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GETTING PHYSICAL:

Exploring Symbolic Physicality/Physical Non-materiality

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This paper is a continuation of the article, "The symbolosphere and nonphysical aspects of mind (2019, johnschumann.com)",. It deals with the nature of physicality/materiality of symbolic concepts and argues that the referents of concepts that are non-physical may require an epistemology that differs from the one that has been used to study material entities.

At some point in its evolution the human brain became capable of producing and processing nonphysical symbolic concepts (e g. freedom, law, democracy, love, hope, motivation, emotion, peace, politics, obstruction). As a result, humans now live in a world that is both physical and nonphysical, and the nonphysical part of the world is made up of precisely those concepts whose labels have no physical referent in the world. But in symbolic reference, as conceived in Peircean sign theory, symbols (words) can get their meaning from other words, not from things. This makes symbols nonphysical/nonmaterial and their reference is grounded in interpretation and imputation (Favareau, 2015), not in physical entities. The position seems dualistic. We have physical world and then we have nonphysical entities in that world. The question becomes how they interact. This difficulty is one of the major reasons for rejecting dualism. I will suggest that if physical brain produces the nonphysical entities, and then the nonphysical entities become part of the human environment and have influence on the physical brain just as the physical environment does, the interaction between the brain and nonphysical world is not problematic. The link is the fact that material human

brains (often acting interaction with other brains) are the generators of the nonphysical world.

The nonphysical entities that I have referred to are symbolic concepts, conceptualization, ideas, idealizations, ideologies, and categories. What are the properties of a physical entity? It is generally assumed that, physical entities require the properties of mass, energy, observability, and causal effects on the world. But there seem to be many symbolic concepts that lack mass, energy and, observability, and still have causal effects. These are concepts such as truth, motivation, emotion, democracy, love, time, kindness, freedom, success, knowledge, justice, determination, anger, hope, mind etc.

MASS is a measure of the amount of matter in an object, usually measured in grams or kilograms (definition of mass, Mass-Chemistry Dictionary- Chemical). There are two basic forms of ENERGY: kinetic and potential. Other types of energy are thermal, radiant, chemical, nuclear, electrical, sound, elastic, and gravitational. OBSERVABLE entities are those whose properties can be directly detected by the senses or inferred from the existence of other physical entities.

Symbolic concepts seem to lack three of the four properties of physical entities (i.e. mass, energy, and observability), but nevertheless they retain the ability to have causal effects on the world.

The Russian physicist, Sergey A. Vasiliev (2012) argues that non-material objects exist, but they have been ignored in physics because of the belief that they are not cognizable (i.e., knowable, perceivable) by the methods of physics. Hence physics knows nothing of concepts such as spirit, mental phenomena, creativity, will, etc. Vasiliev refers to these concepts as physical non-material objects.

As noted, Objects of the Physical Non-material World lack mass, energy, momentum and cannot act in a forced away. Therefore, the energy and strength of physical nonmaterial objects comes from something else which Vasiliev calls nonmaterial-potential. It would appear then that the ability of Nonmaterial Objects to have effects on the world, i.e., on material objects and to do so via Long-Range Action fields is because of an absentional, i.e., something that is not present (Deacon, 2012, 2013). Physical-nonmaterial entities lack the constraint of gravitational fields. The absence of this constraint allows them to have action at a distance without the energy or force.

To elaborate, symbolic entities lack mass, energy, momentum, and direct observability; therefore, symbolic entities are nonmaterial; they have zero materiality. Nevertheless, symbolic nonmaterial entities such as law, belief, hope, democracy can have effects on the material world. Thus, symbolic nonmaterial entities retain one physical characteristic – the ability to have causal influence on the physical world. At the same time, they are free from the influence of gravity. This allows them to have action at a distance which is something that violates the laws/constraints of classical physics. This is not something strange. We should not expect nonmaterial concepts to behave like classical physical entities, but we have to recognize that symbolic nonphysical/physical non-material concepts have their source in the physical brain. They are born of physical thought processes. The label “physical non-material concept” respects the physical source of these concepts and recognizes their profound lack of physical properties (Vasiliev, 2012).

