THE RIGHT HEMISPHERE OF COGNITIVE SCIENCE

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Introduction[1]

The aim of the present study is to establish a theoretical connection between the brain, or more precisely the scientific concepts describing it, and the everyday and scientific expressions referring to the mental world. These expressions often circulate around dichotomies common in Western philosophy and thinking, like emotional–rational, mind–heart, or body–soul. Their connotations are deeply embedded in everyday language; however, they are often hard to notice. Still, they profoundly influence the perception, understanding, and interpretation of mental functions. The main question is the following: could the structure of such concepts originate from human cognition, and from the architecture of the nervous system?

Independently of the philosophical question whether the concepts addressing mental phenomena are somewhere "outside" in the world – as proposed by reductionism, e.g., Ryle (1949) – or produced somehow "inside" the mind – according to Berkeley's solipsism – it is possible that these dichotomies are a "by-product" of our mental system. For example, the left and right hemispheres employ different sets of processes, such as propositional versus appositional (Bogen 1969), to address the diverse task demands of the environment. Such a neural division of labor might provide essentially different perspectives on the world which are well known to all of us, but most individuals do not master both of them equally well.

Broadly speaking, most concepts describing the three spatial dimensions of the nervous system seem to be bound to the traditional philosophical dichotomies: emotion and reason (for right and left hemispheres), cognition and motivation (for the cortex and the limbic system), and action and perception (for anterior and posterior regions). This could be a confusing linguistic factor when theorizing about neuroscience and during the conceptualization and operationalization of experiments. At the same time, realizing this bias could enable new levels of analysis via the metaphorical reinterpretation and recombination of the tags and labels on the brain. For example, the description of the anterior and posterior regions as being responsible for creating the balance of consciousness between the motor and sensory areas (in extreme cases, between involuntary actions versus hallucinatory experiences, e.g., Fischer 1986) could be combined with the emotional–rational dimension of the two hemispheres. Such a perspective would enable brain researchers to pose questions from novel theoretical grounds.

Concepts concerning the mental world have been brought into the scientific discussion from the everyday language of folk psychology: for example, from philosophy, phenomenol-

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ogy and the social sciences in the case of describing the two hemispheres (TenHouten 1985). They are constantly linked to the neural substrates of the brain via experimentation – again, often described by a "common sense" language of everyday concepts. As a result, even purely scientific descriptions and explanations might reflect personal preferences of scientists stemming from subjective cognitive and neural dispositions. In specific cases, this might mean an "individual hemisphericity" as proposed by Bogen, DeZure, TenHouten, and Marsh (1972). For example, taking representations as perceptual symbols (Barsalou 1999) could talk about a right-leaning, whereas taking representations language-like (Fodor 1975, 2008) about a left-leaning, manner of understanding. In a clinical context, the same process could motivate the idea that the core of human functioning is either emotional (as in psychoanalysis or humanistic psychology), or rational (as in behaviorism or cognitive therapy). Putting notions of different kinds in the focus of explanations might hinder scientific discussion in the absence of a common ground.

This problem is especially intriguing when the mind (of researchers) turns towards the (research of the) mind itself. Some mental capacities lend themselves to quantitative scientific analyses, such as perception, memory, or attention. However, others prove very difficult, or almost impossible to describe and account for scientifically, such as the creation and appreciation of fine art, or engaging in productive inductive reasoning. What makes such "soft", or qualitatively complex, mental phenomena so complicated to explore: our language – and philosophy – or our neuroscience? One possibility is that such "fuzzy phenomena" arise from the very architecture of the human mind and brain. Logical, deliberate, sequential and scientific reasoning is only a subset among many other intuitive, spontaneous, and parallel systems. Some of the most fascinating feats of the mind (such as musicality) might fall outside of our rational understanding because the subsystems instantiating them are organized according to entirely different principles than reasoning.

Metaphors and the brain

In an attempt to address the above issue, the first step could be taking a close look at the relations and the linguistic structure of notions of both scientific and folk psychology. The next step could be to try to assess how they are related to the notions describing the brain. Then it would be possible to systematically map the connections of these distinct theoretical levels. The cognitive conceptual metaphor theory (Lakoff and Johnson 1980a) provides a plausible framework for the investigation of the possible links between mental concepts and phenomenal experiences, which could open the way to tracing the responsible neural systems.

