

Cognitive Grammar in relation to Linguistics is an interesting analog to Phenomenology in relation to Philosophy. Thematically, Cognitive Grammar approaches linguistic phenomena from the perspective of language users' experience of perceptual and situational structures — as such, language structure is a kind of formalization, communication, and/or re-construction of patterns of organization within consciousness. This perspective certainly seems amenable to Phenomenology more immediately than paradigms that connect language-meanings to logical propositions, or to the mechanical operations of semantic and grammatical rules. Meanwhile, methodologically, Cognitive Grammar embraces a style of analysis grounded in first-person perspective; the linguist's reflective judgments on which potential expressions in a given language would be deemed acceptable to typical speakers of that language, and why. True, that kind of subjective but evidence-based methodology — linguists using their own sense of syntactic propriety and semantic coherence to determine qualifications like the acceptability of particular sentences, but doing so in the guise of generic speakers' language-use rather than any idiosyncratic preferences the linguist herself may have — is common across many paradigms of linguistic research. In the case of Cognitive Grammar, however, the researcher imagines linguistic phenomena situated in hypothetical perceptual and interpersonal contexts. Issues like acceptability are accordingly assessed with consideration to the overall experiential, practical, and situational enacting and conceptualizing that would constitute the cognitive givens talked about and grounding communicative practice. Insofar as practical and experiential context is treated as intrinsic among the details needing to be consulted for trustworthy assessments of, say, acceptability — rather than comparing a given linguistic performance against dictionaries or style-books — Cognitive Grammar reveals a metatheoretic commitment to the practical/experiential enviroing of cognition in general as something that can be systematically investigated, enough to make linguistics work as a rigorous science.

Cognitive Grammar, in short, requires for the coherence of its scientific aspirations that a kind of first-personal but social-pragmatic analysis — which we can argue is quite akin to Phenomenology — can be performed which is also scientifically rigorous and amenable to third-person follow-up; phenomenological claims being reviewed and synthesized within a scholarly community. Cognitive Grammar needs a story of its scientific merit that overlap with Phenomenology's parallel story: that first-person reports do not devolve into stream-of-consciousness but can mine experience for regulative patterns and recurring desiderata that can be critically examined by a sufficiently sympathetic research community, giving rise to theories and models which can claim third-person objectivity, or at least claim that a reasonable disputative process exists to make claims toward objectivity evaluable and, as such, potentially believable. In short, the phenomenologist can claim that an organizing gestalt she thinks is formulative in her experience as both consciously immediate and logically unified, described from a reflective stance, is not a "subjective" phenomena in the epistemological sense of something idiosyncratic to her, but instead a first-personal phenomenon she can approach as something which others can find also in their own experience; similarly the cognitive linguist can consider her acts of producing or receiving linguistic artifacts, in representative perceptual-situational contexts, bearing in mind that she is a fluent speaker of one or more languages and can anticipate the language-processing practice of others. The very fact of fluency, or competence, implies a certain degree of credibility in ascribing linguistic beliefs to others. Accordingly, so long as we consider a speaker fluent in a language, we commit to finding her basically trustworthy in guessing how fellow speakers would respond to artifacts in that language, and therefore to generalize from subjective judgments outward. This is a good example of how first-person reflection can be scientifically operationalized for multi-party disputation; Phenomenology seems to envision a similar dialectic but one expanded outward from language to cognitive acts and experiential groundings in their totality.

From at least a metascientific perspective, at least, a dialog between Phenomenology and Cognitive Grammar seems promising. Both disciplines topicalize and fine-tune related but complementary methodological issues. Phenomenology, on the one hand, attends more vigorously to a philosophical problematic of origination and a "critique of metaphysics", making a willful "bracketing" of extra-experiential assumptions an intrinsic part of its method. Cognitive Grammar may be sympathetic to but not necessarily dependent on similar philosophical performances. For example, an important issue in modern linguistics is whether we have "innate" mental faculties for creating and understanding language or whether language originates as a specialization or repurposing of some other, more general or primordial faculty. Whatever our intuitions about that, surely those are the kind of assumptions that should be "bracketed" in a phenomenology-style analysis. By comparison, while Cognitive Grammar appears to be internally consistent irrespective of any particular opinion vis-à-vis linguistic innateness, I'm not aware of any crucial importance attached to either entertaining or suspending beliefs about innateness (or any other foundational linguistic-cum-philosophical subject matter, like whether a universal grammar underlies individual grammars or what sort of preceptual inputs qualify as *linguistic* stimuli during childhood). Certainly Cognitive Grammar methodology is not *constituted* by the *absence* of such belief, the way that Phenomenology is essentially shaped by its counter-traditional, "Cartesian" style.

Notice however that Cognitive Grammar does intrinsically orient analysis to disciplinary commitments — to the accuracy of subjective syntactic/semantics assessments and reports, to the value of hypothetical experiential episodes as proxies for actual ones, to the approximate commonality of experience among a language community — which cannot be just passively accepted (or rejected); they must be actively (even if unconsciously) presupposed in the research process. Phenomenology, given how it thematizes both the legitimacy of (experientially-grounded) presuppositions and the suspension of presuppositions drawn indirectly from scientific or philosophical beliefs, therefore points to a latent contrast in metalinguistic commitments between those that are tangential to and those that are constitutive of the Cognitive Grammar affiliated paradigms: without self-consciously withholding considerations on presumptive “metaphysical” linguistic matters (like innateness vs. linguistic empiricism), Cognitive Grammar does not necessarily endeavor to classify its practitioners’ beliefs on the axis of bracketing vs. disclosure — the commitments that can be suspended partitioned from those that seem either experientially irrefutable or transcendently prerequisite for any notion of experiential certainty in the first place. Scientists presumably feel that an *entirely* presuppositionless science is impossible, while a more philosophical angle can investigate how, nonetheless, presuppositions vary in their metaphysical posture. Belief in a “poverty of stimulus” suggesting innateness, say — or, conversely, belief that the rich experiential structure surrounding even small-scale language acts presents substantial language-acquisitional stimuli (thereby falsifying the premise of poverty and that avenue of advocacy for innateness) — can both be claimed to stand differently in the ebb and flow of cognitive-linguistic metatheory than commitments to, say, the disputational objectivization of first-person reports.