If we consider the symbolic concept, "truth," we see that it lacks mass, energy, and observability. This is also true of the concepts, motivation and emotion, democracy, kindness etc. One might argue that "kindness", is observable, and indeed one might observe behaviors that one could, through interpretation or imputation, consider "kindness", but an interpretation or imputation is not the concept. It is merely a classification of a token of the concept kindness.

For example, I may observe and then interpret a behavior as an index of fear, but that behavior is not fear. Fear is a symbolic concept that when experienced is accompanied by some activity in the subject's nervous system that may be perceived by other witnesses. Both the subject and the observers must make an interpretation or an imputation of that behavior. They may call it "fear", or they may refer to it by one or more of the other labels/names for types of fear (e.g., agitation, dismay, distress, anxiety, worry, alarm, panic).

Emotions are symbolic concepts that require an interpretation or imputation by the subject of the emotion and/or by an observer of the subject's behavior. Emotions don't exist independently in the world. They require some activity in the subject's nervous system and a label for that activity by the subject or an observer. The brain or body activity is not the emotion. It might be argued that this neural activity is the energy component in fear. But what kind of energy is it? Could we call it nervous energy or brain-based energy or body-based energy? If so, we would be ascribing to fear a source of energy that does not seem to be a type of energy that is considered a property in physics.

Deacon explains that words can influence people's thinking and behavior, but "it's not because of anything physically or energetically there in words. It's actually about stuff that's not there. What will have an influence in the world is the meaning, the significance, the surprise value; all of these features that come with our talk, our words, our concepts, our thoughts (14)." "I also don't think that thoughts are in the head. I think that neural activity is in the head, but I don't think that thoughts are, in a sense there is some stuff or energy there. It's like words on a page; the words on a page are not what matters, the words on the page *convey* [my emphasis] will what matters" (14). He continues, "what matters is not something physical, chemical, energetic. What's so surprising is that, despite the fact that these kinds of things don't point have the physical characteristics that should, according to our current theories, cause things to happen – they don't have those attributes – nevertheless they're remarkably powerful and

important, once you get to living and mental processes in the world” (Campbell, 2020, 14)

Deacon has explored phenomena that he refers to as “absentals”. These are entities which are not present, but which have causal effects as constraints. Could we argue that the absence of mass, energy, and observability in symbolic concepts constitutes the lifting of three constraints that allow the operation of the single property, “causal effects”? Somehow the human mind became capable of conceiving of, producing, and processing symbolic concepts that can have causal effects without having mass, energy, or observability. One might argue that this came about through language, but one may also argue that language only became possible with the advent of symbolic reference which can be free from the physical properties of mass, energy, and observability. Those constraints became absent, thus freeing humans to go beyond iconic and indexical communication. With symbolic reference, they could communicate about entities that did not have a presence in the material world (i.e. that were absent in the material world but were present in the symbolosphere (Schumann, 2019).

Symbolic concepts then lack three of the four essential properties of physicality, and they do not necessarily refer to material things in the world, but instead they can accrue meaning by their relation to other symbolic concepts (words). Such concepts are special and deserve special attention. They are only minimally linked to the physical world, retaining only the capacity for producing causal effects, and at the same time they free us from some of the constraints imposed by full physicality. But they are also problematic because they are often vague, ambiguous, difficult to define categorically, and they are open to multiple interpretations. Nevertheless, they allow us to talk about absent things, future events, unreal things, nonexistent things and untrue things.

In this regard, Favereau (2015, 253) notes "the 'ground' of symbolic reference in a sense *depends* on such symbols never unilaterally resolving into a single, fixed, intellectual entity or concept." They "will, by design, always be the kind of ongoing and

'open' questions that each new generation of simple users will have to re-articulate and re-negotiate in real time."

