Meta-Descriptive Metaphysics
Extending P.F. Strawson's "Descriptive Metaphysics"
(INCOMPLETE DRAFT: Work in progress, liable to change.)

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NOTE Added 1 Mar 2015
At some point the discussion of descriptive metaphysics here needs to be integrated with the discussion of the nature of mathematical discoveries in geometry, and alternative geometries, in
http://www.cs.bham.ac.uk/research/projects/cogaff/misc/trisect.html
and related papers referenced there, including this (added Dec 2016):
http://www.cs.bham.ac.uk/research/projects/cogaff/misc/maths-multiple-foundations.html

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NOTE Added 22 Apr 2015
This discussion needs to be related to the discussion of varieties of Derived Construction Kits (DCKs) produced by evolution on the basis of the Fundamental Construction Kit (FCK) provided by physics and chemistry.
http://www.cs.bham.ac.uk/research/projects/cogaff/misc/construction-kits.html

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This discussion paper is
http://www.cs.bham.ac.uk/research/projects/cogaff/misc/meta-descriptive-metaphysics.html
A PDF version may be added later (or use 'Print to file' in your browser.)

This is part of the Meta-Morphogenesis project:
http://www.cs.bham.ac.uk/research/projects/cogaff/misc/meta-morphogenesis.html

A partial index of discussion notes is in
http://www.cs.bham.ac.uk/research/projects/cogaff/misc/AREADME.html

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Introduction:
Prospects for Descriptive Metaphysics
Beyond the version presented in Peter Strawson's 1959 Book
Individuals: An essay in descriptive metaphysics

In 1959, Peter Strawson introduced a relatively modest philosophical project *Descriptive Metaphysics* contrasted with what he called *Revisionary Metaphysics*.

This marked a change in how metaphysics could be done and what its status might be, although, as he noted, several previous philosophers had implicitly contributed to Descriptive Metaphysics (DM).

He wrote: *"There is a massive central core of human thinking which has no history - or none recorded in histories of thought; there are categories and concepts which, in their most fundamental character, change not at all."*

Work on DM involved a shift away from grand metaphysical ambitions such as aiming to discover the ultimate nature of reality, and the reasons why reality *must* have those features, towards the more modest goal of merely describing some of the most general features of *how humans regard* (think about, reason about, and communicate about) various aspects of reality.

This descriptive activity need not include consideration of 'Revisionary' metaphysical questions as to whether humans are mistaken about some or all of those features.

A number of questions about the DM project arise in various contexts, for example
(a) in the context of trying to understand similarities and differences between humans and other animals, including their evolutionary precursors, or humans at different stages of development
(b) in the context of trying to design and build more or less human-like intelligent systems -- future humanoid robots or intelligent plant controllers or intelligent online teachers, and
(c) in the context of speculations or discussions about future social/cultural changes.

Strawson did not discuss such questions, as far as I recall. Here are some draft elaborations.

Questions Challenging the Descriptive Metaphysics project:

Question 1: Why consider only general aspects of *human* thinking? Could there be other intelligent entities, for whom questions about descriptive metaphysics will have different answers because they make use of different concepts and categories -- including other animals, future robots, and perhaps even individuals descended from humans in the distant future?

Question 2: How much of human mental activity counts as "thinking"? Should any survey of the most general features of thought take account not only of thoughts expressed in a recognisable human language in the context of philosophical discussions, but also the contents of what we perceive, learn about, and use in our interactions with reality?

For example, am I thinking

- When I recognize a particular smell of new-mown grass next door?
- When I enjoy the view of rapids in a fast flowing rocky river from a bridge across the river (echoing John Austin's remark: 'Fact is richer than diction' [REF?] as 'perception is often richer than diction')?
- When I look at, perceive, enjoy, and wonder at the diversity of forms displayed in plant growth, many of them inviting mathematical analysis, illustrated in http://www.cs.bham.ac.uk/research/projects/cogaff/misc/plants-maths ?
- When I look at a diagram while trying to prove a theorem in Euclidean geometry, and consider locations where additional lines, or curves, might be drawn?
- When I wordlessly control the motion of my hand so as to bring the thumb and first finger to opposite sides of the rim of a cup, ready to grasp the rim to lift the cup?

