Natural and Artificial Languages: how the phenomenology influences our perception and how it can be normatively accounted for

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Abstract

Natural language and artificial languages (mathematic, logic, metalanguages) are categorically different. Nevertheless, we attribute exactly those properties to natural language as those that artificial languages actually have. The reason for this mis-attribution, is our experience and perception of natural language. This paper elucidates these claims with Azzouni's work, and subsequently provides normative guidelines for artificial languages that should help prevent resulting errors.

Keywords: semantic perception, natural language, artificial language, phenomenological influence, artificial language-norms, semantic experience

Azzouni's Semantic Perception, the main inspiration for this paper, is a book that struggles to combat the predominant neo-Gricean view of meaning-endowment. The underlying thread that Azzouni uses to dismantle the neo-Griceans, is to point out their overambitious attempt to force the theory of meaning to be both normative and descriptive. This point becomes more salient when Azzouni shows his descriptive-only account of our natural language-use, the meanings we derive from it, and how that contrasts with the Griceans. For this paper, I will accept Azzouni's technical arguments against the Griceans, and instead focus more on chapter 9, the last main chapter of Semantic Perception. In this chapter, Azzouni talks about the boundaries between natural and artificial languages, and how the phenomenology aids the mistaken impression that these categorically different languages are the same. Nevertheless, despite their categorical differences, Azzouni suggests that natural and artificial languages can work together via proxy-relationships; natural language standing as a proxy for artificial language. How this relationship is supposed to function in practice is not addressed by Azzouni. This omission in the literature gives rise to my following question:

If natural and artificial languages are categorically different, and our phenomenological experience/perception blinds us to this fact, how do we make sure that artificial languages behave the way we want them to behave?

Due to the need for clarification of the first two elements of the question, this paper first tries to show that these are true, and how they are true. Only when this is done, and the crucial factors are properly recognized, can normative guidelines on artificial language-use follow. The paper attempts to address all these issues in the following five sections:

1. Historical and Contemporary Perspectives on Philosophy in Language & Linguistics

1: Section one is a historical introduction of philosophy of language and linguistics. It attempts to show the essence of the problem of language and meaning, and the problems Azzouni faces in Semantic Perception. The main elements of this historical introduction are mentioned in footnotes and scatters throughout Semantic Perception. Due to the lack of historical order, I took the liberty to pick and adapt the relevant material from introduction books, encyclopedias, papers, and Azzouni's presentation of the current problem of meaning endowment. While it is quite a standard historical introduction, it should still prepare the reader a bit better into what is to come.

2. Azzouni's Phenomenological Account of Natural Language

2: Section two is Azzouni's phenomenological account of natural language. It is a summary of chapter 1 to 5 of Semantic Perception, with some additional clarifying sources, minus the more thorough discussions of the neo-Gricean interpretation. This section elucidates the phenomenology of natural language in such a way that it is clearly distinguishable from the phenomenological account the neo-Griceans give. Furthermore, it also gives an idea of how meaning is endowed, and how our perception of natural language deviates from reality.

3. Phenomenological Influence (weak phenomenological determinism)

3: Section three is largely a validation for the phenomenological analysis of section two. Namely, a hardened Platonist might claim that the description of phenomenology is void of scientific use; we care about how things actually are, not how they appear. This simplistic interpretation of science is refuted by Azzouni's two methodological interludes in Semantic Perception. Herein, he shows how accurate phenomenological descriptions in fact aide in uncovering the world. Essentially, we have intuitions, experiences, and perceptions, and, by carefully scrutinizing these, we can come to know which ones to trust and in what circumstances. Similarly, Azzouni shows throughout the book how intuitions have influenced theorizing. As this phenomenon deserves a name, I coined the term *phenomenological influence.* This influence is then shown in four case studies in the philosophy of language and linguistics. Azzouni mentions

something about all of these case studies throughout Semantic Perception. My addition is selecting four clear cases, and working them out a bit further under this common theme. The section then continues to state that, even though these theories have problematic intuitive origins, they could still be scientifically feasible. This is shown by the distinction between normative and descriptive theories, which entails here that some theories do not need to be phenomenologically accurate if they aspire to be normative. For instance, the neo-Griceans could exist in the normative domain, despite the fact that phenomenologically they do not accurately describe natural language. My addition here is, once more, further working out and additionally sourcing sparse comments in Semantic Perception.

4. Natural vs Artificial Language

4: Section four is about natural and artificial language, how they are perceived, how they actually are, and how they interact. For natural language, almost the same characterization from section two is used. The conclusion from this characterization, is that perception of natural language contrasts with how it actually is. Curiously, the same attributes that people perceive natural language to have, artificial language actually has. Mathematics and its practice is used to illustrate this point. Afterwards, the precise differences between the categorically different languages are analyzed, and a method is sought to cross barriers between the two language-forms. This section uses the material from section two, with the addition of Azzouni's ancillary work, to give a more unison presentation of artificial and natural languages, and their relationships. My addition is selecting relevant material and presenting it more orderly under this theme. I also further explain some technically difficult notions and attempt to show the importance of some arguments.

5. Norms for Artificial Languages

5: Section five remarks that, concluded from the previous sections, a) our perception of natural language deviates from reality (section two), b) we are affected by *phenomenological influence* (section three), c) we perceive natural language to be the same as artificial language (section four), and d) we are affected by *linguistic influence* (section five). This is a dangerous mix. The reason for that, is that, if we are influenced by our phenomenological experience, and that leads us to think and act as if natural and artificial languages are the same, then that could result in blindness to errors in artificial language-use, and in mistakenly drawn implications. Even though general awareness could help, the ubiquitous category-crossing of languages in science, and the potential effects this has, urges for more detailed guidelines. Section five attempts to provide exactly this by giving normative maxims for artificial languages. Barring the external discourse demand of maxim 4, briefly mentioned by Azzouni in some of his works, this section is entirely original.

1. Historical and Contemporary Perspectives on Philosophy in Language & Linguistics

Logic and Minimalism

In the beginning of the 20th century, which is still regarded as the early stages of language philosophy, it was popular to think of sentences and expression as carrying a logical form. Well-known contemporary names in philosophy associated with this position are Frege, Russel, Carnap and the early Wittgenstein. To get a feel for how such logical forms were treated, consider an example by Russel of "the present King of France is bald":

1) there is an x such that x is currently King of France
2) for any x and y, if x is currently King of France and y is currently King of France, then x=y
3) for every x that is currently King of France, x is bald

Nowadays, semantic minimalism (largely) fulfills the role of its early 20th century predecessor. Minimalism is the minimal proposition, complete or incomplete, about meaning (semantics) that can be made of an expression. The motivation seems to me closely related to the principle in science of *under-determination:* state exactly or less than what the evidence supplies. Another term that gives a sense of what semantic minimalism is about, is strict/literal content. For these theories, contextual elements of indexicals such as 'I' have a syntactical component, which 'search' for inference, in their inherently constrained parameters, towards salience in a context. They can either, remain semantically neutral between anything that can be 'I', a currently unknown person uttering the expression, or, they can attempt to search in contextual discourse (prior utterances that bind the 'I') for a direct reference. The latter is illustrated by for instance Christina talking in I-form in a novel where she is the main character. In this case the discourse semantics should track the saturation of Christina for 'I'.

During my investigation of the finer merits of theories in minimal semantics I came across this recent classical way of describing language:

> "...the capacity to recognize the systematic connections between meaning and linguistic form. If the connection were not systematic – were not, in some sense or other, *rule based* – language could not function in the way it does. For there would then be no guarantee that the recipient of an utterance could recover from it the thought which the speaker meant to express by it." (Kamp & Reyle, 2013, 7).

Even though Kamp and Reyle (2013) present a respectable way to convert discourse elements into logical semantics, such a way of characterizing natural language is troublesome, and perhaps even untenable; mainly because of what *rule based* and *systematic* mean, namely something normative and strict, which, as this paper will argue, are properties that natural language turns out not to have.

Contextualism

Major pioneers for contextualism were, among others, the late Wittgenstein, Austin, Searle. Contextualism gained popularity and traction in the second half of the 20th century due to language turning out to be highly context sensitive; to a certain extent, even un-controversially so [1]. Among these contextual elements are indexicals, pronouns, context-shifting arguments, incompleteness (of expressions and/or propositions), and more. This finding pressed the question of how we can even communicate when our words and utterances are bounded to contextual factors. Apparently, our words do not directly tell us what is meant, so what does?

