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Computational Semiotics: Language, Logic and Flirting Systems

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Abstract: ***We're about to embark on a mind-bending journey into the wicked world of Computational Semiotics. It's like artificial intelligence's rebellious cousin, flipping the bird to mainstream approaches and finding solace in the arms of semiotics. Yeah, that obscure philosophy of mind stuff, but witha technical twist. Back in the 1970s, when disco ruled and bell-bottoms were hip, two mavericks named Dmitri Pospelov in Russia and Eugene Pendergraft in the U.S. dropped some mind-blowing works, linking semiotics to intelligent systems. But hey, no one paid attention. The world wasn't ready for their brilliance, or maybe it was just too damn unconventional. Fact I'm vaguely interested in Computer science and logic, I've written this paper just for some of the reasons including the fact that "Computational Semiotics" sounds too good and it makes some sense if you're intelligent enough. See ya.***

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1. Introduction

In everyday conversations, the meaning of what someone says goes beyond just the literal words they use. Let's take the sentence **"You're a beautiful woman"** as an example.On the surface, it's a straightforward compliment. However, to fully grasp the message, we need to consider other factors like the situation, what the speaker is emphasizing, and the implied meaning.

Context is essential in understanding the intended message. If a close friend says this to you in a social gathering, it's likely a genuine compliment on your appearance. But if a stranger says it out of the blue or in an inappropriate setting, it could be perceived differently, raising concerns about their intentions. The focus of the sentence also affects its meaning. By highlighting your beauty, the speaker may aim to express admiration, build a connection, or even show romantic interest.The specific emphasis on your appearance shapes the overall message and the relationship between you and the speaker.

Additionally, pragmatic inferences play a crucial role in uncovering the implied meaning. The words chosen and the context provide extra information beyond what's explicitly stated. These inferences can include social expectations, shared knowledge, and what the speaker intends to convey, giving thecompliment more depth and significance.

2. Foundational Theory of Meaning & Foundations

Grice's foundational theory of meaning states that the meaning of an utterance is determined by the speaker's intention to convey a specific message to the listener. According to Grice, when a speaker utters a sentence, denoted as **'u'**, they intend for the audience to believe a certain proposition **'m'**. This intention, referred to as the 'm-intention', is recognized by the audience, and their belief in **'m'** occurs based on thisrecognition.

Let's have a look at the four maxims proposed by the Grice buddy regarding cooperative communication,

1) **Maxim of Quantity:** Speakers should provide enough information to fulfill the listener's informational needs, without providing excessive or redundant information
2) **Maxim of Quality:** Speakers should be truthful and provide information that is supported by evidence or beliefs.
3) **Maxim of Relation:** Speakers should stay relevant to the ongoing conversation and provide information that is pertinent to the topic at hand.
4) **Maxim of Manner:** Speakers should communicate clearly, avoid ambiguity, and use appropriate language and style., when followed could add additional meaning to the actual content spoken.

If we consider the idea that meaning is derived from m-intent, we must examine its underlying foundations. It's important to distinguish m-intent from general intent, as the former specifically relates to the meaning conveyed by an expression, while the latter encompasses broader goals that guide decision-making. While Grice's theories on meaning are widely accepted, there is another theory suggesting that meaning arises from general intent, which can be connected to computational processes. It argues thatin order to understand and convey meaning, both parties must possess similar feelings and experiences, allowing them to construct similar goals and approaches to problem-solving. Sensly speaking, we can utilize more recent formalismsof AGI and enactive cognition. These formalisms provide well-defined concepts, such as "weakness," and allow us to formalize cognitive processes through tasks. Just by working out on these stuff, we could develop a framework that enables better communication between humans and the aliens, in case.

3. What does the semiotics do?

By Semiotics, Signs can be categorized into three types: iconic references, indexical representations, and symbolic representations. Indexes represent a sign's association with its cause or the effect of the subject. They provide information about a causal relationship between the signifier and the signified. Icons, on the other hand, represent unconscious similarities between the signifier and the signified. They rely on visual or perceptual resemblances. Symbols are learned representations that establish associations between the signifier and the signified, regardless of any similarity or causal relationship. Icons were considered the most fundamental, but recent insights suggest that indexes play a more foundational role. Indexes reveal useful information and cues to organisms, while icons capture visual or perceptual resemblances. Symbols, being more abstract, are built upon indexes and icons.

