

Do humans process (also) qualitative information?  
Help from computational metaphysics welcome!

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## From artificial to human intelligence

- ▶ **'sub-symbolic' deep neural network (DNN) based artificial intelligence (AI)** runs into all sorts of problems – due to missing world models? (vs superposition of all world models compatible with statistics of language token use in training data?)
- ▶ **classical, symbolic AI** systems run into problems with the generation and operation of open, extended world models
- ▶ **combined ('Neuro-AI' or similar) approaches** additionally run into problems with interfacing the two in a general way
- ▶ so how do humans generate or access (layers of) symbol systems and world models?  
– **we don't know**
  
- ▶ this points to core philosophical questions: what is **abstraction**? are there proper (Platonic) **abstract objects**? etc.
- ▶ AI research and development offers one of many different routes towards the insight that **something about abstract objects is very 'real' ...**
- ▶ ... a lot of new problems are old problems ...

## Related 'old' problems

- ▶ the '**symbol grounding problem**' of the connection between data and meaning
- ▶ the '**framing problem**' of implementing common sense knowledge and know-how
- ▶ the '**hard problem**' of phenomenological experience
- ▶ the problem of (broad and stable) **abstraction**
- ▶ the problem of (also the implementation of) **universals**

→ in all these cases, 'meaning' seems to evade a purely relational definition, and seems to point to the existence of qualities, forms, universals, etc.

## Quantitative vs qualitative information

- ▶ a helpful distinction from the Philosophy of Information:
  - ▶ **quantitative information**; physically implemented, relationally defined
  - ▶ **qualitative information**; 'meaning' in the (original) sense of Frege's 'Sinn'
- ▶ hitherto still unclear how exactly the two are related
- ▶ **both sub-symbolic, as well as symbolic AI run on quantitative information**, though on different levels; the problem of interfacing them is connected to the (arbitrarily) different relational assignment of 'functional' meaning to the respective symbols

## Quantitative vs qualitative information -2-

- ▶ **human brains** seem to work to a good extent like DNNs, with functionally understood 'meaning' as quantitatively optimized, relational structure, i.e. quantitative information
- ▶ at some point above(?) this, **human minds** seem to work with bits of meaning (most basic: qualia), i.e. qualitative information
- ▶ Gödel: 'The basis of everything is meaningful predication ... Husserl had this, Hegel did not have this: that is why his philosophy lacks clarity ...'
- ▶ **most straightforward way to conceptualize qualitative information is via distinct properties – then giving rise to abstract entities** (the question of pre-existence of abstract objects is secondary to this)

# Two common ways to approach the problem

## (some sort of) Humean Supervenience (Hume, Lewis, ...)

- ▶ **abstract objects as regular patterns found in concrete objects**
- ▶ connects to current AI research, common theories of consciousness, connectionist neuroscience, materialist frameworks, etc → **deflated view of human thought**
- ▶ but people are objects themselves; **how exactly is human thinking implemented?** (the above definition is clear for logic, but not so much for neuroscience)
- ▶ this does not seem to work out (**yet?**); **we run into 'old' problems**

## Platonic abstract objects (Plato, Leibniz, Peirce ...)

- ▶ **abstract objects (at least) as real as concrete ones**
- ▶ bundles of universal, qualitative properties; carrying all sorts of 'meaning'
- ▶ not relationally defined (via web of words, possible worlds etc.), but vice versa
- ▶ **(higher-level) human thought then manipulates actual (though abstract) objects**
- ▶ our 'world model' is then some form of complex, brain-anchored abstract object and requires a complex sub-consciousness – **can this work out scientifically?**

Would Gödel have voted for the later option? – We actually want both!

## In the language of computational metaphysics ...

- ▶ how to **differentiate** *and interface* **abstract and concrete objects**
- ▶ possible from the **logical side** via (a modernized understanding of) Mally's distinction of **exemplification vs encoding** and then modern **object theory** (Zalta *et al.*)
- ▶ less clear how to proceed from the **scientific side**; how do concrete objects process abstract ones, i.e. **how to scientifically bridge this (effectively dualist) distinction?**
  
- ▶ if encoding is realized as **physical information processing**, how does this not run into the **'old' problems?** (qualia seem to be exemplifications, not encodings, etc.)
- ▶ if encoding is related to (proper) **Platonic abstract objects**, then exemplification is different only due to **causal couplings that are in need of scientific explanation** (closer to Meinong than Mally?)