Meaning Endowment

These issues lead to research into how we give meaning in the first place. The following are the current perceived options, as treated in Azzouni (2013a, 351), for how we endow things in the world with meaning [2]:

1) There are things in the world with meaning, and we experience those things (Platonism)
2) We have communicative intentions; we recognize these intentions in each other; we produce sounds and utterances that are interpretable via norms; this enables us to derive meaning (Gricean & Neo-Gricean)
3) We blindly/behaviorally interpret people around us by using interpretation theories, and theoretical posits of meaning (e.g. reference and truth)

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1 The current discussion is for instance about whether indexical element go beyond the Basic Set; so not whether there

2 Apart from Meinongianism, which states roughly that there are non-existent entities.

Current orthodoxy is the Gricean approach. Its popularity is partially rooted in it seeming the only sensible solution. Centrally, Griceans argue that the phenomenon that explains successful communication is speaker intentions; these speaker intentions are universally recognized and everyone knows that they are universally recognized; this subsequently leads to the tacit agreement of social maxims, allowing for smooth communication.

However, the list above is not exhaustive. Azzouni claims that there is an unrecognized fourth option: we experience language artifacts to have meaning-properties, despite the fact that they don't. Essentially, we live in a world where we all mass hallucinate a common, public language, due to the universal evolutionary heritage to experience it so. In contrast to this experience, the actuality is that we all have an individual version of language (idiolect). Fortunately enough, this conflict is perfectly acceptable in practice. The reason being, a) our possible language parameters are inherently constrained, b) we have capabilities to roughly learn how others use language artifacts, and c) our potential experience of objects and events is also inherently constrained. In other words: we are all human, and human idiolects overlap closely enough for most communicative purposes. These claims do not exclude that this hallucination, or mass illusion, of public language could have been exchanged for communication by intention. Perhaps we could have experienced language as Griceans say we do; it is just that in this world we don't.

2. Azzouni's Phenomenological Account of Natural Language

In Semantic Perception, Azzouni focuses mainly on the phenomenology of natural language. He does so for experience, perception and use. Furthermore, he asserts that these phenomena are important, not only because they are the only (empirical) evidence we are currently able to generate, but also because of their guiding ability in choosing which theories are acceptable or prospective. This contrasts to the perception of standard practice in philosophy: common belief sketches phenomenological experience in scientific practice as merely theoretical posit of folk and scientific psychology, which is used in the form of 'qualia' or 'intentional states', while in reality it is used as data that constrains theoretical work (Horst 2005). Moreover, there is a widespread tendency to ignore such 'surface phenomena', and rather focus on the less obvious deep structure of phenomena [3]. This section will revisit some of these ignored aspects and give a more full description of the phenomenology involved in natural language.

Experience of Understanding Expressions

Curiously, we can attribute truth and falsity to 'what John said was false' but not 'those chalk marks are false'. In essence, directions to what physically instantiates the expression is perceived as bizarre. Similarly, the tree itself cannot be true; as long as we are not speaking metaphorically. Only (our) talk about those trees can have truth-values, such as: 'that tree is brown' [4].

These truths can come about, intuitively, because we refer with our concepts, such as 'house', 'tiger', and 'London,' to things in the world; if we refer correctly, with true propositions, then we get truths [5]. However, to quote Azzouni's comment on Chomsky, such a view does not trivially

3 This is where Azzouni and Chomsky diverge on scientific approach. Chomsky thinks surface phenomena, such as the actual languages we speak, are too messy for scientific inquiry. Azzouni disagrees.

4 In philosophical terms: focusing on the physical token will seem absurd; only by focusing on the type it belongs to can we perceive the expression as meaningful.

5 This is the Correspondence Theory of Truth

hold (Azzouni 2013a, 65):

> "Chomsky (2000b, 37, italics in original) puts the point nicely:"
> "We accord [London] curious properties . . . we allow that under some circumstances, it could be completely destroyed and rebuilt somewhere else, years or even millennia later, still being London, that same city. . . . We can regard London with or without regard to its population: from one point of view, it is the same city if its people desert it; from another, we can say that London came to have a harsher feel to it through the Thatcher years, a comment on how people act and live. Referring to London, we can be talking about a location or area, people who sometimes live there, the air above it (but not too high), buildings, institutions, etc., in various combinations (as in London is so unhappy, ugly, and polluted that it should be destroyed and rebuilt 100 miles away, still being the same city)."

> "From this, Chomsky (ibid., italics in original) draws the following conclusion:
> Such terms as London are used to talk about the actual world, but there neither are nor are believed to be things-in-the-world with the properties of the intricate modes of reference that a city name encapsulates."

The resolution of the issue of simple terms can be (Azzouni 2013a, 66-67, listing mine):

> a) to highly abstract the terms so that they neutrally refer to a (very) wide range of things
> b) to heavily paraphrase every instance of the term in order for it to refer
> c) to deny that even simple terms have fixed reference

Option (a) could be attempted, but is should be noted that the non-professional speaker-hearer does not perceive herself to use such abstract terms. Words, or concepts, are thought to simply refer as used; no knowledge is present of *all* the other ways the term can be used in different contexts. Option (b) on the other hand carries some pragmatic and theoretical issues: the process is simply incredibly tedious and perhaps not even useful and/or attainable. Option (c) is Chomsky's and Azzouni's conclusion. Such denial of fixed reference has ramifications for what natural language actually is. However, this does not need to infect our experience.

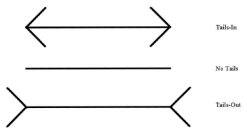
That is, despite Chomsky's analysis of actual reference, we do experience words such as London to have a fixed meaning and reference, and so do expressions. Moreover, this experience is automatic and involuntary. Consider an ant's product in the sand of "IT'S SO COLD HERE" (Azzouni, 2013a, 74). We automatically attribute meaning to the sentence without the ant possibly having any intentions to communicate. The same principle is put by Azzouni (2013a, 73) as follows:

> "Should an avalanche—equally improbably—generate the clear articulation of what sound like words shouted by a human voice full of concern, I'M COMING; PLEASE WATCH OUT; I'M COMING; PLEASE WATCH OUT . . . even with full knowledge of how these sounds were being produced, it would be impossible not to hear them as meaningful—and, indeed, as a warning!"

We thus see meaning, regardless of whether there are communicative intentions or intellectual competence. Further evidence for such meaning attribution is that almost the exact same phenomenon shows up in our tendency to see faces and shapes in everything around us, from clouds to buildings and beyond. Moreover, this phenomenon is what makes it possible for producing and selling anthropomorphous products to be a reality; as is researching it (Swan, 2010).

Meaning Illusion

Meaning attribution is thus instant and automatic. Furthermore, it is experienced as such even with full knowledge that there is no meaning at all. Consider the Muller-Lyer illusion:



(source: Mendoza et al. 2006)

For most people it is impossible to experience both lines as equally long, even after proof by measurement. The visual sciences are full of these cases, for instance: *simultaneous contrast illusion,* the affect of background colors on perceived colors; and *contrast-size illusion*, the affect of background object size on visually perceived object size. These illusions suggest that our (visual) experience is encapsulated from our reasoning and knowledge [6]. When combined with the previous paragraphs' explanation of words and expressions, it should become clear that the same theme applies to language. Think only of how a marking due to weather erosion of "this bank is in trouble" immediately is experienced with saturated meaning when it is eroded in a financial bank or in times of crisis. And so it would be if it is eroded next to a riverbank!

Words are thus experienced as having inherent meaning, even when we become aware that they have none. Put differently: words are experience as having monadic meaning-properties, and are experienced this way without knowledge, context, convention or intention coming into play.

What is Said

The phenomenologically inclined term for how the meanings of our utterances are experienced is w*hat is said.* In order to properly characterize *what is said,* the previous discussion of Chomsky, the ant, the avalanche, and the illusions, are crucial. Keep in mind that these are not all the foundations for characterizing *what is said*. Nevertheless, the material presented in this paper gives a decent foothold for the following characterization:

What is said is experienced automatically; it receives its meaning from the monadic meaning-properties of its words; it does not require speaker meaning; it does not require intentions; background factors are not perceived as coming into play; it does not have to be truth-evaluable.

This last claim can be illustrated by 'Pegasus is flying high' and 'The birds are flying high'. In spite of anything to saturate 'Pegasus' or 'the birds', as no birds are to be seen in the context of utterance, they have perfectly normal meaning. This, without resulting in a truth label such as 'false' due to the proposition not being contextually about something.

