A2. Philosophical Logic

Hyperintension, intension, extension

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Symposium proposal

Short annotation

The aim of this symposium is to explore the notion of hyperintensionality.

This notion is anchored to foundational research in philosophical logic. One example is formal semantics and its research into linguistic meaning, synonymy, reference, and expressive power. Another example is attitude logic and its research into closure principles, illogical attitudes, omniscience, and the flow of information.

The intention behind the symposium is to highlight the different reasons for opting for a hyperintensional framework in one’s semantic, logical or philosophical pursuits and not least the different forms hyperintensional frameworks may assume.
Description of the symposium

The aim of this symposium is to explore the notion of hyperintensionality. This notion is anchored to foundational research in philosophical logic. One example is formal semantics and its research into topics like linguistic meaning, synonymy, reference, and expressive power. Another example is attitude logic and its research into topics like epistemic and doxastic closure, illogical attitudes, omniscience, and the flow of information within one agent or among several agents. The intention behind the symposium is to highlight the different reasons for opting for a hyperintensional framework in one’s semantic, logical or philosophical pursuits and not least the different forms hyperintensional frameworks may assume.

In particular, we wish to investigate how, relative to a given framework, hyperintensions relate logically to intensions and extensions. This investigation presupposes in turn an investigation into what to make of the notions of intension and extension. The most straightforward approach to going hyperintensional would consist in adding a superstructure of hyperintensions onto an existing edifice of intensions and/or extensions. But it is not a matter of course that either intensions or extensions are to be preserved.

The overall purpose informing the symposium is to lend further impetus to the accelerated research into hyperintensions characteristic of various quarters of analytic philosophy. While the need for hyperintensionality is widely appreciated in logically oriented quarters, this is less so with the more informal portions of analytic philosophy, including philosophy of language and epistemology. It is our ambition that a strengthened focus on the need for a generally hyperintension-friendly approach will install the capacity to accommodate hyperintensions as a touchstone for philosophical theories of meaning and knowledge/attitudes/information. We see this symposium as an important move in that direction.

In the following we provide philosophical motivation for exploring the notion of hyperintensionality and some conceptual background.

The enterprise of philosophical logic has been through an extensional and an intensional phase. The former was marked by the efforts of Quine, Davidson and others to interpret all scientific, mathematical and logical language, as well as those fragments of natural language that were deemed reducible to such regimented languages, within a framework of extensional logic, which was the first-order predicate calculus. This logic is well-defined and has well-known properties, but is much too restrictive for the purposes of most fragments of natural language and arguably also for various fragments of logical and other artificial languages. The intensional phase was ushered in by the arrival of possible-world semantics, which established itself as a respectable paradigm of formal semantics in the early 1960s. Much technical and philosophical mileage has since been had out of this intensional logic. Among its virtues were that it was continuous with the prevalent model-theoretic semantics, was able to account for contingency, the de dicto/re distinction, sets versus properties, truth-values versus propositions, etc., and provided a rigorous answer to Quine’s challenge of how exactly to individuate intensions – namely up to necessary equivalence, equating necessary co-extensionality with co-intensionality. Needless to say, though, the possible-world conception of intensions left Quine and other advocates of a frugal logical ontology unimpressed, since possible worlds were invoked as functional arguments. Possible worlds were deemed too abstract and obscure.

However, since Carnap introduced his notion of intensional isomorphism, in 1947, it had been widely acknowledged that some logical objects needed to be finer individuated than up to
logical equivalence. Cresswell, in 1975, defined negatively as ‘hyperintensional’ any individuation finer than logical equivalence: if $A$, $B$ are hyperintensions, it is possible that $A$, $B$ are necessarily co-extensional and yet distinct. Whereas possible-world intensions arguably fit most or all modal contexts, they are demonstrably too crude for explicit attitudes (i.e. those attitudes that are not deductively closed) and synonymy. The problem, in essence, is that what makes possible-world semantics into an extensional logic of intensions is its individuation of intensions (rather than the validation of the principles of extensional logic). Hence, formal theories of meaning and attitudes/information have seen the light of day. For instance, some hyperintensional theories are algebraic, like Bealer’s and Zalta’s, while others are procedural, like Tichý’s, and others again remain within the world idiom, such as Hintikka’s or Priest’s, in order to model (para-) inconsistent beliefs, or turn to $n$-tuples for some notion of structure, like Cresswell’s or Kaplan’s. Explorations into hyperintensional logic have often run in tandem with the research paradigm of so-called structured meanings. However, the exact nature of the relationship between hyperintensions and structured meanings remains an open research question, and is one we would be happy to see addressed in our symposium.

