

Accelerating Behavioral and Social Science Through Ontology Development and Use

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Concept Clearance: New

Title: Accelerating Behavioral and Social Science Through Ontology Development and Use (Mechanism, U01/U19 and U24)

Objective/Purpose: Support independent but collaborative research projects focused on ontology development, dissemination, and use. Support a coordinating center to foster collaboration, share results, address common challenges, and facilitate cross-project learning; provide ontology-related informatics expertise; disseminate resources to support ontology development, uptake, and sustainable use.

Funds Available and Anticipated Number of Awards: Contingent upon NIH appropriations

Award Project Period: 5 years

Council Action: Vote for approval of the concept for Accelerating Behavioral and Social Science Through Ontology Development and Use



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Challenges in Behavioral & Social Science

- Quantity of information is exacerbated by its complexity*
 - Volume of data available challenges our ability to find, extract, and make use of existing data
 - Creates inefficiencies within and across disciplines
 - Rate of publication increase is close to 8-9% each year—doubling of global scientific output roughly every nine years**
- Lack of familiarity with ontology development and use
- No common vocabulary
 - Jingle/Jangle problem: limits aggregation within and across domains
 - Proliferation of theories, constructs and measures
 - Incentives to create “new/innovative” theories and constructs (toothbrush problem)



*Michie, 2017

** <http://blogs.nature.com/news/2014/05/global-scientific-output-doubles-every-nine-years.html>



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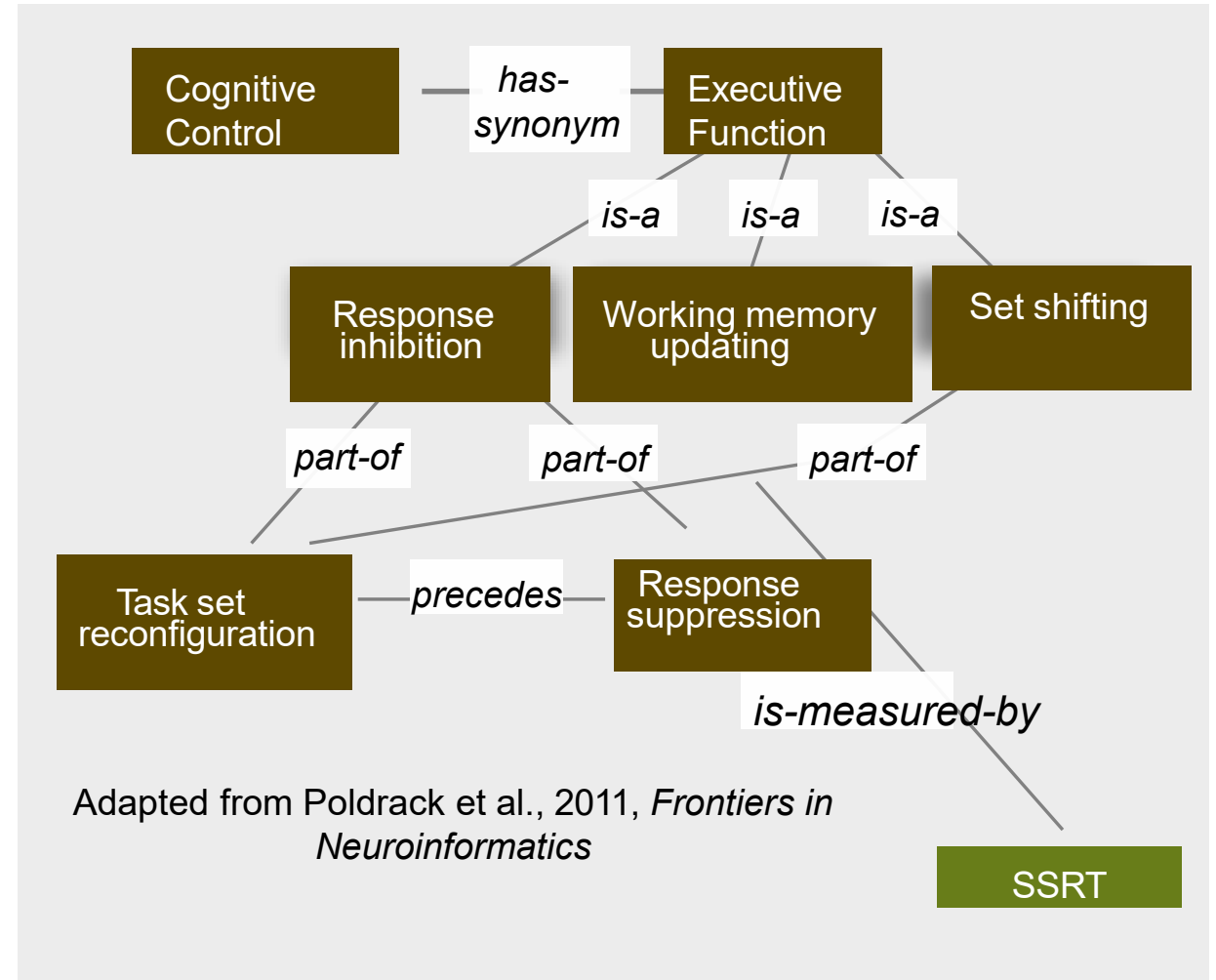
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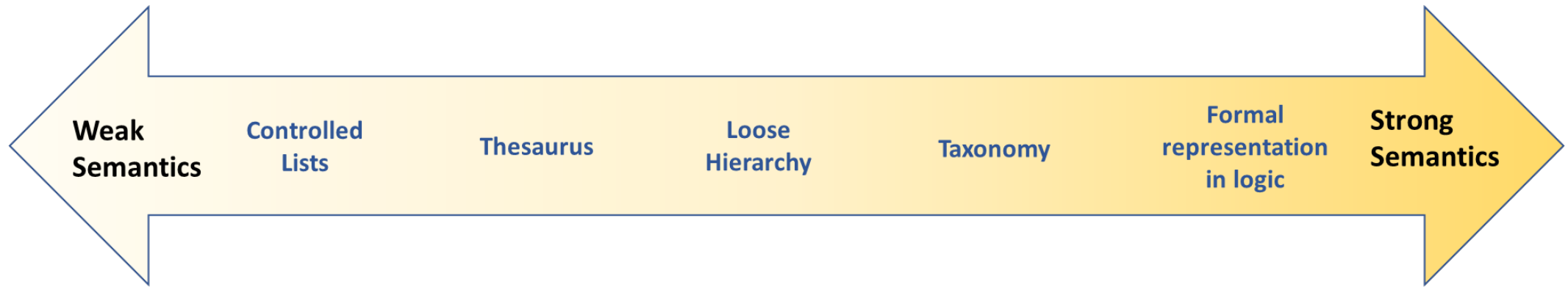
Formal, Explicit specification of a **Shared Conceptualization** (Gruber, 1995).*

