Ontology and Perception

Abstract

The ontological question of what there is, from the perspective of common sense, is intricately bound to what can be perceived. The above observation, when combined with the fact that nouns within language can be divided between nouns that admit counting, such as ‘pen’ or ‘human’, and those that do not, such as ‘water’ or ‘gold’, provides the starting point for the following investigation into the foundations of our linguistic and conceptual phenomena. The purpose of this paper is to claim that such phenomena are facilitated by, on the one hand, an intricate cognitive capacity, and on the other by the complex environment within which we live. We are, in a sense, cognitively equipped to perceive discrete instances of matter such as bodies of water. This equipment is related to, but also differs from, that devoted to the perception of objects such as this computer. Behind this difference in cognitive equipment underlies a rich ontology, the beginnings of which lies in the distinction between matter and objects. The following paper is an attempt to make explicit the relationship between matter and objects and also provide a window to our cognition of such entities.

General Introduction

Lying at the center of this article is the claim that the study of ontology ought to begin with what is perceived rather than what is said. Researchers who are interested in ontology should take as their starting point what is given in the perceptual field rather than what nouns are present in a given language. Some ontological research begins and ends with an analysis of the relationship between a language and its speakers (see for example see Lutz, Riedemann, and Probst (2003), Kayed and Colomb (2002), and Wielinga, Schreiber, Wielemaker, and Sandberg (2001)). There are, however, general problems associated with language that should warn us from investing too much in the implications of what nouns appear in a given language. One such general problem is found in the seemingly simple distinction between mass nouns, such as ‘water’ or ‘gold’, and count nouns, such as ‘human’ or ‘pen’. Some nouns are difficult to place on one side or the other of this distinction. One such noun is ‘glass’, which can be used to refer to an object capable of containing liquids or as a material that composes several such objects. The mass-count distinction is the subject of the section that immediately follows. Fortunately, for those who are interested in the ultimate source of the distinctions drawn within any ontology, we have recourse to some provocative research into infant object perception. Such research indicates that there is a primitive distinction to be made between objects, entities which are coherent wholes, and materials, entities which lack coherence. This is a primitive distinction for the very fact that the infants who seem to make it do so without any significant understanding of the linguistic distinction between mass and count nouns. Next, attention will be given to what is needed on the side of human perceivers in order to not only draw such a distinction, but to use it during daily interaction with the world. It will be argued that we need two types of concepts in order to negotiate our way through the
world. On the one hand we need concepts in order to track real world instances, such as particular buses, walls, and drops of water. On the other hand, we need concepts that are general in the sense that they can be used to recognize that a completely new instance, as when occurs when I am introduced to a new person, belongs to the same class as previously encountered instances. In addition to concepts, we also need to investigate what sorts of rules must be present in order for human subjects to so readily discriminate between objects and materials at such an early age. Such rules must be receptive to surface properties such as color, shape, and texture in order to begin to explain the discriminatory behavior of the infants in the psychological tests cited below. Subsequent to this discussion, the relations among rules and concepts, respectively, will be explored.

The Mass-Count Distinction

It is important to keep in mind that the mass-count distinction is first and foremost a linguistic one. Quite simply, there are mass nouns, such as ‘water’, which refer to matter, or more colloquially, stuff, while count nouns, such as ‘car’, refer to objects. We may be asked to count the number of cars in the parking lot and understand just what this task means. But can we count the number of waters on the table? Are we to count the water in the glass as a unified whole and the small area of water that collected beside it as another? In order to make linguistic sense of the task of counting waters, we would have to add some sort of count term in front of the mass noun ‘water.’ So we may be asked to count the areas or puddles of water on the table which admit counting.

However there is a series of issues which can result in the dissolution of the mass-count distinction. First of all, how are we to determine mass from count nouns? It is clear that whether a noun can be made plural and still make grammatical sense is not an adequate criterion of differentiation. Consider words such as ‘news’ or ‘woods’ and immediately one obtains a grasp of the difficulty of maintaining the distinction. Despite the ‘s’ at the end of these words, in English they function as singular nouns. For example, to relay bad news we say, “The news is bad.”. Further, words that at first glance appear to be of the mass variety also seem to be able to be readily counted. For instance, I may pass two separate ‘woods’ on my way to grandma’s house. In addition, in a restaurant I may easily order two ‘waters’ and have my order understood by the server who has heard it. One may claim that with respect to the latter example that ‘waters’ is an abbreviated form of ‘glasses of water.’ Ware suggests that we define the distinction according to the type of quantifiers and determiners that are used in front of the two types of noun (1979). This seems plausible but undesirable in that we want the distinction to be applicable to nouns, not to noun phrases. The issue is whether mass nouns divide the reference in a different way than count nouns.