What is Implicated

Azzouni's issue with the Griceans concerns *what is said*; not *what is implicated*. The latter involves speaker meaning and intentions. Consider the expression 'Tom looks great', while the speaker cynically looks in Tom's direction. *What is said* is that Tom looks great, but *what is implicated is* quite the opposite. Indeed, with enough ingenuity almost everything can be implicated by a speaker. Therefore, whereas it is mostly clear *what is said*, is not so for *what is implicated*. Also, discussion between speaker-hearers is mostly about *what is implicated*, as the meaning of *what is said* is perceived to be directly visible to everyone. To illustrate the latter point, I think of discussions on novel's meaning; they are never about what is written, but only about what the writer

6 This is the Theory of Mind Modularity (either mass- or moderate modularity)

(metaphorically) alluded to, and what the writer implicated.

Strict/Literal Content

While the notion of literal content is often used by philosophers, Azzouni would rather omit the term in direct phenomenological description. The reason for this normative omission, is that the notion of literal content comes from a second look on sentences and expressions; not from direct experience or impression. The following is an exemplification of what that is supposed to mean (Azzouni 2013a, 190):

(1) Jack and Jill went up the hill

The normal meaning, or *what is said,* is that Jack and Jill went up the hill, and they did so together at the same time. However, when presented with the argument that this statement says nothing about the mutuality of going up the hill, and that they could have either went up together or separately, most people will philosophically conclude that they were wrong in trusting their former reading of the sentence, and subsequently accept the more neutral statement. Notwithstanding that, a true semantic minimalist should remain open to the possibility that somewhere in the grammar, syntax, and idioms, there is an index to be found that really does give inference to that Jack and Jill went up together at the same time. Nevertheless, it is easy to convince the non-professional, and perhaps rightly so, that the strict meaning is different from *what is said*. However, herein lies the danger concerning descriptions of people's phenomenological experience of language. Such strict content, as is subsequently supplied by the philosopher to the non-professional, is never even considered by the non-professional when looking at the sentence in isolation. More strongly, (1)'s statement, as normally interpreted, is already perceived to be strict content. Regular contemplation will not let the non-professional become aware of what the minimal proposition of the statements is. It is only when that perceived minimal proposition is supplied from outside, that the perception changes; and so it is for everyday communication and contemplation.

Because *what is said* is perceived as almost equal to literal content, the expressions that people use are not perceived as trapped in the contexts in which they are uttered. Therefore, they are freely transferred to other contexts with little to no modification, all while retaining their truth-values.

Conclusion Section 2

So, we experience words and expressions as being endowed with meaning-properties, and knowledge of how the expressions are produced does not alter that experience. However, words and expressions do in fact not have such clearly endowed meaning-properties. Nevertheless, we experience and perceive *what is said* as having inherent meaning that corresponds to the words and expressions. Meaning can also be given above *what is said*, which can be done with *what is implicated.* Finally, strict/literal content is locally perceived as being close or equal to *what is said*.

3. Phenomenological Influence (weak phenomenological determinism)[7]

Now that the phenomenology of natural language is more familiar, it might be worth asking why we even care about proper phenomenological description. That it refutes the neo-Gricean phenomenological view is clear, but I want to emphasize another reason for caring: the

7 As far as I am aware, weak phenomenological determinism is a term I needed to coin, as I could not find a similar term that could easily signify what I meant. That said, I prefer the term phenomenological influence, similar to how weak linguistic determinism should rather be called linguistic influence. The reasons is clarity. 'Determinism' is too controversial in meaning, and gives perhaps too strong of an impression.

phenomenology somehow determines how we think, act, and perceive the world. Phenomenological determinism sounds grandiose, but the weak version I defend here is very close to the simple fact that we are guided by our intuitions. Straightforwardly: phenomenological experience gives rise to basic intuitions that, among differently generated intuitions, start our theorizing [8]. The pressing matter is that these intuitions can be hard to get rid of; especially when a careful analysis of the phenomenology generating our intuitions is overlooked. On the other end of the spectrum is strong phenomenological determinism. Kant comes to mind as holding a position that could be characterized as such. For, in Kant's view, we can only perceive the world through our phenomenological experience, and we more or less have to postulate that it has correspondence to the actual world; certain phenomenological induced intuitions are the only way through which we can understand the world, and are therefore non-negotiable [9]. Seeing how the latter version deserves the term "determinism" more, I will henceforth refer to weak phenomenological determinism as *phenomenological influence.* Concisely put, the following is a depiction of *phenomenological influence* and how to deal with it:

It is a bias that tends us towards intuitions and theories, but does not force us; this bias can partially be controlled for by describing our phenomenological experience closely; this description gives us insight into which theories we are prone to accept and create; finally, correct description of pure phenomenological data aides in further theorizing.

The final claim can be elucidated by the theory of weight, which was originally viewed as a monadic property of objects, and subsequently changed to being seen as a relationship between mass and distance. Correct description of the phenomenology aided here to bring about the refusal of the commonsense version of weight and the advance of further theorizing [10].

The principle of phenomenological influence, and the information of the second section, will be used as background information on the following four case studies in philosophy of language and linguistics. These case studies suggest that a large role is played by experiences, perceptions and intuitions on basic theorizing. This, despite the fact that they are not perceived as doing so.

Case 1: Compositionality

In semantics, compositionality entails that all meaning from an expression can be derived from its components. It is closely related to semantic minimalism, which is a theory that states, roughly speaking, that only syntax, grammar, and perhaps phonology give meaning; the rest is mind reading and not linguistics. Compositionality in its basic form states that expressions mean what they mean because all their individual components have monadic meaning properties that ultimately come together in a whole expression. The reason for us being prone to accept such theories is that, firstly, we experience words to be endowed with monadic meaning-properties, and, secondly, we have the impression that what is said is equal or close to literal content.

There would be no cause for concern if the phenomenological experiences were closely tied to a description of actual language-use. However, in this case, usage does differ from our phenomenological experience, because words in isolation are in fact not endowed with monadic meaning-properties in the way experienced by people. We should therefore be careful in accepting versions of compositionality based on intuitions that cannot function as evidence.

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8 My more formal attempt at characterizing how intuitions, experiences and theories interplay is in the appendix A.1

9 This, of course, does not entail that we cannot do proper science and investigate the phenomenology.

10 Description of the phenomenology was of course not solely responsible for the improvement in theory. A thought experiment by Galileo started much of this endeavor. For an account of how that happened, see Topper (2013).

There are however more sophisticated versions of semantic minimalism. Take for instance minimalism of the following kind: words do not have meaning, only expressions do; expressions derive their meaning from all components, such as words; words have occasional meaning in that particular expression; these meanings come from their relational structures in that expression. Another example, similar in sophistication, is the version of minimalism that takes on the Chomskian challenge (house example section 2) and claims that words have meaning; just highly abstract ones. While it is true that these theories still have their roots in phenomenological experience, their versions of semantic minimalism diverge substantially from traditional ones.

Case 2: The Classical Theory of Concepts

We perceive our words to have monadic meaning properties. Therefore, the concepts those words correspond to seem to be in principle, and perhaps easily, definable. Traditionally, necessary and sufficient conditions are needed to give a proper definition. In mathematics this is (usually) exactly what happens. Purportedly, in similar fashion to mathematics, we are able to discover analytical truths by deriving them logically from the necessary and sufficient conditions of concepts. A classic example is: bachelor = non-married male. However, what is telling is how little of these definitions we can actually find in natural language. To drive this point home, consider once more Azzouni's take on Chomsky (Azzouni 2013a, 227):

> "No (nonprofessional) speaker-hearer is likely to offer—or even be aware of—these intricate and important details about the meaning of the word "house" (the following is cribbed with small modifications from Chomsky 2000b, 35–6):"
>
> "Interestingly, that a brown house has a brown exterior, not interior, appears to be a language universal, holding of "container" words of a broad category. In addition the exterior surface (of a house) is distinguished in other ways. If I see the house, I see its exterior surface; seeing the interior surface does not suffice. But the house is not just its exterior surface, a geometrical entity. If Peter and Mary are equidistant from the surface—Peter inside and Mary outside—Peter is not near the house, but Mary might be, depending on the current conditions for nearness. The house can have chairs inside it or outside it, consistent with its being regarded as a surface. But while those outside may be near it, those inside are necessarily not. So the house involves its exterior surface and its interior. But the interior is abstractly conceived; it is the same house if I fill it with cheese or move the walls—though if I clean the house I may interact only with things in the interior space, and I am referring only to these when I say that the house is a mess or needs to be redecorated. The house is conceived as an exterior surface and an interior space (with complex properties). Of course, the house itself is a concrete object; it can be made of bricks or wood, and a wooden house does not just have a wooden exterior. A brown wooden house has a brown exterior (adopting the abstract perspective) and is made of wood (adopting the concrete perspective). If my house used to be in Philadelphia, but is now in Boston, then a physical object was moved. In contrast, if my home used to be in Philadelphia, but is now in Boston, then no physical object need have moved, though my home is also concrete—though in some manner also abstract, whether understood as the house in which I live, or the town, or country, or universe; a house is concrete in a very different sense."