At the same time, Cognitive Grammar can be claimed to illuminate a wider, or at least a different, intellectual spectrum for the objectivizing dialectic than Phenomenology alone. What I mean is that Phenomenology’s path from subjective reflection to rationalistic claims is fairly repetitive: philosophers discuss specific hypothetical/prototypical episodes of consciousness and then write about them in an academic style which invites community reflection and to be read against certain scholarly traditions. Cognitive Grammar does all that too, but there are introduced by virtue of its linguistic subject-matter other discursive facets: the schematic representation of linguistic structure (e.g. parse trees); the diagramming of perceptual-situational *gestalts*; even technological applications... Scholars can debate which tactics for representing language structure are most suited or most organically consistent for describing language artifacts via the Cognitive-Grammatical lens. The representations specific to Cognitive Grammar can be contrasted with those developed in other grammar theories and their correlative research programs, such as Combinatory, Dependency, and Head-Driven Phrase-Structural Grammars. These disparate programs are, also, not exclusively focused on explanatory revelations about human language — contemporary linguists also have practical concerns, like text mining and Natural Language Processing. One question for semantic and syntactic theories is whether they are buttressed by computational evidence — whether software created according to the language models and representations are successful for useful tasks, like classifying documents, machine translation, or pulling information from Natural Language resources.

Cognitive Linguistics in general does not need to mimic these practical concerns — after all, if language understanding does indeed build off of integrated perceptual and experiential situatedness, we should be skeptical about the prospects for computers and “Artificially Intelligent” agents to parse language with anything like native fluency (even setting aside how a machine’s language processing, correct or not in terms of our desired practical ends, cannot be equated to human empathic understanding). Contrariwise, however, we can also speculate that if the gist of Cognitive Grammar is how a plethora of environing situations — the spatial and force-dynamic arrangements trenchant to our construal of practical scenarios — can be sorted into a relatively small set of canonical schema, correlated with details like noun tense and morphosyntactic modes of agreement, then a computational treatment of language need not perceive the full spectrum of situational possibilities in full nuance, but only ascertain which one of several schema are evidenced in a given linguistic artifact. Cognitive Grammar would seem to support intuitions that truly humanlike “AI” Natural Language Processing is an unrealistic goal but that, at least potentially, computational NLP can be achieved to some useful approximation, and employing cognitively realistic language models can help that project. But I have no firm commitments in either direction; my point is that the technological and computational dimensions of linguistics are relevant for Cognitive Grammar whether or not this approach is sympathetic to the, at times, reductionistic paradigms of conventional formal/computational linguistics. Unlike pre-communicative experience, language is structured by the rigors of coordinated thought and normative signification — as language users we must shoehorn private experience into prototypes that can be expressed to others. Language, in effect, reveals that even rawly immediate experience has a logical order that, to some approximation, can be studied in abstraction — first because language merely by existing shows that this abstracting does happen, in one fashion; and second because language is a platform for studying it. Via language we can empirically study the articulations of conscious experience transcribed into a normative semiosis.

Phenomenology, also, gathers consciousness as reflected upon into something partially abstract, or with a structure that can be abstractly re-considered. There are some parameters of organization that seem so primeval to experience as to be indubitable. One is the episodic nature of perception and of deliberate action; mental phenomena seem neither sliced into instantaneous moments nor streaming in expansive segments. Instead, conscious reality is a chain of continuous but brief interludes: in one hypothetical kind of scenario, I open a door, which exercises one family of sensible and kinaesthetic attitudes; then I walk across the room; then I look out the window, and so forth. Such episodes stick together in language and maybe in memory, if I have occasion to say, or to later recall, that “I walked into the room” — the state of affairs I commit to memory or verbiage is actually a sequence of smaller episodes. This in turn subsumes into larger units, like when a narration reads “I walked into my living room, sat at my desk, and began to read”. What stands out inviolably from this episodic bricolage is — minimally the temporality of, but more consequentially, the multiple scales of the temporality of consciousness. Episodes link together and sequentially coalesce into a more durational scale. Phenomenology marks this scale-transition terminology; *protention* and *retention*, for instance, connoting the episodic unity of consciousness over short time spans, is contrasted with concepts like *memory* and *anticipation*.

Meanwhile, an equally salient structuring principle lies in the epistemic attitudes that are carried into perceptual/enactive episodes: consider the contrast between casually looking at the window expecting to see the same scene as any other afternoon and looking inquisitively because I hear a sound outside. Or maybe I see Hugo sleeping on the sofa, a “seeing” which is actually somewhat inferential, because he’s always sleeping on the sofa this time of day. I don’t need to confirm — if I briefly glance and see him lying still and relaxed — that the tabby cat on the couch is Hugo and that he’s sleeping, for me to think to myself (and maybe say to someone else) that “Hugo is sleeping” or “Hugo is sleeping on the sofa”. Of course, such a scenario can be altered: if we have two tabby cats then I may want to look more discriminately to ascertain that it is Hugo on the sofa; or I may want to observe him for a few seconds to check *if* he is sleeping, which is a different perceptual event and a different conscious experience that passively seeing “Hugo sleeping” in the throes of an assuming that he is, in fact, sleeping, by analogy to how seeing daylight out the window is *passive* if it’s mid-afternoon but may be a premeditated investigation if I have just woken up and don’t know the time.

