

TEACHING RESEARCH:

Mind Mapping & Pathfinding Techniques



Agenda

- Types of Thinking
- Mind Mapping
 - The Power of Keywords
 - The Power of Context
 - Concept Mapping
- Pathfinding
 - Maintaining Objectivity
 - Decision/Concept Trees
- Resources

Types of Thinking

CRITICAL THINKING

Asks clarifying questions

Based in Logic

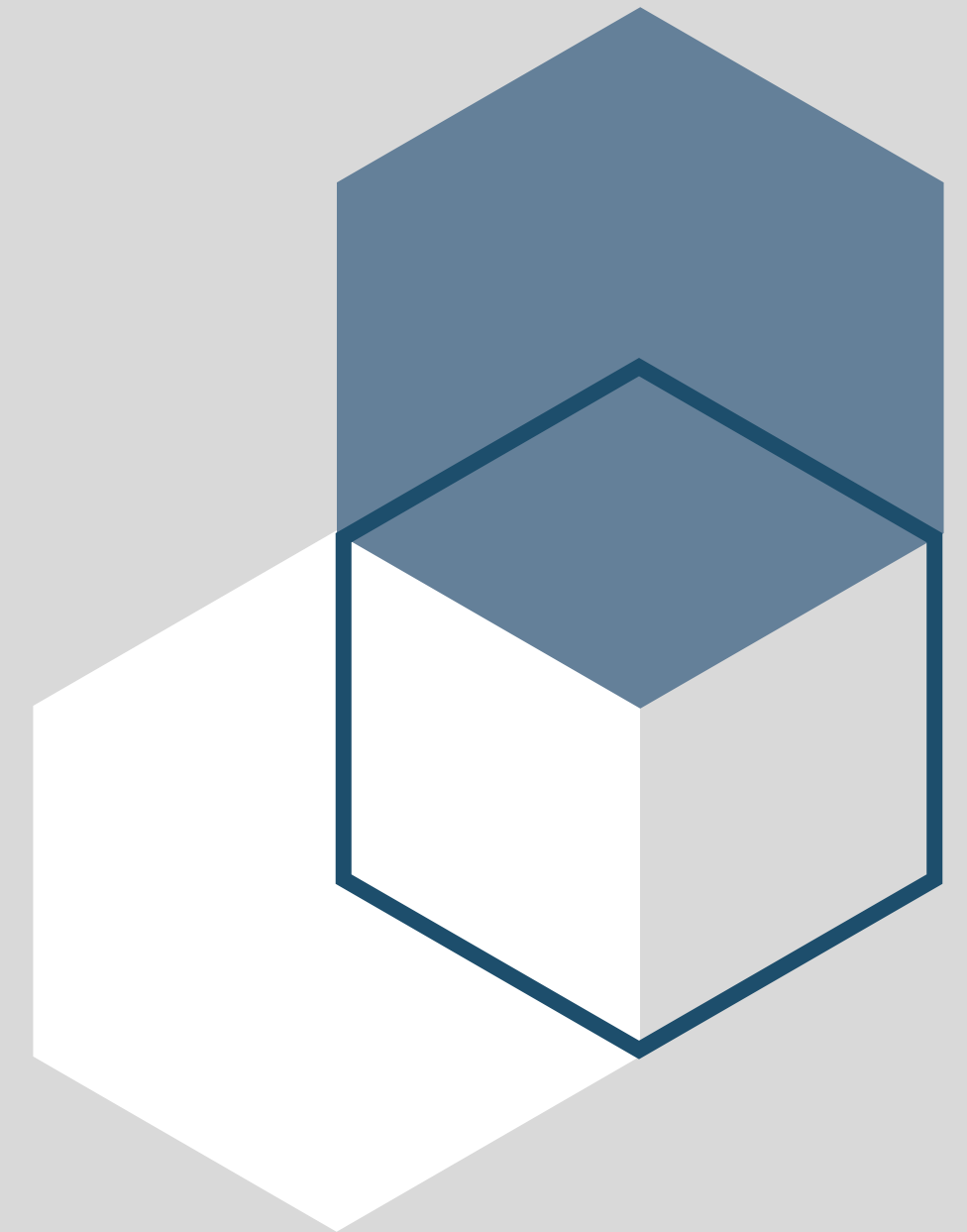
CREATIVE THINKING

Synthesizes ideas to invent new outcomes

Outside the box

[Critical Thinking Resource Guide and Tutorial](#)