Metaphors and the conceptual system

The conceptual metaphor theory of Lakoff and Johnson (1980a, b) proposes that metaphors are not ornaments of language but the building blocks of the human conceptual system. We understand abstract concepts by systematically mapping concrete concepts onto them. The easily comprehendible source domain (e.g., JOURNEY) is mapped onto the abstract target domain (e.g., LIFE). This works on a conceptual level (LIFE IS A JOURNEY) and can be caught in metaphorical expressions like *we had a bumpy year*.

According to Lakoff and Johnson (1980b), only those concepts are not metaphorical that are derived directly from our experiences – concepts of orientation (up–down, in–out), ontological concepts (materials), and structured experiences (eating, moving). The seemingly distant domains of metaphors are connected in specific experiential Gestalts, which are "multidimensional structured whole[s] arising naturally within experience" (Lakoff and Johnson 1980b: 202). The basis of the mappings, for example, in the expression *he is a hothead* is motivated by HEAT and ANGER appearing in the same situation. Its motivation can be closeness in time or space, for example, although cultural aspects can also play an important role. Hence, it is impossible to foretell the metaphors of a certain language, but one might tell which mappings are unlikely. These are the ones that are really counterintuitive to our very human experience, like anger being cold (Kövecses 2002, 2005).

Grady (1997) divides metaphors into two groups: complex metaphors and primary metaphors. Complex metaphors are constructed from primary metaphors. In the case of primary metaphors, sensorimotor and non-sensorimotor experiences get connected in a systematic way (in the expression *warm smile*, physical warmth and happiness are joint). On the basis of this idea, Lakoff and Johnson (1999) created the integrated theory of primary metaphors, according to which these mappings do not simply recall similar experiences, but they are suggested to activate the very same neural circuitry. Some fMRI and EEG data seem to support this prediction. When subjects read metaphorical sentences involving the hands (e.g., *[it is] hard to grab this idea*), many areas responsible for the motor control of the hands are activated (e.g., Rohrer 2005). These results promise that primary metaphors with an experiential basis might one day be traced back to certain neural areas, and that in fact we understand a great variety of knowledge domains by the activation of a relatively few neurocognitive resources (although this is a hotly debated question, cf. Mahon and Caramazza, 2008).

Concepts of neuroscience

Many notions utilized by neuroscientists to describe the brain also possess some experiential background (although mostly indirectly). Several of these are not simply mental concepts: some refer directly to experiences, like the labels of sensorimotor areas, and others to rather abstract concepts like "decision making". These notions are currently grounded to specific neural systems and areas via experimentation. Therefore, notions referring to experiential phenomena, as well as some abstract ones are possible to link to specific brain areas – at least in a specific experimental situation. Nevertheless, these words carry their connotations and broader meanings with them, and they have a place in the conceptual space of psychological notions.

As a result of the neuroscientific explosion of the past decades several such psychological notions have been "located" in the human brain. These words became citizens of two worlds: the networks of concepts and the networks of the brain. Several possibilities follow from this. First, it is possible that the description of the brain somehow follows the structure of notions referring to the mental world – this would be a solipsistic stance. Second, it is possible that there is simply no real relationship between notions referring to mental phenomena and the structure of the labels for the brain – a reductionist stance. Third, the correspondence is somewhere in-between, and these layers influence each other, but they are not related in a systematic way.

Mental metaphors

What kind of metaphors hide behind psychological expressions? Is there a systematic relationship? Actually, there seems to be some kind of "phenomenal" orientation according to light and temperature, alluding to the experiential grounds of the mental world. Here are some examples:

PRECISE THOUGHTS ARE BRIGHT – IMPRECISE THOUGHTS ARE DARK
What a bright mind!
His talk was very dull.

PRECISE THOUGHTS ARE COLD – IMPRECISE THOUGHTS ARE HOT
Cold calculation was the plan.
He has been a hothead with that decision.