"For with symbols, we never do converge on a single referent and this is because symbol grounds and referents are multi-dimensional *as part of their very meaning* (such as "justice" and "opposite") such that to attempt to reduce them to a 'single' referent would be to rob them of precisely what gives them their uniquely distributed and generative power... What we need is good enough orientation to get us at least in the ballpark when speaking with others about such multidimensional and physically referentless terms as 'justice' 'friendship' etc." (253).

What should this type of physicality be called. What label would distinguish it from common scientific notion of "physical"? Some suggestions have been minimally physical, allophysical, quasi physical, symbolically physical, semiotically physical, partial immateriality, and as we've just seen, physical non-material.

I would suggest, at least for the moment, that we refer to such words as "symbolically physical" and to the concept as "symbolic-physicality" or "physical-non materiality". Some have suggested that everything including symbolically physical concepts has its origin in the physical domain and therefore everything is physical. The social sciences, the humanities, and the arts all deal with symbolically physical entities, but they do so through physical mediation. This dependence on the physical world for the emergence and maintenance of the symbolically physical entities is parallel to life being dependent physical entities (non-life) for its existence and maintenance.

Thus, it seems that symbolically physical concepts are eternally linked to the physical world. But then we have to ask whether such concepts can be completely understood by reducing them to their physical components (e.g., neuronal activity in the brain). Some people have argued that if something is processed by the human brain, that entity becomes physical. But the physical brain is promiscuous, it will process any sensation/perception it encounters. The meaning expressed by symbolically physical

words is not the corresponding activity in the brain. Neural activity and its physical manifestation in a signed, spoken, or written word is merely a representation of the word the meaning of which has been assigned to it by human symbolic reference. The meaning has to be inferred by another human being who has the relevant cultural experience. Thus, in some sense, the meaning is in the culture. If I speak the word “poshlust’,” one will not understand its meaning if they are not familiar with the relevant aspects of Russian language and culture. By the same token, Russian speakers will not be able to interpret the meaning of the word, “mediocrity,” if they are not familiar with the relevant aspects of English language and culture. Indeed, native English speakers will not be able to grasp the meaning of “mediocrity” if they haven’t had the requisite experience with the English language and culture. This is because the meanings of words that refer to symbolic concepts are symbolically physical. They cannot be interpreted by physical sight or sound because these entities are not present in our physical world. For example, the meaning of the English words, motivation, democracy, hope, loyalty, or grace are unobservable. One can point to an instance of the concept (a token) if one interprets that instance as an example of the concept.

The sciences and the scientific method emerged, developed, and have been most successful in producing understandings of the physical world. The question I have is whether science and the scientific method are adequate for understanding the symbolically-physical world. The issue seems to be that symbolic concepts require interpretation. Essentially, they are instances of symbolic reference (Deacon, 2012, 2013; Schumann, 2019, first article in this collection). Symbolic entities get their meaning from their reference to and association with other words, not with physical things. If one wants to know the meaning of “mediocrity”, one would have to look it up in a dictionary and derive the meaning from the words in the dictionary definition. Or one would have to hear the word in different contexts to derive its meaning. Or one could ask another person to explain what it means and derive the meaning from the explainer’s words. This is very different from asking what a shovel is, and if asked, one way to respond is simply to show the inquirer some shovels or pictures of shovels and demonstrate their use.

