THE SYNTAX OF BIOCHEMICAL MENTATION

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Abstract
I argue that Homo sapiens and biochemical minds in general function analogously to a computer program. I do not try to advance toward an answer to the question of ‘strong AI’ nor the question of inorganic entities having qualitative experience, but I argue that a program is more than a mere model for human mentality; it is a less sophisticated recreation of it. Such a view may be called weak computationalism for it holds that computationalism’s analysis of how biochemical minds function is correct without necessitating the further claim that the biochemical mind’s capacities can, therefore, be recreated inorganically. Most importantly, I attempt to account for qualia in this scheme of mentality. I posit that conscious human experience can be called computational and that qualia are the fundamental, syntactic entities of that computational experience. That is, human experience is the constant effort to compute and react to qualitative states.

Introduction
Some have argued, notably John Searle, that the Turing Test is not sufficient proof of mentality. He claims it is not merely the appropriate function of the system (i.e., convincing conversational ability) that ascribes it mentality, but the further and elusive element: understanding. While Searle would agree that a program is a useful model for human mentality, he feels that there is an unbridgeable gap between the conscious life of our biochemical brains and what a program could be said to “experience” (if that term can even be applied). He disagrees with the computationalist notion of “strong AI,” which is the view that a sufficiently sophisticated program would experience consciousness.

It is not the intention of this paper to provide a final answer to these questions. If anything, the arguments posed herein may replace Searle’s definitive “no” with an optimistic “maybe.” I wish to argue for a weaker version of computationalism. Without affirming or denying an inorganic program’s potential for mentality, I posit that the biochemical mind is an organic instantiation of a program. I then attempt to account for qualia in this conception of mentality. Again, without addressing whether or not they are present in inorganic programs, I will attempt to show that they are functional entities within biochemical “mentation programs.”

Background
In a 1967 article, Hilary Putnam proposed an alternative to identity theories. Rather than identifying mental states merely with brain states, which he feels do little explanatory work, Putnam maintained that they are “another kind of state entirely... [They are] a functional state of a whole organism.” Putnam’s work firmly integrated functionalism into philosophy of mind and progressed the discussion of “strong AI.” This movement was likely to have prompted Searle’s famous analysis of minds and machines. Searle’s conclusion, which denies that function is a means of defining the mental, depends heavily on “intentionality” as an attribute of mental states.

The word “intentionality” is derived from Latin and its roots convey the idea of “directedness.” In philosophy of mind, “intentionality” is used in this sense. It conveys the notion that mental events are

directed at something or are about something. If I desire a glass of water from the table, if I believe my friend’s hat is stylish, or if I detest the company of my boss, the mental events I am experiencing are about something in the world: the glass of water, the hat, my boss. In all cases, these sorts of states bear “intentionality.”

Searle argued that it is through intentionality that humans achieve understanding and, in his famous “Chinese room” analogy, he attempts to illustrate how programs fall short of it. To understand this argument, it is important to note the role intentionality is presumed to play in language and, in turn, the role of language in our notion of “understanding.” The symbols we use to represent objects, concepts, ideas, etc., are arbitrary. The symbol *cat*, for example, whether spoken, written, signed, or otherwise communicated, has no real relation to any member of the family *Felidae* (nor does *Felidae*, for that matter), but we are able to mentally direct these arbitrary symbols toward their real world referents. So, upon recognizing the symbol *cat*, you can recognize that it refers to your friend’s house pet. Programs however, cannot achieve this directedness. A program merely analyzes the syntax, that is, the structure or shape of the symbol, and responds to it according to a specified set of rules. For instance, it searches its index for an appropriate symbolic association, such as *cute* or *obnoxious*, or behavioral response, such as “petting motion” or “shooing motion.” Hence, programs are not host to intentionality, but may appear to be if the rule set they operate under is complex enough to mimic human responses.

This is Searle’s analysis of the situation. It is intentionality that allows the biochemical mind to achieve semantics, attaching meaning to symbols, while the program remains in the realm of syntax, computing associations between shapes (like Searle in his “Chinese room”).

**The Problem of Intentionality**

I do not believe that the notion of intentionality is sufficient to promote biochemical mentation beyond syntactic computation. This claim can be clarified by an attempt to determine whether there is a categorical difference or a difference of degree between these seemingly distinct notions: (1) being aware of a symbol as representing something in the “real world,” above or beyond the symbol, which we call semantics, and (2) computing a symbol as a mere shape (or meaningless entity) via a set of relations to other formal symbols (or shapes), which is syntactic.

Searle’s analogy assumes the biochemical mind has a categorically superior means of operation (that of semantics) and proceeds to analyze why a program could never achieve it. I wish to challenge his assumption. I posit that what we call semantics is not categorically different from syntactic computation, but refers only to degree of sophistication. The system Searle describes in the “Chinese room” is an accurate description of a program, hence its (disputed) success in challenging computationalism. However, when analyzed thoroughly, it is also an accurate, though highly simplified, description of the biochemical mind.