MIND MAPPING: NEURAL NETWORKS



THE POWER OF KEYWORDS

Defining "keyword"

key·word
/ˈkē,wərd/

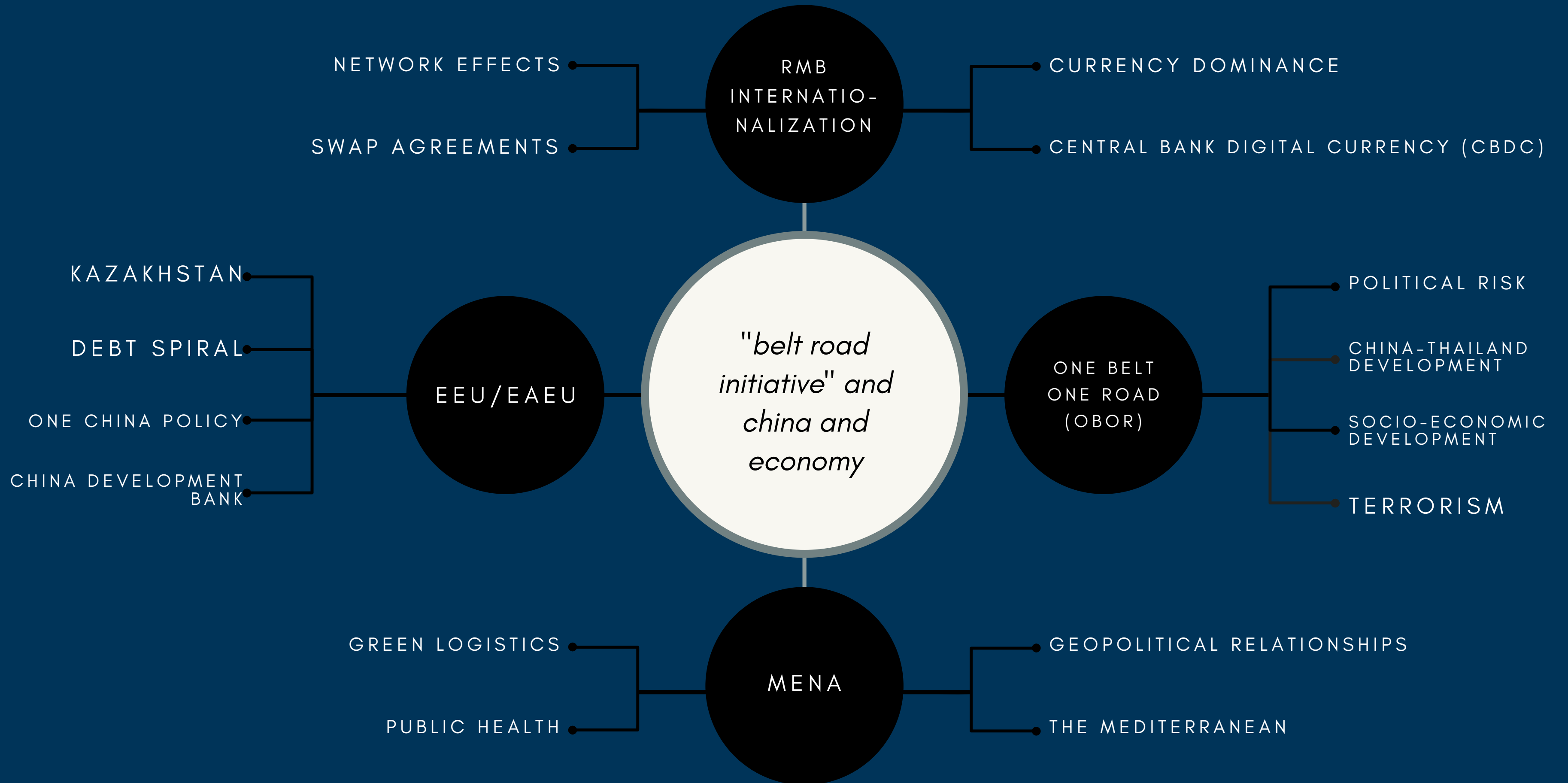
noun

1. a word or concept of great significance. "homes and jobs are the keywords in the campaign"
 - a word that acts as the key to a cipher or code.
 - an informative word used in an information retrieval system to indicate the content of a document.
 - a significant word mentioned in an index.

KEYWORD MAPPING



MIND MAPPING



THE POWER OF CONTEXT

It always depends.

- **Who is asking the question?**
- **Why are they asking?**
- **Where was the source found? (format/hosting)**
- **When was the source created (timeframe)**
- **Who is the creator (consider their biases)**

THE POWER OF CONTEXT

It always depends.

Example Question:

The DOD seeks to better understand the mood/climate of a country's current political administration through the collection and analysis of numerous sources within a defined time frame.

