Discovery : Sense – a fundamental structure of nature – is formally identified with mathematical formulas

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Abstract After twenty four centuries of research, sense – a fundamental structure from nature also called metaphysical sense – has been isolated and formally identified through writing. Sense's written representation can apparently be grasped, just like any object, between two defined sets of formulas with both identical and opposite specificities. One of these sets belongs to mathematics, the other to language. Sense has a clear function : it has a structuring effect to "make up" nature. This effect consists of giving a direction to what it constitutes. This direction can itself be found within nature, within the content of a formula or the very aspect of writing. Notions that are linked to Sense spontaneously united themselves in a formal and thoroughly coherent whole that doesn't allow any exception. Sense also leads to the identification of the natural cognitive function named logic and of another cognitive faculty bound to it and able to grasp it. It thus establishes the nature - language - cognitive ability link.
Keyword : formal language, foundations of mathematics, foundations of language, epistemology, cognitive linguistics.

1 - Introduction

"Sense" conveys the idea of an origin, a goal, a direction taken by reason within an environment also driven by a purpose. However, this natural notion, as intuitive as it may be, could not have been formally identified until now, even within the language where it can be found. It also remained evasive in mathematical formulas.

The discovery of (metaphysical) sense was awaited to determine with formal and objective certainty the origin and the natural purpose of each and every phenomenon and of more abstract notions.

Metaphysical sense is a prerequisite to answer the numerous metaphysical questions about the "sense of".

It was also expected that sense gave the possibility to anticipate what is going to happen in order to find one's bearing with absolute certainty.

Metaphysical sense was supposed to match the sense grasped by language : does this word or text holds any sense ? The same thing was true for mathematics – "the sense of a mathematical formula" being able to shed light on another more formal "sense" associated with a different nature or a different aspect of nature.

It was also expected that sense be linked to cognitive abilities, including the logic and reasoning grasping what has any sense.

The search for sense started with Aristotle in the Antiquity. This philosophical search is also carried out "inside" the common language able to grasp any sense. Sense was then studied through various philosophical streams. In the 17th century, the Port Royal logic opened the way to the analytic approach (through isolated sense units - the sense of words).

Then, the search for sense in writing followed two different approaches which could be summarized by the "sense in words" through linguistics and "the sense in mathematics" through logic.

- The first linguistic approach started in the 19th century with Saussure and the study of language itself as a system. The creation of "semantics", representing an abstract sense, stemmed from it (Bréal). However, semantics turned progressively closer to the idea of "meaning". Yet the search for the meaning of words is not the same as the search for the "metaphysical sense in words" – it grew away from it. Semantics are not formally defined and therefore cannot be applied to mathematical formulas.

- The other approach of the search for metaphysical sense, through logic, began with Aristotle and the search for logical sequences functioning even on themselves (syllogisms). In the early 20th century, Russel and Frege assume the existence of "formal semantics" which could be present in mathematical structures. This approach, whose goal was turn common language into mathematics in order to reveal these "semantics", knowingly ignored the visible aspect of the "sense of words" and was stopped short by a mathematical paradox (Gödel).

Nowadays, the search for sense appears mythical and that for written sense is anachronistic and are therefore abandoned. Nonetheless, studies continued to be indirectly carried out through the search for a definition of semantics and notions close to it.

The purpose of this article is to shed light on the very unexpected formal discovery of sense (or metaphysical sense) which is a fundamental natural element. Sense and meaning are two different things. This finding was incidental, based on a simple and unprecedented observation of formal specificities between sets of formulas. These specificities are at the same time formally and completely identical and opposite.

2 - Structure of the presentation

In a first part, two sets of formulas were compared according to an arrow applied on them indicating the reading direction.

The first set deals with the transcriptions of natural phenomena into common language. A transcription is a description perceived from the location of the phenomenon itself, with no kind of interpretation or any intervention. It is thus more accurate and objective than a description. The other set concerns the mathematical formulas applied to natural phenomena.

