



*GEORGETOWN UNIVERSITY*

# **The Clear and Present Threat of Chem-Bio and Data and Computational Sciences and Technologies' (CB-DCST) Tools and Techniques**

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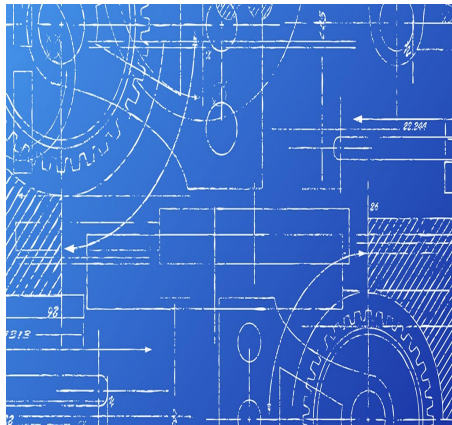
# Acknowledgments

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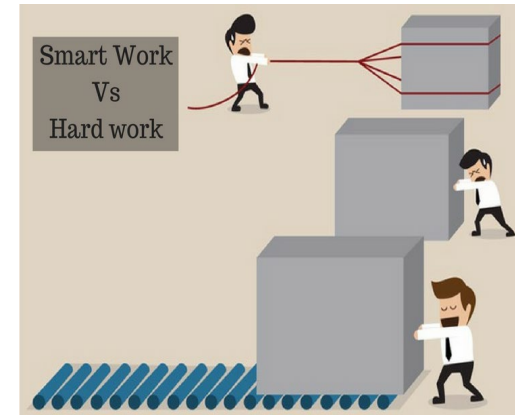
# Progress in CB-DCST

## Knowing-Doing Reciprocity

**Task(s)-to-Tools**  
**Tools-to-Theory**  
**Theory-to-Tools**  
**Tool(s)-to-Task(s)**

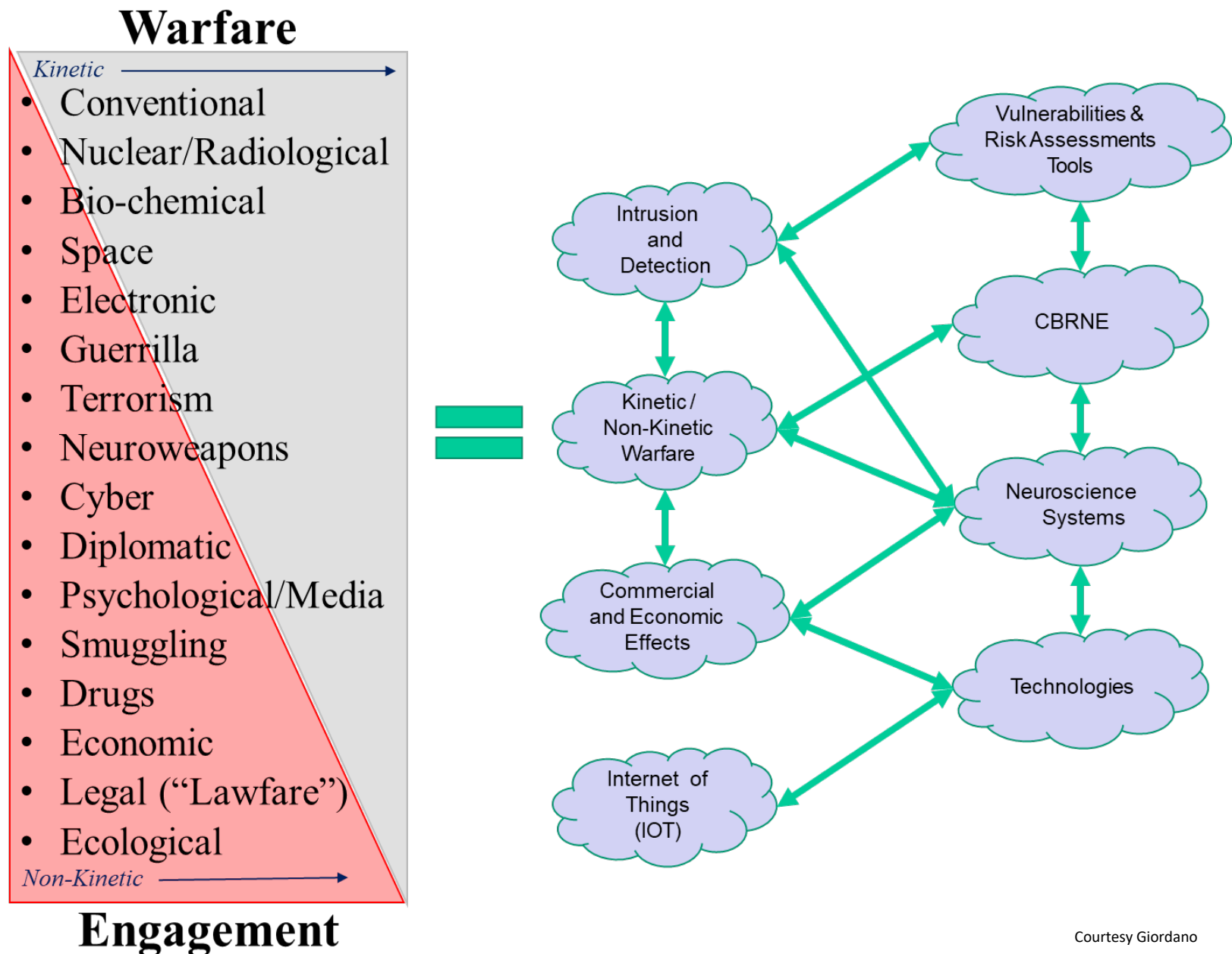


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# Chem-Bio Agents in Conflict Hierarchy