Let us seek out precisely where the claim to the categorical superiority of biochemical mentation breaks down. Imagine I am in a room with a sophisticated conversational/behavioral program and there is an eggplant in our proximity. If we (or “it and I,” if you prefer) are both presented with the formal input symbol *eggplant*, it would seem that my understanding of this symbol is superior. I am aware not only of an array of other formal symbols which relate to my input (such as *edible*, *tasty*, etc.), but also that what the symbol represents is physically present in the room. How do I achieve this awareness? The light refracting from the eggplant is interpreted by my eyes; the taste of it could be interpreted by my tongue; if it is cooked, I am likely to smell it. In short, my senses give me a window to the “real world” that is

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3 In the “Chinese room” analogy, Searle asks us to imagine a man (Searle himself) in a room. He has no contact with the outside world aside from a slot through which sheets of paper may be passed. Through the slot, he receives messages in Chinese which he does not understand. He has a rulebook which explains how to compose an appropriate response. In Chinese symbols, to the input messages. The rulebook does not explain the meaning of any symbol. To the outside world, it seems as though the man in the room understands Chinese, but he does not. Analogously, a program may seem to understand human language because its outputs are convincing, but it does not. John Searle “Minds, Brains, and Programs,” *The Behavioral and Brain Sciences* III, 3 (September 1980), reprinted in *The Nature of Mind*, ed. David M. Rosenthal (New York: Oxford University Press, 1991), 509-19.
lacking in the program, which is only “aware” of an ‘e’ shape, followed by a ‘g’ shape, etc., and its index of related symbols.

But we can conceive of analogous sensory apparatus for the program. As optical technology advances, we draw closer to a lens that can interpret the light reflecting from the eggplant as effectively as the human eye. The light could then be translated into symbols which the program can utilize. Similarly, a chemical sensor could mimic taste, a microphone, hearing, and so on. Our window to the world is not necessarily unique – it is simply the most sophisticated one of which we are presently aware. While we are far from paralleling the sophistication of biochemical mentation artificially, it is becoming clear that the rudiments of its operation are present in the operation of a program.

Consider what is happening when I interpret the light refracting from the eggplant: I recognize, among other things, its shape and color. We can often recognize familiar objects by their silhouette alone. In this and other ways, I am recognizing the patty as a symbol in my reality: as a bit of syntax. Biochemical consciousness, then, may be the sophisticated interpretation of syntax or, stated another way, a high-functioning program instantiated by organic material. The idea of our perceptions being syntactic is more difficult to illustrate for the non-visual senses because of the way in which we experience them. These difficulties will be addressed through the discussion of qualia.

Qualia

If biochemical minds do function analogously to a program, there must be a fundamental language through which they compute, one that enables the interpretation of inputs and the configuration of outputs. This language, like an artificial program’s, would be syntactic in the sense that its symbols would not produce intentionality in the computing mechanism (or mechanisms, depending on how we view perception), they would not “be directed” at anything above or beyond themselves. Rather, the symbols would have a fixed function within the biochemical program and computing would rely only on their formal/structural interrelation, on a set of rules.

I propose that qualia compose this fundamental language. They are the syntactic constituents of the human “mentation program” and of biochemical minds in general. This offers an explanation of the tendency to view human consciousness as categorically superior to the functions of inorganic programs. What appears to constitute intentionality – the categorical difference between our awareness and a program’s “awareness” – is really a matter of our broader access to syntactic cues in the form of qualia and more sophisticated computation of that syntax.

The Syntactic Function of Qualia

If we can overcome our hesitancy to call qualia syntactic, we will find that a functional analysis from a weak computationalist perspective is promising. Qualia would be treated as the fundamental forms that constitute our mentation program’s language (I switch to the term “forms” rather than maintain the use of “shapes” because the language of biochemical mentation cannot be limited to visual symbols). It is a language that no one can grasp in its entirety, but our lifetimes are a continuous effort toward recognizing and indexing the patterns which exist in it. It is difficult to argue this claim directly, but I hope to illustrate its possible validity by refuting some obvious objections. In short, they can be called incongruence, incomprehensibility, and insolubility (an inability to be isolated).

So, let us consider why qualia are not generally thought of as syntactic entities. One reason is the incongruence this idea evokes. It is easy enough to propose (not that it would be readily accepted) that visual experience is a series of highly-complex syntactic symbols being computed in real time. But how is the “scent after rainfall” syntax? How is the “feel of cold on skin” syntax? This is difficult to grasp because of our understanding of syntax. We understand syntax as arbitrary shapes which represent something meaningful. Only through the connection to something in the “real world,” through opposition to what we find meaningful, can we even recognize that something is syntax, that it is intended to be representational and not a squiggle for the sake of itself. This leaves us with a feeling of strong incongruence between our qualitative experience and syntactic entities. But nothing about the nature of syntax requires that it be represented in shapes or symbols.
It is difficult to see that coldness is syntactic, a meaningless “squiggle,” because since we have developed memory, it has always had immediate meaning for us (that is, it has always prompted an immediate functional response). An artificial program’s fundamental ‘perceptions’ are mere shapes, meaningless to us aside from the function they serve in the hardware housing the program, which we have determined in designing it. Our own perceptions, on the other hand, appear to us as meaningful and nondeterministic because we are not as clearly aware of our evolutionarily-implemented programming.