The meaning of symbolic concepts must be grounded in interpretation and imputation (Favareau, 2015) and multiple interpretations are possible. Witness the difficulty that members of the United States Congress have with the symbolic concepts "impeachment, corruption, collusion, intention, obstruction, misdemeanor, and crime." If we were able to conduct an experiment in which we image the brains of Republican and Democratic Congress persons as they produce and hear the word "obstruction" in reference to the impeachment inquiry, and if we were able to observe the patterns of neural and chemical activity during the experiment, what would we learn about the concept, "obstruction"? In the first place, we may find very different patterns of activation within the Democrats' brains and also individual variation across the Republican brains. "Obstruction" would be processed by all the brains, but each brain's activation would simply constitute a physical representation for an interpretation of the symbolically physical concept. We would not learn the physical basis for a definitive, universal, true, correct, and final meaning of "obstruction". This is because the concept of "obstruction" is not physical in the way that entities with mass, energy, and observability are. The same is true of concepts such as motivation, emotion, concentration, identity, acculturation. They are symbolically physical entities created by physical human brains. They actually become cultural entities that exist in a society, but they cannot be reduced to or thoroughly understood by observing brain activity related to them. As entities that are created by physical human brains, the cultural evolution of a concept moves the concept farther and farther from the informativeness of its related neural activation. Of course, someday with the continued development of technology in neuroscience, we may be able to determine the precise neural basis for every instance of a person's thought and use of the concept, "obstruction". But even then, we would simply be noting the varying neural bases for individual interpretations of "obstruction". And of course, the interpretations of "obstruction" (or any other symbolically physical/ physical non-material concept) by individuals and cultures will change over time. The neural activation will change as the concept is reinterpreted within a culture whereas the meaning of iron, sodium, zinc, femur, left ear and other physical entities will be more stable and certainly less contentious. And when a well-designed and implemented

experiment is performed on these physical entities, the results will be minimally influenced by varying interpretations.

WORDS

In the preceding, we have been using the term "symbolically physical". "Symbolic" is a term that appears to be acceptable in academic discourse. But the term "nonphysical" causes problems, and is especially troublesome. To claim that nonphysical concepts/objects exist smacks of dualism, and in the world of science, dualism is a term of derision. It is an insult to the physicalist status of classical physics, chemistry, and biology. From the time of Galileo, true science has been consistently restricted to that which is observable, objective, and mathematically describable. But nonphysical (now "symbolically physical" or "physical non-material") concepts are unobservable and subjective. If this is the case, our symbolically physical world is outside the domain of science (Goff, 2019). If the symbolic world comes out of the physical brain, then there is an ontological continuity between the physical and the symbolically physical, but there may be an epistemic gap between the two. In other words, we may not be able to know the symbolically physical world in the same way and by the same methods that we know the physical world. Observation and experimentation may not be enough. Again, what is involved then is interpretation, imputation, and inference all of which lead to understandings but not to facts or final solutions. This places the symbolically physical aspects of humanity and the human mind in the epistemological domain of the humanities, the arts, and the social "sciences" (anthropology, sociology, psychology, linguistics, and biosemiotics at the level of symbolic reference).

The point I want to make is that when we move to the symbolic end of the Pericean sign continuum, things become different. Quasi, partial, or symbolic physicality puts us in a different world. Just as in physics, when the atom was cracked open, we entered a different world where entities behave differently. At the symbolic end of the sign continuum we find the social sciences, the humanities, and the arts. they behave

differently than do the entities in physics, chemistry, biology, technology, engineering, and mathematics. If we simply treat the physicality of the symbolic world in the same way we treat it in the inorganic and biological worlds, I suspect we will be missing something important about the different kinds and degrees of physicality that we deal with.

Neurobiology and the Symbolically Physical Concept of Motivation in Second-Language Acquisition

Much of my career has involved trying to understand the role of motivation in second language acquisition, and it was a desire to explore the physical basis for motivation that led me to begin studying neuroscience in 1987. I took numerous courses in functional neuroanatomy with Dr. Arnold Scheibel, the distinguished neuroanatomist at UCLA. Coming from background in language, literature, and philosophy, I found it exhilarating to study something that was physical, something that was observable, where referents of the names for things were physical entities, not simply abstract concepts like formalism, constructionism, structuralism, cognition, emotion, and motivation. Even when entities in the brain were not easily labeled, they were given names such as zona inserta, nucleus ambiguous, or substantia innominata, and those entities could be observed, touched, and studied scientifically – they were real!

At the same time, the study of motivation in second-language acquisition already had a history of more than 50 years (Al-Hoorie, 2017) and was continuing with no end in sight. Researchers identified various types of motivation, each capturing a different nuance of the concept: integrative motivation, instrumental motivation, self-determination, attribution theory, goal theories, situated motivation, task motivation, willingness to communicate, skill-challenge motivation, value and expectancy motivation, L2 motivation self-system, identity theory, investment theory, and commitment theory. Each

one of these perspectives illuminated the concept of motivation, but there did not seem to be a final characterization of the notion.