# **Beyond BTWC/CWC: Emerging Threats in Chem-Bio Science/Technology (S/T)**

- **Synthetic Bioagents**
- **Modified microbes**
  - **CRISPR-gene-edited agents**
    - **“Precision” pathologies**
- **Nanoneurotechnologies**
  - **Vectorable nanomaterials**
  - **Aerosolizable nanomaterials/nanobots**

**Force Multiplied by  
Integrative Scientific Convergence (ISC)**

# ISC

## Conjoins:

- Physical sciences
- Natural sciences
- Anthro/social science(s)
- Engineering

**RELIANT UPON DATA INTEGRATION, SHARING,  
AND USE...**

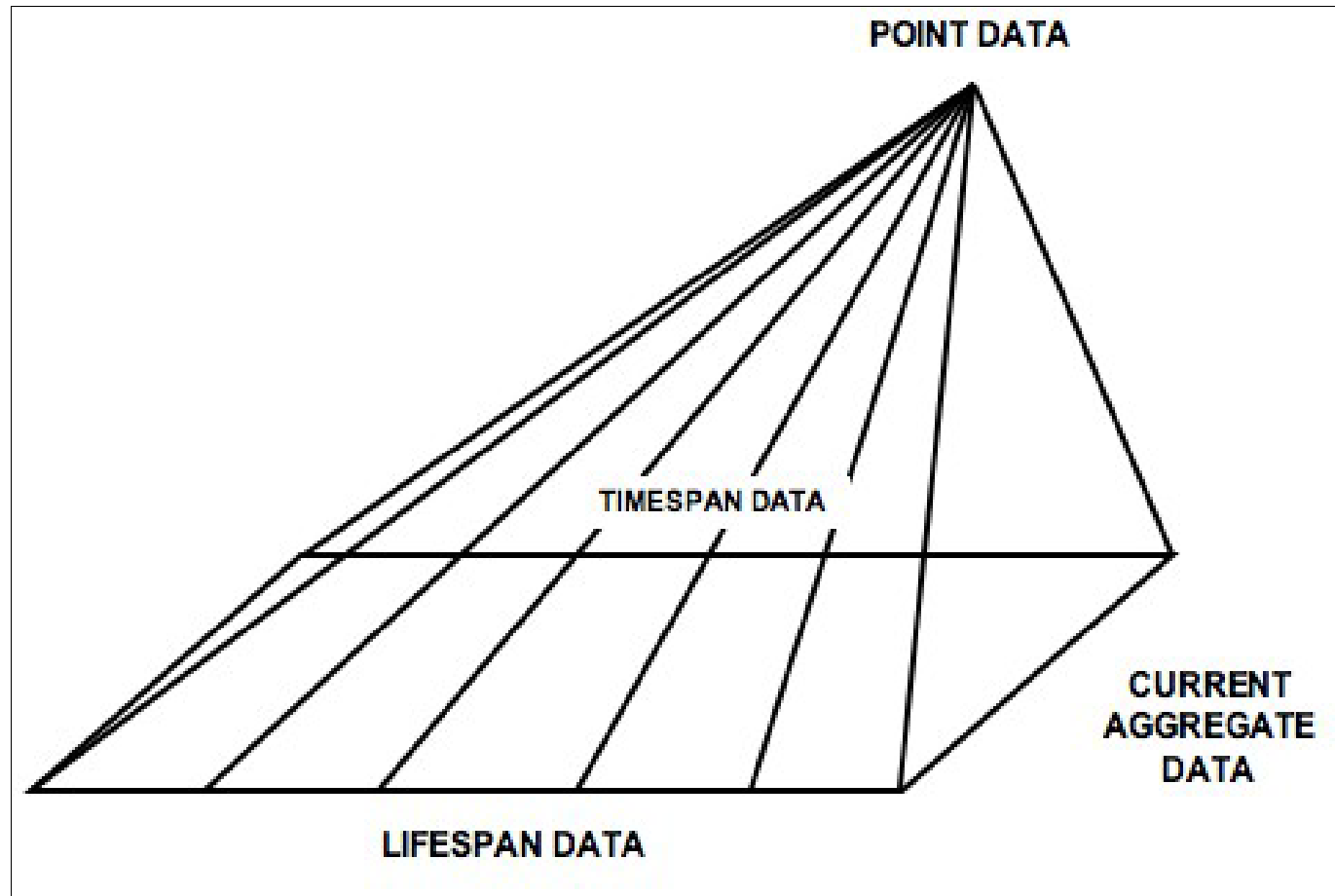
# **BIG DATA**

*Validity, Veridicality, Viability, Volumes, Velocities = VALUE*

# **Big Data Approaches**

- Maximize storage and retrieval**
- Parallel computing**
- Scalable, customizable**
- Accessible and sharable**

