ON COMPOSITION

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> Propositions, as I understand them, occupy no space, and I can make no sense of a true, literal application of the notion of proper (nontemporal) components or parts to things that occupy no space. Others apparently can, and some construct elaborate theories of propositional structure… Perhaps I am blind to a possibility that other, cognitively better endowed philosophers see. From my unseeing perspective, though, it is more likely that the appearance of sight deceives.
>
> Eugene Mills, (2008, 308)

One of the basic components of the computational theory of mind is the Classical Computational Theory of Reasoning [CCTR], according to which, human reasoning processes are formal computations, i.e. "algorithmically specifiable processes that are causally sensitive to – indeed defined over – the syntactic properties of structured mental representations" (Samuels, *forthcoming*) According to Fodor (1987), for CCTR to be a viable cognitive hypothesis, cognitive processes must rely only on the internal properties of mental representations. Traditionally, this has been interpreted to mean that the causal role of mental representations in reasoning must be wholly determined by its syntactic structure. This interpretation assumes that syntax is internal to representations (unlike semantics which, presumably, would be external).

The main goal of this paper is to argue against the internal nature of syntax. If I am right, syntactic properties are not internal to symbolic representations in any metaphysically substantial sense. I will proceed to argue for my claim in three stages. In the first one, I will try to dispel certain myths surrounding the notions of structure and composition; in particular, the kind of composition relevant for

syntax (logic and semantics) is very unlike physical or morphological composition. In short, syntactic components are not parts of expressions, except in a very metaphorical sense. If I am right, the common, but mistaken belief that syntactic properties are internal to symbolic representations stems from the continuous use (and abuse) of part/whole metaphors when talking about composition and structure. On the second stage, I will use this clarification to argue that syntactic properties are physiological, this is, that the syntactic profile of a symbol depends on its function or role within a language or system. In consequence, so shall I argue, syntactic properties are not internal.

Physiological Composition

At least since Frege's famous seed metaphor[1], it is commonly recognized that logical components are not physical parts.[2] Not every component is a part; nor every part, a component. Otherwise, there would be no composition in the abstract realm (Mills 2006). Yet, we commonly speak about the structure and the components of abstract entities like the English language or the natural numbers. Abstract objects have no physical parts. Still, some of them are simple, and others are complex. Complex abstract entities are composed of simpler ones, yet this composition has no physical reality. Composition, after all, is analysis-relative. What the components of something are depends on the purposes of its analysis.

[1]. According to which, logical consequences are contained "as plants are contained in their seeds, not as beams are contained in a house" (Frege 1950, 101).

[2]. In order to avoid further misunderstandings, let me make an artificial distinction between "parts", which I shall use to talk about physical parts, and "components", which I will use to refer to the things that are structured into complex wholes.

"Components/Constituents", "structure/form"[3] and "analysis" are deeply interconnected notions, so that it is impossible to make sense of one without the others.[4] To analyze is to reveal the structure and components of a complex entity or system,[5] so that its components are those elements that contribute to or are relevant to explain why the system has certain property or properties. In other words, for something to be a component of a system is to have what Cummins (1975) called a "function" in that system. That is why "component" and "constituent" are synonymous with "factor", and to analyze is better understood as factorization than decomposition. There may be many ways to analyze a complex object, just as there are reasons for analysis. Depending what properties we are trying to explain about the object, we may analyze it in different ways and, therefore, come up with different sets of components. The electrical components of a car, for example, are those that are relevant to explain the electrical working of such mechanism. Each of them, therefore, has a function that contributes to the car's electrical system working the way it does. These components are different from, say, its hydraulic or mechanical components. Something is a mechanical component of a car if it explains, through its interaction with the other mechanical components, the mechanical functioning of the car. Not every part of the car is relevant for this purpose and, therefore, not every part of the car is a mechanical component. Think of the seat covers or the license plates. They play no mechanical role and therefore do not qualify as mechanical components. Yet they are still parts of the car. Ditto for the syntactic, semantic or logical components of linguistic

[3]. I will use each term in these pairs as synonyms.

[4]. A more complete development of the intimate relations between these notions is the central purpose of my forthcoming book. I hope these brief remarks serve for now.

