6 Para-Natural Kinds

Roy Sorensen

A para-natural kind is an absence defined by a natural kind. For instance, cold is defined as the absence of heat and shadow as an absence of light.

There is a folk taxonomy for para-natural kinds. Scientists refine this taxonomy by improving the alignment of our commonsense categories with the corresponding para-natural kinds. After William Hershel discovered infrared light, physicists acquiesced to his talk of invisible shadows (despite the locution echoing the oxymoronic “invisible light”). When William Ritter went on to discover ultraviolet light, physicists continued the process of extending ‘shadow’ across the electromagnetic spectrum.

Just as scientists discover new natural kinds such as the platypus and the electron, scientists discover new para-natural kinds such as biological niches (Smith and Varzi 1999).

Elsewhere I have argued that scientists have overlooked para-reflections and para-refractions (Sorensen 2003): picture a white beach ball and a black beach ball resting on the surface of a placid pond, as shown in figure 6.1.

The sun is shining from behind you and to your left. The white ball has a reflection because light is bouncing off the ball and onto the flat water. What about the black ball? Since the black patch is due to the light that does not reflect off the ball, that patch cannot be a reflection of the ball. The distinction between para-reflections and shadows is salient in cases of objects that have both simultaneously, as shown in figure 6.2.

The black ball has a para-reflection on the side near the sun and a shadow on its far side. If a hot duck wants to cool off, it will paddle to the ball’s shadow, not to its para-reflection.

There is little pressure to correct the marginal confusions between reflections and para-reflections because the generalizations that govern the host work well for the parasite. For instance, the virtual image of a fish’s shadow is displaced in accordance with Snell’s law even though Snell’s law concerns light rather than the absence of it.
Figure 6.1
A reflection and a para-reflection.

Figure 6.2
Simultaneous reflection and para-reflection.
The positive transfer of learning from host to parasite is copious—and symmetrical. Students often learn about the host by studying its parasites.

Absences are not substances and so are not natural kinds. But they have so many other features of natural kinds (lawfulness, mind-independence, projectibility) that they are frequently mistaken as natural kinds.

Since money is not a natural kind, bankruptcy is not a para-natural kind. Nor are voids that form fortuitously. Consider the hidden figure in *The Tomb and Shade of Washington* (figure 6.3). The “silhouette” is depicted as forming coincidentally; the figure does not inherit the structural integrity of the trees and plants which frame it.

Figure 6.3
James Merritt Ives, *The Tomb and Shade of Washington*. 
Para-natural kinds also differ from *substances* that get defined in opposition to other natural kinds. Consider pure samples. To borrow an example from Sarah Sawyer (2003), corundum is a colorless mineral with the pure chemical constitution Al₂O₃. If mixed with a little chromium (less than 1 percent is enough), the mineral is a ruby. (The chromium makes it red.) If corundum is adulterated with titanium and iron, the mineral is a sapphire. (These trace contaminants make it blue.) If absences never mattered for kind individuation, mineralogists would not be able to distinguish pure corundum from rubies and sapphires.

**Extending Plato’s Metaphor**

Plato compared definers to butchers (*Phaedrus* 265d–266a). The amateur hacks the carcass, the expert carves at its joints. Similarly, a good definition reflects pre-existing divisions.

In the segmental sense, a joint is a body part joined to another body part. In the privational sense, a joint is the gap between the two segments. This opening promotes actions such as bending, gliding, and rotation.

Natural kinds correspond to the segments. Para-natural kinds correspond to the openings.

The Greek atomists show early appreciation of the mechanical liberties conferred by para-natural kinds: a plenum makes for a static universe in which objects gridlock. By placing atoms in a void, the atomists could explain the locomotion of a cart, the absorption of a sponge, the filtering of a sieve, and the “suction” of a siphon.

**Contrast with Artifacts**

Natural kinds owe their features to their internal nature. They have characteristic origins, and characteristic patterns of change (such as the phase structure of water). This regularity is underwritten by a rich network of causal interactions that are kept stable. Similarly, shadows wax and wane systematically. Sundials exploit this regularity.

Artifacts contrast with natural kinds. Clocks are alike in that their purpose is to measure time, but this end can be achieved by diverse physical principles. Thus there are sundials, water-clocks, hourglasses, pendulum clocks, and digital clocks. Artifacts morph easily into other artifacts such as when a door becomes a table. This flexibility makes sense given that artifacts are so dependent on intentions.
Para-natural kinds depend on natural kinds but otherwise share the contrasts with artificial absences. For instance, origins are important: your shadow cannot have been cast by someone else.

