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The importance of non-attentional operations for Attentional Semantics

Giorgio Marchetti

Abstract

Attentional semantics aims at finding the attentional instruction conveyed by the meanings of words, that is, the sequence of attentional operations that one has to perform if one wants to consciously experience what the meanings of words express. To achieve this goal, attentional semantics tries: firstly, to identify the sequence of the essential, elementary conscious experiences that invariably accompany, characterize, and are prompted by, the use of the word being analyzed; secondly, to describe these conscious experiences in terms of the attentional operations that are responsible for their production.

However, attentional semantics cannot rely only on these two levels of analysis. It has to take into account also those unconscious or non-conscious operations that, directly or indirectly, serve either as the support that makes it possible for the attentional operations to take place, be completed, and occur in a certain way, or as the necessary complement that makes it possible to execute and implement the activities determined and triggered by the conscious experiences.

A taxonomy of such unconscious operations is here proposed, based on the kind of conscious experience that the specific relationship existing between the organ of attention and the other organs makes possible. Four kinds of conscious experience have been identified: 1) conscious experiences that are determined by the direct application of attention to the other organs; 2) conscious experiences that are determined by the direct or indirect influence on the organ of attention of some other organs, independently of whether or not attention is applied to them; 3) conscious experiences resulting from the operations, performed by the other organs, on the products of the activity of the organ of attention; 4) conscious experiences resulting from activities that are triggered, organized and controlled by previous conscious mental acts. The unconscious operations involved in, or related to, each of the four specific kinds of conscious experience are then analyzed. The impact of such unconscious operations on the analyses of the meanings of words in attentional terms is described in general; some specific considerations are made about the analysis of the meanings of the words “time”, “thought” and of some modal auxiliary verbs.

Keywords: conscious experience, attention, meaning, Attentional Semantics, unconscious operations, time, thought, modal auxiliary verbs

Conscious experience

Everything we know is known in and through our consciousness. We come to know the world as it is thanks to our conscious experience. Conscious experience is the only level of reality we can directly access: all the other levels can be accessed only indirectly via the privileged medium of consciousness. Consequently, the world appears to us as our consciousness lets us experience it: it

unavoidably bears the hallmark of our consciousness. Its qualities and characteristics are the qualities and characteristics of our consciousness.

Conscious experience in general is determined by attention: as Mack and Rock (1998) have extensively shown with their work on the phenomenon of inattentional blindness, there cannot be consciousness without attention.

The phenomenal character of conscious experiences, that is, the fact that when we consciously perceive something, we have a subjective experience of that something, we feel it, we have some sensations of it, can be explained by considering the organ of attention as the source of the organism's nervous energy, and attention as the nervous energy that gives the organism the possibility of performing actions capable of directly affecting the organism's state of energy. The attentional activity performed by the organism involves a temporary variation or disequilibrium in the state of the nervous energy. This variation or disequilibrium constitutes the phenomenal aspect of consciousness. The amount of energy necessary for the organism to reestablish the equilibrium represents the quantitative aspect of the sensation.

Our conscious experience can be of different kinds. We experience reality as sounds, colours, pains, emotions, images, ideas, meanings, thoughts, expectations, etc. Each kind of conscious experience is determined by the way we use our attention: If we apply it to our sense-organs, we will have visual, auditory, olfactory, gustatory or tactile sensations; if we apply it to the proprioceptive system, we will have proprioceptive sensations; if we focus it on the sensory information stored in our memory, we will be able to imagine and remember something; if we use it to compare an object A with an object B, we will be able to make a judgment, or to form an idea, about them; if we focus it on the basic attentional operations that constitute, and that one has to perform to have, a certain experience, we will deal with the essential structure of that experience, which is usually referred to as the meaning of the word designating that specific experience (to explain, for instance, what "ironing" means, one has to exemplify with words or gestures the activity, which unavoidably entails directing the interlocutor's attention towards what constitutes the essential structure of that activity: the interlocutor will be then led to perform exactly those attentional operations that characterize the activity); and so on. However, our conscious experience is determined also by the way the activity of attention is modulated by the organs of our body. All our sensations, perceptions, memories, judgments, and so on, can in fact vary according to whether we feel calm, extremely excited, or under stress.

Each kind of conscious experience has its own qualities. Visual experiences possess different characteristics from auditory ones; the perception of a real sound is qualitatively different from the recollection of that same sound; a tactile perception of "soft" can last for a variable amount of time

and be qualitatively variable over time, whereas the conscious experience of the meaning of the word "soft" lasts only for a fragment of a second and is qualitatively identical every time it occurs (in this paper, when speaking about the "conscious experience of the meaning of a word", I refer to the minimal conscious experience necessary to understand the meaning of such a word; obviously, if we have enough time at our disposal, after this minimal experience we can extensively think about, imagine, or recall various occurrences of what the word refers to, thus having different kinds of conscious experiences connected or associated with such a word).

Having supposed that the phenomenal character of conscious experiences is determined by the variation in the state of the organism's nervous energy/attention, the qualitative aspect of conscious experiences, that is, the fact that each kind of conscious experience has its own qualities, can be explained only if we hypothesize that the organ of attention is composed of different parts, each of which is dedicated to process only a specific kind of information. According to this hypothesis, conscious experiences of different qualities are processed by different, dedicated parts of the organ of attention: when paying attention to a specific perceptual or mental modality, a specific area of the organ of attention is stimulated, and a specific sensation arises. The specificity of each area represents the qualitative aspect of sensation. Indeed, it would not be possible to explain the qualitative aspect of conscious experiences if we considered the organ of attention as an undifferentiated unit, not divided into sub-specialized units: signals coming, for instance, from different sense-organs would produce qualitatively undifferentiated variations in the state of the nervous energy. The organism would be able to feel only quantitative differences. To explain qualitatively different variations we have then to resort to the concept of an organ of attention subdivided into or composed of different parts.

Such a concept of a segmented organ of attention seems to be well supported by empirical evidence (Pashler, 1998). As far as the *perceptual processing stage* is concerned, there is evidence:

- favouring the hypothesis of the existence of modality-specific perceptual attentional systems (that is, separate perceptual attention systems associated with different sensory modalities), instead of a unified polymodal attention system. In fact, people appear capable of selecting visual stimuli in one part of space and auditory stimuli in another part, even if there is a decrement of performance in comparison with selecting visual and auditory stimuli coming from the same side (Driver and Spence, 1994); moreover, capacity limits in recognition appear to be more severe when processing multiple stimuli presented through a single modality compared with multiple modalities (Treisman and Davies, 1973);

- from divided-attention studies, that, when the total load of stimulus processing does not exceed a certain threshold, subjects are able to process information arriving on more than one channel at a time. In fact, when targets differ from non targets along a simple featural dimension, many elements can be processed in parallel without evident capacity limits (Shiffrin and Gardner, 1972); moreover, parallel, unlimited-capacity search is possible when targets are defined by membership in a well-learned symbolic category;

As far as more *central processing stages* (response, selection and more generally thinking) are concerned, there is clear evidence from PRP (Psychological Refractory Period) studies of the existence of dissociations between the central processing stage and the perceptual processing stage. Perceptual analysis, whether overloaded or not, occurs without interference from ongoing central operations (Pashler, 1989); there is obligatory queuing of cognitive operations such as response selection and associative retrieval that is independent of sensory modality; certain variables that mitigate perceptual overload do not affect central interference: whereas detecting two attributes of a single object circumvents the perceptual capacity limits (Duncan, 1984) that are usually involved whenever two perceptual detections occur at the same time, it does not attenuate the magnitude of central, bottleneck-based interference (PRP effect) (Fagot and Pashler, 1992).

The meanings of words

A very important kind of conscious experience is represented by the meanings of words and sentences, both for the space they occupy in our daily conscious life and for their specific characteristics.

The meanings of words and sentences have a special weight in the general economy of our consciousness that cannot be underestimated: we live in a world of words since the very beginning of our life; words are continuously used both by others and by ourselves with pragmatic, educational, social, psychological, economical and political intents; words mould our experiences and perceptions. Most of our conscious life is occupied by them.

Indeed, it is primarily in our consciousness that we experience the meanings of words[1]: when we hear a certain word, say “apple”, we can be said to have understood its meaning if we are conscious of it, that is, if we are able to differentiate it from the meaning of other words, or if we are able to distinguish the object to which this word refers from other objects. We understand the meaning of

[1] I have treated this topic more extensively in Marchetti (2003).

the word apple because we know that the word “apple” does not mean the same as, for instance, the words “pear” or “table” mean, and does not refer to the same objects to which these words refer.

The meanings of words and sentences afford us the opportunity to have a particular kind of conscious experiences. The meanings of words isolate, decontextualize, “freeze” and classify in an articulated system the ever changing and multiform stream of our conscious experiences.

The basic, linguistic meaning of each word isolates only some elements and some combination of these elements from all the possible elements and combinations of our daily experience: the word “red” identifies only a certain kind of visual experience, which differs, for instance, from what the word “yellow” identifies.

The meaning of each word decontextualizes the elements and relations it isolates: the meaning of the word “apple” applies to all sorts of apples, independently of their form, colour, qualities, weight, and so on; likewise, the word “or” applies to different contexts, independently of the entities or events that it connects. By abstracting some elements and relations from any context, words can be applied to a whole set of occurrences or events.

The meaning of each word “freezes” the elements and relations it isolates, thus making it univocal, valid for, and shared by, everybody, and, to a certain extent, stable over time: consequently, the communicative function of language is safeguarded. If our interlocutor says “I would like a cup of coffee”, we understand perfectly well what he wants, even if he does not specify exactly which kind of coffee he would like, what form the cup should have, and so on. Obviously, the fact that words represent only a decontextualized version of the elements they isolate can sometimes generate ambiguities in the interpretation of what one intends when using them. These ambiguities, which originate from the extended, figurative, metaphorical or unusual use of the word, can only be resolved by resorting to the implicit knowledge or to the contextual information.

Words classify in an articulated system of contents and functions the elements and relations they isolate. Each word has a certain relationships with the other words, with regard to both the content and the syntactic function. The word “father”, identifying a certain kind of parental entity, bears a certain content relation with the words “mother”, “son”, “brother”, and “grandmother”. At the same time, as a noun, it bears a certain relationship with verbs, adjectives, prepositions, the other nouns, etc.: it cannot, for instance, works as a preposition or a verb; it can be qualified by an adjective; and so on.

