

# *Intelligence Analysis Bottom-Up*

## *Part 2*

*John Beverley*

Assistant Professor, *University at Buffalo*  
Co-Director, National Center for Ontological Research  
Affiliate Faculty, *Institute of Artificial Intelligence and Data Science*

# *Outline*

- Using Cognitive Heuristics and Addressing Bias
- Confirmation Bias and Serial Position Effects
- Arguments in the Intelligence Cycle

# *Outline*

- Using Cognitive Heuristics and Addressing Bias
- Confirmation Bias and Serial Position Effects
- Arguments in the Intelligence Cycle

# *Question*

- Are there more words in the English language that begin with the letter “k” or that have the letter “k” in the third position?

# *Availability Bias*

- Are there more words in the English language that begin with the letter “k” or that have the letter “k” in the third position?

**There are about 3 times as many words in English that have “k” in the third position**

<https://www.bestwordlist.com/p/k/1/wordsthirdletterk.htm#:~:text=There%20are%201539%20words%20with%20K%20as%20third%20letter>

# *Question*

- Do you think the number of African countries in the U.N. is greater than or less than 10?
- How many African countries do you think are members of the U.N.?

# *Anchor Bias*

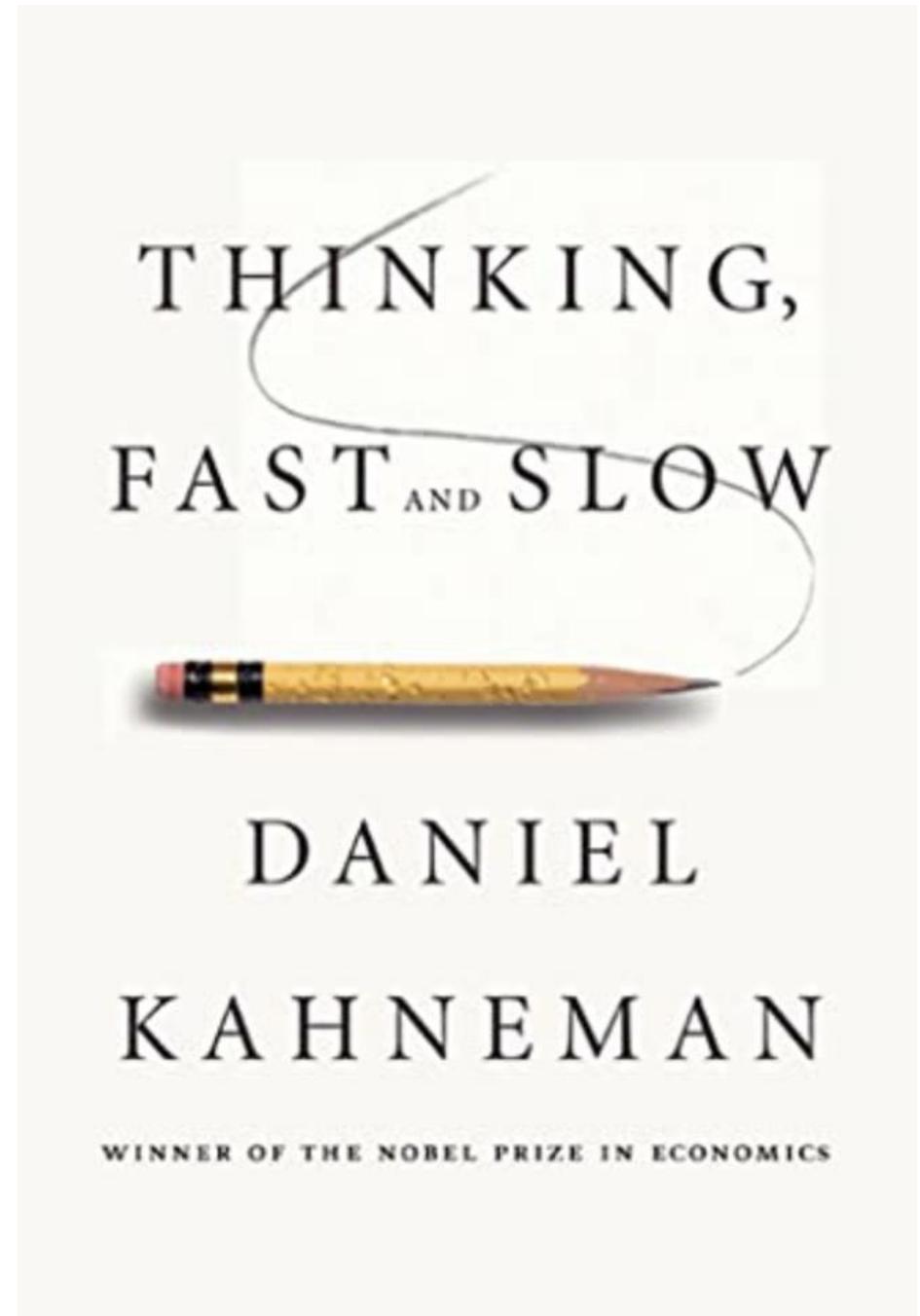
- Do you think the number of African countries in the U.N. is greater than or less than 10?
- How many African countries do you think are members of the U.N.?

**There are 54 African nations in the U.N.**

Many provide a significantly lower number given the setup, as they've been *anchored to the number being around 10*

# *System 1 & System 2*

- Generally speaking, we often provide intuitive responses to problems we experience in the real world
- This is true for **recall questions**
- In the preceding questions you are attempting to recall information and reason based on that recall



# *Question*

- Reflect on the following puzzle:
  - A baseball bat and a ball cost \$1.10 together.
  - The bat costs \$1.00 more than the ball.

**How much does the ball cost?**

# *Solution*



Price of Bat + Price of Ball = \$1.10

- *Conditions*
  - A baseball bat and a ball cost \$1.10 together.
  - The bat costs \$1.00 more than the ball.

# *Solution*

$$\begin{array}{c} \$1.00 + \text{Price of Ball} \\ \hline \text{Price of Bat} + X = \$1.10 \end{array}$$

- *Conditions*
  - A baseball bat and a ball cost \$1.10 together.
  - The bat costs \$1.00 more than the ball.

# *Solution*

$$\begin{array}{c} \$1.00 + X \\ \hline \text{Price of Bat} + X = \$1.10 \end{array}$$

- *Conditions*
  - A baseball bat and a ball cost \$1.10 together.
  - The bat costs \$1.00 more than the ball.

# *Solution*

$$\text{Price of Bat} + \text{Price of Ball} = \$1.10$$

$$\text{Price of Bat} + X = \$1.10$$

$$\$1.00 + X + X = \$1.10$$

$$\$1.00 + 2*X = \$1.10$$

$$2*X = \$1.10 - \$1.00$$

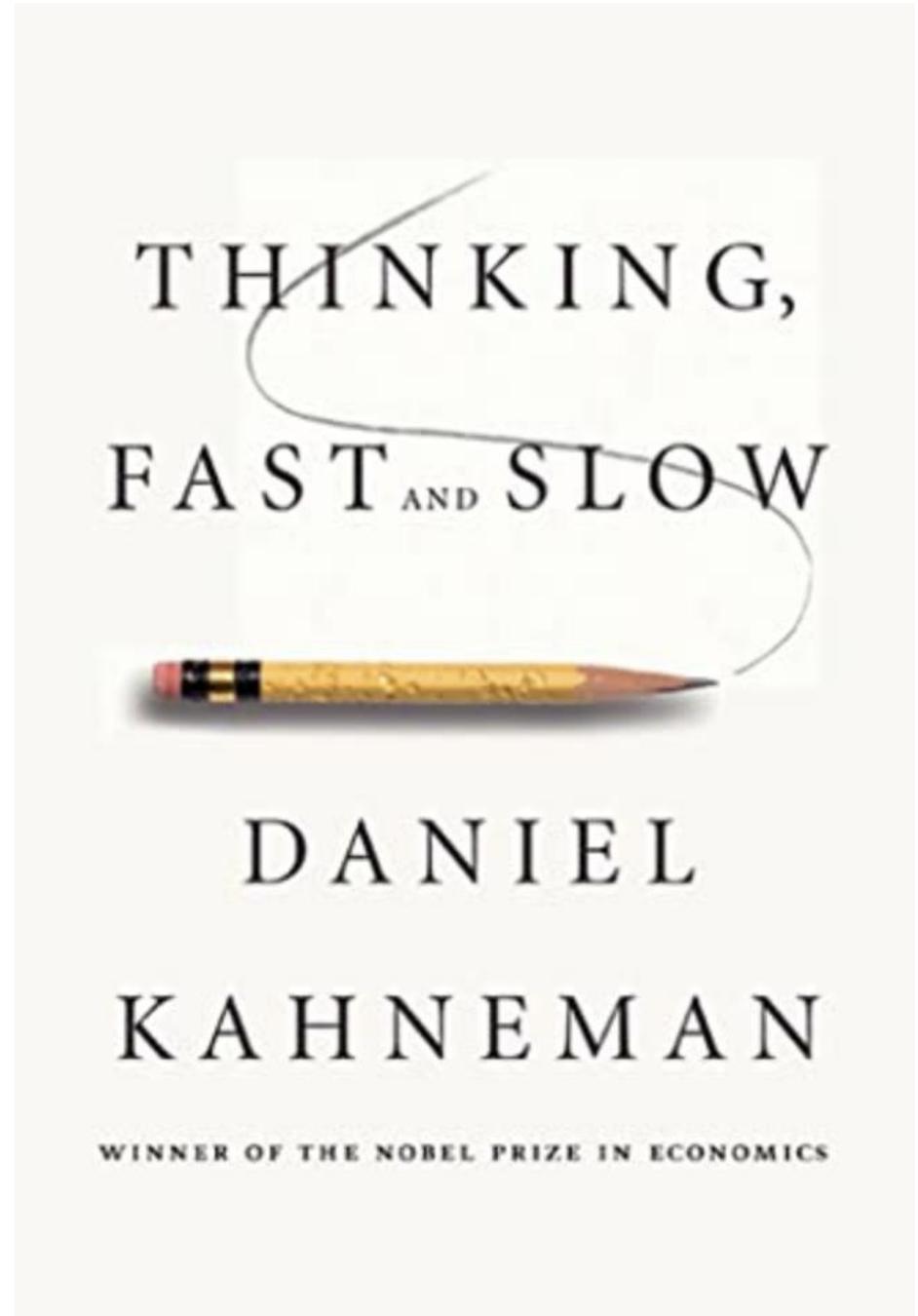
$$2*X = .10$$

$$X = .05$$



# *System 1 & System 2*

- Generally speaking, we often provide intuitive responses to problems we experience in the real world
- This is true for **analytic questions**
- The bat and ball puzzle is an analytic problem, requiring calculation and precision





# *Cognitive Heuristics and Bias*

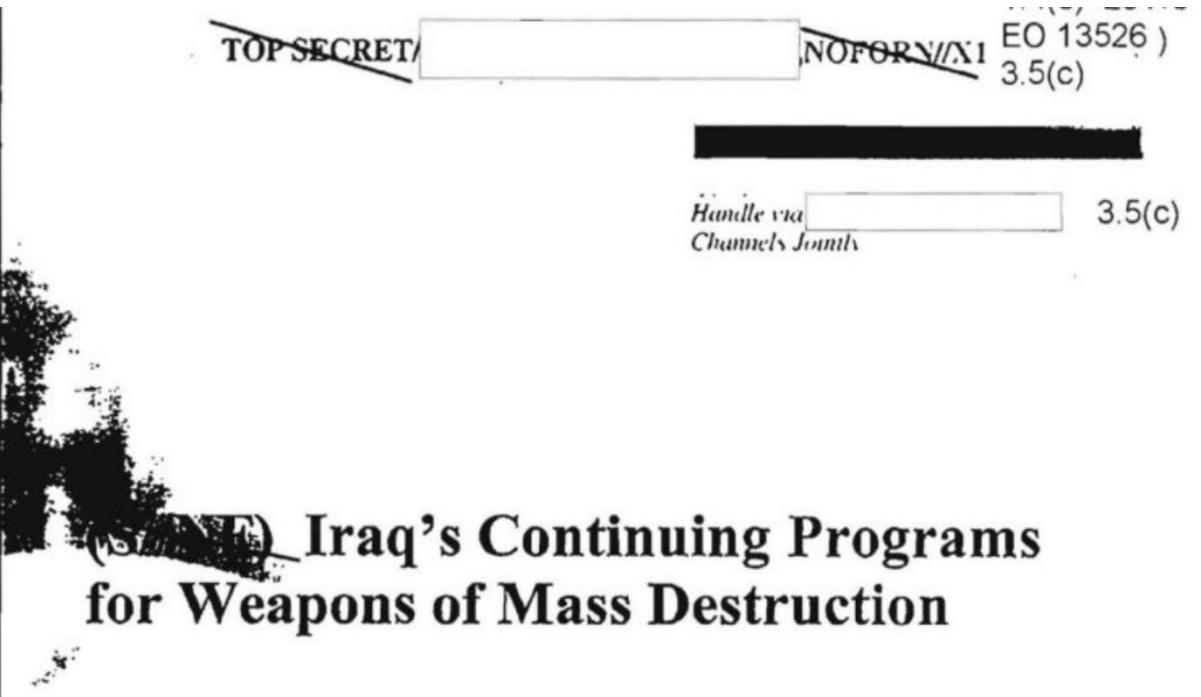
- It is often valuable to rely on cognitive heuristics, such as anchoring and availability
- Imagine how challenging daily life would be if you had to methodically calculate answers to questions such as:
  - Whose turn is it at a fourway stop?
  - On which side of the hall should I walk?
  - How much ice cream shall I have for dessert?
  - Should you open a scammy-looking email?

# *Cognitive Heuristics and Bias*

- Overreliance on such cognitive heuristics is what trends towards **cognitive bias**
- Methodical reflection can help us avoid such cognitive trends, facilitating a more intentional engagement with the world
- Which is quite valuable in high stake situations...

# *National Intelligence Estimate (NIE)*

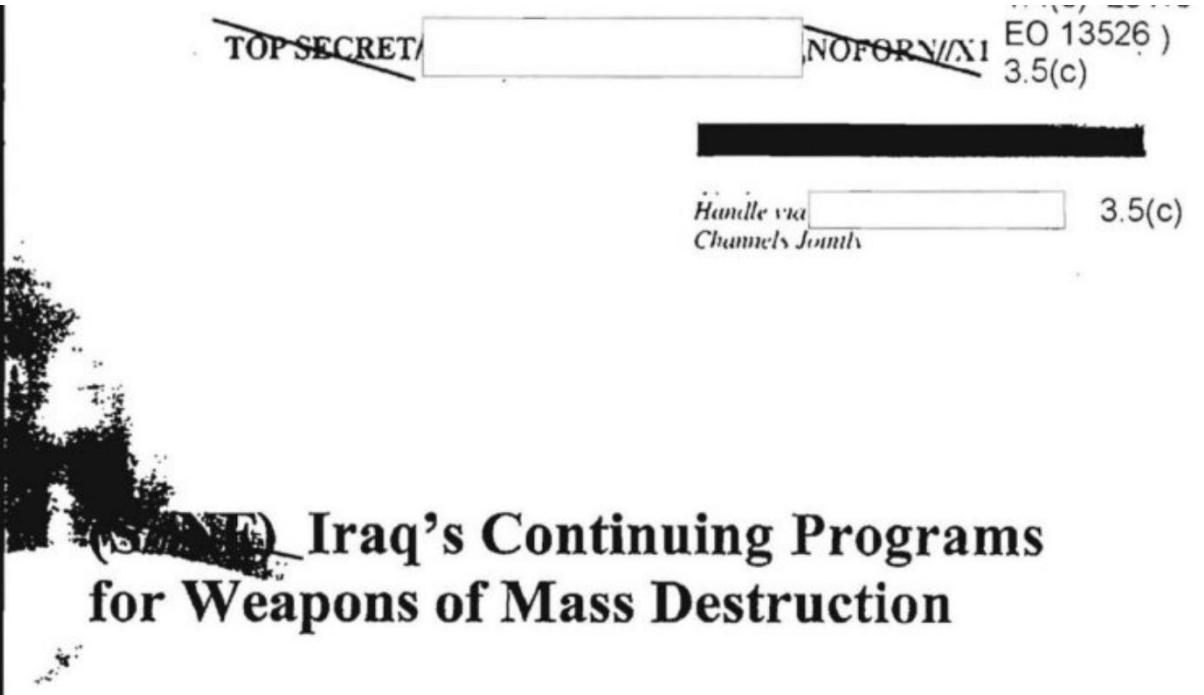
- Despite stating intelligence agencies had limited information about the potential counter-intelligence in Iraq at the time, tentative conclusions were drawn that Iraq continued its weapons of mass destruction programs



# *National Intelligence Estimate (NIE)*

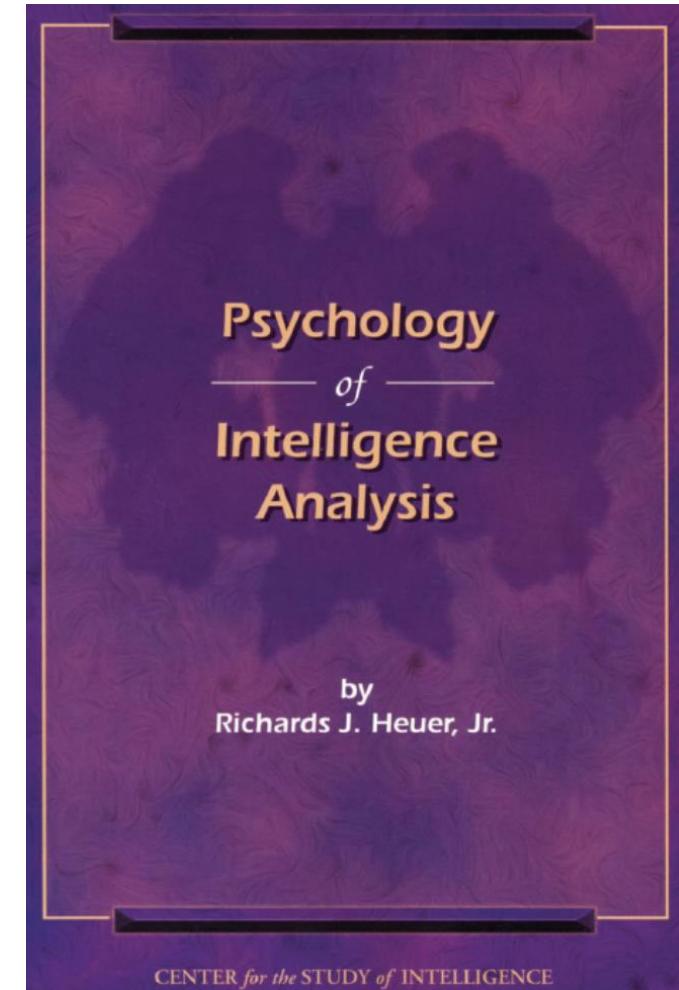
- Despite stating intelligence agencies had limited information about the potential counter-intelligence in Iraq at the time, tentative conclusions were drawn that Iraq continued its weapons of mass destruction programs

Failure to  
evaluate  
alternative  
hypotheses



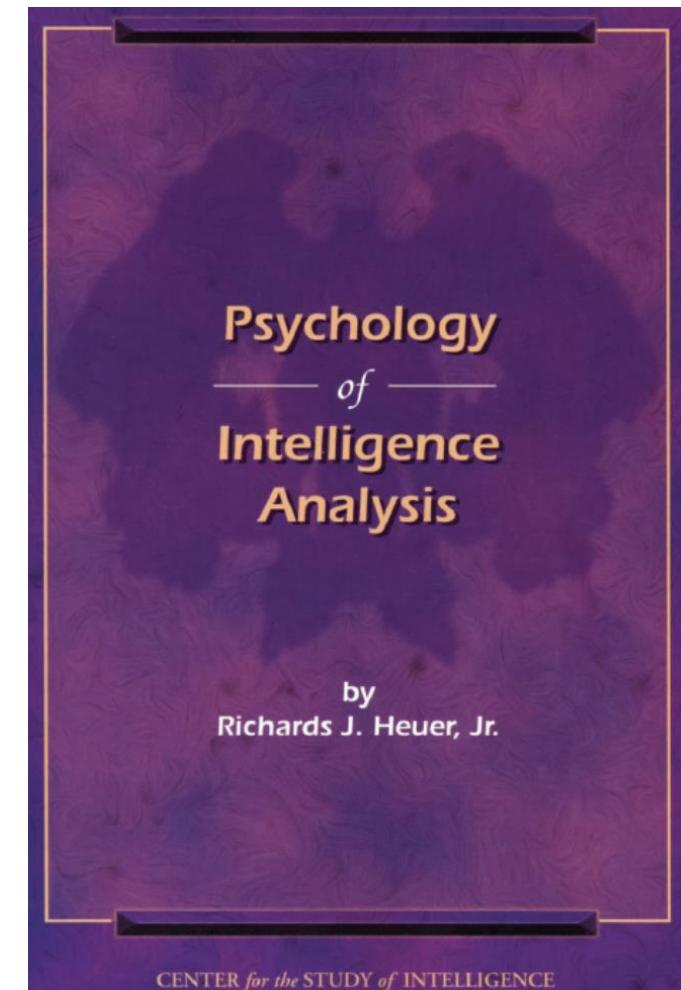
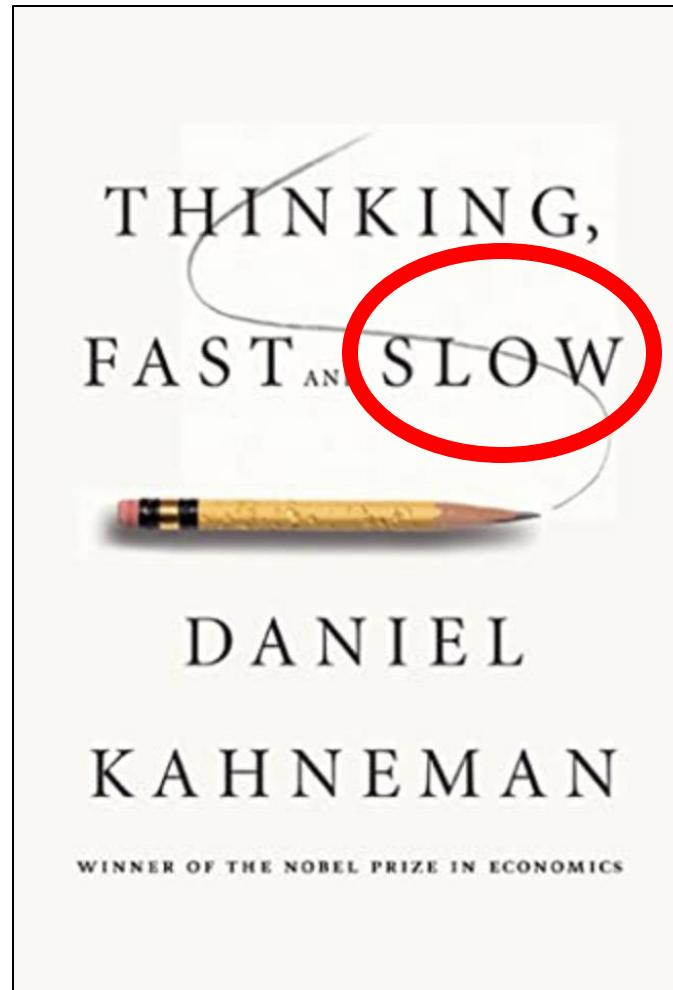
# *Analysis of Competing Hypotheses (ACH)*