[5]. I will use the term "system" to make reference to any complex entity susceptible of analysis.

entities. What makes something a logical constituent of a sentence, for example, is not so much that it is one of its physical parts (or a part of one of its physical tokens), but that it is an element necessary to systematically account for the sentence's logical properties (the same holds for propositions, specially if they are abstract objects with no physical parts). Similarly, the semantic components of a sentence are those that explain its semantic profile. The syntactic form of a sentence, accordingly, is nothing but the specification of how its semantic components contribute to it having the semantic properties it has.

Notice that, even if they are all physical objects, the set of constituents of a system need not constitute a physically identifiable unit. Constituents may be physically related, yet not physically united into a larger physical object. Consider the human digestive system. The organs that constitute it are physical objects. They are physically related and physically interact with each other within the system. Yet, we would not say that the digestive system is a big physical object (so that the intestines, the stomach, etc. are its physical parts). After all, a system is a physiological unit, not necessarily a physical one. When we say that a system is *complex*, rather than simple, we do not mean to imply that it is a large object with physically identifiable parts. All it takes for something to be structurally complex is to have analytically identifiable components, each one with a particular function or role within it.

The Extrinsic Nature of Syntax

> There is form in the syntactic sense, and there is form in the physical sense. These two things have practically nothing to do with each other… Given any physical object, no matter what its morphology [physical shape], it could have any syntactic structure at all.
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> John-Michael Kuczynski, (2006, 798 & 802)

This approach to composition gives us good reasons to assert that structural properties are not always intrinsic. It has been argued (by Lewis 1983 and Fodor 1987, 2000, for example), that since the structure of a complex system is wholly dependent on the identity and arrangement of its constituents, structural properties are always intrinsic. This means that they can be determined independently of any relation the system may have with other entities. Let's call this the "intrinsicalist argument". Well, this line of thought is entirely spurious. Determining a system's composition requires deep knowledge of its physiology and this, in turn, may require substantial knowledge of how the system interacts with other systems or what role it plays within another, larger system. As I said above, a system's composition (and, therefore, its structure) is analysis-relative. Depending on what property, feature or dimension of the systems drives its analysis, its corresponding structural properties may be intrinsic or not.

Take the logical structure of a formula in an artificial logical language. One the one hand, it is true that it is wholly determined by the identity of the formula's constituents and their arrangement. However, even this is already imbued with extrinsic information about the formula, because the very *identity* of its constituents is determined, in part, by how the formula interacts logically with other formulae (and this, in turn, depends on what logical system it belongs to). Consider the following three formulae:

(1) $p\&q$

(2) $p.q$

(3) pvq

Taking into account only the physical shape of these tokens, it may seem like all three formulae have different logical form. Each of them seems to be constituted by different symbols. However, any basic level logic student should be able to tell you that (1) and (2) have the same logical form (she may even say that they *are* the same formula). This is because basic level logic students know that "&" and "." are two of the many notations used to symbolize a conjunction. Thus, they do not see a difference in the composition of (1) and (2). Thus, to have different shape is not the same as being different symbols. To know whether two different shapes – like "&" and "." – correspond to different symbols or not, one must have some substantial syntactic and semantic knowledge about the language the symbols belong to (Kacsynski 2006). Thus, to know the syntactic composition of a formula requires syntactic knowledge about the language the formula belongs to. At least since the seminal work of Saussure (1916), we know that this is the rule, rather than the exception in human languages. This is as true of artificial logical languages as it is of any other language. Just think of "a", "a" and "*a*". Despite their differences in shape, they are all the same lowercase letter. Their identity *as letters* is not intrinsic, but extrinsic.

This, of course, is nothing but the restatement of the well-known phenomenon of multiple-realizability, introduced by Hilary Putnam (1967). As Searle (1990) has already pointed out, a direct consequence of multiple-realizability

is that "syntax is not intrinsic to physics" (p. 26).[6] If a formal system can be adequately realized by multiple physical systems, then syntactic properties cannot correspond to any peculiar physical features of any system that realizes it. In Searle's words, "syntax" is not the name of a physical feature (p. 27).