Therefore, the meaning of each word isolates, condenses, immobilizes and reduces the manifold, multiple and ever flowing conscious experiences of our life in a stable, decontextualized and shared form. But how can this happen? What is it that makes meanings perform this function?

Essentially, each meaning is composed of a sequence of elements: the invariable elements that, independently of any individual, specific occurrence of a given conscious experience, are at the core, and are responsible for the production, of any instance of that conscious experience. The sequence represents then the skeleton that supports and allows the conversion or actualization of the meaning into any of its sensible, perceptible instances, whether they are images, memories or something else.

The elements composing the meanings of words are attentional operations: each word conveys the condensed instructions on the attentional operations one has to perform if one wants to consciously experience – either as a pure meaning, an image, a real perception, a thought process, a concept, or something else - what is expressed through and by it. Every instance of a given conscious experience is composed of, and forms on, a sequence of elementary attentional operations, each one of which leads to a corresponding elementary conscious state. When, for instance, we see a cat, we have a series of conscious experiences: first of all, we are conscious of seeing it, that is, of having a visual experience as opposed to, say, a gustatory one; then we are conscious of its physical qualities: its shape, the colour and softness of its fur, its long whiskers, tail, and ears, and so on; moreover, we see that it moves and that its movements are of a particular kind. Possibly, these kinds of visual experiences can be integrated by some other kinds of conscious experiences, such as the tactile and auditory ones. All these experiences are determined primarily by the operations we attentionally perform. The visual conscious experience is determined by the fact that we have applied our attention to our organ of sight (and not to some other organ); the conscious experience of the physical qualities of the cat is determined by the results of the operations performed by our attention on, and by means of, the organ of sight: focusing on the scene, scanning the scene, retaining the shape of the foreground while discarding what lies in the background, fusing the shape with its surface characteristics, following its movements, and so on; the conscious experience of the other physical qualities of the cat derives from the application of attention to the other sense-organs.

Attentional semantics (Marchetti, 2003) aims at finding the attentional instruction conveyed by the meanings of words, that is, the sequence of attentional operations that one has to perform if one wants to consciously experience what the meanings of words express. To achieve this goal, attentional semantics tries:

1. firstly, to identify the sequence of the essential, elementary conscious experiences that invariably accompany, characterize, and are prompted by, the use of the word being analyzed;

2. secondly, to describe these conscious experiences in terms of the attentional operations that are responsible for their production.

The first step, the identification of the elementary conscious experiences produced by the meanings of words, can be performed thanks to the fact that any conscious experience implies the possibility of being distinguished and differentiated from the other ones. We can be said to be conscious of something only if we are able to recognize it and distinguish it from other things. The conscious experience of something, say of a pear, lets us distinguish it from other fruits: it has certain phenomenal qualities – form, taste, colour, etc. - that other kinds of fruits do not have; like the other kinds of fruits, but unlike stones, it goes bad; it does not perform the same actions that human beings do. We are conscious that a given object is a pear only if we can distinguish it, on the basis of its form, colour, taste, etc., from the other kinds of fruits, or from the other objects. Whenever we are able to distinguish something from something else, we are conscious of it, even if we do not possess a name for it, like when we meet an object for the first time, or when we have the intention to say something but we do not find the right word. Sometimes we are conscious also of something that we are not able to distinguish or describe: for instance, despite hearing something, we cannot describe exactly what we heard. In such a case however, the only consciousness we can be said to have of what we heard is precisely its undistinguishableness: we can only distinguish it from the other objects and events of our life by defining it as undistinguishable. Consciousness is a fundamental locus and means that allows us to recognize differences and draw distinctions.

When we use a certain word or inflect it in a certain way, we have the conscious experience of its meaning, that is, we know that it differs from the other words or from the same word but inflected in a different way precisely because it means something different from them: if we substitute it with another word, or if we inflect it differently, we will express a different idea or concept. It is the conscious experience of the meaning of a given word that makes us differentiate it from the meanings of other words, or that make us distinguish the objects to which the word refers from other objects. If we consider, for instance, the plural inflection of nouns, we can give a first rough description of the conscious experience it produces by saying that the plural form, as opposed to the singular form, implies a multiplicity of objects, actions or events: when we say “apples” we refer to more than one apple. This is not however the sole conscious experience we have when using the plural form. Actually, if we compare the word “apples” with “fruits”, we will clearly notice that the plural introduces a certain kind of equivalence or uniformity between the various objects: whereas “apples” might simply give the idea that there is more than one apple, “fruits” unequivocally shows not only that there is more than one fruit, but also that it is possible to group

under one common category objects of different kinds: from this point of view, apples, pears, bananas, and so on, despite their apparent diversity, are all equal, and share something in common. Obviously, by making further comparisons, we might distinguish some additional characteristics, and give a more precise and comprehensive account of the elementary conscious experiences of the plural form.

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The ability to recognize something and distinguish it from something else is not unique to conscious beings like us. Also an artificial device can detect something without being conscious of it. However, the way we conscious beings distinguish and recognize objects and events entails some fundamental processes and consequences that do not take place in non-conscious beings. Every time we distinguish or recognize something, we perform this operation in relation to ourselves as beings that form and emerge thanks to the very operation of distinction or recognition. Therefore, the act of distinguishing or recognizing something entails for us the possibility of emerging as sentient and operating entities that differentiate from the other objects and beings. All this can be explained if we consider what being conscious means in operational terms. Our conscious experience can be operationally defined as the variation of our state of nervous energy induced by, and consequent upon, our use and application of our own nervous energy (Marchetti, 2001). The possibility for us to feel and experience what we are and what we are doing, and what the other objects and beings are and do gives us the advantage of directly knowing ourselves and the other objects and beings, without the necessity of any symbolic intermediate mediation. By means of consciousness, we continuously relate the objects, events and the other beings of the world to ourselves: an object becomes an object and acquires a form and meaning for us only as long as, in some way, we can relate it to ourselves. By making us experience directly how the object relates to us, what kind of effect the object has on us, how the object limits us, and how our activity can modify the object, consciousness is the privileged way for us to acquire and construct our knowledge of the object. It is through consciousness that we understand how an object relates to us, learn how to use it, and get to know it. Consciousness gives us an immediate understanding of the object, and of the meaning that the object has for us. By understanding what relation exists between the object and us we give a meaning to the object, and the object acquires a meaning for us. The meaning the object has for us corresponds with our conscious experience of the relation between the object and us. Conversely, understanding what relation exists between us and the objects, events and the other beings of the world also implies for us to be able to acquire a form and – through self-consciousness – to assign a

meaning to ourselves. We acquire the form that the relation between ourselves and the objects, events and other beings of the world makes possible; we acquire a meaning when, by self-consciously seeing ourselves as an object, we are able to conceive ourselves as a means or instrument to an end, and consequently to set an end for ourselves. We emerge therefore as an entity having our own form, autonomy, independency, and meaning through a continuous process of differentiation that highlights and establishes the difference between ourselves and the objects, events and the other beings of the world. The form and meaning we conscious beings have or acquire and the form and meaning the objects, events and the other beings of the world have or acquire are thus tightly entangled. An object exists, has a form and a meaning because we conscious beings exist who gives it a form and a meaning, and we conscious beings exist, have a form and a meaning because by acting we have been able to differentiate ourselves from that object. Therefore, consciousness and self-consciousness are the fundamental device by which: a) the objects, events and the other beings of the world - becoming the means that make a conscious being take shape - acquire a meaning and a form; b) we conscious beings - differentiating ourselves from the objects, events and the other beings of the world - take shape and acquire a meaning.

It could be claimed that the definition of consciousness (and self-consciousness) as the prime organ that allows us to directly know, and assign a meaning to, the objects, events and beings of the world by relating them to ourselves is too restrictive and does not account for all that which consciousness allows us to do. Undeniably, such a claim should seem more than reasonable if one considers, for instance, the eighteen functions listed by Baars (1988): definition, context-setting, adaptation, learning, editing, flagging, debugging, recruiting, controlling, prioritizing, access-control, decision-making, executive, analogy-forming, metacognitive, self-monitoring, autoprogramming and self-maintenance. As he argues: “it is doubtful whether any shorter list can do justice to the great and varied uses of conscious experience” (Baars, 1988, p. 347). I believe, however, that the variety of functions he lists can be reduced to the one I propose inasmuch as they let us relate ourselves to the objects and events of the world, thus making us understand both ourselves, the objects and the relations between ourselves and the objects. Indeed, all the activities we can consciously perform - reducing and resolving ambiguity of interpretation (definition, context-setting, editing, flagging, debugging, and analogy-forming function), learning and adapting to novel events (adaptation and learning function), setting goals, organizing, carrying out and controlling our mental and physical actions (flagging, recruiting, control, decision-making, and executive function), assigning priorities to the information to process (prioritizing and access-control function), and controlling and acting upon our own conscious states (metacognitive, self-monitoring, autoprogramming and self-maintenance function) - allow us to understand how the

events, the objects and the other beings of the world relate to us: that is, they allow us to define, and assign a meaning to, both them and ourselves. Similarly, it is precisely because we already have some knowledge of ourselves, as well as of the objects, the events and the other beings of the world, and of the relations between them and us, that we can perform certain actions and set ourselves certain goals. And this holds even though not everything we do takes us to, or is based on, a full understanding of the objects and events of the world, and of the relations between them and ourselves. After all, a limited, partial, imperfect knowledge or, even worse, a lack of knowledge, anyway represents for us a certain kind of cognitive basis on which we can proceed to construct a future, more comprehensive knowledge.

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After identifying the elementary conscious experiences that invariably characterize the meanings of words, attentional semantics tries to describe these conscious experiences in terms of the attentional operations that are responsible for their production. To this aim, attentional semantics has to take into account the whole set of basic operations that attention can perform: from the possibility of orienting it, to that of focusing it at variable levels of size and intensity; from the possibility of sustaining it for variable amounts of time, to that of variously combining the attentional operations and thus forming new complex attentional wholes; from the possibility of storing in memory what is under the focus of attention, to that of allowing the planning, controlling and performing of complex and difficult tasks.

Considering for example the case of the plural inflection of nouns, a first approximate account in attentional terms of the conscious experiences that we have identified as characterizing it, that is, the experiences of “multiplicity” and “equivalence”, could be the following one. The conscious experience of “multiplicity” results from having repeatedly focused our attention, and from having each time thus obtained - whether in the form of a perception, a recollection, a mental image, or something else – an object that differs from the others for some aspect: the place it occupies, the time in which it occurs, the form it has, etc. The conscious experience of “equivalence”, as well as that of “difference” implicit in the experience of “multiplicity”, relies instead on the possibility of performing the following attentional operations:

- addressing attention to a certain object A,
- suspending it momentarily from A, but in such a way as to keep or maintain A, as it were, in the background for a certain time,

- while simultaneously focusing on a new object B,
- comparing B with A,
- and getting the result of the comparison.