- **Formal**: machine readable with well-defined semantics
- **Explicit**: enumerates the types of concepts used and the constraints on their uses
- **Shared**: the conceptualization is agreed on and accepted by those working in a discipline
- **Conceptualization**: the relevant concepts and the relationships among them that exist within a specific domain

* <https://www.sciencedirect.com/science/article/pii/S1071581985710816>



A Continuum of Semantic Specification



- No single method to build knowledge representation structures/ontologies
- Requires informational/computational and domain expertise from beginning to end
- A single ontology might not work for all applications



Figure from NASEM Consensus Study



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Ontologies in the Behavioral Sciences

Accelerating Research and
the Spread of Knowledge*

Robert M. Kaplan, Chair

Katy Börner, Committee Member

Bruce F. Chorpita, Committee Member

David Danks, Committee Member

Mark A. Musen, Committee Member

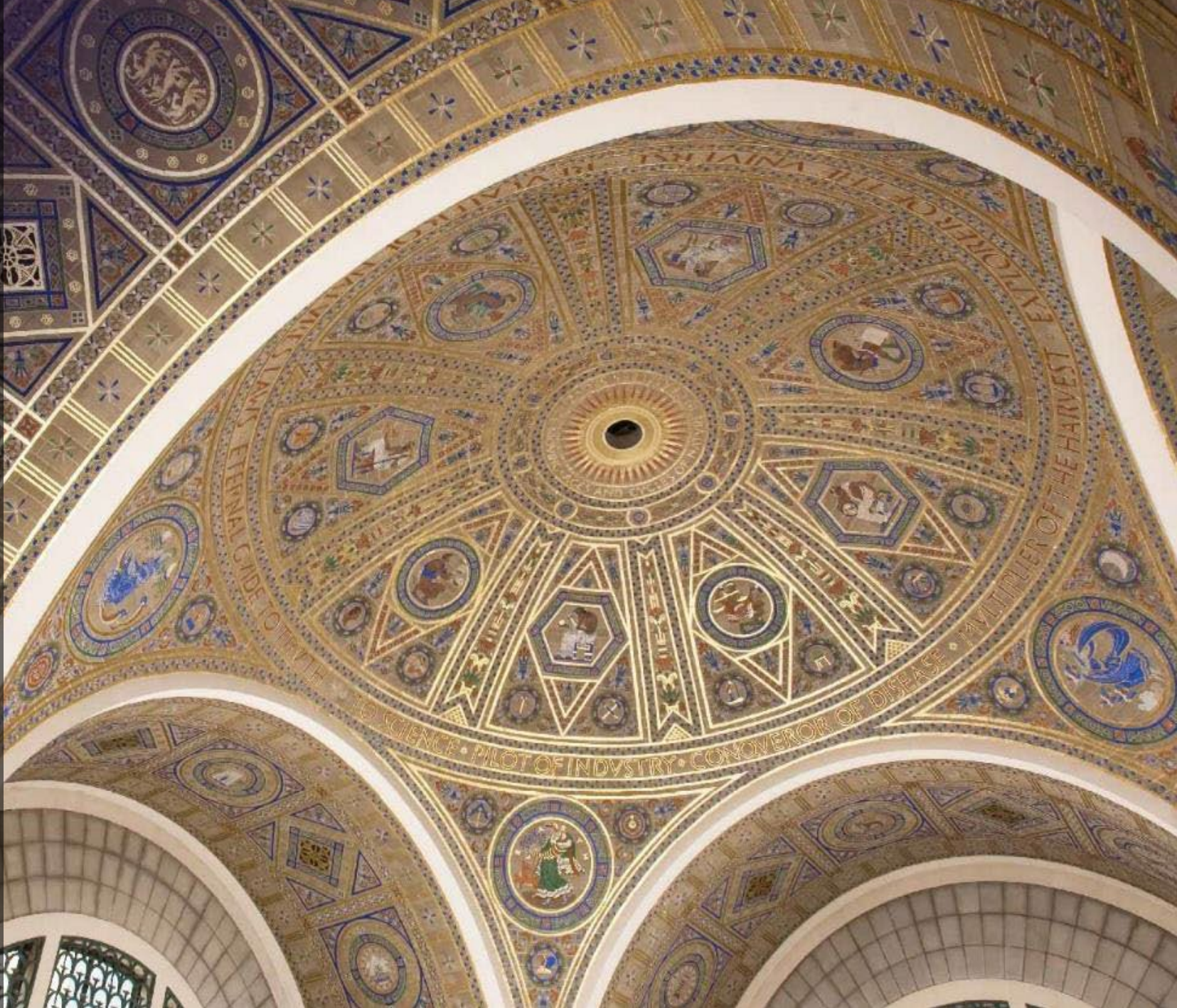
Vimla L. Patel, Committee Member

Timothy J. Strauman, Committee Member

James F. Woodward, Committee Member

Alix Beatty, Study Director

*<https://nap.nationalacademies.org/catalog/26464/ontologies-in-the-behavioral-sciences-accelerating-research-and-the-spread>



NASEM Consensus Study Conclusions

“Ontology development and use has the potential to move behavioral science forward from a domain in which research is generally siloed and the data and results are often incompatible to one in which the evidence is searchable and more easily integrated and in which computer technology is leveraged in the **discovery of new relationships, the development of novel hypotheses, and the identification of knowledge gaps.”**

“Although ontologies are central to the advancement of science, there are no existing funding mechanisms for the development and maintenance of such systems and for the tools that support them. Sustained public and private support for the long-term development, dissemination, and maintenance of ontologies in the behavioral sciences and related tools is needed.”



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Ontologies Accelerate Scientific Advances