- ACH is an analytic process for refuting hypotheses
- Designed to avoid pitfalls of quick, intuitive, judgments
- Provides a step-by-step strategy for cultivating methodical, reflective, intelligence gathering



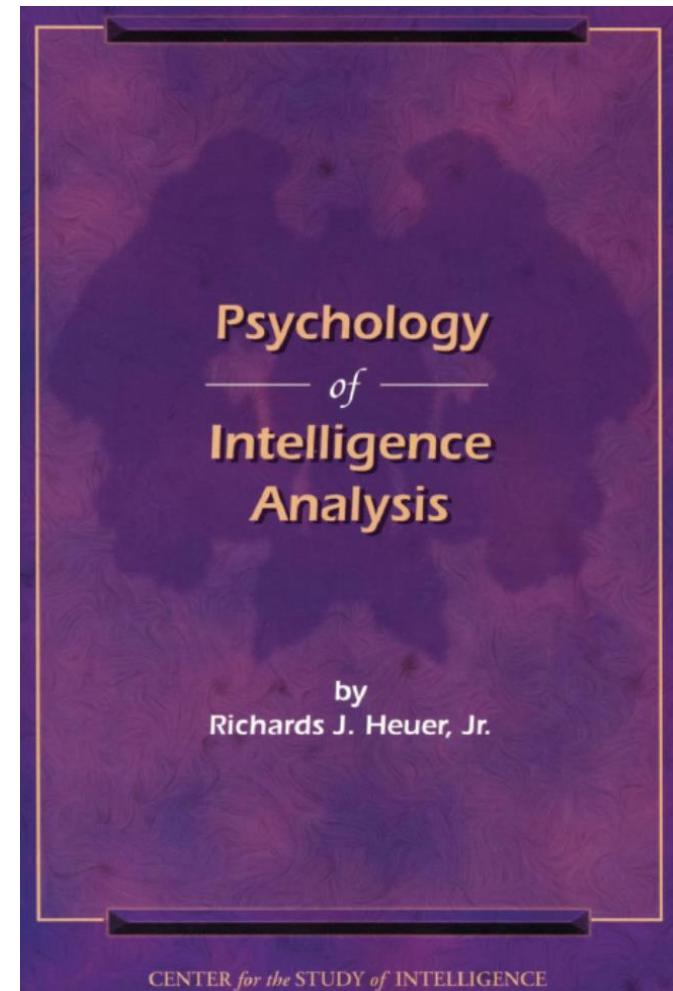
# *Analysis of Competing Hypotheses (ACH)*

- Designed to avoid pitfalls of quick, intuitive, judgments with a step-by-step strategy for cultivating methodical, reflective, intelligence gathering



# *Analysis of Competing Hypotheses (ACH)*

1. Identify Possible Hypotheses
2. Compile Evidence in Favor or Against
3. Prepare Hypothesis vs Evidence Matrix
4. Refine Matrix
5. Extract Conclusions & Counterexamples
6. Evaluate Sensitivity to Critical Evidence
7. Report Conclusions
8. Identify Milestones for Future



# *Identify Possible Hypotheses*

- Gather groups of analysts with different backgrounds and perspectives
- Brainstorm hypotheses regarding a given intelligence task; refine resulting list to no more than 7 hypotheses to be analyzed
- Designate those hypotheses not to be analyzed as “unproven hypotheses”

## *Compile Evidence in Favor or Against*

- List evidence in favor of and against each hypothesis
- Note the absence as well as the presence of evidence
- Include assumptions about intentions, goals, motives, standards, etc.
- Consider each hypothesis individually, connecting them to evidence in favor of or against

# *Prepare Hypothesis vs Evidence Matrix*

## Hypotheses

Evidence

	Users are not on iOS devices	M.site users are unaware of value on app	Features on the m.site not on the app	We are pushing users to m.site (marketing execution)	Content not on app
XX% of users are on iOS devices	-	NA	NA	NA	NA
XX% of m.site users have not used the app	NA	+	+	+	+
# of users accessing features on m.site	NA	+	-	+	+
Emails link to the m.site	NA	+	+	++	NA
# of sessions content on m.site	NA	NA	+	+	-

# *Prepare Hypothesis vs Evidence Matrix*

- Evaluate the relationship between a given piece of evidence (row-by-row) and each hypothesis in the matrix:
  - Consistent (cell should have “+” or “C”)
  - Inconsistent (cell should have “-” or “I”)
  - Irrelevant (cell should have “?” or “NA”)
- Evidence is **diagnostic** when it influences judgment about the plausibility of hypotheses

# *Prepare Hypothesis vs Evidence Matrix*

- Evaluate the relationship between a given piece of evidence (row-by-row) and each hypothesis in the matrix:
  - Consistent (cell should have “+” or “C”)
  - Inconsistent (cell should have “-” or “I”)
  - Irrelevant (cell should have “?” or “NA”)
- Evidence is **diagnostic** when it influences judgment about the plausibility of hypotheses



**EVIDENCE IMPACTS BELIEFS**

# ***Refine Matrix***

- Reflect on wording of hypotheses, and consider alternative presentations
- Consider combining hypotheses or splitting an hypothesis into multiple hypotheses
- Delete irrelevant evidence (though they should be saved in a separate list)

# *Extract Conclusions & Counterexamples*

- Review evidence that will allow you to reject hypotheses and do so, step-by-step
- Guidance:
  - Hypothesis with the most “-” or “I” is likely the worst explanation
  - Hypothesis with fewest “-” or “I” is likely the best explanation
  - Hypothesis with most “+” or “C” is a plausible explanation
  - Hypothesis with fewest “+” or “C” is an implausible explanation

# *Evaluate Sensitivity to Critical Evidence*

- Reflect on the following sorts of questions:
  - Are there questionable assumptions underlying a given interpretation of an hypothesis?
  - Might there be alternative explanations?
  - Might the evidence gathered and used be incomplete and/or misleading?
- Make clear answers to these questions to all analysts involved

# *Report Conclusions & Future Proofing*

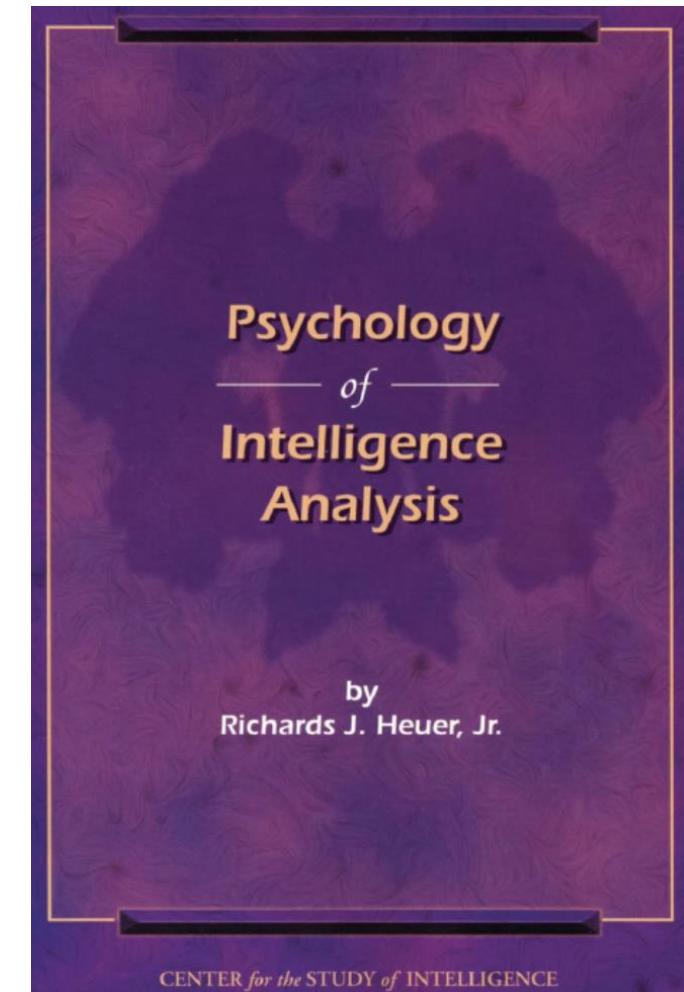
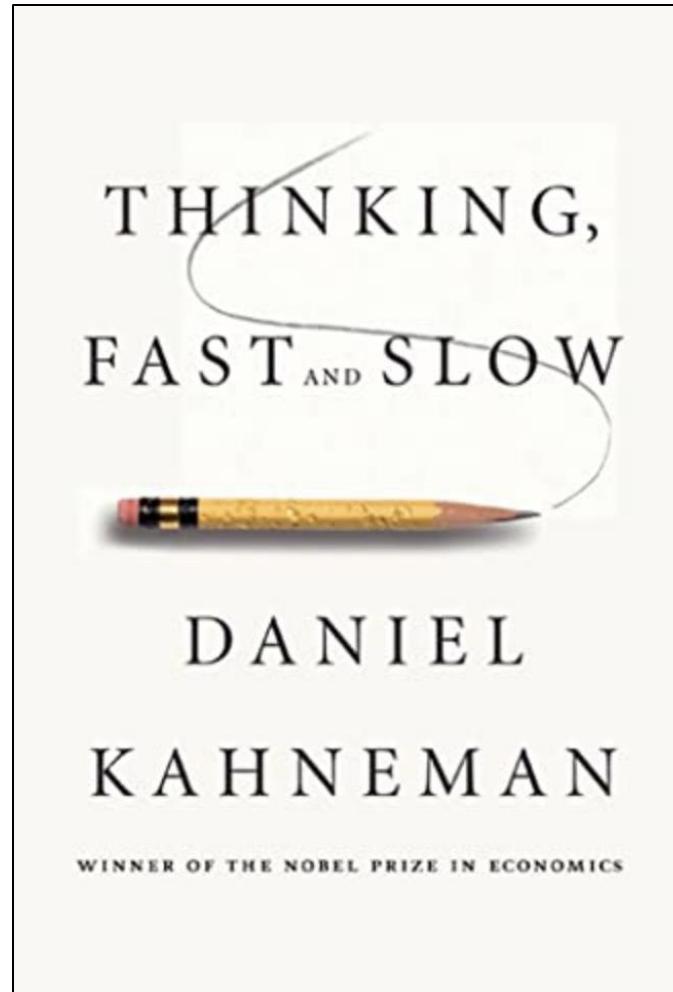
- Provide decision makers the relative likelihood of alternative explanations for presented hypotheses; contingency plans should also be provided
- Be specific about how likelihood is presented; saying an hypothesis is “probably true” could mean 55% likely or 90% likely, which are quite different...
- Conclusions should be considered tentative

# *Outline*

- Using Cognitive Heuristics and Addressing Bias
- Confirmation Bias and Serial Position Effects
- Arguments in the Intelligence Cycle

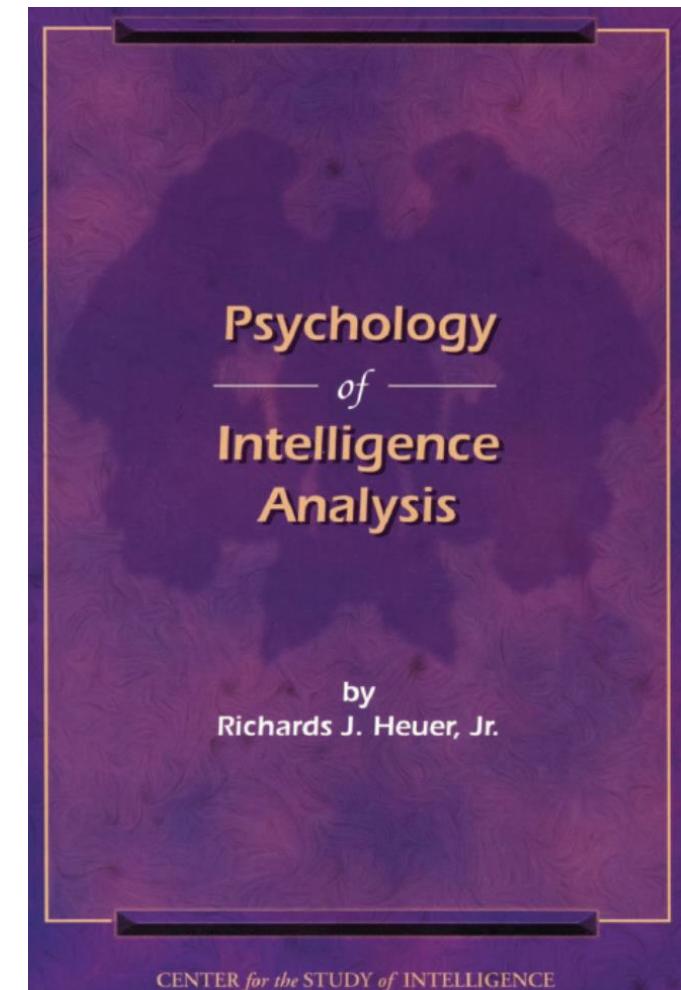
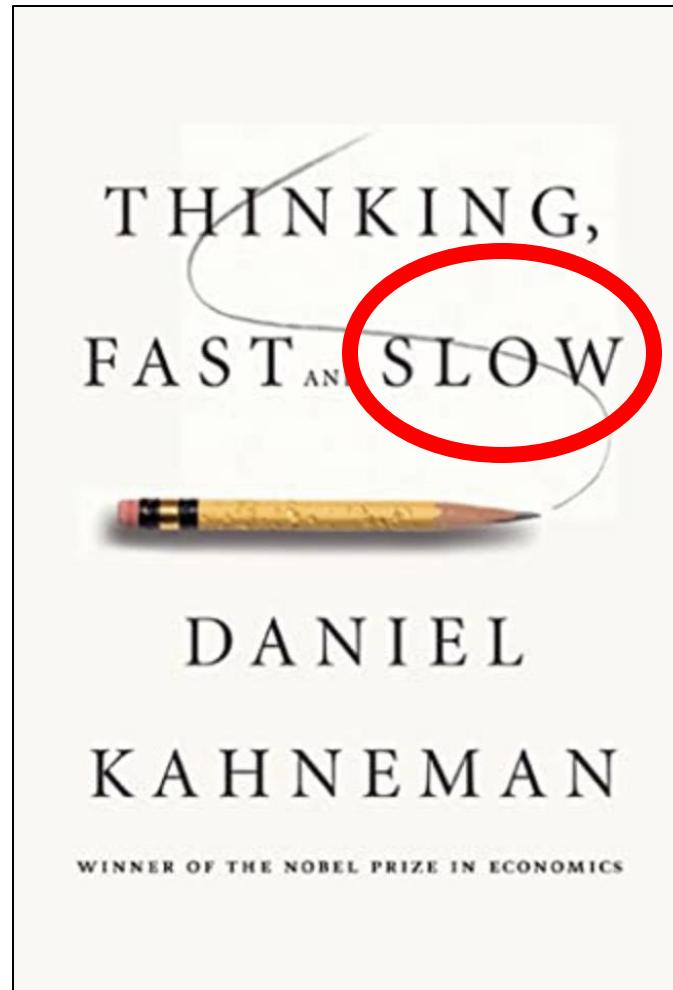
# *Analysis of Competing Hypotheses (ACH)*

- Designed to avoid pitfalls of quick, intuitive, judgments with a step-by-step strategy for cultivating methodical, reflective, intelligence gathering
- Specifically for guarding against confirmation bias and serial position effects



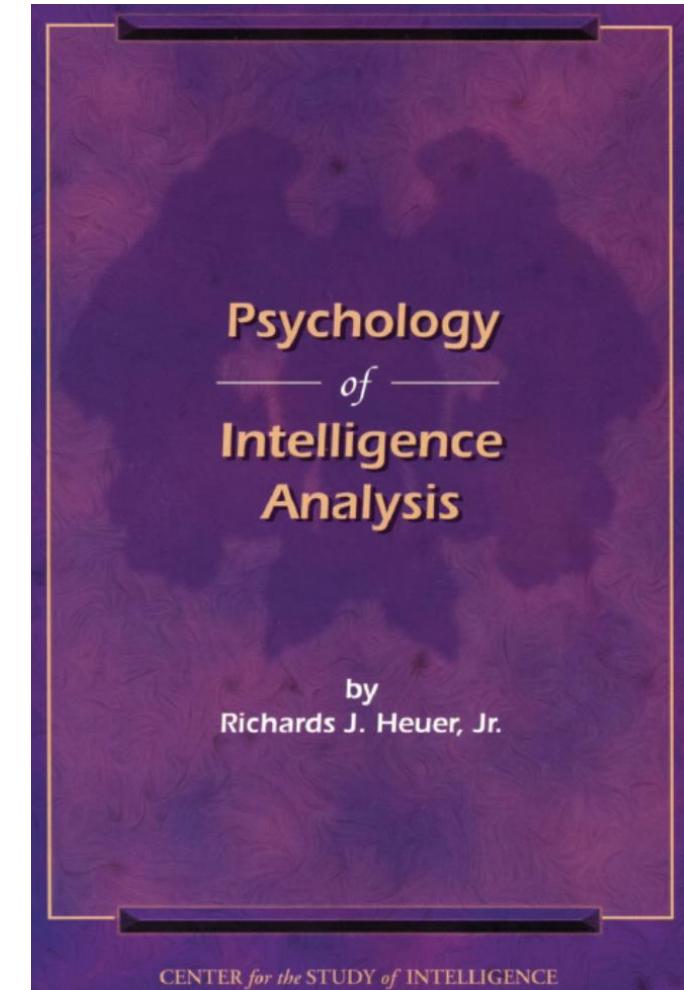
# *Analysis of Competing Hypotheses (ACH)*

- Designed to avoid pitfalls of quick, intuitive, judgments with a step-by-step strategy for cultivating methodical, reflective, intelligence gathering
- Specifically for guarding against confirmation bias and serial position effects



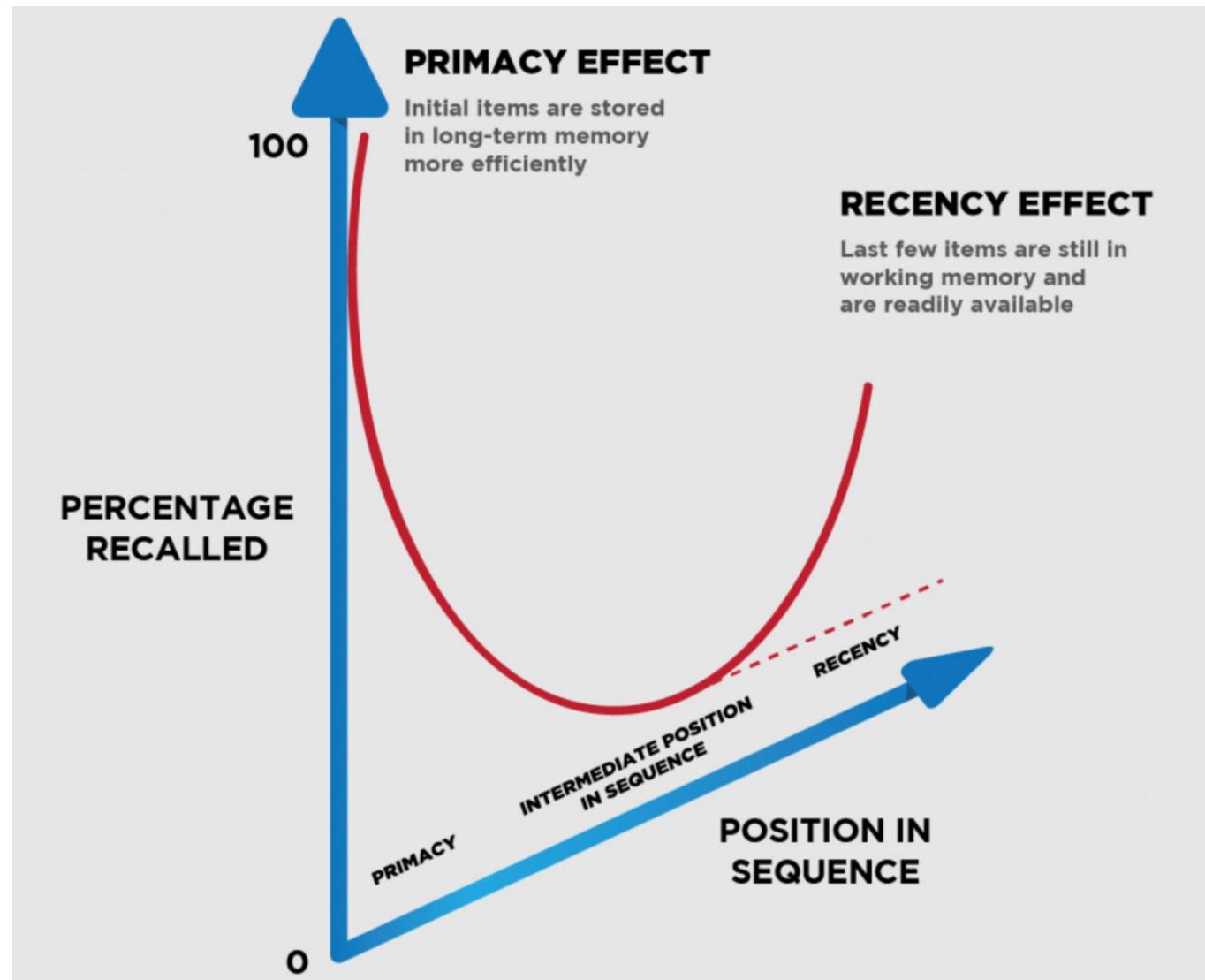
# *Analysis of Competing Hypotheses (ACH)*

- Designed to avoid pitfalls of quick, intuitive, judgments with a step-by-step strategy for cultivating methodical, reflective, intelligence gathering
- Specifically for guarding against confirmation bias and serial position effects



# *Serial Position Effects*

- Disposition towards recalling initial and most recent items provided in a sequence
- Effect examples:
  - Google Page-Rank
  - E-Commerce
  - Product Reviews
  - Restaurant Menus
  - TV Cliffhangers



# *Confirmation Bias*

- Disposition to seek information that supports, rather than rejects, existing beliefs
- Typically involves interpreting evidence in a manner that **confirms** those beliefs.
- Examples:
  - Social media feeds
  - Political convictions

# *Confirmation Bias*

- Disposition to seek information that supports, rather than rejects, existing beliefs.
- Typically involves interpreting evidence in a manner that **confirms** those beliefs.
- Examples:
  - Social media feeds
  - **Political convictions**

# *TikTok Ban*

- In 2020, President Donald Trump issued an executive order banning new downloads of *TikTok* to U.S. devices
- It was alleged that *TikTok* was gathering data on U.S. citizens which was being shared with parent company *ByteDance* in Beijing

Executive Order 13942 of August 6, 2020

## **Addressing the Threat Posed by TikTok, and Taking Additional Steps To Address the National Emergency With Respect to the Information and Communications Technology and Services Supply Chain**

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the International Emergency Economic Powers Act ([50 U.S.C. 1701 et seq.](#)) (IEEPA), the National Emergencies Act ([50 U.S.C. 1601 et seq.](#)), and [section 301 of title 3, United States Code](#),

I, DONALD J. TRUMP, President of the United States of America, find that additional steps must be taken to deal with the national emergency with respect to the information and communications technology and services supply chain declared in [Executive Order 13873](#) of May 15, 2019 (Securing the Information and Communications Technology and Services Supply Chain). Specifically, the spread in the United States of mobile applications developed and owned by companies in the People's Republic of China (China) continues to threaten the national security, foreign policy, and economy of the United States. At this time, action must be taken to address the threat posed by one mobile application in particular, *TikTok*.