If B is equal to A, we will have an experience of "equivalence"; if they are not equal, we will have an experience of "difference". It has to be noticed that the apparent contradiction between the experience of "difference", implicit in the "multiplicity", and the experience of "equivalence" disappears when we consider that the latter experience concerns the object that is pluralized, while the former concerns something that is associated with the object, such as its spatial or temporal localization, or some of its features[2].

It has to be noticed that the researchers interested in analyzing the meanings of words in attentional terms only recently have felt the necessity to take into account, if not the very whole set of basic operations that attention can perform, a great part of it. Whereas the two pioneers of this kind of research, that is, Silvio Ceccato and Giuseppe Vaccarino, adopted for their analyses respectively only one and two basic attentional operations - Ceccato's analyses are based on the "attentional state", whereas Vaccarino's ones are based on the moments of "active attention" and "interrupted attention"[3] -, the recent generation of researchers (Benedetti, Marchetti, Oakley) has opted for a wider set of basic attentional operations.

Contrary to Ceccato's and Vaccarino's rigid "digital" conception of the attentional states, Benedetti proposes an "analogical" conception of the attentional states: precisely a conception that accounts for the variability in intensity, duration and applicability of the attentional states (Benedetti, 2001, p. 118). Benedetti (2001, 2005) identifies the following basic attentional operations: attentional focalisation; attentional discarding; change of intensity of attentional focalisation; maintenance of attentional focalisation for variable amounts of time, which is at the base of the construction of temporal categories; attentional movement, and evaluation of the attentional movement, which are at the base of the construction of spatial categories. He conceives of this set of basic operations as an open one that can always be modified, enriched and improved.

Oakley (2004) identifies six components of attention that "may count as the basic cognitive scaffolding of complete semiotic theory" (Oakley, 2004, chapter 1, p. 11): alerting, orienting, selecting, sustaining, controlling, and sharing. According to him, meaning construction can be explained by means of these six fundamental processes. They represent the necessary conditions for

[2] For a more detailed analysis of the plural, see Marchetti (1993).
[3] For a brief introduction to their researches and methods, see Somenzi (1987). Under their influence, when I started my activity of research in this field, I too adopted only one basic attentional operation: the attentional movement (Marchetti, 1993).

the construction of meaning as well as for the execution of the other cognitive processes, such as perception, conceptualization, consciousness, memory, learning, and social interaction. They are the building blocks on which he founds his analyses of acts of meaning making that occur verbally, non-verbally, and communally[4].

I think that one can immediately and easily see the advantage of adopting a wider set of basic attentional operations simply by comparing the disarming and appealing simplicity of the analyses made by Benedetti with Ceccato's and Vaccarino's. While the former explains the meaning of very basic and primitive words, such as "to be", by resorting to few essential attentional operations, the latter have to resort to a longer series of operations: which, even only from the point of view of the pure historical formation of meanings and mental categories, certainly makes Ceccato's and Vaccarino's analyses unconvincing as opposed to Benedetti's.

The importance of non-attentional operations

Despite the fact that we can describe the conscious experiences prompted by the meanings of words, we must be aware that we cannot be conscious of all the operations that underlie and give rise to these conscious experiences. Some operations performed by our organs occur at an unconscious or non-conscious level, and remain unconscious to us: only the final result of these operations becomes conscious. As Phylyshyn says, they are cognitively impenetrable (1984). When estimating whether a certain object A is higher than an object B, we will be conscious of either A, B, and the fact that, say, A is higher then B; but we will not be conscious of the underlying mechanisms that allowed us to do the estimation. If we multiply 3 by 4, we know that the result is 12, but we do not know how we got it. Likewise, if we apply our attention to the organ of sight, we will become conscious of the scene before us, and to a certain degree we can even become conscious of how this organ works, of the movements it can make, of its limits, and so on; however, below a certain level we will have no conscious access to the operations performed by the organ: we cannot be conscious of the neuronal activities taking place along the optical nerve or inside our brain, but only of the results of such activities.

Some of these unconscious or non-conscious operations, by supporting and modulating attention, have a direct impact on our conscious experience; some others bring to bear only indirectly on consciousness. Anyway, it seems quite obvious that without such an unconscious or non-conscious support, there could not be conscious life at all. Most of our conscious experience is due to this support, and it would be rather difficult to explain how conscious experience occurs without

[4] On Oakley's work, see Marchetti (2004).

resorting to it. Therefore, if attentional semantics wants to give an exhaustive and complete account of the operations that produce the meaning of a certain word, it has to rely not only on two different levels or steps of analysis – that is: a) the identification of the elementary conscious experiences that invariably the use of the word brings about, and b) the description of the attentional operations that produce such conscious experiences – but also on a number of unconscious or non-conscious operations, and on the respective organs, that serve either as the support that makes it possible for the attentional operations to take place and to be completed, or for them to occur in certain way, or as the necessary complement that makes it possible to execute and implement the activities determined and triggered by the conscious experiences.

The researchers interested in performing semantic analyses based on an attentional description have variously felt the necessity to resort to these unconscious, non-attentional operations, and on their organs. Ceccato resorts to memory, the organ of thought and the operation of comparison Ceccato, 1969, 1972, Ceccato and Oliva, 1988, Ceccato and Zonta, 1980); Vaccarino to memory (Vaccarino1981, 1997); Marchetti to memory, a comparison system, and a motor system (Marchetti, 1993); Benedetti, who explicitly recognizes that mental categories are not constituted only by attentional operations (Benedetti, 2001, p. 76), resorts to memory, representation and comparison (Benedetti, 2001, 2005); Oakley's articulated system resorts to memory, categorization, and valuation: "The individual and social processes of attending determine, and in turn, are determined by, three interrelated cognitive processes: memory, categorization, and valuation" (Oakley, 2004, chapter 1, p. 11).

Until now, however, no serious attempt has been made to theoretically set these non-attentional operations in the wider framework of the attentionally-based semantics, and exhaustively describe and organize them in an articulated comprehensive system. As a first step in this direction, I will sketch a taxonomy of the non-attentional operations and of the relevant organs that supply the necessary complement and support to the attentional operations.

The taxonomy I propose is based on the kind of conscious experience that the specific relationship existing between the organ of attention and the other organs makes possible. So far, I have identified four fundamental and specific kinds of conscious experiences, each of which is produced by the specific way the organ of attention or the products of its activity affect, or are affected by, the other organs:

1. conscious experiences that are determined by the direct application of attention to the other organs;

2. conscious experiences that are determined by the direct or indirect influence on the organ of attention of some other organs, independently of whether or not attention is applied to them;
3. conscious experiences resulting from the operations, performed by the other organs, on the products of the activity of the organ of attention;
4. conscious experiences resulting from activities that are triggered, organized and controlled by previous conscious mental acts.

Let us now analyze in some detail these four kinds of conscious experience, and describe the organs and operations that make them possible.

Conscious experiences determined by the application of attention to the other organs

The first kind of conscious experience is, no doubt, the most common one and is exemplified by most of the physical sensations and perceptions we can have (tactile, auditory, visual, etc). They can be either stimulated by a real external stimulus that we passively undergo or actively search and expect, or elicited and evoked by retrieving the information stored in our memory. We produce them by focusing our attention either on our sense-organs and proprioceptive system, or on our memory system: what we obtain are respectively real sensations and perceptions, and imagined or remembered sensations and perceptions.

The organs necessary for attention to produce this first kind of conscious experience are therefore the sense-organs, the proprioceptive system and memory. It is the activity done by these organs that supplies the organ of attention with the material that allows us to have physical sensations, perceive and feel physical things, imagine, recollect, evoke and represent physical objects, events and situations, but also have hallucinations (as observed by Ceccato, we have hallucinations when we take or mistake what is actually a product of the representational activity for a product of perception[5]). Anyway, these experiences could not take place without the active participation of attention. In fact, what mainly characterizes them is the fact that they last only as long as we focus our attention on our sense-organs and proprioceptive system, or on our memory system: as soon as we withdraw our attention from these organs, these conscious experiences disappear.

It is important to underline that the sense-organs and the proprioceptive system do not only supply what we could define raw, unstructured sensations, such as colours, sounds, smells, and the

[5] Ceccato, 1974, p. 221.

like, but also, up to a certain degree, structured perceptions. As, for instance, Spelke's work shows (1990)[6], infants innately possess a set of principles about the physical word that serves as the basis for their subsequent learning and to direct their attention to relevant aspects of the input. Spelke has identified four such principles guiding the infant's perceptual analysis of the physical word: boundedness, cohesion, rigidity and no action at a distance. These principles, which are not modality specific, reflect basic constraints on the motions of physical objects, and make it possible for infants, as well as for adults, to identify one or more objects even when they are adjacent or partially occluded by each other: they permit perceivers to apprehend physical objects as persisting bodies with internal unity and stable boundaries.

Phylyshyn (1999) lists some other evidence concerning visual perception that clearly confirm that our sense-organs and proprioceptive system provide us with structured perceptions. No doubt, the more striking evidence is that optical illusions are not destroyed by demonstrating their falsity: even after you have had a good look, for instance, at the Ames room, it still looks as though the person on one side is much bigger than the person on the other side. Therefore, our perceptual system, when we apply our attention to it, supplies more than raw sensations: it supplies us with partly structured perceptions.

Another important source of evidence is represented by the experiments on visual search. There is a vast amount of research that undisputedly shows that at the first stage of vision, which, strangely indeed, psychologists label as "preattentive" or "vision before attention"[7], some features pop-out and guide the following, subsequent stages of vision (Wolfe, 1994). The features that certainly have this property are: colours, orientation, motion, size, curvature, various cues of depth, and several aspects of form. "Preattentive" processing of more complex properties like object shape, letters or faces seems to be efficient only if stimuli are overlearned (Wolfe, 1998, 2000). Further evidence comes from the asymmetry of many basic feature searches: in a display, it is easier to find a moving stimulus among stationary distractors than to find stationary target among moving distractors; it is easier to find the presence of something than to find its absence; it is easier to find a deviation from a canonical stimulus than it is to find a canonical stimulus among deviants. Using Wolfe's words (Wolfe, 1998): "preattentive processes divide the scene into 'things' and the preattentive basic features describe the 'stuff' out of which perceptual 'things' are made". All this clearly testifies to the complex role played by our perceptual system in supplying structured perceptions.