Here, too, is an apparently “transcendental” or “categorical” (allowing a Kantian echo) pattern in consciousness — the sliding scale of activeness and passiveness in perceiving; the varying degree of epistemic thematization saturating different parts of experience. There are things we take for granted based on the familiarity of our most typical environments, becoming part of the propositional hum of things generally disclosing themselves in ways that carry information but no surprises. There are other things we are consciously aware of wanting to know. Some of our information about the world comes from presumptive expectations that we only really register when they are violated — say I suddenly see Hugo, having awoken, jump down from the sofa; now I have to update my baseline conception of how things are obtaining in my immediate surroundings. In that case I would not be startled to hear him scratching the chair, as compared to if I had not seen him wake up: our construals are woven from baseline assumptions and then the occasional anomalies where my assumed picture must be revised. But layered within this cycle of passive experience and disruptive revision is another genre of epistemic episodes which is more deliberate and proactive; planning perceptual encounters around specific, epistemically thematized concerns, like looking out the window to trace an unfamiliar sound. This scale of epistemic passivity and activity can be set against — and in consciousness interweaves with — the scales of temporality.

We have then at least this matrix — the double-scale of temporal granularity and epistemic attentiveness — which seems to emanate from the depths of consciousness and yet have something like an abstract structure. Looking over the phenomenological (and philosophy of mind) tradition, we can find other such prereflective abstracta, like the contrast between hyletic sense-data (the purely embodied qualitative character of red or of silky smoothness) and qualia as propositional content (*red* and *smooth* as predicates); or the contrast between fully private experience (like corporeal sensations) and intersubjectively negotiated perception — we may not see the same scenes in exactly the same ways, but at least in productively *similar* ways, if we are in similar locales and vantage-points. A full catalog of these structures would involve a historical overview of Phenomenology as a whole, which is divergent from my aims in this paper. I want to highlight, however, that Phenomenology produces a philosophical narrative about certain ur-structures — described, if all goes well, not from prior scientific or world-view commitments but from commonsensical meditations on (mundane, everyday) consciousness — which can be thematized with the extra performative precision of scholarly discourse; with the care of finding the right language, entrenching usages, diagramming the conceptual relations which should be easier to memoize precisely because of terminological rigor (“protention”; “episodic”; “epistemic attitude”; “enactment”). These structures get lifted out of the experiential realm and begin to condensate into an abstract regime, something defended like intellectual turf, discussed and analyzed.

Cognitive Grammar also has ur-structures — for sake of argument, consider on one hand the linguistic double-parameters of spatial and force-dynamic schema and, on another, the phenomenological double-scales of temporal granularity and epistemic thematization. Once entered in the intellectual ledger, the cognitive-linguistic schema become subject to a range of formal systemizations, from technical representations of language structures to lexicons, compilations of parts of speech and type-theoretic lexical classifications as well as of inter-word relations, even computer code for representing or automatically building representations of language artifacts. There have not been thus far analogous options for elaborating the phenomenologist's ur-structures — no code-repositories curated by Phenomenology research groups, no technological enhancements of phenomenological literature, for the most part. This is doubtless a manifestation of the historical context where Phenomenology has emerged, but we are now in a different context. Perhaps some 21st-century phenomenologists will engage with computers as aggressively as Husserl engaged with mathematics in the *Formal and Transcendental Logic* or the *Investigations*.

Language, in short, is — at least on one level — a *formal system*, notwithstanding that it is also a human medium possessing an arguably irreducible layer of human subtlety and context-sensitivity. Linguistics in general, and perhaps Cognitive Grammar in particular, has to bridge experience and formalization. Spatial and force-dynamic schema are — for example and so to speak — one side of the bridge as perceptual *gestalts*; but their formal trace is excavated analytically through syntactic and morphosyntactic theories; and a systematic model of morphosyntax involves something like formal language-representation. Insofar as parsing structures are described via “parse graphs” — the parsed sentence notated, with the supplemental data marking the contrast between a sentence spoken in an unstudied human context and the sentence as an object of analysis, as a graph of inter-word relations — then morphosyntactic agreement is a parameter manifest in specific inter-word pairs. So morphosyntactic agreement qua linguistic phenomenon straddles the experiential and formal realms — it can be studied in terms of what perceptual situations call for a particular noun or verb to be aligned with a particular verb, adjective, or adverb; it can also be studied as an enrichment of a formal structure. Through such formal strata Cognitive Grammar is not siloed in its study of perceptual groundings, but widens its disciplinary circle to reach a constellation of formal techniques that resonate with grounding experiential intuitions in suggestive ways, revealing both the potential and limits of formalization.