POSITIVE EMOTIONS ARE BRIGHT – NEGATIVE EMOTIONS ARE DARK
We had a brilliant time in the evening.
Dark intentions seized him.

POSITIVE EMOTIONS ARE HOT – NEGATIVE EMOTIONS ARE COLD
His revenge was cold as ice.
She had warm feelings towards him.

Such concepts, which are based on mappings of primary metaphors, could combine, as subtle metaphorical building blocks, into the complex structures of abstract concepts. For example, irrationality is traditionally linked to emotions, while reasoning often seems to be logical, and mathematical proofs seem to be objective, while attitudes or feelings are often considered subjective. The more abstract concepts provide a kind of cognitive orientation in the mental space of folk psychology. In this huge network of associations, expressions bring along a number of connotations across contexts. Mappings could ground highly abstract, complex mental concepts like empathy or intuition to low-level perceptual sensations or phenomenal orientations. All this could add up to an Idealized Conceptual Model (Lakoff 1987) of the mind in Western culture and philosophy.

According to this analysis, psychological concepts that serve as tools for scientists to describe the human brain might be a part of a mental space that refers to experiential grounds (both phenomenal and cognitive), which in turn is a product of the brain itself. The aim of this study is to take a look at the metaphorical space of mental concepts with respect to neural architecture. Are there connections between the "phenomenal", the "cognitive", and the "conceptual" aspects of words referring to mental life? Do these correspond to the descriptions of the neural regions of the brain?

Hypotheses

1) Psychological concepts can be arranged in a mental space representing the three spatial dimensions of the nervous system: the left and right hemispheres, the cortical and limbic systems, and the anterior–posterior regions.
2) University students majoring in psychology arrange these words differently compared to students who do not major in psychology as a result of their elaborated knowledge.

Methods

Participants

Altogether 83 graduate (MA) level university students completed the test, 48 of whom were majoring in psychology, and 35 students who were not.

Test

In the framework of a pilot study, a questionnaire was created. Participants had to assess psychological concepts in a forced choice task, according to three spatial dimensions of the brain. The questionnaire constituted of 105 words, each of which had to be assessed according to dichotomies of everyday, folk psychological expressions referring to the three neural axes of the nervous system: thinking vs. emotion for the left and right hemispheres, consciousness vs. instinct for the cortex and the limbic system, and action vs. perception for the anterior and posterior regions. For every word, participants had to decide for each three axes whether it fits one or the other dimension – there were no "neither" or "both" options. The 105 test words were a collection of the following:

1) Expressions of folk psychology *(heart, mind).*
2) Expressions of scientific psychology *(cognition, reflex).*
3) Expressions of sensorimotor orientation *(warm–cold, inner–outer*).
4) Expressions having some cognitive orientation *(subjective–objective, personal–social).*

The latter contained rather more general expressions as the sensorimotor orientation, although from a more philosophical domain.

Results

The data was analyzed with the SPSS 17.0 software. A series of Pearson's chi-square tests were used to compare the two groups. Where the two groups did not differ, a second chi-square test (with 50% expected frequencies) was calculated on the whole sample, but when the first test showed a significant difference, the second test was run on the two groups separately.

The two groups categorized the majority of the words identically. There were only 11 cases (out of the 315) where only one of the groups was able to categorize a word according to one of the dimensions, but the other group was not. Two more words (*bright* and *quality*) were located