In order to attempt to answer this question we need to set aside quantifiers and determiners and deal with them separately.

Another possible criterion that could be used to maintain the mass-count distinction is to hold that the two differ according to what they refer to. So, as Cartwright explains, count nouns refer to individuals while mass nouns such as ‘water’ refer to stuff (1979). This suggests that there is a genuine ontological distinction that corresponds to the linguistic one. But, we may certainly ask whether mass nouns use a different referring mechanism than count nouns. In other words, when we say ‘milk is a good source of calcium’, it appears as though we are not intending to refer to a discrete mass of milk but rather to a type of matter. The question seems to be whether milk in this sentence refers to a different kind of entity than ‘man’ does in this sentence: ‘man is an animal.’ And if so where does this difference rest? Is it an ontological difference having to do with the
nature of being of that which is referred to? Or is the difference found in the way we think about what they name?

In addition, what can we say of cases where it is not clear whether we are referring to a type of matter or a particular collection of matter? When a person who is gasping for breath says quite simply, “water”, is he referring to a type of matter or an instance?

**Quine’s Body-Mindedness**

There are several issues that could be raised based on the observation that mass nouns can be classified according to whether they refer to an instance of matter or they refer to a type of matter. First and foremost, we may ask how we come to form types of anything. A concomitant topic consists in whether types exist in the world or only in the minds of human observers.

Perhaps all we have is a world of individuals. If so, it is unclear whether such a world includes discrete instances of matter and what individuating criteria can be applied to matter in such a way as to result in discrete instances. Moreover, matter has the additional problem of not being a body in the sense of Quine (1974). At stake is the relationship between the cognitive representation of matter and Quine’s observation that human beings are instinctively body-minded. If we accept the claim that there are representational advantages bestowed upon bodies, what does this mean for the representation of matter?

Let us begin to address this latter question by first attempting to describe the presence of the matter concept and its role within human cognition. What I suggest is that we look upon the matter concept in much the same way as the object concept. However, there is a fundamental difference between the two. This difference is first noticed in psychological experiments conducted on infants, and it is appropriate for us to note the results from such experiments as they shed light upon how basic the distinction between matter and object actually is.

There are many experiments (for example, Baillargeon et al. 1985; Chiang and Wynn, 1997; and Huntley-Fenner et al., 2001) which show that while infants readily track objects, such as toy cars and rubber ducks, they fail to track discrete instances of matter, such as sand or gel. The literature regarding infant object recognition (Spelke 1994) suggests that the reason for this is that instances of matter lack certain principles or properties that objects possess. According to Carey and Xu (2001, p. 207) infant experiments on object recognition point to the following conclusion:

> These infant studies suggest that the object tracking system is just that: an object tracking system, where object means 3D, bounded, coherent physical object. It fails to track perceptually specified figures that have a history of non-cohesion. (Emphasis in original work).

An example of this is found in two experiments (Baillargeon et al. 1985, Chiang and Wynn 1997). In each experiment, infants were presented with one of two trials. In one, a coherent, bounded object was dropped behind a screen that was placed in front of the infant (object trial). In the other, sand was poured behind a screen (material trial). In both cases the screen was removed after the initial presentation to test the subject’s response to the disappearance of the item in question. The results were that the infant subjects showed surprise (as measured in amount of time the infant spent
gazing at the area where the object or material was supposed to lie) upon the outcome of the object trial, but did not show surprise in the material trial. These experiments lend support to there being an object tracking system within our cognitive repertoire, but not a material tracking system.

What are we to make of the fact that infants routinely fail to track instances of matter? Furthermore we can ask a more fundamental question: when presented with a non-solid instance of matter, does the infant perceive a non-solid instance of matter? I want to claim that this is indeed what the infant perceives. Notice how this is a more detailed claim than that found in the literature pertaining to infant object perception. The claim made by Carey and Xu above seems to suggest that what the infant perceives is primarily a non-object in the standard sense of objects being three-dimensional, coherent entities. This is an important claim, but it does not tell us much with respect to the infant’s perception of matter instances. What I would like to do below is to attempt to fill in the details with respect to the perception of discrete instances of matter.

The broader point to be made is that perception alone cannot account for the fact that there is a fundamental difference between objects and non-objects, the latter of which includes materials such as clay or sand. Rather, perception must be linked to more advanced cognitive systems which are both flexible and specific enough to be sensitive to incoming perceptual information, yet rigid and general such that the information that comes in is properly classified and tracked (or not tracked in the case of a discrete instance of matter). Seen in this way, perception is not a lower level cognitive activity that is divorced from higher level activities such as categorization. It is, instead, embedded within cognition. Furthermore, without perception, there would be little need for categories or concepts as well.