In some respects, shadows meet hopes about natural kinds better than any natural kind. For instance, shadows are homoromerous: any part of a shadow is a shadow. Consequently, a shadow can be made of nothing but shadow (any light in a shadow is pollution). So each part of a shadow is homogenous with respect to its intrinsic properties.

Shadows are so well behaved that the founders of projective geometry have precisely axiomatized their movements. Given all this lawfulness and predictability, shadows have been of considerable interest to scientists—especially astronomers who can only examine objects telescopically.

Nomic Legacies

Para-natural kinds inherit the lawfulness and projectibility of the natural kinds that shape them. A black raven confirms “All ravens are black” but a white handkerchief does not (despite the logical equivalence of “All ravens are black” and “All non-black things are non-ravens”). W. V. Quine’s explanation is that ‘black’ and ‘raven’ pick out natural kinds but ‘non-black’ and ‘non-raven’ do not.

I agree that ‘raven’ picks out a natural kind. I agree that ‘non-raven’ does not. But I think ‘black’ picks out a para-natural kind. (‘Non-raven’ is not a para-natural-kind term because it is merely the complement of ‘raven’.) Black is an absence of hues arising from a relative absence of light flow (whereas white is an absence of hues arising from an indiscriminate flow) (Sorensen 2008, 217–218). Blackness can be achieved in a variety of ways just as blue can arise from disparate physical mechanisms.

Many would be reluctant to go along with Quine’s assimilation of colors to natural kinds. Colors are secondary qualities, properties that arise from a combination of psychology and primary qualities. Whatever this does to the status of black as a para-natural kind, it does raise an interesting issue about secondary qualities. Black is the appropriate visual response to an absence of light-flow, so the physical component of the secondary quality is an absence rather than the presence of physical stimulus.

Human beings prefer to picture reality positively. Philosophers precisify this conviction in various ways, such as the linguistic claim that negative statements can be paraphrased as positive statements. This preference for the positive leads scientists to interpret absences as positive things. For instance, black is taken to be the color of maximally efficient
light-absorbers. They insist that the blackness of a lightless cave is only
darkness, not blackness. In unguarded moments they will describe sun-
spots as black; but once the lack of a light-absorber is noted, they will
redescribe sunspots as merely dark.

The distinction between positive and negative is often relative to a scale.
'Sobriety' is a negative term insofar as it indicates absence of drunkenness,
but it is a positive term with respect to character assessment.

Grammar is only an imperfect guide to the positive-negative distinction.
Logicians have tried to put the distinction on a more principled basis by
associating positiveness with specificity. In keeping with the philosophical
tendency to associate the less real with the psychological, philosophers
have also tried to characterize negative terms in terms of disbelief or frus-
trated expectations.

Anything less than a chapter-length summary of these efforts (some
worthy descendent of Gale's 1976 review) would fail to do justice to the
sophistication and insightfulness of these efforts. Yet in my opinion, these
efforts are premature because a patient study of absences shows that they
come in a rich assortment. People do not carefully sort items they plan to
discard. More specifically, metaphysicians have not carefully classified the
absences they wish to expel from their ontologies. Just as a physical anthrop-
ologist learns much by meticulously examining trash, a metaphysical
anthropologist can learn much by studying what philosophers wish to
dismiss as unreal.

Scientists agree that they sometimes mistake the negative for the posi-
tive. Benjamin Franklin believed that electric current flowed from where
it is to where it is not. His factual errors led to the entrenched misnomers
about the positive and negative poles of batteries.

A shadow conforms to many of the laws governing its host, light. As a
bonus, a shadow echoes the boundaries of its caster. Galileo exploited this
fidelity when measuring the heights of lunar mountains.

But a shadow is an absence of light. The laws of light only indirectly
apply to shadows. If shadows were directly under the jurisdiction of the
law, they would be counterexamples to important corollaries about how
things behave. During a lunar eclipse, the earth's shadow appears on the
far side of the moon without penetrating the moon. Shadows have no
mass or momentum. They move, but not because one stage of the object
causes the next stage of the object. Yet shadows propagate at speeds that
precisely relate to the speed of light in the medium in question. The proper
path to understanding a shadow is always a detour off the main road of
physics.
As is evident from the controversial career of the vacuum, Aristotelian philosophers and many hardheaded scientists have denied that para-natural kinds are appropriate objects of study. After all, absences are not even objects!

However, para-natural kinds inevitably come along for the ride once we accept a metaphysics of natural kinds. Just as citizens underestimate the contribution of illegal immigrants to their economy and overestimate the ease with which they can be expelled, theoreticians underestimate the services of absences—and their entrenchment.