To extend the point: Chomsky talks about 'redecoration' being strictly inside, but if, as Azzouni comments, Thanksgiving takes place, and the outside of the house is livened up with ornaments and colors, someone can perfectly understandably say "That house needs to be redecorated" (Azzouni 2013, 227). This expose is an extension of the treatment of London in section two. What the examples attempt to illustrate, is what an absolute mess is would to attempt axiomatization of the concept "house"; accounting for all the implication relationships of the concept simply seems

intractable. Necessary and sufficient conditions are thereby invalidated; even for simple natural language terms. This explains why philosophers are still unable to satisfactorily define important concepts such as knowledge, despite valiant efforts to do so.

The classical theory of concepts has remained with us for so long because our intuitions make it seem so acceptable. Only recently, about 1970s onwards, has popularity risen for different approaches to concepts. The prototype theory of concepts is an exemplar of this revision. It defines concepts in stereotypes and in distance relationships to other concepts. Somewhat related is the theory-theory of concepts, which states that people have mini-theories about concepts and their implications. These mini-theories can be defeasible and adjustable, like most theories, and do not necessarily need to be conscious or explicit. Such theories give up on necessary and sufficient conditions, but by doing so come much closer to what natural language actually is.

Case 3: Concepts and Bivalence

The pervasiveness of the need for necessary and sufficient conditions, is partially due to the intuition of universal bivalence: terms, universally, have only two truth-values (true or false). The following discussion from Azzouni (2013a, 235-240) exemplifies how odd such an intuitive notion is:

(1) This stone is not thinking about Vienna
(2) The square root of two is not blue

Do truth-values apply? They certainly are not true [11]. How about 'baldness'? Either the term applies, or it is a negation of the term; something is either bald or not bald. Thus we get positive expressions like these: 'the circus is bald', 'the bench is bald', 'the field is bald'. Conversely, the same goes for negations: 'the circus is not bald', 'the bench is not bald', and 'the field is not bald'. Every single one of these sounds odd. The ensuing "vagueness" of term usage indicates that perhaps the term 'bald' can only be applied to- or negated of something that is naturally able to be bald.

I informally attempted a couple of these puzzles with a handful of people by asking questions. For at least the non-philosophically inclined, the dialogue had the following form:

Q: "Is this book happy?"
A: "…....No?"
Q: "So you are saying it is not happy?"
A: "….What?!..uhhh"
Q: "Well, is it happy or not?"

Confusion ensues, after which the person claims to not know, and then waits for the answer. The clue of this interaction is that, once the non-professional feels they are *required* to apply a term, they will often claim epistemic ignorance; even for innocently simple cases like the one above. The perceived options available for applying a term such as truth thus are: the term applies; the term does not apply; I do not know whether the term applies. The missing option, not easily spotted, is that terms have a constrained domain of usage, and that going outside that domain is perceived as bizarre.

This pervasive commitment to bivalence is thus based on intuitions closely related to those of the classical theory of concepts. It arises partially from the phenomenological experience that words have monadic meaning-properties that make us blind to the modular-like encapsulation.

11 And for the anti-Russelian and pro-Strawsonian they are not false either.

Further committing us to bivalence are intuitions such as the law of excluded middle or law of non-contradiction. They tend to intuitively disallow non-appliance or vagueness. To complicate matters further, commitment to bivalence is not easily thwarted by the non-professional speaker-hearer, as she will invoke epistemic ignorance when pressed.

Case 4: Mathematical Platonism

Mathematical Platonism is a doctrine asserting that mathematics deals with objects that exist, are abstract, and mind- and language independent. Concepts of language are often associated with these objects. Mathematical Platonic objects are thus like mathematical concepts. The triangle, addition, multiplication and many more are examples of these objects. Historically, reasons for believing in the existence in abstracta has come in different forms. Roughly, first came Platonism, then came the assurance of Descartes' well intending God, and finally there is rational intuition of different sorts. All these views are additionally guided by some notion that these objects are indispensable.

It is easy for non-mathematicians and non-philosophers to be dismissive of Platonism, either writing it off as silly, or, by means of showing respect for a venerable idea, view it as a beautiful metaphor. Nevertheless, for many professionals there are numerous desires for grounding these objects in reality. First, the phenomenological experience of unity in mathematics; everyone can grasp concepts and answers independently of each other. Second, the intuitions of truths needing to be about something that is preferably real. Third, the idea that what our best scientific practices are about, need to be considered ontologically real [12]. These three reasons, although incomplete, give an idea of why Platonism is so appealing. Indicative of this drive in current age is the (slight) edge in popularity that Platonism has over nomimalism with regard to abstract objects: 39.3% versus 37.7% (Bourget, & Chalmers, 2014).

Not surprisingly, mathematicians are the most natural Platonists. They work with abstract objects every day; and indeed, for philosophers of mathematics there is plenty of Platonistic debate. This debate prevails despite frequent conclusions that there can be no good reason for believing in Platonism, or not believing in it for that matter (Balaguer, 2001). Leaving that aside, there are two general explanatory options: either mathematical work itself gives the impression that Platonic objects exist, or the best arguments for Platonism are to be found in mathematics and its practice.

Azzouni, however, has a very clear way of dealing with Platonism. The following reasoning can be found in Azzouni (2004, listing mine):

1) everything that exists is mind- and language independent
2) we recognize this independence by an epistemic role of the object
3) mathematical abstract object have no epistemic role; if these abstract objects had ceased to exist in 1968, mathematical practice would have continued exactly the same

Therefore, abstract mathematical objects do not exist, and thus mathematical Platonism fails.

Lessons from Case Studies

It is certain that the phenomenology of the non-professional speaker-hearer is too crude and simple to provide proper theories all on its own. Furthermore, what also becomes apparent by the previous case studies is that some theories are influenced by these same phenomenological experiences and intuitions. However, it is worthwhile to stress that these conclusions do not entail that these theories are inconsistent or useless. This, despite the (likely) fact that they are blind to their intuitive origin in the phenomenology, and despite the theories' negligence to account for the

12 With this I allude to Quine-Putnam's Indispensability Thesis.

correct phenomenology. To understand how this can be the case, the following subsection gives an important distinction for general theories. The distinction is used to designate the domain a particular theory should be in, and to suggest what they should strive for.

3.1 Methodological Distinction for Theories

An important categorical distinction for theories is that of normative and descriptive theories. Below is how I would like to sketch both in combination with their role in holistic science:

> ***Normative*** (prescriptive): how something should be, or what we stipulate something should be, which can be done by axioms, rules, norms and more.
>
> It is possible for normative theories to be *special-science theories*; those that are in principle reducible to physics, whatever "in principle" means. However, such normative theories only attempt to capture some of the phenomenology and focus more on theory tractability. Underlying sciences have no direct influence on these normative *special-science theories*. Instead, they are modified and judged based on theoretical virtues. Such normative *special-science theories* are also called *top-down autonomous special-science theories*. Examples are Platonism, ethics, and classical economic theories of rationality.
>
> ***Descriptive*** (positive): can describe our experience, our pattern of use, the state of the world; a description of the phenomenology.
>
> It is the purported holistic ideal for *special-science theories* to be descriptive theories. They attempt to capture all phenomenology concerned, and aspire to explain them in the underlying sciences, such as neurophysiology and physics. These theories are also called *bottom-sensitive autonomous special-science theory* [13]. Examples are biology, chemistry, and, slightly more controversial, many aspects of psychology and behavioral economics.

To find out in which domain a theory belongs, the following question should be asked (listing mine):

1) Does the theory attempt to describe (all) the phenomenology of its topic?
2) Does the theory have systematic or substantial epistemic counterexamples?
3) Is the theory able to have *thick epistemic access* [14]?

In general, if one of the above is not met, then the theory belongs in the normative domain. There are however exemplar qualifications to be made on this statement. First, when the theory is able deal with question number two, by adapting the theory sufficiently and/or having enough gross correlation to characterize surface phenomena, it can remain defeasibly descriptive. Second, it takes argument to show that the systematic and substantial counterexamples are not due to some error in measurement, equipment, circumstances, etc. Third, thick epistemic access is defeasible; there can be controversy over whether something exists, and we can be universally wrong. So, evidently, these questions are supposed to serve as guidelines for prescribing an appropriate ambition for theories; not as axiomatic law.