For conjectured partial explanations of some of those processes see:
http://www.cs.bham.ac.uk/research/projects/cogaff/misc/changing-affordances.html

- When I see a large object coming rapidly towards me and I unthinkingly(!)jump to the right to avoid it because I am aware of a wall on my left?

Anyone trying to design a human-like robot will have to give it mechanisms supporting abilities similar to those listed above, in addition to mechanisms for deducing Aristotle's mortality from (1) his humanity and the additional premiss (2) that all humans are mortal. So why shouldn't descriptive metaphysics also include core unchanging features of *non-verbal* forms of cognition (non-verbal, but intelligent, information processing), insofar as they, like the verbal forms, make use of components and relationships with generative power (e.g. the power to accommodate infinitely many diagrams in Euclidean geometry, or infinitely many different perceivable processes of change in spatial configurations)? [Strawson did discuss, in a limited way, a world only containing sounds that change over time, perhaps echoing a similar thought experiment by Jean Nicod. One problem with many such thought experiments is that philosophers considering what is and is not possible generally fail to consider the vast array of possibilities about which we have learnt through decades of computer systems engineering. Strawson was writing too soon to have had the benefit of such knowledge.]

Some philosophers (including Strawson?) seem to take it for granted that there is a special subset of human mental functioning that is obviously concerned with "thinking", and that all such thinking involves internal or external use of sentences. Some even claim that before the development of human language used for communication, mental contents could not exist[REF Dennett?]. But the behaviours of many other intelligent animals make that idea hard to take seriously. Consider, for example, the weaver birds tying knots when making nests. [The following video is no longer available. I would be grateful for a link to a suitable replacement showing weaverbird nest making.]
http://www.youtube.com/watch?v=6svAIgEnFvw

Question 3: A related question is: Can the "central core" change over time? We are products (in part) of biological evolution, sharing some of our history with animals that clearly do not think exactly as we do, though there must be some overlap, which we rely on when we interact with them in shepherding sheep or when we successfully command or entice a cat to come nearer, or when a dog brings you a stick to be thrown for it to fetch. Perhaps that overlap grew out of common pre-verbal evolutionary ancestry?

Question 4: There were once no humans on this planet. Our earliest human, or nearly human ancestors, presumably had ways of perceiving, thinking, deciding, intending, preferring, choosing, etc. So how did our pre-human ancestors, and perhaps our earliest human-like ancestors, think about what exists, before our current modes of conceptualising reality developed? Was there a massive discontinuity between non-thinking organisms (e.g. microbes) and the first ones that could think? Or was there only a succession of small changes between microbes and humans? (NB: *continuous* change is impossible in biological evolution when discrete sequences of individuals are involved.)

How much overlap is there between human thinking (a form of information processing) and various kinds of (non-human) forms of thinking, where information about something is acquired, stored, derived, combined and used to control actions, which many animals clearly do, even insects landing on a pollen-laden flower. If a bumble-bee's flight did not use information about locations, orientations and structures of flowers it would very rarely be in a position to feed.

What biological pressures on natural selection drove at least some animals toward a kind of mental life that makes use of the sorts of metaphysics Strawson has in mind? Why then don't all animals do the same?

Are special mechanisms -- e.g. special kinds of brain functions -- required before human ways of thinking become possible? Is one consequence of research in descriptive metaphysics production of new criteria of adequacy for theories about brain mechanisms? Would that mean evidence about human brain mechanisms could contradict a DM theory, by showing that our brains could not support the required structures and processes.

Natural and Artificial Minds

Could artificial brains use the same metaphysics? Are digital computers capable of supporting uses of language based on that metaphysical core? What about the non-verbal information structures mentioned in Question 2?