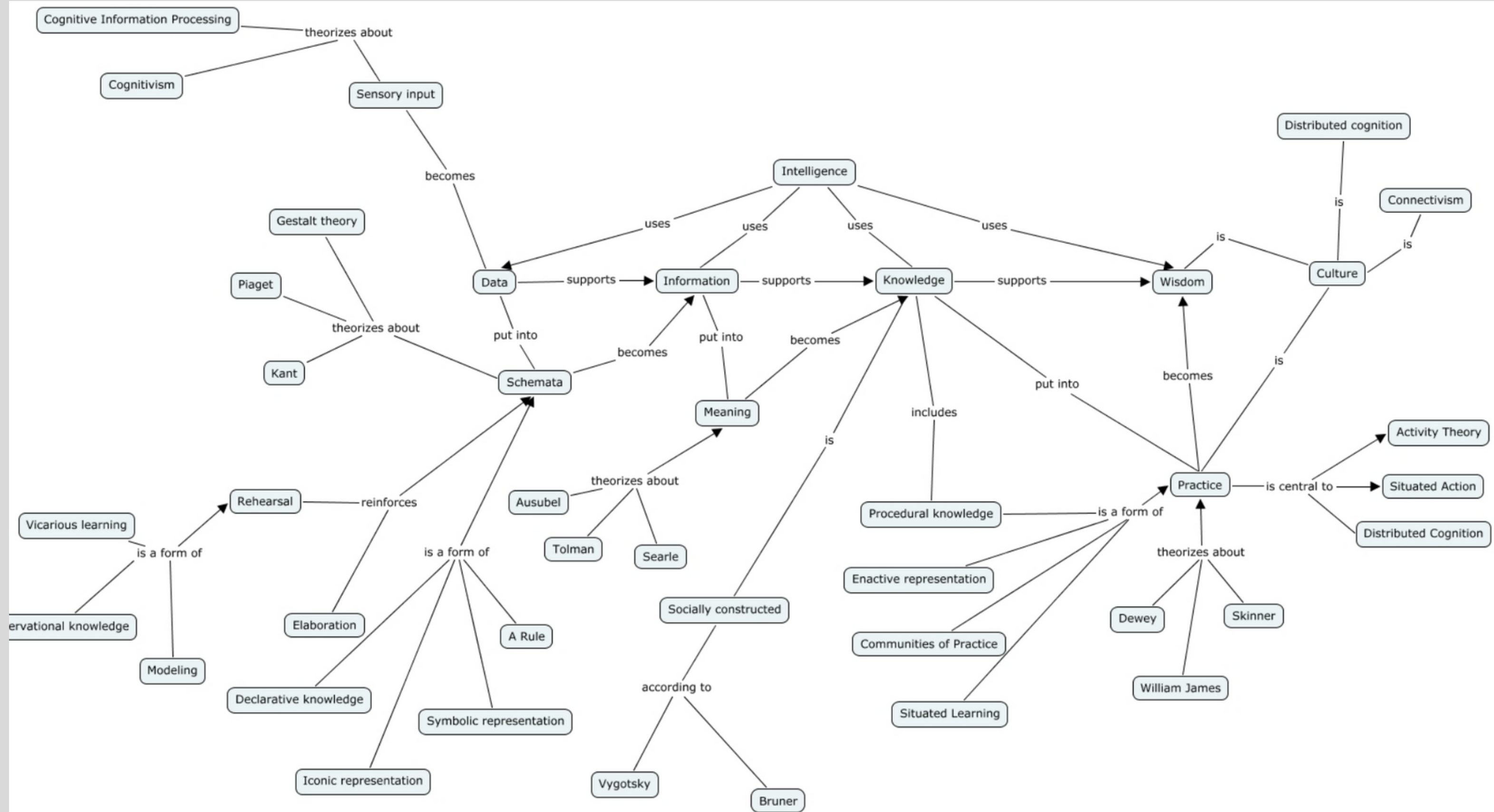
Potential Source:



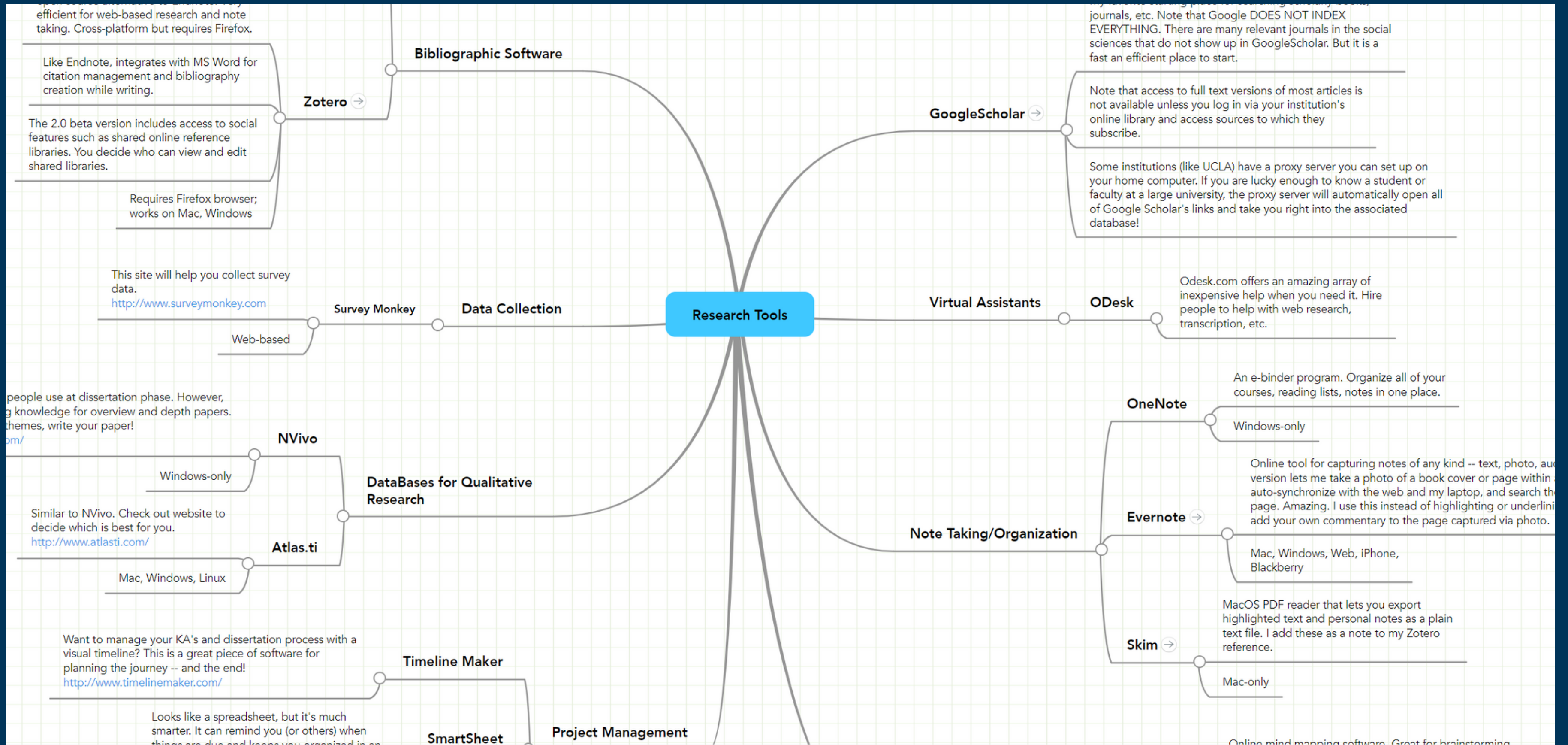
An angry Reddit post by the Foreign Affairs Minister that insinuates a neighboring country has purposefully undermined peace talks through the testing of new air-to-surface missiles.