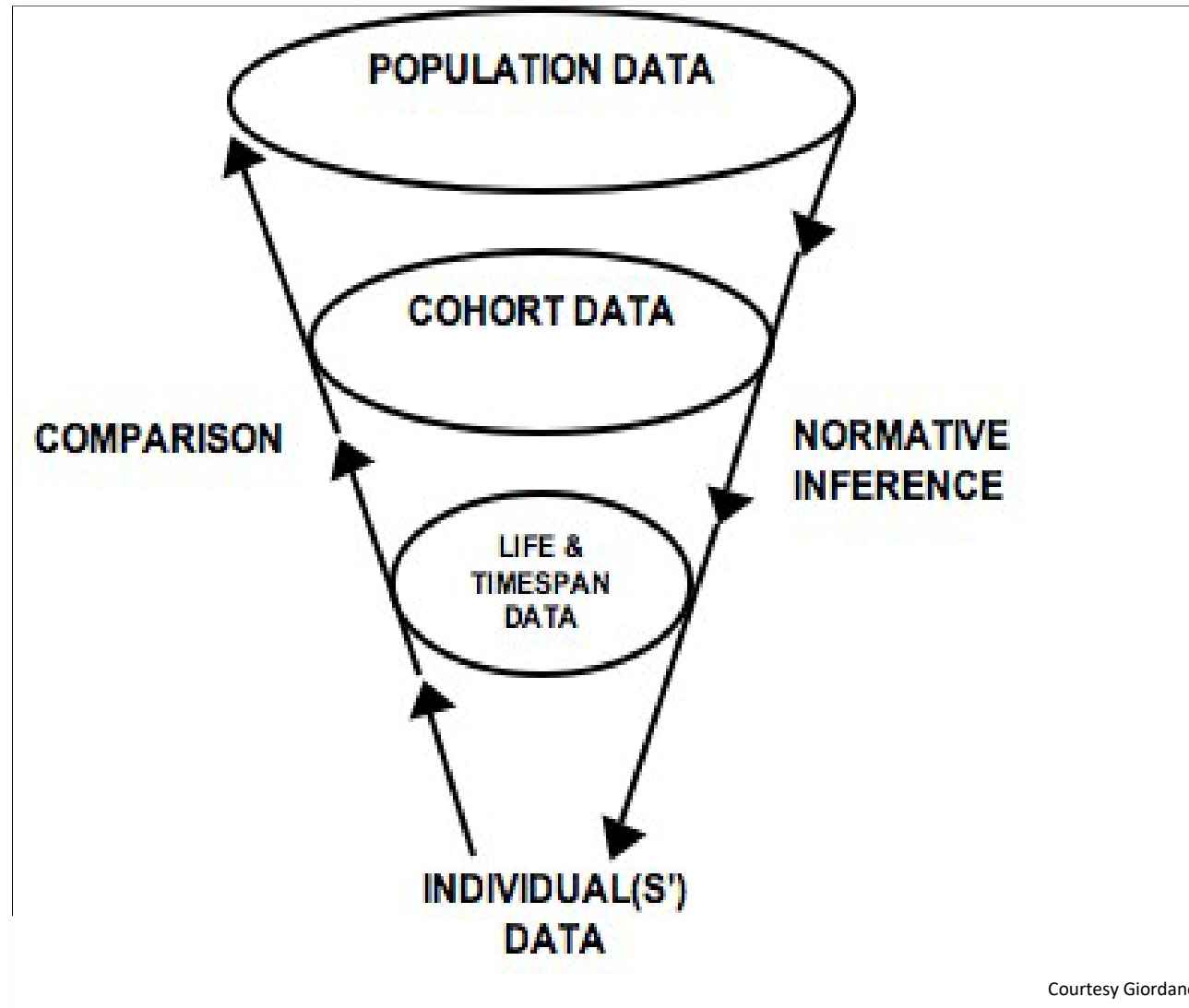
# Individual Data

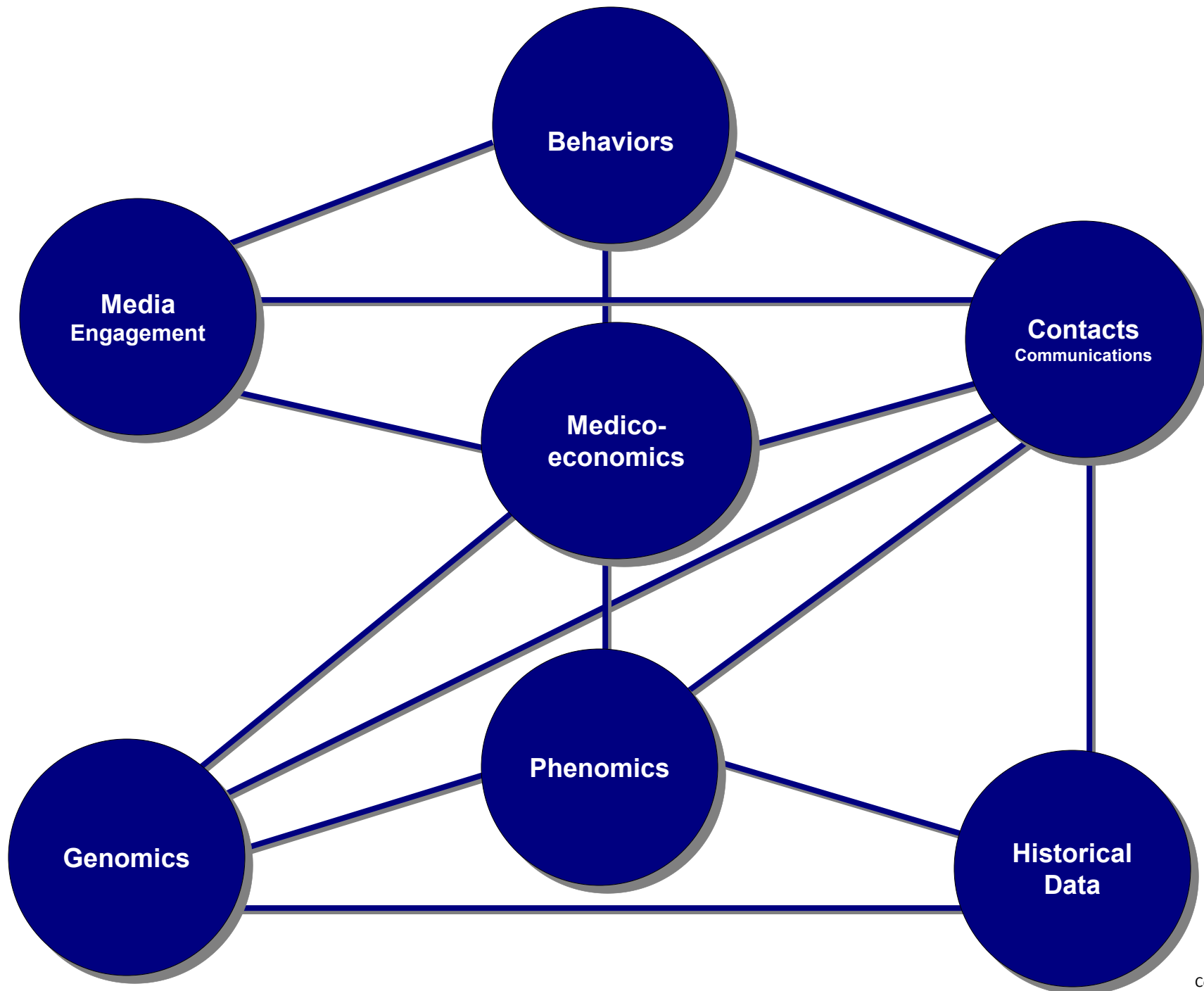


Courtesy Giordano



# Group-Analytic Data





# Big Data Caveats

**If it's assessable, it's accessible**

**If it's tagged, it's targetable**

***If it's stackable, it's hackable***

**What's hackable is manipulable**

- **What's controllable is corruptible**

# Big Data S/T Requires Computational S/T

For Acquisition, Assimilation, Syntheses, and Access...

## Across domains

- Subcellular to social