It is remarkable that these formulas are the ones grasping natural phenomena in the most objective way. The natural phenomenon mostly illustrated is the same for both formulas ; “the energy of solid in movement”.

Then, in a second part, in order to confirm the obtained “sense”, one checked if it had the same historically expected specificities. “Metaphysical sense” should be simple – it should provide order and be found in the common language (when the latter has a sense) and in mathematics. It should also be as formal as mathematics, highlight the link with logic in language and cognition, and present a natural orientation function.

3 - Observations

PART I - SENSE

3.1 The arrow on transcriptions

There is only one linguistic set on which a unidirectional and continued arrow can be thoroughly applied : that of the transcriptions of observable natural phenomena.

The transcription unit

> *The transcription unit is the word. “tree” refers to a particular tree in a forest, with an observable development. There is a before and an after, including changes (an evolution) – a seed becomes a shoot which then turns into a tree finally covered by snow ...*

before ⟼ after
... tree ...

About the elements of a transcription formula

> *Each element knows a before and an after, a change of state ; the mountain misses a rock, the rock changed position, the rolling begins and ends, the tree is standing and then crushed ;*

⟼ ⟼ ⟼ ⟼ ⟼ ⟼ ⟼ ⟼
From the mountain, the rock tumbled down and rolled over the tree

About the transcription formula

> *The rock “tumbling down” happened before it started “rolling” down the slope. The word “tumbled” should be placed earlier in the sentence. The arrow isn’t continuous :*

⊢———————— X ————————⟶
the rock rolled over the tree, from the mountain it tumbled down

The word "tumbled" was placed back before the word "rolled". Elements are put one after the other as a succession, according to the time when they occurred from the phenomenon's point of observation itself (objectively). The arrow is continuous :

├──────────────────────────────────────→

From the mountain the rock tumbled down, it rolled over the tree

Comments on transcriptions
- this set is entirely written in letters
- sense is visible in writing (sense of words)
- they correspond to formulas whose content naturally bears "a sense"

3.2 Absence of any arrow with applied mathematical formulas

There is only one linguistic set on which a unidirectional and continuous arrow cannot be applied, whether it is an element or a formula. This set corresponds to mathematics applied to natural phenomena and doesn't allow any exception.

About the formula on "kinetic energy" :

The written formula in its conventional single line witting :

⇔ ⇔ ⇔ ⇔

$$e = 0{,}5 \ x \ m \ x \ v^2$$

e : kinetic energy in joules
m : mass in kilograms
v : speed in meters per second

Elements in the formula can be rearranged with the formula remaining the same. A continuous arrow with a unique direction cannot be applied :

⇔ ⇔ ⇔ ⇔

$$v^2 \ x \ 0{,}5 \ x \ m = e$$

⇔ ⇔ ⇔

$$v^2 = v \ x \ v$$

The same written formula stated without respecting the conventional single line witting (a convention can be rejected). A continuous arrow with a unique direction cannot be applied :

⤡ ²⤢
⇔ m v
e = x
0,5
⤡

About one element ; an element doesn't have any before-after moments

$$\underset{e}{\leftrightarrow}$$

Note : in the field of applied mathematics, all the notations which apparently have to be read in the left-right direction, like "v^2", are writing notation conventions. Their direction isn't based on any internal linguistic specificity. These conventions cannot be considered as contradictory to the observations made in this presentation.

Comments on mathematics applied to natural phenomena :
- this set is written according to the mathematical symbol convention
- there isn't any visible "written sense"
- they correspond to formulas for which the existence of a sense has not yet been determined

3.3 Comparison between the formulas and the arrow

The two formulas mentioned above – about the kinetic energy generated by a moving solid and the falling rock that rolls over the tree – describe the same phenomenon.