Whereas possible-world semantics maintains an extensional principle of individuation of intensions, a possible-world-intensional approach such as Montague’s is notorious for failing to validate various principles of extensional logic. Therefore, perhaps the fundamental question to raise when it comes to hyperintensions is whether it is feasible, or desirable, to aim for an extensional logic of hyperintensions, or whether the ambition to validate the principles of extensional logic also for hyperintensions is either unattainable or misguided. Thus, what are the prospects of preserving properties like the compositionality of meaning, the transparency of reference and sense relations, existential quantification into hyperintensional contexts, and extensionality as a criterion of individuation and substitution? And what is a hyperintensional context, anyway? Must the adoption of such contexts perhaps come with a semantics that alters the semantic properties of terms and expressions? Are there cardinality issues to look out for when adding hyperintensions to one’s logical ontology?

Furthermore, we find ourselves confronted yet again with Quine’s old challenge to intensional logic: What is the precise individuation of intensions? Should we perhaps adopt a range of hyperintensional criteria of individuation, tailored to particular contexts, rather than privileging one particular individuation? Research in this direction may revive an interest in, inter alia, Church’s so-called Alternatives, which he defined relative to the logic of functions he invented (the lambda calculi). A function-based approach is potentially a fruitful paradigm of hyperintensional individuation, but ultimately just one among several options.

Finally, a deeper perspective with potentially far-reaching consequences is that the quest for hyperintensions may exceed the bounds of model-theoretic semantics and set theory. Of course, it is always a technically feasible option to introduce hyperintensions, of various sorts (like hyperpropositions, hyperproperties, etc.), as (intra-theoretical) primitives, in which case a range of such primitives can be simply added to a model-theoretic structure. But as soon as one wishes to define and describe hyperintensions intra-theoretically, it is no longer obvious just how to go hyperintensional merely by means of structure-less entities like mappings or sets. The era of hyperintensionality may conceivably see a revival of structured, or complex or compound, logical entities (whereas the received view has tended to be that structure is syntactic structure only). Thus, the relationship between hyperintensions and structured logical objects adverted to above may turn out to run deep. But the hyperintensional quarters are as yet far from having arrived at anything like a consensus or a dominant view on this topic.
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Work in progress
“Spaces of Impossible Worlds: a Trilemma.”
“Ways to Construct Spaces of Impossible Worlds.”
“Constructions of Impossible Worlds.”
“A Problem for the Equal Weight View.”
“Stalnaker, Logical Omniscience, and Fragmented Minds” (with Weng Hong Tang.)
“Disagreement and Conceptions of Evidence” (with Nikolaj J. L. L. Pedersen.)

Selected honors and awards
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BOOKS

SELECTED PAPERS
- ‘Contra Bealer’s reductio of direct reference theory’ (w/M. Zouhar), Logique et Analyse, forthcoming.
- ‘Two conceptions of technical malfunction’ (w/M. Carrara), Theoria, forthcoming.
- ‘How hyper are hyperpropositions?’, Language and Linguistics Compass 4 (2010), 96-106.


‘Knowing that p rather than q’, *Sorites* 20 (2008), 125-34.

‘Explicit intensionalization, anti-actualism, and how Smith’s murderer might not have murdered Smith’, *Dialectica* 59 (2005), 285-314.


40 papers published since 1998

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Selected PUBLICATIONS
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JOURNAL ARTICLES:
2010: Lambek Calculi with 0 and Test-Failure in DPL, forthcoming in Linguistic Analysis.
CONFERENCE PROCEEDINGS:


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2009: Formal Philosophy Report, weekly post to *LORIWEB*.


PRESENTATIONS

2010: *What is a Deduction? Integrating Logical, Psychological, and Philosophical Perspectives*, with Catarina Dutilh [philosophical component], and Andy Fugard & Niki Pfeifer [psychological component], 2010 meeting of the European Society for Philosophy and Psychology (ESPP), Essen, Germany, August.


2009: *Non-Commuting Residuation Models with Process Exclusion*, PLS7: The Seventh Pan-
Hellenic Logic Symposium, Patras, Greece, July 15-19.
2009: Negative Information and Informational Asymmetry, ECAP-09, Barcelona, Spain, July 02-04.
2008: A Procedural Interpretation of Split Negation, Logic Tea Colloquium, Institute for Logic, Language, and Computation (ILLC), University of Amsterdam, The Netherlands, September 15.
2008: Inferential Information-Gain and Negative Information, EPS-Research Seminar, Tilburg Institute for Logic and Philosophy of Science, Tilburg University, The Netherlands, March 27.
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Perceptual Information