The Matter Concept

Here, let us take stock of what kinds of entities we need in order to recognize, re-identify, and track collections of matter. The view taken up here is that there is a hierarchy of concepts which we must describe in order to begin to speak about recognizing matter. We will begin by describing our more general concept of matter.

First, there is matter which is a broad superordinate category that stands as a contrast-class to object. When enumerating the principles that determine whether an entity falls under the matter category, we want the principle to be sufficiently flexible to handle a wide variety of types of matter. In addition, we must keep in mind that at least in infancy, the matter concept seems to be underdeveloped in contrast to the object concept.

What determines matter from objects are certain irregularities of shape which are present in the instances of the former. Matter, the concept, is attuned, in the way that our perceptual system is attuned to perceiving objects and matter instances and not molecules, to discontinuities in shape, which objects, as a general rule, do not present. However, there are always exceptions to general rules which we will observe in a moment. The fact that matter corresponds to shape irregularities means that there are different criteria which are used to recognize, re-identify, and track matter instances.

This is an important point which Keil, Kim, and Greif develop within their chapter in Forde and Humphreys (Eds., 2002). In their chapter, Keil et al. speak of the perceptual shunt as key to
cognitive processing of low-level perceptual information. The shunt is claimed to be a mechanism that channels perceptual information to different parts of the brain for subsequent higher level cognitive processing. The idea is that in order for this process to work, our cognitive structure must be sensitive to salient perceptual information. In Keil’s et al. (2001, p.13) words, “data can only enter the system if it sets off primary perceptual triggers.” The attempt for us is to apply these ideas to the perception of instances of matter.

The experiments conducted on infants point to the conclusion that objects, in the standard sense, are assimilated according to shape. However, matter instances are assimilated according to the material which composes them. Soja, Carey, and Spelke’s (1991) experiment included presenting infants (2 year olds) with a named object with a T-shape and a named non-solid matter instance of a novel shape. After the infants were habituated to the two items they were shown two more sets of items. After being shown the T-shaped object, infants tended to apply the stimulus name to a T-shaped object made of a different material as being more similar to the original object than a collection of separate objects made of the same material, but having a non-T-shape. However, when presented with a matter instance of a novel shape, the infants applied the stimulus name to a differently shaped entity made of the same material rather than a similarly shaped entity made of a different material. This experiment shows that there is an interesting dynamic between shape and material which is applied to differentiate matter instances from objects.

There are several questions involved in interpreting the results of this experiment. First and foremost is the question of how the subjects are receptive to the fact that material composition is salient in one trial and not the other. In other words, just what are they using to apply the stimulus word and how are they using it?

I would suggest that what the subjects perceive are discrete matter instances. However, in order to assimilate the stimulus with the target, the child must perform two different tasks at two different levels of cognitive processing. First, she must somehow mentally extract the material composition of the named stimulus. Also, she must have some notion that the material composition in the material experiment is salient. Yet it is not so in the object trial. At issue is how this is performed. The answer must be found at the top-level of conceptual formation rather than in bottom-level perceptual experience. There are constraints which guide the mind in order to perceive instances of matter. One such constraint was mentioned above. Shape irregularity seems to be a good candidate for matter instance recognition. Allow me to elaborate why I single out shape irregularity as being salient to the classification of matter.

There is, according to my interpretation of the above experiment, an important distinction to be made between perceiving shape irregularity and using it to assimilate two matter instances to a single name. The recognition of the fact that the named stimulus is of a novel shape signals to the infant that the substance of which it is composed is of primary import. (Of course there are other such signals found in surface properties, for instance texture and color distribution, which we will set aside here.) This leads the infant to overlook differences in shape upon being asked to assimilate names to different instances of matter. There are obvious objections to this interpretation. For example, just how do we define a novel or irregular shape? A man is irregularly shaped in a sense. Are we to classify a man as an instance of matter?

My first response would be to say that shape irregularity refers to asymmetry in shape. But this will
not due for we can certainly think of counter examples. For instance a symmetrical portion of gold is called gold and this holds irrespective of its symmetrical shape. It is interesting to consider the following. If a semi-solid matter instance such as clay were molded into a T-shape and presented as a named stimulus, would infants subsequently assimilate the name to targets of the same shape as in the object trial? The current literature on infant perception (Huntley-Fenner 2001) seems to predict that the result of such an experiment would depend upon how the named stimulus was presented. So, if we formed the semi-solid material into a T shape prior to presentation, then infants would assimilate the name according to shape. However, if we perhaps fashioned the material into a T-shape before the infant’s eyes, then assimilation would take place based upon material composition. In any event, it seems to me that it is entirely possible or even very likely that an irregular shape marks a matter instance, however difficult it is to theoretically define.