Is it possible to produce intelligent machines (robots) that share and make use of human-like metaphysical assumptions? Could future work in robotics and AI address the need for machines to share our metaphysics in order to engage with us and satisfy our more complex requirements (e.g. companionship for some lonely people, or help with household chores)?[See Sloman (2010a) "...It's harder than you think..."]

Is it really an unchanging core?

Could detailed empirical research provide evidence that Strawson's claim that there is a "massive central core" shared by ALL humans, is an exaggeration?

What about new-born infants, for example (discussed further below)?

Do all cultures necessarily share the same core? Could a more thorough study of descriptive metaphysics show that there are different cultures with different sets of metaphysical concepts and theories, not all mutually incompatible? For example, although Strawson (as far as I recall) did not mention this, there seem to be cultures where the possibility of an unending sequence of natural numbers has not been thought of, and there may be some individuals who have grown up in such a culture that are no longer capable of coming to grasp such a possibility. (Compare the difficulty of learning a first human language late in life.)

Could there be deep differences in core concepts even *within* a culture, for example when an atheist scientist and a religious fundamentalist find it hard to communicate?

What about differences between a bricklayer and a quantum physicist, or differences between a typical contemporary of Aristotle, and someone who has grown up in the 21st Century using wireless devices to access the internet and converse with absent friends?

Recent metaphysical extensions

Consider a software engineer who thinks about layers of virtual machinery operating concurrently in a computer with many interacting components performing different types of information processing in cooperation with each other and a human user, such as the processing required for storing some text, for searching in it, modifying it, correcting spelling errors, formatting it, displaying it on a screen, packaging it into an email message, encrypting it, transmitting the encrypted message across the internet to several destinations some in another country on another continent, and then checking successful receipt, managing records of what was sent to whom when, and handling backups in case of hardware failures or user errors.

The kinds of spatial, temporal, and causal interactions between sophisticated virtual machines performing many functions concurrently, are very different from the interactions between parts of a physical machine, such as a gravity-driven clock, or a petrol-driven car engine, or domestic plumbing system. Some of the generally unnoticed differences, including the complex interacting causal powers and the multi-strand multi-layer supervenience relations of components of virtual machinery are summarised in Sloman (2013).

Many devices making essential use of complex virtual machinery that are now parts of the thoughts and actions of young children could not have been part of Strawson's experience by 1959, though at least he had experienced telephones, radio communications, television and cinema, so the gaps between his concepts and ours are not as large as the gaps between Aristotle's or Kant's concepts and ours.

Certainly, by 1959 there had already been discussion of the possibility of intelligent machines (including Turing's paper in *Mind* 1950) but a vast amount has been learnt since then about both the difficulties of creating human-like intelligent machines and the concepts, formalisms, technical tools and forms of production that can support such creation Sloman (2010b).

Some of the new technology depends on abilities that are not unique to humans, including the ability to look at a flat surface and see moving patterns (e.g. shadows cast by moving objects, or images on a computer or TV screen), and the shared ability to cause a fingertip to tap or slide past part of a shape on the surface. Does Strawson's massive central core include such mundane commonalities -- which are very close to abilities other animals use, e.g. when exploring a surface with nose, lips, tongue, trunk, claw, or finger.

Metaphysical boot-strapping during individual development?

If there is some special essentially human common core of the sort described in Strawson's book (including the ability to look at, think about, or talk about remote or even long dead individuals), how do individual humans come to have this sort of conceptual/metaphysical competence?

After all, we don't seem to have it when we are new-born babies, so there must be some sort of boot-strapping process during the life of each individual -- one of the key assumptions of Piaget's genetic epistemology, partly inspired by Kant's views on these matters. Kant claimed that some experiences can 'awaken' new concepts in humans, e.g. concepts of shape and spatial location, even though the concepts are not derived from the experiences by some process of generalisation from instances. (Compare Chomsky's claims about the genetic component in language development.)

