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Towards a Contemporary Ontology

The New Dual Paradigm in Natural Sciences: Part II

Module 4: The formal ontology of the conceptual natural realism (CNR)

Introduction

Module 4: "The formal ontology of the conceptual natural realism (CNR)"

Course modules

Modules	Topic	Suggested Readings
SECTION ONE		
0.	<i>Introduction and Course Overview</i>	
1.	QFT: an evolutionary interpretation of nature from cosmology to neuroscience	Refs.: 1-5.
2.	QFT in fundamental physics and the Aristotelian-Thomistic ontology of nature	Refs.: 6 , chs. 5-6; 7-8.
SECTION TWO		
3.	Formal philosophy and formal ontology	Refs.: 9-11.
4.	The formal ontology of the conceptual natural realism (CNR)	Refs.: 12-15.
SECTION THREE		
5.	The formal ontology of the natural realism (NR)	Refs.: 16-18.
6.	The duality algebras/coalgebras in CT and the notion of Universal Coalgebra	Refs.: 19-24.
SECTION FOUR		
7.	“Modal logics are coalgebraic”: an application to NR and to the duality logical/ontological truth	Refs.: 24-28.
8.	<i>Conclusions</i>	

Bibliography

Bibliography of the Module 4

Bibliography

▪ Main References:

1. G. BASTI, «From formal logic to formal ontology. The new dual paradigm in natural sciences», in *Proceedings of 1st CLE Colloquium for Philosophy and History of Formal Sciences, Campinas, 21-23 March 2013*, FABIO M. BERTATO (ed.), Campinas UP , Campinas, 2014. [[attached](#)]
2. N. B. COCCHIARELLA, «Logic and ontology», *Axiomathes*, 12 (2001), 117-50; [[attached](#)]
3. NINO B. COCCHIARELLA, *Formal Ontology and Conceptual Realism* , Springer Verlag, Berlin-New York, 2007 (available as lecture notes series at PUL in a zipfile) [[attached](#)]).

▪ Other references:

4. J. W. GARSON, «Quantification in modal logic», in *Handbook of Philosophical Logic. Second Edition, Vol. III*, D. GABBAY E F. GUENTHNER (eds.), Springer , Berlin-New York, 2001, pp. 267-324.