If that ambition is the normative domain, then it should be judged based on theoretical

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13 I take the special science terms from Azzouni's Semantic Perception (2013a), second methodological interlude.

14 The term is Azzouni's contrast to thin epistemic access. The debate on finer points is in progress, but for the purposes of this paper it is enough to state that there needs to be some epistemic access. See Azzouni (1997) for finer details.

virtues. Mathematics is a successful example: a normatively constrained practice based on axiomatic rules making scientific practice tractable [15]. Mathematics is definitely not the only practice that is theoretically virtuous; many other normative forms of scientific artifacts and theories pass the criteria. A basic list of such theoretical virtues is: evidential accuracy, causal adequacy, explanatory depth, internal consistency, internal coherence, universal coherence, beauty, simplicity, unification, durability, fruitfulness, and applicability (Keas, 2017). These are once more defeasible guidelines, but, nevertheless, very important ones.

4. Natural vs Artificial Language

This section starts with perception of natural language, which is followed by how it actually is. This contrast is already partially shown in section two, but is elaborated on here for clarity. The perception we have of natural language closely jibes with that of how an artificial language actually functions. To show that is the case, an example is given of mathematical practice. This example attempts to illustrate that, despite social factors involved in human practice, mathematics and mathematical practice still function in accordance with the public constraints of an artificial language. Similarly, according to the perception of natural language, social factors play a role, but, ultimately, we have a public language that has meaning due to its words, and difficult problems in language can be solved by the experts. However, crucially, this is not so according to natural language in actuality. The difficulties that arise from categorical differences between actual natural language and artificial language, lead to the last part of this section, which analyzes the particularities further, and subsequently shows how the barriers between these different forms of language can be crossed.

Natural Language as Perceived

Some key characteristics of our experience and perception of natural language are the following (listing mine):

a) we experience, and therefore perceive, our words to have monadic meaning-properties
b) we perceive expressions meaning to be composed of the individual words and what they mean
c) we are committed to bivalence via the notion of concepts needing to be defined with necessary and sufficient conditions

From these characteristics there are a couple of options to define roughly what the perception natural language is. The two that adhere most to these characteristics are [16]:

- Platonism: an old and venerable position that states that words and expression are concepts that link to ideal objects that exist non-materially. An often-cited example is the triangle; all the versions we see around us are imperfect ones trying to copy the perfect concept of triangle. The meanings of words are then housed in these Platonic objects, and it is our task to try and grasp them.

- Public Language: the idea that we speak languages with terms that are held in common by

15 Importantly, to prevent confusion, note that mathematics is used to be descriptive*;* mathematics itself is not descriptive. Confusing this would be an example of Quinean use/mention error.

16 Meinongianism and rational deep structure of the mind are two other options that which have been proposed at some point in time. I consider them, isolated to the current domain, either close enough to Platonism, or not intuitive enough for the non-professional to be perceived to be an account of natural language.

> all of us. Ordinarily, people recognize that some people have superior knowledge of (parts of) the language, and are therefore willing to defer the true knowledge of words to experts. Nevertheless, in principle it is possible for everyone to know the meaning of all the words in the common language.

Platonism, however, is an option that is, due to its sophistication, only open to philosophers; not to the non-professional speaker-hearer. Therefore, public language is the only real option for the non-professional.

With this last piece of knowledge, we can give a fair description of language-perception. Namely, natural language is a public language. It has words with monadic meaning-properties, and they determine what sentences mean. Of course, we can use implicature to state all kinds of things over and above *what is said*, but in general a good speaker means what she says by *what is said*. When a problem arises in language-use, the non-professional speaker-hearer defers her responsibility to experts, who, in turn, store their expertise in a common store of knowledge.

Natural Language in Actuality

How natural language actually is, was partially characterized in section 2 and case study 2, by for instance Chomsky's depiction of the troubles of referring to London, and by the troubles of the meaning of 'house'. They showed what an inferential mess even simple terms are, and that therefore we might need to give up on necessary and sufficient conditions. What is also importantly related to this, is that even our basic terms are not indexed with all possibilities of their instantiation in context. In philosophical jargon: we do not know all tokens by looking only at the type. This can be illustrated by symphonies (Azzouni, 2013a, 18):

> "It takes a bit of puzzling to figure out what the *tokens* of a symphony might be: The score? Live events with musicians? CDs? CDs being played on a stereo? All of these?"

CDs did not exist in the past, and, surely, people did not consider the exact technology for CDs in the past, seeing how that would have allowed them to make CDs in their respective time. The same reasoning applies to tokens in the future; we simply do not know how all things can be tokened. Nevertheless, we talk about symphonies just fine; just as if it remains having a fixed meaning, even when new tokens arise. This principle is also illustrated eloquently by the following expression, which I borrow from the United States Supreme Court Justice Potter Stuart in his 1964 case on the threshold of sexual obscenity: "I know it when I see it". That there is a definable threshold, Stuart has no doubt about, but he wisely, and perhaps unorthodoxly, defers his knowledge of the definition to empirics instead of reason.

This, in addition to other reasoning, entails that there is a practice of defeasibility of the definition of terms; they can be open to empirical results and thereby become open to reinterpretation. If gold would empirically be able to be blue, then it is not an analytic truth that gold is yellow. Terms thus have a certain flexibility, despite them not always being perceived that way; as was shown with 'house' and 'London'. This flexibility is also apparent in the practice of deference to experts. When pressed on definitions and applications of terms and expressions, the non-professional is happy to invoke epistemic ignorance.

This gives the following problem: where do these experts house their public information? Presumably by some statistically weighted average of opinions, or more objectively, in their publicly available work. The location of public information will not be further discussed here however.

Artificial Language Exemplified by Mathematics

Artificial languages are human inventions that have great ability to produce certain valuable proofs unattainable in natural language. The kind of properties they are allowed to have is arranged by stipulation, such as with the use of axioms. In other words: they are normatively constrained by necessary and sufficient conditions. These syntactic and semantic properties do not have to be immediately transparent, but can be investigated by those attending the artificial language. This is something that could be called discovering. Crucially, that does not mean that artificial languages themselves are discovered, much like how fictional characters are not discovered but created instead. However, artificial languages, in contrast to fictional characters, do in fact have fully constrained implications. The thriving of the professional fields concerning artificial languages, is related to finding all these internal implications, and also the external applications. Contrarily, psychological factors, such as how mathematicians go about proving theorems, and what kind of mental faculties they use, hardly get any attention from academics; and so it is for social factors.

These social factors do play a role however. If only for the fact that it is not necessarily straightforward that mathematics is, with respect to other scientific fields: comparatively successful, in almost universal agreement on the majority of topics, retroactively corrective of its mistakes, and stable over time. Some explanatory options for these phenomena are the following (listing mine):

1) Smart people, as a group, heavily self-select into the mathematic profession
2) There are abstract objects, and by becoming finely attuned to them, we rationally intuit the correct answer from these objects
3) There is something about mathematics and mathematical practice that drives towards unity and stability

Option (1) I will dismiss based on common sense, and also on some empirics (Hauser, 2002). Option (2) was already discussed in case study four on Platonic objects, and was found lacking. Instead, option (3) seems more promising to explore. What seems crucial in defending (3) is that we are able to explain how mathematicians do what they do without positing something like guidance from abstract objects or revert to skepticism[17].

Fortunately, Azzouni has sketched exactly such a view that explains mathematical practice (Azzouni, 2006). Essentially, what that evidence needs to show, is that there are more than sociological grounds for the stability of mathematics; this, due to sociological structures being highly defeasible and unstable over time in the majority of practices and sciences. One fact that hints at the existence of such a non-sociological relationship is that, unlike other sociological practices, mathematical errors are easy to spot; so, despite a common abundance of errors, mathematics remains stable. Similar stability is observable in the logical rules of mathematics over time [18]. The primary explanation for this overall stability is the open visibility of the constrained application for certain mathematics such as geometrics, and the open visibility of logical rules itself. Simply put: there is a well-defined process of formal derivation, and, supposedly, by following this process, everyone will be driven to the same correct answers. However, what is obvious to anyone actually looking at mathematical practice, is that mathematicians in fact hardly follow or use these derivations that logical rules demand of them in formal proof (Barwise, 1989). How mathematical practice can remain sociologically stable despite the widespread non-application of the inherent feature of mathematics which makes it so stable, derivation, needs further explanation. Azzouni

17 Kripkensteinian arguments are sure to point out skepticism toward any such mathematical rule following. However, as Azzouni points out, empirically this skepticism simply does not hold: we can find out when someone is a correct rule follower or not; and all this without coercion.