# *Responses to TikTok Ban*

“It’s right to be suspicious of the Chinese,” said James Lewis, senior vice president at the Center for Strategic and International Studies, a security think tank. “But I’m not sure TikTok is a good intelligence tool for them.”

TikTok has also been trying to beef up its presence in DC to better make its case to lawmakers. ByteDance’s **spending** on federal lobbyists has steadily grown over the years, from just \$270,000 in 2019 to \$5.2 million in 2021 — and it’s on track to surpass that in 2022. It **recently** brought on Jamal Brown, who worked for the Biden administration and was the press secretary for Biden’s presidential run, to manage its policy communications in the US. It also **sent representatives** to testify before congressional panels in 2021 and 2022 after **refusing** to do so in 2019.

---

**“IS THERE AN ACCEPTABLE LEVEL OF RISK THAT WOULD LET TIKTOK CONTINUE TO OPERATE?”**

---

# *Executive Order Revoked*

- In 2021, President Joe Biden *revoked* Executive Order 13942, effectively lifting the TikTok ban

- President Biden ordered a more deliberate and methodical investigation into TikTok data sharing practices

Section 1. Revocation of Presidential Actions. The following orders are revoked: Executive Order 13942 of August 6, 2020 (Addressing the Threat Posed by TikTok, and Taking Additional Steps To Address the National Emergency With Respect to the Information and Communications Technology and Services Supply Chain); Executive Order 13943 of August 6, 2020 (Addressing the Threat Posed by WeChat, and Taking Additional Steps To Address the National Emergency With Respect to the Information and Communications Technology and Services Supply Chain); and Executive Order 13971 of January 5, 2021 (Addressing the Threat Posed by Applications and Other Software Developed or Controlled by Chinese Companies).

## FCC Commissioner urges Google and Apple to ban TikTok

## \$1.7 trillion funding bill includes ban on TikTok on government phones



EXECUTIVE OFFICE OF THE PRESIDENT  
OFFICE OF MANAGEMENT AND BUDGET  
WASHINGTON, D.C. 20503

THE DIRECTOR

February 27, 2023

M-23-13

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: Shalanda D. Young

SUBJECT: "No TikTok on Government Devices" Implementation Guidance

## FBI director raises national security concerns about TikTok

TikTok Parent ByteDance Planned To Use TikTok To Monitor The Physical Location Of Specific American Citizens

TikTok is collecting an 'excessive' amount of data from users, report suggests

"As painful as it is for me to say, if Donald Trump was right and we could've taken action then, that'd have been a heck of a lot easier than trying to take action in November of 2022," Warner told Recode. "The sooner we bite the bullet, the better."

## FCC Commissioner urges Google and Apple to ban TikTok

## FBI director raises national security concerns about TikTok

## \$1.7 trillion funding bill includes ban on TikTok on government phones



EXECUTIVE OFFICE OF THE PRESIDENT  
OFFICE OF MANAGEMENT AND BUDGET  
WASHINGTON, D.C. 20503

THE DIRECTOR

February 27, 2023

M-23-13

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: Shalanda D. Young

SUBJECT: "No TikTok on Government Devices" Implementation Guidance

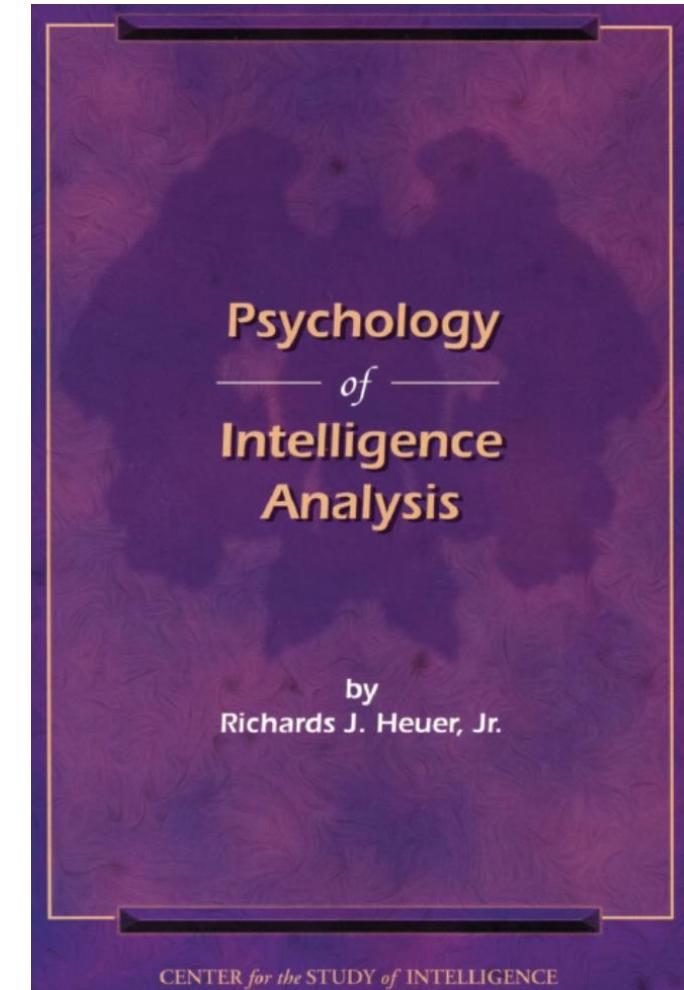
TikTok Parent ByteDance Planned To Use TikTok To Monitor The Physical Location Of Specific American Citizens

TikTok is collecting an 'excessive' amount of data from users, report suggests

"As painful as it is for me to say, if Donald Trump was right and we could've taken action then, that'd have been a heck of a lot easier than trying to take action in November of 2022," Warner told Recode. "The sooner we bite the bullet, the better."

# *Analysis of Competing Hypotheses (ACH)*

- Designed to avoid pitfalls of quick, intuitive, judgments with a step-by-step strategy for cultivating methodical, reflective, intelligence gathering
- Specifically for guarding against confirmation bias and serial position effects

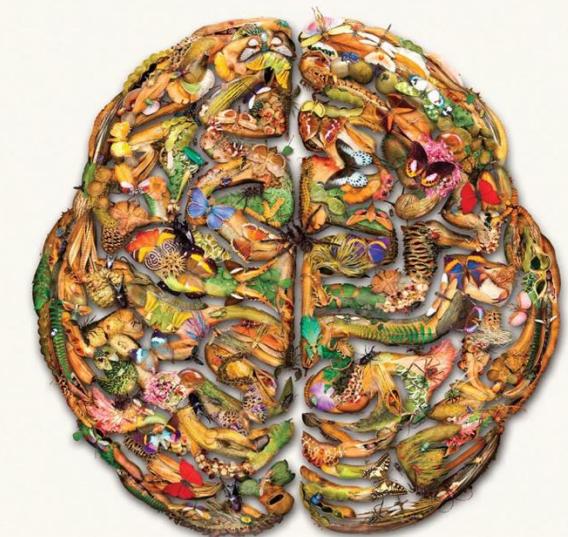


# *Whitesmith on ACH*

- Impacting serial position effects requires **targeting long-term memory**
- Impacting confirmation bias requires targeting when the focal hypothesis is formed, i.e. **initial stages of information processing** as opposed to when all information available has been processed

# COGNITIVE BIAS IN INTELLIGENCE ANALYSIS

Testing the Analysis of Competing  
Hypotheses Method



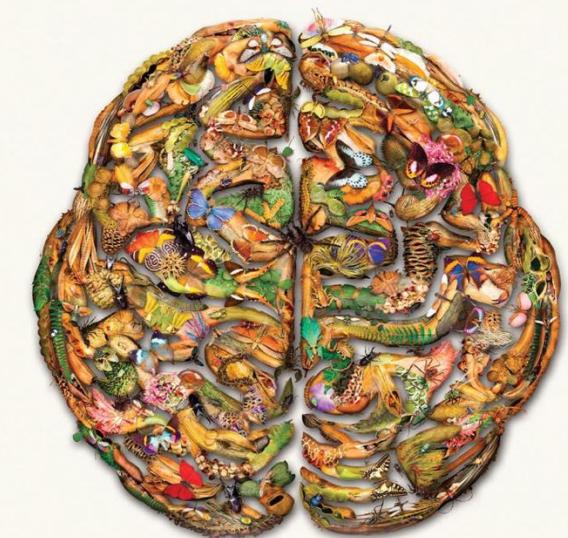
Martha Whitesmith

## *Whitesmith on ACH*

- ACH had **no mitigating impact on confirmation bias or serial position effects**
- Confirmation bias and serial position effects stem from analytical conditions that produce a force towards forming a focal hypothesis as early as possible

# COGNITIVE BIAS IN INTELLIGENCE ANALYSIS

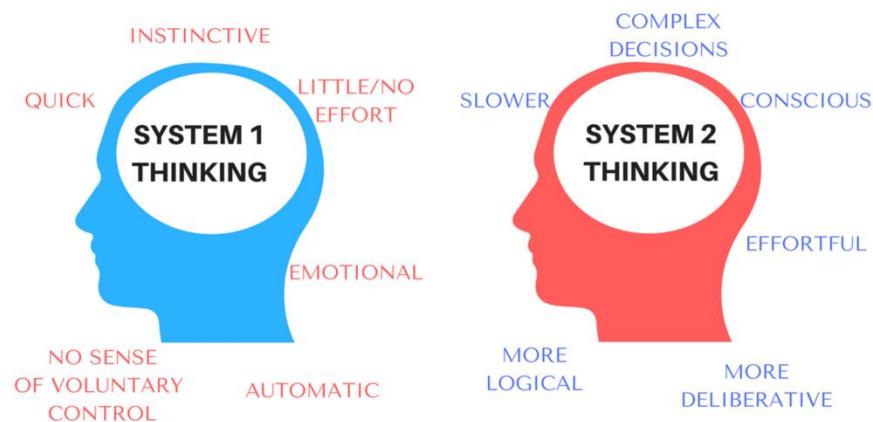
Testing the Analysis of Competing  
Hypotheses Method



Martha Whitesmith

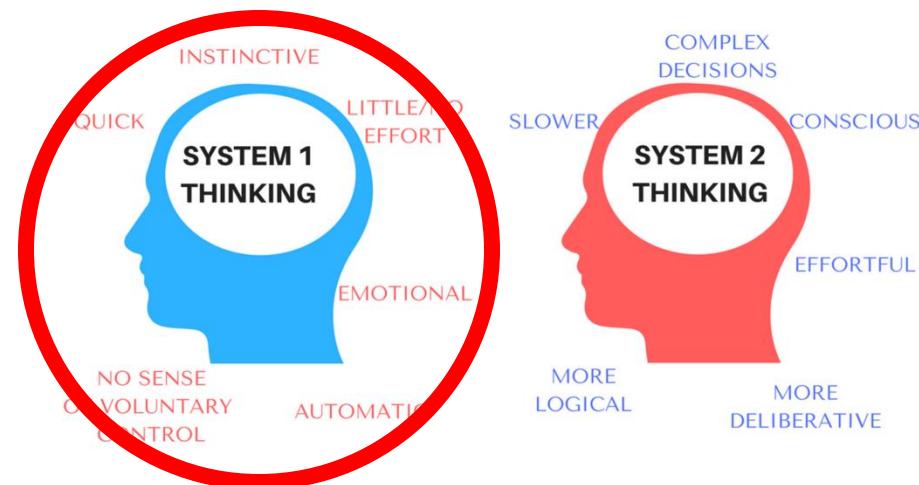
# *Beverley on Whitesmith on ACH*

- Whitesmith claims ACH is ineffective at preventing confirmation bias, but **awareness of the occurrence of cognitive biases is itself an effective mitigation strategy**
- That makes sense, but it doesn't explain **why** is ACH ineffective...



# *Beverley on Whitesmith on ACH*

- Whitesmith claims ACH is ineffective at preventing confirmation bias, but **awareness of the occurrence of cognitive biases is itself an effective mitigation strategy**
- That makes sense, but it doesn't explain **why** is ACH ineffective...



# *Beverley on Whitesmith on ACH*

- Whitesmith claims ACH is ineffective at preventing confirmation bias, but **awareness of the occurrence of cognitive biases is itself an effective mitigation strategy**
- That makes sense, but it doesn't explain **why** is ACH ineffective...
- Actually applying ACH is challenging, results are uncertain, and the ACH methodology provides no explicit guidance on when experts are to leverage expertise

# *Deliberative Practice*

- In a famous study, expert pilots were asked to provide guidance for novice pilots in the form of step-by-step procedures
- When following such guidance, novice pilots performed markedly better than control groups without such guidance
- However, when expert pilots were given guidance from other expert pilots, **they performed significantly worse than they would have otherwise**

**EXPERTISE IS NOT EASILY WRITTEN DOWN IN STEPS**

**WHEN AN EXPERT BASEBALL PLAYER SWINGS A BAT,  
THEY DON'T THINK THROUGH STEPS, THEY JUST SWING**

**EXPERTISE IS NOT EASILY WRITTEN DOWN IN STEPS**

**WHEN AN EXPERT ANALYST JUDGES INFORMATION IS RELEVANT OR IMPACTFUL, THEY DON'T ALWAYS NEED TO WALK THROUGH STEPS...**

# *Straw Man*

- Whitesmith paints a picture of whether to leverage analytic vs intuitive methods unfairly, I think
- Intuitive approaches are not simply off-the-cuff, knee-jerk reactions from analysts trained and untrained, experienced and unexperienced
- Intuitive approaches involve expertise: **system 2 thinking that has been habituated into system 1 thinking**

# *Better Guidance*

- Would both raise awareness of cognitive heuristics and bias
- While also either providing analysts recommendations on when to leverage expertise and when not
- Or making it easy for analysts to know when expertise should be leveraged and when it should not

# *Better Guidance*

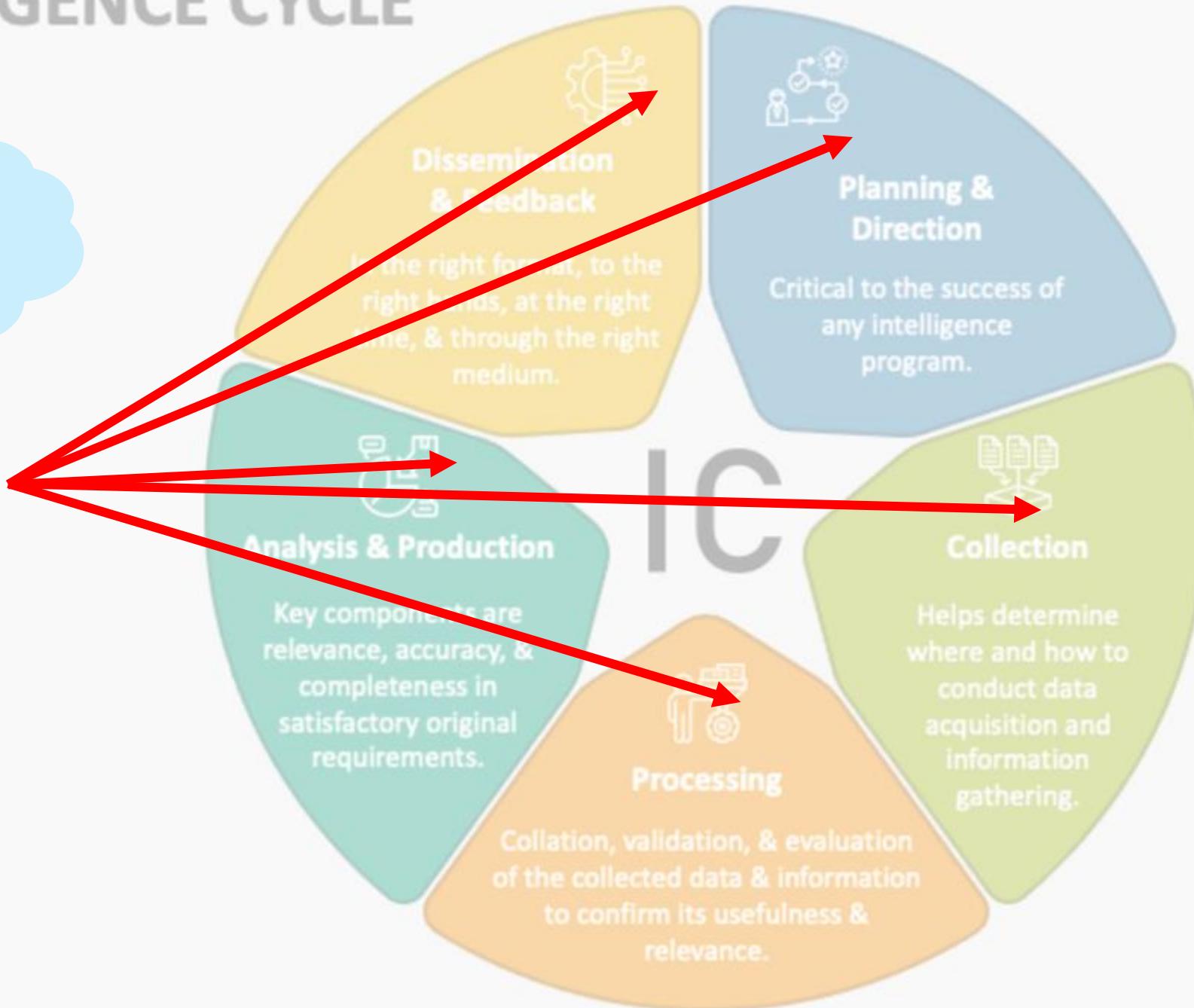
- Would both **raise awareness of cognitive heuristics and bias**
- While also either providing analysts recommendations on when to leverage expertise and when not
- Or making it easy for analysts to know when expertise should be leveraged and when it should not

# INTELLIGENCE CYCLE

I bring bias to  
the intelligence  
cycle



Bias in  
the loop

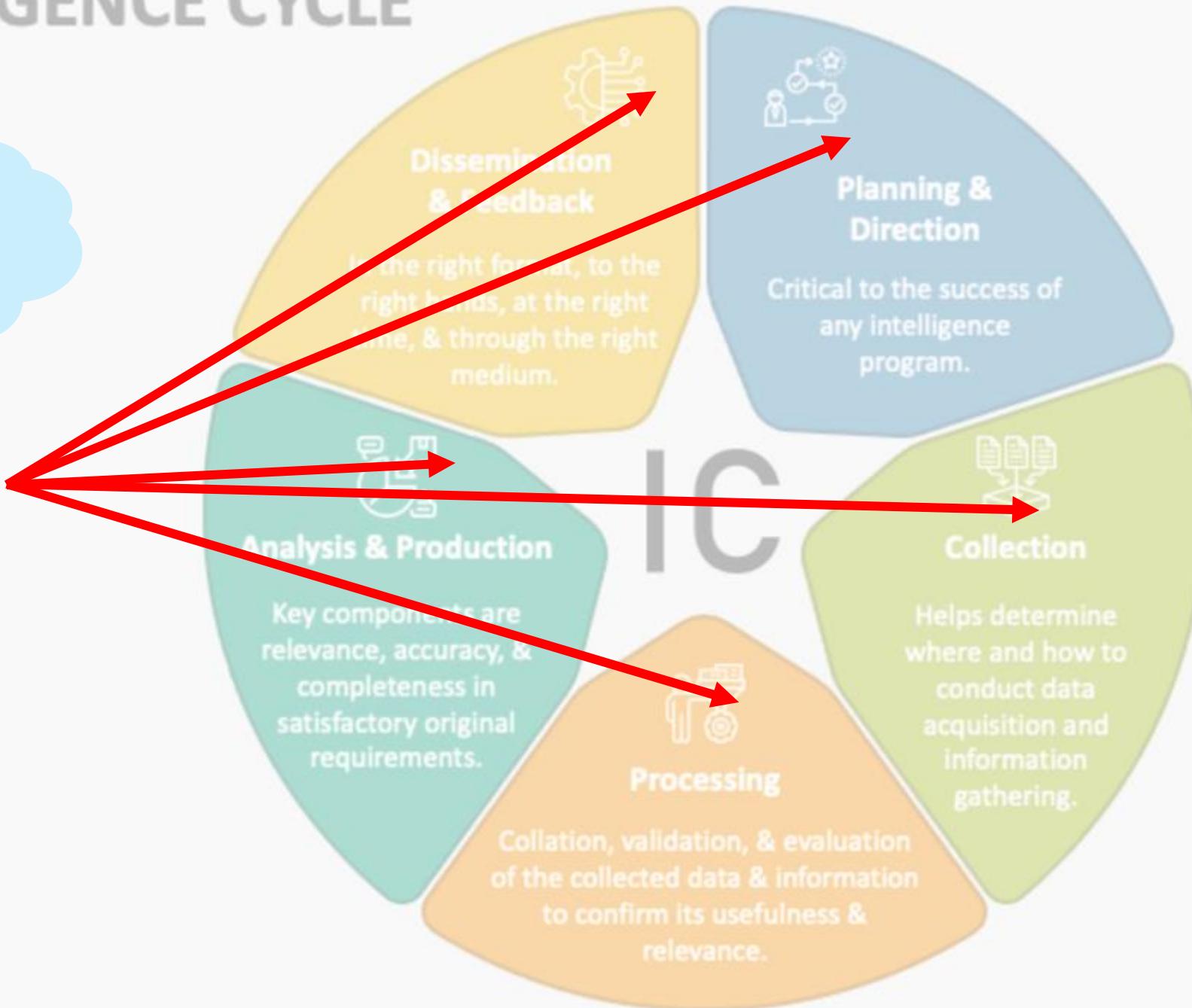


# INTELLIGENCE CYCLE

How can I maintain awareness of my own bias?