Additionally, the concept “motivation” was related to other concepts: incentive, desire, goal, reward, approach, action tendency, wanting, liking, emotion, affect, arousal, valence, appraisal, reward, motivating source, force, stimulus, stimulation, inspiration, inducement, spur, reason, drive, ambition, initiative, determination, enterprise, enthusiasm, commitment, persistence, investment, engagement.

I began to think that there might be a neurobiological system that subserved all of these motivation types. In 1997, I published a book called, “The Neurobiology of Affect in Language”. In the 1980s and 90s psychologists began studying the cognitive appraisals of stimulus situations that generated particular emotions. There were several psychology laboratories that converged on roughly the same set of appraisals (novelty, pleasantness, goal/need significance, coping potential, and self and social image, Scherer (1984). I thought these appraisal categories would be relevant not only to emotion but also to motivation. I then used these categories to analyze and classify the items on questionnaires used in research on motivation in second-language learning. All the items were relevant to one or more of the appraisal categories.

The question for me then became “where in the brain are these appraisals produced and processed?” This occurred just at the time when neuroscience was beginning to view the brain as a highly distributed, integrated, and entangled set of networks that process stimuli over many neural regions. The appraisal terms did not correspond to clearly identifiable regions or networks. A fact that has now become recognized about many psychological concepts.

It was about at this time that I began learning about Peircean sign theory. Semiotics is the study of signs, broadly icons (signs indicating identity or similarity with things in the world, indexes (signs indicating relation of association with things in the world) and

symbols (signs that did not necessarily refer to physical/material entities in the world, but which could derive their meanings from their relationships with other words).

It became apparent that the human world was filled with symbolic words for concepts that did not necessarily refer to material things, for example, plea, realm, regret, courage, disavowal, agency, vacancy, aggravation, syndrome, eminence, snobbery, phobia, psychiatry, formalism, kindness, friendship, emotion, motivation, sin, beauty. It also appeared that there were degrees and kinds of physicality.

But it was “motivation” that most interested me. One could not point to this concept. One couldn't touch it. It took many different forms, each requiring the definition using related words. But the definitions were not always transparent; there were often vague, ambiguous, and new kinds of "motivation" were frequently proposed. They were nowhere and everywhere. And there were very unlike the entities studied in physics, chemistry, and biology.

Symbolic Reference and Science

The central issue to be addressed in this section is the extent to which we can get certainty and finality in our investigations of the symbolically physical aspects of the symbolosphere. I suggest that because symbolic reference involves sign-sign/word-word relationships, the phenomena that are constructed in this way are inherently ambiguous, interdependent, interrelated and difficult to isolate. This situation is certainly characteristic of the humanities, but perhaps is also of the social sciences. Below I use motivation in second language acquisition (a social science) to illustrate the characteristics of symbolicaly physical entities.

The Motivation Word Web

The list the various types of motivation and related words on pages 15 and 16 give a sense of the symbolic word web that the term, "motivation", occupies. It is real, but it is a symbolically physical entity that accrues meaning from its relationship with all these words and others. In many cases, words in this list can be substituted for "motivation" because they are synonyms. They are structurally different entities that generate meanings that are similar to the meaning of "motivation".

I would argue that none of these perspectives is wrong. Each of them offers a characterization of motivation that captures some aspect of the phenomenon, but none of them are complete or final. Additionally, it may be the case that finality may never be achieved when we are dealing with symbolically physical phenomena. The natural sciences are much more grounded in physical/material world. In scientific inquiry where words unambiguously index material entities in the environment that can be verified by the senses or the senses plus some amplifying technology (e.g., the electron microscope), certainty can more easily be achieved. However, if a social scientist were to hypothesize that integrative motivation is associated with high proficiency in second language acquisition, confirmation or disconfirmation of the hypothesis would involve several levels of symbolic relationships. The first step would be to operationalize the definition of integrative motivation in a series of questions that second language learners could respond to on a Likert scale. For example,

1. Studying French can be important to me because it will allow me to be more at ease with fellow Canadians who speak French.
2. Studying French can be important to me because it will allow me to meet the converse with more varied people.
3. Studying French can be important to me because it will enable me to better understand and appreciate French Canadian art and literature.
4. Studying French can be important to me because I will be able to participate more freely in the activities of other cultural groups.

