Semiotics and philosophy, related to semantics  
  
The discipline of semiotics is the study of signs, reality and meaning. The meaning of such a token ultimately relates to what it denotes in reality, whilst this relation cannot be deferred from the shape, structure or other characteristics of the token itself due to its total arbitrariness. In the early 1900s, De Saussure used a dyadic model that stressed that the token (the \*\*\*signifier\*\*\*) and the entity in reality (the \*\*\*signified\*\*\*) were as inseparable as the two sides of a piece of paper [@Saussure:1983ka]. This piece of paper he called the \*\*\*semiotic sign\*\*\*, denoting the whole. This ‘self-containment of the sign’ is one of the major principles of semiotics. Constructing the semiotic sign from its distinct parts is called \*\*\*semeiosis\*\*\*. The signifier, in combination with their ability for semeiosis, provides humans with the tool to converse with each other. The tokens provide humans with a vocabulary, the semeiosis makes them understand about what entities they talk about. Semantics, then, emerges as a result of the semeiosis that connects the distinct parts of the inseparable semiotic sign.

Sanders Peirce [in: @Sowa:2000di] developed another model to further investigate the semeiosis part of semantics. He built a triadic model of the semiotic sign, including signifier and signified, and the \*interpretant\* which expresses the mental and, hence, individual sense making. This part is also known as the \*thought\* component; we will refer to it as the \*\*\*conceptualisation\*\*\*. This triadic model of the semiotic sign was coined by Peirce as the \*semiotic triangle\* (ibid.), depicted in \cref{fig:semiotic-triangles}(a), and subsequently used and modified by Ogden and Richards [@Ogden1989], Ullman [@REFERNTIE], and others. We introduce our modifications, as depicted in \cref{fig:semiotic-triangles}(b).   
  
![The triadic model of the semiotic sign, according to Peirce (a), and modified by us (b).][def:semtriangle]  
  
Where Peirce denotes the “object”, we prefer the use of “entity” due to the ambiguous nature of the former in IT modelling and architectures. We consider an entity to stand for a thing or an event, but also a category of entities, a relation between entities and a property of an entity. And we prefer the use of token over representamen and consider it either an atomic element or a particular composition of atomic elements. We include directional denotations for the edges that are connected to the conceptualization vertex, and use names that underline the individual and mental nature of the sense making. Finally, we add the causal characteristics that the edges represent, as introduced by [@Ogden1989]. Whenever we use \*sign\* we refer to the semiotic sign.

The dualistic nature of the semiotic sign should be constantly kept in mind: on the one hand, it emphasises the distinction between the entity and the token, and on the other hand it insists on its self-containment. Moreover, no direct physical or mathematical relation exists between the entity and the (random) tokens that we use to refer to it that reality at the other hand (mental). Although an association exists between the two, it emerges as a mental one only. Hence, the dotted line in the semiotic triangle. Semeiosis is realised as being the subjectivation-concretisation, and abstraction-representation processes that connect the conceptualisation with the token and entity. Furthermore, according to Ogden and Richards [@Ogden1989], the edges of the triangle carry distinct characterisations: the subjectivation/representation edge is causal and expresses \*correctness\*, the abstraction/concretisation edge is causal as well but expresses \*adequacy\*, while the indirect association edge about signification expresses \*trueness\*.

OF: Here we introduce the semiotic triangle. This ST and its ribs have been defined by xx, xx, xx. En dan wat zij zoal zeiden (of niet) en je eigen product hieronder tonen.   
  
Apart from this strict semiotics notion, semantics are also influenced by philosophy and need consensus on the question “when are we committed to the existence of certain entities?”. It is relevant to acknowledge that humans maintain assumptions and background knowledge, both of which impact the semeiosis and, hence, semantics. This is where the conceptualisation plays an important role as frame of reference to our understanding, also denoted as the \*ontological commitment\*. Consider the following cases:  
   
\* Assume we utter that “the king of France is bald”. This sentence has got a useful meaning, being that in case of a king of France, the dear fellow is as bald as a coot. We did not say \*that\* a king of France exists, nor \*that\* bald men exist; we only used these two phrases to \*refer\* to things that might or might not exist. Hence, we do not need to commit to the existence of a king of France, nor to the existence of bald men, before we can formulate the sentence that \*if\* there is a king of France, he must be bald. Still, and despite being a meaningful sentence, “the king of France” does not refer to something (as France is a republic), and therefore we cannot render the truth of the sentence.

\* Assume we utter that “the species \*leo\* (lions) is extinct”. Despite the similarity with the linguistic structure of the previous sentence, in this case we do need to commit to the existence of the species leo. The reason for this is that we do not imply here something about one individual but about something that many individuals have in common, i.e., that which defines an entity as member of the leo species. Without accepting that “there is something” that we consider characteristic of the species of leo and leo alone, we defy the group as a whole, i.e., the universal type that each of them instantiates. And if we defy the existence of the universal type, we defy that “there is something”. But if we defy that “there is something”, it would be nonsense to even speak about any of its qualities, in this case extinction. Therefore, by defying the existence of the species, we defy the meaning of the sentence itself. We therefore are forced to commit to the existence of the species.  
  
The contrast exemplified by these examples shows that only when we commit to something (here “the species \*leo\*”), the theory that we propose (here “is extinct”) can \*refer\* to that in order to \*establish its validity\*; clearly, in our world the theory is invalid, i.e., renders `False`, given the many counter examples of lions being alive. We consider this the philosophical cornerstone for semantics: we can assess the semantic validity of any proposition if and only if the underlying ontological commitment can be referred to. Furthermore, any assessment towards semantic interoperability of two semantic theories cannot be made without an assessment of the similarity between their underlying ontological commitments. Note, however, that “We look to (…) Ontology not in order to know \*what there is\*, but in order to know what a given remark or doctrine, ours or someone else’s, \*says\* there is” [@Quine:1953er].     
  
There is one more aspect about semantics that we would like to highlight, necessary to further clarify the difference between semantics as experienced by humans, and semantics that apply for computers (elaborated on in \cref{bridgehead-semantics}): According to [@Grice:1991BT;@Schulz2007], two subtypes of meaning exist: first, \*semantic\* meaning, semantics as how the tokens are meant to be interpreted, explained by Grice as \*what is said\*. We consider this equivalent to our notion on semantics above. Additionally, Grice considers another subtype that he explains as the \*pragmatic\* meaning. We like to consider this second subtype as the meaning that emerges from the tokens in the specific \*context of use\*, the meaning that is required to draw conclusions. Considering a heart rate reading of 128BPM, for instance, the same bits will refer to very different health conditions in the context of elderly (triggering an alarm) than in the context of new-borns (indicating perfect health).   
  
  
  
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