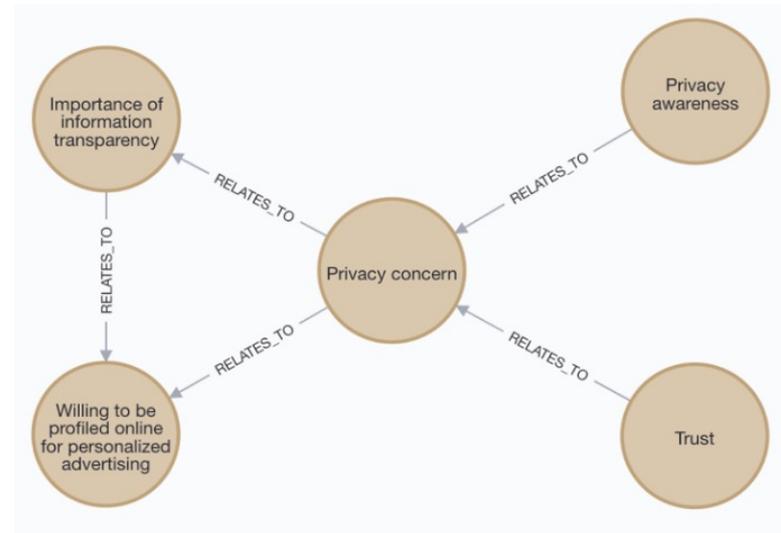
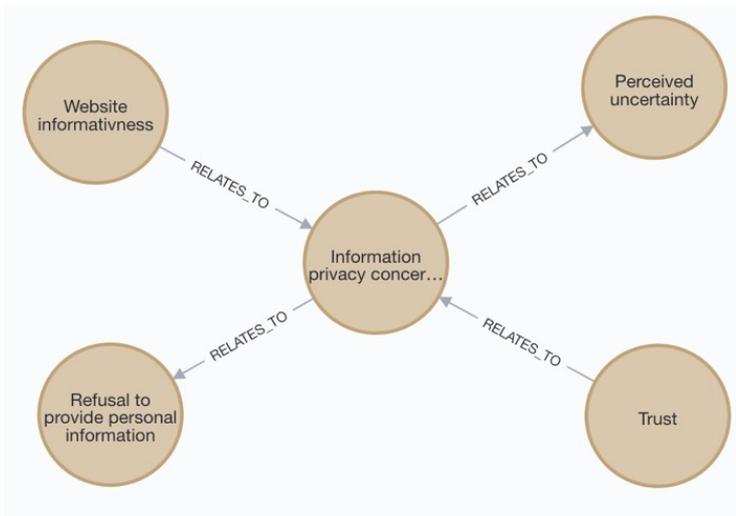
Example 6: Concept Network Centrality Measures

Concept	Betweenness centrality	Closeness centrality	Outdegree centrality	Indegree centrality
Trust	726	0.38	17	61
Perceived uncertainty	126	0.26	2	4
Mutual dependence	81	0.28	28	16
Product expertise	65	0.31	9	9
Purchase intentions	44	0.21	1	2
Harmonious conflict resolution	40	0.28	15	10
Perceived information asymmetry	38	0.34	1	3
Fears of seller opportunism	38	0.34	1	3
Information privacy concerns	38	0.29	1	3
Information security concerns	38	0.29	1	3

Model

Tasks	Descriptions	Suggested Possible Methods
Jungle conundrum	Identification of similar causal models in a large knowledge network (Song et al. 2021b)	Graph isomorphism analysis (Song et al. 2021b)
Endogeneity issues	Identification of potential endogeneity issues, such as omitted variables and simultaneity issues.	DAG analysis methods (Textor et al. 2011), such as identifying direct paths, backdoor paths, and colliders.
Critical elements	Identification of critical elements in a knowledge network	Social network methods, such as structural cohesion analysis to identify the critical nodes that connect a model or bring together different models.

Example 7: Model Conceptual Isomorphism



Conceptual isomorphism score=0.636

Theory

Tasks	Descriptions	Suggested Possible Methods
Identification of theories	Retrieve theories	Cypher queries
Theory impact	Analysis of the impact of a theory in a knowledge network	Cypher queries to report the frequency of a theory appearing in a knowledge network.

Example 8: Theories Referenced in the *MISQ* Trust Curation

Theory	Frequency
Agency theory	3
Technology acceptance model	2
Social exchange theory	1
Social capital theory	1
Theory of planned behavior	1
Theory of reasoned action	1
Social presence theory	1
Theories of human information processing	1
The theory of interpersonal similarity	1
The theories of trust formation	1
The theories of satisfaction.	1
Innovation diffusion theory	1
Incomplete contract theory	1
Relational exchange theory	1
Visual rhetoric theory	1
Message exchange theory	1
Adaptive structuration theory	1
Media synchronicity theory	1

Theme

Tasks	Descriptions	Suggested Possible Methods
Knowledge fragmentation	Evaluation of the cumulative nature of a knowledge network	Network density to compare networks.
Literature gap	Identification of gaps in the literature	Social network analysis to identify structural holes and weak ties.
Comparative analysis	Tracking the development of a theme by journal and time	Cluster analysis (Shmueli et al. 2017) to group concepts, definitions, and theories to identify themes in a set of journals and over defined time periods.
Model integration or simplification	Condense and simplify causal models related to a particular topic area	Graph summarization methods, such as clustering, classification, pattern set mining, and outlier detection (Liu et al. 2018)

Supporting Tools

- Supporting app for coding
 - Codasaurus
- Supporting app for knowledge extraction and synthesis
 - Analysaurus

Q&A

Thank you very much!

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