[6] See also Soja et al. (1991).

[7] I say "strangely indeed" because this first stage of vision actually involves some kind or amount of attention. In visual search experiments subjects are requested to look for one target item in a display containing some number of distracting items. Therefore, they apply their attention to their visual system, even if for a short period. In my opinion, then, it would be better to speak of "preliminary attention" rather than of "preattentive" or "vision before attention".

Conscious experiences determined by the influence on the organ of attention of other organs

These conscious experiences arise when the activity of the organ of attention is affected by the activity of some other organs, independently of the fact that attention is applied to them. We can distinguish here between two different kinds of experiences according to which kind of influence is exerted on the organ of attention. The first one is elicited when an organ affects pervasively and unselectively the physical structure of the organ of attention, thus altering or modulating indistinctively all its operations; the second one, when an organ sends the organ of attention circumscribed and selective instructions on what operations it has to perform.

Typical examples of conscious experiences elicited by the first kind of influence are physiological states such as pain, pleasure, thirst, hunger and tiredness, and psychological states such as emotions, moods and impulses. When they occur, they temporarily transform the mode of working of our brain and body, either speeding up, slowing down or altering in some other way both our brain processes and our physical activities: we cannot behave as if they were not occurring. They share in common with the conscious experiences analyzed in the preceding paragraph (those determined by the application of attention to the other organs) the character of *immediacy* and *intuitiveness*, that is, using Ducasse's words (1944, p. 134), the fact that "however much we may learn *about* them, yet we do not know *them* unless we ourselves have felt their intrinsic quality". They have this character because the organ or organs that cause the specific physiological or psychological state affect, directly or indirectly, the physical structure of the organ of attention, altering in a global and indistinct manner its way of working for periods of time that may even be relatively long. As a consequence, our perceptions, thoughts and sensations, in a word, all our conscious activities assume a distinct character that is specific to each kind of physiological or psychological state. When, for example, we feel "enthusiastic", all our movements, actions and thoughts seem to be driven by a force that comes from within us but that we cannot control, a force that pushes us to perform them and makes them easy to perform. This kind of influence on the organ of attention gives therefore a distinct form to all the conscious experiences we can have: thoughts, perceptions, images, memories, etc.

The second kind of influence affects not so much the physical structure of the organ of attention as the operations it performs. While the first kind of influence affects indirectly, yet pervasively, the operations of the organ of attention, the second kind pilots them directly, yet selectively. The first kind of influence is exerted on the physical substratum of the organ of attention, and has a physical character; the second, on the operations of the organ of attention, and has a symbolic and procedural

character. The first kind of influence modulates the global working of the organ of attention, independently of the operations it has to perform; on the contrary, the second kind specifies precisely what operations the organ of attention has to perform. While the first kind of influence gives a distinct form to all the conscious experiences we can have, irrespectively of whether they are thoughts, perceptions, images, memories, or something else, the second kind gives origin to specific thoughts, perceptions, images, memories, and so on. The second kind of influence can be brought about by all the automatisms, schemas, frames or unconscious procedures that we have acquired and learnt during our life, and that make us perform complex activities such as speaking, driving, playing games, doing specific work, achieving goals, and so on. This kind of influence is exerted also by all those mental or psychological elements that are not innate, but subjectively or culturally acquired, determined, and usually structured and organized in fields or networks, such as concepts, memories, representations, motivations, intentions, expectations, desires, interests and aspirations.

Let us now make some considerations about the first kind of experience, that is, those occasioned when an organ affects pervasively and unselectively the physical structure of the organ of attention. Due to the tight interconnection of all the organs of our body, practically any of them can directly and indirectly affect the organ of attention, even though there are certain that seem to have been selected through evolution as specialized means of modulating brain activities in general: an example is given by the organs that secrete hormones, neurotransmitters and neuromodulators. A specific but very important kind of influence on attentional activity is that exerted by the organic substrate of the organ of attention. Everyday we have the experience of feeling physically and mentally exhausted, of not being able to do any kind of activity any longer, and the consequent necessity to rest and sleep. Sleep is the principal means our organism has of recovering lost energy. Since dreamless sleep is characterized by the fact that, while some vital functions of our organism continue to be performed, we cannot exert any control over our attention[8], and we have no conscious activity or experience whatsoever, one can infer that one of the most important kinds of energy that has to be restored is that necessary for the organ of attention to work.

A very special kind of conscious activity we have during sleep is dreaming. Dreaming is the product of the combination of two different kinds of conscious experience: a) sensory conscious experiences, that is, conscious experiences determined by the direct application of attention to our memory system, and b) conscious experiences elicited by the direct or indirect influence on the

[8] According to La Berge, "the major 'computational' goal of resting sleep appears to be the blocking of sensory information from reaching the cortex and the prevention of information processing within and between cortical areas" (La Berge, 1995, p. 185). The brain would achieve this goal through a dramatic shift of activity of the thalamocortical circuitry, which is one of the main organs responsible for attentional activity, from a regular-spiking mode to a burst-firing mode.

organ of attention of some other organs, independently of whether or not attention is applied to them. Dreams are made of sensory conscious experiences: we see, hear, smell, touch, etc., which makes us feel active, participate directly to our experience. But dreams are also made of a part that does not depend on our will; they proceed independently of our decisions, they go on even if you do not want them to. As Paul Valéry observed (I translate from the Italian version): "When one dreams, one cannot choose" (Valéry, 1990, p. 144).

What else does the consumption of the energy of the organ of attention involve, besides the phenomena of falling asleep and not having any kind of conscious experience, or having a very particular kind of conscious activity such as dreaming? A very intriguing and appealing suggestion was made by Ernst Mach (1886), who argued that it is probable that time-sensation is connected with the organic consumption of our attentional energy: "we feel the *work of attention* as time" (Mach, 1890, p. 111). He arrived at this conclusion by observing that: a) so long as we are conscious, time-sensation is always present, while in dreamless sleep – where our attention is completely exhausted - the sensation of time is lacking; and b) during severe effort of attention time is long to us, during easy employment short: "in phlegmatic conditions, when we scarcely notice our surroundings, the hours pass rapidly away" (Mach, 1890, pp. 111-112). Time-sensation would then be correlated with and conditioned by the "fatiguing of the organ of consciousness", which goes on continually in waking hours, and the labour of attention, which increases just as continually. Consequently: a) "the sensations connected with greater expenditure of attention appear to us to appear *later*" (Mach, 1890, p. 112); b) "it is intelligible why physiological time is *not reversible* but moves only in one direction. As long as we are in the waking state consumption and the labour of attention can only increase, not diminish" (Mach, 1980, p. 115).

Moreover, Mach's proposal seems well apt to account for all those cases of discrepancy between psychological time and physical time, that is, when the perceived order of events does not correspond with the real order in which events succeed. It is a well-known and ascertained fact, for example, that, given certain conditions, a stimulus A that arises objectively and physically at the same time as, or even later than, B may subjectively appear to occur earlier than B (Vicario, 1997). These kinds of phenomena, which are generally known as "prior entry" (Sternberg, Knoll and Gates, 1971), "counterclockwise error" or "backward time referral" (Dennett, 1991), clearly show that temporal relations do not depend exclusively on the real sequence of the events, and that some non-temporal factor - such as, attention[9] (Sternberg, Knoll and Gates, 1971), or the degree of

[9] The idea that when a person attends to a stimulus, he or she perceives it as having occurred earlier in time than it would if he or she was not attending to it has been claimed and attested by many psychologists, such as for instance Wundt and Titchener. Although the empirical evidence for this phenomenon – also known as "prior entry"- has been questioned on the methodological ground that it could reflect the influence of response biases on the observer's judgement (Pashler, 1998), the latest research, successfully attempting to reduce, if not eliminate entirely, the influence

resemblance between the events or stimuli (Vicario, 1997) - intervenes in the construction of the psychological time. According to Mach's proposal these puzzling phenomena are made possible by the simple working of attention. We can have a conscious subjective perception of the order of events that is irrespective of the real order in which events occur because we are provided with an attentional mechanism that allows us to focus on events independently and irrespectively of the order in which they occur, and because the very organic consumption of the attentional energy determines time-sensation: the event on which attention is focused first is felt to happen earlier in time[10].

In my opinion, these suggestive observations by Mach open up a new perspective on the way of analyzing in terms of attentional operations the conscious experience of "time", as well as those experiences that are related to the experience of time, such as "sequence", "succession", "period", "past", "present", "future", "after", "before", and so on. The philosophical tradition has prevalently explained time as a succession or sequence of events, occurring either in the external physical world or inside the consciousness of the sentient subject, which can either be grouped in periods of variable durations, or conceived as following one another in a developing or evolving manner[11]. While seeing time as occurring in the external, physical world has led to the realistic conception of time as an intrinsic and objective quality of objects, existing independently of the subject (Plato, Newton), seeing it as occurring inside the consciousness of the sentient subject has led to the psychological conception of time as something inextricably related to, and derived from, the internal experience of the succession of ideas and psychical states (Saint Augustine, Locke, Berkeley, Hume). Both of these conceptions have encountered several difficulties in explaining time experiences without contradicting themselves. Certainly, the main cause of the contradictions lies in the circular explanation that they have given of time: time as a succession of perceptions or ideas (Hume, Berkley), time as order (Leibniz), time as the present (Saint Augustine), time as the becoming (Aristotle), time as duration (Descartes), time as a period, time as an extension, and so on. In fact, how can one explain, for instance, the experiences of "succession" or "sequence" without resorting to a more primitive experience, be it that of time or that of space? Indeed, one can experience a succession or sequence of events only after having experienced the fact that an event follows another in time or space, that is, the fact that the events are present at different times or places, and therefore, only after having had those peculiar experiences that are known as "time" and

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of response biases and other confounding factors, confirms the existence of a robust prior entry effect (Shore and Spence, 2004).

[10] Mach backs up his thesis by quoting Dvorak's experiments: "Dvorak has shown, in a series of experiments which he carried out at my desire, years ago, that this relation may be produced at will, the object on which the attention is centred appearing (even in the case of an actual tardiness of 1/8-1/6 of a second) earlier than that indirectly seen" (Mach, 1980, 112-113).

[11] For a critical and historical review of the philosophical explanations of time, see Ruggiu (1998).