18 At least till the 20th century. After the 19th century, mathematical practice changed to more separate and additional forms of logic and proof forms. These are to be seen as more mathematics; not as replacing old mathematics.

(2004a) talks about this issue. In the paper, Azzouni talks about these "informal-rigorous proofs" and how they, for instance, rely on background knowledge and/or capabilities of the person reading the proof. Examples of this are (Azzouni 2004a, 95):

> "Emulating the proof of Theorem 2.9.1, we can easily prove ...', or '... [w]hat we did for A we can also do for B\ or '[w]e first do it for two groups—not that two is sacrosanct. However, with this experience behind us, we shall be able to handle the case of any finite number easily and with dispatch ...', or 'All these verifications have a certain sameness to them, so we pick one axiom ... and prove it holds ...', or '... repeat the argument on this relation with 7T2. After n steps, the left side becomes 1, ...'. (Herstein [1975], pp. 72, 105, 104, 134, 148, respectively)".

More globally put: what the mathematician appears to do, is indicating how a derivation can be obtained. Hence the paper's title: "*derivation-indicator view of mathematical practice"*. Remaining is then the issue of how these indications of informal-rigorous proof keep their connection to the constraining and stable feature of formal derivation. Pressing is the concern of Rav (1999), who provides examples of developed higher-order logic systems that remain unaxiomatized: matrix theory, graph theory and combinatorics, probability theory, number theory, and group theory. The argument extends to the fact that these mathematical fields are highly applicable and fruitful. To avoid the conclusion that derivation is unnecessary, which demotes mathematical practice once more to sociological agreement, a postulate needs to be made. Azzouni provides one. He claims that these informal-rigorous proofs use (mentally created) algorithms that codify how a derivation can be obtained [19]. This codification and its (tacit) recognition by practitioners is what makes mathematical practice such a stable empirical phenomenon.

Note the analogy between such ordinary mathematical practice and semantic minimalism. They are parallel positions that would either be both true or both false if natural and artificial language are similar in kind. Comparative to mathematics, the *derivation-view* in linguistic/semantic nomenclature is: the meaning of expressions is derivable by deep structures of grammar and syntax that are encoded in them and the terms; even when we are not yet able to derive this structure completely, or do so in practice. However, the crucial split here, once more, is that artificial and natural languages are categorically different. Meaning in ordinary mathematical practice can be derived in principle, via concepts that are consistently defined by necessary and sufficient conditions. This is not so for natural languages. Therefore, a *derivation-view* in natural language needs much more work to become acceptable, if it is possible at all.

Normatively Crossing Barriers of Natural and Artificial language

Before an attempt is made to cross barriers between categorically different languages, the problem needs to be put more clearly. The paradoxes of natural language aide to accomplish that purpose. Consider the following two examples of what are called liar paradoxes:

(1) this sentence is false

(2a) 2b is true
(2b) 2a is false

These sentences can only be true when they are simultaneously false, and vice versa. This problem has been omnipresent from the ancient Greeks till current age. Purported solutions that have gained some acceptance have appeared only recently. Perhaps the most sought after solution is related to the differences between metalanguages and natural languages. Essentially, metalanguages are

19 Almost needless to say, this is ultimately an empirical issue.

artificial, consistent, and are able to comment on their topical language; a language for commenting on language as it were. These purported solutions claim that these liar-paradox sentences do not express genuine propositions, and that the hierarchical view of a metalanguage is needed to evaluate notions such as truth. However, in reality it is just the reverse! In natural language we in fact do take these liar paradoxes to contain propositions; no wonder these paradoxes have proven so stubborn.

The liar's paradox is part of a class of self-referential sentences. Azzouni concludes *triviality*[20] of natural language based on these self-referential sentences. His conclusion follows from the fact that, by using, a) two universally accepted basic inference rules of modus ponens and substitution of equivalence, and, b) a sentence with a self-referential element, we can prove that any sentence is both true and false (Azzouni, 2013) [21]. Take the following self-referential sentence:

(3) if (3) is true, then all purple things are happy

From this, we can surprisingly conclude that all purple things are happy. Such a proof entails that every sentence in the natural language is trivial unless it manages to focus on an inference by way of an idiom in the language. Fortunately, the non-professional speaker-hear always does, as the common unwillingness, and ability, for lengthy and tedious logical inferences of similar proofs to Azzouni's should indicate.

One might wonder whether this proof leads to the severe conclusion that natural language is inconsistent. The reasoning supporting the claim is that, when truth-value is expected, as in the case in these self-referential sentences, none can be properly given. This, despite the sentences being grammatical and sufficiently semantic. Moreover, the tools for consistency in our language are based on these very basic inference-rules. Their breakdown into contradiction almost forces us to conclude that natural language is inconsistent.

A lesson for languages attempting to be consistent, is that they cannot merely focus on local idioms to draw inference relationships; global focus is necessary. If we focus on the basic idioms of reasoning and the idioms of truth, which look perfectly fine when viewed in isolation, then we have the global problem of inconsistency due to the synergistic implication relationships. The same principle is illustrated by Harris (1982), who shows how intuitionist logic[22] cannot coexist with classical logic in the same language. Intuitionist and classical logic can exist separately just fine; only when they combine into a mutual language does intuitionist logic collapse, and gains all unwanted abilities of the more expressive classical logic.

This same principle can be advanced against those thinking natural language can encompass metalanguage. Namely, a language can hardly be more expressive than one that can express the truth and falsity of everything. Therefore, if a metalanguage were part of the same language as natural language, then all the rules of the metalanguage would simply collapse; the metalanguage is

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20 I think Azzouni mistakenly uses the term triviality in isolation, instead of stressing that he is arguing for logical triviality only. Azzouni even talks in some of his works of the *external discourse demand*, a demand that terms should not be hijacked, but used holistically if possible. This should also be done then with trivial to prevent confusion. In any case, henceforth: logical triviality.

21 Azzouni (2013) is one of multiple ways to prove it. See the paper for the relatively simple proof.

22 Intuitionist logic rebels against the inferences in mathematics and classical logic of the kind $\neg \neg A \rightarrow A$ (if not not A then A) or equivalently, $A \vee \neg A$ (A or not A). Classical logic is bivalent, whereas intuitionist logic refutes the Law of Excluded Middle.

allowed to infer all that natural language can infer, which is the undesirable inference of the truth and falsehood of every sentence. Natural language and metalanguage thus need to be categorically separate.

Hofweber (2009) claims that if English is inconsistent, as just argued for, then it traps one in that language. Effectively, Hofweber denies a bridge between inconsistent and consistent languages, on the basis that there is no logical reason for getting out of an inconsistent language. Purportedly, there is no rational procedure for doing so; the inconsistent and trivial language does not contain one. Azzouni, very sensibly, repudiates this claim. He asserts that we reason about our language from outside all the time without even realizing it. To support this assertion, he stipulates we use a metalanguage of English, which he calls *regimented English.* This consistent (artificial) regimented version allows us to reason and comment on the inconsistencies of *unregimented* English. In other words, the metalanguage is supposed to function as a "...collective and normative (systematic) rewriting of the semantics of unregimented English sentences" Azzouni (2013, 3181). These normative rules can then aide the escape of unwanted empirical results in our natural language. Azzouni, for instance, suggests ignoring cases like the liar's paradox with the mundane attitude of "don't care". Rational in this case, is not following the logical rules wherever they lead, which is logical triviality, but is the decision to normatively overrule them whenever they show up. This measure prevents our reasoning in natural language from becoming entirely logically trivial [23]. The reasoning behind this flippant normative assertion is that (most) mistakes in natural language are *local* and *isolated.* Illustrative is the social norm of shunning cases like the liar's paradox: nobody actually draws inferences on such deviant cases.

The possibilities for crossing the borders between natural language and metalanguage are shown in Azzouni (2007a). The basic trail of thought is that, if we get clear about the logics of the languages being different, and that if we give up on necessary and sufficient conditions, then we get a metalanguage which can describe the semantics of natural language, without the metalanguage needing to have more expressive power than the natural language.