Yes or No?

CONCEPT MAPPING

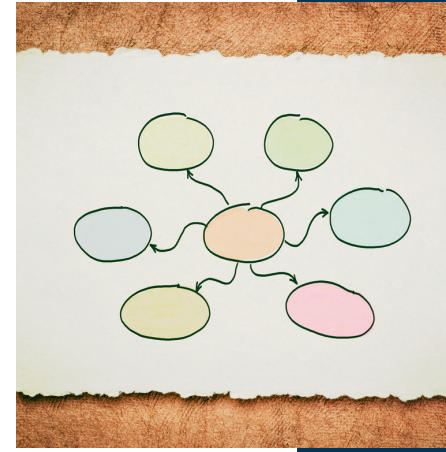


CONCEPT MAPPING: LIT REVIEW



Teaching Mind Mapping for Research

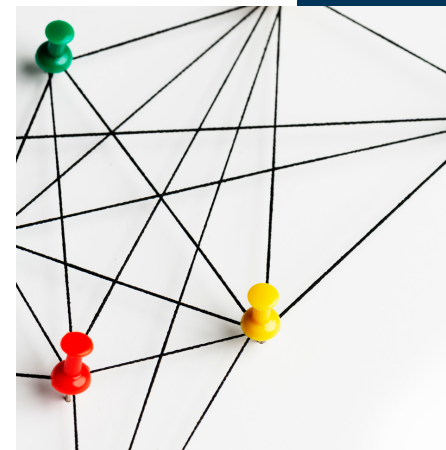
PROCESS FOR INSTRUCTION



Create a Keyword Map during the instruction session when demonstrating search techniques. Begin keyword mapping with terms from the first search.



Have students help you build a Mind Map from the Keyword Map after completing a second and third round of searches



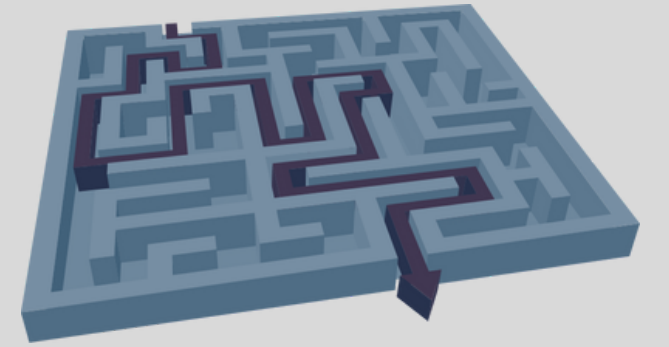
After three to four of searches, discuss the relationships between keyword terms and how they are linked/related. Use this discussion to introduce the concept of Context. Add labels to your connecting lines to transform it into a Concept Map



Create new map (or continue add to the existing map) by using the Concepts as idea bubbles and matching the sources found during the keyword searches



PATHFINDING



Pattern Recognition and Observation

Definitions:

"The plotting by a computer application of the best route between two points" - definitions.net

"one that discovers a way especially : one that explores untraversed regions to mark out a new route" - merriam-webster.com

Pathfinding in research:

Examining what you already know in relation to the available sources to find unique pathways forward.



