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Strong Semantic Computing*

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Abstract

Standard computing will be characterized as a functional extension of syntax. Using BICA claim of continuity between human-animal-robot cognitive architectures, we will define strong semantics as the ability of a cognitive architectures to consult cognitive maps, in particular phenomenal content maps (Damasio, 2010}. This follows the work on semantic maps, yet the maps we postulate are based on phenomenal markers not syntax and predicative logic. We define extra strong semantic maps (and extra strong computing in general) as those that go beyond human capabilities. The goal of strong semantic computing in autonomous robotics should be to 'know what is going on' (Sanz, 2012) before engaging in detailed logical analysis. Such sort of *Gestalt* computing is needed in advanced autonomous robotics, especially robots functioning in human environments.

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1 Introduction: Between Syntax and Pragmatics

We understand what syntax means: symbol manipulation. We understand what pragmatics means (at least by my favorite definition): relation of symbols to the users, and this interactions with the external world. I never knew what semantics really meant though some of the best philosophers tried their best to elucidate this point. Semantics "deals with certain relations between expressions of a language and the objects (or 'states of affairs') referred to by those expressions" (Tarski 1944 p. 345). Standard philosophical discussion of the topic at (Davidson, Harman, 1972). In very general terms, semantics is supposed to be about meaning (e.g. of a sentence), but this is vague. If such 'meaning' comes from the user's interaction with the world – then semantics falls within pragmatics. If the 'meaning' comes from some form of advanced symbol manipulation (I can predict, with a good likelihood, what sense a given word plays based on its position in a sentence), then semantics falls within syntax. Semantic web research often uses complex syntactic formulae to tackle the vital issue in connotative semantics: how to interpret contextual and metaphorical meaning of words and language expressions. *Impressive work*, but it reduces semantics to syntax.

A competent user just knows in what sense a given ambiguous term is used in a given context – quite clearly with no need for connotative semantics. Is this 'direct grasp' a special place for semantics, or is it just a proficient use of syntax, or of pragmatics? Maybe it is some special admixture of both? Certain authors claim that to grasp semantic meaning we need an interpreter, one with *intentionality* (Searle 2002). But now instead of one opaque notion (semantics) we have two. If a robot introduces intentionality (directedness towards something) into the world, quite clearly such intentionality is pragmatic since it describes its relation with the world. In fact, a robot is a part of the world. Human

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intentionality is often viewed as different, but different how? Philosophers use awkward terms (e.g. Searle's *mentations*) to express such specificity. Within a neutral framework such as BICA, those attempts are ostensibly futile. If there is something special about semantics, we still need to know what it is.

Yet, the notion of semantics is non-empty. Syntactic approach, based on language, grammar and maybe logical structures based directly on it, relies on symbols. Pragmatic approach relies on interactions with the users and through them with the external world and relatively straightforward permutations of such interaction in one's memory. The level between the two, while often laden with vague anthropomorphic intuitions, seems to bring in a general image of the world. One may say that this is the sphere of intuitive grasp broader than any detailed (syntactic) description. The goal of this paper is to give this intuitive level, or a general image of the world, a naturalistic grasp. We look for a regulative definition, not a common language or lexicographic analysis.

Semantic networks are a good start. They form knowledge representations by reconstructing the relations of meaning among concepts. While syntax is about specific symbols and their formal relations, semantics is about higher level representations. The difference is like that between a sentence and a map. The notion of weak semantics (or, weak semantic maps) is a good segue to the main point of this paper although it is still formulated in the old logic-of-language paradigm or conceptual spaces (Gardenfors, 2004). "The notion of weak semantic maps was introduced recently as distribution of representations in abstract spaces that are not derived from human judgments, psychometrics, or any other a priori information about their semantics. Instead, they are defined entirely by binary semantic relations among representations, such as synonymy and antonymy. (…) those narrow weak semantic maps are not complete in this sense and can be augmented with other semantic relations." (Samsonovich, Ascoli 2013).

The weak semantic maps approach is a big step towards de-athropologization of semantics and bringing it to the realm of BICA. It lets us put forth a more general, and radical, view that leaves syntactic structures aside and links AI with modern cognitive psychology. The idea that we think primarily through the mind-maps (Damasio 2010) opens a potentially fruitful avenue for semantic computing.

2 Human-level Phenomenal Computing

The idea is to embed phenomenal markers and psycho-motoric functions, as multi-layer maps, directly in the AI grid.

2.1 The Sanz's challenge.

Knowing what is going on is what I call the Sanz challenge for AI. Riccardo Sanz (Sanz, 2012) claims that programming based on adding functionalities to functionalities, e.g. in building a self-driving car, meet its limits in complex unpredictable environments. While it works in delimited environments, it doesn't in complex real-life situations: Even an individual with IQ much below average understands how to comport oneself in a complex environment, in which a very smart robot makes massive mistakes. In order to avoid those mistakes an AI agent needs 'to know what's going on', which is more than adding functionalities over functionalities.

Weak semantics as defined above is unlikely to meet the challenge. Cognitive architectures need to 'see' the big picture before they start 'thinking' in terms of semantics and propositional logic.

2.2 Big pic computing

Try to have a close look at a realistic painting of river at sunset. It is not hard to grasp. Yet, try to describe it in language. It is easy to give a general description of the gist of the theme and composition