"space". Likewise, how can one explain the existence of "periods" or the experience of something that "lasts" or "continues" without resorting to a "beginning" and to an "end", or to a "before" and to an "after", that is, without resorting to notions or concepts that already imply and presuppose the more basic experience of time? These difficulties led Kant to put forward the third fundamental conception of time as an *a priori* form of sensibility: by doing so, however, he definitely gives up and precludes any possibility of further analyzing time experience in positive terms. The current definitions given by dictionaries show that the problem of the circular explanation is not yet solved. These are, for instance, some of the definitions of time given by *The New Shorter Oxford English Dictionary* (1993):

1. A finite extent of continued existence; e.g. the interval between two events;
2. A period in history;
3. A period of existence;
4. A recognizable part of the year;
5. Duration conceived as having a beginning and an end.

As one can see, these definitions make use of words such as "continued" "period", "duration", "beginning" and "end" that unavoidably presuppose and imply the experience of time: the *definiens* includes the *definiendum*, the former cannot do without the latter and vice versa, and the circularity is guaranteed.

In my opinion, the first serious attempt at getting out of this kind of difficulty has been made by Ceccato (Ceccato, 1969, 1972, Ceccato & Zonta, 1980) who has always insisted on the necessity of looking for an a-linguistic counterpart of language, and of providing not so much a linguistic definition of the meanings of words as an operational one. In this view, he carried out many analyses of meanings in terms of attentional operations, including those of space and time (he symbolized with an S the single attentional state, and used the sign ‾ above the attentional states to indicate their combination and the order in which they are combined):

"Si prenda un oggetto molto piccolo, magari la pallina di una penna a sfera, e si cerchi di considerarla come 'spaziale'. Ci si accorgerà di doverla mentalmente rompere, articolare, almeno per un momento, in due pezzi, avvertendo in mezzo una specie di intervallo e continuando d'altra parte a sentire l'unità della pallina. Se traduciamo in termini operativi queste impressioni, descriviamo la categoria di spazio come composta da una cosa ($\overline{S\,S}$) e una pluralità ($\overline{S}\,\overline{S}\,\overline{S}\,\overline{S}\,\overline{S}$), ed è lo stato di attenzione centrale, del plurale, a generare la sensazione di intervallo. In altre parole diremo che lo spazio corrisponde all'articolare pluralisticamente 'cosa'. (…) La categoria di 'tempo' rovesci(a) la situazione: si parte cioè da una pluralità (pallina al tempo 1, pallina al tempo 2) e si 'restringe', unifica, condensa questa pluralità in 'cosa'" (Ceccato & Zonta, 1980, pp. 209-210) (I translate into English: "Take a very small object, such as the ball of a ballpoint pen, and try to consider it as being "spatial". You notice that, at least for a moment, you have to mentally break it down and articulate it into two pieces, feeling between them a kind of interval and continuing at the same time to sense the unity of the ball. If we were to translate these impressions into operational terms, we would describe the category of

space as being composed of a thing ($\overline{\S\S}$) and a plurality ($\overline{\S\S}\S\overline{\S\S}$), and it is the state of central attention, of the plural, which generates the sensation of an interval. In other words we would say that the category of space corresponds to articulating pluralistically 'thing'. (…) The category of 'time' inverts the situation: that is we start off with a plurality (ball at time 1, ball at time 2) and we 'narrow down', unify, condense this plurality into 'thing' ").

For Ceccato, then, the experience of time is opposed to that of space: it is an experience in which a situation that is composed of a plurality of events or objects, that is, where an event or object is mentally constructed (whether in the from of a perception, an idea or something else) more than one time, turns into a situation composed of a single event or object. Ceccato's analysis rightly points out one of the fundamental features of time experience: the fact that when we see an object from the temporal point of view, or when we live a situation as unrolling or evolving in time, we *repeatedly* experience that object or situation, we perceive, see, imagine, consider or think about it more times. This analysis however, while representing a first important attempt at describing time experience without using elements that in their turn derive from and are built on time experience, is unable to account for at least three fundamental features of time experience:

a) the fact that by means of time experience we are able to order events, that is, to establish that a certain event A comes before event B. Ceccato leaves completely the explanation of our capacity to order events to the intrinsic *succession* or *sequence* of the two categories of "thing" ($\overline{\S\S}$) composing the category of "plural" ($\overline{\S\S}\S\overline{\S\S}$): the order in which events occur is determined then by the bare succession or sequence of the categories of "thing". In fact, he mentions: "ballpoint at time 1, ballpoint at time 2", without explaining how it is possible for us to determine "time 1" and "time 2", that is, how we can construct, perceive or conceive of a given event or object as occurring at "time 1" instead of at "time 2". But how can a succession or sequence explain time order? To have a succession or sequence of things or events we must have a "before" and an "after", or a "now" and a "then", or a "here", and a "there": one thing or event must follow another in time (or in space), and we must know what "to follow" means and implies, otherwise we could neither see, perceive or conceive of a temporal (or spatial) succession or a sequence of things or events, nor a bare a-temporal and a-spatial one ("first", "second", third", and so on), but only have a kind of experience such as "one thing, another thing, still another thing, and so on". The very notions and experiences of succession and sequence rely on the more basic experiences of time and space;
b) the fact that our evaluation of the duration of a given period - say, an hour – depends on how much attentional energy we have spent either to perform a given activity during that period (as Mach notices, for instance, during severe effort of attention time is long to us, during easy employment short), or to focus on or evaluate time itself (as James observes: "a day full of

waiting, of unsatisfied desire for change, will seem a small eternity […] It comes about whenever, from the relative emptiness of content of a tract of time, we grow attentive to the passage of the time itself", James, 1983, p. 589[12]);

c) the fact that psychological time moves only in one direction.

Another researcher who has put forward an analysis of time in terms of attentional operations is Vaccarino (Vaccarino, 1981, 1997). In Vaccarino's intention, his analysis of time should explain: "la tradizionale metafora del tempo come di un *aliquid* imponderabile che scorre irreversibilmente, procedendo con lo stesso ritmo" (Vaccarino, 1997, p. 38) (I translate: "the traditional metaphor of time as a weightless something that flows irreversibly, going on with the same rhythm"). Apart from the difficulties that in general I personally have in understanding and testing Vaccarino's analyses – to carry out his analyses he adopts a highly formalized system, based on the moments of "active attention" and "interrupted attention", that not always lets one easily control the rightness of his results, so that one can only intuitively feel their soundness -, his analysis of time:

"TE = v^g = $\overline{O\Delta}$ = /TEMPORALE/" (Vaccarino, 1997, p. 38)

seems, as far as I can understand it: a) to leave out, and not to consider, that fundamental feature of time experience that makes us evaluate the duration of a given period of time according to the level of attentional energy we have spent during that very period; and b) to leave to the succession of the attentional moments the task of explaining our capacity to give a temporal order to our conscious experiences: in fact, TE, that is, "temporal" is a: "passaggio 'v' che metamorfizzandosi in 'g' si rende aggiuntivo" (Vaccarino, 1997, p. 38) (I translate: "temporal" is a "passage 'v' that metamorphizing in 'g' becomes something additional"). Also Vaccarino's analysis, then, does not overcome the difficulties raised by Ceccato's analysis.

Benedetti's proposal (Benedetti, 2001, 2005) of considering the variable duration of the attentional state as the basis for the construction of categories and words related to or involving time - such as the grammatical category of verbs, "moment", "instant", "when", "while", and so on - is patently a circular explanation of time. It explains time by using terms and concepts (the attentional state has a variable "duration"; attention can be focused on objects for a "variable amount of time") that are already temporal categories, that is, terms and concepts that contain and are built on time

[12] This latter kind of duration judgement is known also as "prospective duration judgment" or "experienced duration". On its dependence on attention, see Block and Zakay (2001) and Tse et al. (2004). As Block and Zakay point out: "most theorists propose attention-based models of experienced duration (…) In these models, experienced duration increases to the extent that a person allocates more attentional resources to processing temporal information" (Block and Zakay, 2001, pp. 68-69).

experience: as such, they cannot explain time, but can only be explained by resorting to the notion of time. Benedetti's proposal encounters, then, all the problems that any circular explanation raises: if we explain time experience in terms of the variable duration of the attentional state, how can we explain the variable "duration" of the attentional state? The conscious experience of "duration" can be explained only by resorting to notions such as "beginning" and "end", that is, notions that to be explained require the more fundamental experience of time. Moreover, Benedetti's analysis, like Ceccato's and Vaccarino's, is also not able to account for the main features of time experience (its dependence on attentional energy expenditure; counterclockwise error).

Mach's suggestion that "we feel the *work of attention* as time" seems to me, then, the only proposal that at present can offer a valuable solution to the problem of exhaustively and coherently describing time experience in terms of attentional operations. In fact, it affords an explanation of the main features of time experience (the irreversibility of psychological time; the possibility it implies of ordering events and conceiving of successions and sequences; the dependence of duration judgment on attentional spending) based on the consumption of attentional energy, thus avoiding those circular explanations that have characterized the attempts made until now of analyzing time by means of attentional operations.

Conscious experiences resulting from the operations, performed by the other organs, on the products of the activity of the organ of attention

This kind of conscious experience arises when the products of the activity performed by the organ of attention - that is, other conscious experiences - are combined, used to form other mental constructs, or further worked out thanks to the activity performed by one or more other organs. We all commonly experience, for instance, the possibility of comparing things: we can see and say that a given person is "taller" than another, or that a given food is "saltier" than another. This possibility has even been grammatically formalized in our languages by means of the comparative forms. We do not know how it works: we simply look at things, or consider them, and find that we are able to say: "A is more interesting than B", or "A is more beautiful than B". We are conscious of the starting situation ("A" and "B") and of the final situation ("A is more interesting than B"), but we are not aware of the mechanisms that allow us to get from the former to the latter. We can therefore only formulate some hypothesizes about what these mechanisms are and what kind of operations they perform. One can assume, for example, that in order to perform a comparison there must be at least a memory system that stores the conscious information concerning the comparison term ("B"), and a mechanism that measures the thing to be compared ("A") against the term of comparison. The

important thing to know, anyway, is that, whatever these non-conscious mechanisms are, they are nevertheless necessary to get the comparison between A and B, and that attention alone is not sufficient: without these non-conscious mechanisms we will never be conscious of the differences between A and B.