(Gardner, 1985, p. 179).

Now disagreements could enter at any level of the analysis -- from the initial definition of integrative motivation, to the questionnaire probes designed to elicit information about that motivation. Such studies are unlikely to generate closure. Where they have been conducted, there have always been other researchers who would prefer to use different definitions of motivation or to examine different kinds of motivation or to examine them in different settings or to examine them with different instruments in different populations. As a result, in fact, over the past 60 years there have been literally hundreds of such studies (Al-Hoorie, 2017) and the question of motivation in second language acquisition is still not settled. Because the notion of motivation can only be interpreted by reference to other concepts, closure may never occur. Operationalizing definitions is the social scientists' attempt to get a clear referent for the concept under investigation, but because reference of this sort can only be achieved by consensus, there is always room to disagree with the consensus and an effort to establish a different one.

What does this mean for the study of motivation and SLA? It should not lead researchers to be discouraged about the nature of their efforts. On the contrary, they should just understand the nature of the symbolic world in which such research is conducted. Social sciences are largely carried out in the symbolic world where words do not have physical referents. Therefore, precision, closure and unique solutions are much more difficult to achieve. But that is simply the nature of the symbolic world in which social scientists work. It should also be noted that the exact sciences have only become exact in certain cases when they have been blessed with a technology that can produce physical indexes for their constructs.

If the mind indeed includes the brain, the body, the environment, action in the environment, and the symbolosphere, it is important that we understand it as such. If we live in both inorganic and organic physical worlds AND in a symbolically physical/physical non-material world, and if the phenomena we are interested in are symbolic constructs which may operate differently from physical entities, then the knowledge we

derive from our research may have a very different epistemological status than that derived from the sciences of the physical. It may be important to investigate the kind of knowledge that can be derived from research on symbolic entities.

It would appear then that part of human life is unexplainable by science and not fully explainable by anything else. Because of the success of the physical sciences and more particularly of the technologies that have come out of them, the term "science" has become an honorific, a carrier of prestige. And if one wants one to be considered a scientist, and wants their field to be considered a science, and wants their research to be considered scientific, then considering issues of symbolic physicality may not be advisable. But in semiotic terms, science, scientist, and scientific are examples symbolic reference. The concept "science" is not observable, not material. There is no Archimedean point outside the universe that defines these terms. We can point to work we consider science, people we consider scientists, but what they do and the restrictions they may place on their domain are conventions.

Thus, science and the scientific method find themselves in certain difficulties when they face the symbolically physical/physical non-material world produced by the human ability for symbolic reference. Nailing down non-observable symbolic entities is not what science developed to do. This is because nonphysical entities do not have the same order of determinism as entities in the physical realm. Symbolic concepts can be degenerate and pluripotential. Symbols (words) can have synonyms whereby the same or similar meanings can be carried by different words, and a single symbol (one word) can carry several different meanings (polysemy). And in the case where the entities refer to our nonmaterial world, they are unobservable because they lack a physical form.

If the object of research is something physical, then the norms of the scientific method are generally appropriate. But if the entity is the product of the human ability to create symbolically physical concepts, we may have to ask whether the scientific method provides the right epistemology. In the study of symbolically physical concepts (e.g.,

emotion, motivation, identity, acculturation, self, attitude, patience, goal, appraisal, etc.), does normative empirical science permit the accrual of final conclusions? When science and the scientific method are extended to symbolically physical entities, are we demanding too much of them? Are we asking science to do that which is only appropriate to the symbolic worlds of the arts, humanities and the "social" sciences?