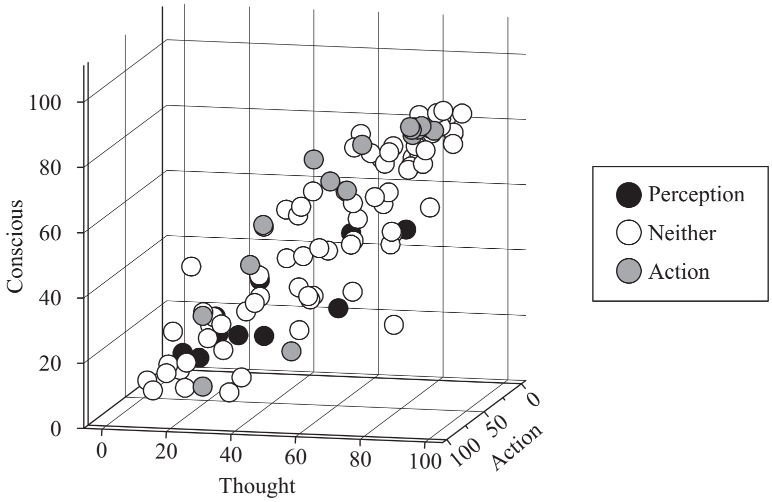

Figure 1. The 105 psychological expressions in a conceptual space, corresponding to the three spatial dimensions of the brain. Each point represents a word.

on the opposite side of the action–perception axis for the two groups. Altogether this was an approximately 4% difference. Almost all words were categorized either as conscious–thought–action or instinct–emotion–perception, suggesting a pervasive linguistic dichotomy. Only the word *association* was categorized as instinct and thought. Only the following words were categorized as action, but not as emotion, or instinct: *reflex, social, creativity,* and *mystical*.

As the difference between the two groups was marginal, the next step was to aggregate the data, in order to calculate an average value for each word on all three dimensions. On this restructured data set a factor analysis was run that revealed that the three linguistic dimensions actually fit onto a single component, this being responsible for 75% of the variance in the sample. Figure 1 shows a hypothetical three-dimensional mental space corresponding to the three linguistic dimensions of brain. Every point represents a word, by taking its average value on the three axes as coordinates. The single component runs diagonally from the emotion–instinct–perception corner to the thought–conscious–action corner.

Finally, a hierarchical cluster analysis was performed using the word's average values on the three axes. Two large clusters emerged. One of them crowded around the word *mental,* while the other around the word *hypnosis*. The former constituted of two smaller clusters labeled as "scientific" and "wisdom", while the latter as "emotion" and "arousal". The structure of the two large and a number of smaller clusters are presented in Table 1. Taken together, neither of the hypotheses were confirmed.

Discussion

The results of the present study do not provide strong evidence, even though there are some interesting findings. First, the fact that university students majoring in psychology did not differ significantly from the other group of students indicates that the concepts used in the study

Table 1. Results of a hierarchical cluster analysis: Dendogram using average linkage

```
C A S E        0       5    10   25
Label          +-------+-----+----+

heart         -+
feeling       -+
soul          -+-+
deep          -+ |
warm          -+ |
mystical      -+ +-----+
inner         -+ |     |
intuition     -+-+     |
unconscious   -+ |     |
sensual       -+ |     |
sentiment     -+ |     |
emotion       -+ |     +--+
visceral      -+-+     |  |
empathy       -+       |  |
wet           -+       |  |
subjective    -+-+     |  |
reception     -+ |     |  |
passive       -+-+-----+  |
below         -+ |        |
hazy          -+ |        |
hypnosis      -+ |        +-------+
dark          -+-+        |       |
sensation     -+          |       |
instinct      -+          |       |
desire        -+---+      |       |
unintended    -+   |      |       |
artistic      -+   +-+    |       |
affective     -+   | |    |       |
ambiguous     -+   | |    |       |
arousal       -+---+ +----+       |
homeostasis   -+     |            |
reflex        ---+---+            |
spontaneous   ---+   |            |
body          ---+   |            |
motivation    ---+---+            |
social        ---+                |
action        -+                  |
                                  |
active        -+                  |
will          -+-------+          |
direct        -+       |          |
intended      -+       |          |
planned       -+       |          |
evaluation    -+-+     |          |
verbal        -+ |     |          |
rational      -+ |     |          |
logical       -+ +---+ |          |
mathematical  -+ |   | |          |
scientific    -+ |   | +-----+    |
concrete      -+ |   | |     |    |
objective     -+-+   | |     |    |
cleverness    -+     | |     |    |
deductive     -+     | |     |    |
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C A S E        0       5    10   25
Label          +-------+-----+----+

reason        -+     | |     |    |
intellectual  -+     | |     |    |
nous          -+     | |     |    |
consciousness -+     | |     |    |
attention     -+     | |     |    |
mind          -+     +-+     |    |
head          -+     |       |    |
sense         -+     |       |    |
cognitive     -+-+   |       |    |
conceptual    -+ |   |       |    |
quantity      -+ |   |       |    |
intelligible  -+ |   |       |    |
quality       -+ |   |       |    |
high          -+ |   |       |    |
bright        -+-+   |       |    |
dry           -+ |   |       |    |
wit           -+ |   |       |    |
mental        -+ +---+       +----+
abstract      -+ |           |
plausible     -+ |           |
awareness     -+ |           |
analog        -+ |           |
above         -+-+           |
inductive     -+ |           |
thought       ---+           |
superficial   -+             |
cold          -+             |
outer         -+-----+       |
clean         -+     |       |
positive      -+     |       |
metaphoric    -+     |       |
apperception  -+     +----+  |
perception    -+     |    |  |
threshold     -+---+ |    |  |
symbolic      -+   | |    |  |
low           -+   | |    |  |
visual        -+   +-+    |  |
shallow       -+   |      |  |
slow          -+-+ |      |  |
wisdom        -+ +-+      +--+
memory        ---+ |      |
experience    -----+      |
negative      -+---+      |
imagination   -+   |      |
determined    -+   |      |
individual    -+   |      |
conditioning  -+---+---+  |
fast          -+   |   |  |
association   -----+   +--+
behavior      -+-+     |
motion        -+ +---+ |
free          ---+   +-+
creativity    -------+
```