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What is the relationship between information and knowledge? Recently (Floridi [forthcoming 2], Floridi [2011]), I argued that semantic information—understood as well-formed, meaningful and truthful data—upgrades to knowledge if and only if it is correctly (Floridi [forthcoming 1], Floridi [2011]) accounted for. The basic idea is rather simple. Each piece of semantic information (e.g., “the beer is in the fridge”) is constituted by a Boolean question and answer (“Is the beer in the fridge?” + “Yes”), which, as a standalone item, does not yet constitute knowledge, but poses further questions about itself. Such further questions require the right sort of information flow in order to be answered correctly, through an appropriate network of relations with some informational source. If all Mary can do, when asked why she holds that the beer is in the fridge, is to repeat that that is the place where the beer is to be found, the fact that the beer is actually in the fridge only warrants the conclusion that Mary holds the information about the location of the beer, but nothing else. For all we know, Mary might have uttered “the beer is in the fridge” as the only English sentence she knows, or she might have dreamed or guessed correctly the location of the beer. Indeed, the beer that she reports to be in the fridge might have been removed by John, but then more beer might have been placed in the fridge by Peter, making Mary right, yet only accidentally.

The result of such analysis is an informational definition of knowledge according to which a knowing subject S knows that p if and only if:
1. p qualifies as semantic information;
2. A accounts for p, that is, A (A, p);
3. S is informed that p; and
4. S is informed that A (A, p).

The articulation of this analysis in terms of a network theory of account, and its defense, especially against a potential Gettierization, are explicit tasks with which I have dealt in Floridi [forthcoming 2]. In this paper I shall explore an important consequence of the informational definition of knowledge: if knowledge is accounted information, what happens when we apply this definition to the analysis of perception and testimony? The thesis defended is that perception and testimony are the only two sources of information about the world, but, strictly speaking, they do not yet provide knowledge of the world. They are the necessary information providers.

References
Towards an extensional calculus of hyperintensions

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ABSTRACT

By ‘intensional logic’ one often means a logic which fails to heed various laws of extensional logic, such as compositionality, referential transparency, existential generalization, and substitution of identicals. But ‘intensional logic’ may also mean that the logic in question comes with a rich ontology of intensional entities and the means to logically manipulate them. This is the notion both of intensionality and hyperintensionality germane to Transparent Intensional Logic (TIL). TIL is a large-scale framework of procedural semantics that flouts none of the principles of extensional logic and is, insofar, an extensional logic.

Extensionality is achieved by distinguishing between three levels of abstraction, offering three different kinds of complements for the same logical rules. The highest level is the hyperintensional level of procedures that produce intensional or extensional entities, as well as lower-order procedures, as their products. These procedures are in TIL defined as algorithmically structured constructions consisting of constituents which are the operations that are to be applied to input entities in order to produce a product (if any). The second level is the intensional level of partial functions conceived as set-theoretical mappings, some of which are defined on possible worlds. Finally, the lowest level is the extensional level of functional values.

TIL is an anti-contextualist, pro-transparency semantics, because TIL constructions are assigned to expressions as their context-invariant meanings. But depending on the context in which a construction occurs, different derivation rules must be specified in order to logically manipulate the product of the relevant construction. Yet TIL lacks as yet a proof theory for hyperintensions. This paper presents a sizeable fragment of such a proof theory, in the shape of a calculus for TIL constructions. This work builds on Tichý (1982, 1986), where particular derivation rules have been specified for the intensional portion of TIL based on a simple theory of types. However, current TIL is hyperintensional, constructions being typed within a ramified theory of types.

A fragment of such a theory has been specified in Duží et al. (2010, §2.6 and §2.7). First, the supposition with which a construction can occur and the three kinds of context were defined. Second, the rules of substitution were specified following these principles: (a) in a hyperintensional context only procedurally isomorphic constructions can be substituted, because the very construction is here the object of predication; (b) in an intensional context equivalent constructions (that is, constructions producing one and the same function) can be substituted, because the whole function is the object of predication; and finally (c) in an extensional context congruent constructions (that is, constructions that happen to construct the same value of their products for a particular valuation \( v \)) can be substituted, because this very value is the object of predication. Third, the rules of existential generalization relativized again to the particular contexts in which a construction occurs must be defined. In Duží and Jespersen (ms.) the rules of existential generalization into hyperintensional context have been defined. Their generalization to lower intensional and extensional context is straightforward.

What remains to be done is extending Tichý’s calculus as presented in (1982, 1986) to the hyperintensional level, which involves cut rules and in particular the \( \beta \)-rules of contraction and expansion. These rules are the fundamental computational rules of the \( \lambda \)-calculi. But in
the logic of partial functions, which is part and parcel of TIL, \( \beta \)-rules must be treated carefully. The reason is the invalidity of \( \beta \)-reduction in case it involves drawing an extensionally occurring construction of an argument into an intensional or hyperintensional context of the construction of a function. To devise a valid rule of \( \beta \)-conversion, we developed a generally valid substitution method that corresponds to the method of lazy evaluation in functional programming languages.