Special Section on CEIG 2021

Towards a human-like approach to path finding

Vahid Rahmani ^a, Nuria Pelechano ^b

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<https://doi.org/10.1016/j.cag.2021.08.020>

Abstract

Path finding for autonomous agents has been traditionally driven by finding paths, typically by using A* search or any of its variants. When it comes to virtual humanoids, traditional approaches rarely consider aspects of human orientation. In this work, we propose a new path finding algorithm, inspired by research regarding how the brain learns and builds cognitive maps. Our approach represents the space as a hexagonal grid with counters, based on brain research that investigated how memory cells are fired. Our path finder then combines this with exploring unknown environments while building such a cognitive map, using a modified heuristic that takes into account the cognitive map. This approach shows how as the agent learns the environment, the paths become shorter



Technical Section

Multi-agent parallel hierarchical path navigation meshes (MA-HNA*) ☆

Nuria Pelechano

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[cag.2019.10.006](https://doi.org/10.1016/j.cag.2019.10.006)

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One of the main challenges in video games is to compute paths as efficiently as possible. As both the size of the environments and the number of agents increase, it becomes harder to obtain results in real time under the constraints of memory and computing resources. Hierarchical approaches, such as HNA* (Hierarchical Navigation Meshes) can compute paths more efficiently, although they suffer from bottlenecks for some configurations of the hierarchy. For other configurations, the method suffers from a bottleneck in the step that connects the Start and Goal positions with the bottleneck can drop performance drastically. In this paper we present two methods to overcome the HNA* bottleneck and thus obtain a performance boost for all configurations. The first method relies on further memory storage, and the



Simulating travel paths of construction site workers via deep reinforcement learning considering their spatial cognition and wayfinding behavior

Minguk Kim ^a, Youngjib Ham ^b, Choongwan Koo ^a, Tae Wan Kim ^a

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Abstract

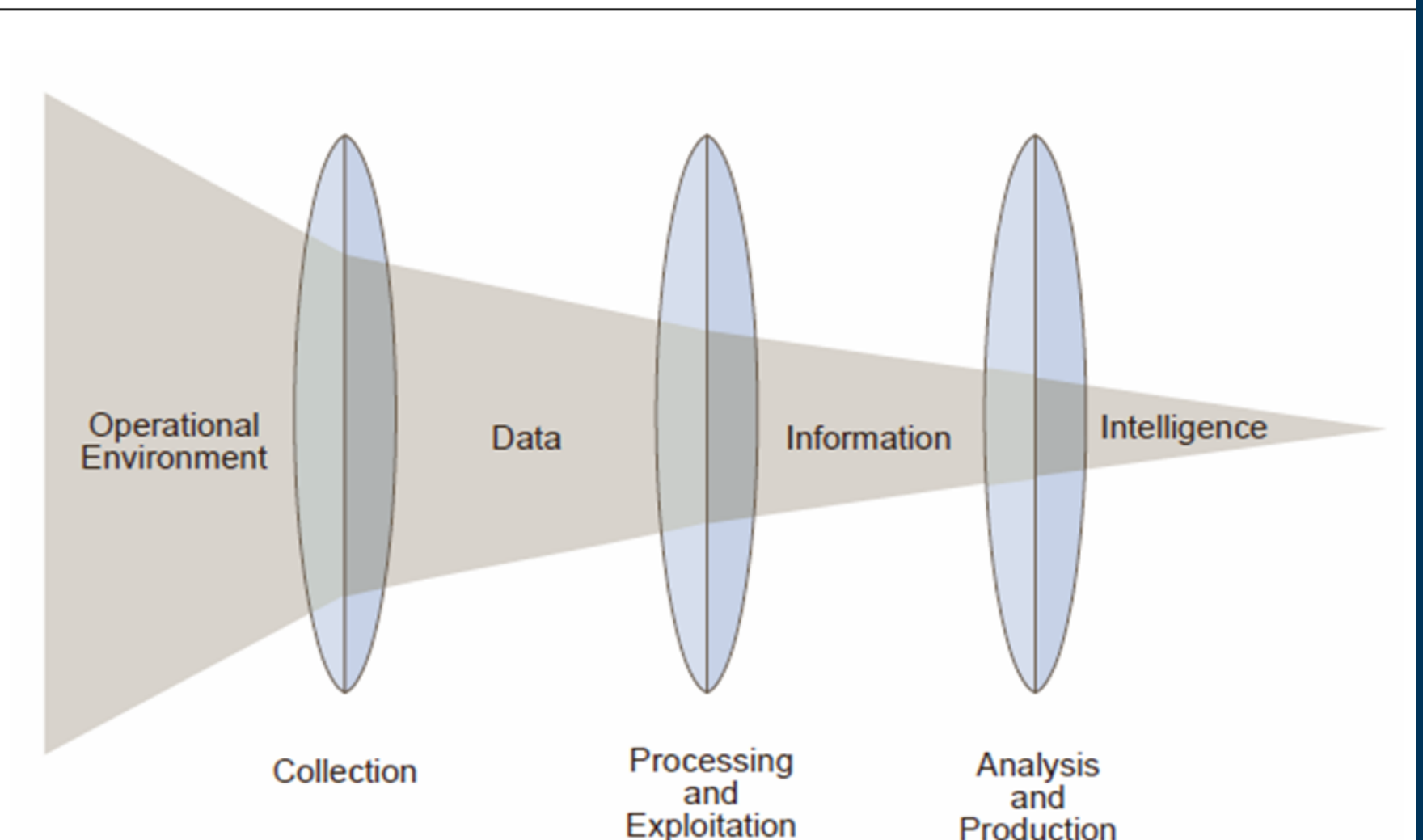
Many optimization methods for construction site layout planning (CSLP) generate the shortest path of workers to calculate traveling costs and site safety performance. However, this approach often degrades the solution's reliability because workers in real-life situations do not necessarily take the shortest path to their chosen destination. Thus, this paper proposes a novel approach for generating realistic paths that mimic their wayfinding decision-making process. This approach uses deep reinforcement learning, for which the framework to facilitate its use includes the following elements: (1) the required properties and functions for site objects; and (2) the state, action space, and reward functions intended. The similarity between the paths simulated and the real workers' trajectories has been validated better by 17.8% than the traditional A* algorithm.