Taking the arrow in consideration, specificities are at the same time identical and opposite for both sets of formulas :

Applied mathematical formulas	**Transcriptions**
- complete absence of any arrow - convention in math symbols only	- complete presence of an arrow - convention in letters only
- no visible sense in writing	- visible sense in writing
- complete absence of any unidirectional development of the phenomenon - abstract natural phenomenon	- complete unidirectional development of the phenomenon - observable natural phenomenon
?	- the content has a sense

3.4 Identification of the sense and its opposite

Natural sense can be extracted from the chart :

Transcriptions
- complete presence of an arrow - observable natural phenomenon
- complete unidirectional development of the phenomenon
- the content has a sense

Sense stands for “the continuous and unidirectional development” that makes up each and every observable natural phenomenon

Its opposite is not an arrow oriented in the opposite direction as it would be a continuous arrow as well. The following extract from the previous chart actually sheds light on what its opposite is.

Applied mathematical formulas
- complete absence of any arrow - abstract natural phenomenon
- complete absence of any unidirectional development of the phenomenon
?

The opposite of the presence of natural Sense :

The opposite of sense is the (abstract) withdrawal of the development making up an observable natural phenomenon.

Note : establishing a mathematical pattern for any natural phenomenon, also called “abstraction”, ends up driving the phenomenon away from its natural environment. Abstraction withdraws the development that makes up the phenomenon itself – its sense.

PART II - CONFIRMATIONS

3.5 Confirmation with the identification of logic

3.5.1 Logic applied to transcriptions

In writing, logic, with the use of linking words “if, because, yet…”, invariably results in the reconstruction of the unidirectional and continuous arrow.

1 - In this formula, the arrow isn’t continuous

→ → →

The butterfly lays its eggs. The caterpillar eats cabbage. The butterfly lands on the cabbage.

2 - Logic moves and rearranges the different steps in order to recreate their development

The ***butterfly*** *doesn't* ***land on the cabbage*** *to eat because it cannot feed – it does not have any digestive system. However, since it lays eggs and eggs turn into caterpillars and that* ***caterpillars eat cabbage****, then the butterfly lands on the cabbage to* ***lay its eggs****.*

3 - As a result, the continuous arrow is recreated

$\longrightarrow$

the butterfly lands on the cabbage, lays its eggs, the caterpillar eats the cabbage

Note : linking words "if, then, because... " disappear when the succession of events is recreated.

3.5.2 Logic on applied mathematical formulas

These formulas do not have any unidirectional arrow. There isn't any before or after moment, any development or "sense" to recreate. Logic doesn't work on these formulas.

Whatever the chain of thoughts to reach the formula may be, it can be written in various similar ways, without any unidirectional and continuous arrow.

$\rightarrow$	$\longrightarrow$	$\leftrightarrow \; \leftrightarrow \; \leftrightarrow \; \leftrightarrow$
If...	*however...*	$e = 0,5 \times m \times v^2$
$\rightarrow$	$\longrightarrow$	$\leftrightarrow \; \leftrightarrow \; \leftrightarrow \; \leftrightarrow$
If...	*however...*	$v^2 \times m \times 0,5 = e$

3.6 Confirmation with the use of cognitive abilities

- The purpose of a cognitive ability is to recreate the succession of observed steps. This capacity, which is also called "logic", is similar to the logic used when writing.
- Another cognitive ability can determine whether a development has fully been recreated by logic or not. This ability, named "common sense", is similar to the identification of the continuous arrow in writing.

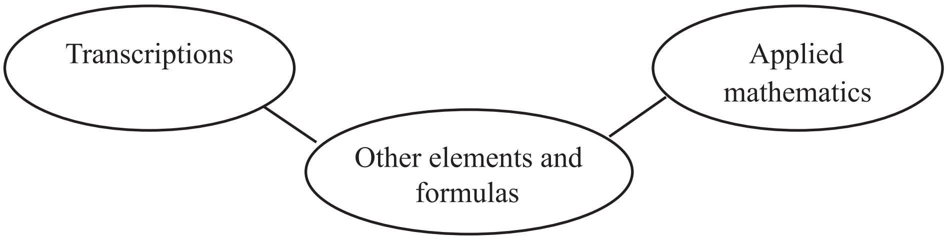
3.7 Confirmation with the nature - language - ability link

One of nature's constant elements – the unidirectional and continuous development of natural phenomena – corresponds to a written representation, namely the arrow applied on transcriptions. What's more, a cognitive ability (common sense) can grasp it.