How does all that metaphysical cognitive development work? What mechanisms make the process possible? Would the same process work in all environments? Does it go awry in interesting ways for some individuals, such as feral children or individuals with abnormal brain development? (Cf. research by Annette Karmiloff-Smith on neurodevelopmental abnormalities.)

Improving a metaphysical core

And finally, is it possible to *improve* on the common metaphysical concepts, beliefs, and ways of thinking, that humans use (if Strawson is right)? Would any such improvement necessarily involve what Strawson called **revisionary** metaphysics, or would it depend on how the changes are produced?

For example, it seems likely that before the development of an agreed technology supporting reliable measurements of lengths our current metrical way of thinking about length could not have existed. There may instead have been a biologically supported collection of mechanisms for detecting and

reasoning about partial orderings of length (e.g. A is longer than B, and A is longer than C, but it is not known whether B is or is not longer than C).

Biological perceptual mechanisms, especially vision, can be very good at dealing with partial orderings of spatial relationships, whereas extending the ontology to include absolute measures of length, forming a total ordering, requires use of a fairly elaborate technology for producing reliable and comparable numerical values for distance, height, thickness, slope, etc., as well as social agreements on standards. (The use of stereoscopic vision is reliable only over short distances.)

A shared metric depends on comparisons with "standard" objects or object categories (adult thumb length, a normal adult male's pace, a platinum rod in the Louvre, etc.) Extending metrical concepts beyond the use of measurements based on comparison with standard objects requires further technological advances for instance sub-microscopic measuring devices and various telescopes using either triangulation or adaptive focusing devices to record distances.

Under what conditions could we do even better than we already do, and what would the consequences be? This question assumes that revisionary metaphysics is possible, and asks how revisionary metaphysical proposals could be evaluated? (I suspect the ideas of Lakatos(1980) about evaluation of scientific research programmes are relevant to evaluation of metaphysical research programmes -- blurring the distinction between science and disciplined types of metaphysical enquiry.)

Perhaps we should conclude, from some of the historical examples, and from facts about individual development in infancy and beyond, that **metaphysical revision** is far more prevalent than most people think, even if much of that revision lacks the combative features Strawson seems to associate with **revisionary metaphysics**.

This document doesn't (yet) propose answers, but we can start with a label for an "umbrella project" attempting to answer such questions about the origins, benefits, limitations, alternatives, and possible future developments in, what descriptive metaphysics describes.

Meta-descriptive metaphysics and meta-morphogenesis

In the light of all the examples suggesting that metaphysical systems that are in common use may have different features and that many of them change over time, I tentatively offer the label "Meta-descriptive Metaphysics", to refer to these topics. This should also be added as a new sub-project in the Meta-Morphogenesis project (concerned with on evolutionary and developmental transitions in types of information processing in living things):
http://www.cs.bham.ac.uk/research/projects/cogaff/misc/meta-morphogenesis.html

In a way Strawson came close to anticipating this project, when he wrote:

> *"Metaphysics has a long and distinguished history, and it is consequently unlikely that there are any new truths to be discovered in descriptive metaphysics. But this does not mean that the task of descriptive metaphysics has been, or can be, done once for all. It has constantly to be done over again. If there are no new truths to be discovered, there are old truths to be rediscovered. For though the central subject-matter of descriptive metaphysics does not change, the critical and analytical idiom of philosophy changes constantly. Permanent relationships are described in an impermanent idiom, which reflects both the age's climate of thought and the individual philosopher's personal style of thinking."*

A little more thought might have led him to conclude that just as the central core of mathematics can (rightly or wrongly) be displaced after a long and distinguished history (as seemed to some mathematicians to occur with the development of modern formal logic and formal systems) so might the central core of our thinking about the universe as a whole. Similar comparisons can be made about changes in our thinking about the subject matter of physics and biology.