I would like to juxtapose this interdisciplinary continuation of Cognitive Grammar with the academic dissemination of Phenomenology — how the professional philosophical milieu where Phenomenology is mostly practiced shapes its transition from first-person speculation to an intellectual enterprise which, at least in its ways of organizing social resources, operates as a science. Cognitive Grammar operates in a similar milieu, but the strata of formalization evident in linguistics adds a wrinkle that has no direct analog in philosophy. Alongside the discursive and institutional norms which guide the systematization of Cognitive Grammar — the discipline of academic writing, peer review, conferences — there are also structural norms sited in linguistic formalizations through which cognitive theories can be explored. This is a development which phenomenologists should observe carefully, because the structural elaboration upon phenomenological research can be augmented beyond *just* inter-textual disputation in an academically curated speech situation, and can engage with formal systems as logical and technological artifacts. Scholars, of course, debate, refine, and mathematize formal systems in similarly self-conscious academic circles; but insofar as they are modeled and simulated in technological and computational environments, formal systems *also* become technical artifacts which can be explored and manipulated. Alongside the “Communicative Rationality” of academic performance, they buttress a *technical* rationality of implementing computer models, crafting the algebra of formal systems, codifying inter-system translations, and so forth. Computational linguistics, to take one example, is a technical as well as an intellectual practice.

The paradigms of these research programs that emphasize engineering over academic disputation don't necessarily align seamlessly with Cognitive Grammar, and still less with Phenomenology. Despite their *internal* commitment to “bracketing” phenomenologists are still educated participants in the modern world and many presumably do accept in broad outlines the scientist's worldview. Many phenomenologists probably “unofficially” believe that mental phenomena have mundane neurophysical explanations (they are not magic or divine revelations or flux in a sacred ether), however opaque to consciousness itself. So Phenomenology is not *constitutively* antagonistic to a “natural science” of cognition and perception. In the Philosophy of Mind, moreover, the path to materialistic perspectives on mental phenomena seems to diverge in two directions — one being the direct study of material systems themselves that we reasonably believe are seats for the neurophysical correlates of consciousness, like neurons and synapses; the other is a more functionalist attempt to describe the systematic organization of such material systems, on the premise that it is easier to make scientific process by seeing the brain (or the entire embodied nervous system) as a large-scale functional system than by reductively studying the biology and physics of microscale constituents, like nerve cells. Sure, we may believe that vision is driven

by cells in the eye and optic nerve, as well as specific brain regions; but the explanatory gap between whatever organic properties we may discover researching these bodies and the lived immediacy of visual qualia seems no less expansive. At least as a supplement to such microphysical investigation, functionalist methodologies can potentially narrow, even if not eliminate, such explanatory gap. In Cognitive Grammar, for instance, the subtle variation between schematically similar situations is in a sense transcended by morphosyntactic rules; our language-forming process of mapping perceptual givens to morphosyntactic and lexical prototypes and finding a communicatively stable encoding for them certainly seems amenable to functional description: such meta-cognitive finessing of our preceptual surround is a good candidate of a *functionality* available to our minds, as we are (and in our being) intelligently intersubjective and information-processing life-forms. Insofar as we have formal presentations of perceptual and enactive structures that seem both subjectively realistic *and* faithful to a kind of inner logic, we have the possibility for a rapprochement between Phenomenology and cognitive functionalism, the two paradigms bridged by the *functional* utility of cycling between immediate and subtly particular experience and formally tractable concept-systems we use to construct productive precis of our environing situations — which in turn can be modeled as formal systems and investigated in that light. Language bears witness to this experiential-to-formal-to-experiential rotation in an especially ubiquitous and well-structured topos, which is why linguistic methodologies like Cognitive Grammar can be a useful case-study for phenomenological formalization in general.

The preceding discussion has set forth why I believe the formalizing strategies available to Cognitive Grammar should be interesting to Phenomenology, in part because they are perforce available to Phenomenology as well. A formalized cognitive linguistics may not be immediately a formalized Phenomenology, but it comes tantalizingly close to that, as I hope to show before the end of this paper. But I have until now been addressing this formalization obliquely, talking *about* Phenomenology and Cognitive Grammar as scholarly phenomena rather than *within* either (or both). Here, for most of what follows, I will focus in on one specific formal development of Cognitive Grammar from both a cognitive and computational perspective, which I will then conclude by placing in a more classically phenomenological context.

## Part I Cognitive and Computational Process

Any attempt to bridge Computational Linguistics and Cognitive Grammar or Phenomenology must solicit one or several “founding analogies”, linking phenomena on the formal/computational side with those on the cognitive/computational side. Here, I will start from the analogy of *cognitive* and *computational process*, or generically “process” (of either variety). Processes, per se, I will leave undefined, although a “computational” process can be considered roughly analogous to a single function implemented in a computer programming language. The story I want to tell goes something like this: understanding language involves many cognitive processes, many of which are subtly determined by each exact language artifact and the context where it is created. Properly understanding a piece of language depends on correctly weaving together the various processes involved in understanding its component parts, and the structure of the multi-process integration is suggested by the grammar of the artifact. Grammar, in a nutshell, uses relationships between words to evoke relationships between cognitive processes.

My formal elaboration of this model will be inspired at an elementary level by process *algebra* in the computational setting, but more technically by applied *type theory*. Inter-process relations are the core topic of Process Algebra, including sequentiality (one process followed by another) and concurrency (one process executing alongside another). In practice, detailed research around Process Algebra seems to focus especially on concurrency, perhaps because this is the more complex area of application (designing computer systems which can run multiple threads in parallel). It is likewise tempting to imagine that cognitive-linguistic processes exhibit some degree of parallelism, so that the various pieces of understanding “fall into place” together as we grasp the meaning of a sentence (henceforth using *sentence* as a representative example of a mid-size language artifact in general). Nevertheless, I will focus more on *sequential* relations between processes, suggesting a language model (even if rather idealized) where cognitive processes unfold in a temporal order.