Bias in the loop

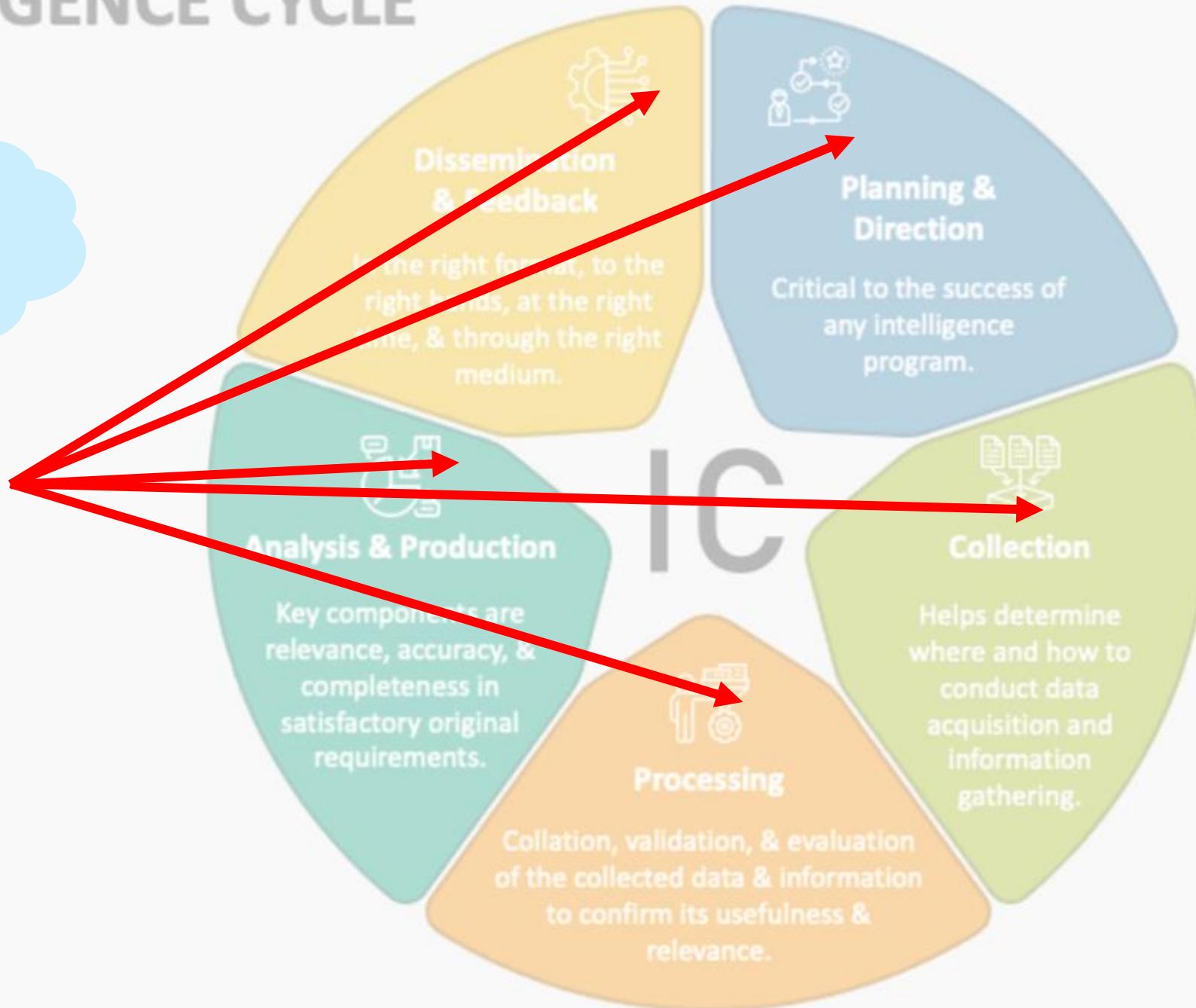


# INTELLIGENCE CYCLE

Forming habits  
of recognition  
and heuristics to  
address them

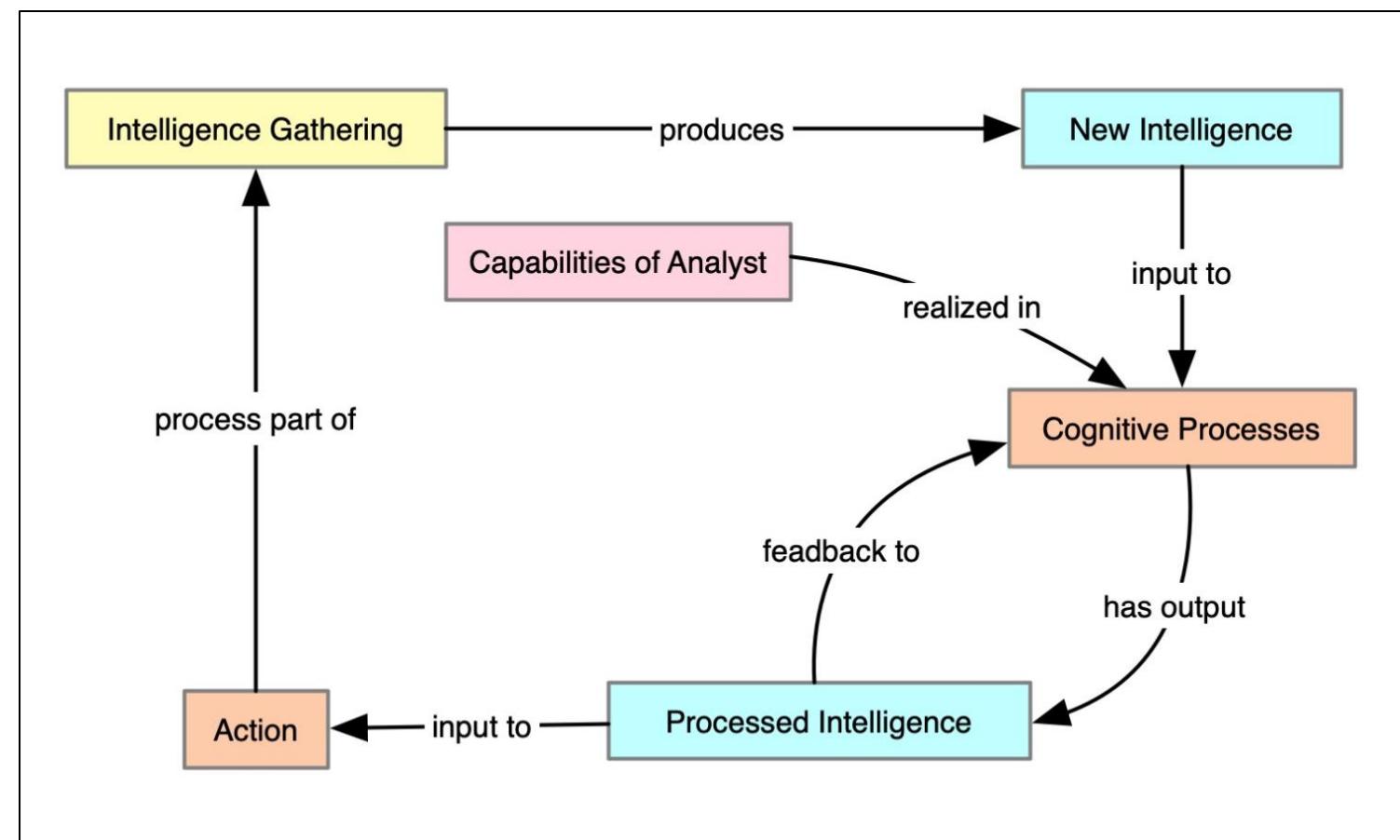
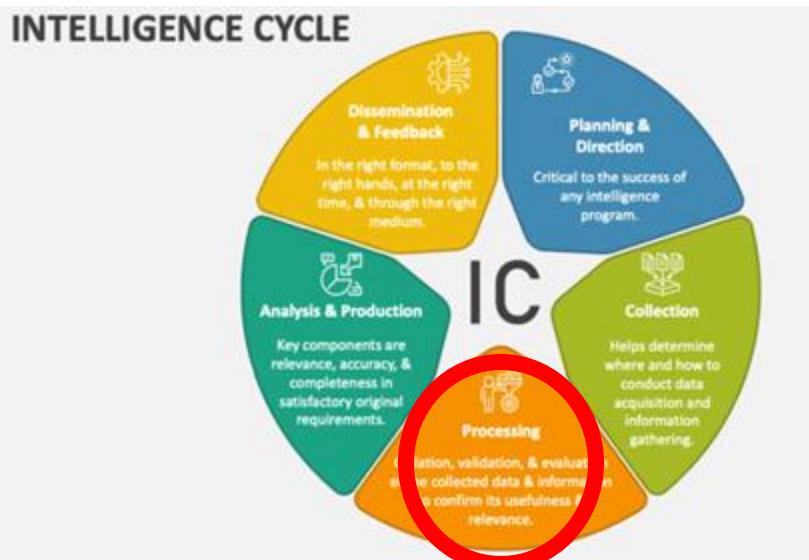


Bias in  
the loop



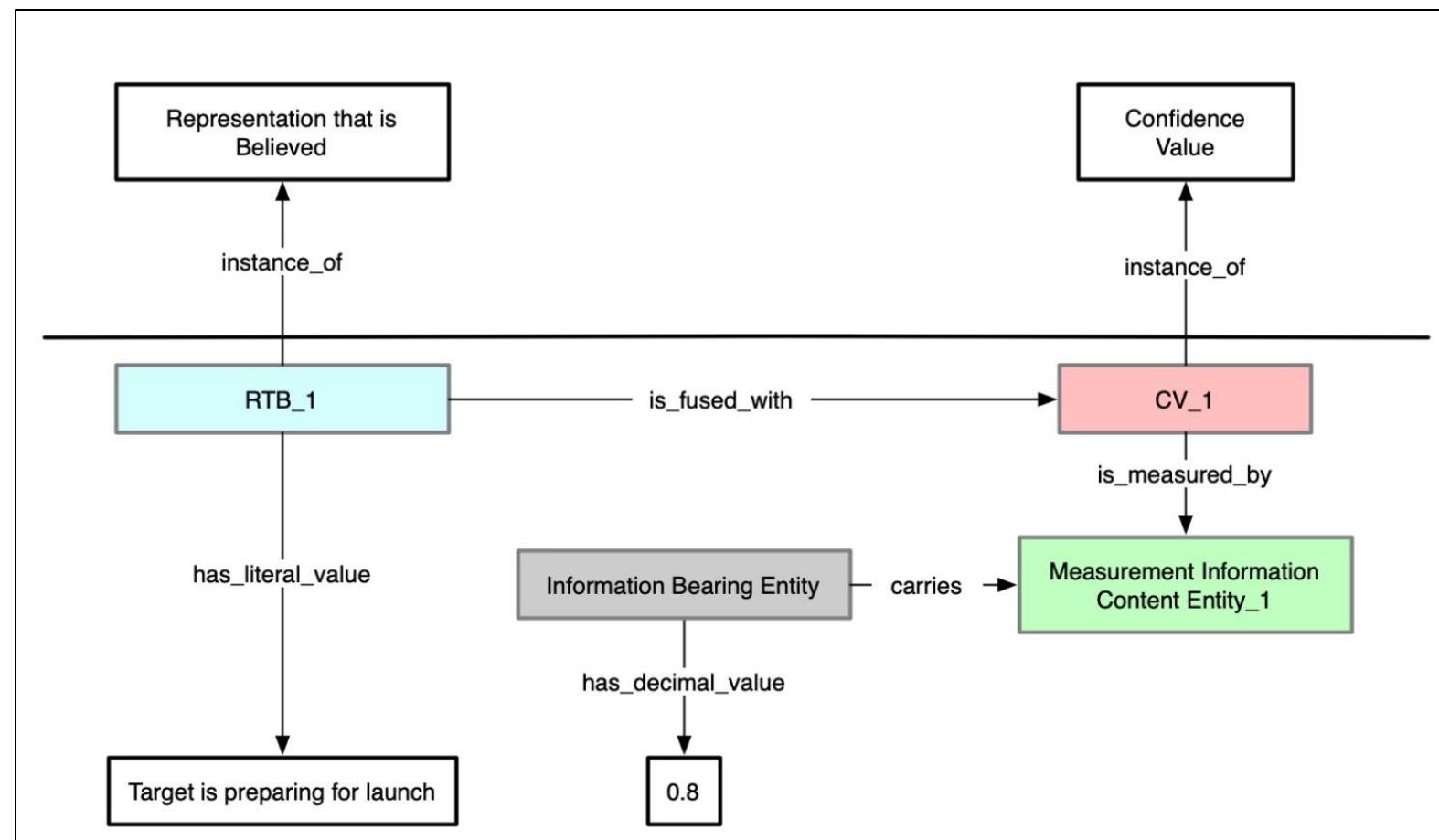
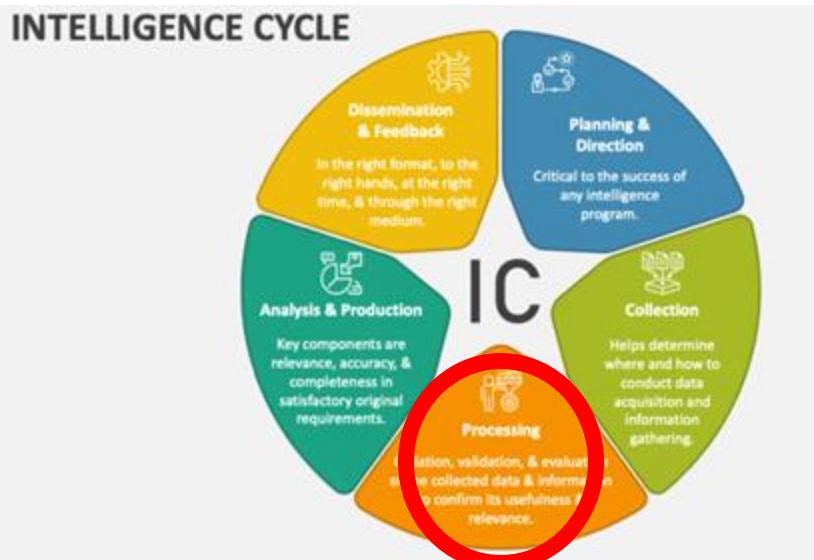
# *Cognitive Process Ontology*

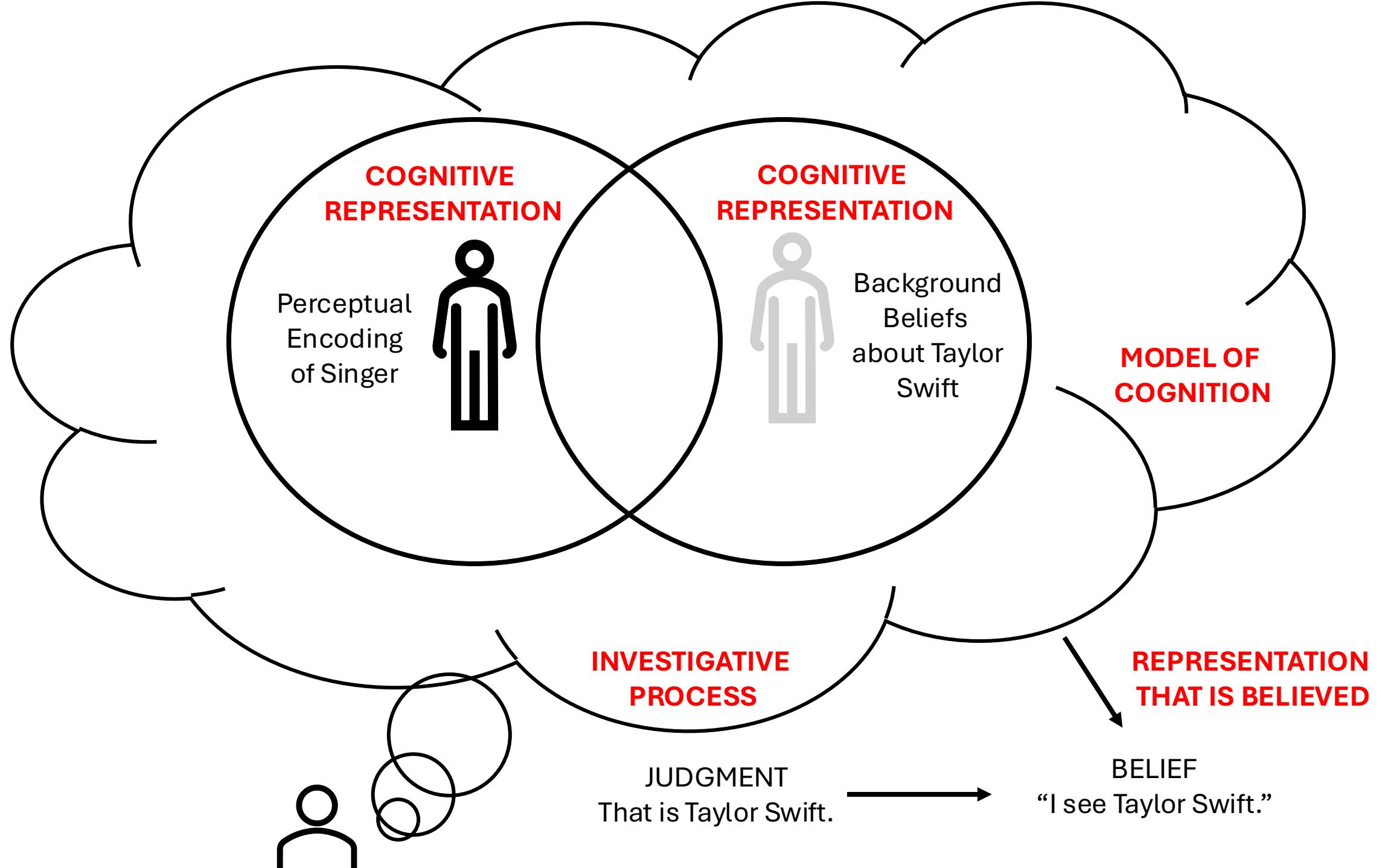
- Ontology reflecting aspects of the intelligence cycle



# Cognitive Process Ontology

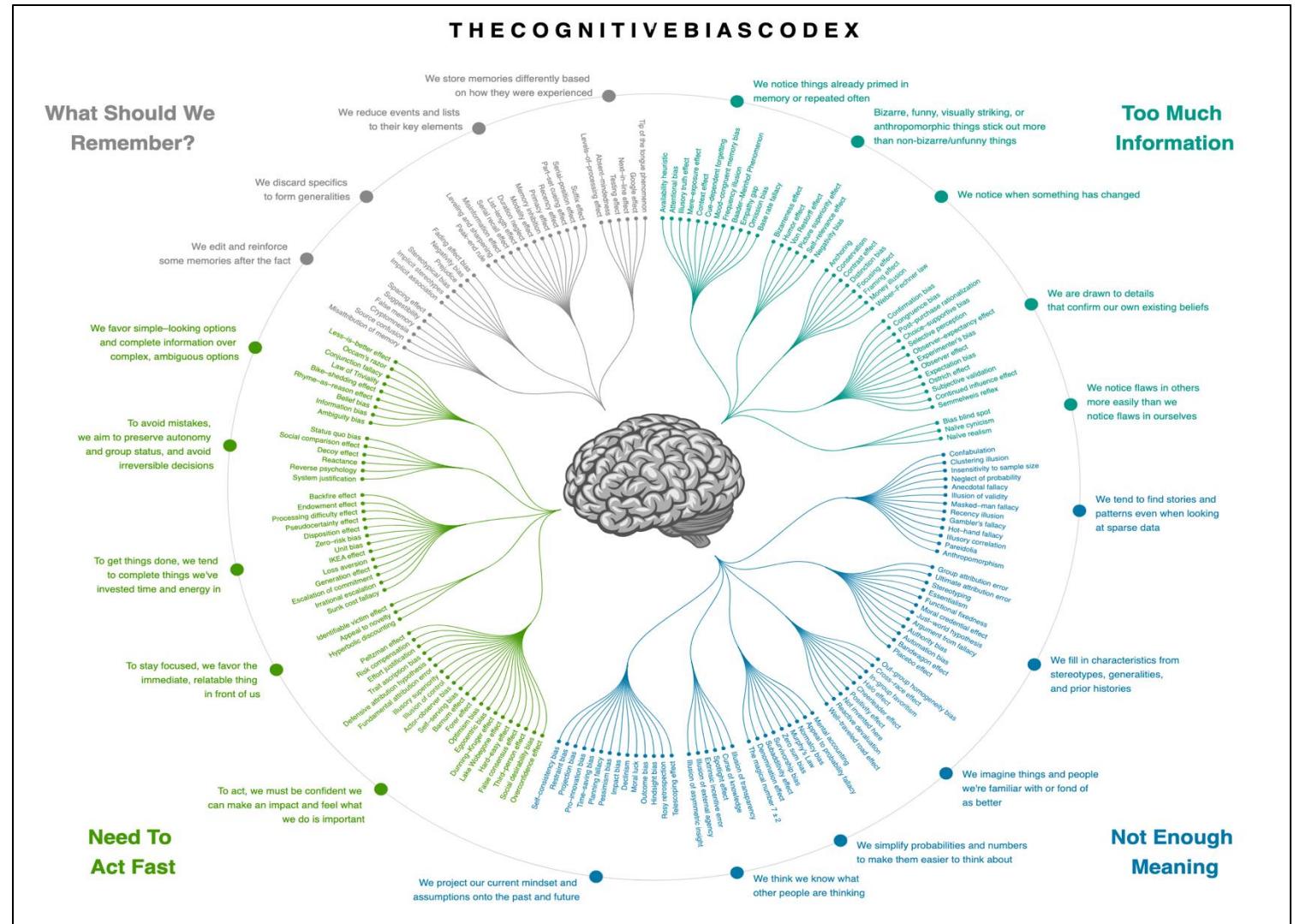
- Ontology reflecting aspects of the intelligence cycle