As illustrated below, there are already researchers working on various aspects of a sort of *comparative* descriptive metaphysics, most of them in complete ignorance of Strawson's work and also mostly in complete ignorance of one another, though most of them don't broaden the task to include transitions produced by biological evolution. (I don't claim to have found more than a small subset of parallel strands.)

There seems to be an opportunity for some imaginative philosophers to attempt to bring all these strands together and to facilitate communication and mutual help and criticism between these unwitting meta-descriptive metaphysics researchers. Perhaps this will one day lead to agreement among them, or at least in larger subsets than now.

Strawson's Descriptive Metaphysics -- And beyond.

Preamble

Various philosophers have, in the past, attempted either to characterise in a very general way what form the totality of existence actually takes, or the form it must take, if it is thought that there are describable alternative forms, of which one necessarily fits how things are.

There are enormous problems with such projects, not least the problem of relating such claims to what can be learnt from scientific investigations of how the world is. Some philosophers have claimed that all such theories are (in the words of David Hume) nothing but "sophistry and illusion", fit only to be consigned to the flames.

Often this is elaborated by claiming that metaphysical theories are nonsensical, lacking sufficient content to be either true nor false, or, in the disparaging judgement Wolfgang Pauli is reported to have made of a paper by a physicist: "not even wrong".

Popper

Karl Popper offered a slightly more tolerant view of metaphysical theories as not yet being part of science (i.e. objective shared knowledge) because they are incapable of being falsified (or contradicting any observation), and therefore lack empirical content. This might be said of the earliest form of atomic theory of matter, for example. However Popper allowed that some metaphysical theories are useful as pre-cursors to science, if the theories are capable of later being extended so as to be potentially falsifiable empirically.

I don't recall whether he thought that concession allowed metaphysical theories to be capable of having a truth-value before such modification. At one point he regarded Darwin's Theory of Evolution by Natural Selection as metaphysical because incapable of being falsified, though later he revised his judgement and became a champion of Darwin, even proposing some of his own hypotheses about achievements of natural selection. [REF]

Metaphysics in recent years

In recent years many analytical philosophers have been attempting to address metaphysical questions head on, writing papers about, and debating questions about grounding, about the nature of causation, about whether mathematical entities exist, about mind-body relationships, and other topics -- without feeling any need to apologise for ignoring older debates about the status of metaphysics, and its connections, or lack of connections, with science.

I am not sure Hume's ghost is now reading the papers approvingly and thinking "Oh, so that's how to avoid sophistry and illusion".

But he might well have approved of an earlier proposal by Peter Strawson, in his 1959 book, where he introduced a distinction between *descriptive* metaphysics and *revisionary* metaphysics.

Descriptive metaphysics (DM) can be thought of as a form of conceptual analysis concerned with very general concepts describing pervasive aspects of the universe. Instead of addressing questions about the nature of reality, or what exists, or why it exists, or what the best way to think about it might be, DM focuses instead on merely trying to characterise some of the deepest and most pervasive aspects of human thought about the nature of reality, leaving it to revisionary metaphysics to consider whether those aspects are in some way wrong, or could be improved upon.

One example worth noting is Strawson's observation that humans typically do not think about the world as containing material things, like trees, rivers, skin, bones and neurons, alongside non-material things like minds and their contents, such as desires, preferences, emotions, moods, beliefs, intentions, sensations, etc. Rather, we think about ourselves, other people, and some, if not all animals, as entities that straddle the divide: for a person can, like any physical object, have a spatial location, a size, a shape, a weight, causal interactions with other physical objects. But unlike a tree, a river, a piece of skin, a bone or a neuron, a human can also have thoughts, preferences, intellectual capabilities, memories, and abilities to come up with new ideas. So P-predicates (physical predicates) and M-predicates (mental predicates), are standardly applied by humans to entities like people and other animals, rather than to distinct substances. On the other hand, a flash of lightning or a grain of sand satisfies only M-predicates. An individual neuron cannot want to study philosophy, but there could be disputes about whether some collections of neurons might.