Once such an extensional calculus of hyperintensions has been specified, the next step will be the examination of its meta-mathematical properties such as completeness and decidability.

**Bibliography**


Duží, Marie and Bjørn Jespersen (ms.): Transparent quantification into hyperpropositional contexts *de dicto*. Submitted.


Abstract

In a possible-world framework, an agent $a$ can be said to know a proposition $p$ just in case $p$ is true at all worlds that are epistemically possible for $a$. Roughly, a world is epistemically possible for a just in case the world is not ruled out by anything $a$ knows.

This framework presupposes an underlying space of worlds that we can call epistemic space. Traditionally, worlds in epistemic space are identified with possible worlds, where possible worlds are the kinds of entities that at least verify all logical truths. If so, it follows that any world that may remain epistemically possible for an agent verifies all logical truths. As a result, all logical truths are known by any agent, and the corresponding framework only allows us to model logically omniscient agents. This is one of the familiar hyperintensional problems that emerge in the standard possible-world framework, and it shows that the framework cannot be used to model non-ideal agents that fall short of logical omniscience.

A familiar attempt to model non-ideal agents within a broadly world-involving framework centers around the use of impossible worlds where the truths of logic can be false. If we admit impossible worlds where “anything goes” in epistemic space, it is easy to avoid logical omniscience. If any logical truth is false at some impossible world, then no logical truth need be known by any agent. As a result, we can use an impossible-world involving framework to model extremely non-ideal agents that do not know any logical truths.

A much harder, and considerably less investigated challenge is to ensure that the resulting epistemic space can also be used to model moderately ideal agents that are not logically omniscient but nevertheless logically competent. Intuitively, while such agents may fail to rule out impossible worlds that verify complex logical falsehoods, they are nevertheless able to rule out impossible worlds that verify obvious logical falsehoods. To model such agents, we need a construction of a non-trivial epistemic space that partly consists of impossible worlds where not “anything goes”. This involves imposing substantive constraints on impossible worlds to eliminate from epistemic space, say, trivially impossible worlds that verify obvious logical falsehoods.

In this paper, I will show that the following claims form an inconsistent triad:

1. (Non-Omni) Worlds in epistemic space allow us to model agents that are not logically omniscient.
2. (Non-Tri) Worlds in epistemic space are either possible or non-trivially impossible.
3. (Max) Worlds in epistemic space are maximal.

Derivatively, I will argue that this shows that successful constructions of epistemic spaces that can safely navigate between the Charybdis of logical omniscience and the Scylla of “anything goes” are hard, if not impossible to find.
Proposition, procedure, predication

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ABSTRACT

This paper applies a realist procedural semantics to the problem of propositional unity. The problem is what unifies individuals, properties, etc., into a unit that is not a mere enumeration of entities and which is capable of being true/false, being known and believed to be true/false, and figuring as complement of various logical connectives and operators.

My thesis is that the key to solving the unity problem for atomic propositions consists in accounting for predication and that the key to accounting for predication consists in construing it as an instance of the abstract procedure of functional application. This procedure is the organizing principle of the propositional components, since it organizes them as functions and arguments without executing any applications. This holds whether the functions are 1-place ones like properties or many-place ones like relations. The procedure extends to molecular propositions formed either from extensional or intensional connectives or from hyperintensional operators.

This paper considers two variants of propositions. Propositions are uniformly identified with hyperintensionally individuated logical procedures, but one procedure produces truth-values while the other procedure produces truth-conditions (possible-world propositions). Non-empirical propositions are instances of the procedure of application, while empirical propositions are instances of, first, the procedure of application and, next, the procedure of abstraction (namely, over the values of modal and temporal variables).

The underlying logic of this conception of propositional unity is provided by Tichý’s neo-Fregean Transparent Intensional Logic, which is formally a hyperintensional, partial, typed lambda-calculus whose syntax is furnished with a procedural semantics.

BIBLIOGRAPHY

Logical reasoning gives rise to some of the starkest examples of hyperintensional phenomena. Here, K-axiom-based epistemic closure for explicit knowledge is rejected for even the most trivial cases of deductive inferential reasoning on account of the fact that the closure axiom does not extend beyond a raw consequence relation. The recognition that deductive inference concerns interaction as much as it concerns consequence allows for perspectives from logics of multi-agent information flow to be refocused onto mono-agent deductive reasoning. Instead of modeling the information flow between different agents in a communicative or announcement setting, we model the information flow between different states of a single agent as that agent reasons deductively. The dynamic information structure in question is then seen to have its properties modelled by an operationalised version of the nonassociative Lambek calculus, with commutation restricted to bracketed pairs.