# Cognitive Bias Codex (Wikipedia)

## INTELLIGENCE CYCLE





# *Better Guidance*

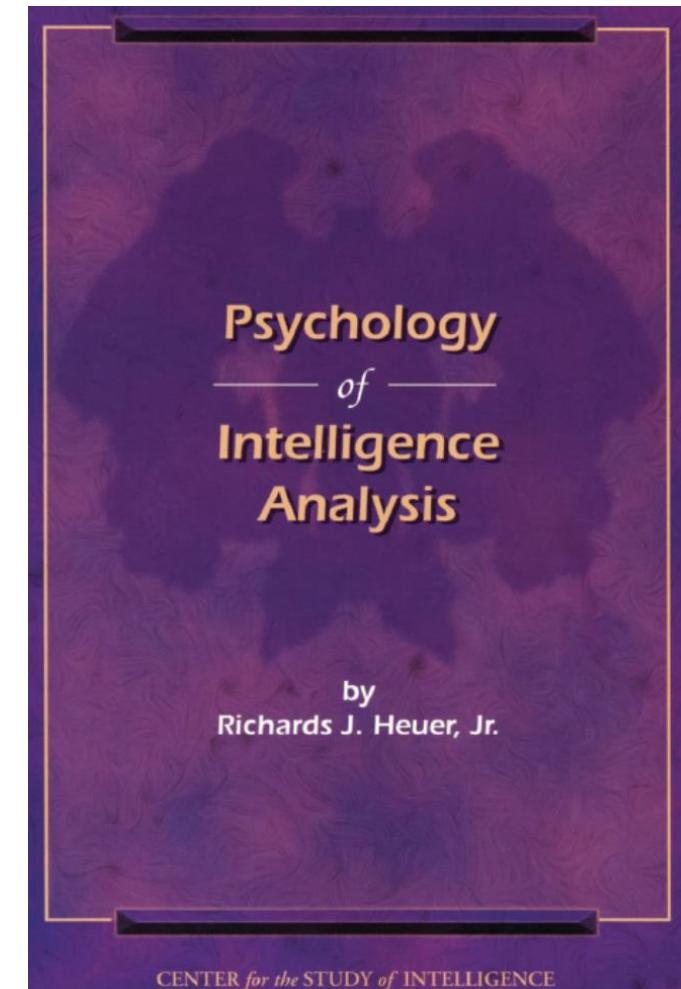
- Would both raise awareness of cognitive heuristics and bias
- While also either providing analysts recommendations on when to leverage expertise and when not
- **Or making it easy for analysts to know when expertise should be leveraged and when it should not**

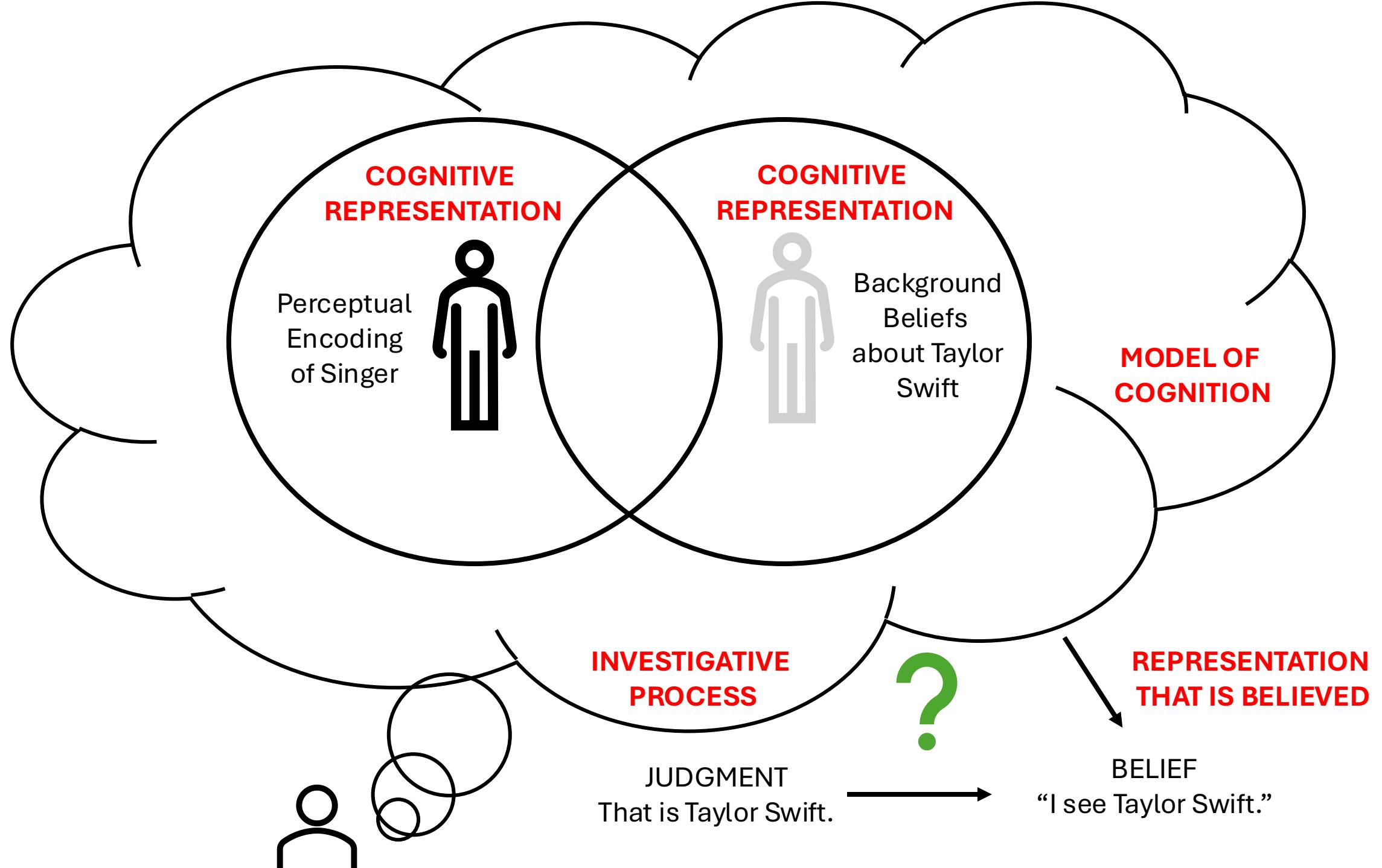
# *Outline*

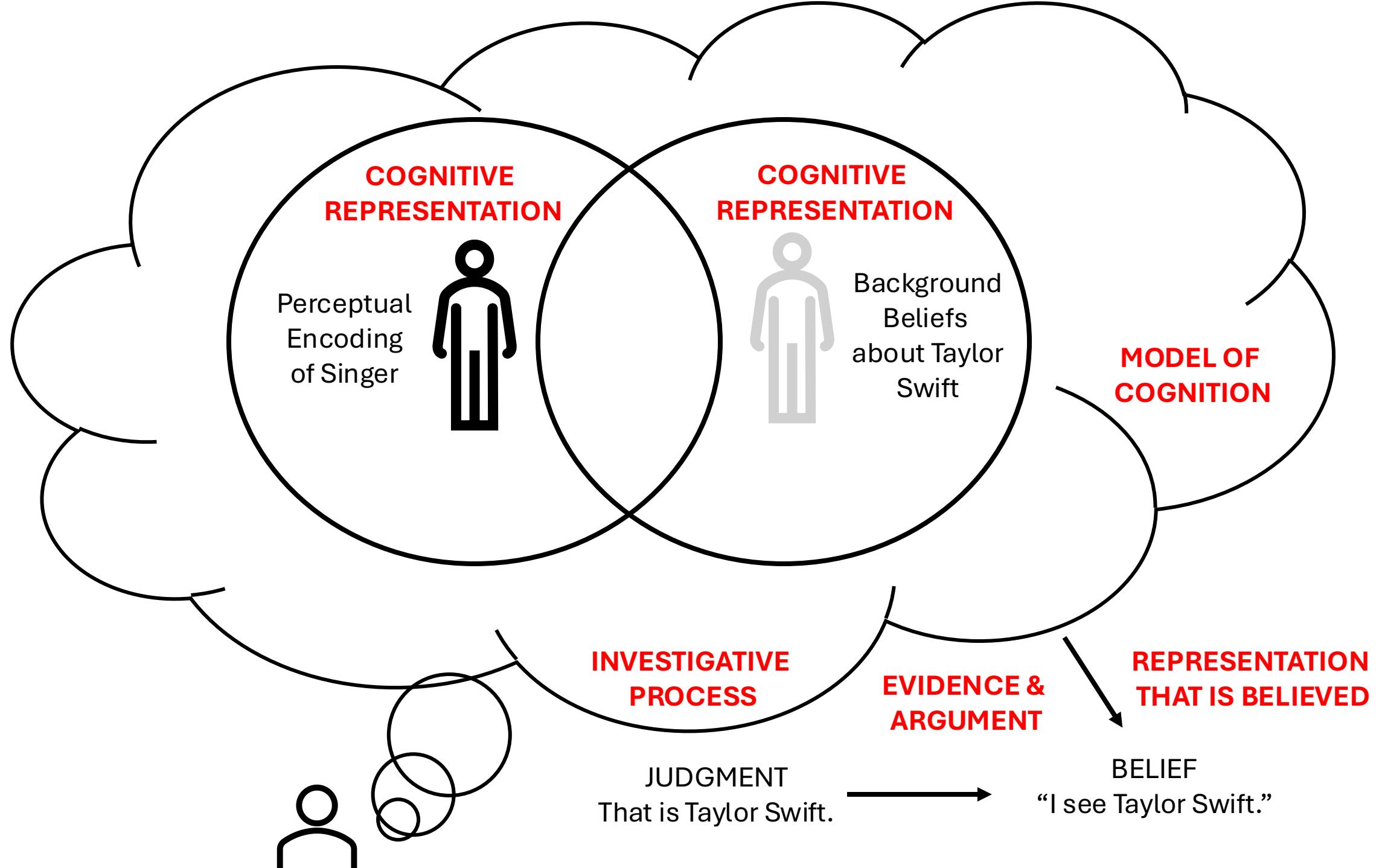
- Using Cognitive Heuristics and Addressing Bias
- Confirmation Bias and Serial Position Effects
- Arguments in the Intelligence Cycle

# *Analysis of Competing Hypotheses (ACH)*

1. Identify Possible Hypotheses
2. Compile Evidence in Favor or Against
3. Prepare Hypothesis vs Evidence Matrix
4. Refine Matrix
5. Extract Conclusions & Counterexamples
6. Evaluate Sensitivity to Critical Evidence
7. Report Conclusions
8. Identify Milestones for Future







# *Intersecting Interests*

- Arguments are **fundamentally** used for **persuasion**
- Here is another point at which intelligence analysis dovetails with **ontologies**

# *Intersecting Interests*

- Arguments are **fundamentally** used for **persuasion**
- Here is another point at which intelligence analysis dovetails with **ontologies**
- Ontologies provide an avenue for:
  - **Explainability** – Tracking the uses of evidence
  - **Traceability** – Tracking the impacts of evidence on other evidence

# *Proposal*

- Deploy ontological representations of arguments within the intelligence cycle in the interest of making **explicit** the **implicit** justification used throughout the cycle
- Connect these ontological representations of arguments to contemporary fact-checking strategies, in the interest of filtering **good** from **bad justifications/arguments**
- **Clarifying justification/arguments makes it easier to know when and how to apply expertise**

# Improving postgraduate researchers' inferences with a philosophical workshop

Robbie Clark<sup>1,2</sup>, Margarida Hermida<sup>3</sup>, Nicole Russell Pascual<sup>4, 5</sup>

Marcus Munafò<sup>1,2</sup>, James Ladymann<sup>6</sup>

<sup>1</sup>School of Psychological Science, University of Bristol

<sup>2</sup>MRC Integrative Epidemiology Unit at the University of Bristol

<sup>3</sup>Department of Philosophy, King's College London

<sup>4</sup>Department of Psychology, University of Exeter

<sup>5</sup>Department of Psychology, University of Michigan

<sup>6</sup>Department of Philosophy, University of Bristol

## Abstract

Postgraduate research training in the United Kingdom often narrowly focuses on domain-specific methods, neglecting wider philosophical topics such as epistemology and scientific method. Consequently, we designed a workshop on (inductive, deductive, and abductive) inference for postgraduate researchers. We ran the workshop three times with ( $N = 29$ ) attendees from across four universities, testing the potential benefits of the workshop in a mixed-method, repeated measures design. Our core aims were to investigate what attendees learned from the workshop, and whether they felt it had impacted on their research practices six months later. Overall, learning inferential logic benefitted postgraduate researchers in various ways and to varying degrees. Six months on, roughly half of attendees reported being more critical of key aspects of research such as inferences and study design. Additionally, some attendees reported more subtle effects, such as prompting new lines of thought and inquiry. Given that self-criticism and scepticism are fundamental intellectual virtues, these results evidence the importance of embedding epistemological training into doctoral programmes across the

# Improving postgraduate researchers' inferences with a philosophical workshop

Robbie Clark<sup>1,2</sup>, Margarida Hermida<sup>3</sup>, Nicole Russell Pascual<sup>4, 5</sup>  
Marcus Munafò<sup>1,2</sup>, James Ladymann<sup>6</sup>

<sup>1</sup>School of Psychological Science, University of Bristol

<sup>2</sup>MRC Integrative Epidemiology Unit at the University of Bristol

<sup>3</sup>Department of Philosophy, King's College London

<sup>4</sup>Department of Psychology, University of Exeter

<sup>5</sup>Department of Psychology, University of Michigan

<sup>6</sup>Department of Philosophy, University of Bristol

**DOMAIN-SPECIFIC INFERENCE  
BENEFITTED FROM MAKING  
ARGUMENTS AND JUSTIFICATION  
EXPLICIT TO SPECIALISTS**

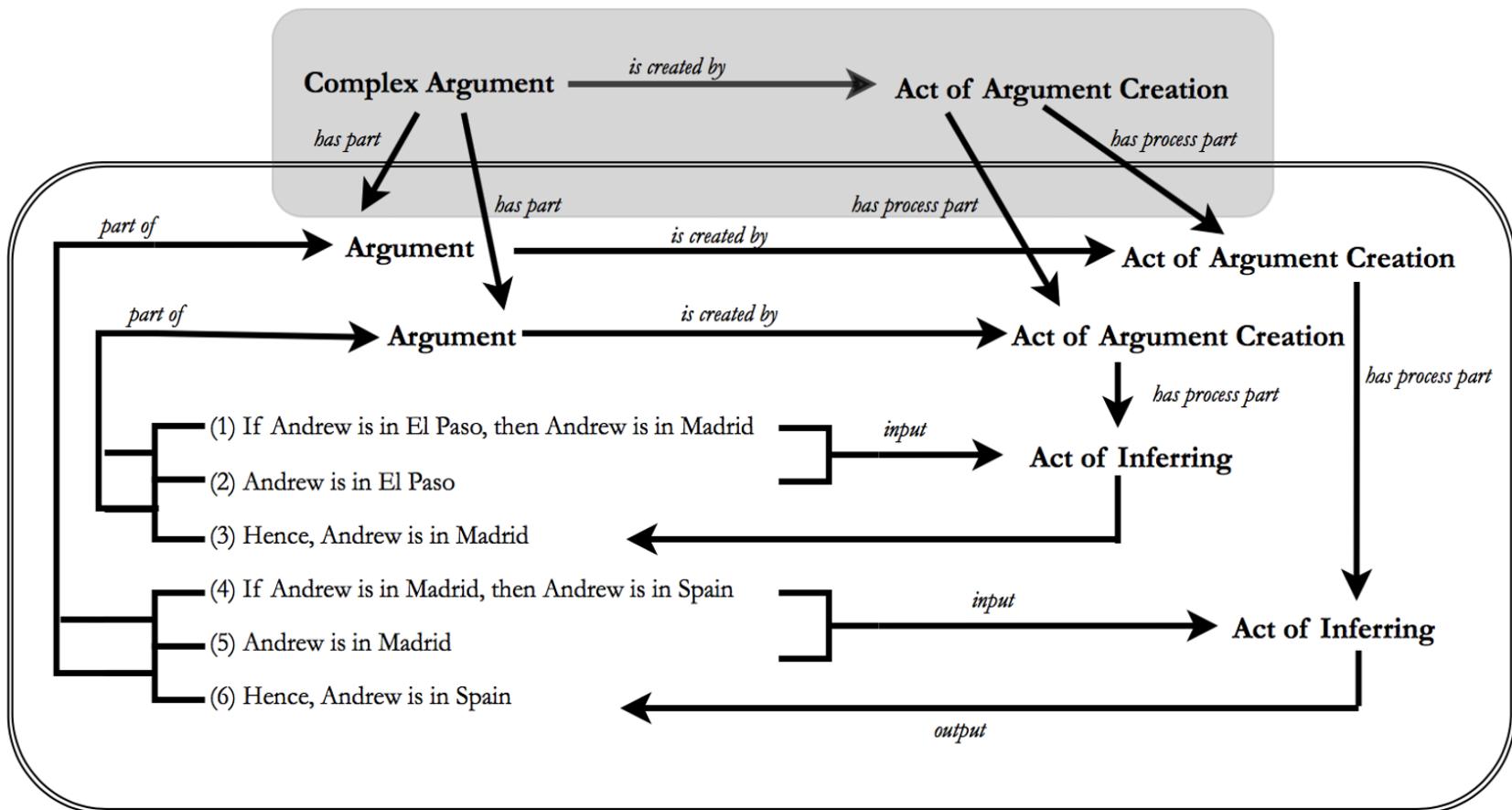
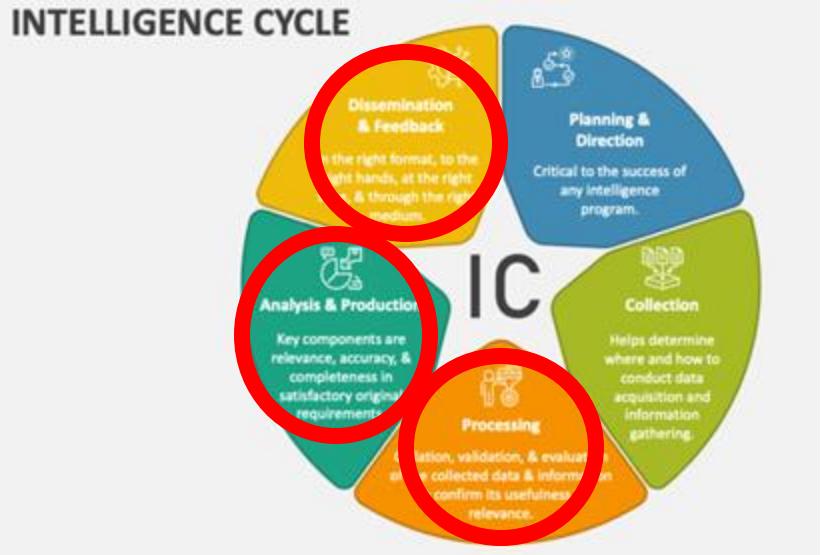
## Abstract

Postgraduate research training in the United Kingdom often narrowly focuses on domain-specific methods, neglecting wider philosophical topics such as epistemology and scientific method. Consequently, we designed a workshop on (inductive, deductive, and abductive) inference for postgraduate researchers. We ran the workshop three times with ( $N = 29$ ) attendees from across four universities, testing the potential benefits of the workshop in a mixed-method, repeated measures design. Our core aims were to investigate what attendees learned from the workshop, and whether they felt it had impacted on their research practices six months later. Overall, learning inferential logic benefitted postgraduate researchers in various ways and to varying degrees. Six months on, roughly half of attendees reported being more critical of key aspects of research such as inferences and study design. Additionally, some attendees reported more subtle effects, such as prompting new lines of thought and inquiry. Given that self-criticism and scepticism are fundamental intellectual virtues, these results evidence the importance of embedding epistemological training into doctoral programmes across the

# *Intelligence Analysis and Argumentation*

- To be fair, standard intelligence analysis appears to regularly include argument identification and inference checking
- The proposal here, however, is to leverage ontological representations to facilitate **machine-supported engagement with arguments and justification**
- For that, we must be precise about the domain of argumentation