Of course, he said a great deal more than that in the 1959 book, and others have written about and some have criticised his distinction between two kinds of metaphysics, but for now, I simply want to note that there is at least a prima-facie case for the existence of a coherent activity of descriptive metaphysics, with the goal of discovering and describing some of the most general aspects of the ways in which humans think and talk about what exists and what they presuppose in their perceptions, intentions, and actions.

This might be thought to be very different from the pure philosophy that metaphysics was originally thought to be, insofar as a descriptive metaphysician formulating and answering questions about how humans think and talk about reality leaves open the possibility that philosophers can learn much from linguists, anthropologists, sociologists, psychologists, and others who don't think of themselves as doing philosophy. I.e. descriptive metaphysics could become a new branch of (philosophically flavoured) science, or at least could contribute to and learn from scientific research on human thought and language. Does that mean that descriptive metaphysics is just another branch of science, of special interest to philosophers?

I don’t think Strawson intended that, but how can a study of general features of the ways in which humans think or speak about the universe and everything in it, and other things not in it (e.g. mythical gods, round squares and Jane Austen’s heroines) fail to be, at least in part, an empirical study?

In (1960) R.M.Hare published an ingenious attempt to find a third way between mysterious metaphysical knowledge and abundant anthropological knowledge about human thought and language. He considered two ways of trying to find out how a dance (e.g. a waltz goes). One way starts from ignorance and requires observing and interviewing waltzing wizards. Another way is only available to a waltzing wizard, who for some reason has the skill but has never attempted to describe the skill, and does not have ready answers. Such a person could set about watching and interviewing other waltzers, but need not do so. The wizard can interrogate his own expertise by trying to perform a waltz, and trying out variants on the steps to see which do and which do not feel right. Hare compared this with the processes of philosophical analysis based on examples, famously illustrated in Austin (1956) in connection with gaining insight into the differences between doing something by accident and doing it by mistake, by trying to fit the two descriptions to to different ways of killing your neighbour’s donkey. Inspired by Austin, Ryle, and others I once wrote a tutorial on how to do conceptual analysis Sloman (1978-4), which I later extended by distinguishing "logical geography", the subject matter of conceptual analysis as normally practiced from "logical topography", the study of aspects of reality underlying the particular logical geography currently in use, but possibly supporting alternative logical geographies in different languages and cultures. For more on that look here.

The point of all this is that when philosophers talk to one another they sometimes find ways of convincing themselves, if not each other (!) that they are exhibiting a special sort of skill (conceptual analysis) that is neither an empirical investigation into how words are used, nor a collection of arbitrary definitions and their logical consequences.

However, Strawson’s wedge between Descriptive and Revisionary Metaphysics provides a chink in a doorway leading to new terrain, where the philosophical practice of conceptual analysis can be enormously enriched, and combined with new disciplines, including computer-supported model building using and extending methods and theories of Artificial Intelligence.

That’s because there must be alternative general conceptual frameworks supporting perceiving, acting, learning, teaching and communicating, since it is clear that not all individuals see or think about the world in the same way.

For example, among humans there are differences in cultures with very different understandings about what sorts of things can and cannot exist, and even within a particular culture changes in widely used science and technology can produce dramatic changes within a decade or two: as our generation has witnessed. We now have children for whom the pages on an illustrated magazine are broken tablets, as they don’t react when stroked or tapped. Moreover, long before the dramatic effects of changes in information technology, Piaget, Vygotsky and others had demonstrated that an individual human will see the world and think of the world and interact with the world in deeply different ways during different stages of development -- for which any observant parent can collect examples.

