Conceptual Spaces, The Unified Conceptual Space Theory, and Metaphor

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Main Contributions
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Motivations

- Address a fundamental shortcoming in cognitive science research .

"For reasons I'll try to make clear, the heart of a cognitive science is its theory of concepts. And I think that the theory of concepts that cognitive science has classically assumed is in a certain way seriously mistaken."

- Explicate the relationship between concepts and language and show how the two pull apart.

- Provide philosophical support for previous work I have done in AI and work I hope to do in future.

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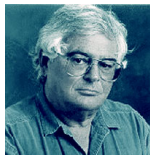- Address a fundamental shortcoming in cognitive science research .

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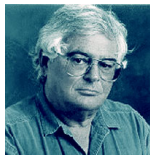- Address a fundamental shortcoming in cognitive science research .

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- Demonstrates how most contemporary debates over theories of concepts divide over whether concepts are best understood as mental representations or as non-representational abilities.

- Concludes that there can be no single correct ontology, and that both perspectives are logically necessary.

- Details three critical distinctions that are frequently neglected:
  - Between concepts as we possess and employ them non-reflectively and concepts as we reflect upon them.
  - Between the private (subjective) and public (inter-subjective) aspects of concepts.
  - Between concepts as approached from a realist versus anti-realist perspective.

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- Pragmatic, detailed, and distinctive account of concepts in terms of:
  - Their essential nature.
  - Core (and extrinsic) properties.
  - Context of application.

- Done within the framework of Gärdenfors' conceptual spaces theory of concepts (CST):
  - Offered as a bridging account, best able to tie existing theories together into one framework.
  - Set of extensions offered (Unified Conceptual Space Theory or UCST) as means of pushing Gärdenfors' theory in a more algorithmically amenable and empirically testable direction.

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- Following on ideas from Gärdenfors (2004) and Geuder and Weisgerber (2002). . .

- UCST describes how all an agent's many different conceptual spaces, as described by Gärdenfors, are mapped together into one unified space of spaces, as well as. . .

- . . . How an analogous process happens at the societal level.

- CST and UCST put to work offering a distinctive account of the co-emergence of concepts and experience.

- An experimental application of the theory is presented, in the form of a simple mind-mapping-type program.

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Concepts

- Roughly, individuable units of structured knowledge that meet Evans' Generality Constraint.

- Partly constituted by beliefs.

- Allow agent to step back from strict experience-in-the-moment to take a wider view.

- Can usefully be categorized into first-order (possessed by all conceptual agents) and higher-order (possessed by some).

- Can usefully be classified as well by the sorts of things they reference: i.e., object concepts - action concepts - property concepts.

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Concepts and Representations

"The gun I reach for when I hear the word **representation** *has this engraved on it: 'When* **P** *is used by* **Q** *to represent* **R** *to* **S**, **who is Q and who is S**?*

- Require *active* intentionality: agency.

- Not ontological reals but a perspective, one that, as reflectively capable agents, we can't set aside.

- No internal (or external) representations, no mental representations: just representations.

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- Anathema to Davidson, Sellars (early if not late), McDowell.

- Central to Merlin Donald's account of cognitive-cultural evolution.

- Article of faith to "animal concepts" people, whose criteria for attributing concepts are:
  - Evidence of an ability to derive general classes from specific instances.
  - Demonstration of a flexible pattern of behaviour based on this ability, especially when confronted with novel situations.
  - Demonstration of surprise upon making a mistake (Newen and Bartels 2007, Allen 1999).

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Gärdenfors' Account
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Basic Principles

- Neither associationist nor symbolic accounts of cognition, on their own, are adequate to addressing the nature of concepts.

- Just as accounting for cognition in terms of concepts bridges different levels of cognition, so, too, do concepts themselves.

- "There is no unique correct way of describing cognition" (Gärdenfors, 2004) – and no unique correct perspective on concepts.

- No unique correct perspective on any particular concept, either, not least because concepts *change*.

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Basic Principles

- Neither associationist nor symbolic accounts of cognition, on their own, are adequate to addressing the nature of concepts.

- Just as accounting for cognition in terms of concepts bridges different levels of cognition, so, too, do concepts themselves.

- "There is no unique correct way of describing cognition" (Gärdenfors, 2004) – and no unique correct perspective on concepts.

- No unique correct perspective on any particular concept, either, not least because concepts *change*.

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Unified Conceptual Space

Basic Premises

- Similarity-space-based theory of concepts, where concepts are described in the neutral language of geometry.

- Concepts exist within *conceptual spaces* either as points within those spaces or as generally convex shapes.

- An agent has a different conceptual space for each possible domain.