## Across levels

- Individual, cohorts, groups, populations

## Across geographic locales

- Complete geospatial access

## Across time

- Individual and historical time spans

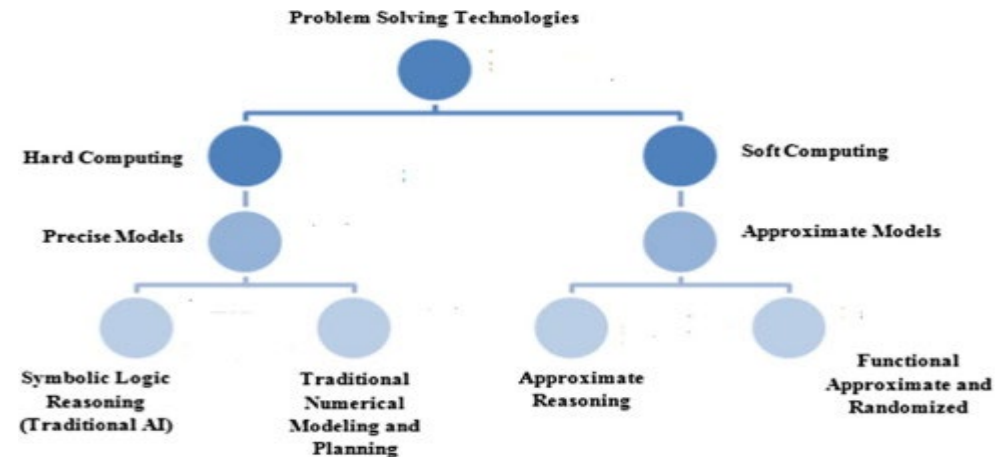
## Across groups

- Comparatively and normatively

# Artificial Intelligence (AI)

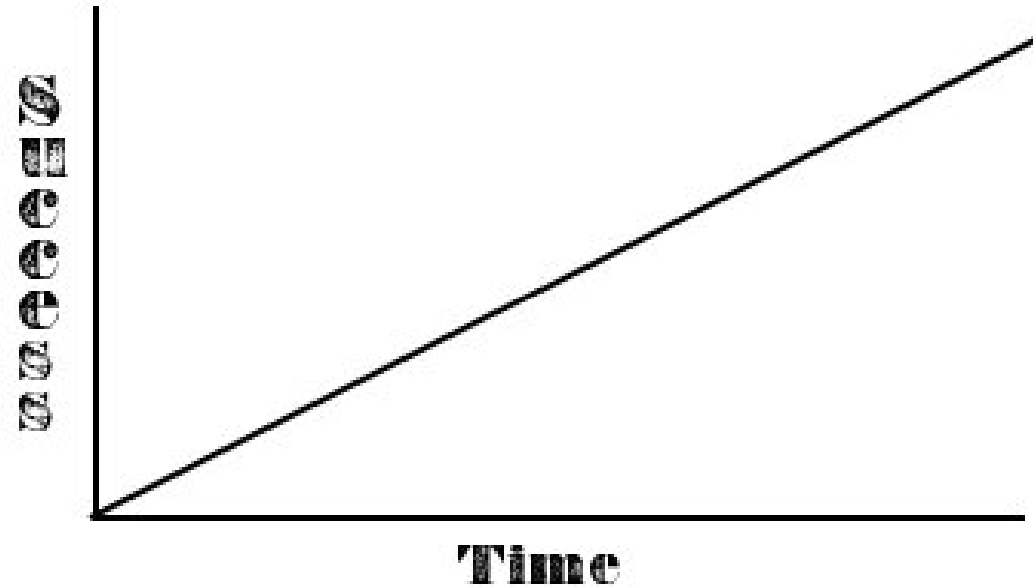
## The Two Themes of AI

- Hard AI – make computers do what humans do
  - Eventually computers will think
- Soft AI – make computers more sophisticated
  - Lets make computers better at solving some of our day-to-day problems