→ back to the question: **can the later work out scientifically?**

## Model A or 'A-world'

- ▶ specific proposal for how to solve the **emanation problem**, i.e. how to recover modern science **in detail**, within models like the ones of Plato, Leibniz, Gödel ...
- ▶ illustrates more generally which problems have to be solved; puts all pressure on science (which is good at re-inventing ontology!) to make this a 'workable' project
- ▶ **core problem is thus the micro-structure of our world** – here we have to make specific ontological commitments; what is matter? wherefrom causation? etc.
- ▶ interaction & constitution/combination problems lead to monadic idealism  
→ '**Plato & Leibniz updated for modern science**' – platonic & scientific realism
- ▶ **world fundamentally build** not from particles or fields in spacetime, but more generally **from universal, qualitative properties**
- ▶ defense: show compatibility down to mathematics of our best scientific theories
- ▶ offense: think through the consequences to devise **new experiments**  
→ a scientific approach to (then pragmatic) idealism ('reverse Gödel')

→ see M. Korth, *Information, Intelligenz and Idealismus*  
Brill/Mentis 2026, English manuscript on PhilPapers.org

# New experiments?!? – (some) conceivable consequences

## Effects from the universal nature of the building blocks

- ▶ quantum nature of reality at micro-scale
- ▶ relativity as necessity for identity preservation
- ▶ ...

## Possible advantages from handling universals

- ▶ stable biological organization via non-physical feedback markers?
- ▶ **information processing cut short?**
- ▶ ...

## Processes/structures across the Neuroscience/Psychology gap

- ▶ physical memory partly as a register for non-physical structures?
- ▶ 'super-coordination' of neural activity? (still with a lot of constraints!)
- ▶ ...

# The example here: Information processing cut short?

## If humans process qualitative information

- ▶ then this should be connected to **evolutionary advantages** over purely quantitative information use, and some advantage would need to have been **accessible early-on**  
→ **what is the 'evolutionary purpose' of qualia?** (= one-property abstract objects)

## What's special about qualitative information?

- ▶ this question is itself part of the project to tackle the problem
- ▶ **working hypothesis:** qualitative information is 'transparently' given, not relationally defined; and 'works' via some form of material inference or 'semantic logic/aesthetic'  
→ **most straight-forward way to conceptualize this is Platonic realism** → whatever is special about abstract objects is special about qualitative information
- ▶ **connects to object theory in (albeit here stronger) Platonic interpretation**  
→ see E. Zalta's contribution to 2025 Kurt Gödel Essay Prize

# An example hypothesis ...

The ability to process qualitative information allows humans to avoid the problems of classical AI (and combined approaches) with generating and handling complex world models

- ▶ **universal** → world models automatically contain each abstract entity only once; instances are connected to 'classes', existing relations are automatically imported
- ▶ **qualitative** → all conceivable negations are automatically implemented
- ▶ **abstract** (= w.r.t. material consistency requirements incomplete) → incomplete entities behave 'quantum object-like' within world models:

'Your cat' collapses from 'superposition' of all conceivable cats to a specific cat once I encounter it (the abstract/concrete distinction is orthogonal to this!)

- ▶ Wait, isn't this just what abstract objects do, Platonic or not?
  - Yes, but here without additional physical computation efforts for 'binding' etc.
- **we should be able to distinguish the two cases w.r.t. brain structure & activity**

## ... and an example (so far thought-)experiment

### Compare computational effort for object recognition

- ▶ as a first step in 'binding'; i.e. placing properties/objects in world model
- ▶ **(naive) symbolic AI**: list search scales  $\propto$  number of properties  $n$  and number of identifiable objects  $N$ , overall  $O(n \cdot N)$
- ▶ **(naive) sub-symbolic AI**: object recognition scales  $\approx O(N)$
- ▶ **quantum computing via Grover algorithm**: list search scales  $\propto n$  and the number of amplification steps to reach the required accuracy, overall  $O(n \cdot \sqrt{N})$
- ▶ **universal qualitative property handling**: object 'setup' depends only on the number of properties (which negate all alternatives), i.e. overall  $O(n)$  – like Grover w/o amplification – and automatically imports all background knowledge?