(even the more scientific ones) are deeply embedded in everyday thinking. This philosophical and folk psychological background certainly has some influence on the conceptualization and operationalization of scientific research, and on the interpretation of results. Words expressing psychological phenomena bring along their net of connotations, and these might shape the understanding of mental life and the human brain, since researchers most of the time have to choose from concepts with a history that is not neutral.

Another interesting finding was that the dichotomies corresponding to the dimensions of the brain do not differentiate sufficiently among the psychological expressions examined in the study – according to the factor analysis, their majority actually fits on one axis. This could be important for brain researchers since it sheds light on the conceptual ambiguity of words used to describe very different levels of processes in the nervous system. Perhaps the philosophical mind–body problem appears here: although it was often difficult for individuals to make a decision regarding one word or another, the fact that notions were eventually arranged according to one dimension suggests that a Cartesian dualism is deeply embedded in scientific and folk psychology. This could be true even for scientists or philosophers who actually deny being Cartesian. Another problematic aspect is the categorization that a hidden assumption creates. For example, psychological notions, which most people would consider "emotional", eventually should be linked to the "mind", and not the "body". There may be a number of lurking paradoxical consequences of language use in natural sciences exploring the human brain.

The cluster analysis revealed an interesting structure among concepts: they grouped together more or less in accordance with the predictions of the conceptual metaphor theory. For example, in the emotion cluster, words of perceptual orientation *(deep, warm, inner, dark),* and cognitive orientation *(subjective, spontaneous, active)* were located near to folk psychological expressions *(heart, soul, body),* and scientific expressions (*empathy, unconscious,* and the main label of the cluster, *hypnosis*). These four levels were in similar correspondence also on the other large, the mental, cluster as can be observed in Table 1.

The reason for choosing these categorizing concepts was that they were everyday expressions with a meaning that can be easily taken for granted by researchers as well. Thus, they seemed to be good candidates to bridge the gap between scientific and everyday language regarding the mental world. Nevertheless, it is possible that the test was not constructed accurately, and only one axis emerged because the test did not differentiate enough between the three dimensions. Another possibility is that the description of the brain does follow the structure of notions referring to the mental world. It is precisely the way language is used, both in folk and scientific psychology, that distorts the perception of the nervous system and does not allow for a sophisticated differentiation between the three spatial dimensions of the brain. Is it the right hemisphere that deals with emotions, or the limbic system? What is the role of the limbic system in the left hemisphere? The constraints of language might be important to be taken into consideration when studying the neural systems of the brain.