3.8 Confirmation with other formulas

Writing conventions cannot be used as a landmark to determine whether formulas transcribe a development (sense) or not. These conventions were historically created without taking into account the links : sense - letters and sense withdrawal - math symbols.

The analysis through the arrow is the only landmark to categorize elements and formulas. It classifies them into three sets ; those on which the arrow is thoroughly applied, those for which the arrow is completely absent and the others.



3.8.1 For elements from the third set which are conventionally written in letters

An element written in letters may not have any development :

> *The word "unicorn" isn't a transcription ; it doesn't describe any observable natural phenomenon. There isn't any before, after, or any development. It doesn't hold any meaning.*

$$\text{before} \longmapsto X \rightarrow \text{after}$$

... unicorn ...

> *It isn't an abstraction either since it doesn't correspond to any natural phenomenon. No development was withdrawn.*

$$\leftarrow X \rightarrow$$

... unicorn ...

> *The same goes for the following words :*

$$\longleftarrow X \longrightarrow$$
$$\longmapsto X \longrightarrow$$

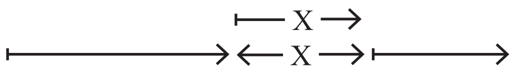
logarithm
symbol
infinite

In this third set, one word isn't affected by a "sense" (development). It could be ambiguous to say that it doesn't have any sense since "no sense" doesn't establish whether the natural development was withdrawn or whether it never existed. It therefore does not distinguish an abstraction from a fiction.

Note : a word that isn't affected by sense can still have a meaning – "unicorn" means "mythical animal". This meaning, though, has nothing to do with sense ; it does not follow any development. Sense and meaning are two different things.

1.8.2 For formulas from the third set which are conventionally written in letters

Formulas including a word which has no development and isn't abstract (like a fiction) cannot show any continuous development (sense).



From the mountain goes down the unicorn.

1.8.3 Mixed formulas (letters and mathematical symbols) from the third set

Formulas cannot contain any continuous arrow :

> The use of a word at the beginning of a formula seems to give a unique direction to the whole formula (suggesting not only a natural development and therefore a sense but also the transcription of a natural phenomenon) :
>
> 
>
> *Admitting* $z = x + y$ ...
>
> Yet, the unidirectional arrow is applied on "admitting" and not on "x, y and z" whose position in the formula can be swapped :
>
> 
>
> *Admitting* $z = x + y$ ... *Admitting* $x + y = z$ ...
>
> And since "x, y and z" aren't abstractions, no arrow can be applied to them :
>
> 
>
>
> *Admitting* $z = x + y$ ...

For each and every case from the third set of formulas, the absence of arrow corresponds to formulas that are commonly described as having "no sense".

4 - Discussion

In the transcription of a phenomenon, the natural and continuous succession of events structures the writing in one direction. Writing in letters stems from this development, with one direction and the capacity to orderly place words one after the other in a continuous sequence.

During the "abstraction" process of the said phenomenon, through writing, the natural development is put aside and this withdrawal dismantles the writing so that it can no longer be read in only one way. The possibility to write in mathematical symbols, following no writing direction, results from the development withdrawal.

Consequently, a structure can orientate the writing in one direction. Its absence can deconstruct it by taking away this direction.

One can deduce that both formulas actually consist of structural assemblies granting them their aspect and specificities. These formulas could as well be different assemblies of similar structures. (These structures are described in another presentation).

The development of a phenomenon can also be found in the content of formulas and elements (words). The content knows a before and an after as well as a continuous succession of steps occurring one after the other. This succession is what gives a "sense" to a formula or a word ; "a word has a sense".