- The process of carving up a particular conceptual space into various possible shapes is the process of *categorization*.

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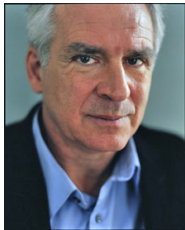
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"Philosophers will complain that my arguments are weak; psychologists will point to a wealth of evidence about concept formation that I have not accounted for; linguistics [sic] will indict me for glossing over the intricacies of language in my analysis of semantics; and computer scientists will ridicule me for not developing algorithms for the various processes that I describe. I plead guilty to all four charges" (Gärdenfors, 2004).

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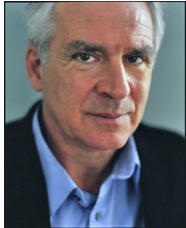References

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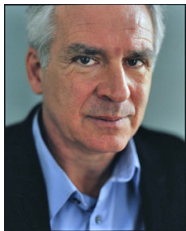- Offered as scaffolding, and like all scaffolding, meant to be temporary.

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Peter's Vision

The full monty …

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Local and Distal Connections

- Concepts, as before, are well-behaved sub-regions. They can be collapsed to points. Points can be expanded to sub-regions.

- All points within the Unified Conceptual Space have a certain logical relationship to all contiguous points in that space.

- Two kinds of distal connections:
  - By reference.
  - By logical structure as building blocks.

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Unified Conceptual Space

- Describable along three dimensions:

  - **axis of generality**: from maximally specific to maximally general

  - no class/instance distinction: any instance can, within practical limits, be treated as a class

  - **axis of abstraction**: from maximally concrete/physical to maximally abstract/mental

  - mental and physical are two directions along a continuum

  - **axis of alternatives**: from maximally similar, to maximally different

  - arrived at by adjusting the values of any of the concept's integral dimensions

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The Building Blocks

- object concepts

- action/event concepts

- property concepts

- (logical connectors - "glue")

- components (similar-type sub-parts)

- parameters (integral dimensions)

- contextuals (associated)

Only object concepts and action/event concepts have components.

All three have parameters and contextuals.

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Core Hypothesis

"The core hypothesis here is that **a metaphor expresses an identity in topological or geometrical structure between different domains.** *A word that represents a particular structure in one domain can be used as a metaphor to express the same structure in another domain.... In this way one can account for how a metaphor can* **transfer information** *about one conceptual domain to another."*

"**A metaphor does not come alone** – *it is not only a comparison between two single concepts but it also involves an identification of the structure of two complete domains."*

"the peak of his career"

- vertically highest point in e.g. a mountain

- career: measured in terms of time (one dimension) and social status (second dimension)

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Finding Metaphor

- Metaphors often used to make the abstract concrete.

- Argue in my thesis for a kind of perspective dualism: "physical" and "mental" are rough areas along a continuum between zeroth- and higher-order concepts.

- Physical objects and actions/events are paradigmatically things experienced through our sensorimotor engagements with them.

- Abstract/mental objects and action/events are often (not always) couched in metaphorically sensorimotor-based terms: "*fueling* the frenzy of the crowd" (pouring fuel onto) or "cultivating hope" (planting, watering, etc.).

- Similar to Gärdenfors' notion that we find typically metaphors between ontogenetically "basic domains" and ones we acquire later on.

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- Abstract/mental objects and action/events are often (not always) couched in metaphorically sensorimotor-based terms: "*fueling* the frenzy of the crowd" (pouring fuel onto) or "cultivating hope" (planting, watering, etc.).

- Similar to Gärdenfors' notion that we find typically metaphors between ontogenetically "basic domains" and ones we acquire later on.

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Metaphorical Death

- Sometimes the mapping between primary domain and target domain gets absorbed into the target domain.

- Or: sometimes the secondary meaning becomes primary.

haven

- In (American) English, used to mean a harbor, with a metaphorical meaning of "place of refuge".
  - Now, the metaphorical meaning is primary and the the "old" meaning all but forgotten.
  - Still retains the meaning of "harbor" in the Scandanavian languages: *hamn* in Swedish, *havn* (I think) in Danish. But *föra något i hamn* - "guide something into harbour" = "bring something to a successful conclusion".

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Litera and Metaphors

- Metaphor arises any time one applies a concept outside its primary domain of application.

- But no two domains of application are ever *exactly* the same, so...

- The idea of a "primary domain of application" is a conceptual abstraction.

- All meaning involves mapping across different domains of application, never (strictly speaking) just *within* one domain.

- Plus, domains shift over time and often expand.

- Conclusion: No sharp distinction between literal meaning and metaphor: all meaning is in a sense metaphorical.