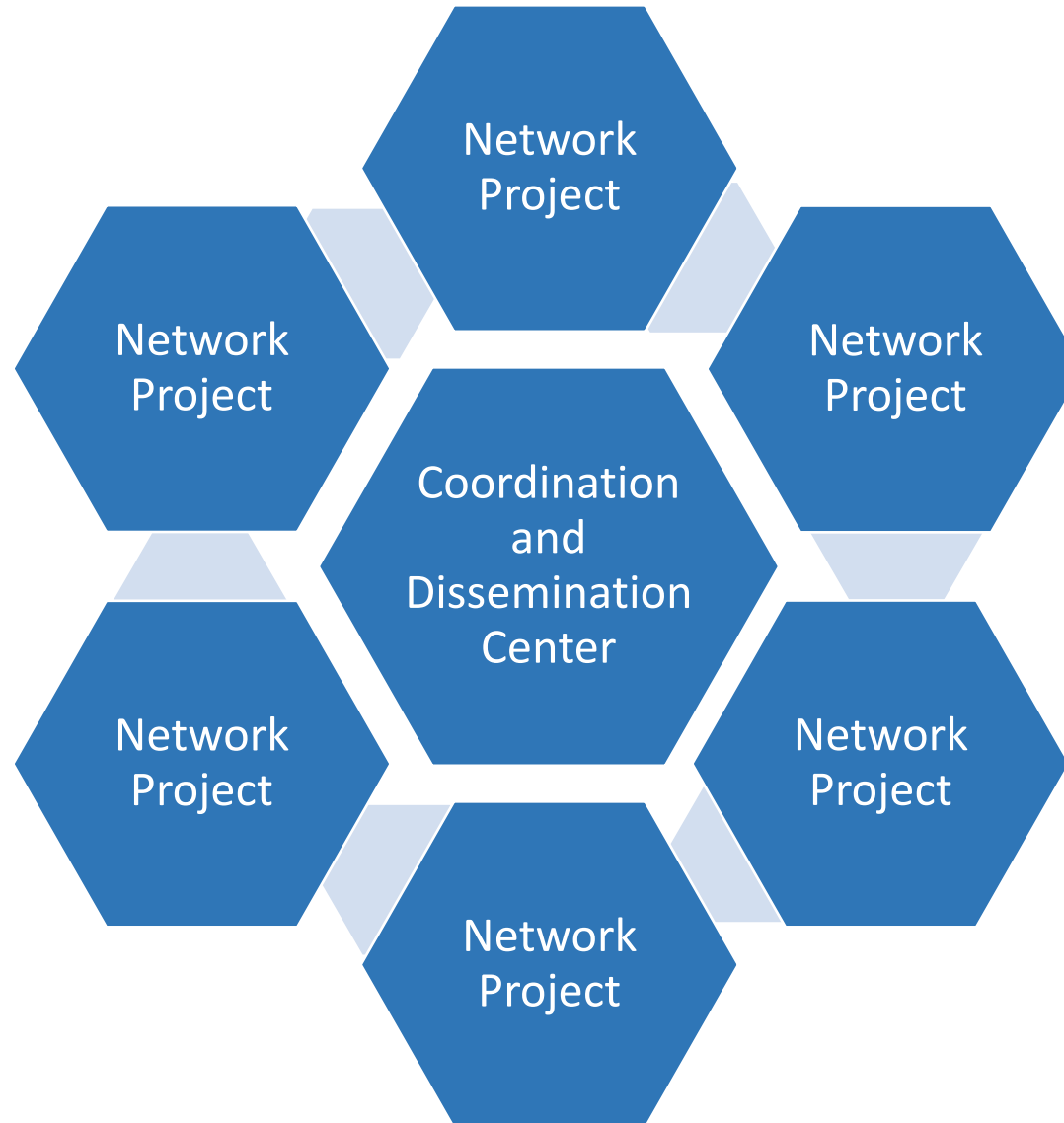
- Supports transparent, reproducible, and replicable science
- Facilitates communication, comparison, and integration of discovery
 - Makes domain assumptions explicit
 - Allows for identification of conceptual and empirical inconsistencies, unanswered questions, and novel hypotheses
 - Shared understanding of the structure of information within a domain allows for aggregation of knowledge within and across-disciplines
 - Enables reuse of domain knowledge: e.g., enhanced meta-analyses



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Proposed Initiative Structure



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Coordination and Dissemination Center

- Support coordination and convening to foster collaboration, share results, address common challenges, and facilitate learning across projects
- Provide ontology-related computational and informatics technical expertise
- Compile and disseminate lessons learned, best practices, and other resources to support ontology development, uptake, and sustainable use
- Active outreach/coordination with relevant entities to increase understanding of and demand for BSSR ontology-related content, tools and resources



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Research Project Network

- Network will support independent but collaborative research projects
- Projects supported through this initiative will:
 - Develop ontological content, resources, or tools that are “fit for use”
 - Test innovative models of ontology development and refinement
 - Have a detailed plan for dissemination and sustainability
 - Include multi-disciplinary teams
 - Have ongoing engagement with the intended end-users



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Deliverables

- Multiple sustainable research resources such as:
 - Enhanced ontological content and infrastructure for BSSR
 - Technology platforms to facilitate data exchange and aggregation
- Advances in computational methodologies to develop and curate ontologies
- Tools and resources to support ontology dissemination, uptake, and sustained use
- Formation of professional networks to engage, inform, and build capacity for ontology use in BSSR



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Council Action:

Vote for approval of the concept, Accelerating Behavioral and Social Science Through Ontology Development and Use



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NIH Behavioral Ontology Development Working Group Members

- Janine Simmons, NIA (co-chair)
- Christine Hunter, OBSSR (co-chair)
- Dawn Morales, NIMH
- Rebecca Goodwin, NLM
- Mary Ann Hantakas, NLM
- In-Hye Cho, NLM
- Miranda Jarrot, NLM
- Lis Nielsen, NIA
- Jon King, NIA
- Luke Stoeckel, NIA
- Rick Moser, NCI
- Dana Wolff-Hughes, NCI
- Mike Spittel, OBSSR
- Dana Greene, OBSSR



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