The "sense" of a word has nothing to do with its meaning. Words and formulas are also used to grasp fictions and assumptions. The question "does this make sense ?" tries to determine whether the phenomenon knows a before and an after and what its natural development is. Sense is a natural landmark. It isn't an intentional message sent by nature – it is no "sign" and does not have any "meaning". Sense and meaning are two different concepts.

The Latin root of the word "sense" is "directio", that is to say "direction". Sense (development) is represented by a continuous arrow pointed in one direction. This written representation is quite basic – it does not need any language to be understood : it is more fundamental than language itself ; it is a meta-linguistic representation (what is expected from sense).

The identification of natural sense in writing and in the content of elements and formulas (sense of words) is made formal through the identification of its opposite – the absence of direction for writing and for the content of applied mathematical formulas.

One can expect that sense be completely absent (withdrawn) from formulas as structured as those belonging to applied mathematicss, though they are based on natural phenomena. Carnap said that anything that "doesn't hold any empiric content, any experimental basis (whether physical or sensory) doesn't make any sense".

Following the pattern of common language, one expects that applied mathematics which are almost structured to form a language have a sense – a mathematical sense. However, sense (development) is completely absent from that field.

Mathematics applied to natural phenomena don't have any sense (any development). It was taken away from them through abstraction.

Their appearance of language precisely comes from the structuring properties of the structures making them up. After the withdrawal of the structure of sense, other structures rearrange themselves to produce formulas that look like another language.

Sense in elements and formulas is thus isolated and grasped by both sides. It is more essential than transcriptions and applied mathematics as it structures them, makes them up, which confirms its meta-linguistic nature.

It brings together what was being sought by both semantics : the "sense of words" and the "formal" aspect of a supposed sense of mathematics.

As a result, common language becomes more of a "language of nature" compared to applied mathematics. Indeed, sense which was supposed to be manmade (and thus subjective) is in fact an external, natural, formal and therefore objective element which can be grasped only by transcriptions. Common language appears formal since it can deal with formal elements. On the other hand, mathematical formulas which were until now considered to be formal and objective cannot grasp Sense. They deal with nature in an incomplete manner, which is a flaw in itself. The withdrawal of Sense being man's operation, mathematics are more subjective.

What is called "Natural Sense" was deduced from the sense identified within writing and formulas. Natural Sense consists of the unidirectional and continuous development that makes up every observable natural phenomenon. Sense is different from "time" even though they are close. It is more structuring, more intertwined with natural phenomena. It designates the continuous succession of steps and transformations occurring one after the other. It includes the living (and not "life", please) as it is objective, like Frege assumed. It is no human invention.

Thus identified, Sense corresponds to the expected intuitive Sense – it implies continuity, some before and after moments and an orientation.

Sense is a true discovery – it is a new element whose nature was still unknown until today. It can neither be directly grasped by an applied mathematical formula nor by a transcription as it is fundamental.

Sense is one of nature's fundamental structures and has to do with anything concrete, physical. It had been qualified of "meta-physical", however could more precisely be defined as "infra-physical".

Confirmations –

In this presentation, the discovery of Sense was confirmed by the identification of two cognitive abilities which are linked to it.

The search for the arrow's continuity and direction applied on formulas corresponds to the cognitive ability to show "common sense". Common sense's natural function is to determine whether the development of a natural phenomenon follows a unique and continuous direction (with no stepping back or interruption).

Sense (development) being formal and objective, the ability to use the common sense able to grasp it is therefore objective and as formal as mathematical operations.

The search for the other arrow, representing the absence of direction (sense) on formulas doesn't consist of any ability since one cannot assume that a cognitive ability would spontaneously look for abstraction.

These two combined arrows also show that sense (development) can neither be present nor can it be withdrawn from other formulas, like fictions. The analysis with the arrows can therefore determine the state of sense in every written case.