The bridge structure between natural and metalanguage is only adjusted for primitive sentences that arise in the metalanguage. Primitive, as used here, are all basic expressions that do not contain logical idioms (e.g. axioms), and thus those that make natural language inconsistent. The tools needed for this endeavor are the following:

- primitive sentences (S)
- Tarski-biconditional as truth predicate for inconsistent natural language (S or not S)
- Truth predicate T* in metalanguage for truths about natural language

With these tools we can make move (1) in the metalanguage, but we cannot make (2) [24]:

(1) $S \rightarrow T^*S$ (if S is a fact then S is true)
(2) $S \leftrightarrow T^*S$ (S is a fact if and only if S is true)

The first move is straightforward enough; if we have a sun in our solar system, we also say it is true.
The denial of the second move in the metalanguage states that just because something is true, it does not imply that something is also the case. So, just because 'I am the pope' is true, due to the

23 How rational should be characterized beyond following logical principles, Azzouni happily leaves aside for now.

24 The → sign signifies the logical form of "if-then", and the ↔ sign signifies the logical form of "if and only if". The same results for (1) and (2) apply for the negation of S and truth predicates of falsity F*.

properties of natural language, that does not imply that it is actually the case that I am the pope. In the metalanguage we simply do not allow such an inference. So, regarding truth-conditions of primitive sentences in the metalanguage, we have given up on necessary and sufficient conditions. Instead, we apply *sufficient* conditions; only logical idioms are allowed to keep using necessary and sufficient conditions.

The difference between (1) and (2) is a nice visualization of how metalanguages normatively constrain the natural languages. Natural language, mind you, is still inconsistent due to its ability for self-reference; we simply decide to exclude those areas which prove to cause trouble. This approach is admittedly very post hoc. It is, nevertheless, for good reasons: it is extremely hard to predict the effect of local parts and local change on the global outcome. This is especially the case for a highly rich and expressive language such as the natural language.

In order to make the entire crossing argument more clear, the analogy of natural language and metalanguage having a proxy relationship might serve well. It is more than an analogy really. In the prior arguments, natural language terms function as a proxy for the metalanguage; English functions as proxy for regimented English. In other words, an inconsistent language is used, and, by normatively idealizing it, we get an artificial and consistent metalanguage. This is not unlike what happens in many ordinary sciences. Namely, as already shown, mathematicians write proofs in the everyday vernacular of natural language; a language that is supposed to indicate, or proxy for, a proof.

Azzouni (2013a, 342) gives a characterization of such proxy relationships, in which a statement proxies for its proxy target:

> "A set of locutions D1 , . . . , Dn , . . . proxy for proxy-target locutions D1 * , . . . , Dn * , . . . if the implication relations and the representation properties (for example, what the terms in the statements are taken to hold of) of D1 , . . . , Dn , . . . are stipulated in public practice to be those and only those of D1 * , . . . , Dn * , ..."

If the last part of the sentence looks familiar, it is because "if and only if" and "those and only those" are similar in kind: namely, the ↔ sign. This means that necessary and sufficient conditions apply here, which should indicate the strictness required for a proper proxy relationship.

How well this proxy condition is practiced, is an empirical and descriptive question. The first reason suggesting an imperfect execution, is how difficult it is to ignore (or supplement) certain perceived meanings. Illustrative is the → sign. Translated into natural language, it is the *if-then* construction. However, contrarily to natural language, the → of logic is true if the antecedent is false, no matter what the succedent is. For example, the following proposition is true in logic: if you are Santa Claus, then you are the Pope. The proposition is true because the antecedent, you being Santa Claus, is false. This practice is not restricted to formal logic; the same principle is used in mathematics. I remember well the confusion in the lectures of classical logic and the subsequent reluctant acceptance from fellow students. I gathered it came from the uneasiness of calling such a proposition true. Do however note that, in contrast to the initial emotional perception, the practice of stipulating such cases to be true, and therefore being allowed to play a role in proofs, can be surprisingly lucrative, as is demonstrated by mathematics. The second reason suggesting current imperfect execution of the proxy condition, is the great misunderstanding over normative terms that have too much emotional association [25]. Telling people they should be rational, as happens in economics, is often met with a vehement response, if only for the fact that the non-professional

25 My guess is that this happens even among professionals; only to a lesser extent; but perhaps more importantly so.

perceives rationality as slightly cold and emotionless. More on this in section five.

Conclusion Section 4

Natural languages are perceived to have the same properties as standard mathematics and other artificial languages: they are public and are defined by necessary and sufficient conditions. This perception is incorrect; natural languages are idiolectical, inconsistent, and not so definable. The combined use of artificial and natural language must be done by idealizing natural language into a metalanguage; a language that is consistent. This is exactly what for instance mathematicians do, without them perceiving themselves as doing so. The metalanguages, however, still use natural language terms and expressions. These natural language expressions do not represent themselves in the metalanguage, but, rather, serve as proxy for an expression or term in the metalanguage.

5. Norms for Artificial Languages

The previous section showed that the combination of natural and artificial languages should be normatively constrained. Due to the lack of depth in detailing these constraints in section four, further elaboration seems of vital importance. This importance mainly comes from the apparent indispensability of both language-forms. Namely, natural language is used in even the most artificial language-driven professions. It is therefore reasonable to hypothesize that we are biologically unable to speak strictly in artificial languages. Not just because of the lack of evolutionary pressure and opportunity to do so, but also because natural language captures certain valuable qualities, such as flexibility, that are mostly unavailable in artificial languages. This likely implies that both artificial and natural languages are here to stay, in everyday talk as well as in science. And, if that is the case, then some norms and guidelines for how they work in combination, side-by-side, and on their own, is no superfluous luxury. Indeed, its importance and ubiquitous application in the sciences make it seem required.

Linguistic Influence (weak linguistic determinism)

To further promote the claim that norms and guidelines are required, I invoke *linguistic influence,* which closely relates to *phenomenological influence*. *Linguistic influence* states that the language and concepts we have, influences our ability to perceive and think about the world. This is often associated with *strong linguistic determinism*, and with the so-called Sapir-Whorf hypothesis or Whorf hypothesis. Curiously, it is an often-refuted hypothesis, without their supposed authors ever having claimed anything of the sort (Scholz et al. 2016). Strong linguistic determinism states that we are trapped as it were by our language, and that we cannot think beyond it. In this theory, 'determined' is actually clearly appropriate. However, such a rigid determination can be refuted. For instance, Thierry et al. (2009) shows that people are faster at differentiating between colors when they have a term for it. Crucially, this does not mean that those that do not have a term for the color cannot differentiate. They can. However, what studies like these do show, is that there is in fact an influence. Therefore, I will use *linguistic influence* as an extra reason for linguistic norms [26]. Namely, it suggests that, we must be careful with what we name, how we name it, and what we think we can do with what we name.

Maxims of Artificial Language

To reiterate, the reasons for normative maxims are, among others, a) that our perception of natural language deviates from reality (section two), b) that we are affected by *phenomenological influence* (section three), c) that we perceive natural language to be the same as artificial language

26 For a more detailed account of whorfian discussion see Scholz et al. (2016). For an account of multiple Whorfian hypotheses and their refutation, see Pinker (2007, 124-151). And, for an attempted unification between linguistic determinism and linguistic influence, see Regier and Key (2009).

(section four), and d) that we are affected by *linguistic influence* (section five). All these factors combined can lead to errors in language-use. Therefore, it is vital that the use of artificial language, and deliberate coining of terms, is guided by some proficient guidelines that represent the interest of scientific progress and clear communication. For this section on maxims of artificial languages, I intend to include regimented English and all consistent metalanguages. So, incorporated here are all languages that are axiomatized, attempting to be consistent, allowing logical inference in principle, and allowing for implication-relationships. Coined (technical) terms that are not axiomatically defined are regarded here as terms serving as proxy for a target in a regimented language (metalanguage). Below will follow first, a set of principles on which these maxims will be based, and second, a couple of roughly defined maxims with explanation for each. Even though the maxims are incomplete and in progress, they give a direction for where such normative guidelines should be headed.