There are two more constraints placed on the cognitive processing of matter instances which I want to touch upon. The first is what I refer to as the uniformity constraint which tells us that there is something peculiar about perceiving matter instances. Uniformity says that instances of matter are in general composed of a uniform material throughout the instance. This applies especially to solid, opaque masses such as a nugget of gold. Of course, this assumption could be dead wrong. There could be a mass of some other mineral or metal concentrated in the center or scattered throughout. Nevertheless, we tend to apply matter instance uniformity based upon surface uniformity. This applies equally to translucent, non-solids such as water, even when it has been mixed with, say, salt. The tendency is to view the mixture as being uniform throughout the instance.

Moreover, the last constraint, which delineates our perception of matter instances, is that in general they do not present to us any significant surface divisions. In other words, objects present us with parts at the mesoscopic level, which is the level at which we perceive. For example, cups have handles and humans have arms. Of course, there is not a clear boundary between the handle and the remainder of the cup, and the arm from the remainder of the human. Nevertheless, instances of matter lack this phenomenon. From this, we seem to be much more able to mentally parse the cup into parts than the contents that the cup contains.

What we are left with then are three constraining principles – the principle of irregular shape, uniformity, and lack of perceptible surface divisions – which interact to give us the matter concept. There are significant, outstanding questions that one could ask of these constraints. For instance, are we to look upon them as necessary or sufficient conditions for the matter concept? And further, how do they interact?

What I would like to do is to briefly articulate some of the relationships that exist among these principles. First, let me make this observation regarding the uniformity principle. Whether an instance of matter is uniform is not discoverable upon immediate visual perception. This sets uniformity apart from shape irregularity and the lack of perceptible surface divisions, which are perceived upon immediate visual inspection. What this means is that uniformity is something which the subject derives on the basis of the other two principles. This derivation is important to the perception of an instance of matter. This is because the perception of matter instances includes depth information, information upon the physical properties of the instance at points that are hidden from visual inspection. This is what distinguishes it from the perception of animals or artifacts whose inner, physical properties are much more intricate and are available only to those with specialized knowledge, such as biologists. So, the perception of portions of matter proceeds from
shape irregularities and a lack of perceptible surface divisions to material uniformity throughout the portion in question. Of course, a lack of perceptible surface divisions is more strongly connected to material uniformity than shape irregularity is. When perceiving an instance of matter, a lack of surface divisions implies uniformity of material throughout the instance.

What I would like to do now is to contemplate whether we have left something out of our analysis of perceiving portions of matter. Perhaps the three principles weighed above are aspects of a more fundamental principle that explains the perception of matter instances. I offer the following for consideration. There is a difference of degree in what I call the three-dimensional definiteness between instances of matter and standard objects. When perceiving a particular portion of matter from a particular angle, it is much more difficult for the subject to mentally construct the perceptual properties of the part that is obstructed from visual inspection than is the case with standard objects. This is due in large part to the three principles described above. Irregular shape and the lack of perceptible surface divisions make the determination of what is on the other side difficult. Yet, with, for example, a T-shape object, it is not very challenging to surmise what the object would look like if rotated. However, the uniformity principle does at least tell us what type of matter the occluded side is made of. So, in a sense, uniformity reduces the amount of indefiniteness we have concerning the three-dimensional view of the matter instance in question. It counteracts to a certain extent the uncertainty with which irregular shape and lack of perceptible surface divisions leave us. For instance, when presented with a large portion of gold, we cannot properly imagine what the occluded section looks like based on visual perception alone. However, we do assume that gold composes the unseen section whatever particular shape it may have.

Of course there are problems with these remarks as well. It seems as though the lesser degree of three-dimensional definiteness applies well to certain types of matter instances. But can the same be said of a portion of water, which given its transparency is perhaps more three-dimensionally definite than a T-shaped object? This objection I intend the reader to consider. But it contains a point on which I would like to focus next: the notion of types of matter.

**Types of Matter**

There are different types of matter, many of which we lack specific names for. First of all, there is the heap or collection of objects at close spatial quarters such as an archipelago. This type can be further divided into heaps which have parts of uniform shape and size such as piles of sand and those composed of parts of all shapes and sizes, for instance a heap of garbage. Next we have semi-solid types of matter, which include peanut butter and clay. Also, there are kinds of fluids such as gases and parcels of air in physical geographic parlance. Furthermore, we have liquids such as water, and finally solid kinds, for instance, gold.