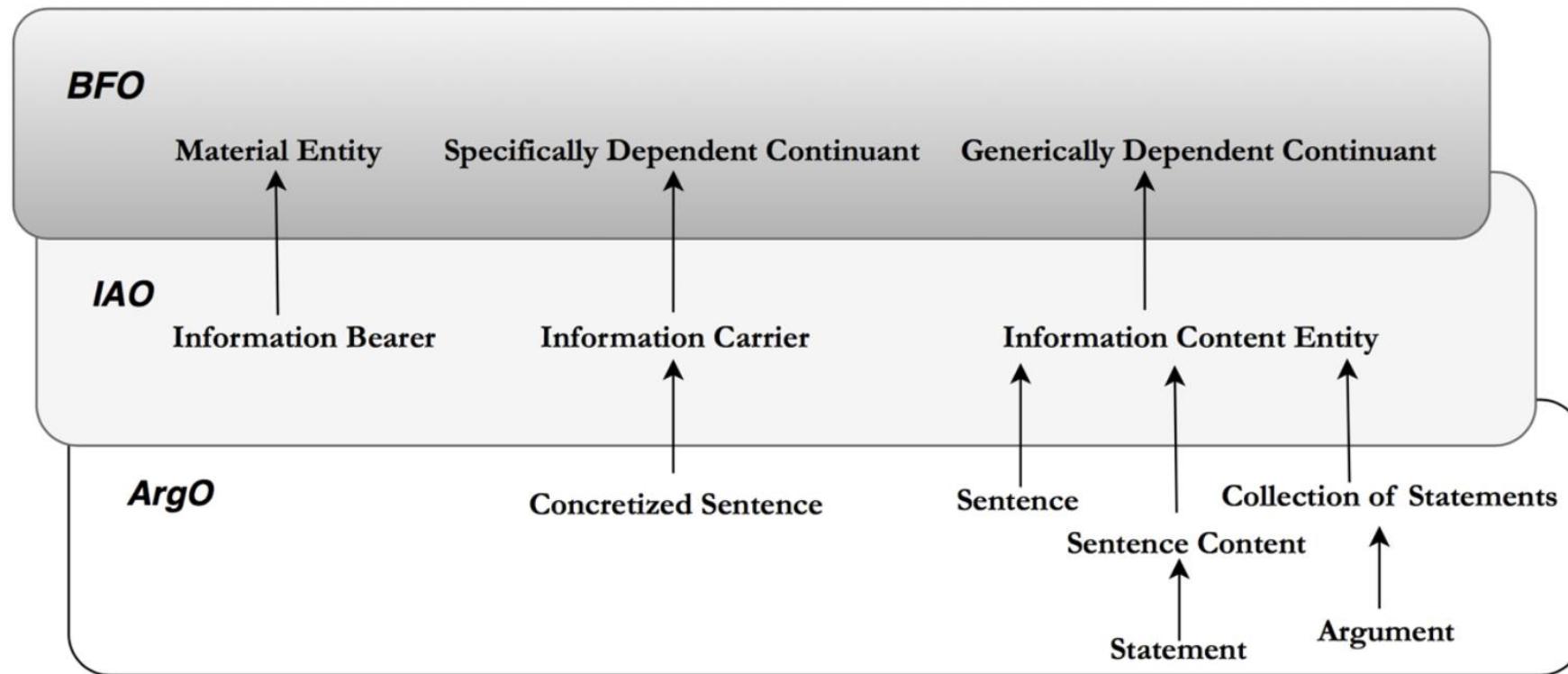
# *Arguments in the Intelligence Cycle*



# *Argument Ontology Best Practices*

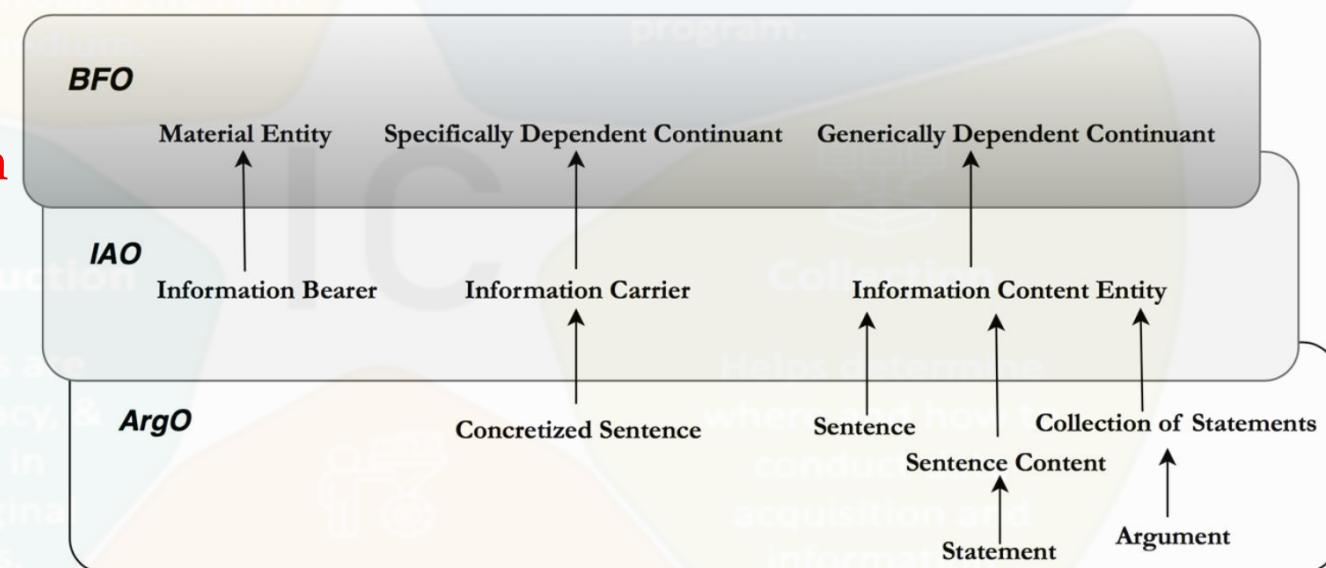
- An ontology should accurately represent entities and relationships within its stated scope:
  - Distinguish sentences from their contents
  - Distinguish sentence contents from what they are about
  - Distinguish sentence contents from their roles within arguments
  - Permit representation of multiple sentence and content types
  - Depict complex arguments

# *ARGO: The Argument Ontology*



# *Argument Ontology Best Practices*

- ARGO must:
  - Distinguish **sentences from their contents**
  - Distinguish **sentence contents from what they are about**
  - Distinguish sentence contents from their roles within arguments
  - Permit representation of multiple sentence and content types
  - Depict complex arguments



Proceeding  
Collation, validation, & verification  
of the collected data & information  
to confirm its usefulness &  
relevance.

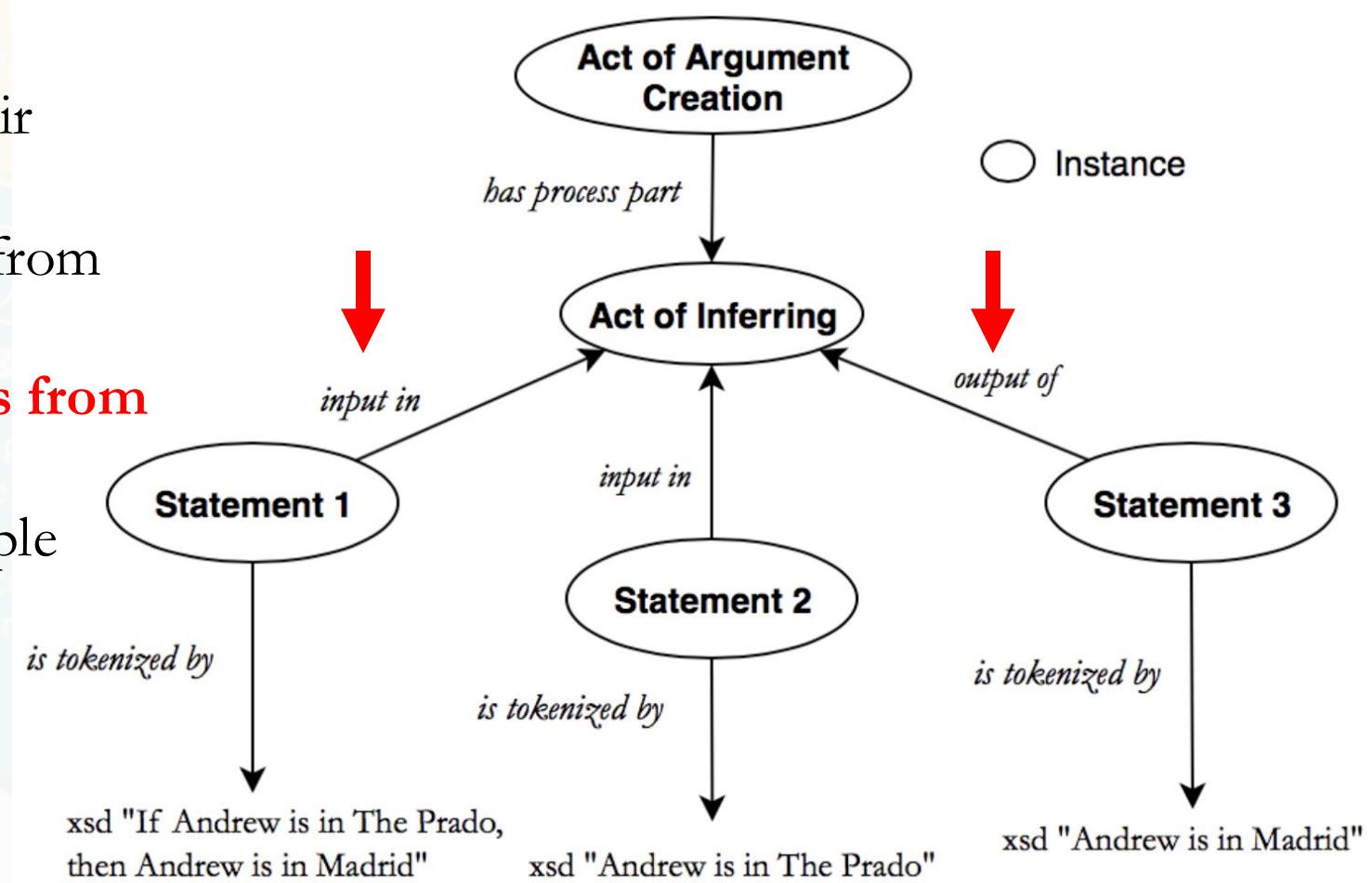


# *Sentences and Content*

- An **expression** consists of patterns of character shapes in a language, such as the string of characters comprising this clause
- A **concretized sentence** is a subclass of **expression**, instances of which satisfy some conventional rules of grammar
- Both are distinct from **statement**, a subclass of **information content entity** whose instances are the contents of **concretized sentences**
- The **concretized sentence** “Susan is happy” expresses the **statement** that Susan is happy, which is plausibly about Susan’s jocularity

# *Argument Ontology Best Practices*

- ARGO must:
    - Distinguish sentences from their contents
    - Distinguish sentence contents from what they are about
    - Distinguish **sentence contents from their roles within arguments**
    - Permit representation of multiple sentence and content types
    - Depict complex arguments



# *Premise, Supposition, Conclusion*

- Arguments are ordered collections of statements involving premises, suppositions and a single conclusion

# *Premise, Supposition, Conclusion*

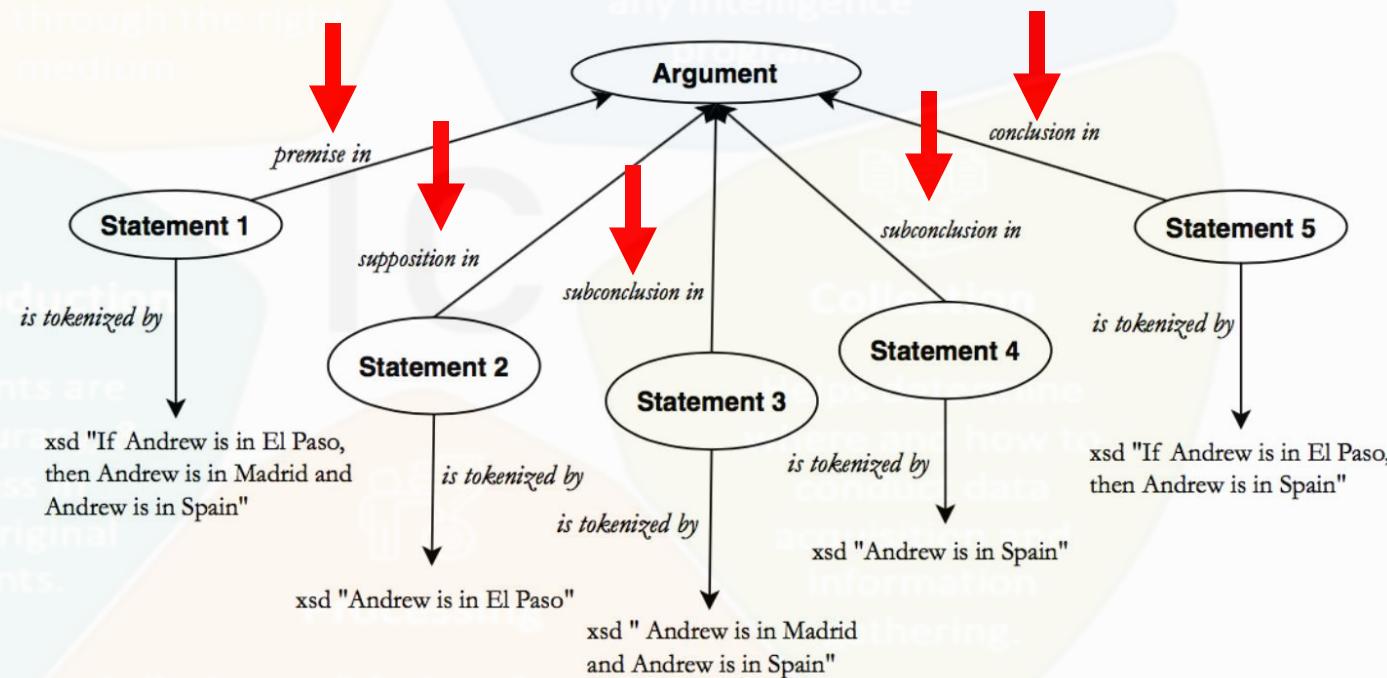
- Arguments are ordered collections of statements involving premises, suppositions and a single conclusion
- A premise is a statement in a relation to an argument as the affirmed input of an act of inferring; a conclusion is a statement part of an argument that is the output of an act of inferring

# *Premise, Supposition, Conclusion*

- Arguments are ordered collections of statements involving premises, suppositions and a single conclusion
- A premise is a statement in a relation to an argument as the affirmed input of an act of inferring; a conclusion is a statement part of an argument that is the output of an act of inferring
- Suppositions are inputs to act of accepting in which an agent entertains a statement as true or false independent of belief or evidence

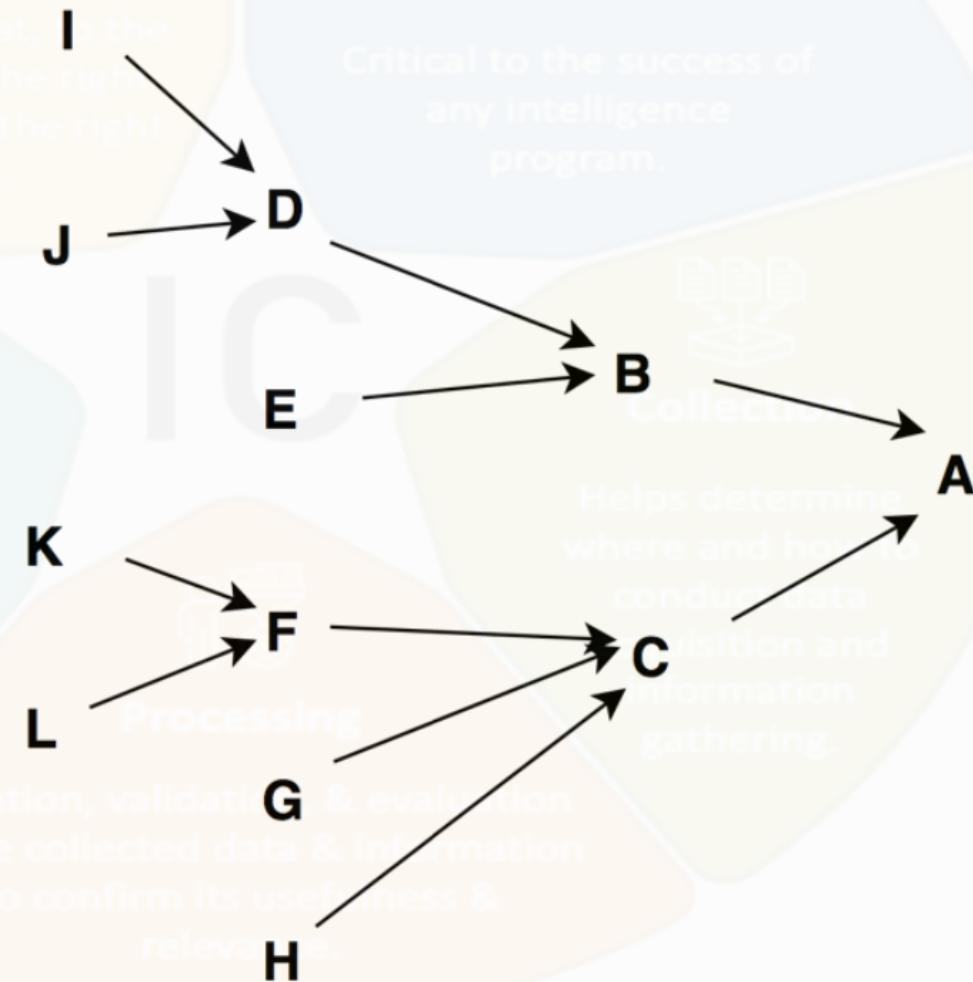
# *Argument Ontology Best Practices*

- ARGO must:
  - Distinguish sentences from their contents
  - Distinguish sentence contents from what they are about
  - Distinguish sentence contents from their roles within arguments
  - Permit representation of **multiple sentence and content types**
  - Depict complex arguments



# *Argument Ontology Best Practices*

- ARGO must:
  - Distinguish sentences from their contents
  - Distinguish sentence contents from what they are about
  - Distinguish sentence contents from their roles within arguments
  - Permit representation of multiple sentence and content types
  - Depict **complex arguments**

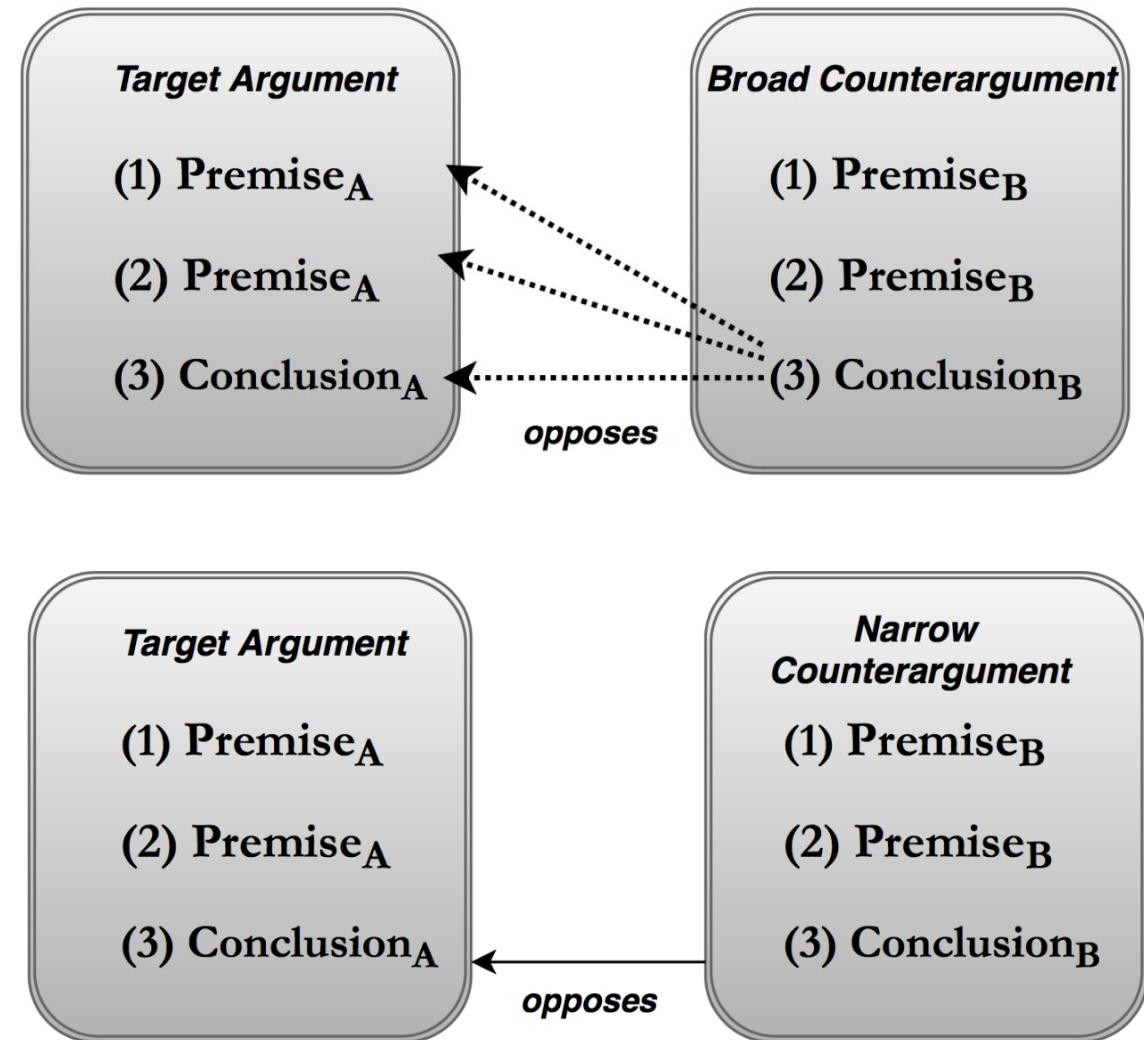


# *Subconclusions*

- A **subconclusion** is part of a **complex argument** that is:
  - Affirmed or accepted input in an **act of inferring**
  - Affirmed or accepted output in an **act of inferring** in an argument distinct from the first
  - Such that both arguments are parts of the **complex argument**

# *Counterevidence*

- Finding **counterevidence** for a conclusion may undermine an argument in different ways
- Classifying these ways informs how ontologies play with intelligence analysis under ACH



# *Application: Fact-Checking*

- Simple strategies involve **tagging**  $\langle claim, evidence \rangle$  pairs indicating when evidence supports or undermines the claim
- Sophisticated models attempt to **provide missing evidence** or **correct claims**
- Each such strategy attempts to leverage claims and evidence, a relationship often characterized in terms of **arguments**

# *Blueprints*

- Suppose statement X in argument A conflicts with statement Y in argument B, resulting in pair options for *<claim, evidence>*:

**<A, B>**

**<X, B>**

**<A, Y>**

**<X, Y>**

- Connected by mereological relationships, opposition relationships, etc.