On both the cognitive and computational side, temporality is relative rather than quantified: the significant detail is not “before” and “after” in the sense of measuring time but rather how one process logically precedes another in effects and prerequisites. No theoretical importance is attached to *how long* it takes before processes finish, or how much time elapses between antecedent and subsequent processes (in contrast to subjects like optimization theory, where such details are often significant). We can set aside notions of a temporal continuum where subsequent processes occupy disjoint, extended time-regions; instead, one process follows another if anything affected by the first process reflects this effect at the onset of the second process. Time, in this sense, only exists as manifest in the variations of any state relevant to processes — in the computational context, in the overall state of the computer (and potentially other computers on a network) where a computation is carried out. Two times are different only insofar as the overall state at one time differs from the state at the second time. Time is *discrete* because the relevant states are discrete, and because beneath a certain scale of time delta there is no possibility of state change.

Analogously, in language, I suggest that we set aside notions of an unfolding process reflecting the temporality of expression. Of course, the fact that parts of a sentence are heard first biases understanding somewhat; and speakers often exploit temporality for rhetorical effect, elongating the pronunciation of words for emphasis, or pausing before words to signal an especially calculated word choice, for example. These data are not irrelevant, but, for core semantic and syntactic analysis, I will nonetheless treat a sentence as an integrated temporal unit, with no value attributed to temporal ordering amongst words except insofar as temporal order establishes word order and word order has grammatical significance in the relevant natural language/dialect.

While antecedent/subsequent inter-process relations are among those formally recognized in Process Algebra, this specific genre of relation is implicit to other models important to computer science, such as Type Theory and Lambda Calculus. If *type-T* is a type, then any computational process which produces a value of type *type-T* has a corresponding (“functional”) type (for sake of discussion, assume a “value” is anything that can be encoded in a finite sequence of numbers and that “types” are classifications for values that introduce distinctions between functions — e.g., the function to add two integers is different than the function to add two decimals; more rigorous definitions of primordial notions like “type” and “value” are possible but not needed for this paper). Similarly a process which takes as *input* a value of *type-T* is its own type. If two processes have these two types respectively — one outputs *type-T* and the other inputs *type-T* — then the two can be put in sequence, where the output from the antecedent becomes the input to the subsequent. In this manner inter-process sequential relations become subsumed into “type systems” and can be studied using type-theoretic machinery rather than Process Algebras or Process Calculi as such.

There also exists a robust type-theoretic tradition in (Natural Language) semantics, which is disjoint from but not entirely irrelevant to the type systems of formal and programming languages. Semantic types are recognized at several different levels of classification, but some of the most interesting type-theoretic effects involve medium-grained semantic criteria that are more general than lexical entries but more specific than Parts of Speech. For example, the template *I believed X* generally requires that *X* be a noun (*?I believed run*), but more narrowly a certain *type* of noun, something that can be interpreted as an idea or proposition of some kind (*?I believed flower*). Asher and Pustejovsky point out the anomaly in a sentence like “Bob’s idea weighs five pounds” (ex. 2 p. 5), which possesses a flavor of unacceptability that feels akin to Part of Speech errors but are not in fact syntactic errors. The object of *weigh* is “five pounds” and its subject is “Bob’s idea”, which is admissible *syntactically* but fails to honor our semantic convention that the verb “to weigh” should be applied to things with physical mass (at least if the direct object denotes a quantity; contrast with *Let’s all weigh Bob’s idea*, where the *idea* is object rather than subject). These conventions are analogous to Part of Speech rules but more fine-grained: there is a meaning of *weigh* which has (like any transitive verb) to be paired with a subject and object noun, but beyond just being nouns the subject must be a physical body (in effect a sub-type of nouns) and the object a quantitative expression (another sub-type of nouns). Potentially, type restrictions on a coarse scale (e.g. that the subject of a verb must be a noun) and those on a finer scale (as in this sense of *to weigh*) can be unified into an overarching theory, which spans both grammar and semantics — for instance, both Part of Speech rules and usage conventions of the kind often subtly or cleverly subverted in metaphor and idioms (see “flowers want sunshine”, “my computer died”, “neutrinos are sneaky”, as rather elegantly compactified by assigning sentient states to inert things). This is one way of reading the type-theoretic semantic project.

Along with Process Algebra, my take on linguistic understanding is informed by type theory (in both computational and linguistic contexts), but particularly by the merged notion of *typed* processes. So if we say that something has the *type* of a physical-body noun — that “Physical Body” is a type in the overall semantics of language — then I propose a

corresponding type of cognitive (perceptual and conceptual) processes characteristic of perceiving and reasoning about physical things. A particular designatum — a bag of rice, say — is subsumed under the semantic type insofar as our perceptual encounters with that thing — and/or our conceptual exercises pertaining to its properties and proclivities (like being difficult to carry) — are roughly prototyped by a certain generic kind of cognitive process. This assumes that there is a similitude among processes of perceiving and thinking about physical bodies (at least the mid-sized, quotidian physical things that tend to enter nonspecialist language) sufficient to subsume them under a common prototype, which I then argue forms the cognitive substratum for the semantic type “Physical Object”. Moreover, I contend a similar cognitive substratum can be found for other mid-scale semantic types that underlie analyses of semantic acceptability and metaphoricality, like “Living Thing”, “Sentient Living Thing” (“flowers want sunshine” is metaphorical because it ascribes propositional attitudes to something whose type does not literally support them), and “Social Institutions” (“The newspaper you’re reading fired its editor” exhibits a “type coercion” where *newspaper* is read first as an object and then as a company). One feature of semantic types is the lexical superposition of different types to produce what (in a slightly different context) Gilles Fauconnier calls a “blend”: in “Liverpool, which is near the ocean, built new docks”, the city is treated as both a geographic region and a body politic.