What I want to suggest is that the reason we need a type classification of matter is that different types of matter are inductively rich. This is to say that their formation facilitates important inferences pertaining to how instances of matter behave. This is perhaps a point that is worth emphasizing. Knowing that an instance of matter belongs to a particular type tells us something about its physical composition. So a semi-solid mass, or to stick with our terminology, a semi-solid instance of matter, can be divided into smaller portions that are composed of the same semi-solid material. In addition, knowledge that a matter instance belongs to a particular type tells us something about the behavior of the instance of matter. For example, a semi-solid instance would
provide a certain amount of resistance upon surface contact. In addition, if we placed a semi-solid instance on the top of an inclined plane we would not expect it to move toward the bottom. We would expect a liquid such as water to do so, however. There are two implications to be drawn from this observation.

I am intrigued by Pascal Boyer’s (Millikan, 1998) argument for category-specific tracking processes. Tracking instances of a different matter type would, I theorize, involve different processes due to different motions. Tracking a cloud of gas moving through the air is a lot different than tracking a slab of bronze as it is being fashioned into a statue. I want to say it is different because there seems to be a difference in the degree but not the kind of cohesion amongst the respective types of matter to which these instances belong. In fact, we can establish a continuum of cohesion among kinds of matter ranging from the least cohesive fluids such as smoke to the most cohesive solid masses such as gold with semi-solids in the middle.

I also think that since different kinds of matter have different behaviors, then it can also be claimed that discrete matter instances are more than just collections of parts. For instance, an area of water is more than a collection of water molecules. This is because although significant chunks of material can be added to or taken away from an instance of matter, we still view that matter instance the same as before the change. What this seems to imply is that instances of matter bear a significant resemblance to Aristotelian substances, at least as they are described in Book VIII of the Metaphysics.

What bothers me about this claim is that there is a problem with respect to Aristotelian substantial change. Aristotle recognized that although an entity may change, we still acknowledge the changed entity as being identical to the entity which existed before the change. There is something out there in the world and in the entity in question which causes this phenomenon. For Aristotle, it is this something that is matter. In Book VII, Chapter 1 of the Metaphysics, line 1042 a 32, we read the following: “But clearly matter also is substance; for in all the opposite changes that occur there is something which underlies the changes.”

The problem of applying this principle to an instance of matter rests in the following. Imagine a scenario in which we have a quantity of water in a glass. We then take the glass and pour some amount of the water out, leaving us a smaller quantity of water (which we will designate Q1) remaining in the glass. Next, some new water is poured into the same glass. Finally, we pour another amount of water out leaving us another quantity of water (designated as Q2), which is exactly the same amount as (Q1). The question arises whether the water that remains in the glass at (Q2) is the same as that at (Q1). We really cannot be certain that the water at (Q1) stayed at the bottom during the course of the second out-pouring, or that some molecules somehow moved into the amount which was poured out. In sum, we cannot determine whether the whole or any part of (Q2) is identical to (Q1) in which case there seems to be no causal foundation for us to call the (Q2) water the same as the (Q1) water.

But we would be correct in calling the (Q2) water identical to the (Q1) water and this not because they have identical quantities. Rather, their identity is based on two considerations. First of all, they are uniform wholes and this is true regardless of how many molecules of (Q2) are different from (Q1). Secondly, the two quantities display identical behaviors, for example, each react in the same way upon coming into contact with something else. The glass holds both in the same way. This is
in addition to the other perceptible physical properties such as color, which are used in identification. They are the same type of matter, but are the instances the same? I want to claim that they are because they are of the same type in addition to being the same quantity. Whether or not they have the exact same molecules we leave to the scientist to determine.

But one obvious objection to these observations is that we could be completely wrong about calling the two quantities the same. Suppose it was not water which was poured into the glass but some chemical that bears a striking resemblance to it. In which case at (Q2) we have some sort of water-chemical mixture that differs from (Q1) which was entirely composed of water. Here we have two different types without even knowing it.

This is certainly a serious objection. But the key is to notice that it misses the point that I wanted to make. The point is to discover how we re-identify matter instances across change. The objection cites the fallibility of our knowledge. The fact that our knowledge can be wrong is a separate issue from how, in fact, we do come to identify and assimilate. It is the case that we do identify entities as being the same. We do track entities across time. We need to do so in order to survive. How we perform these tasks is a different observation than the observation that we could be wrong. Besides, I could be equally wrong in believing that I am a philosopher. Perhaps I am a victim of a deception. To which I reply that perhaps this is true, but it is highly unlikely.