There are many kinds of operations that can be performed on the products of the activity of the organ of attention, and consequently many kinds of conscious results that can be obtained. We can perform some quite abstract operations, such as: refer a thing, object or event, say A, to another one, say B; evaluate A on the basis of B; integrate a sequence of attentional operations, say A B, into a new single item, say C, a phenomenon known in psychology as *chunking* (Miller, 1956); abstract what is common to A and B, thus getting a new superordinate category, say α; add A to B; subtract A from B; multiply A by B; divide A by B. But we can also perform some more concrete, perceptible operations, such as: turn a pure mental construct, such as a meaning, into a mental image or a perceptible representation; elicit from a given conscious experience ideas, representation, emotions, desires, etc., by means of free association; imagine something that has not yet occurred, or mentally represent how a given situation could evolve, what form a certain object will assume (an experience that has been variously tested and analyzed by psychologists: see, for instance, the experiment on the mental rotation of a three-dimensional object reported by Shepard and Metzler, 1971); and so on. Undoubtedly, the production of such images or representations requires a mechanism able to combine and work out the perceptive material stored in memory. These kinds of representations or images must not to be confused with the representations or images we get by simply focusing our attention on our memory system, that is, with the first of the four kinds of conscious experiences we are describing, those determined by the direct application of attention to the other organs. While the representations we get by focusing our attention on our memory system *reproduce* in a simplified way something we have already experienced, the representations we get by elaborating and further working out the perceptive material stored in our memory system *produce* something new, allowing us to anticipate future events and even what we might never have seen before: a difference well known to psychologists (see, for instance, Denis, 1991).

All the operations that are performed on the products of the activity of the organ of attention by one or more other organs are identified and designated by the words “to think”, “thinking” and “thought”. Not all authors, however, share this opinion. For Ceccato and Zonta (1980) these words refer only and specifically to that kind of activity, or to the results of such a kind of activity, by means of which we mentally connect things – whether they are meanings, images, ideas, thoughts or feelings -, relating one thing or group of things to another. They conceive of thought as a

correlational or combinatorial activity that allows us to relate or connect a given mental construct A with a mental construct B via a certain kind of relation C. Undoubtedly, in most of the cases, when we think we correlate things to each other, and we do this for many purposes: to measure the distance between things, to assess their mutual size or quality, to infer one from the other, to establish a causal relation between them, to combine them, to separate them, etc. Many kinds of relationships can then be set between things: causal ("A is due to B", "Because of A, B lost his job"), spatial ("B stayed in front of A"), temporal ("A arrived before B"), logical ("If A, then B"), physical, psychological, aesthetical, and so on. Considering the predominance and importance in our everyday life of the correlational thought, and that the manifold diversity and variety of relationships that can be set between things is reducible to a general, basic form of activity, that is the correlational one, it is easily understandable why one can be led to suppose that thought has this very specific form.

However, Ceccato and Zonta's definition of thought and thinking as a purely combinatorial or correlational activity seems too limited to me: it does not cover all the various and different instances of thought experience. This is due to several reasons.

Firstly, we use the words "thoughts" and "to think" to indicate some other kind of mental activity that can hardly be conceived of as a combinatorial or correlational one. Sometimes we use the verb "to think" as synonymous of "calling to mind", "remembering" or "directing one's attention to something" as in: "He thought of his father"; sometimes as synonymous of "occupying one's mind with something" as in: "I can't stop thinking about her". In all these there is no correlational activity at all: we call to mind a thing, direct our attention toward a thing, have in mind and cannot get free from a thing, but do not correlate that thing to, or combine it with, something else. What our attention is doing is moving toward a thing, or trying to escape from it, but not relating it to something else.

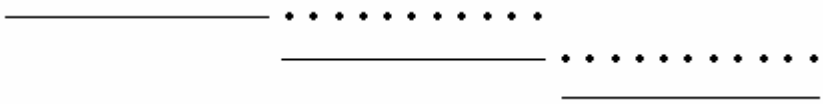
Secondly, it does not account for some instances of the visuo-spatial thought. When we think, for example, about a flower in the act of opening, an image that is usually shown in naturalistic documentaries, or how clouds change their form, we are not relating things to each other: we are simply applying a certain transformational rule to the object of our thought (the flower, the cloud). We do not relate the flower (or the cloud) at time T_1 to the flower (or the cloud) at time T_2. We do not segment our experience into parts that we combine by means of a conscious relation; on the contrary, our experience assumes a sense of uninterrupted continuity.

Thirdly, despite describing how two things can be combined, it does not account for the possible result of the combination. When we add 2 and 3, we get 5. The correlational conception of thought describes how it is possible to relate a certain thing to another thing, but it does not show either that

that specific relation can produce a certain result, or how that specific relation produces that result. It describes how 2 can be combined with 3, but it does not show either that this combination makes 5, or how the combination makes 5. The correlational conception of thought specifies what position the mental constructs occupy in the correlation, and the sequence in which they occur. It does not consider the propulsive, driving and pushing forward aspect of thought, that is, the fact that a correlation of things, but even one single thing, can produce, cause, recall, evoke, and summon up another thing. While it provides a description of the way the various mental elements follow one another in the correlation, it does not provide a description of the way the combination of these various elements produces, or can produce, a certain effect, consequence, outcome, etc.

Furthermore, Ceccato and Zonta's account of the correlational activity of thought raises two kinds of difficulty. Firstly, their hypothesis (derived most probably from the belief that all instances of thought can be reduced to the general, basic form of correlation) of the existence of a specific organ of thought having the specific function of correlating mental elements seems highly implausible. Ceccato and Zonta (1980, pp.62-63) state that:

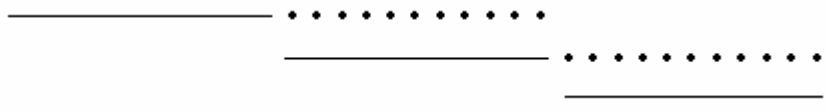
"Se vogliamo dare un organo suo al pensiero, lo possiamo immaginare come un combinatore (di) microunità. La combinazione minima ne contiene tre ed esse sono sempre differenti fra di loro per il momento occupato nello svolgersi del pensiero, sicché ognuna ne esce caratterizzata, anche se da nessun'altra particolarità, da questo momento ad essa assegnato nella combinazione. Ecco i tre momenti. La prima cosa viene mantenuta presente all'aggiungersi della seconda, che a sua volta è mantenuta presente all'aggiungersi della terza, che viene così a prendere il posto della prima, a succederle. Ecco i tempi in uno schema rappresentativo:



ove la linea punteggiata indica il mantenimento della unità che porta questa a trovarsi in parte compresente con le altre (…) Ma per maggiore facilità adottiamo una schematizzazione forse meno corretta ma più immediata, topologica, in cui l'unità presente unitamente alle altre due occupa una casella superiore, e le altre le due inferiori, di lunghezza dimezzata:

Una seconda particolarità di queste combinazioni triadiche è che l'unità presente con le altre due, e così "a cavallo" loro, è sempre costituita da un rapporto posto fra le due dall'attenzione (…) Per le tre unità costitutive di una correlazione, di questa unità minima del pensiero, si sono adottati i nomi di: 'correlatore' per l'unità a cavallo delle altre due; 'correlato 1°' per l'unità presente per prima; e 'correlato 2°' per l'unità presente per ultima". (I translate into English: "If we want to give an organ to thought, we can imagine it as a combiner of micro-units. The minimum combination is made up of three units and these are always different from each other because of the different moments they occupy while producing the flow of thought. In this way each one of them is characterized, even though by no other particularity, by this moment assigned to it by the combiner. Here are the three moments. The first thing is kept

present as the second is added, which in turn is kept present as the third is added, which then takes the place of the preceding one,. Here are the times represented in a diagram:



where the dotted line represents the maintaining of the unit in such a way that it is partly concurrent with the others. But to make things clearer let's adopt a maybe less correct but more immediate, topological, diagram in which the unit present together with the other two occupies the upper box, and the other two the lower box , of half the length:

A second particularity of this triadic combination is that the unit present with the other two, and therefore straddling them, is always made up of a relationship between the two as a result of attention (…) The following names have been adopted for the three units which make up a correlation, of this minimum unit of thought, *correlator* for the unit straddling the other two; 1st *correlatum* for the first unit present; 2nd *correlatum* for the second unit present").

Undoubtedly, Ceccato and Zonta supply here a general description of the way correlational thought unfolds and develops in time that, in so far as it concerns the order in which the various mental elements follow one another, seems to me quite sensible and clear (but I cannot say the same of their description of the way the mental elements overlap, for the reasons that will soon become clear). However, their proposal of the existence of a specific "organ of thought" is quite questionable. Why should we resort to such an additional, specifically dedicated organ as the "organ of thought" to account for a function that can be as well carried out thanks to the joint and coordinated action of some other organs that were originally designed to perform other, more basic functions? Why should nature have developed an extra, specific organ to perform a certain activity when that same activity could be performed equally well by the organs already existing? One should remember in these cases the dictum: *Natura non facit saltus.* As I showed in my analyses (Marchetti 1993, 1994), in order to produce such "correlating elements" (Italian: "correlatori") as the conjunction "and", the "noun-adjective correlation" and "noun-verb correlation", you do not need a specific "organ of thought": you can get them by means of more basic, primitive, multi-function organs, such as memory and a measurement or comparison system. Therefore, rather than proposing an organ of thought dedicated to a specific function, as Ceccato and Zonta did, it seems more sensible to opt for a solution of a system or set of different and distinct organs, each one devoted to performing a generic function, that can independently, when necessary, be used to originate and produce different kinds of "correlating elements", operators, and the like.

Secondly, Ceccato and Zonta's account of the thought process in terms of the overlapping of mental elements turns out not to be a proper explanatory means. They do not clearly specify whether this overlapping implies that the two mental elements are both consciously present, or that only one of them is conscious and the other is unconscious. In either case, however, their account is not satisfactory. Indeed,

1. in the former case, the overlapping of simultaneous conscious elements conflicts with evidence from both what one can subjectively, personally experience and what laboratory research shows: it is not possible to be conscious of two different scenes, however complex they may be, or contemporaneously think about two or more different things or have or keep in mind two or more ideas, concepts, or meanings. Moreover, as shown by the PRP (Psychological Refractory Period) effect, central, post-perceptual stages of mental processing are subject to a single-channel bottleneck. When people try concurrently to select and produce two independent speeded responses (task 1 and task 2), central processing limitations arise: the decision-related stages of task 2 cannot commence until the corresponding stages in task 1 have been completed. Planning one response delays planning of another, even when the person attempts to produce both as fast as possible. This queuing arises when tasks involve post-perceptual processing such as planning of actions, perceptual comparison, mental rotation, and memory retrieval[13]. As Pashler observes: "It seems probable, therefore, that many operations that comprise thinking are limited to taking place one at a time" (Pashler, 1998, p. 404).
2. in the latter case, the fact that there are unconscious mental elements or operations that occur at the same time as the conscious ones, despite being highly plausible from a psychological point of view, does not represent *per se* an *explanation* of how they can interact, connect or relate, but only a superficial and likely, though to be ascertained, *description* of the phenomenon: indeed, the co-occurrence may be a simple and accessory consequence of a more basic process. Different and various unconscious mental operations can take place in our brain contemporaneously, and they can occur at the same time as the conscious ones, but this does not necessarily imply that there is a causal or actual relationship or link between them. Phenomena can co-occur without being, for this only reason, correlated.