“Weighs”, too, as a verb, can be given a typed-process interpretation. In its least metaphoric sense, “to weigh” connotes a practical action of measuring some object’s weight by using something like a scale; as *cognitive* process the verb embodies an ability to plan, reflect upon, or contemplate this practice. So an “idea weighing 5 pounds” is anomalous because it is hard to play out in our minds a form of this practical act where the thing being weighed is mental. However, there are plenty of more figurative uses related to “weighing ideas”, “heavy ideas”, and so forth, so we are able to isolate the dimension of “judging” and “measuring” which is explicit in literal “weighing”, and abstracting from the physical details use “weigh” to mean “measure” or “assess” in general. The phrase “weigh an idea” therefore connotes its own cognitive process — imagining someone thinking about the idea in an evaluative way — but this figurative “script” is closed off by “5 pounds” which forces us to conceive the weighing literally with a scale, not figuratively as a kind of mental assessment. Once again, the type anomaly can be seen as a failure to map the linguistic senses evident in a sentence to an internally consistent set of cognitive procedures for dilating the semantic content seeded within each word.

Notice that I am treating cognitive processes, in themselves, as semantic more than grammatical phenomena. Literally, weighing something is a multi-step act (lifting it on the scale, reading the measurement), and even in our mental replay of hypothetical weighing-acts it seems impossible not to imagine distinct phases (just as it is impossible not to picture left and right sides of an imaginary cow). However, I assume that the cognitive script is figured by the lexeme “weighs” as a connotative unit: whatever internal structure our mental script of “weighing something” has, this structure is not a *linguistic* structure that must be encoded grammatically. Similar, the concept *buttered toast* suggests a confluence of perceptual, physical-operational, and conceptual aspects — we are inclined to regard toast as *buttered* if it looks a certain way and also if we have seen someone apply butter to it (or have done so ourselves) and also if we are in a context where we expect to find toast that may be buttered (we are not disposed to call a piece of bread in a grocery store “buttered toast” even if it has that appearance). So the adjective “buttered” introduces multiple cross-modal parameters in addition to the underlying concept “toast”; but I feel that the lexeme aggregates these parameters into a single *linguistic* unit. In Langacker’s terms, the various elements of “buttered” do not suggest *constructive effort*, as if deliberate *linguistic* processing were needed to unpack the linguistic entity to its constituent parts. Instead, “buttered” functions *semantically* as a unit (and likewise syntactically as the unit entering relations with other words — e.g. buttered-toast is an adjective/noun pair, not the noun “butter” at the root of the adjective) — even if its cognitive process is multi-faceted. Indeed, this is precisely the signifying economy of language: it captures complex cognitive procedures by iconic, repeatable lexical units.

On that theory, tying specific word-senses to stereotyped cognitive processes is a matter of semantics, not grammar per se. Grammar, I contend, comes into play when multiple processes need to be integrated. The concept “buttered toast”, for example, seems to start from a more generic concept (toast) and then add extra detail (the buttering, with all that implies conceptually, pragmatically, and sensorially). This is suggested by the substitutability of just “toast” for “buttered toast”:

▼ (1) I snacked on toast and coffee.

▼ (2) I snacked on buttered toast and iced coffee/.

Because the first sentence is perfectly clear, it seems that the ideas expressed (at least in this context) by *toast* and *coffee* are reasonably complete in themselves, so the adjectives have the effect of starting with a complete idea and adding on extra detail. Procedurally, then, it seems like we have some process which takes us to “toast” and “coffee” and then, subsequent to that (logically if not temporally) we add the wrinkle of re-conceiving the toast as buttered and the coffee as iced. In

short, the adjective-noun pairing is compelling us to run a pair of cognitive processes in sequence, one establishing the noun-concept as a baseline and one adding descriptive detail by an “adjectival”, a specificational process.

Counter to that analysis, someone might judge that phrases like “buttered toast” and “iced coffee” are conventional enough that we don’t interpret them through two meaningfully disjoint processes. This is entirely possible, given how erstwhile aggregate expressions become established units — what Langacker calls *entrenchment*. Different phrases exhibit different levels of entrenchment:

▼ (3) I snacked on toast and instant coffee.

▼ (4) I snacked on toast and Eritrean coffee.

Arguably “instant coffee” is a *de facto* lexical unit, partly because reading it in terms of constituent parts is rather nonsensical (there’s no non-oblique way to understand “coffee” being qualified as “instant”). Surely, however, “Eritrean coffee” is heard as a compound phrase (at least in 2019 — it is unlikely, but not impossible, that future Eritrean coffee growers will be so successful that we hear the phrase as a brand name or culinary term of art, like “Hershey’s kisses” or “French toast”). The status of “iced coffee” is probably somewhere between those two. But to the degree that a language element (whether word or phrase) is entrenched and generally processed linguistically as a unit, I maintain, it tends to be governed by an integrally complete cognitive process — not necessarily one without inner structure, but where the elements of this structure piece together perceptually and situationally, rather than seeming to be *linguistically* disjoint conceptualizations that are brought together by the shape of linguistic phrases. Conversely, where a cognitive process has this integral character, discursive pressures nudge the language toward entrenching some descriptive phrase as a quasi-lexeme; what starts being heard as a compound designation evolves to the point where language users don’t attend to constituent parts.