Intent is inherently tied to the task at hand. By considering the context, which encompasses both the agent and the environment, a task is formed to capture the relevant aspects. Enactive cognition, for example, can be formalized using tasks that define decision problems, moving away from the conventional notions of agents and environments. To formalize intent, it can be treated akin to a goal, consisting of a set of criteria that, when fulfilled, signify its completion. To ensure a flexible ground, meaning must be approached by representing the environment, including cognition, as a collection of declarative programs, with the universe acting as the interpreter. Now, let's see how we (humans) understand a thing, like thing things.

a) Environment

The environment is a collection of states, with one state designated as the present state. Declarative programs are functions that assign truth values (either "true" or "false") to states. An objective truth in this context refers to a declarative program that evaluates to "true" for a specific state. It allows us to capture meaningful statements about the states in the environment.

1) $V = \{V \subset P$: V is finite$\}$ is a set whose elements we call vocabularies, one of which we single out as the vocabulary v.
2) $L_v = \{l \subset v : \exists\ \varphi\ \Phi(\forall\ p \in l : p(\varphi) =$ true$)$ is a set whose elements we call statements. L_v follows Φ and v, and is called implementable language.
3) $l \in L_v$ is true if and only if the present state is φ and for all $p \in l$, $p(\varphi)$ = true.
4) The extension of a statement $a \in L_v$ is $Z_a = \{b \in L_v$: $a \subset b\}$.
5) The extension of a statement $A \subset L_v$ is $Z_A = \bigcup_{a \in A} Z_a$

b) Language representation

We assume a set Φ whose elements we call states, one of which we single out as the present state. A declarative program is a function f: $\Phi \rightarrow$ {true, false}, and we write P for the set of all declarative programs. By an objective truth about a state φ, we mean a declarative program f such that $f(\varphi)$= true

1) V is a set of vocabularies, where each vocabulary V isa finite collection of declarative programs from P.
2) L_v is a set of statements, where each statement l is a subset of the vocabulary v. It represents implementable language.
3) A statement l is considered true if the present state is φ and for all $p \in l$, $p(\varphi)$ = true.
4) The extension of a statement $a \in L_v$ is $Z_a = \{b \in L_v : a \subseteq b\}$.
5) The extension of a set of statements $A \subseteq L_v$ is $Z_A = \bigcup_{a \in A} Z_a$

c) r-task

For a chosen r, a task α is a triple $h S_\alpha, D_\alpha, M_\alpha i$, and Γ_v is the set of all tasks given r. Given an r-task α:

1) $S_\alpha \subset L_r$ is a set whose elements we call situations of α.
2) S_α has the extension ZS_α, whose elements we call decisions of α.
3) $D_\alpha = \{ z \in ZS_\alpha : z$ is correct$\}$ is the set of alldecisions which complete α.
4) $M_\alpha = \{l \in L_r : ZS_\alpha \cap Z_l = D_\alpha\}$ is the set of modelsof α.

d) Representation / Symbol

A task α can be considered as a Peircean symbol, where:

1) $s \in S_\alpha$ represents a sign within α.
2) $d \in D_\alpha$ denotes the effect of α on the perceiver, which can include sensorimotor activities associated with perception, serving as a referent.
3) $m \in M_\alpha$ represents an interpretant that establishes the connection between signs and referents.

Now, we could just split up the task into child and parent tasks. Such that, a symbol α is a child of ω if $S_\alpha \subset S_\omega$ and $D_\alpha \subset D_\omega$. This is written $\alpha \subset \omega$. We call $|D_\alpha|$ the weakness of a symbol α, and a parent is weaker than its children.