**Natural Kind or Para-Natural Kind?**

Sometimes there is uncertainty about whether something is a natural kind or a para-natural kind. Early astronomers modeled stars as holes in the celestial sphere. A celestial fire burns on the other side of the sphere. As the sphere moves, the holes move in unison. So instead of postulating many light sources that manage to move while maintaining their relative positions, the hole-theorist postulates a single perforated sphere and a single source of light.

Sometimes scientists are confident that one member of a pair of terms denotes an absence but are unsure which is the positive term and which is the negative. Is heat the absence of cold or cold the absence of heat? Ernst Mach (1896/1986) believed that the question made no empirical difference and so regarded the issue as merely verbal—and perhaps a little comical—anticipating a bit of Gerald Grow’s humor (figure 6.4).

Atomists eventually persuaded most physicists that cold is indeed the absence of heat. The issue was not verbal—and, contrary to Mach’s positivism, it would not have been verbal even if there were no way to resolve the dilemma.

The intense chemical activity of chlorine can be modeled as the effect of an electron hole in its outer shell. The absence of this electron behaves like a positive charge because electrons are attracted to the gap.

Indeed, Paul Dirac modeled the proton as a hole in a sea of negative-energy electrons. Such a hole would act like a positive energy electron with a reversed charge.

Hole-theorists offer you something for nothing. Instead of postulating a new entity, you postulate a gap in an entity to which you are antecedently committed. You solve the problem by using less of the stuff you already have!
Yesterday, I found out that I am a cartoon character, and I've spent all night trying to decide if I'm the lines or the spaces in between.

Figure 6.4
Cartoon by Gerald Grow.

In addition to this parsimony with substances, there is parsimony with respect to forces. As illustrated by the least-effort principle in mechanics, we prefer explanations that postulate fewer forces. We prefer explanations that appeal to omissions rather than commissions. Failures to prevent the natural course of events provide a simpler explanation than interventions.

Epistemologically, para-natural kinds have the same potential to solve confirmation puzzles, in particular, Carl Hempel's Raven paradox and Nelson Goodman's new riddle of induction. Psychologically, developmental studies should reveal para-natural-kind thinking in toddlers just as developmental psychologists have discovered natural-kind thinking in children almost as soon as they can be interrogated.
Kripke Tests

Para-natural kinds pass many of the tests we employ to distinguish natural kinds from nominal kinds. Saul Kripke emphasizes tests which demonstrate that beliefs about the object are not necessary for reference. Consider the ignorance test. If agnostic or misinformed speakers still manage to refer, then their knowledge about the kind cannot be responsible for reference. A more objective link, such as causation, is needed.

‘Shadow’ passes Kripke’s ignorance test. Speakers make errors of omission and commission about the nature of shadows and yet still successfully refer to them.

Kripke’s account of how natural-kind terms achieve reference extends smoothly to para-natural-kind terms. In lecture three of Naming and Necessity, Kripke illustrates his concept of a reference-fixing description with ‘heat’. The sensation of heat was used to lock on to a natural kind, but ‘heat’ does not mean the sensation of heat. If we apply the reference-fixing account to ‘sound’ we get an interesting answer to the riddle: “If a tree falls in a forest and no one hears it, does it make a sound?” Physicists dissolve the riddle by distinguishing between two senses of ‘sound’, one for sound waves and the other for auditory sensations. But Kripke would not admit that there is a sense of ‘sound’ in which it means the auditory sensation. Instead, auditory sensations merely fix the reference of sound. So Kripke’s answer to the riddle is that the tree would make a sound. This underscores the objectivity of sounds.

A parallel story applies for ‘cold’. The sensation of cold was used to lock on to the para-natural-kind of cold (the absence of heat, or more specifically, thermal energy). The reference-fixing description can be positive without the corresponding kind being positive. Ice would be cold even if there were no one around to feel cold. Coldness is objective.

Natural kinds are still needed to differentiate absences from one another. Mice die from cold, not darkness or silence.

Putnam Tests

Hilary Putnam emphasizes tests that are designed to show that nominal essences are not sufficient to pick out natural kinds. If speakers with the same beliefs (individuated narrowly) pick out different things, then their environments must determine the meaning. Imagine a Twin Earth in which there is a smoky type of substance that projects from objects that block
light sources. To the prescientific eye, the dark gas-like projections behave just like shadows: they assume the shapes of their casters, defy gravity, and obey the laws of projective geometry. But the dark projections are actually substances rather than absences of light. The dark things people see would not be shadows even though the speakers on Twin Earth use a word that sounds just like ‘shadow’.