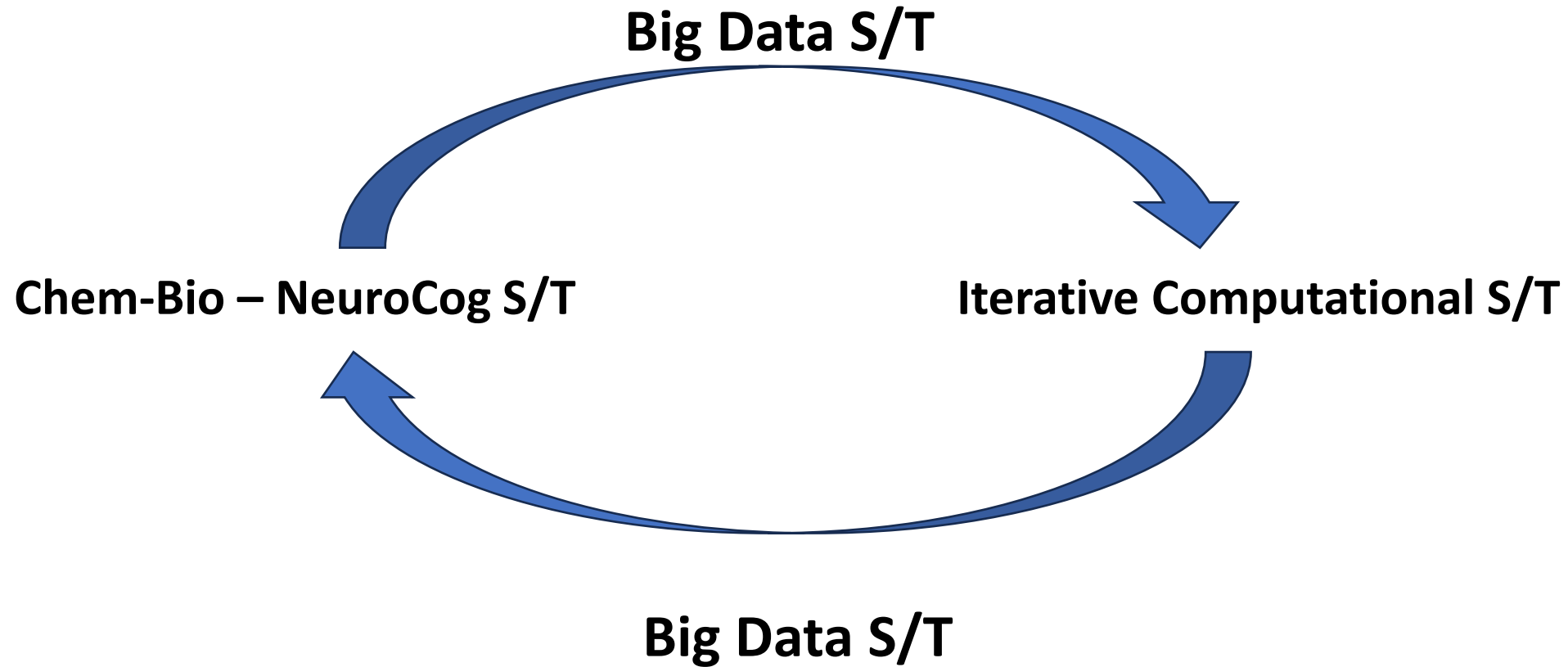


# Advances in DCST

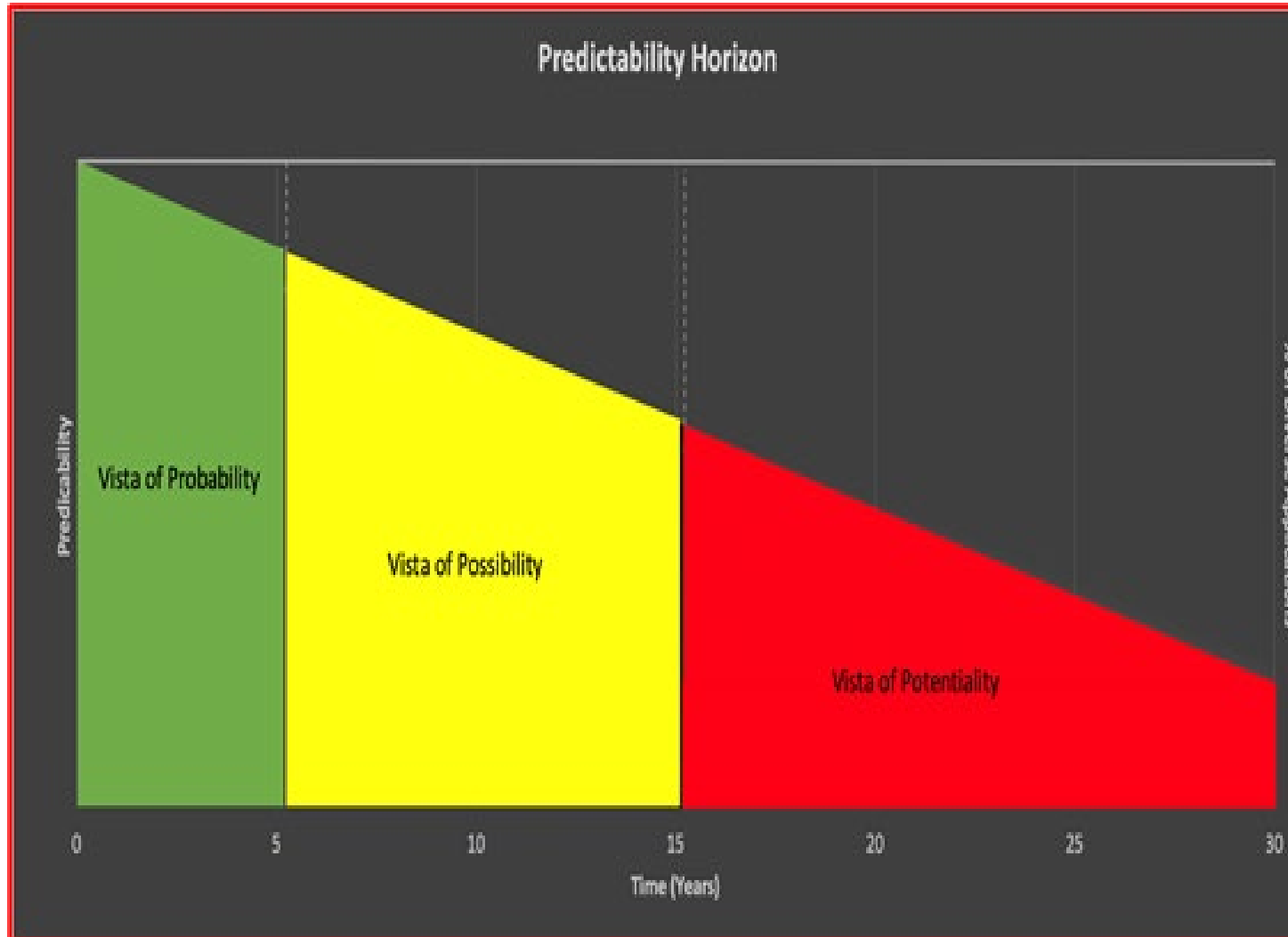
- Accuracy
- Diversity
- Scalability
- Speed
- Volume
- Workability  
Use in practice



# CB-DCST Complementarity & Reciprocity



# Volumes, Velocities ... and Vistas





# CB-DCS/T on the World Stage

- **Global Sight-picture 2020**
  - **China (on pace to outspend US/EU by an order of magnitude over the next 10 years)**
    - Predicted 60-68% increase in RDTE by 2025
    - Predicted 50-53% market share by 2025

## 2025-2030 Vista

- **Russia**
- **Iran**
- **North Korea**
- **Virtual nations**
- **Nonstate actors**

**Lack of focus and commitment to cyberbiosecurity provides exponential growth opportunities for exploitation**

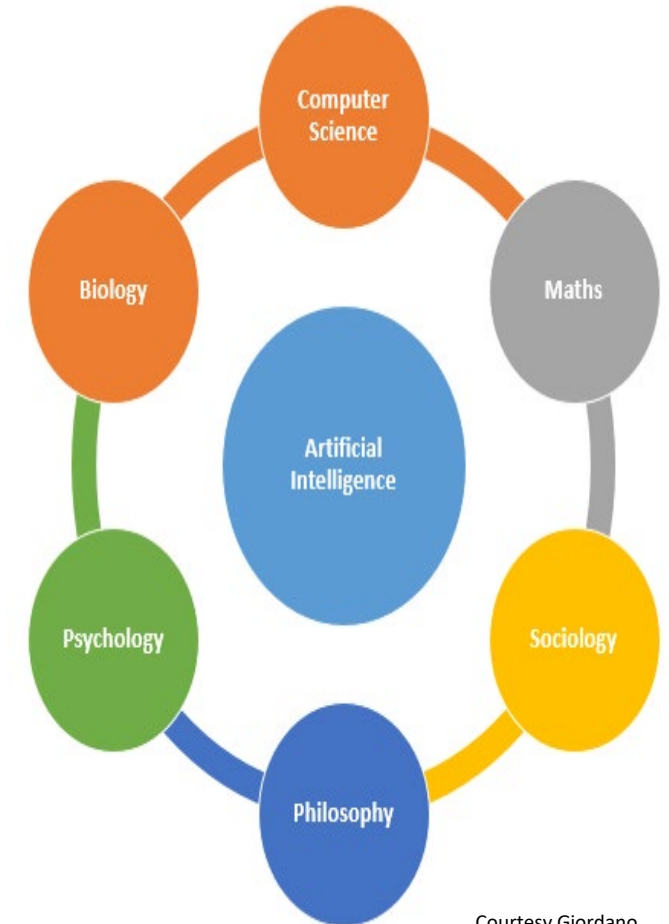
# Ethico-legal Issues & Risks

## Technology focal

**Intersecting unknowns**  
**Capabilities, limitations**  
**Validity, viability of use**  
**Runaway and Wexelblatt effects**

## Social

**Autonomy: of system(s) and users**  
**Awareness, understanding, consent**  
**Justice: provision/access**  
**Informed consent for use**  
**Dual use**



# Core Questions and Issues

- What do we do *with* the information and capability we have?
- What do we do *about* the information and capability we don't?
- Given what *can* be done, how do we (and who will) decide upon what *should* be done?
- Will we be able to do what we decide we should?