Scientific metaphors in psychology

On the basis of this arrangement of the psychological concepts, and when expanding the analysis to the mental world's conceptual space, it is possible to interpret the words describing

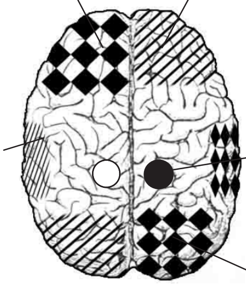

Figure 2. The different approaches within psychology, arranged according to their key metaphors in a hypothetical brain

the nervous system in a metaphorical map. The key concepts of various theories and approaches in psychology (Pléh 2010), some of which are associated with certain brain regions in one way or another, might talk about the neural dimension being central in the specific theory at hand. For example, the key concepts of psychoanalysis (e.g., libido, unconscious, instincts) could be viewed as metaphors mapped onto a broad variety of human functions representing limbic level functions. In other words, psychoanalysis might project limbic level functions on the whole brain. This analysis could be broadened to include further schools, approaches, or simply theories in psychology.

Gestalt psychology proposed a holistic view, its name directly referring to the "shape as a whole", or the "form as a unit"; the defining Gestalt principles (similarity, continuation, closures, etc.) all come from the visual domain. Combining these two main characteristics would put Gestalt psychology somewhere in the right (holistic) occipital (visual) regions. Behaviorism, emphasizing stimulus–response-based classical and operant conditioning as the main processes of human functioning could be linked to frontal areas, which are responsible for learning, attention, inhibition, and control. The denial of consciousness (and even mental phenomena) links this perspective also to subcortical regions, and more specifically to regulatory systems. Humanistic psychology, or the "third force" emphasizing self-actualization and creativity could be linked to the right hemisphere, where the representation of the self seems to be more elaborated. The case of cognitive psychology is going to be addressed in the next section. As a result, approaches within psychology can be arranged in the brain based on their key metaphors (Figure 2).

The search for new paths in cognitive science

Looking at cognitive science from this perspective, an interesting picture emerges. Key ideas of early cognitive science, such as generative grammar, the formalization of mental functions, Turing machine-like serial operations on symbols, and allowing for conscious thought

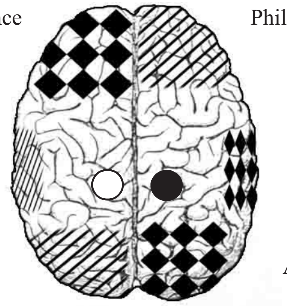

Figure 3. Cognitive science, as a common approach within disciplines, covers a broad variety of epistemic capacities of the brain

might all talk about a left-hemispherical, language-based, and sequential approach, dealing with primarily cortical processes. Chomsky's (1957) groundbreaking ideas came from the linguistic domain, and syntax was (metaphorically) mapped onto the brain as computations, more specifically as the *Language of Thought* (Fodor 1975, 2008). The brain was considered to be a special computer, where even emotions are "calculated".

It is important to note that cognitive science defined itself as an interdisciplinary approach right from its outset, and as a result has bridged various disciplines like psychology, linguistics, anthropology, philosophy, neuroscience, and artificial intelligence (Pléh 2010). This has provided a broad epistemic capacity that promised to cover all major epistemic approaches (towards the mind) that the brain seems to produce (Figure 3).

At the same time, a number of the "soft functions" of the mind remained elusive, not just because it is extremely challenging to write a viable computational protocol for them. Another reason could have been the initial linguistic, and rule-based approach coming from the left hemisphere, and it might not be possible to map procedures of one hemisphere on the whole brain.

Intriguingly, from the 1970s cognitive science went through a gradual shift, perhaps driven by the need to take the missing aspects into consideration. As the first era lived up its theoretical resources, new currents appeared, still, primarily within the established domain. Connectionism (and pragmatism in general) offered models that were not based on rules or computations in the classical sense, but on information processing carried out by the structure itself (Rumelhart and McClelland 1986). This could reflect a shift towards the right hemisphere, having relatively more white matter, and being generally more interconnected than the left hemisphere (for a review, see Beeman 1998). The architecture (the "body") or the procedure was proposed to be prior to knowledge, or rules. Using terms that are describing memory systems, this was also a move from the declarative to the procedural, a distinction stemming from Ryle's (1949) knowing what vs. knowing how. Similarly, as opposed to explicit rules or functions, implicit processes became an independent research area, exploring verbally and/or consciously inaccessible (not left-hemispherical) functions.