What really determines the reference of ‘shadow’ are the samples of shadows used by founding speakers. The word ‘shadow’ is an effect of those shadows and it is the causal connection that fixes the reference, not the stereotypes and superstitions that guided early discourse about shadows.

The good performance of shadows on these Putnam tests and Kripke tests should be expected: para-natural kinds are “copying” the test results of their corresponding natural kinds!

**Back-up Strategy**

If an apparent natural kind does not seem to fulfill the requirements, then one should entertain the possibility that it is actually a para-natural kind.

Consider the issue of whether diseases are natural kinds. On the one hand, diseases have many of the marks of natural kinds:

The diverse systems of classification in the history of medicine proceed not, in most cases, from mere convenience or arbitrary choice, but from a first reliance on descriptive accounts worked out prior to some access to the underlying causal processes of these conditions. Once the underlying nature is discovered, ideally a specific virus or bacteria, the previous descriptive account is either reformed or adjusted to the now discovered underlying disease process. (D’Amico 1995, 557)

Patients defer to physicians to learn what diseases they have. We all engage in this linguistic division of labor when wielding terms such as ‘arthritis’. On the other hand, diseases appear to be deficiencies, departures from the norm that compromise survival and reproduction. These privations lack integrity. Pathogens can exist separately from the organisms they infect (and are themselves subject to diseases). But the disease itself depends on its sufferer: diseases depend on the organism in the manner moth holes depends on a moth-eaten shirt.

One way to reconcile this dependency with the resemblance to a natural kind is to characterize diseases as para-natural kinds. Given the analogy between diseases and irrationalities, fallacies and fads, there may be scope for para-natural kinds in the social sciences.
Second Order Para-Natural Kinds

First order para-natural kinds are absences defined by natural kinds. Second order para-natural kinds are absences defined by para-natural kinds. Nasal passages are para-natural kinds defined in terms of holes in the nose. Choanal atresia is an absence of these holes, in particular a congenital failure of one or both nasal passages to open. There is a whole family of congenital disorders that consists of absences of holes: esophageal atresia, anal atresia, aortic atresia, and so on. These holes have vital functions. People with an absence of these holes must have them surgically supplied.

Some types of fossils are second order para-natural kinds. Archeologists have found footprints with an important human characteristic: the absence of a gap between the big toe and the next toes. This second order absence is evidence of a stable longitudinal arch. This can be seen in the impressions of the heel and of the ball of the foot left by humans walking with a normal gait on soft ground.

Or consider the “waves” that pass through shadows. Although they obey nearly all the laws that govern normal waves, they cannot be real waves because they do not transfer energy. Their medium is a shadow. These para-waves are second order para-natural kinds.

There can be third order para-natural kinds, fourth order, and so on. This hierarchy may stimulate the traditional doubts about an unparsimonious proliferation of absences.

This worry may be tempered by the thought that if one is going to be unparsimonious, then be unparsimonious about absences! There is no substantive addition to your ontology. This bookkeeping loophole is analogous to that touted by believers in the principle of unrestricted composition. Consider the creative accounting of David Lewis (1991, 81). Yes, Lewis counts any combination of objects as an object. No, he has not added anything to his base ontology. Lewis starts with \( n \) cats. He applies the principle of unrestricted composition and gets \( 2^n - 1 \) cat fusions. But not any more cats.

Lewis (2004) counts absences as causes. So his initial stock of cats must be supplemented with many absences of cats. But he does not have any more substances than he began with.

One limit on this precedent is that mereological fusions are extensional. Many absences may have a psychological aspect. In 1838 the explorer Charles Wilkes mapped the South Seas.
Spreading out all five vessels from north to south, so that an estimated twenty miles of latitude could be continuously scanned on a clear day, they sailed over the coordinates of these “vigias,” or doubtful shoals. Invariably they found no sign of any hazard, and Wilkes would later send a list of these phantom shoals to the secretary of the navy. As the Ex. Ex. was proving, exploration was much about discovering what did not exist as it was about finding something new. (Philbrick 2003, 77)

Absent shoals are creatures of expectation. These psychological absences are prone to the general problems of mental overpopulation. But para-natural kinds are objective absences. Shadows and craters are not mind-dependent.

**Historical Controversy**

Parmenides objected to absences on the grounds that non-being cannot exist. Atomists were accused of smuggling non-being back into reality with their claim that empty space is available for the movements of atoms. The history of science has involved various Parmenidean purges in which absences get pushed out the front door. The resulting absence of absences creates negative pressure which then draws them back in—usually through the back door.