The second cognitive ability is logic. The recreation of the unidirectional and continuous arrow from the mixed up steps of a transcription corresponds to the capacity to use "logic". This ability reorders the events in a continuous sequence. The ability to use logic is thus exclusively bound to Natural Sense.

There is only one possible sense for each transcribed natural phenomenon. Consequently, logic can have only one result. This ability is therefore as formal and objective as that of common sense.

In applied math formulas, because sense was withdrawn, there is no succession of events to rebuild. Logic is not applicable, it cannot show any result. One can deduce, in this case, that what is called logic actually isn't. Besides, logic was qualified of "binary", "mathematical" or many other things ; it is very different from a cognitive ability.

Logic, which has been sought for since the Antiquity, is identified as well. It cannot be applied on itself, as Aristotle assumed with syllogisms. It is not the basis of the universal language including mathematics as supposed by Leibniz and implemented by Frege and Russel through the calculation of predicates.

Both capacities to use common sense and logic are therefore linked together and complete each other. They become apparent during the tracking process (not the "enquiry"). Common sense follows one continuous path. When it is interrupted or gets meddled with another trail then logic intervenes, resorting on evidence, and recreates the continuity of the path.

These abilities spot what happened before in order to determine what is naturally expected after. They thus take part in the orientation by anticipation.

Like in language, the identification of these two abilities changes or even reverses the relation of objectivity between common sense and abstraction. Common sense was supposed to be subjective and blurred compared to abstraction (with mathematics), which seemed more objective and formal.

However "Common sense" is a formal ability that provides a formal and objective certainty on natural phenomena. On the contrary, the abstraction process is less objective as it is manmade.

Both abilities, common sense and logic, coherently confirm the discovery of Natural Sense (Sense). The identification of Sense was expected to establish the link between one of nature's elements, the language in which it can be found and the cognition (common sense) able to grasp it.

5 - Conclusion

This presentation shed light on the accidental and unexpected discovery of Natural Sense. The comparison of applied mathematics with transcriptions in common language showed that an arrow indicating the reading direction formally represented Sense. Sense was being sought for inside words whereas it structures nature. It also structures writing, as well as the content of formulas to give them a direction.

Applied mathematics led to the identification of Sense, because of the latter's complete absence inside formulas, as a result of abstraction. It revealed sense's structural aspect and shed light on the formal nature of this discovery.

Sense is a discovery, a new kind of element, one of nature's fundamental infrastructures. It is the first formally identified element to be more fundamental than writing and therefore more fundamental than what is grasped by mathematics and common language.

It can lead to the specification of the notion of "time", which is close to it, and of already acquired philosophical and mathematical knowledge. Quantifiable notions are now formally linked to Sense – becoming philosophical subjects – and philosophical notions can now be formalized – turning into mathematical objects.

Sense can also lead to the revision of the formula building rules in order to replace the conventions and mixed usage standing in its way.

The discovery of Sense is not enough to show precisely what applied mathematics are nor what they grasp. However, it proves that applied mathematics and common language are made up of a limited number of intertwined formal structures which can almost be restructured as language when one of them is withdrawn. This clearly states that language is formal.

The basis of this discovery is the fact that the presence or the absence of arrow (sense) for both sets of formulas doesn't allow any exception. It cannot be directly observed in this presentation, all the more so as writing conventions may hamper it, however these difficulties were compensated by confirmations.

The first confirmation consists of the formal identification of both abilities of logic and common sense. These two abilities are completely coherent with Sense, which is unprecedented for such gathered topics.

This confirmation puts an end to more than two millennia of research on metaphysical Sense, logic and common sense (through "reason").

The presentation shows evidence that the natural cognitive abilities of common sense and logic are as formal as mathematical operations. They are objective and fit to grasp the Sense of natural phenomena. What is essential to grasp anything natural is also essential to be able to find one's bearings through anticipation.

These abilities can lead us to wonder ; could abstraction be developed without affecting common sense and logic as they have opposite functions ?

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