But what about (1) and (3)? Do they have the same logical form or not? If we ask the same logic students above, they may say that no, they do not have the same logical form: (1) is a conjunction, while (3) is a disjunction. However, how do they know that? Not by any internal inspection of the symbols. It is because of their knowledge of the logical system that these formulae belong to. They know that these symbols and, therefore, the formulae that contain them, have different logical profiles. The inferential behavior of conjunctions is different from that of disjunctions. Thus, *p* may be derived by simplification from (1), but not from (3).

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[6]. From this, Searle goes on to immediately conclude that syntactic properties are not objective, but "always relative to an agent or observer who treats certain physical phenomena as syntactical." (Ibidem) For a defense of computational realism, i.e. the theses that syntactic properties in general, and computational properties in particular are objective rather than observant dependant, see Boccardi (*forthcoming*).

I find it surprising that people so often jump from syntax being extrinsic to it being subjective (i.e. Searle above). If I am right, syntactic properties in general, and computational properties in particular, are as objective as any other physiological property. Nobody claims that the fact that mammals have stomachs is subjective, even though it is a physiological fact about mammals and, as such, extrinsic. In a completely different context, for example, Gordon McCabe has argued – against Weyl classic (1952) – that since relationships between objects can be objective (as well as subjective), extrinsic properties can be objective as well.

> "For example, the speed of a particle is an objective extrinsic property of a particle, an objective relationship between that particle and a reference frame. The fact that the speed of a particle is not invariant under a change of reference frame does not entail that the speed of a particle is not an objective property" (McCabe 2007, 145)

In yet another philosophical contexts, ethical utilitarianism claims that *all* moral properties of actions are extrinsic, yet it would be a mistake to jump from this to the consequence that utilitarianism is a version of relativism.(Thanks to Robert García, for this example).

(3) is derivable from q, but (1) is not, etc. That is what it means for (1) to be a conjunction and (3) a disjunction.

Notice that these inferential capacities are far from being intrinsic to the formulae. They belong to the formal system as much as to the symbols. Ultimately, it is because of the rules of the formal system that (3) is derivable from q, but (1) is not, for example. Thus, it ultimately depends on what rules govern a formal system whether a formula is a conjunction or a disjunction (or something else altogether). If the same rules applied to "&" and "v" (in some system different from our traditional one), they would not be different symbols (in that system). This means that if there was a system where "&" and "v" were interchangeable in any derivation without affecting the derivation's validity, they would be the same symbol (and therefore (1) and (3) would have the same logical form).[7] Thus, in order to know that "&" and "v", unlike "&" and ".", are different symbols, that is, in order to know whether (1) and (3) have different logical form or not, one requires substantial knowledge of, among other things, what rules are valid in the system the formulae belongs to. This means that logical form is hardly intrinsic to formulae.[8] Whether or not a formula is, say, a conjunction or a disjunction, is not one of its intrinsic properties, because it depends, among other things, on how that formula interacts logically with other formulae in the system.

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[7]. The inverse, however, may not always true. After Quine (1970, 1973), many logicians believe that if rules are changed so that new theorems appear or old theorems disappear, the meaning of the operators change as well (and, therefore, the logical form of the formulae where they occur changes too). However, a few others, like Putnam (1957, 1962, 1968), Morton (1973), Paoli (2003, 2007), Read (2008) and Estrada (2008) challenge this thesis. For them, a formula may keep its logical form even across systems with radically different rules. For example, while different rules apply to modal operators on different modal systems (K, S4, S5 etc.), they remain the same logical operators – necessity and possibility.

[8]. I am helping myself here to Dunn's (1990) epistemological heuristics for detecting intrinsic properties.

Some may bark at the idea of the identity of a symbol *not* being an intrinsic property. But that would be a mistake. I am not saying that symbols are entities whose identity is not intrinsic (I have no idea what *that* would mean). What I am saying is that whether an entity is a **token** of a certain symbol **type** or not is not one of its intrinsic properties. The point is altogether different. My point is that syntactic categories (just like logical o semantic categories) are physiological categories. They tell us about the syntactic function of words or symbols. And functions are not intrinsic properties. We cannot know what the function of an element is within a system if we do not know what its overall effect, role or contribution to that system is. We cannot know the syntactic (semantic or logical) category of a symbol or expression if we do not know its role, not within a particular sentence or phrase, but in the whole language (or *language game* if you will). And without knowing which syntactic categories the expressions of a sentence belong to, we cannot know its syntactic structure. The syntactic structure of a sentence, therefore, is not intrinsic to the sentence.