I have been collecting evidence for changes in proto-mathematical understanding and competences summarised in this (still messy) discussion of ’Toddler Theorems’:
http://www.cs.bham.ac.uk/research/projects/cogaff/misc/toddler-theorems.html

It is clear to anyone who studies development in young children or other animals that an important aspect of ontological development is acquiring new ways of thinking about spatial structures and processes -- something I think Kant noticed, though I am not sure Strawson understood its importance. Many people, including some philosophers, mathematicians and engineers, assume that everything that

is important about space is captured in the Cartesian coordinate representation of space. But that's a deep mistake (as I think Piaget understood -- as shown by his last two books for example, on Possibility and Necessity).

One of the important differences between space as experienced by animals (including young children, and the precursors of Euclid) and space as represented using Cartesian coordinates is that experienced space can be actively explored in ways that naturally lead to discovery of topological concepts involving continuity, contact, connectedness, and structure-preserving transformations of various types. Normally topology is thought of as a fairly advanced branch of mathematics (and historically its study by mathematicians came relatively recently). But Sauvy & Sauvy(1974), much influenced by the ideas of Piaget, demonstrate a variety of games and 'play' activities that can lead a child to extend her ontology structures and processes with topological concepts.

A philosopher concerned mainly with the concepts and forms of argument used in philosophical discussions might not regard topology as important for descriptive metaphysics. But careful observation of the varieties of ways in which an understanding of spatial structures, relationships, processes and causal interactions is essential for everyday life of humans, and how different sorts of understanding of space are required by different animals (for example birds that build nests out of nearly rigid twigs and weaver birds who make nests out of long thin leaves that can form tight knots) shows that the ontology of spatial structures, processes and interactions is as crucial a part of our everyday metaphysics as the ontologies used in talking about things. Actions don't always speak louder than words, but some things are easier said than done.

A metaphysics that fails to meet important requirements for intelligent doings is as limiting as a metaphysics that doesn't meet requirements for intelligent sayings. And the pre-cartesian metaphysics of space is crucial for many of the doings of intelligent animals, though people who have no experience of trying build working robots with animal abilities may find this hard to understand.

(Simplified versions of such building should be an essential component of every undergraduate philosophy course if it is to be fit for educating 21st century philosophers. This was already obvious in 1978.)

Returning to descriptive metaphysics:

No normal human child could make metaphysical discoveries about space required for normal life (i.e. the topology of space) merely by playing with sets of numbers, algebraic expressions, and equations.

Moreover, as far as I know none of the computer-based mathematical theorem provers developed so far is capable of making these discoveries either. That may just reflect on the limitations of current AI researchers. Or it may be an indication that some of the forms of computation (inference, discovery, proof) that occur in brains require mechanisms that are significantly different from digital computers (and turing machines).

An example might be chemical computations, involving mixtures of discrete and continuous transformations, already known to be required for biological evolution starting from nothing but collections of molecules. Ganti (2003) But computational mechanisms are not enough: architectures in which the mechanisms are assembled to perform required functions in cooperation are also required -- including virtual machine architectures But that's a topic for another time.

Much of the development in the conceptual frameworks, or metaphysical theories used (unconsciously) by young children is driven by the environment with which they interact, and different physical, technological, social and cultural environments will drive the growth of different

metaphysical frameworks underpinning perception, action, thought, language and learning in different directions. Some of the differences will be relatively trivial such as how finely the space of floor coverings that we label 'mats', 'carpets', 'rugs', etc. is divided up or where the boundaries are (e.g. I believe several English and French words are not inter-translatable because of such differences. [REF John Lyons, Semantics.]

This is also true as regards the concepts used in different linguistic communities for classifying emotions, as shown by Wierzbicka, (1992). However, despite the evidence for conceptual diversity at levels where some psychologists had expected to find cross-cultural universals she claims that there are underlying shared "atomic", or "universal primitive", concepts, for example "feel", "say", "think", "know", "good", "bad", "do", "happen", and "want".