There are important exceptions. With his edict of 1277, Pope John XXI escorted the void in through the front door. Although nominally aimed at the Arab infidel Averroes, the real target was known to be the excesses of the Aristotelians. Exclusion of the vacuum was forbidden (to make room for the Christian doctrine of creation from nothing), and this promoted interesting speculations about the behavior of objects in vacuums. Can they be seen? Might they move less than infinitely fast?

Vacuum research became empirical in the seventeenth century. The devout Blaise Pascal defied René Descartes’s plenism with explicit barometric arguments for a vacuum (leading Descartes to confide to Christian Huygens that Pascal had too much vacuum in his head).

Absences are traditionally viewed as a special problem for materialism. The Lewis dialogue on “Holes” features a materialist trying to parry objections based on holes. Roberto Casati’s and Achille Varzi’s *Holes and Other Superficialities* (1994) characterize holes as immaterial beings.

But absences are as much a difficulty for the idealist as the materialist. The mental realm has vanishing points, objectless emotions, lexical gaps, and other embarrassing whatnots (Sorensen 2007). Absences, like existence and time, pose a generic ontological challenge.
Some Parting Imagery

A patriot about natural kinds would object to an outsider’s advocacy of aboriginal rights for absences. Their sentiments parallel those voiced by Prime Minister Paul Keating immediately preceding the Australian Bicentenary in 1988 (figure 6.5).

“I do not believe that the symbols and the expression of the full sovereignty of Australian nationhood can ever be complete while we have a flag with the flag of another country on the corner of it.” What is the Union Jack of absences doing on the masthead of realism?

The seven points of the star below the Union Flag represent each of the six original states of Australia plus a star for the Commonwealth’s internal and external territories. The right half depicts the Southern Cross, the brightest constellation visible from the Southern Hemisphere. Although the Southern Cross is large in spatial extent, it is composed of only five stars or perhaps only four if you count only the four prominent stars needed to form the Latin cross. Some Australians claim the Southern Cross is the smallest constellation.

But Northern Hemispherians might claim smaller constellations. The three brightest stars of Triangulum form an isosceles triangle. Canis Minor has only two stars, Procyon and Gameisa. (Canis Minor is one of Orion’s hunting dogs.)

A constellation is an extended pattern of stars. This rules out single-star constellations: a single point cannot constitute a shape. However, the Australians could still claim to have the smallest constellation, and, simultaneously, the biggest. Next to the Southern Cross is a dark shadow called the Coal Sack. This is the head of the Emu, a negative constellation. It is

Figure 6.5
The Australian flag.
an immense expanse of blackness between stars and the bands of the Milky Way caused by the dust and gas clouds of space.

Ancient aborigines knew that the male emu sits on his mate’s eggs. The bird symbolizes the role of Aboriginal Elders in the initiation of boys into manhood. The constellation may have also played a role in Aboriginal navigation and their calendar. In any case, the Emu is the largest and longest known constellation.

Some may resist calling the Emu a constellation. But bear in mind that constellations are not natural kinds. The stars only look to be closely situated and to have shapes from a terrestrial perspective. Constellations are visual mnemonics that help us remember the positions of randomly distributed stars. Negative constellations serve this mnemonic function just as well as positive constellations.

The Emu is not a para-natural kind. It is a fortuitous formation like the hidden figure in *The Tomb and Shade of Washington*. Even so, the Emu is a grand absence, worthy of note on a map of the night sky, and if it were a genuine para-natural kind the Emu would be of still greater interest.

**Summary of Three Theses**

My parity thesis has been that, by and large, what goes for natural kinds goes for para-natural kinds. So there is linkage; if you adopt a metaphysics of natural kinds, then you will also be committed to para-natural kinds.

Conventionalists may interpret this linkage as a new destructive premise: if the interesting features of natural kinds are also features of para-natural kinds, then natural kinds are no more real than shadows.

However, I am a believer in natural kinds. My more specialized work on shadows, para-reflections, and their ilk has been guided by natural-kind reasoning. It is no coincidence that the parasitical kinds have the same interesting features as the host. They owe their order to natural kinds, not the other way around.

The recommended attitude toward para-natural kinds is that they are a bonus, an unanticipated byproduct of a metaphysical system that has appealed to common sense and scientific thinkers since the era of Aristotle.

**Acknowledgments**

I thank Gerald Grow, at <http://longleaf.net/ggrow>, for permission to reprint his cartoon.
References