PATHFINDING: MAINTAINING OBJECTIVITY



IC ANALYTIC STANDARDS - OBJECTIVITY

Relationship of Data, Information and Intelligence



KEY ASSUMPTIONS CHECK

A TRADECRAFT PRIMER: STRUCTURED ANALYTIC
TECHNIQUES FOR IMPROVING INTELLIGENCE
ANALYSIS

Common Perceptual and Cognitive Biases

Perceptual Biases

Expectations. We tend to perceive what we expect to perceive. More (unambiguous) information is needed to recognize an unexpected phenomenon.

Resistance. Perceptions resist change even in the face of new evidence.

Ambiguities. Initial exposure to ambiguous or blurred stimuli interferes with accurate perception, even after more and better information becomes available.

Biases in Evaluating Evidence

Consistency. Conclusions drawn from a small body of consistent data engender more confidence than ones drawn from a larger body of less consistent data.

Missing Information. It is difficult to judge well the potential impact of missing evidence, even if the information gap is known.

Discredited Evidence. Even though evidence supporting a perception may be proved wrong, the perception may not quickly change.

Biases in Estimating Probabilities

Availability. Probability estimates are influenced by how easily one can imagine an event or recall similar instances.

Anchoring. Probability estimates are adjusted only incrementally in response to new information or further analysis.

Overconfidence. In translating feelings of certainty into a probability estimate, people are often overconfident, especially if they have considerable expertise.


Biases in Perceiving Causality

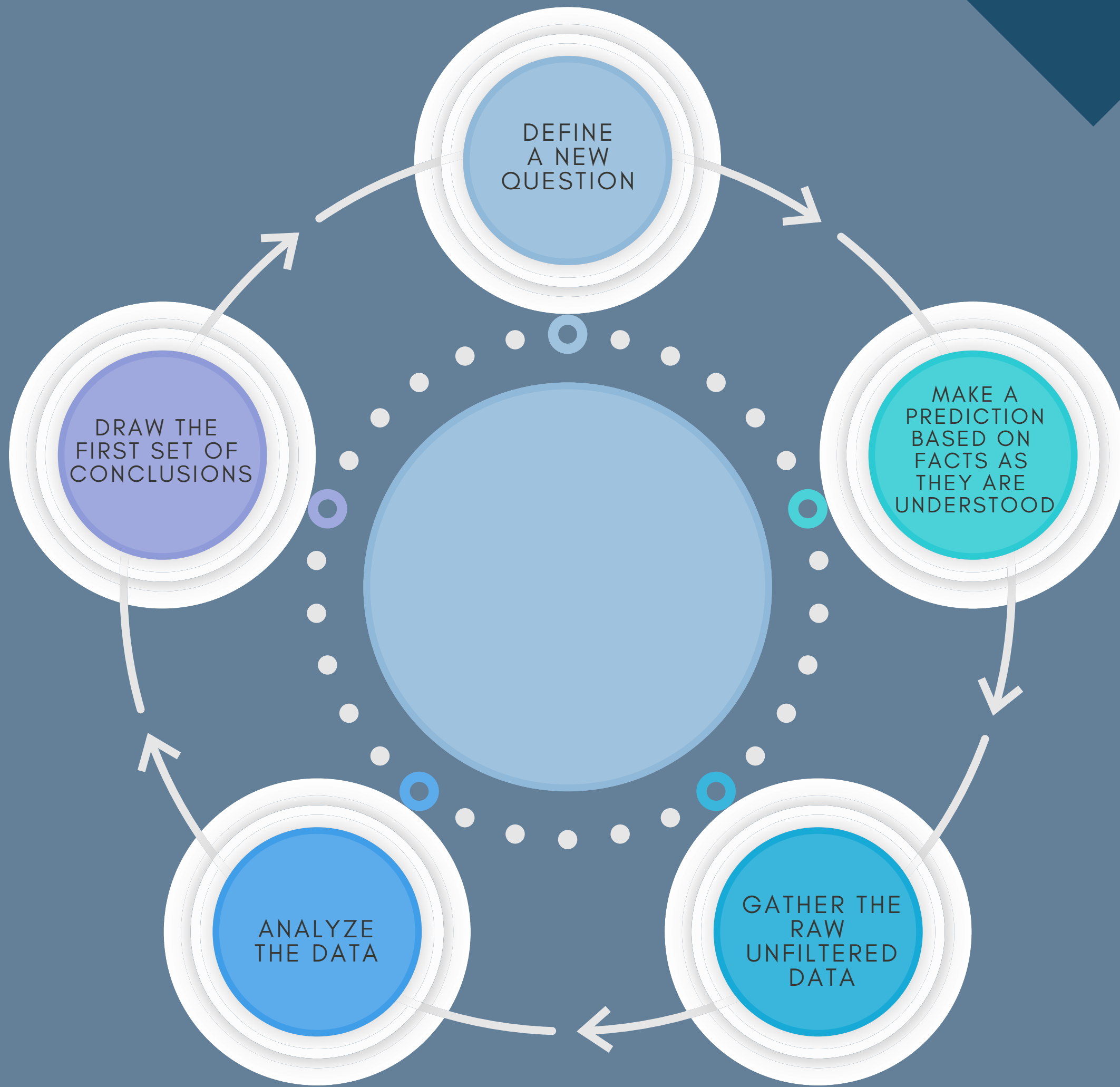
Rationality. Events are seen as part of an orderly, causal pattern. Randomness, accident and error tend to be rejected as explanations for observed events. For example, the extent to which other people or countries pursue a coherent, rational, goal-maximizing policy is overestimated.