Bibliography II

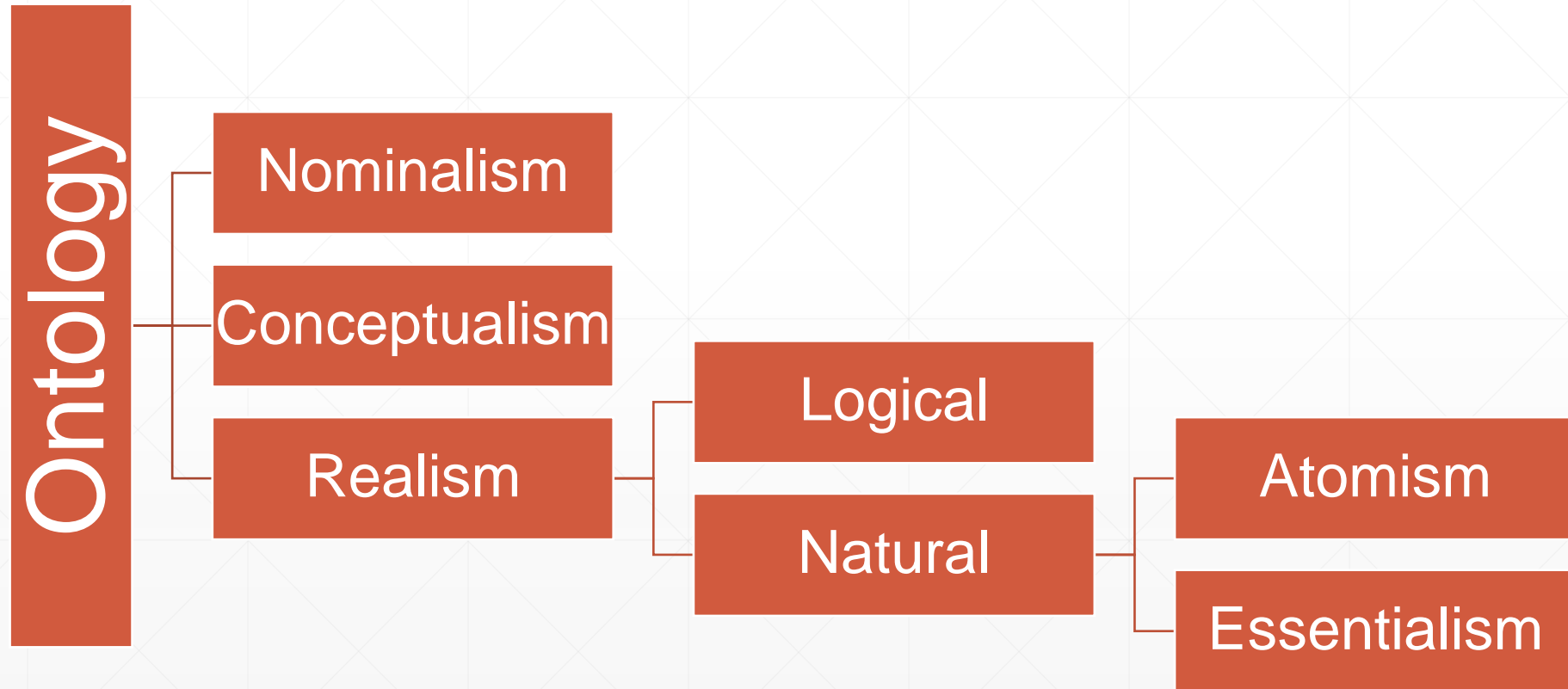
5. G. BASTI & M. SHAHID (EDS.), *Ontologia formale e ontologie. Uno strumento per il dialogo interdisciplinare e interculturale*, Editrice Apes, Roma, 2015 (in press: with contributions of Habermas, Searle, Ales-Bello, etc.).
6. A. ALES-BELLO, «Ontology and phenomenology». In: Roberto Poli – Johanna Seibt (eds.), *Theory and Applications of Ontology – Philosophical Perspectives*, Springer, Dordrecht 2010, chap. 14, 287-328 [[attached](#)]

Module 4

The formal ontology of the conceptual natural realism (CNR)

A scheme of the main ontologies

Let us start again from the last slide of the last lecture: thge taxonomy of the main ontologies:



Main differences between the two forms of naturalist ontologies

- The principal difference between these two types of naturalism is that **essentialism admits the *general reference***, i.e., the ability of referring of common names to natural kinds (e.g., “animal”, “mammal”, “horse”, etc.), and not only of proper names to individuals (e.g., “*that* horse, Fury”), while the atomism does not.
- Consequently, the essentialism is able to distinguish between **different *de re* modalities — *actual* and *virtual* — either of natural individuals, or of natural properties and relations, both *causally* (not logically) founded**. On the contrary, the atomism reduces the *de re* modalities ($\forall/\exists x \Box Ax$), to the *de dicto* modalities ($\Box \forall/\exists x Ax$) and hence **reduces the causal necessity to the logical necessity**. Effectively, as Quine emphasizes the *de re* modalities suppose the existence of **essences** (=necessary predicates). From this, the connotation as “logical atomism”, (LA) for all those ML like Carnap’s one defined on monadic predicates, not admitting the distinction between necessary (essential) and contingent (accidental) predication
- The “essentialism” is thus able to distinguish also, not only in **logical** but also in **natural** predication, between different modalities (**possible** (i.e., true only for some possible worlds) and **necessary** (i.e., true for all possible worlds)) according to the **extension of the causal relations** determining them. In this way, it is able to distinguishing, respectively, between, **predication of natural properties and relations** (“predication of accidents (properties/relations)”), and **predication of natural kinds** (“predication of essences”).