The Material Object Concept and Material Objects

Before we proceed, I call attention to the fact that thus far we have been careful to speak of matter instances. This is because it is important to notice the differences between discrete instances of matter and what is known in the literature on infant perception as standard objects. These differences are ontological. What I wish to do now is to speak of the conceptualization of matter instances. For this reason, I will use the term material object instead of matter instance. This is meant to reflect that just as we need an object concept to track objects, we also need a material object concept to track material objects. However, let me make clear that a material object refers to a discrete instance of matter. From now on I will use the terms ‘material object’ and ‘matter instance’ or some variation of the latter interchangeably to refer to particular portions of matter.

With this in mind what remains is a description of the material object concept and material objects. Specifically, we should ask just what are material object concepts, why do we need them, and how are they formed?

Basically, what is meant by the material object concept is the cognitive representation of material objects that is utilized during cognitive processing. They are collections of special properties that distinguish material objects from standard objects. Surface texture and color seem to be two such properties to which material object concepts must be receptive. We need material object concepts in order to re-identify and track an enormous range of possible individual material objects.

What is of particular difficulty when devising a strategy to deal with a theory of matter is the amazing array of possible material objects that could exist in the world. Somehow a comprehensive theory must be able not to explain them all, but to accommodate a large majority of them. Take for example a heap of similar objects such as tennis balls. According to what was said above, this would be a material object. After all it resembles a heap of sand. But even if it is a material object
how can we know this? Texture and color don’t seem to tell us anything different in the case of a heap of tennis balls than a single tennis ball does.

First, we know it is a different object from a single tennis ball not because of color or texture. The salient feature seems to be the irregular pattern of edges which the heap presents to the observer. As the visual system builds the primal sketch of the entity in the sense of Marr (1982), the viewer is presented with an irregular collection of edges which outline it. Contrast this with a single tennis ball, which presents a comparatively regular set of edges. Second, we know the heap is a material object because it has a certain behavior; it reacts a certain way upon surface contact. We know, for instance, that taking a ball from the bottom of the heap will probably have consequences for those balls above it, even those balls that are not in immediate contact with it.

But we may ask why we need material object concepts at all? There are two reasons for this. First our material object concepts must be able to capture and preserve properties that distinguish among the different types of matter. Secondly a material object concept must also capture specific properties of particular matter instances.

**Convergence**

What I would like to do now is to connect the entities that we have discussed in order to form a coherent explanation of material object perception. The strategy is what I call convergence, which is one that attempts to combine top-down and bottom-up approaches to explaining the mystery of material cognition. The mystery is how people can easily recognize and re-identify material objects given the infinite variety of shapes and sizes they may have. To begin, I will attempt to clarify the explanatory strategy of convergence and attempt to situate such a strategy within the literature on cognition and perception.

Traditionally there are two approaches regarding human conceptual development which are referred to above by the terms ‘top-down’ and ‘bottom-up’. Top-down approaches are committed to the assumption that our concepts are formed independent of human-world interaction. One variant of a top-down approach is conceptual nativism which holds that we are born with at least some, if not all, of the concepts we have during the course of our respective lifetimes. On the other hand, bottom-up approaches are committed to the assumption that our concepts develop out of human-world interaction. The term ‘bottom-up approach’ is an umbrella term for all varieties of empiricism. The strategy of convergence is meant to simultaneously acknowledge such assumptions and also to set them aside. I would argue that setting these assumptions aside is important for two reasons. First of all, the debate between empiricism and nativism, despite its rich philosophical history which is too long to report in this article, may in fact be a diversion from what we should be seeking an explanation for. Namely, we should be seeking an explanation for human-world interaction, for without such an explanation the debate between empiricists and nativists would be incomprehensible. Secondly, and along such lines, we should be working toward building an ontology which exists independently of any assumptions like those made by the empiricists and nativists. The strategy offered below, that of convergence, marks the very start of such an endeavor.

I will focus on our formation of material object concepts, which are used to track specific instances of matter. We may ask how material object concepts are formed. My view is that they are formed through a union of conceptual constraints and perceptual information.
First of all, the matter concept is a collection of properties to which the perception of matter instances must be attuned. We have tried to find these properties above. These properties play a major role in determining which objects are to be placed into the material object class. However important these properties are in the recognition of material objects, they do not provide us with the ability to single out specific instances of matter.