Trends surfacing in cognitive linguistics during the 1980s addressed right-hemispherical language capacities such as pragmatics (Pléh 2000) – one outstanding example is relevance theory (Sperber and Wilson 1995). Embodiment (Lakoff and Johnson 1999) put the body (represented stronger in the right hemisphere) in the center of cognition. The idea that sen-

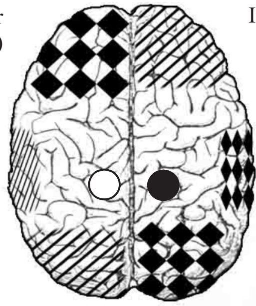

Figure 4. Approaches of cognitive science, arranged metaphorically in a hypothetical brain

sorimotor areas are responsible for semantic processing not only challenged the Cartesian mind–body distinction, but also practically reduced the "mind" to the "body" (with the latter having stronger neural representations in the right hemisphere), advocating a neo-empiricist agenda. Figure 4 shows a brief summary of the various threads within cognitive science that seem to be open enough to integrate new approaches corresponding only loosely to some original ideas.

Epistemology and the brain

The main message of the present work is that every paradigm or approach might have a model of the mental world which is motivated by the neural preferences of scientists. Every attempt to give a complete account of the broad and diverse phenomena produced by the human brain is a result of specific personal dispositions in perceiving, understanding, and interpreting cognition. Metaphorically speaking, by projecting a subset of neural functions on the brain as a whole, every approach creates "brains" that are skewed to one region or another, as a result of overrepresenting it compared to the rest. For example, Chomskyan generativists could be conceived as having a metaphorical brain of a set of large left-hemispherical language areas, and a microscopic right hemisphere. Researchers and their approaches might be identified according to their way of reasoning: what kind of work methods, and more specifically, neural processes do they prefer when they frame problems and solutions?

When a certain approach is clearly articulated by a scientist, followers with similar neural dispositions join the new track, and schools are formed. The trends in the second phase of cognitive science are inspiring because they attempt to introduce research topics that can be associated with the "other side", the right hemisphere. This has opened up ways to explore aspects of the mind that are especially difficult to describe logically, formally, or verbally. However, importantly, waves in science do not follow one another in a linear fashion: approaches often exist and develop parallel. The brain might not be a computer as we know computers today, but this is still a strong model with testable predictions. Even though embodied cognition claimed a revolutionary approach, it has rather added a new perspective than put aside thousands of years of philosophy of the mind. Chomsky's or Fodor's legacy and contributions are not washed away by newcomers but are placed in a broader perspective – in a more complete metaphorical brain. Recent tendencies also emphasize one specific neural perspective over another, thus they also have a – novel and innovative – skew to their epistemology. Only the combination of the various approaches can provide a comprehensive picture of human cognition.

In this respect, scientific research itself serves as a diagnostic tool to gain insight into the workings of the brain. The Idealized Cognitive Model of the mind in Western culture provides a basic framework that is not neutral in the first place. It serves as a background behind the figure, the models and metaphors that scientists propose according to their preferred working methods and "mental perception". The interaction between these figure(s) and the background is what makes cognitive science a unique endeavor: this is the point where understanding turns towards understanding; the mind becomes the subject as well as the object of research. However, only the novel metaphors of the mind, which are yet to come, can tell us which part of the brain is going to have the privilege to lead (again) science and research during the next period of time.

The present pilot study has attempted to bring attention to the intricate relationship between psychological concepts and brain research. On the one hand, it tried to shed some light on the strong heritage of language referring to human cognition, which is deeply rooted in folk psychology, and perhaps influences neuroscience, as well. On the other hand, it tried to highlight how the personal perspectives of scientists could be expressed in their works and in the threads of science in general. Hopefully, it can contribute to the study of the mind by reflecting on the language of cognitive science.

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