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Meaning Making and Metaphor

- Metaphor primarily a semantic not a linguistic issue: you have to get the concepts right to get the language right.

- Concepts inseparably involve syntax and semantics.

- *All* meaning making involves a mapping of disjoint and often contrasting conceptual spaces onto one another.

  - Mis-matching dimensions ignored in favour of dimensions that *do* match.

  - Always takes place relative to a *contrast class*, which provides the context.

  - This makes metaphorical meaning highly context sensitive.

  - Never one single metaphorical meaning.

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Metaphorical Continuum

- In place of binary distinction between literal and metaphorical, get continuum from:

    - Implicitly to explicitly metaphorical.

    - Familiar to novel applications.

    - Nearly adjacent to widely separated conceptual spaces.

    - Primary to secondary and tertiary meanings.

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Along the Continuum

- Application of unexpected property: *pink elephant* (but also *black swan!*).

- Sometimes these become conventionalized expressions.

- Introduction of unexpected contextual: *pigs fly, mountains whisper*.

- Source of proverbs and poetical expressions.

- Explicit comparison of two normally unrelated things: *heart of gold, eyes of ice* but not *heart of cardiac muscle*.

- Conventional metaphor.

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Simile

- Can be handled in similar way.

- Explicitly drawing attention to application of some unexpected property.

He was as happy as a lark.

But not: *Not as he super was or a pit or not*

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Relation of Metaphor to. . .

- Strict identity: The mapping for primary to target domain is exact.

- Concept combination: Novel mappings. Fodor's infamous "pet fish".

- Metonymy: Mapping of part to whole or whole to part.

"The main metonymic operations are **pars pro toto***, where a part represents a whole as in 'there are twenty heads in the class room', and* **toto pro pars***, where a whole represents a part as in 'Paris announces shorter skirts.'"*

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UCST and Metaphor

- Provides mechanism by which different domains get mapped together.

- Provides detail of different kinds of mapping:

  - Between object and object, action/event and action/event, property and property.

  - Between some object, action/event or property and a property of that object, action/event or property.

  - Between some object, action/event or property and a contextual of that object, action/event or property.

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Conceptual Spaces and Metaphor
Conclusions
References

Core Ideas
Developing These Ideas
Unified Conceptual Space Theory and Metaphor

UCST and Metaphor

- Provides mechanism by which different domains get mapped together.

- Provides detail of different kinds of mapping:
  - Between object and object, action/event and action/event, property and property.

  - Between some object, action/event or property and a property of that object, action/event or property.

  - Between some object, action/event or property and a contextual of that object, action/event or property.

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Toy Application

- Attempt to move discussion from realm of "purely" philosophical into domain of practical cognitive science application.

- Similar to Gärdenfors' idea (2004a) of an updated "semantic web" application that, rather than searching "intelligently" for key words and phrases, helps the user generate her own externalized conceptual spaces.

- Proof-in-concept of next generation mind-mapping software, one that's backed by an actual theory of concepts.
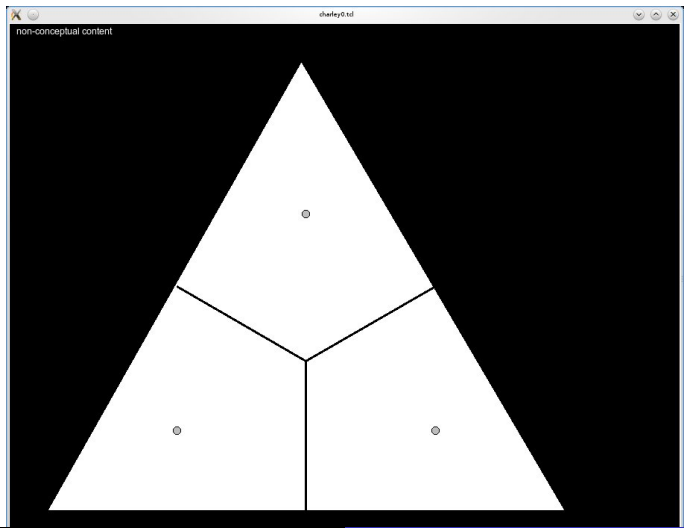
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Opening Screen

Conclusions

- CST and UCST provide one way of moving beyond the rigidity of many "purely" symbolic accounts and reasoning with uncertainty. (ATT-Meta is, of course, another.)

- CST provides a formalized way to talk about similarity that does not run afoul of Goodman's well-known objections to similarity.

- CST and UCST have only fairly preliminary things to say about metaphor and much less to say about metonymy.

- Their main contribution in this area is talking about and providing a mechanism for how domains get mapped onto one another in a way that is, sometimes, understood to be metaphorical.

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