In order to have specific material object concepts that track specific matter instances we also need lower level perceptual information. What is meant here by lower level perceptual information is information about shape, size, location, etc. that is specific to this area of water, for example.

Thus the claim is that our material object concepts, which are used to track specific instances of matter, are formed where the properties of the matter concept and lower-level perceptual information converge.

**The Material-Object Concept – A Test Case**

Now let us take the time to test some of the ideas included above in a test case. The case is designed to be difficult in order to see how well the ideas discussed so far withstand some significant pressure.

Let us imagine we have in front of us two entities. One entity is a rock of a particular shape and color. The second entity has the exact same shape and size as the first, but it is obvious due to its distinct physical properties that it is gold. So, the first object we refer to as ‘a rock’, a count noun; while the second we refer to as ‘gold’, a mass noun.

What is the true difference between an object and a material object? In this instance we have two entities with the same surface properties of shape and texture. Further, they can be said to have the same behaviors in that both react identically to surface contact and both are coherent in the same way. In addition, if one is irregularly shaped, then so is the other. Moreover, let us suppose that their shape is such that it does not indicate any distinct mesoscopic parts. In sum, the constraints meant to distinguish between matter and object seem to apply to both entities. So, the distinction seems to break down at this point.

However, I argue that there is indeed a difference between the material object, gold, and the object, rock. The difference rests in the composition of the entities and the uniformity assumption discussed above. In the case of gold, we assume that the color gives us information about what the entity is composed of throughout its extension in space. In fact, we would be truly shocked if we found out that the gold on the surface was just a patina. Notice that if we did make this discovery the piece of gold would become instead a gold covered rock. This applies even in cases not involving precious metals where there is a desire for material uniformity, such as coal.

Further, it is uninteresting to apply the uniformity constraint to the rock. Instead, we would be more interested if we were told that the rock was not uniform throughout and contained sections of gold scattered within it; in which case it would still be called a rock, but it would be one with scattered portions of gold within it. The point is that speculating about and coming to know of the innards of the rock does not affect its status as a rock as much as in the case of gold. Also, we have different
names for both types of objects. We do not call gold a ‘gold rock’ but we have special names, such as ‘gold nugget’ or ‘piece of gold’ for a significant portion of gold.

Next, we may inquire as to what degree this object/material object distinction is captured by the linguistic mass/count distinction. The problem is that language does not encapsulate this distinction in its entirety. The difficulty is that ‘gold’ can be used to refer to a type of matter which is defined by the properties that gold has. However, it can also be used to refer to a particular material object composed of gold. Somehow we know that when a miner shouts, “I’ve found gold”, he is referring to some particular portion of gold with boundaries as yet to be discovered. Yet, similarly, we know that when a milk-drinker says that, “milk is a good source of calcium”, he is referring to a type of matter and not to some particular material object. It is my contention that a major part of how we can decipher these different referents is that we have an order or hierarchy of concepts which help us to understand our world. And just as there are higher-order constraints that aid our understanding, these same constraints help us to decode and make sense of our language.

A Final Objection

Before we conclude, let us consider yet one more objection. The objection is provided by Millikan in her 1998 article “A Common Structure for Concepts of Individuals, Stuffs and Real Kinds: More Mama, More Milk, and More Mouse.” Millikan’s argument challenges some of the core assumptions underlying the claims found in this paper.

First, according to Millikan, concepts are not constructed by attending to properties. Millikan’s aim is to provide a nondescriptionist account of concept formation. Concepts are not formed through the listing of specific properties. This is because properties cannot be used as the basis of individuation. Rather, the extensions of concepts, the instances that fall under the concept, are determined much more primitively through a process along the lines of what philosophers of language would call rigid designation. In other words, concepts do not describe entities; instead, they point to or enumerate entities. Indeed Millikan’s analysis of concepts proceeds along the lines of an analysis of how the nouns we use in our language refer. This relates to her view on how the use of language comes to influence our concepts. She claims, “Having substance concepts need not depend on knowing words, but language interacts with substance concepts, completely transforming the conceptual repertoire” (Millikan 1998, p. 55).

Secondly, it is important to realize what Millikan classifies as substances. Substances include “stuffs” such as milk and gold, individuals such as Bill Clinton, Mama, and the Empire State Building, and real kinds. Examples of real kinds include Rosch’s (1975) basic level categories such as mouse and house which children learn first (Millikan 1998).