Obviously, this theory presupposes that there is an available distinction to be drawn between a “procedural” synthesis of disparate cognitive processes and a perceptual and/or conceptual synthesis constitutive of individual cognitive episodes. Phenomenology seems to back this up — there are some conceptual compounds that seem more episodically fused than others. Buttered toast may evoke a temporally not-quite-instantaneous conceptualization — at the core of the concept is a practical activity that takes a few seconds to complete — but we also can imagine the buttering-act apprehended in one sole episode. On the other hand, “Eritrean coffee” ties together concepts of much more scattered provenance; the perceptual unity of *coffee* (in the sense of a specific liquid in a specific container) along with the abstract geopolitical “background knowledge” implicit in the adjective “Eritrean”. As a cognitive synthesis “Eritrean coffee” is conceptual rather than perceptual. Provisionally we can treat this in the context of “buttered toast” being a partially-entrenched phraseology while “Eritrean coffee” is undeniably a phrasal compound, something whose constructive form must be parsed linguistically rather than figuratively.

This analysis, though, needs many caveats. After all, many bona fide *phrases* (not “quasi-lexemes”) nevertheless exhibit significant Phenomenological unity — i.e., they evoke integral perceptual complexes: *big dog*; *hot coffee*; *speeding car*; *red foliage*. Linguistically these seem like an underlying concept acquiring perceptual specificity via adjectival modification: “hot” was how the coffee came to my experience because I experienced it as hot (it wasn’t like I experienced the coffee and then had to contemplate whether it is hot or cold). After all, coffee must be experienced as hot, cold, or lukewarm; it cannot be experienced without temperature (assuming I am coming into contact with it and not just looking at it). Similarly a car must be seen as at rest, moving slowly, or speeding; foliage must be seen as having some color. I have argued, however, that unless entrenched as idiomatic phrases adjective-noun pairs like *hot coffee* or *buttered toast* should be read as grammatical complexes and accordingly (in my theory) as junctures between distinct cognitive processes. On the other hand, I argued that “instant coffee” was effectively entrenched *because* there is no simplistic conceptual unity between “instant” and “coffee”, which makes it harder to hear the phrase as descriptive. Instead, the semantics of that particular adjective-noun connection are circuitous and a little hyperbolic: “instant” coffee is coffee as a substance (not a drink, in that state) from which coffee the drink can be quickly (but not instantaneously) prepared. There is a lot going on the seemingly simple “instant coffee”: the shift from coffee-as-substance to coffee-as-drink; the “instant” exaggeration. In this case, the adjectival modification has *so many* moving parts that, I’m inclined to argue, it is hard to cover the whole scenario with a descriptive phrase; which in turn creates selective pressures for some pseudo-lexical unit to emerge (which turned out to be “instant coffee”) as a mnemonic for the whole conceptual multiplex. Indeed conceptually intricate wholes tend to quickly acquire pithy conventional nominalizations simply for rhetorical convenience (“Brexit Negotiations”; “Quantum Gravity”; “International Transfer Window”; “#metoo”).

Notwithstanding these variations, I still find a certain logic in the relation between phenomenological unity and semantic entrenchment. Perceptually integrated wholes may correlate with linguistically aggregate constructions insofar



as there is a transparent logical destructuring in the perceptual unity: in the case of substance-attribute pairs (like “hot coffee”) — deferring in the phenomenological context to Husserl’s account of dependent moments — there is a basically unobvious distinction between an underlying concept (like coffee) and the qualities which are its mode of appearance as well as conceptual predicates (like hot, cold, black, or light, describing sensory properties innate to the experience of a coffee-token as well as state-reports that can be propositionally attributed to it). Although the minimal sensate intention of the coffee and the predicative disposition toward ascriptions like *black* and *hot* are consciously intertwined, surely I am aware of a logicity in experience that gives the sensate and predicative dimensions different epistemic status. I don’t think of my experience of the coffee’s being hot as just a hot sensation qua medium of my sensorily apprehending the coffee, but rather as the sensate mechanism by which I observe the apparent fact that the coffee is hot, as a state of affairs and not just as subjective impression. We are constantly extrapolating our perceptual encounters to propositional content along these lines. As such, I contend such an (in some sense) innate perception-to-predication instinct grounds the procedural slicing of linguistic processes: *hot coffee* retraces in a linguistic construction the logical order of a coffee perception which on one level is a raw perceptual encounter but is simultaneously a predicative attribution. “Hot coffee” denotes a substance that can be experienced in the mode of a base concept (coffee) which is given predicative qualification (the coffee *is* hot). The fact that there may not be a noticed temporal gap in *experience* between the sensate perception and the epistemic posture does not preclude a certain logical antecedent-subsequent ordering: the concept “coffee” is the predicative base for my propositional attitude that what I am dealing with here is hot coffee, not hot-sensations-disclosing-coffee or coffee-I-experience-as-hot (but who knows, maybe I’m hallucinating) or any other artificial skeptifying of my actual experience, which is of raw perception pregnant with propositional content.