Also Libet (2004) stresses the importance of the overlapping of mental elements, but for another reason: it will avoid breaks in the stream of consciousness, and more precisely, in the stream of thoughts, the feeling of continuity in sensory experiences being assured by what he calls the

mechanism of "automatic subjective referral" (Libet, 2004, p. 113). Apart from the implausibility of the simultaneous occurrence of several different conscious non-sensory experiences and more in general postperceptual events, implausibility that has been revealed by the PRP effect (Pashler, 1998) and that speaks against the overlapping in time of thought events, Libet's hypothesis seems untenable even for another reason. If the feeling of continuity we experience in our stream of consciousness was to be determined only by the overlapping in time of conscious events, it would be impossible to explain why the gaps created by dreamless sleep, anesthesia or some other kind of interruption are not experienced directly as such, that is, as gaps of consciousness, but indirectly, as a conscious experience of having lost consciousness. As Evans observed (1970, p. 185): "It is only by inference that we know that we have been unconscious, or by being told of this by someone else. In a sense, therefore, consciousness does not record its own interruptions, but gives the impression of being unbroken, although it is not". No one can be conscious of being unconscious. The feeling of continuity is assured even when there is an actual temporary interruption, due to either sleep, anesthesia or some other reason, in our conscious life, that is, when it is absolutely impossible that an overlap of conscious events occur.

Our subjective feeling of a smooth flow in a series of thoughts, and more in general of all the other kinds of mental elements, does not depend so much on the overlapping of such elements, as I tried to show (Marchetti, 2001), as on a more complex interplay between what I called "the schema of self" and the "perceptual system". Our schema of self is continuously modified according to what we consciously perceive, and, conversely, we consciously perceive what our schema of self occasions. Every action we perform is a direct consequence of our previous conscious experience. The existence of an uninterrupted sequence of single units of conscious perception, the Jamesian stream of consciousness, is secured precisely by the fact that the previous units play a direct, causal role in the production of the following ones. The consistency and coherence of the stream is ensured by the schema of self that tends to run the perceptual system and the organism in general according to a hierarchy of principles, goals and rules at the top of which there is one fundamental principle: the principle of survival, which can operationally be translated into the following imperative "operate in order to continue to operate".

Apart from the specific difficulties raised by the description of thought in terms of an overlapping of mental elements, the definition of thought as a purely correlational activity is anyway too restrictive. The correlational thought is certainly an important kind of thought, probably the most important one, and it can certainly be described by means of a general form, but it is just one kind of thought. By defining thought only as a correlational activity, Ceccato and Zonta seem to

[13] Below some threshold of processing demand, many *perceptual* elements can, on the contrary, be processed in parallel

have made the same kind of mistake they attribute to other authors (Ceccato and Zonta, 1980, p. 68): that of confusing a specific kind of thought with the general structure of thought, which is tantamount to defining music through, or as, one of its particular species, such as a sonata or a fugue.

In my view, the correlational thought is a particular species of a more general class of conscious experiences: a class identified by, and composed of, the conscious experiences that arise when the product of the activity performed by the organ of attention (that is, an earlier conscious experience) is worked out by some other organ. We could represent this more general form of thought as follows:

$$op \rightarrow \mathbf{C} \Rightarrow \mathbf{C_1}$$

where C_1 represents the conscious experience that arises as a consequence (=>) of the operation (*op*) unconsciously performed (→) on an earlier conscious experience C. It is important to notice that while the operation on C is performed by an unconscious mechanism (we do not know what kind of operations our mind performs when we add 2 and 3: the only thing we are aware of is that we get 5[14]), the instruction to perform it may be either consciously given or unconsciously occasioned (we can deliberately decide to add 2 and 3; but a certain idea or sensation can come to our mind because of free association, without any deliberate input).

This way of representing thought accounts for and covers all the instances in which:

a) we perform any kind of operation on a conscious experience. When we "think of" someone, in the sense of directing our attention toward someone, we perform a certain operation *op* (direct our attention toward) on (→) someone (C); as a consequence (=>) we will have the image of that someone (C_1) in our mind. Likewise, when we "think about" an opening flower, we apply a certain transformational rule *op* (open) to (→) a flower (C); as a consequence (=>) we will imagine an opening flower (C_1);
b) we produce a conscious experience from an earlier one. When we evoke a sensation by means of free association with an image, we produce (=>) a given sensation (C_1) by operating on (→) an image (C) applying a certain association rule (*op*). When after seeing some dark clouds, we think that it will rain soon, we produce (=>) the idea that it will rain soon (C_1) by performing some

without evident capacity limits (Pashler, 1998).

[14] Most probably, when adding 2 and 3, our mind does not perform the sort of real mathematical operation a calculator or a computer does, but simply retrieves from memory the result that we learnt by heart when we were first taught maths.

kind of inferential operation (*op*) on (→) the perceived dark clouds (C). When adding 2 and 3 we get 5, we perform a certain operation *op* (add 3) on (→) 2 (C), having 5 (C_1) as a result (=>);

c) we relate things to each other. If for instance we want to compare someone (John) with someone else (his wife) to see who is taller, we will perform a certain operation *op* (compare against John's wife) on (→) John (C) that will give as a result (=>) "taller" (C_1): which will be expressed by a sentence like: "John is taller than his wife". If we want to consider or analyze the consequences of smoking tobacco, we will perform a certain operation *op* (analyze the consequences of smoking) on (→) tobacco (C) that will give as a result (=>) "cancer" (C_1): which will be expressed by a sentence like: "Smoking tobacco causes cancer" or "Smoking means cancer". If we want to describe who is with John, we will perform a certain operation *op* (describe who is with) on (→) John (C) that will give as a result (=>) "Mary" (C_1): which will be expressed by a sentence "John is with Mary" or "John and Mary".

Obviously, the new conscious experience $\mathbf{C_1}$ (for instance "Cancer", in "Smoking tobacco causes cancer") can in turn be further operated on:

$$op \rightarrow \mathbf{C_1} \Rightarrow \mathbf{C_2}$$

giving rise to a new conscious experience $\mathbf{C_2}$ ("Stop smoking"), which can be operated on in turn. The road is thus opened to the possibility of forming long and articulated thoughts. This potentiality allows us to develop our thoughts along infinite, different lines, or towards infinite, different directions and dimensions. Most probably just because of the relevance this potentiality has for the cultural and scientific development of human society, human beings contrived and developed in their history dedicated linguistic and symbolic tools designating specific ways of operating on conscious experiences, producing new conscious experiences from earlier ones, and relating conscious experiences to each other. Conjunctions, prepositions, the subject-verb correlation, the noun-adjective correlation, mathematical and logical operators, and the like have precisely these functions.

In this section we have analyzed at some length the operations that can be performed on the products of the activity of the organ of attention: these operations are generally designated by the words "to think" and "thought". We have seen that attention alone is not sufficient to perform such kinds of operations. Some other organs are needed, such as memory, a comparison system, and a representational system: they perform those unconscious operations on the products of the

attentional activity that allow us to produce new conscious experiences from earlier ones, and relate conscious experiences to each other: in a word, to think.

Conscious experiences resulting from activities that are triggered, organized and controlled by earlier conscious mental acts

This kind of conscious experience arises as a consequence of previous conscious mental states such as decisions, volitions, desires, intentions, plans, interests, motivations, aspirations, necessities, possibilities, and so on (from now on, for sake of brevity, I will call them "intentional states"): that is, mental states by which we purposefully deliberate to do things, move, work, think about things, imagine, perceive, etc. Even though this fourth kind of conscious experience may resemble in some way the first and the third kind of conscious experiences described above, it actually differs from them. Indeed, while the first kind shows how we can consciously experience perceptions, images and memories, and the third kind how we can consciously experience thoughts and elaborate representations, this fourth kind shows how we can consciously *decide, will, intend, plan, etc*. to consciously perceive, represent, remember, and think. Moreover, it encompasses also all those cases that are not comprised by the other two kinds of conscious experiences, that is all the occurrences in which we put into action plans, ideas or intentions that do not have as their primary goal that of eliciting physical sensations, or of further mentally work out previously produced mental constructs, but something else: for instance, performing physical actions such as walking, sitting, moving hands, arms, etc.

There are three main kinds of conscious experiences that arise as a consequence of an intentional state:

1. The first is represented by all those conscious experiences that are intentionally and explicitly triggered by the intentional act: if I decide to eat something, I will have the experience of eating something.

The other two are a sort of by-product of the act performed intentionally: they are not intentionally and explicitly produced, but nonetheless they accompany almost every intentional act:

2. The second is represented by all those conscious experiences - physical sensations, emotions, feelings, thoughts, ideas, etc. – that unavoidably accompany, follow on, and are strictly relevant to, the specific activity triggered by the intentional state. If we decide to stand up and walk, for

instance, we will have not only the experience of standing up and walking, but also some other accessory, unwanted and unexpected experiences: we will see things from a different perspective, we will feel more tired than before, or perhaps we will have a temporary sense of dizziness.

3. The third is represented by those conscious experiences that still more indirectly, yet in a more profound and fundamental way than the second, qualify the activity triggered by the intentional state. In fact, these conscious experiences make us aware of the fact that, by means of our conscious activity, we can govern and exert a voluntary control over our own actions, affect the course of our own actions, set our own aims and objectives, and choose what to do next: in a word, become self-conscious. The recurring and frequent experience that a given intentional state, for instance the intention to stand up and walk, has, or has not, produced the desired effect or course of actions, makes us aware of the fact that "if we want to stand up and walk, we can" or that "we are able to stand up and walk". Usually, this kind of self-awareness is expressed by means of the auxiliary verbs "may", "can", "must", "need", "shall", and "will", or by means of verbs such as "to want", "to have to", "to be able", "to chose", and "to intend". These conscious experiences can then be considered as a kind of *meta-conscious experiences*.