There is a reason why Millikan includes such various items under the substance category. Specifically she wants to claim that there is not a genuine ontological distinction to be made between material objects, or in her terminology, stuff, such as milk, and objects, such as mouse. Here is Millikan (1998, p.56) describing the relationship between concepts and ontology:

My claim will be that these apparently quite different types of concepts have an identical root structure and that this is possible because the various kinds of “substances” I have listed have an identical ontological structure when considered at a suitably abstract level.
The concepts *mouse* and *milk* have the same structure, so Millikan claims, as concepts of individuals like Mama and Bill Clinton. The claim is that stuff concepts, such as gold, are rooted in our cognitive structure because they are conceptually and ontologically similar to individual objects. Millikan makes another point that is worth mentioning here. She claims that there is a distinction to be made between a substance concept and the properties that a substance is known to possess. She states:

> It is because knowledge of the properties of substances is often used in the process of identifying them that it is easy to confuse having a concept of a substance with having knowledge of properties that would identify it (Millikan 1998, p. 63).

So, in sum, the acquisition of substance concepts involves storing information about substances and associating this information with the correct set of properties.

**A Brief Response**

Allow me to respond to Millikan by noting some of the consequences of her position. First of all her position seems to be much more complex than the one offered in the body of this paper. Further, this complexity is found in the way the mind perceives the world, not in the world itself.

Millikan’s view seems to contradict the empirical findings relating to infant perception cited above. This is a point that Paul Bloom emphasizes in his Open Peer Commentary response to Millikan (1998). Infants applied names for objects very differently from names for stuff or material objects as seen in the experiment conducted by Soja et al. (1991).

Secondly, it is not clear to me how we are to link our information of substances to the correct list of properties. In order to do so, it would seem we would have to think of an additional cognitive mechanism. This would be in addition to the perceptual shunt talked about above which is necessary to pick out the salient properties of objects and material objects alike. Under Millikan’s view we would need some sort of structure to connect the important properties to our information of substances. Further this structure, it would seem, must translate our perception of properties and our information on substances into a uniform format or perhaps language. It appears as though Millikan is committed to some form of the position that the mind is a general processor, which holds that the mind employs a general strategy and/or language across tasks.

The consequence of this view is that online processing, the kind of cognitive processing that operates on perceptual information, becomes inordinately difficult and slow. This is because perceptual information, our knowledge of properties, and our substance concepts must be joined together and subsequently processed. Again, this contradicts the fact that infants readily and easily distinguish between objects and material objects. In addition, if perceiving substances occurs the way Millikan describes, then it is hard to see how readily we can make distinctions that are relevant to our survival. When I cross a street and notice that there is a bus rapidly moving toward me, I do not link bus properties with bus substance. Instead, I do know quite early in my perception of the bus that it is an object and furthermore has a likely trajectory which, if I don’t take immediate action, will threaten my survival. Millikan overlooks the fact that perception, to be of any use to us, must not only be accurate and consistent more often than not, but also must be agile and quick.
enough to deliver real-time information to cognitive systems of more sophistication.

A simpler explanation is available if we recognize that there are different entities in the world, ontologically speaking. Two such entities include objects and material objects. The world is complex. However, the way ordinary people conceptualize the world is much less so.

**Conclusion**

In sum, we have attempted to notice what place perception has, not only within our cognitive capacity, but within our daily interaction with the world around us. Our concepts must be amenable to perceptual information in order for us to make sense of the world in which we live.

Thus, the claim is that we must utilize both a top-down and bottom-up processing mechanism in order to classify matter into types. Also we need this explanation to build material object concepts which are used to track particular material objects located within the visual field. Also, we’ve proposed three general constraints: uniformity, shape irregularity, and absence of perceptible surface division on the mesoscopic scale. We also considered whether these three may be aspects of another general constraint, which we referred to as three-dimensional definiteness which limits material objects to having a uniform material composition throughout. These filter down to the material object concept level and facilitate the classification of matter into types. However, they don’t provide us with specific types. Rather, specificity comes from the perception of material objects. The representation of material objects is sensitive to texture, color, and irregularities in shape which material objects possess.

There are two reasons for treating material object concepts. First, they are inductively rich and their processing is sufficiently complex. Different types of material object behave differently upon surface contact. There seems to be a continuum of coherence, which explains this. Second, this richness is not entirely captured by language, specifically by the mass-count distinction.

**Acknowledgements**

I would like to thank Roberto Casati, Randall Dipert, Gerald Erion, Barry Smith, and an anonymous reviewer for helpful comments. All remaining errors belong to the author. I would also like to acknowledge the National Science Foundation for supporting this research under the IGERT program at the State University of New York at Buffalo under award number DGE-9870668.

Jeffrey S. Galko  
State University of New York at Buffalo

**References**


_______________________________________________________________
Copyright ã 2004, Humboldt State University