A taxonomy of the difference senses of being/existence in natural languages I

- In **mathematical logic univocity** of the being meaning intended as **existence**, i.e., consistent **membership** to a given class: $\langle \exists x P x \Leftrightarrow x \in P \rangle$, so that the existence predicate $Ex!$ is equivalent to the satisfaction of a **second order formula** such as $\langle Ex! \models \exists P P x \rangle$
- On the contrary, the **philosophical logic analogical character** of the being meaning. I.e., it maintains the ordinary language distinction between, **the being of the predicative relation (copula)** (the *being of the essence* in the classical ontology, the being of “what is” or *quidditas* of an existent), and the **being of the existence**, and hence of the **existence predicate**, interpreted as “being existent (according to the modality of a given essence, or as individual instantiation of ”: *E!a*. Moreover, in Quantified ML (QML), it is possible to distinguish between the **possibilist** and the **actualist** quantification.

A taxonomy of the difference senses of being/existence in natural languages II

- Therefore, following for the sake of simplicity Cocchiarella's symbolism that we justify in the next section, within a **possibilist formal ontology** (apart from its conceptualist or naturalist justification), we can synthesize the main senses of being/existence in the philosophical logic in the following way:
 1. $\langle \exists x, \exists F; \forall x, \forall F \rangle$: what **can exist** (*potentia esse*, “being potentially”), but does not exist **actually** (*actu esse*, “being actually”), both as to an individual x and as to a (nominalized) property F , either in the **conceptual** or in the **natural** realm;
 2. $\langle \exists^e x, \forall^e x; \exists^e F, \forall^e F \rangle$: what exists **actually**, both as a generic individual x , and as a property F , either in the **conceptual** or in the **natural** realm;
 3. $\langle E!(a) := (\exists^e y) (y = a) \rangle$: what **is existing** as a concrete individual a in the **natural** realm, and **never as a property** F , that is, $\langle (\forall^e F) \neg E!(F) \rangle$ (symbolization of Aristotle's distinction ***substantia prima / secunda***).

CONCEPTUAL AND NATURAL PREDICATION IN CNR AND NR ONTOLOGIES

- For understanding the main difference between Cocchiarella's **conceptual natural realism (CNR)** and mine **natural realism (NR)** let us start from the illustration of the **conceptualist bias** underlying CNR taken at its deeper roots in **quantified modal logic (QML)**.
- In a famous paper on QML **J. W. Garson** stated:
 - One of the most significant points of difference between semantical treatments of QML concerns the domain of quantification. Some systems quantify over objects, while others quantify over what Carnap (1947) called individual concepts. The second approach is more general, but it is also more abstract and more difficult to motivate (Garson, 2001, p. 271).
- The generality of conceptualism is because from the Renaissance on – that is after the abandon of the Aristotelian naturalism – the **possibilism** in ontology supposes the **conceptualism** in QML semantics.
- On the contrary, we see below that we can use in NR a *possibilist* ontology without being *conceptualist*, and hence we can use an *objectual* QML semantics without any need to use the free logic. On the contrary, we see below that we can use in NR a *possibilist* ontology without being *conceptualist*, and hence we can use an *objectual* QML semantics without any need to use the free logic.