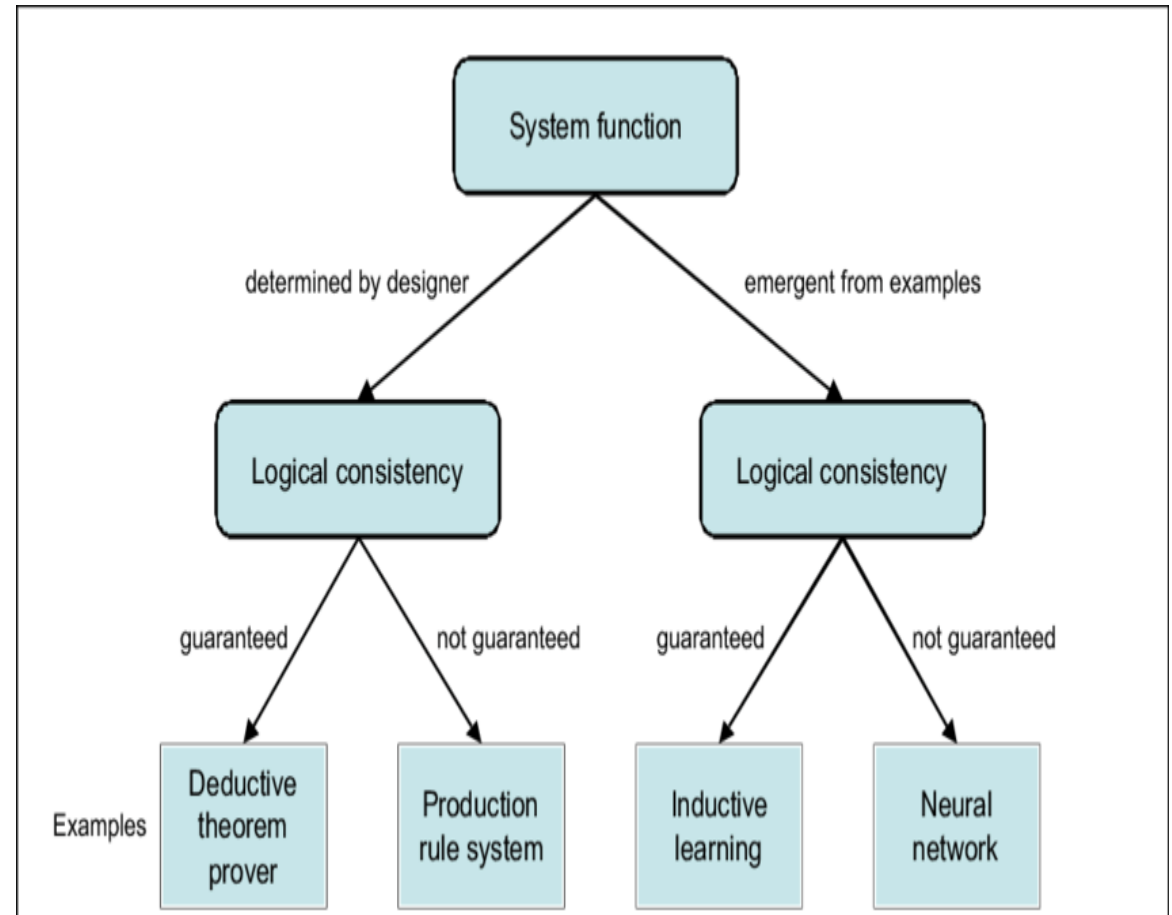
# Issues...Tensions...Conflicts

## *Dilemmata*

- **Prevention**
- **Protection**
- **Public Health**
- **Privacy**
- **Personal Liberties/Rights**
- **Potentially Punitive Implications**

# CB-DCST Ethics on the World Stage

- **Cosmopolitan Cognizant**
- **Community Capable**
- **Accommodating Pluralist**
  - Needs
  - Values
  - Norms
  - Mores
- **Affected by/Affecting:**
  - Economics
  - Politics
  - Power Balances



# Any Consideration of Using CB-DCST Should Be Informed by...

## 6-W Questions:

- ***What*** S/T are available for current use?
- ***Why*** is S/T considered or advocated for use?
- ***Who*** will receive S/T?
- ***When*** will S/T be considered (algorithm/protocol)?
- ***Where*** will S/T be engaged (e.g., locale, nation, domain, etc.)?
- ***Which*** mechanisms will be in place for ongoing provision of services/resources?

As Framed by...

## 6-C Considerations:

- ***Capacities*** and limitations of the S/T
- ***Consequences*** incurred by S/T on individuals and systems in the short, intermediate, and long term
- ***Character*** of the use case and user(s) affected by S/T
- ***Contexts*** of need and value that influence use of S/T
- ***Continuity*** of research and revision
- ***Consent*** for use through provision of most information possible

# **Globally Relevant Design**

**Appreciates Cultural Diversity**

*Cosmopolitan “Palette”*

**Acknowledges Local Needs/Values**

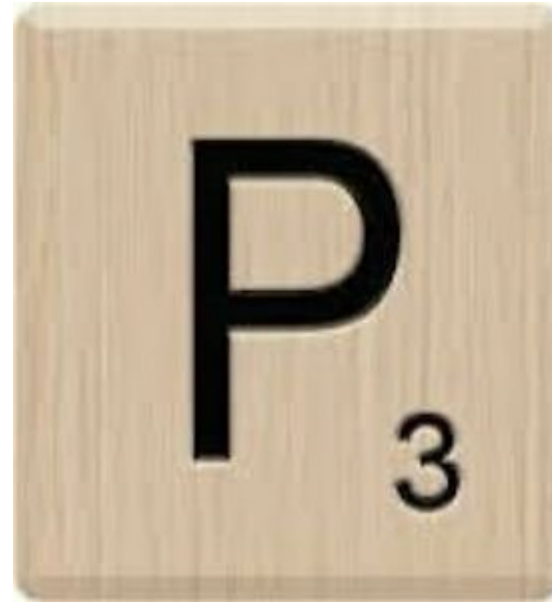
*Community “Canvas(es)”*

**Anticipates Particularities of “Collective Efforts”**

*Combinatory Constructs*

# Mechanisms for Change

- **Persons = Participants**
- **Participatory Alignment**
- **Purposivity**
  - **Identifies goals**
  - **Identifies outcomes**
  - **Provides administrative basis for affect and sustainability**