**BUT how to investigate this separately from the underlying quantitative processing?**  
(which would have to initiate the delivery of qualia to our subconsciousness)

**AND which specific algorithms do we use for comparison in experiments?**

→ **we need models like A-world to map out hypothetical details to test for;**  
**the search for consequences should then be formalizable in object theory**

Thank you for your attention!

**Take home message:**

If Platonic abstract objects exist and if humans can process them, then we should be able to find experimental evidence for this at the Neuroscience/Psychology interface

more: M. Korth, *Information, Intelligenz und Idealismus*  
Brill/Mentis 2026, english manuscript on PhilPapers.org:



## Appendix I:

Ontology, Gödel, perception vs imagination, private qualia, identity & 'anchoring', neuroscience

# Does the ontology of such models include an infinity of basic properties?

## In Model A

- ▶ this is first of all an empirical question similar to how we do not know about physics before experiments
- ▶ seemingly infinite 'ranges' of properties (color shades etc.) might be the result of the bundling of simple ones
- ▶ Platonic realists (and many scientists implicitly) usually accept an infinity of at least basic mathematical entities

# Do all abstract objects pre-exist in such models?

## In Model A

- ▶ non-physical, basic properties, but not complex abstract entities are pre-existing
- ▶ complex entities form in individualized minds based on physical signals being converted to non-physical properties and then simple abstract objects by our sub-consciousness
- ▶ against the backdrop of our existing world model, physical signals would have to be helpful enough to enable this
- ▶ shared biology would guarantee (at least partially) successful communication
- ▶ universality of the basic building blocks leads to seemingly universal nature of complex abstract objects

# A Gödelian outlook

## For models like A-world we find ...

- ▶ ... conceptual and mathematical realism
- ▶ ... physical (unlike subjective) time to be not fundamental, but the outcome of the development of a material part of reality, i.e. of a subset of objects with properties which change according to consistency rules
- ▶ ... ontological arguments to be 'trivially' correct, but without immediate necessary consequences for the material world, as they prove abstract existence only

# The difference

## Gödel – rational optimism

- ▶ the pre-supposed (wished-for?) effectiveness of logic to deal with ontology requires necessary implications between properties ('epistemic stability' → see L. Hornischer's contribution to 2025 Kurt Gödel Essay Prize)
- ▶ this leads to all sorts of 'eternal truths' (Hegel's semantic logic made proper, so to say); we can then identify positive properties, that existence is positive, etc.
- ▶ all contingency, including its yardstick physical time, ends up to be just down to our limited experience of a perfectly well-ordered whole, implying theism

## A-world – pragmatic idealism

- ▶ idealism not as rationally derivable outcome, but as something scientific inquiry might establish as best overall fit
- ▶ allows for contingent understanding of positive properties, existence, ...
- ▶ ontological arguments then seem to imply at the meta-level that if there is a strict 'semantic logic' (instead of a 'semantic aesthetic') between properties, then all abstract entities are (pre-)existing – which would take us back to Plato's Meno ...
- ▶ rational optimism would then be justified

# How would imagination and perception differ?

## In Model A

- ▶ first of all, this is again an empirical question
- ▶ the **boundary is not as rigid as we often think** (drugs, schizophrenia, meditation)
- ▶ a straightforward hypothesis would be that the two happen at **different levels of abstraction**
- ▶ with **perception/qualia** as 'pushed' by our consciousness ...
- ▶ ... and **imagination** most often happening at a level where more easily manageable concepts stand in for the complex objects of perception
  
- ▶ the necessity of such a distinction between qualia and concepts of qualia was anyhow proposed in Philosophy by M. Nida-Rümelin
- ▶ **'proper encoding'/abstraction** in the common sense at the higher level(s)
- ▶ the **activation of perception in imagination** would remain a possibility, e.g. in those special cases mentioned above

**but why/how would such a layered mental structure have evolved?**

## why/how would such a layered mental structure have evolved?

- ▶ the **direct handling of perceptual objects** would always take them and their implications as true; this would work like what we expect for **instincts**
- ▶ 'Zoos are not for animals' - certain reactions cannot be avoided
- ▶ being able to push qualitative signals to a **more abstract level would take pressure from lower levels to immediately follow implications**
- ▶ this allows for reflection and (attempts at) global optimization
- ▶ once such a mechanism is available, higher-level abstraction is in reach
  
- ▶ one powerful feature of language would then be to indicate 'here is a thing', without attaching any (or more than the minimum?) of properties to it
- ▶ (large parts of?) abstract thought would then indeed be conceptual, but taking all of human thought as language-based would still not be right
- ▶ the hypothesis above might be experimentally testable: do ('lower') animals remember individuals? do we not remember individuals in detail? etc.