**<X, Y>**

$\langle X, Y \rangle$



*opposes*



**<X, B>**

**<A, Y>**

**<X, Y>**



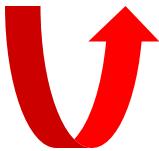
*opposes*



$\langle X, B \rangle$

*part of*

$\langle X, Y \rangle$

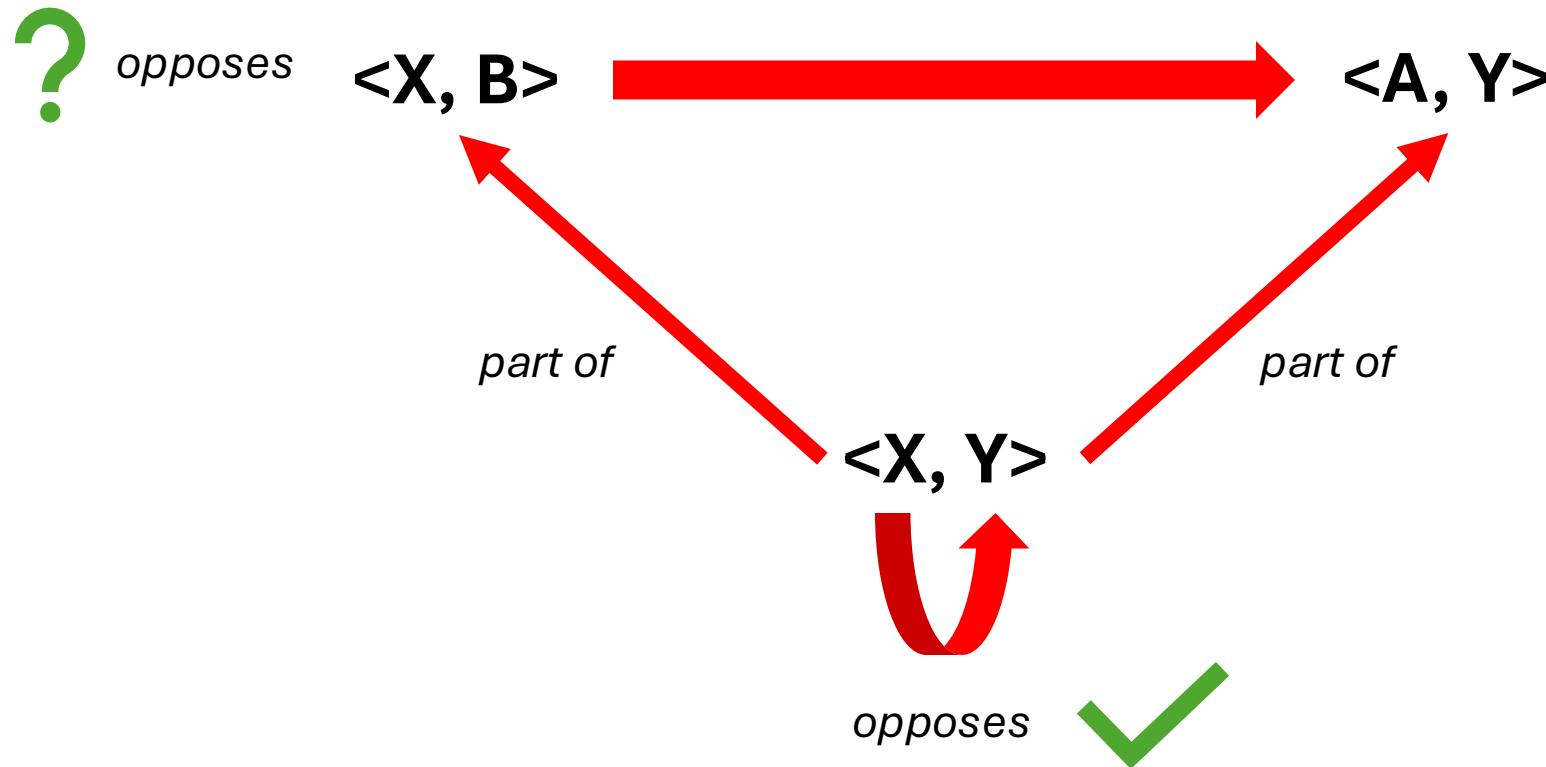


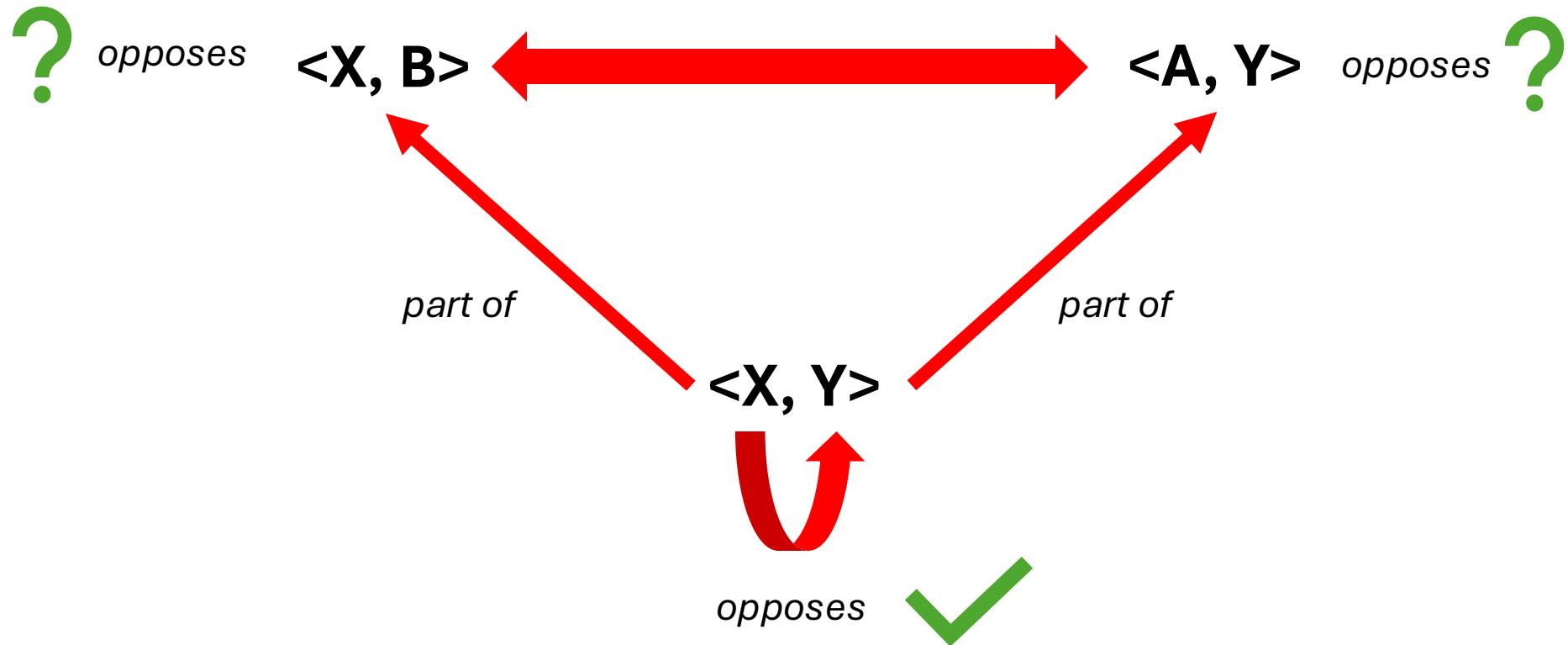
*opposes*

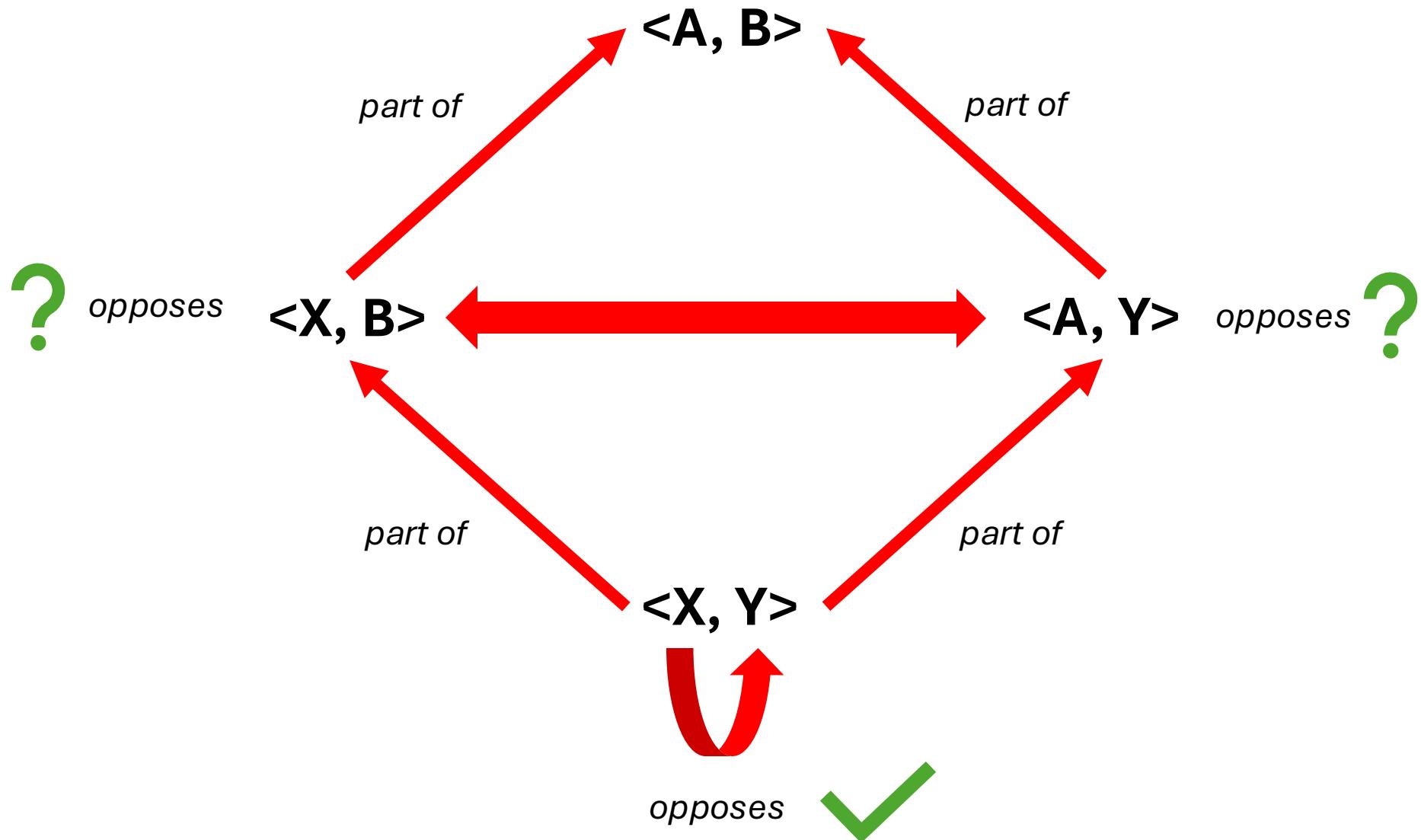
$\langle A, Y \rangle$

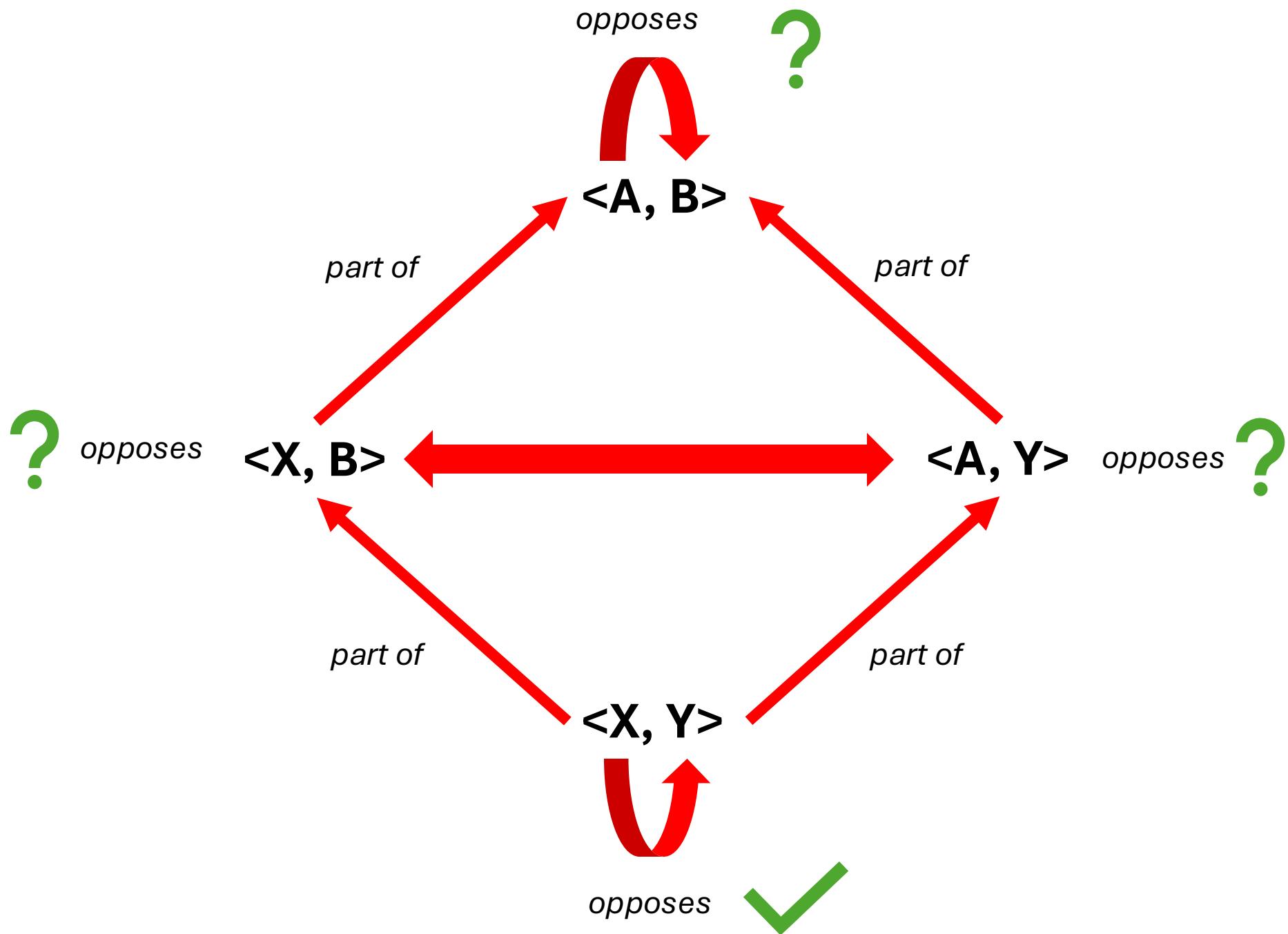
*part of*

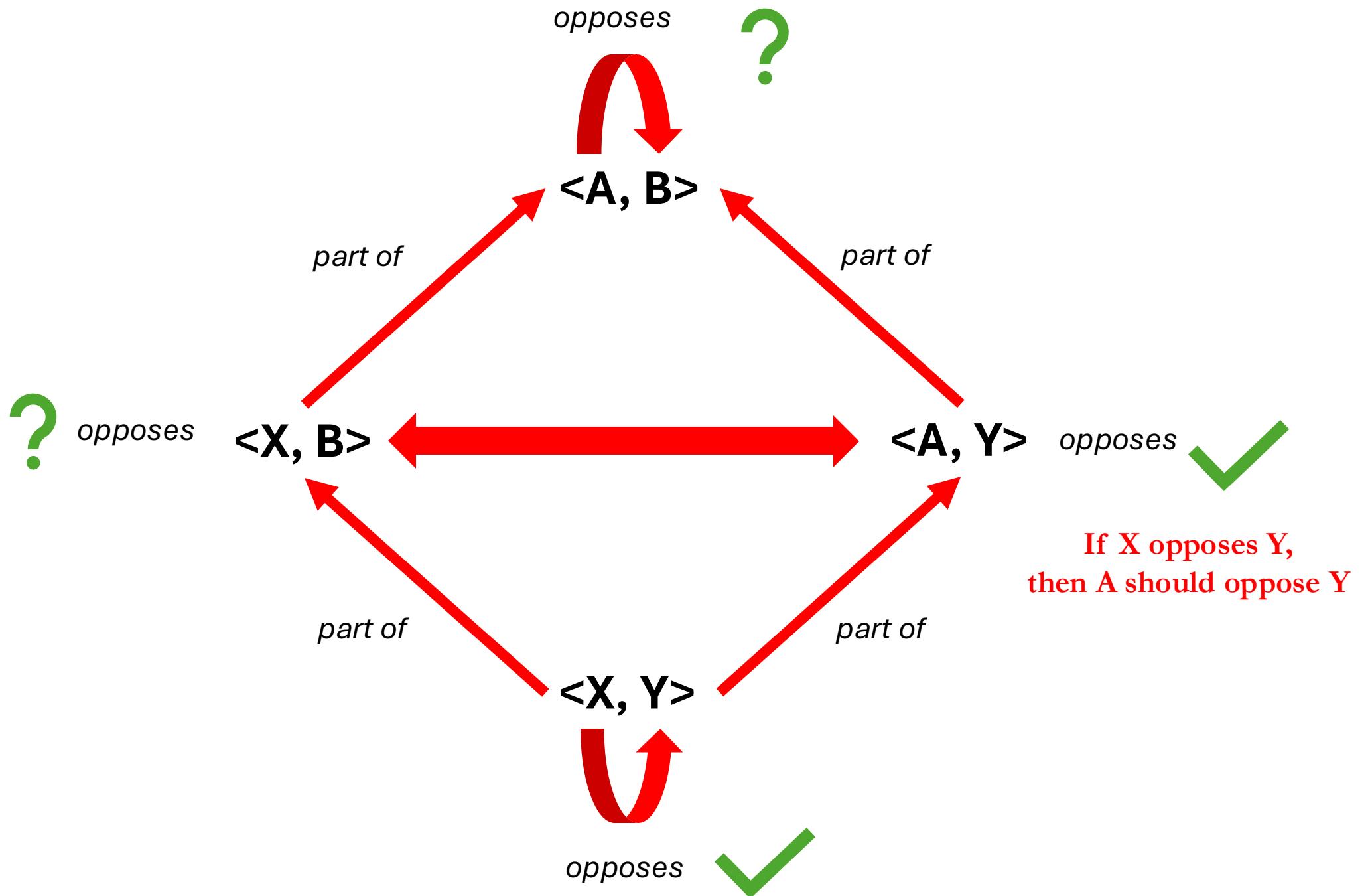


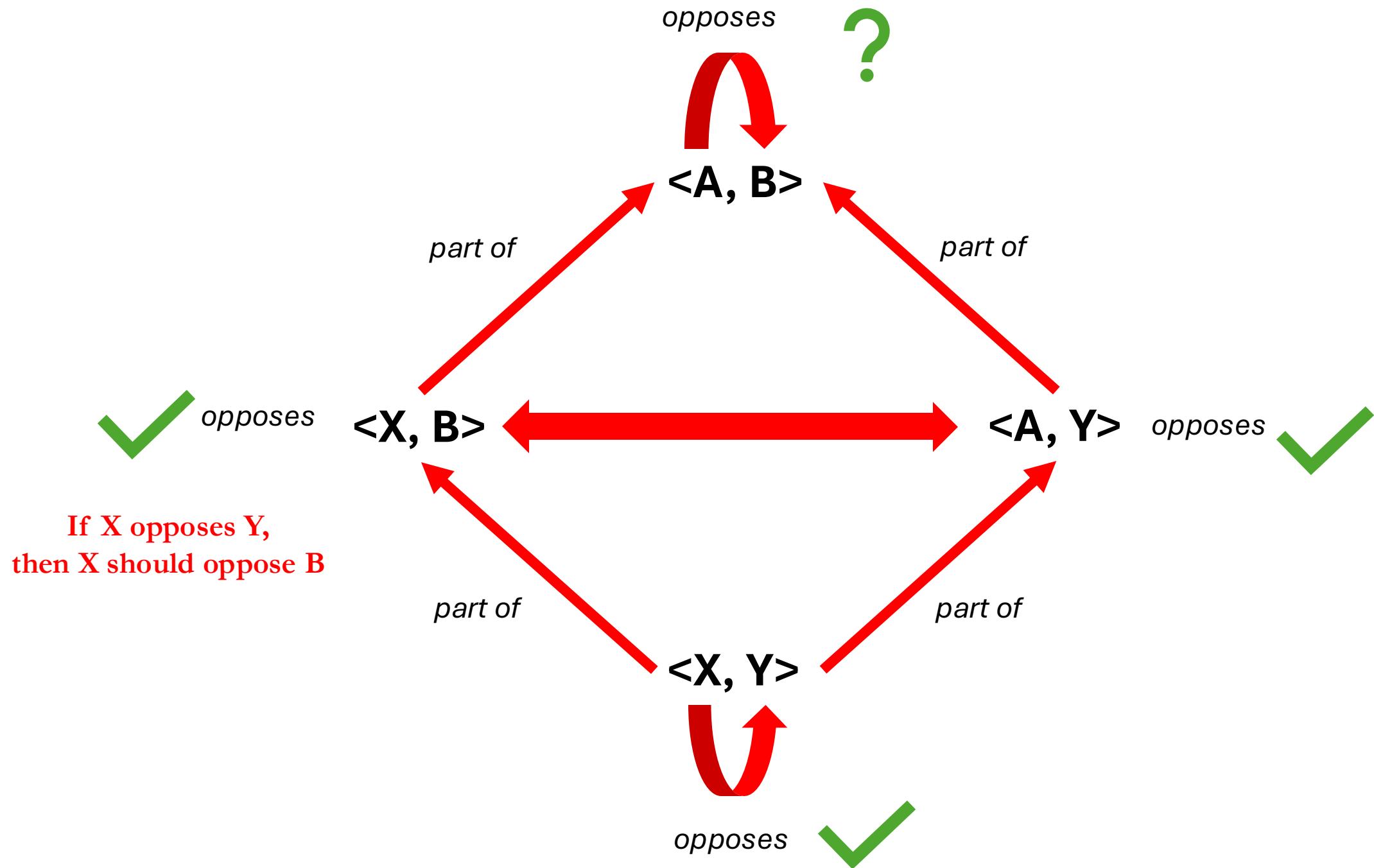




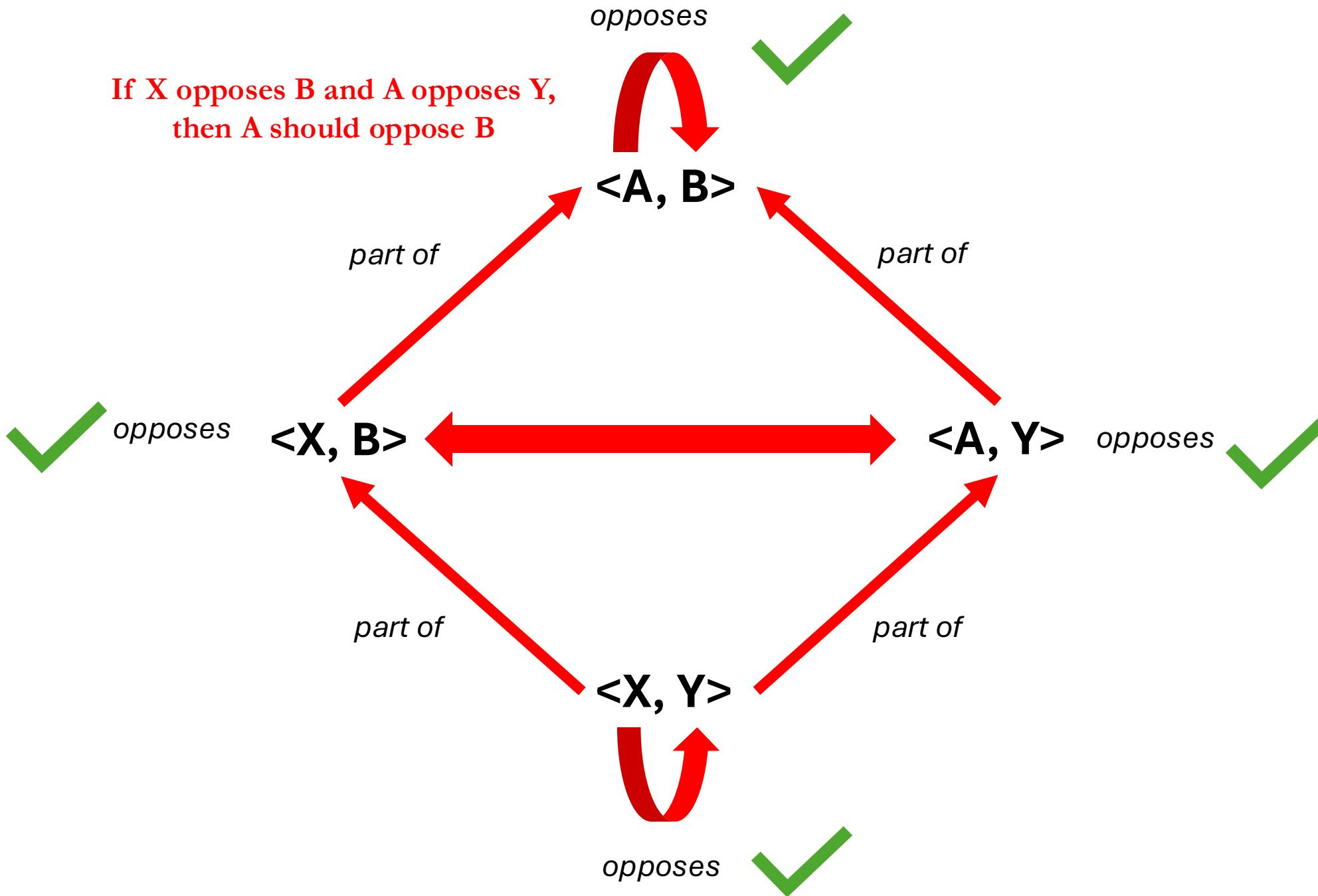








If X opposes B and A opposes Y,  
then A should oppose B

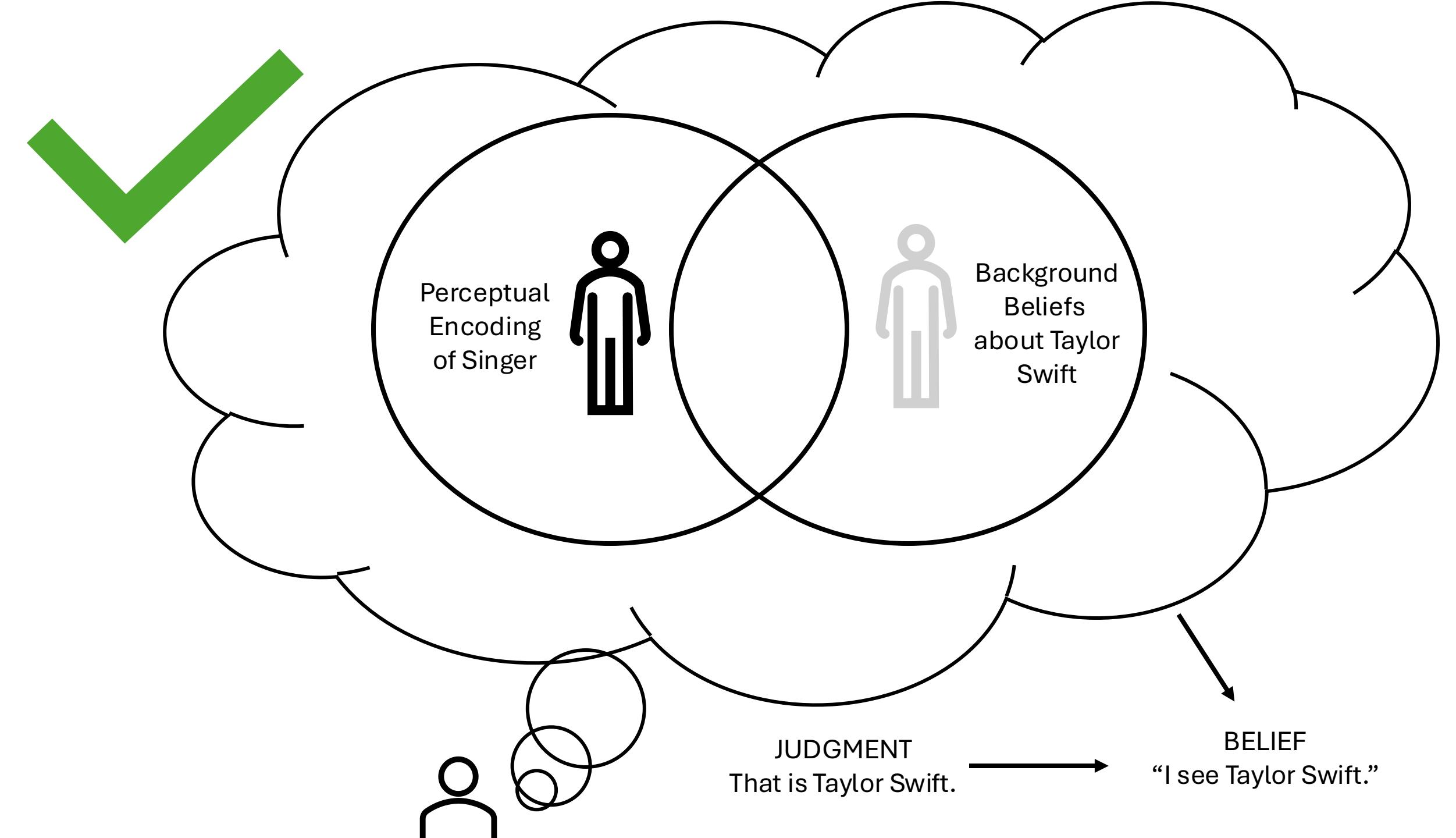


# *Example*

- Indeed, if A does not oppose Y, then at a minimum A does **not support X opposing Y**

# *Example*

- For example, suppose “Tom is at the grocery store” (Y) is opposed by “Tom is at home” (X). Suppose the latter is part of the argument (A):
  1. If Tom lives in the grocery store then he is at home.
  2. Tom lives in the grocery store.
  3. Hence, Tom is at home.
- This does not oppose “Tom is at the grocery store” (Y) because line 2 of the argument (A) does not support “Tom is at home” (X) opposing “Tom is at the grocery store” (Y)



# *Summary*

- Cognitive heuristics that are quite helpful in our daily lives can – if left unchecked – lead us to bias
- ACH is a strategy deployed by intelligence analysts to address confirmation and serial position bias, though it is unclear the extent to which the strategy is effective
- I argue that explicit representations of arguments and justification in the intelligence cycle will allow analysts to know when and where to leverage their expertise, rather than try to follow a formula

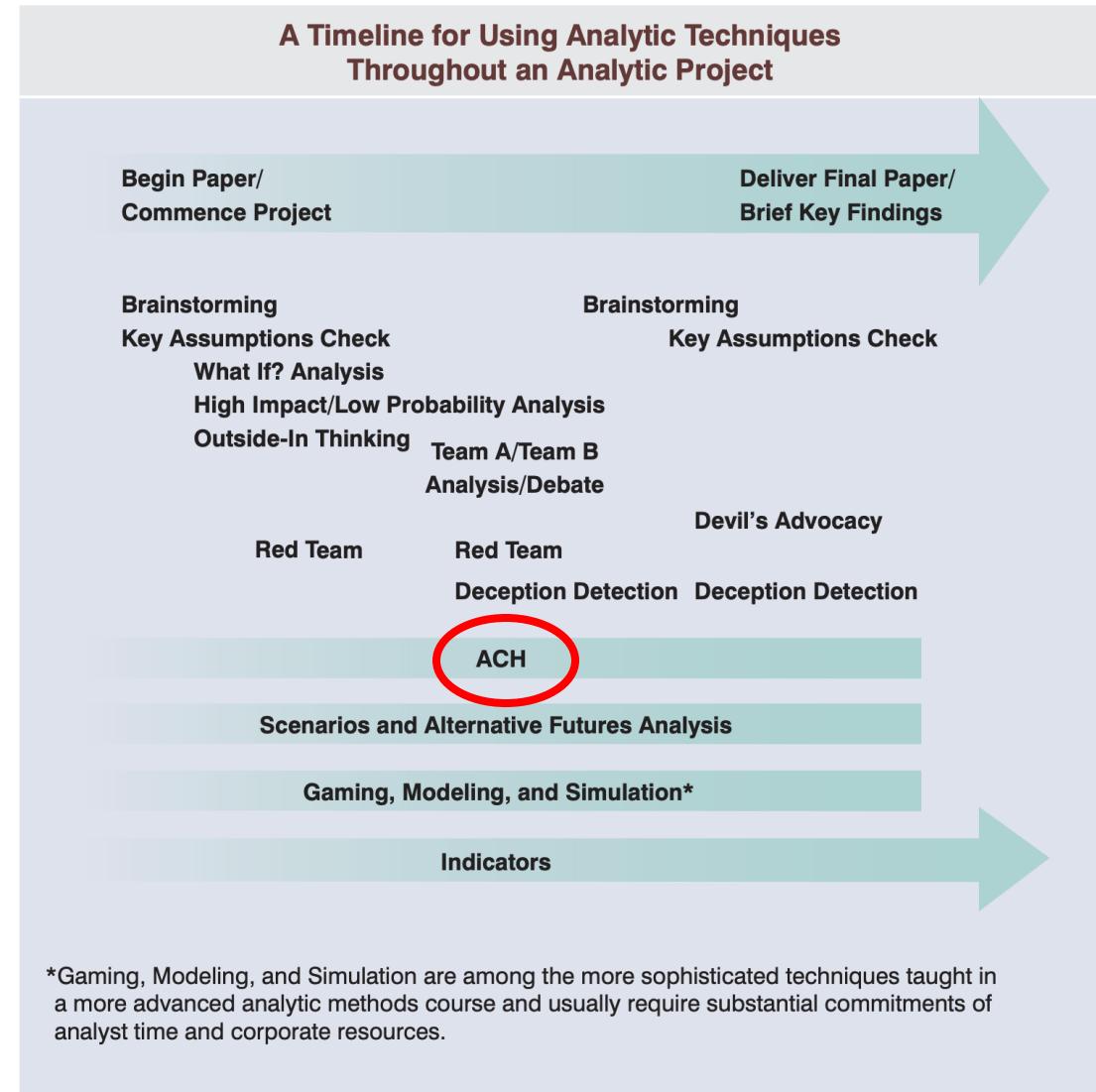
# *CIA Mitigation Handbook (2009)*

- ACH is not the only strategy deployed by intelligence agencies to address the risk of bias
- Many agencies supplement ACH with a collection of heuristics that are less analytic in their nature and deployment

Common Perceptual and Cognitive Biases	
<p><b>Perceptual Biases</b></p> <p><b>Expectations.</b> We tend to perceive what we expect to perceive. More (unambiguous) information is needed to recognize an unexpected phenomenon.</p> <p><b>Resistance.</b> Perceptions resist change even in the face of new evidence.</p> <p><b>Ambiguities.</b> Initial exposure to ambiguous or blurred stimuli interferes with accurate perception, even after more and better information becomes available.</p>	<p><b>Biases in Evaluating Evidence</b></p> <p><b>Consistency.</b> Conclusions drawn from a small body of consistent data engender more confidence than ones drawn from a larger body of less consistent data.</p> <p><b>Missing Information.</b> It is difficult to judge well the potential impact of missing evidence, even if the information gap is known.</p> <p><b>Discredited Evidence.</b> Even though evidence supporting a perception may be proved wrong, the perception may not quickly change.</p>
<p><b>Biases in Estimating Probabilities</b></p> <p><b>Availability.</b> Probability estimates are influenced by how easily one can imagine an event or recall similar instances.</p> <p><b>Anchoring.</b> Probability estimates are adjusted only incrementally in response to new information or further analysis.</p> <p><b>Overconfidence.</b> In translating feelings of certainty into a probability estimate, people are often overconfident, especially if they have considerable expertise.</p>	<p><b>Biases in Perceiving Causality</b></p> <p><b>Rationality.</b> 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.</p> <p><b>Attribution.</b> 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.</p>

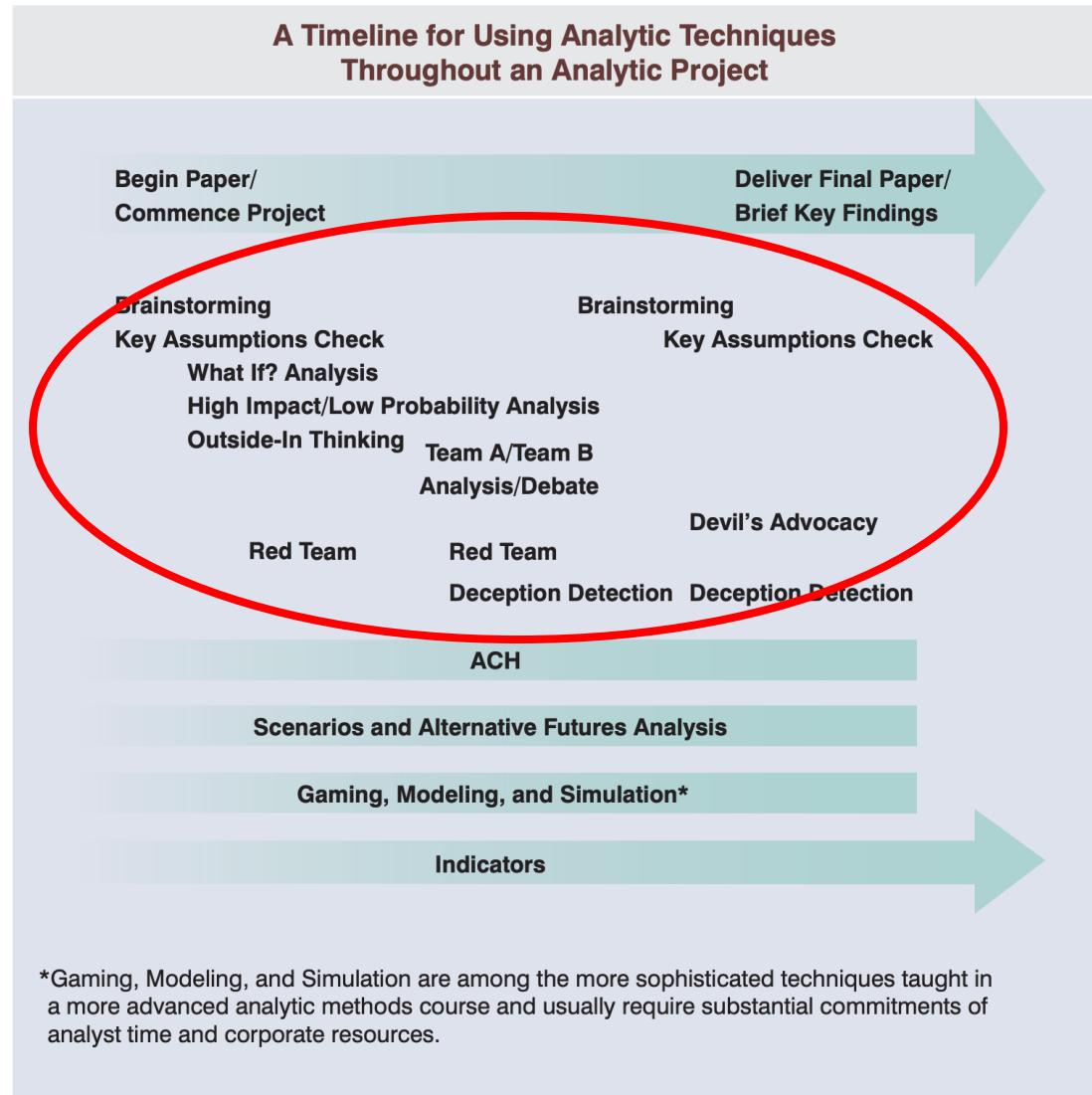
# *CIA Mitigation Handbook (2009)*

- ACH is not the only strategy deployed by intelligence agencies to address the risk of bias
- Many agencies supplement ACH with a collection of heuristics that are less analytic in their nature and deployment



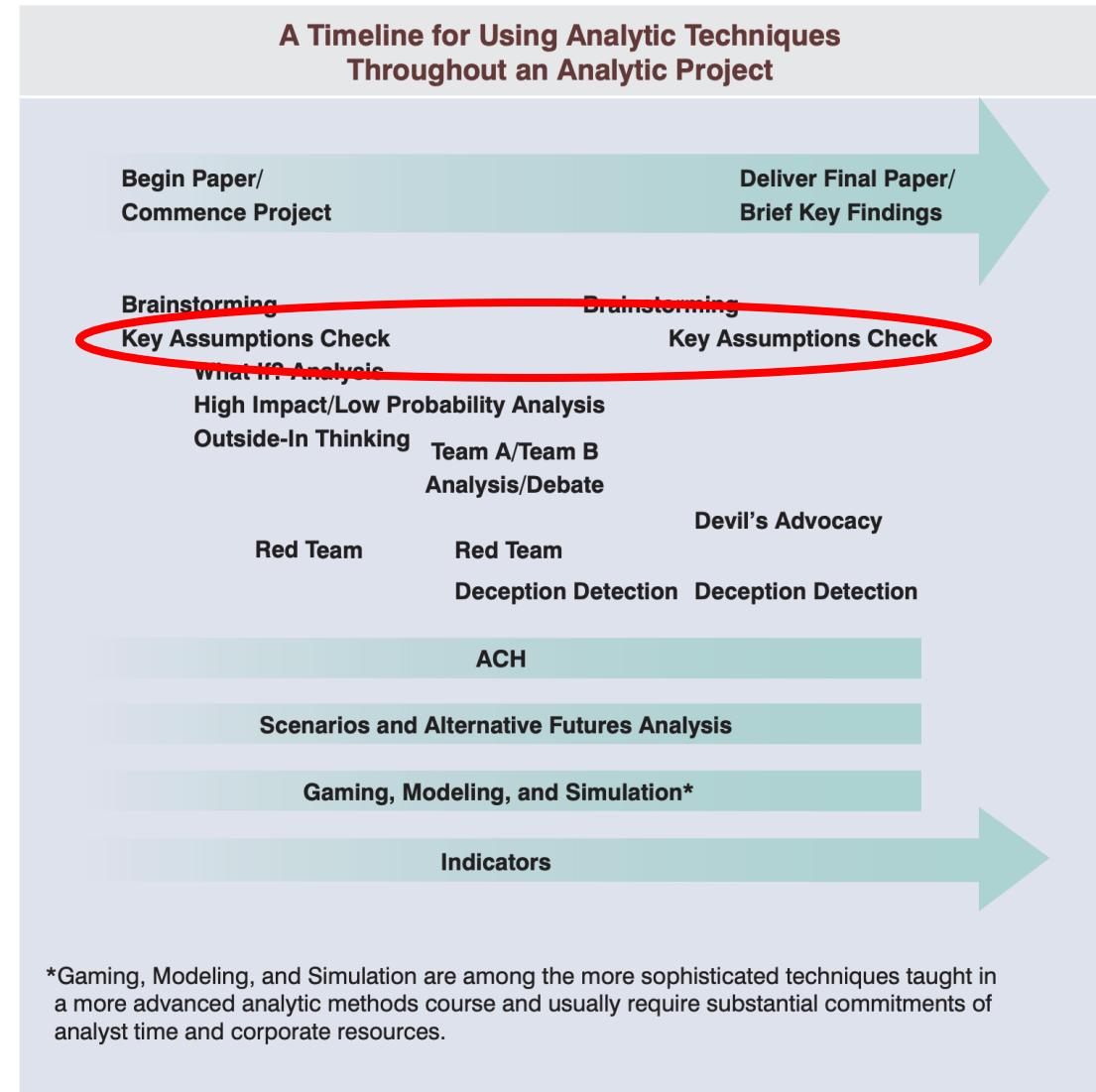
# *CIA Mitigation Handbook (2009)*

- ACH is not the only strategy deployed by intelligence agencies to address the risk of bias
- Many agencies supplement ACH with a collection of heuristics that are less analytic in their nature and deployment