So I wish to justify claims that (non-entrenched) phrases complexes like “hot coffee” are unions of disjoint cognitive processes by noting that while such phrases evoke a certain perceptual unity, they evoke a *kind* of unity which we habitually regard *conceptually* as divided into sensate givenness founding epistemic attitudes. Cognitive processes are not exclusively perceptual; they are some mixture of perceptual and conceptual (and enactive/kinaesthetic/operational). A perceptual unity can cover two conceptual aspects, like a sheet covering two mattresses. So the perceptual unity of hot coffee can become the conceptual two-step of coffee as substance and hot as attribute; committing this unity to cognition as an overarching lifelong faculty involves registering a thought-process of coffee as a substance which can, in acts of logical predication, be believed to be hot or cold, black or light, etc. The apprehension of the substance is a different cognitive process than the predication of the attribute, in terms of how these mental acts fit within our epistemic models, even if these two processes are experientially fused. Typically we see the coffee before we touch or taste it, so already the coffee has a logical status apart from the heat we predicate in it. Likewise, even if the black color is inextricable from our perceiving (apart from odd situations where we drink the coffee without looking at it), we know the color will change if we add milk (even if just in principle because, preferring black coffee, we don’t actually do so); so we know the coffee has a logical substrate apart from its color too. All of this ideation is latent in the coffee-perceptions notwithstanding whatever perceptual unities we experience that cloak logical forms like substance/attribute under the inexorable togetherness of disclosure (the phenomenological impossibility of spatial expanse without color, say). In short, disjoint cognitive processes can be required to reconstruct a perceptually unified situation or episode, insofar as we are not just living through the episode but prototyping, logically reconstructing, signifying it — the perceptual unity in the moment does not propagate to procedural atomicity in absorbing the episode into rational exercises.

Experience, then presents *both* perceptual unities and cognitive-propositional multiplicity; language can inherit both holism on the perceptual side and compositionality on the rational side, even in a single enactive/perceptual episode. Depending on how we via language want to figure and express experience, we can bring either unity or compositionality to the fore. Our linguistic choices will evoke perceptual unity if they select entrenched word-senses or quasi-lexical forms; they will evoke compositionality if they gravitate toward compound phrases and complex, relatively rare lexicalizations and modes of expression. To the degree that we are interested in a cognitive-phenomenological *semantics*, we can attend to the first part of this equation, to how the understood atomicity of a word sense or a conventionalized phrase often suggests an object or phenomenon consciously apprehended as an integral whole; we can trace phenomenologically the apperceptive unity that seems to drive the linguistic community’s accepting lexical atoms in this sense. Conversely, to the degree that we are interested in a cognitive-phenomenological *grammar*, we can attend to how logically composite predication emerges even within perceptual unity, because our encounter with phenomena is not (save for exotic artistic or meditative pursuits) the “dasein” of irreflective sensory beings immersed in a world of pure experience but the deliberate action of epistemic beings carrying (modifiable but not random) propositional attitudes to perceptual encounters.

Modeling grammar as a coordination between cognitive processes may be an idealization, precisely because the

compositive and integrative faces of consciousness are two sides of the same coin: it's not as if we work through a thought of "coffee" or "toast", abstract and without sensory specificity, noticeably prelude to conceived/perceived attributes like "hot", "cold", or "battered". But we can still ascribe to linguistic-understanding processes an idealized, "as if" temporality, treating the elucidating a sentence as a sequence of procedures leading from bare concepts to well-rendered logical tableau, suffused with some level of descriptive and situational particularity. So we go from *coffee* to *iced coffee* to *battered toast* and *iced coffee* to *snacking on battered toast and iced coffee*; each link in the chain stepping up toward propositional totality. My point is not that the logical form of the sentence is composed from logically primitive and abstract parts, which is fairly trite; my point is that such logical composition is only apparent after a pattern of cognitive integration that is more subtle and exceptional. Extra-mentally, battered toast is just toast with butter on it, a fairly simplistic logical conjunction. Read as a baton passed between two acts of mind, however — conceiving toast and then conceiving it battered — the conjunction is more elaborate; the cognitive resources of "battered" are not just "something with butter on it" but the implication of a sensory summation (the flavor, color, scent) and operational narrative (we have seen or performed the deliberate act of applying the butter). Similarly a person dressed up is not just someone whose torso is encircled by articles of clothing; a barking dog is not just an animal making random noises; a stray cat is different from a lost cat. In their interpenetration, cognitive processes develop (in the photographer's sense) narrative and causative threads that are latent in worldly situations but reduced out of logical glosses; that is why it seems incomplete, lacking nuance, or beside the point to explicate semantic meanings in logical terms, like "bachelor" as "unmarried man" (we can certainly imagine a sentence like "My best friend has been married for years but he's still a bachelor", meaning he still has the habits and attitudes of his single days).

A theory of sentences building from conceptual underspecification to logical concreteness does not preclude there being different scales of specificity. "I snacked on toast and coffee" is just as acceptable as "I snacked on battered toast and iced coffee". The communication conveys as much situational detail as warranted in the conversational, pragmatic context. Language always has the *capability* to push further and further into specificity; how exhaustively the language user avails of this capability is a matter of choice. As theorists of language we must then analyze how language possesses the *latent* capacity to draw ever finer pictures; the adjectival *battered* toast and *iced* coffee takes the granularity of signifying at one level (the level of the "I snacked on toast and coffee" sentence) and layers on (or really layers *within*) a yet more specific level. The architecture how this happens is well addressed by type-theoretic methods (both coarse and mid-grained).

Note that "battered" in "battered toast" is in the current examples not absolutely essential; the sentences without this qualification are similar in meaning to the sentences with it. This suggests that if the adjectives designate (or solicit) cognitive processes that build upon some other (logically) prior process, the anterior process can also suffice on its own, at least in the context of these example sentences.

## Part II Procedures and Integration