Canva



# Process in Praxis

- **Pragmatic analyses**
- **Preparatory posture**
- **Personnel**
  - perceptive
  - pessimistic as *skepsis*
  - persistent
- **Predictions**
  - probabilities, possibilities, potentialities
  - problems: containable, retrievable, reversible, and/or forgivable?
- **Prudence in decision(s) and action(s)**
- **Policy**

Pp

*Pp*

# Preparedness

Preparation ≠ Prevention (of Relative Promise of Positive Outcomes)

Readiness Stance/Posture: Focused, Flexible, and Fast Moving/Adapting

Recognition and Responsiveness to *Both* Idiosyncratic and Systemic

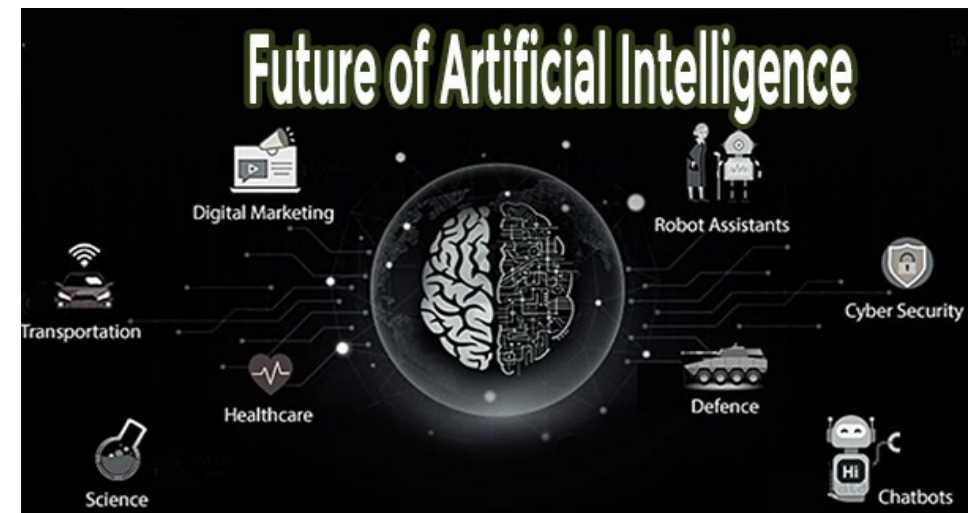
Benefit(s)

Burden(s)

Risk(s)

Threat(s)

Harm(s)



# **“Preparedness Process”**

- **Identify risk scenarios that evolve from specified events**
- **Craft strategies for preemption, preparation, response, and amelioration**
- **Examine (setting, exploring, and exploiting) conditions at the operational level across all elements and the physical, cognitive, and informational domains**
- **Create strategies that are relevant, durable, and can be targeted for demographics and psychographics in the face of severe cultural impact**
- **Identify/plan a robust framework to remain effective and adaptive to a changing environment as risks and society (co-)evolve**

# Get SMART: Security, Management, Administration, Research, and Training

- Need for BINA – NOW (see Kostiuk, 2012)
- Need programmatic cyberbiosecurity by design
- Need for ongoing surveillance (of field and RDTEU loci/foci)
- Need for discourse/dialog/dialectical engagement
- Need for education & training
- Need for currency, critique, & revision

*Fixity of Purpose Requires Flexibility of Method*

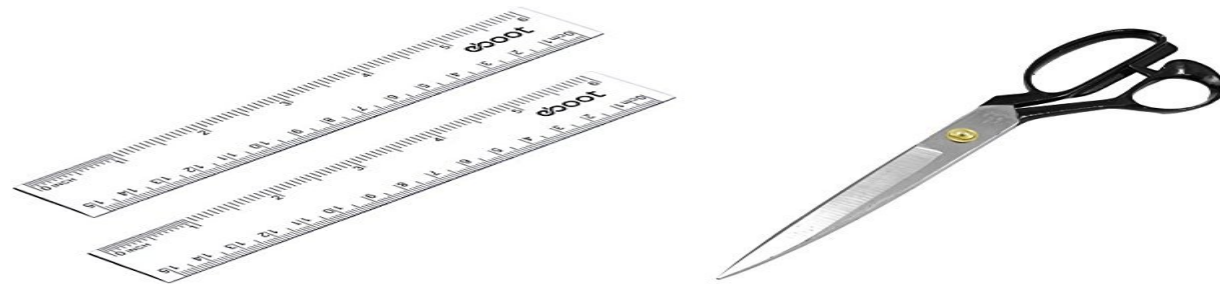
# *Quo Vadis?*

- **Realistic Insight**
- **Technoeconomic Savvy**
- **Security-by-Design**
- **Globally Relevant & Responsive Ethics**

# Take-Home Messages

Reflection, insight, and prudence must be the stepping stone for all future acts of inquiry, invention, and intervention...

*“Measure twice, cut once,”* for all too often, there is no turning back.



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