A second reason we are hesitant to call qualia syntax is that we cannot comprehend the entirety of the inputs we have the capacity to receive in the way that we can comprehend the entirety of the inputs an inorganic program has the capacity to receive (again, this is because we have engineered the program and knowingly its potential inputs). Therefore, it seems that our potential inputs generate a web of experiences and choices so vast that our behavior could never be explained in terms of a Turing “machine table.” It may well be true that we could not explain our own behavior in this way: to comprehend one’s own “machine table” in its entirety seems paradoxical.

The error, however, is taking this to mean that a human “machine table” cannot exist in the abstract. Like Descartes’ 1000-sided polygon, we can mentally grasp the concept, but we cannot grasp its physical realization, that is, we cannot fully visualize it. This means that we may well be operating like a highly-sophisticated program whose “machine table” is incomprehensible to any entity we are aware of. However, various fragments of the human “machine table” can be understood and the attempt to understand these fragments is what we refer to as commonsense psychology or, when formalized, behavioral science, biology, etc.

A third difficulty in characterizing qualia as syntax, which I have called insolubility, is that each quale is usually part of a more complex symbol. Although a quale could, theoretically, serve as a single symbol, we can never experience a quale in isolation, making it difficult to compare it to, say, the letter ‘a,’ which we can easily isolate and explain its relation to every other bit of syntax within its system. This is probably due to the fact that qualitative experience is not experienced until multiple qualitative states are combined in the brain.

Every time-slice we experience is composed of a myriad of symbolic constituents (circular-redness, roundness, taste-in-mouth, shoes-pressing-into-feet, etc.), because we are always experiencing a taste, touch, sound, etc. while awake and, though we may have no memory of them, during unconsciousness as well. These constituents give rise to a myriad of what could be called more complete or compound symbols (angry-person, broken-lighter, bus-stop). No one can itemize the entire syntactic language constructed by those evolutionary processes that have resulted in qualia, therefore, neither can they isolate its constituents. Since we can never compute individual bits of our computational language, it is difficult to know, introspectively, that computation is the nature of our mentation.

Because of these and perhaps other difficulties, we do not consider our reality to be composed of a network of syntactic qualia. But is this not a viable means of explaining our experience? We cannot fully delineate the network, but our effort to delineate and utilize a relevant portion of it is an apt description of the progression of human knowledge.

From the moment we are born, we are processing syntactic information in the form of qualia. Hence, I would call qualia our primary syntax. Certain frames of experience, or time-slices, are similar to ones we have experienced previously. When we become accustomed to a certain combination of qualia due to its common repetition, we produce arbitrary shapes or sounds and agree that these shapes or sounds will correlate with that set of qualia. Hence, I would call these shapes secondary syntax (I am not suggesting that linguists should adopt this terminology; it simply helps to illustrate my case). These shapes and sounds compose our many languages.

As we move between perception of primary syntax (qualia) and secondary syntax (our languages, signs, etc., which are also qualia), we achieve what has come to be known as intentionality. But we have never transcended our network of syntactic qualia. Primary and secondary syntax are parts of the same syntactic network which our biochemical minds constantly process. Linguistic symbols must also be

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4 I am indebted to Dr. Katrina Sifferd for providing background in neuroscience.
experienced qualitatively. The symbol “cat” is not about the cat in our lap, but is correlated with the cat by computation of the two syntactic bits of qualitative input involved. The symbol “cat” is both symbolic (because it is not a qualitative cat) and qualitative (because it must be experienced/computed by the same mechanisms). Conversely, the qualitative cat is also both symbolic (because it is a meaningless “shape/texture/sound-symbol” arising in our environment) and qualitative (because it is a qualitative cat).

Though it is purely speculative and not intended for anthropological scrutiny, it may be beneficial to consider the evolution of language in early humans or, perhaps, pre-human hominids. Consider, for example, the emergence of a vocal symbol for water. If we imagine how the symbol emerged, it seems more correct to call the process which yielded it one of association rather than intentionality. The vocalization that, for some group, came to “mean” water did not somehow point to water, but became associated with water through constant repetition amongst members of the group. The vocal symbol is no more or less a symbol than those symbols which compose the sight, sound, and feel of water. A strong associative bond is created between each of these qualitative states and members of the group are able to experience resurgent qualitative states drawn from direct experience with water upon hearing the vocal symbol, even when water is not in the vicinity.

Over time, this systematic association of secondarily syntactic symbols becomes more complex and yields the sophisticated and abstraction-capable languages we know today. But even complex abstract concepts, with no concrete physical referents, are understood through an associative process, a computational process.

**Conclusion**

*Homo sapiens* are a biochemical instantiation of a syntax-manipulating program. Hence, experience is synonymous with computation. We recognize and respond to a correlation between symbols in our environment according to a complex set of rules which developed evolutionarily. Intentionality is a term we use to identify our sophisticated level of syntax manipulation in an era in which artificial entities are beginning to mimic it at a rudimentary level.

**REFERENCES**