To further strengthen my point, let us also look at how syntactic analysis is actually done in linguistics. We do not determine the syntactic category of an expression by merely inspecting it. We do it by comparing it with other expressions in the language. To see what role an expression plays in a sentence, it is not enough to dissect such sentence. It is also necessary to see how the same expression occurs in other sentences and, furthermore, what other expressions could also play a similar role or occupy the same place in the sentence.

Consider the current debate surrounding the question of whether "rather than" clauses are arguments or adjuncts in knowledge statements. The question is what syntactic profile does the clause "rather than John" have in a sentence like (4)

"John knows it was Paul, rather than Mary, who broke the window." According to Schaffer (2008), its role is to explicitly provide one of the arguments of the ternary function denoted by the verb "knows". According to Blaauw (2008), it is an adjunct. Several tests have been proposed in the literature to determine whether an XP (that is, an X-phrase, where X is an arbitrary lexical category) is an adjunct or an argument: adjuncts can be iterated, while arguments do not; adjuncts are semantically independents, but arguments are not; adjuncts can be freely added to any complete, well formed sentence, while arguments cannot; adjuncts are optional, arguments not; etc.

This is not the kind of information one can get by mere decomposition of the sentence in the most rudimentary sense. (All we could find out that way is that the clause is there and that it could be removed as well. The syntactic information this gives us is minimal.) To test any of these features, one must look well beyond the sentence itself and compare it with other, similar sentences. For example, to determine whether "rather than Mary" is an adjunct in (4), one must first find out whether

(5) John knows it was Paul who broke the window.

has a *hidden variable* for the explicitly missing argument. Now, hidden variables – if they exist – are syntactic elements articulated, not at surface grammar, but at the level of logical form. This means that they are syntactic components of the sentence that correspond to no word or morpheme. Obviously, there is no w
ay of inspecting the sentence to find out whether there is a hidden variable or not, because – by definition – they are not there, at the surface. Instead, we need to bring in more information, about more sentences and broader linguistic fields to

determine the syntactic structure of (5) and (4). I think this clearly settles the question whether syntactic properties are internal or external.

That is the fallacious step in the intrinsicalist argument above. In general, what the constituent 'parts' of a complex system are is not always an intrinsic property of the system. In particular, neither the logical form, nor the syntactic and semantic structures of an expression are intrinsic. Before setting the issue to rest, let me address a couple of further concerns one may have before accepting the extrinsic nature of syntax.

Are *all* syntactic properties external?

So far, my argument seems to have established that not all syntactic properties are internal. Since I have worked mostly out of examples, I cannot presume to have shown that *all* syntactic properties are external. There may be some internal syntactic properties after all. Let's go back to the examples above. One may say that even though whether formula (1) (or (2), for that matter) is a conjunction or not is an external issue, the same formula may have other more basic syntactic properties internally. For example, one may argue that, even if one cannot say that the ampersand in (1) represents a conjunction without looking beyond the sentence itself, one can at least see, just from inspecting the formula, that it must be some binary propositional operator or other.[9] However, this is still very unlikely. It may

[9]. One may even argue that the property of being a conjunction is not actually syntactic, but semantic. After all (1) is a conjunction *because* of what its ampersand *means*. Now, the ampersand's property of being a binary operator, on the other hand, seems much more syntactic for sure. Arguing against this concern would go further beyond the goals of this article. It may suffice to say that my take on logical form is the traditional one, and the burden of proof for changing its status from syntactic to semantic is on the other

still be the case that "*p*" is the binary operator, while "&" and "*q*" are its arguments. The internalist may take a step back and argue that at least the syntactic fact that at least one of the symbols is a propositional binary operator is internal to the formula. But even this won't do, since one of them cannot be a propositional operator, unless at least one of the others is a propositional variable. But once again, this is not an intrinsic property of any of the formula's symbols. For one thing, propositional variables must be able to stand alone as formulas, and this is something we cannot know about a symbol just by inspecting its occurrence in a complex formula. And even if we remove the propositional requirement, it is still possible that none of the symbols in (1) is an operator. It may be that all of them are propositional variables and that the language's syntactic convention is to express conjunction by setting propositional variables next to each other. The possibilities are much broader than the internalist imagines.