# *CIA Mitigation Handbook (2009)*

- ACH is not the only strategy deployed by intelligence agencies to address the risk of bias
- Many agencies supplement ACH with a collection of heuristics that are less analytic in their nature and deployment



# *Key Assumptions Check*

## **Key Assumptions Check: The 2002 DC Sniper Case**

The outbreak of sniper shootings in the Washington, DC area in the fall of 2002 provides a good example of how this technique could have been applied. After the initial flurry of shootings, the operating assumption that quickly emerged was that the shootings were the work of a single, white male who had some military training and was driving a white van. If law enforcement officials had conducted a Key Assumptions Check, they could have broken this statement into its key components and assessed the validity of each statement as follows:

<b>Key Assumption</b>	<b>Assessment</b>
The sniper is a male.	Highly likely (but not certain) given past precedent with serial killers. We are taking little risk by not looking for a female.
The sniper is acting alone.	Highly likely (but not certain) given past precedents.
The sniper is white.	Likely, but not as certain, given past precedents. We would be taking some risk if we rule out nonwhites as suspects.
The sniper has military training/experience.	Possible, but not sufficient reason to exclude from consideration potential suspects who have not had any military training.
The sniper is driving a white van.	Possible because you have a credible eyewitness account but worthy of continuing scrutiny given the number of white vans in the area (more than 70,000 registered in the Maryland suburbs of Metropolitan Washington, DC) and that different kinds of vehicles are being described.

# *Key Assumptions Check*

## **Key Assumptions Check: The 2002 DC Sniper Case**

The outbreak of sniper shootings in the Washington, DC area in the fall of 2002 provides a good example of how this technique could have been applied. After the initial flurry of shootings, the operating assumption that quickly emerged was that the shootings were the work of a single, white male who had some military training and was driving a white van. If law enforcement officials had conducted a Key Assumptions Check, they could have broken this statement into its key components and assessed the validity of each statement as follows:

<b>Key Assumption</b>	<b>Assessment</b>
The sniper is a male.	Highly likely (but not certain) given past precedent with serial killers. We are taking little risk by not looking for a female.
The sniper is acting alone.	Highly likely (but not certain) given past precedents.
The sniper is white.	Likely, but not as certain, given past precedents. We would be taking some risk if we rule out nonwhites as suspects.
The sniper has military training/experience.	Possible, but not sufficient reason to exclude from consideration potential suspects who have not had any military training.
The sniper is driving a white van.	Possible because you have a credible eyewitness account but worthy of continuing scrutiny given the number of white vans in the area (more than 70,000 registered in the Maryland suburbs of Metropolitan Washington, DC) and that different kinds of vehicles are being described.

**A Key Assumptions Check** could have allowed law enforcement officials to:

- Avoid jumping to conclusions (the sniper is white, has military training, and is driving a white van) that did not hold up under closer scrutiny. By explicitly examining each assumption, officials could have avoided prematurely narrowing down the potential pool of suspects to a group that did not include the actual perpetrator. Similarly, they might have been more cautious about accepting that the sniper was driving a white van.
- Be receptive to new leads and citizen tips, such as eyewitness reports that the sniper fled the scene driving a specific model Chevrolet.
- More seriously consider evidence that subsequently became available, which contradicted a key assumption. If officials had stated explicitly that they were assuming the sniper was acting alone, they might have been sensitive to new information that contradicted that key assumption. Often this type of information gets “lost in the noise” if the analyst has not already thought about what key assumptions he or she is making.