The connection between objectualism and free-logics

- So, immediately after, Garson recalls us which is the deep motivation of the choice of free logics in the **objectual**, interpretations of QML like in Hayaki's **actualist** ontology we discuss below, that is,
 - “The basic assumption, made in the semantics for quantificational logic, is that **every constant** (such as g) **refers to an object** in the domain of quantification. (...) From the provable identity $\langle g = g \rangle$ we may thus derive, $\langle \exists x (x=g) \rangle$ by Existential Generalization. If g abbreviates “God”, then $\langle \exists x (x=g) \rangle$ reads “God exists” [but also “the unicorn exists”, if g denotes the unicorn] (Garson, 2001, p. 267). [Square parenthesis is mine, even though it shortens the sequel of Garson’s argument]”.
- This explains why in an objectualist QML we can use **names (constants) as rigid designators (RD)** and why Kripke’s relational semantics, because using them, considers its «possible worlds» as having a **stipulatory nature**: its QML is a free-logic. For the same reason, it is accused of **essentialism** even though not on a naturalistic basis, despite its **causal theory of reference**. All oddities that have a «natural» solution by giving a causal or naturalistic foundation to **possibilism**.

The core-strategy of Cocchiarella's CNR

- In the light of the precedent discussion, it is more evident where is **the richness** (a **possibilist** ontology) and simultaneously **the weakness** (its **conceptualist** interpretation) of Cocchiarella's CNR ontology. Effectively, the strategy of redefining consistently different types of predication, and hence of **quantifiers domains** with the related modality operators, on different “cut-down's” of the possibilist space gives a great expressive richness to the semantics of CNR formal ontology
- It is summarized in the following passage:
 - Just as a predicate can be taken to stand **in double way** both for a **concept** and a **natural property** or relation, so too a predicate variable can be taken in a double way to have both **predicable concepts** and **natural properties** or relations as its values. **The difference** between the universals in the one order and the universals in the other is reflected **not in a difference between two types of predicate constants or variables**—where the one type stands for concepts and the other stands for natural properties and relations—but **in the kind of (higher-order) reference that is made by means of predicate quantifiers**, i.e., the quantifiers that can be affixed to predicate variables and **that determine the conditions under which a predicate constant can be substituted for a predicate variable**. In this way, the difference is reflected not in a difference of types of predicate variables to which predicate quantifiers can be affixed, **but in a difference between the predicate quantifiers themselves**, i.e., in **the types of referential concepts the quantifiers stand for** (Cocchiarella, 2013, p. 317).

Natural and conceptual signification

- It is thus possible to distinguish in CNR a **double signification**, “**natural**”, on one side, and “**conceptual**”, on the other side, of **the same predicate**, that, following Cocchiarella, can be symbolically translated into a **double indexing** of the predicative quantifiers and explicitly referring to Aquina’s epistemology of the **double intention** (“**first**” and “**second**”) of the human intellect judging faculty:

$$(\forall F^j)(\exists x_1), \dots, (\exists x_j) F(x_1, \dots, x_j)$$

- Conceptual meaning** (i.e., the predicate F means a concept). The quantifiers are without indexes, because the conceptual meaning is the normal case in CNR.

$$(\forall^n F^j) \diamond^C (\exists^e x_1), \dots, (\exists^e x_j) F(x_1, \dots, x_j)$$

- Natural meaning** (i.e., the predicate F means a natural property/relation. Where: \forall^n means that the predicative variable, argument of the quantifier, is denoting a natural property/relation F . \exists^e means that the finite set of individual variables, x_1, \dots, x_j , arguments of the quantifier, are denoting a set of natural beings *actually existing*. \diamond^C means that the modal operator of possibility has to be intended in an *alethic-ontic* sense of *causal possibility*, C , “real” and not “logical”

The alleged cosmological relevance of CNR ontology and its conceptualist limit

- What makes interesting the CNR is its pretension of giving a formal ontology suitable of the *change of paradigm* related to the contemporary evolutionary cosmology, because of its pretension that its possibilist ontology can reckon with **natural kinds of physical and/or biological objects** that are **only potentially existing in the cosmological causal, nested texture**, within one of the many possible universes.
- This is **only an alleged pretension** in CNR, however, because of the conceptualist bias weakening intrinsically the CNR ontology, and its use of causal modal operators \Box^C/\Diamond^C , as **arbitrary (hypothetical) cut down's of its possibilist QML**.
- This conceptualist bias of CNR, preventing it of being a NR, is so expressed by Cocchiarella:

The conceptualist bias of CNR

“There is no general comprehension principle that is valid in natural realism, incidentally, the way that the comprehension principle: (CP^*_λ) valid for conceptual realism. Natural properties and relations are not formed, or constructed out of other properties and relations by logical operations. But this does not mean that no natural property or relation can be specified in terms of a **complex formula**, i.e., a formula in which logical constants occur. What it does mean is that such a specification cannot be validated on logical grounds alone, but must be taken as a **contingent hypothesis** about the world” (Cocchiarella, 2007, p. 280)).

- Where (CP^*_λ) is the Fregean “comprehension principle” (CP) of ZFC set theory, “extended above” via the “unrestricted” (CP^*) for allowing the presence of higher order classes inside it, without falling in the Russell’s paradox, and “enriched” for simple expressivity, with Church’s variable binding operator λ .
- Of course no true ontology of **natural realism** can be based on such a purely hypothetical interpretation of natural properties and relations (causes) within a conceptual framework. For this reason CNR, as Cocchiarella himself vindicates, can at last pretend to be a formal ontology of **cosmology based on QM**, but not on **QFT**, and hence cannot be a formalization of the Aristotelian-Thomistic ontology of nature where **natural predication is primary as to the conceptual one** $\rightarrow NR \neq CNR$.

CNR/NR interpretation of natural kinds

- Two main differences between **natural kinds** (ontology) and **classes** (logic) → distinction natural/logical predication:
 - 1. Natural kinds inclusions genera/species** cannot be justified in terms of **classes/sub-classes inclusions** (=class membership like if sub-classes were individuals) because natural kinds are **collections of concrete individuals (classes-as-many)** → they do not support any *reductio-ad-unum* like logical universals.
 - Solution of the well-known in Middle-Age fallacy of the confusion between **distributive** (membership) vs. **cumulative** predication, (Fx vs. xF), like in the paralogism: «The Apostles are twelve, Peter is Apostle, then Peter is twelve (instead of one of them)» (Quine). For this reason, both in Platonic and Thomistic tradition the term used for the **formal causality**, is “**participation**”, of the individual to the species, and of the species to the genus, by which the reversal of the verse both of the implication and of the inclusion relations as to the logical ones is perfectly justified also in the natural language.
 - 2. Natural kinds inclusions both of species in genera and of individuals in species** can be justified in terms of **sharing of the same causal texture** and not in terms of **sharing of the same set of definitions like classes** → they are **conjunctions of individuals denoted by common names A** and not of identity relations expressed through a **predicate F** .

Conceptualist interpretation of natural kinds in CNR I

- However, because is lacking in CNR a **formal calculus of relations** able to distinguish **logical and causal necessity**, i.e., the logical necessitation of implication, $p \Vdash q$, from the ontic necessitation of causation $p -\Vdash q$, CNR offers an absolutely insufficient ontology of natural kinds.
- Simply by its **(CP*_λ)** it can give a coinceptualist justification of natural kinds in terms of **complex formulas** i.e., of **predicative expressions including a relative clause**.
- Therefore, **the articulation genus/species** as expressed in ordinary languages by “common complex names”, such as “rational animal” in metaphysics, or “fermionic particle”, or “bosonic particle” in fundamental physics, is syntactically given by the use of the forward slash “/”.
- This is a binary operator acting on (a) expressions of the category of common names, such as A , and (b) formulas defining the relative clause φ , like either B , in the case of species, or Fx in the case of a property. In this way, A/φ is a name too, that is a complex name that reads: “ A that is φ ”, “the animal that is rational”, “the particle that is fermionic (i.e., with a fractional spin)”, “the particle that is bosonic (i.e., with an integer spin)”, etc.