Attribution. Behavior of others is attributed to some fixed nature of the person or country, while our own behavior is attributed to the situation in which we find ourselves.

METHOD:

REINFORCES THE USE OF LOGIC

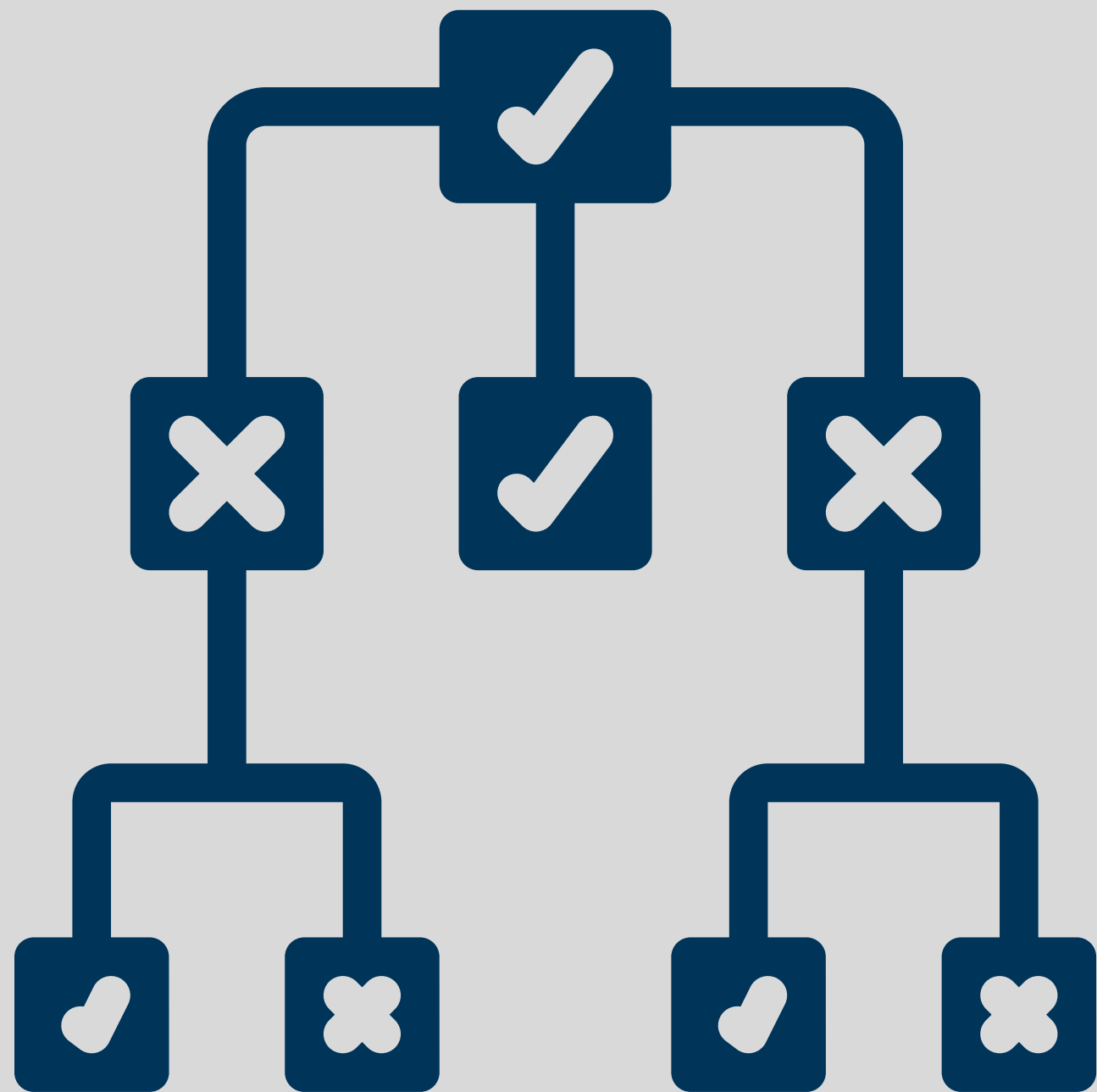
-
1. Review the assumptions made in the prompt or subject content
 2. Make a note of everything you think you know as fact
 3. Systematically question why you believe those facts to be true
 4. Create another list of assumptions that contains only items that have to be true, and consider what would cause your assumptions to be untrue
-
- 