# Are qualia not privately generated and exclusive?

## In Model A

- ▶ physical and non-physical properties on the same footing:
  - ▶ individual material objects from 'particle bundles' of universal material properties, e.g. universal spin in concrete particle
  - ▶ individual non-material objects from bundles of universal non-material properties, e.g. universal red in concrete mental content
- ▶ universal material properties essential to our understanding of laws of nature
- ▶ are universal non-material properties the basis for successful intersubjective communication beyond 'success in material world' cases?
- ▶ **very hard to conceive science-like models of phenomenological experience without universal non-material properties**
- ▶ would correspond to each particle having its own spin-property, so that we would have to check for every particle pair according to which pair-specific law their individual spin-properties would interact
- ▶ we are happy to embrace Platonism for physical properties (universal mass, spin, etc. properties for all particles) – should be our first guess for mental properties, too

# How would our minds be anchored to ensure their identity in a world of universals?

## Starting from universals and the evolution of a monad population only ...

- ▶ **easy loss of identity at micro-scale**, because any conceivable particles are abstract objects as long as their properties are not handled consistently
- ▶ spatial properties are one way out; **space for identity, not identity from space**
- ▶ stable identities can form at the molecular scale thanks to **evolutionary learned consistency rules** for handling the subset of properties that make up the physical world
- ▶ when monads reach out to non-physical properties, these must be 'anchored' in individualized bodies for stable growth (scepticism and truth become issues then)
- ▶ only complex minds do then allow for the 'free' handling of abstract objects (anchored in a world model, anchored in a body, etc.)
- ▶ and these minds have to have a complex (and multi-monadic) sub-consciousness to handle both physical and non-physical properties by different rules
- ▶ would lead to **additional 'neural design principles'** (besides energy optimization) like 'pass everything important through matter'
  
- ▶ **alternatives:** pre-established harmony, dispositional properties, ...

# Neuroscience & Model A

## Neural processing of visual information

- ▶ **structures known:** photoreception, bipolar & ganglion cells, LGN, V1-V5 areas, ...
- ▶ **pathways known:** dorsal stream or 'where/how pathway' (semi-automatic, vision-for-action) for location, motion, spatial relationships; ventral stream or 'what pathway' (executive control, vision-for-perception) for object details
- ▶ higher up involvement of areas for attention, memory, decision making, ...
- ▶ prefrontal cortex (memory, decision-making) for maintaining & manipulating objects (decision-making as critical component of object recognition)
- ▶ temporal lobes (long term memory, semantic processing) for contextual information
  
- ▶ **we can pin down brain areas & pathways that are sensitive to certain object details** (including positioning & motion)
- ▶ we can often not pin down the details (i.e., identify sub-structures or sub-pathways)
- ▶ we can usually not say how exactly the parts work together (especially cross-modal)

## Neural processing of visual information -2-

- ▶ we cannot yet explain invariance & robustness, top-down influences, substantial individual differences, development & injury recovery
- ▶ it especially remains **unclear how the overall distributed representations are integrated** (e.g. by synchronization or convergence of neural connections), especially across modalities, if ambiguous or in conflict and for (exponentially) complex objects
- ▶ there is a decent amount of room for the assumptions made by model A and the hypothesis of human minds processing Platonic abstract objects

## Neuroscience experiments / outlook

- ▶ **from quantum theory to cognition**; in A-world Neuroscience we could look at quantum theory for experiments; similarities are found because objects at the bottom are not yet individualized, those at the top not anymore
- ▶ 'Neuro double slit experiments'; does brain processing look as if intermediates are missing?
- ▶ 'Neuro Bell experiments'; do brain processing statistics indicate 'entanglement', i.e. simultaneous, distant activity related to same content
- ▶ 'Neuro Kochen-Specker experiments'; do brain processing statistics indicate 'contextuality', i.e. same activity delivers different contents?
- ▶ ...
- ▶ **and back from cognition to quantum theory**; if the link holds, can abstract object cognition serve as blue print for the development of quantum computing algorithms?
- ▶ ... but unlike abstract object manipulation, quantum computing can make use of only few and sharp (material) semantic implications