Principles & Maxims

- ***Goal of Communication***: communicating in science is primarily for the purpose of directly transferring information and ideas as clear and precise as fruitfully possible, and practitioners mostly have the intention of doing so

- ***Cognitive Limitation***: since we are human and have limited cognitive abilities, it is no luxury to have clarity of language-use, in what are already cognitively demanding sciences

- ***Visibility of Errors***: the sociological aspect of science thrives when errors are visible and therefore more easily correctable

Maxim 1: A *term in the artificial language should not trigger contrary idiomatic meaning or substantial distance in meaning in the natural language*

Failure to apply this maxim can lead to the breakdown of all principles. 'Rationality' in economics is such an example. There are at least two issues with the term. The first is that basic economics states that people should be rational because it is best for them. However, the term is a misnomer if all that the basic economics wants to say is that a person should be consistent and unexploitable. 'Rationality' is a term people balk over and attribute all kinds of meanings to which are far from the intended proxy target, such as being cold and calculative instead of kind and caring. The second problem, and perhaps the more pressing problem, is that an unconstrained appeal in economics on rationality can lead to monstrosities such as the Rational Addiction Theory (Becker & Murphy, 1988). Needless to say, the non-professional has no appetite for calling drug addicts rational. The reason Becker and Murphy do so in this particular case, is because of their unrealistic assumptions. They assume that people are *maximizers* with unlimited computing power. In other words, people can instantly calculate all possible ranges of probabilities of future states of the world, and therefrom infer the best (statistically) possible decision for there particular preferences. If that decision turns out to be drug addiction, then so be it. Some economists object, and argue that people are *satisficers* instead; people make rational decisions based on their limited knowledge and computing ability. The problem with even this weaker version is, of course, that we think that drug addicts are not satisficing anything, but are unfortunately, and irrationally, addicted to a substance that at times even the addicts would rather be rid of. What has thus happened with the Rational Addiction Theory, is that the specific artificial language has deemed addiction to be rational, but that the transfer to natural language (or rather regimented language) does not work the same way due to the unwanted implications [27].

27 This is very close to the verdict in logic: the argument is valid, but not sound (i.e. the argument is valid, but not applicable due to the premises being false).

'Significance' is another example. In statistical papers it refers to the p-value; in natural language it means something along the lines of 'sufficiently great or important to be worthy of attention'. So, while it is something worthy of attention in natural language, a statistically significant result has to imply nothing of the sort, as any statistician will know. The issue can be easily observed with students learning to use significance in statistics; it is perceived as a confusing mess when actual implications need to be drawn, and if it is not so perceived, that probably entails that the students have merrily, and unjustifiably, taken the natural language idiom as guidance.

Maxim 2: *Artificial terms should signal that they are technical terms*

Terms should signal their technicality, and do so without superfluous cognitive load. One way a technical term can fail to signal, is when the reader can blithely read a paper while thinking a natural language term is used. Thereby, the reader can become ignorant of the nuances, and, even worse, unknowingly ignorant.

In order for a term to signal its technicality, several methods can be used. The first is social-convention rules. It is commonly understood for instance that when a term is more sharply defined in the text that it is likely that the writer wants to establish the technicality. This, however, is not enough. Preferably there is empirical research for how and when terms signal their technicality and/or importance. I think a good example of such a practice is executed in Semantic Perception, where "*what is said"* is written in italics for every appearance.

Maxim 3: *Artificial terms should only be used or coined when a natural language variant cannot give the appropriate impression*

As long as the technicality of a *regimented English* term is signaled, an intuitive term in the natural language serves a much better purpose than forced artificial terms. To illustrate the point, consider the *bad example* of using 'prosopagnosia' instead of 'face blindness' in psychology. For contingent reasons, a Greek term is used instead of an English one in the English literature. This could be classified as a (mock) technical term that unnecessarily complicates the learning process; 'face blindness' signals very intuitively that it means being blind to faces, whereas "prosopagnosia" does not.

Next, consider the *mediocre example* of 'aphasia': "an inability to comprehend and formulate language because of to damage to specific brain regions". The term aphasia has intuitive meaning in its Greek etymological origin of 'speechlessness' or 'without speech'. However, the difference with the bad example is that 'speechlessness' does not indicate anything about brain damage; someone can be without speech while not having brain damage at all. Moreover, the concept cannot be easily named with current natural language terms. This excuses the use of the (mock) artificial term "aphasia".

Now, let's look at a *good example* of the term 'DNA', which stands for the physical basis for the transmission of genetic information (and more). There is simply no easy natural language term available that can take its place. Attempts such as 'physical life information' are long, give inflexibility in its use, and fail to cover the term fully.

Finally, consider the *excellent example* of the term "implicature". It is used by Griceans for implying something that is different from the meaning of the words. Similarly, *what is implicated* is used by Azzouni. The reason for the term "implicature" being slightly quirky, is that, in natural language, "implying" has the idiomatic meaning of a) *what is implicated,* and b) that of implication via inference, such as 'one plus one implies two'. Rules of inference via communicative intentions

and norms are crucial for the Griceans. Therefore, it is important that the two are not confused. Not only does the term "implicature" prevent this confusion: it is also able to remain intuitive.

Maxim 4: *A specific artificial term should not be coined for a term with the same letters that is already widely in use and has different meaning*

This maxim serves the purpose of preventing hijacking of terms. It is essentially equivalent to the external discourse demand: any particular field should not heavily adjust terms used in other discourses if external discourse and holism of science are of any importance. Rather, either all external discourse should be convinced using the term in the newly presented way, or a different term should be coined to express the difference in meaning. The term 'truth' is a prime example of a word that is a favorite to hijack. Think only of those who are fed up with the difficulties of the term 'truth', and therefore decide to call all subjective thinking true.

Maxim 5*: The meaning of the artificial language terms should correspond to the emotional impression of the term when seen or heard*

If a term stands for something awful, but makes you think of honey and sunshine when you see or hear it, then that entails that there is something wrong with the appearance of the term. The primary reason for this is the principle of cognitive limitation. This maxim needs to draw greatly from empirics that suggest what shape of terms trigger what kind of emotion (if that is empirically possible), and also empirics that suggest what kind of phonetic form triggers what kind of emotion.

Maxim 6: *Artificial language terms should be adjusted and coined based on pragmatic "cash value"*

This maxim is for the sake of making the maxims more globally consistent. If there is any doubt about what the maxims suggest, this maxim should be kept in mind as ultimately guiding the outcome. Take for instance the *if-then* of classical logic. It might be unintuitive, but changing it without there being any fruitful alternatives defeats the purpose of the maxims. These issues need to be weighed for every term individually; beforehand, and sometimes even post hoc. This weighing process might be aided by modifying normative structures that are already in use, such as the general theoretical virtues.

Conclusion and Comments Section 5

These maxims for artificial languages, it should be noted, are given despite science generally being written in what is perceived and what is (unknowingly) attempted to be *regimented English*. The natural language terms are thus already of an artificial kind; the metalanguage of *regimented English.* This should be quite intuitive, as scientists perceive themselves as communicating in a consistent language that is able to be used precisely if only enough effort is put into it.

The problem, however, lies with the quality of the artificial languages, and its proxy relationships; natural language terms proxying for the metalanguage of *regimented English.* It is sub-optimally executed at best, judging from the few examples given here, and severely lacking at worst. This, in combination with the ubiquitous presence of the interaction between the language-forms, is the primary reason for these normative guidelines.

Overall Conclusion

The new phenomenological account of natural language by Azzouni provides an important insight: natural language drastically differs from artificial language. Furthermore, we do not

perceive this to be so. This insight inspired the creation of the normative principles and maxims for artificial languages of section five. However, what is not addressed in this paper, is a thorough investigation into the current misuse of artificial terms, and the effects this has on scientific progress. Such an investigation could potentially improve the calibration of the maxims, as well as validate further attention towards the issue.

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Appendix

A.1 Structure of the interplay between experience, intuitions and theories

We have experience (X), therefore we are inclined to have theory (Y). Intuitions (I) play a role in the inclination. The influence of these factors on theories come in three easily identifiable ways:

1) Theory (Y) comes *directly* from our experience (X). Intuition (I) plays a part, but is almost equal to theory (Y) and experience (X) and plays no further causal role.
2) Theory (Y) comes *indirectly*, with our intuition (I) *moderating* the experience (X) to get to theory (Y)
3) Theory (Y) comes *indirectly*, with our intuition (I) *mediating* the experience (X) to get to theory (Y)

An example of (1)'s direct influence of (X) on (Y) is the theory of weight. We experience and perceive weight. Intuitions are mixed in to be sure, but the theory presents itself quite naturally: physical object have the property of weight.

An example of (2)'s indirect influence of (X) on (Y) is the theory of bivalence for terms: a term either applies or it does not. The primary phenomenological source is that we experience and perceive (X) our words to have monadic meaning-properties. In addition, we are attached to the intuition (I) of Law of Excluded Middle. Combine the two in austere fashion and the theory of bivalence (Y) comes out.

An example of (3)'s indirect influence of (X) on (Y) is Public Language. We experience (X) our words to have monadic meaning properties. When we start thinking about how are words and corresponding concepts are used by speaker-hearers, we get the intuition (I) that for our concepts to mean what they mean they need to be housed in a place which is commonly accessible. This brings us to theory (Y) of Public Language which houses these concepts in a common pool for people to grasp.