The Scientific Method

Question assumptions at every stage

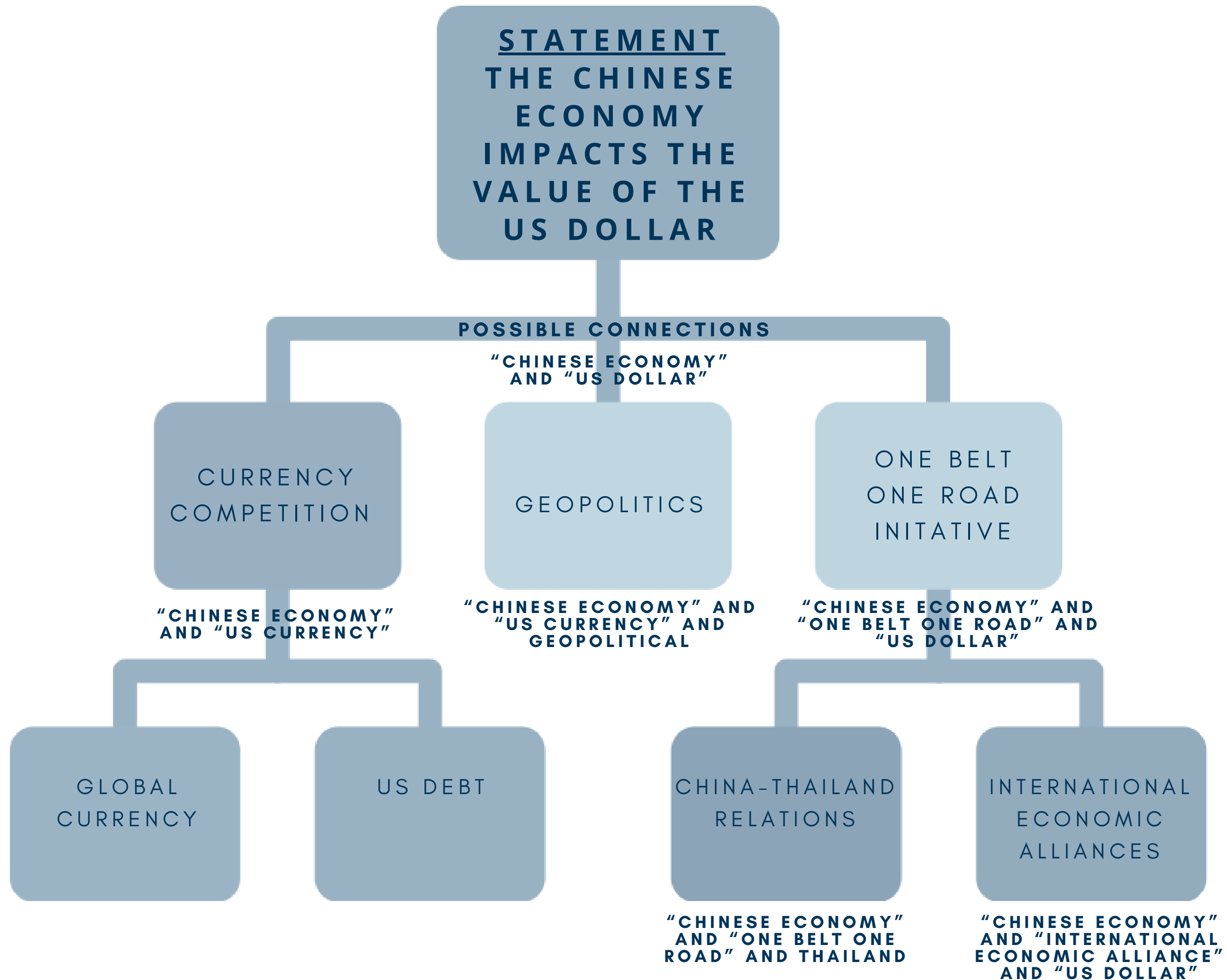
PATHFINDING: DECISION/CONCEPT TREES



*Mind Maps begin with
a topic.*

*Decision Trees begin with
a choice.*





Mind Mapping & Decision Tree Resources

- [MindMeister.com](https://www.mindmeister.com) (free)
- [TheBrain.com](https://www.thebrain.com) (free)
- [Draw.io](https://draw.io) (free)
- [MindMup.com](https://www.mindmup.com) (free)
- [MindMapping.com](https://www.mindmapping.com) (free teaching resources, paid mind map building)
- [Intellectus Statistics](https://www.intellectusstatistics.com) (free)
- [Creately.com](https://www.creately.com) (free account or low cost personal account)





Thank you!

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