Conclusion

Let's for a moment, divide the world into four spheres: the Nanosphere (the world of subatomic physics), the Physiosphere (the world of classical physics and chemistry), the Biosphere (the world of living things) and the Symbolosphere (the world of symbolically physical/physical non-material concepts). Biosemiotics can be seen to cover the biosphere and the symbolosphere. Out of the biosphere (physical life) came the symbolosphere (symbolically physical concepts). Thus, the world of symbolic reference links the physical biosphere with the symbolic concepts that are entertained in the humanities, and the arts. This is the domain of the human abilities for interpretation, imputation, implication, and imagination. With the biosphere having developed the evolutionary basis for the creation symbolically physical concepts, a link was established between the two cultures. This link provides us conceptual framework for a wissenshaft (Brier, 2014) and a semiotics for the humanities (Colby, 2014) for a curriculum that extends from inorganic world to the organic world to the world of symbolic reference where the laws of physics do not have to apply - the worlds of fiction, fantasy, philosophy, religion, ethics, aesthetics, bullshit, alternate facts, and opinion, politics, and truthiness.

I've suggested that perhaps the tenets of science may not be totally appropriate for the study of abstract symbolically physical/physical non-material concepts. However, to suggest any limits on science is also apostasy and is not easily tolerated in physicalist circles, but the exploration of the symbolically physical world relies on and requires the human abilities for interpretation, imputation, association, and assertion. No teleology or

ultimate resolution should be expected, but the meanings and the issues that such symbolic concepts carry do not go away. Thus, the epistemological question of whether, in its current construal, science is adequate for the study of nonmaterial symbolic concepts remains an important issue. Scientists often view of the work done in the nanosphere of subatomic physics as unscientific and the same criticism could be leveled at the work done at the other end of the continuum, the symbolosphere. But that may be simply because of the way the physical nature of the physiosphere and biosphere have been inappropriately imposed on the nanosphere and the biosphere.

ADDENDUM

Lisa Feldman Barrett is a psychologist and a neuroscientist whose work has focused on emotion, and as I've suggested above, emotion is a physical/nonmaterial concept. Therefore, in this addendum I would like to briefly discuss her work which I think is relevant to the notion of the materiality/physicality of abstract concepts. Barrett and colleagues have developed "the theory of constructed emotion". They argue that there are no areas or regions of the brain that are dedicated to specific emotions. Barrett (2017) uses the analogy with ingredients one might find in one's kitchen. Core neural systems "combine in complex ways roughly analogous to recipes, to produce diverse instances of happiness, sadness, anger, fear, and so on. The ingredients themselves are multipurpose, not dedicated to emotions but participating in their construction. Incidences of two different emotion categories such as fear and anger, can be made from similar ingredients, just as cookies and bread both contain flour. Conversely, two instances of the same emotional category, like fear, will have some variation in ingredients, just as some cookies and nuts and others do not" (36).

The experience an individual has when feeling such emotional states or perceiving and interpreting emotional behaviors of others during development become concepts. These

concepts have linguistic labels such as happiness, sadness, fear, anger, disgust etc. which are conceptual categories. In many ways one could argue that humans create labels for their affective experiences, and these labels become linguistic concepts to categorize different sets of emotional states. This phenomenon is known as degeneracy (Edelman and Galley, 2001; Schumann, 2018; Barrett, 2017). It refers to the situation in which neural entities with architecturally different structures can produce or contribute to the production of the same output. The output emerges from the interaction among the relevant entities. In addition, there is the principle of pluripotentiality where a single component can produce or contribute to the production of many (often related) outputs.

Binding labels to our emotional experiences would be very different without the human ability for symbolic reference and more generally the ability for language. In the past, there was the assumption that if there is a label/ word for a mental entity, there must be a dedicated physical structure in the brain as the referent of that label. This led, in scientific circles, to the assumption that there was a biological basis for each emotion or at least for what were considered basic emotions (eg, happiness, fear, sadness, disgust, anger). Thus, emotion related words could be expected to have unique physical substrates supporting them.