But what about the property of containing three symbols? At least *that* must be internal to the formula. However, this is also not so. It depends basically, on how we identify symbol units, and this is also nothing internal to the formula. It may be the case that "*p&*" constitute one symbol and "*q*" another, or maybe all together form a single one. Furthermore, if Stanley above is right, there may be hidden variables in the formula. As I have argued elsewhere (2003), even if we took the whole set of strings of a language, if we do not know its vocabulary, we cannot induce its most basic syntactic features; much the less if we only take an expression in consideration.

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side. Still, I am not very worried about this issue because, as I shall now argue, even other more obviously syntactic properties are also extrinsic.

The internalist is not going to give up so easily. She may still reply that even if the syntactic properties of expressions in *most* natural and artificial languages are extrinsic, this need not mean that this is so for all possible or actual languages. What about strings of strokes in Hilbert's finitistic arithmetic? Hilbert's aim (1928) was precisely to devise a language where semantics was transparent from syntax and syntax was transparent from its morphology. One stroke means 1, a string of two strokes means 2, a string of three strokes means 3, and so on. Aren't the syntactic properties of the expressions of *this* language intrinsic? But even here we can imagine a different linguistic context where these same strings have different syntactic structure. For example, these strings could belong to a language – let's call it Schmilbert's language – where, instead of a vocabulary of one single symbol, the stroke, the vocabulary consists of two symbols: the single-stroke and the pair-of-strokes. Then, we may adopt the syntactic rule that single-strokes must never occur to the right of pairs-of-strokes and that no string can contain two adjacent single-strokes. Take now the expression "|||||". In Hilbert's language its syntactic structure is simple enough: it's a string of five strokes. However, in Schmilbert's language, it syntactic structure consists of one single-stroke followed by two pairs-of-strokes. Any other way of splitting the expression in single-strokes and pairs-of-strokes would violate Schmilbert's syntax and, therefore, would not be well-formed. Therefore, even for expressions as simple as the strings of strokes in Hilbert's language, syntax is extrinsic.

Notice that all along the article I have developed syntactic analogues to the now famous context-shifting arguments used against the compositionality of language. The basic principle behind context-shifting arguments is that an expression *e* has a property *P* intrinsically, if it is not possible for *e* to acquire or

loose *P* just by switching contexts.[10] In our case, the properties *P* in question are syntactic, but the structure of the arguments is the same. For radical pragmaticists, the goal of the context-shifting arguments is to show that some relevant properties of linguistic expression (mostly, their truth conditions) are not compositional, i.e. that expressions with the same syntax (i.e with the same syntactic constituents and syntactic structure) can have different properties. For me, the goal is not to show that syntax is not compositional (what could *that* mean?[11]), but that expressions with the same morphology (the same morphological constituents and morphological structure) can have different syntactic properties.

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[10]. Cf. Travis (1997). Notice, however, that I do not suscribe to the commonly-assumed conclusion of context-shifting arguments that any semantic feature that shifts between contexts is not compositional, since it relies on the premise that contextual properties cannot be compositional in the relevant sense. For a little more detailed view of my take on this point, see Barceló (forthcoming).

[11]. Well, I actually *do* know what *that* could mean, if we want to further push the similarities between the two cases: Syntax is not compositional in so far as the syntactic properties of expressions cannot be explained compositionally from the syntactic properties of their morphological constituents and structure. In other words, it is false that for all expressions *e*, the syntactic properties of *e* are a function of (a) the syntactic properties of the constituents of *e* and (b) the morphological structure of *e*. To paraphrase Fodor (2001), the morphology of an expression is *inexplicit* with respect to its syntax. However, "compositionally" has traditionally taken to mean the compositionality of properties like truth conditions from the semantic properties of syntactic components and structure. Cf. Clapp *forthcoming*.

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