As we could split the child and parent tasks into sub-tasks, we could simply represent an organism with experiences, preferences and feelings,

An organism o is a quintuple $h v_o, e_o, s_o, n_o, fo_i$, and the set of all such quintuples is O where

1) v_o is a vocabulary specific to the organism.
2) We assume a v_o-task β, where S_β represents every situation in which organism o has made a decision, and D_β contains every such decision. Given the set Γ_{vO} of all tasks, $e_o = \{\omega \in \Gamma_{vO}: \omega \subset \beta\}$ is a set whose members we call experiences.
3) A symbol system $s_o = \{\alpha \in \Gamma_{vO}: \exists \omega \in e_o$ where $M_\alpha \cap M_\omega \neq \emptyset\}$is a set whose members we call symbols. s_o is the set of every task to which it is possible to generalizefrom an element of e_o.
4) n_o: $s_o \rightarrow N$ is a function we call preferences.
5) f_{oi}: $s_o \rightarrow f_o$ is a function, and $f_o \subset L_{v_o}$ is a set whose elements we call feelings, such as reward and qualia, from which preferences arise.

Symbols in the symbol system, s_o, have at least one shared interpretation in an organism's experiences. This allows the grounding of feelings, represented by f_o, to be rooted in those experiences. In humans, feelings, such as reward signals and qualia, play a crucial role in driving motivations and value judgments. While statements about what is cannot directly derive statements about what ought to be, feelings serve as the foundation from which all other value judgments can be derived. The impetus behind intent, which is intrinsic to meaning, is shaped by these feelings. We attribute the origins of feelings to natural selection and explain meaning as a mechanistic process. Each statement or symbol in the symbol system, s_o, represents sensorimotor activity that includes feelings. Therefore, f_o is a function that maps symbols to sensorimotor activity. For an organism, statements and symbols have meaning when feelings can be associated with them. Since every symbol in s_o has an interpretation rootedin the organism's experience, feelings can be ascribed to all symbols based on that experience. If qualia are not a concern, feelings can be simulated using "reward" functions. However, simulating feelings that result in human-like behavior posesa greater challenge. To simplify our analysis, we assume preferences, denoted as n_o, which are determined by the experience of feelings.

4. Meaning of Meaning

Let's put these ideas in simpler terms using our example. Imagine two symbols, α and ω. When we say $\alpha \approx \tilde{\approx}\omega$, it means that the feelings, experiences, and preferences linked to these symbols are kind of similar for different organisms. We can think of it like a measurement of how alike twosymbols are in terms of how they make us feel and what they mean to us. So, if two symbols have a similar impact on our subjective experience, we can say they're roughly equivalent.

k means $\alpha \in s_k$ by deciding *u* and affecting *o* if and only if *k* intends in deciding *u*:

1) That *o* interprets the situation at hand with $\omega \in s_o$ such that $\omega \approx \alpha$,
2) *o* recognizes this intention, for example, by predicting it according to $\gamma_k^0 \in \arg\max_{\alpha\in K} |Z_\alpha|$ such that $K = \arg max_{\alpha\in\gamma_k^0}$ no (α), $\Gamma\gamma_k^0 = \{\omega \in \Gamma_{\upsilon 0}: M_{\zeta_k^0} \cap M_\omega \neq \emptyset,$
3) And (1) occurs based on (2), because k intends to cooperate and will interpret the situation at hand using what it believes of o's intent.

To comprehend meaning, it is essential for organisms to engage in mutual influence and possess shared experiences and feelings. This is reflected in the presence of comparable symbols in their symbol systems. By aligning preferences and inferring intent based on these shared aspects, organisms can gain a deeper understanding of meaning. However, all of this assumes that organisms have reasonable capabilities and competence. In this interplay of influence, shared experiences, and aligned preferences, the essence of meaning unfolds.

5. Flirting with a Machine

LLMs, like those fancy language models, can spit out some pretty convincing text that might make you think they understand and feel like humans do. But let me tell you a secret—they don't actually experience emotions. Yup, they'remissing that whole internal state thing that gives rise to our feelings. See, us humans, we have this whole complex mix of biology, thoughts, and social stuff going on that creates our emotions. It's influenced by our unique backgrounds, beliefs, and even physical sensations. But LLMs? They're just really good at crunching numbers and spotting patterns in language. They don't have their own personal experiences or the ability to genuinely feel things like joy, sadness, or love. Sure, LLMscan generate text that seems emotionally charged, but it's all based on what they've learned from tons of examples in their training data. It's like they've become masters at mimicking emotions without actually experiencing them

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