Her conclusion is that

> *"...The definitions proposed here differ in various respects from so-called classical definitions; ....they take the form of certain prototypical scripts or scenarios, formulated in terms of thoughts, wants, and feelings. These scripts, however, can be seen as formulas providing rigorous specifications of necessary and sufficient conditions (not for emotions as such, but for emotion concepts), and they do not support the idea that boundaries between emotion concepts are "fuzzy." On the contrary, the small set of universal semantic primitives employed here allows us to show that even apparent synonyms such as sad and unhappy embody different-and fully specifiable-conceptual structures, and to reveal the remarkable precision with which boundaries between concepts are drawn: even between those concepts which at first sight might appear to be identical or only "stylistically" different. Upon closer investigation, human conceptualization of emotions reveals itself as a system of unconscious distinctions of incredible delicacy, subtlety, and precision.*

This is partly similar to the framework proposed in Schank & Abelson (1977) for analysing a wide range of commonly occurring situations using a fixed set of semantic primitive types and instances of those types, organised into a collection of "scripts" with the aim of showing how a computer model could replicate many of the operations of human memory by making use of schematic structures composed of those scripts. Related ideas proposed not only for language understanding but also information structures based on perceptual processes were suggested by Minsky (1978), then elaborated in subsequent work.

Over the last few years increasingly many researchers and engineers have investigated systematic frameworks capable (it is hoped) of generating all the types of concepts humans have found useful and assembling them into larger structures as intentions, beliefs, plans, theories, arguments, stories, etc. This kind of research is supported in new ways by the combination of the unimaginably large (and constantly growing) store of verbal, pictorial, and other types of information available for study in the internet and the rapid advances in new technologies for interrogating that store of information (data-mining on a vast scale).

But such research requires a starting ontology of types of information that can be investigated in order to explore the variety of ontologies used by humans. (Of course, that boot-strapping ontology can itself be revised and extended in the process.)

Many have implemented special subsets of what has so far been learnt, and deployed them in working systems, for example as a framework for organising knowledge in a company with different departments that have different interests and knowledge but need to communicate with one another, and need their software tools to communicate also (e.g. different departments doing research, design, implementation, testing, manufacture, distribution, marketing, sales, user training, user support, and

long term planning). IBM and others provide toolkits to support rich and varied combinations of information in useful ways. An example is the IBM Modeler mentioned here:
http://www-01.ibm.com/software/analytics/spss/

An example from recent research research in AI is Lehman,Chan,& Bundy (2013) which describes mechanisms using higher order logic for handling different ontologies as described in the abstract:

> *"....The proposed basic mechanisms for evolution are called Ontology Repair Plans. These operate on ontologies formalised as contexts, i.e., as multiple logical theories. In such a setting, ontologies may contradict one another or introduce redundancies with respect to one another, without any of them containing logical contradictions or redundancies. When, though, an inconsistency or a redundancy between two or more ontologies becomes explicit, it may be resolved by the application of an Ontology Repair Plan, as each plan compiles together a pattern for diagnosis and transformation rules for effecting a repair. The repair can combine the retraction and/or addition of axioms as well as the deeper modification of the language in which the ontology is represented...."*

Possible additional topics:

- Ontology changes in children at various stages of development [Compare Piaget, and Annette Karmiloff-Smith]
- Other animals and how their ontologies differ, and develop. E.g. bats
- Evolutionary changes: ontology contents, forms of representation, mechanisms uses, ...

We need a meta-theory to accommodate all this, providing a new level of universality: with potential for multiple branching pathways across different time scales in different contexts: a cooperative, multidisciplinary, multi-national investigation?
[I am not interested in applying for grants. Feel free to use any ideas here in your grant proposals.]

The importance of ontologies for scientific advances.
Aims of Science:
Sloman(1978) Chapter 2 argued against Popper that there are many examples of important scientific advances that have something of the character of metaphysical theories insofar as they cannot be falsified, but which are important contributions to science: they are theories about what is possible and attempts to explain how certain things are possible. (A Kantian project.) The chapter shows how progress in constructing, extending and applying such theories can be evaluated over an extended time period using ideas presented by Lakatos(1980) on how to distinguish progressive from degenerating research programmes.

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