Conceptualist interpretation of natural kinds in CNR II

- In the case of a genus/species denotation, the inclusion of an individual into the A -kind (where A denotes a class-as-many), is true iff x is an A , i.e.:

$$x \subset A \leftrightarrow (\exists yA) (x=y)$$

- Where the variables x, y, \dots , in referential phrases, that is, as arguments of quantifiers, i.e., $\forall x, \exists x$, must be understood “at least implicitly, as containing the ultimate superordinate common name ‘object’” (Cocchiarella, 2007, p. 146). The inclusion into a species of a given genus, that is, into the A/F -kind for which the complex name A/Fy holds, is true iff x is an A/F (e.g., “the particle is a fermion”), i.e.:

$$x \subset [A/Fy] \leftrightarrow (\exists yA/Fy) (x = y)$$

Conceptualist interpretation of natural kinds in CNR III

- **The superordinate common name ‘object’** is nothing else the conceptualist, modern version of the naturalist, classic “transcendent name” (or, simply *transcendental*, in the sense of ‘transcendent any ontological category’) ‘thing’, both coextensive with the primary *transcendental* of “being”, but with a disastrous shifting of meaning.
- In the **Classic Scholastics, and specifically in Aquinas (1225-1274)**, ‘thing’ is for the same ‘being’, as far as it is endowed with an essence, making it ‘something’, i.e., ‘a being *really* identical with itself and different from whichever other being’. In **Modern Scholastics** and hence in **Modern Thought**, specifically **from Francisco Suarez on (1548-1617)**, the reduction of the transcendental “thing” to the transcendental “object”, **supposes some “transcendental ‘subject’” from whom all the differences among objects derive.**
- In Suarez, and hence in Descartes and Leibniz following this same conceptualist shifting, is thus present *in nuce* the “**subjective transcendentalism**” characterizing **I. Kant’s ontology** and hence **E. Husserl’s formal ontology** in which ‘beingness’ (*entitas*) is systematically interpreted as ‘objectness’ (*Gegenständigkeit*) (for a systematic treatment of this difference, between Classical (naturalist) and Modern (conceptualist) notion of “transcendental” see (Basti, 2011)).

Conceptualist interpretation of natural kinds in CNR IV

- From this standpoint, it is not very significant that that **CNR is “non-transcendental”**, because, after J. Piaget’s genetic epistemology and K. Lorenz’s biological Kantianism, “conceptualism is based **on a socio-biological theory** of the human capacity for language, culture and thought, and therefore **presupposes some form of natural realism, as the causal ground of that capacity**” (Cocchiarella, 2007, p. 288).
- Despite of this, CNR is absolutely unable to give a **NR causal justification** of natural kinds at the ontological level, and at the epistemic level of their human conceptualization.
- Now, the “specification principle” in CNR is depending on an axiom of comprehension (**CP**), in its unrestricted form for allowing an extension of CP from ZFC set theory to a **higher order logic of classes**, even though enriched with the use of Church’s variable binding operator λ , (**CP*** _{λ}):

$$(\exists F) ([\lambda x_1 \dots x_n \phi] = F)$$

Conceptualist interpretation of natural kinds in CNR V

- In this way, the “naturalism” of CNR and his “causal explanation of natural kinds” is only a masked form of conceptualism and does not match at all the paradigm change with which fundamental physics and cosmology is today challenged.
- Indeed, as Cocchiarella himself recognizes, no **rigid designators** are allowed in CNR since **S5** ML is not satisfied in it. Its ML is **S4**.
- Finally, the **socio-biological conceptualism** of CNR formal ontology make it possible even more weak the **hypothetical naturalism** of this ontology. Indeed, this means that at the variation of the socio-biological conditions, also what we hypothetically consider as natural must change too.
- Are thus **hypothetical** also the **ontological** and even the **metaphysical** truth?
- Evidently CNR is a too weak formal ontology of the natural realism...