All these three kinds of conscious experience, despite being prompted by a previous operating of the organ of attention, cannot arise and take place without the involvement of some other different organ. Without, for instance, the musculoskeletal system, we could never perform those physical actions we want or have to do, and therefore we could never experience the causal link between our decision to perform a given action and the performance of that very action. Likewise, without what I have called the "schema of self" (Marchetti, 2001), we could never attain self-consciousness. The appearance of self-consciousness is originally made possible by the uninterrupted interaction between the subject's "schema of self" and its "perceptual system" (Marchetti, 2001). The perceptual system makes it possible for us to be conscious, whereas the schema of self provides the innate and acquired unconscious rules that make us perceive, move, act, behave, and live in general. Our behavior and activities are primarily regulated and determined by the set of unconscious rules, principles, and schemata incorporated in our schema of self. Every conscious perception affects the schema of self, modifying and updating it. Every modification of the schema of self implies a new particular instruction to the perceptual system and in general to the organism (as we have seen, this uninterrupted interaction of the schema of self and the perceptual system assures the existence of the stream of consciousness). The fact that the schema of self is updated and fed by the perceptual system implies the notion that what we consciously perceive

plays a causal role in our behavior. Among the other things, the schema of self also gets to learn and embody this notion. From that moment on, the fulcrum of almost all our decisions, strategies and choices move from our schema of self to our consciousness: our behavior and activities will be governed and controlled not so much by our innate instincts as by what happens in our consciousness.

Anyway, it is important to notice that the involvement of organs different from the organ of attention, such as the "schema of self", while being necessary for the production of conscious experiences associated with self-consciousness - that is, those that are usually expressed by means of verbs such as "may", "can", "must", "need", "shall", "will", "to want", "to have to", "to be able", "to chose", and "to intend" –, is not sufficient. Indeed, the conscious experience of volition differs from one of duty, or possibility, despite the fact that both share the necessity, in order to occur, to involve organs different from the organ of attention: when we say: "I want to work", we express a conscious experience that is quite different from that which we express when we say: "I have to work", or "I can work". What is it that makes them differ? What is it that characterizes a conscious experience of volition as such? A conscious experience of volition is built on the same structure on which is based a conscious experience of duty, or of any other intentional state: a certain intentional state causes a certain action. What differs between these various conscious experiences is the different stress each of them lays on the intentional state prompting the action and the action it prompts. By definition, these differences in stress can only be determined by the activity of the organ of attention: they cannot be ascribed to any other organ. Conscious experiences associated with self-consciousness can therefore be produced only thanks to the common activity of the organ of attention and the other organs.

Let's analyze more in detail some of these conscious experiences, trying to identify what implications they have for our attention: how does each of them pilot our attention? Toward what does each of them draw our attention? Let's start with a "neutral" situation, where no intentional state is implied, for instance: "I open my hand". Now compare this situation with one where our action is guided or prompted by an intentional state, such as: "I can open my hand". We immediately feel a difference. Let's try to describe this difference in attentional terms: where does our attention go? What does our attention do? The use of "can" implies a specific stress on the action prompted by the intentional state: it underlines the fact that we have no problem in opening our hand, if only we desire to do that. Now let's try with a different kind of intentional state: "I want to open my hand". The attention is brought here not so much on the action prompted by the intentional state, as on the intentional state itself: the verb "want" specifies that we have no problem in mentally triggering or activating our intentional state because the act of triggering or activating it

depends completely on us (but it does not specify whether the action can be as easily prompted: indeed, one thing is to want to do something, quite another to be able to do what one wants to). Also the sentence: "I must open my hand" focuses our attention primarily on the intentional state: it does not state anything about our actual capacity to perform the action. However, unlike "to want", "must" underlines that the intentional state, and its activation, depends not so much on us as on someone or something else.

We can also extend this analysis to other verbs and languages. Table 1 shows some of my tentative, coarse comparative analyses between the main English, German, French and Italian verbs expressing volition, duty and capacity. If we divide the common structure on which these kinds of

Italian	**French**	**English**	**German**	**The intentional state prompting the action**	**The actual action prompted by the intentional state**
Potere	Pouvoir	Can, To be able to	Können		The actual action depends solely on the subject's capacity
		May, Might	Dürfen		The actual action depends on the permission given to the subject
Volere	Vouloir	To want	Wollen	The act of triggering the intentional state depends on the subject	
		Would like	Mögen	The action depends on the subject's intentional state	
Dovere	Devoir	Must, To have to	Müssen	The act of triggering the intentional state does not depend on the subject but on an external authority/obligation	
		Shall, should, ought to	Sollen	The act of triggering the intentional state does not depend on the subject but on an external advice/convention	

Table 1

conscious experiences are based into its two main parts, that is: a) the intentional state prompting the action (what one intends to, wants to, desires to, can, must, etc. do), and b) the action that is actually prompted by the intentional state (what one actually does as a consequence of one's

desires, intentions, necessities, etc. to do), we can easily specify toward which part each specific conscious experience draws our attention, and for what purpose.

Conclusion

In this article we have seen that the fundamental tool we have to analyze the meanings of words is our consciousness. Meanings are conscious experiences, even if of a particular kind: they differ from other kinds of conscious experience - such as perceptions, images, memories, and so on - in that they isolate, condense, freeze, and reduce the manifold and ever changing flow of our conscious life in a stable, decontextualized and shared form; moreover, they do not possess the same rich phenomenal quality that characterizes the other kinds of conscious experiences.

The meaning of a word is composed of a sequence of elements: the invariable elements that, independently of any individual, specific conscious experience the meaning can prompt, are at the core, and are responsible for the production, of any instance of that conscious experience. The elements composing the meanings of words are attentional operations: each word conveys the condensed instructions on the attentional operations one has to perform if one wants to consciously experience what is expressed through and by it.

Being a conscious phenomenon, the meanings of words can be accessed directly through consciousness: we can consciously distinguish a meaning from the other meanings. By comparing the meaning of a certain word with the meanings of other words, we can isolate the minimum conscious elements that compose it, and identify the sequence of these elements. Once the elementary conscious experiences that compose the meanings of words have been identified, it is possible to describe them in terms of the attentional operations that are responsible for their production.

However, an exhaustive and complete account of the attentional operations that compose and produce the meanings of words also requires the description of the unconscious or non-conscious operations that serve either as the support that makes it possible for the attentional operations to take place and to be completed, or for them to occur in a certain way, or as the necessary complement that makes it possible to execute and implement the activities determined and triggered by earlier conscious experiences.

We have proposed a taxonomy of such unconscious or non-conscious operations, and of the relevant organs, based on the kind of conscious experience that the specific relationship existing between the organ of attention and the other organs produces. We have identified four fundamental kinds of conscious experiences:

1. conscious experiences that are determined by the direct application of attention to the other organs;
2. conscious experiences that are determined by the direct or indirect influence on the organ of attention of some other organs, independently of whether or not attention is applied to them;
3. conscious experiences resulting from the operations, performed by the other organs, on the products of the activity of the organ of attention;
4. conscious experiences resulting from activities that are triggered, organized and controlled by earlier conscious mental acts.

Each one of these four kinds of conscious experience is elicited and produced by the joint activity of the organ of attention and the other organs. Accordingly, we can identify four kinds of unconscious or non-conscious operations:

1. those performed by the sense organs, the propriocetive system and memory that elicit most of the physical sensations and perceptions we have (tactile, visual, auditory, olfactory, gustative, proprioceptive);
2. a) those performed by the interoceptive system, the internal milieu and viscera, nociceptors, and all those substances (such as hormones, neurotransmitters, neuromodulators) that elicit physiological states such as pain, pleasure, thirst, huger, and tiredness, and psychological states such as emotions, moods, and impulses.
   b) those represented by all the automatisms, schemas, frames that we have acquired and learnt during our life and that make us perform complex activities such as driving and playing games;
3. those performed by organs such as memory, comparison systems and representational systems that allow us to variously combine our conscious experiences and to relate conscious experiences to each other: in a word, to think;
4. those performed by organs such as the musculoskeletal system and what I have called the schema of self. They allow us to intentionally plan and perform actions and activities, and to have those conscious experiences that are associated with self-consciousness: that is, those that make us aware of the fact that, by means of our conscious activity, we can govern and exert a voluntary control over our own actions, affect the course of our own actions, set our own aims and objectives, and choose what to do next.

The identification of these kinds of unconscious and non-conscious operations is essential for an exhaustive analysis and description of the elementary attentional operations that compose the meanings of words, and the way these attentional operations are combined. Without them it would be practically impossible to account for the different ways attentional operations take place, can be combined and related, give rise to other conscious states, can be modulated and controlled by earlier conscious states. They represent the necessary complement and counterpart of attentional operations in the construction of most of, if not all, meanings.

The taxonomy I have proposed helps us classify words in relation to the kind of unconscious or non-conscious operations we have to resort to when analyzing their meanings. Following such a taxonomy, we can classify words according to whether they refer to conscious experiences of:

1. exteroceptive and proprioceptive sensations, such as colours, sounds, tastes, smells and movements; sensations related to space; physical objects, beings, events and activities;
2. a) interoceptive sensations, such as thirst, hunger, tiredness, and sexual desire; sensations of pain, pleasure and time; innate psychological states and activities, such as emotions, feelings, moods;
   b) culturally acquired psychological states and activities, such as motivations, intentions, expectations, desires, interests and aspirations; complex activities that, to be performed, require learnt schemas, frames, and automatisms;
3. thought activity and the products of such activity, such as conjunctions, prepositions, relative pronouns, the name-adjective correlation, the subject-verb correlation, logical and mathematical operators, articles, the singular and plural forms, indefinite adjectives and pronouns, abstract nouns, verbs referring to abstract actions, etc., that is, most of what Ceccato has defined as "mental categories"[15]; or:
4. meta-mental activities, usually identified by verbs such as "may", "can", "must", "need", "shall", and "will", "to want", "to have to", "to be able", "to chose", "to plan", and "to intend".

Although this list is not exhaustive – many words cannot be exactly classified in this list, because they result from the combination of different kinds of unconscious or non-conscious operations – and has only to be considered as a first approximate attempt at classifying words according to the kind of unconscious or non-conscious operations that are involved, I think it represents anyway a good basis for future research work and analyses on the meanings of words.

[15] See Ceccato, (1969), Vaccarino (1974) and Benedetti (2001).

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