Barrett (2017) examines several reasons why the notion of "biological fingerprints" was so readily accepted and so enduring. She argues that such essentialist thinking is intuitive. We see our own emotional states and those of others are accompanied by bodily feelings, facial expressions, and behaviors. So, when we are told that there are specific physical systems that relate to our emotional/mental states it is an easy explanation to believe.

From Barrett's perspective and the semiotic perspective presented above and in Schumann (2019), the concept of emotion and the concepts underlying various emotions are precisely that –CONCEPTS. They are not observable. We can't see or touch these concepts; we can only infer them from behavior. This leads us to believe, quite easily, that the concepts must be grounded in something physical, and in this

case, it is something physical in the brain and/or the body. So the easiest thing to do is to believe those essences exist and just assume that we do not have the technology at this point to specify those mechanisms, but we optimistically assume that they will be found with the development of new technology. Emotion concepts are physical-nonmaterial entities which involve multiple distributed biological mechanisms. Barrett notes, "if scientists believe in a world of essences that are waiting to be discovered, they will devote themselves to finding those essences, a potentially endless quest" (162).

From the semiotic perspective, falling into the essentialist trap is always a danger. Mistaking or conflating the name of an entity with an imagined or expected clearly defined neurobiological substrate may be quite unconscious. And then the question becomes where in the brain can we find depression, democracy, idiocy, idiosyncrasy, and ideology. With respect to many concepts and certainly with emotional concepts, our biology is functionally general, but we take the concept name and impose it on our biological, affective, and cognitive introspective responses. These names become culturally conventionalized, but our brains and bodies do not correspond to these engaging cultural conventions.

Barrett argues that although her emotion concepts are not instantiated in unique biological organs, they are nevertheless real. In the same way, I would argue that physical-nonmaterial symbolic concepts are real. From my perspective, emotions and symbolic reference are both constructed entities. Barrett's research is concerned with emotion, but there are also other concepts that are real as well. For example, physical-nonmaterial symbolic concepts such as certainty, socialism, reason, participation, goal, and reward are very much the same kinds of things. They are physical only to the extent that they have causal effects. Barrett recognizes these as a different form of reality. She recognizes that the terms we use as labels for emotions are cultural constructs, not biological entities. They are symbolic terms that societies/cultures impose on certain mental states and other physical-nonmaterial entities.

Prediction

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The brain has both top-down and bottom-up processes. In a highly distributed manner, the brain stores an individual's past experiences. In the production of a mental state, information comes in from the world where it is mediated by information from the brain and the body. The information from these internal and external sources is integrated into a model and generates a prediction about what action should be taken next. If the action is successful, that information is recorded in the model. If the action is unsuccessful the system initiates the relevant corrections.

Within the brain, model construction begins in the limbic regions and the motor system. It includes also information signals from multi-model association cortices which are influenced from interoceptive and somatosensory information signals from the body resulting in a prediction for action. The success of the action is processed once again in the brain and the body for error correction and becomes part of the modified model.

Now the question becomes what is the nature of the information signals that come from the body and the world. Would some interpretation be involved in producing the prediction and action?

Favereau (2015) notes that what has to be explained is how something that is nonphysical/ physical-nonmaterial created by the physical brain. Barrett and colleagues hypothesize a neural substrate for predictive processing. I suggest that perhaps the same neural substrate may underlie the human ability to create symbolically physical entities. Biosemiotics may be able to use the biology of predictive coding to help explain the physical brain's ability to create physical-nonmaterial symbolic entities.

Similar to Barrett, Favereau argues that imprinting, developed via an organism's experience in the world (i.e., feeding, mating, and avoiding danger), creates meaning in

the form of if/then action programs. However, human organisms must navigate situations that present a wave function of competing and often contradictory if/then opportunities and demands from which an action must be chosen. Such a situation requires an interpretation of the meaning of the alternatives that results in the collapse of the wave function in the form of a response. So, it may be the case that prediction and interpretation work together to subserve relevant action. On the other hand, "prediction" and "interpretation" may be degenerate terms for the same neural process.

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