

On Drawing Lines on a Map

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Abstract

The paper is an exercise in descriptive ontology, with specific applications to problems in the geographical sphere. It presents a general typology of spatial boundaries, based in particular on an opposition between *bona fide* or physical boundaries on the one hand, and *fiat* or human-demarcation-induced boundaries on the other. Cross-cutting this opposition are further oppositions in the realm of boundaries, for example between: crisp and indeterminate, complete and incomplete, enduring and transient, symmetrical and asymmetrical. The resulting typology generates a corresponding categorization of the different sorts of *objects* which (complete) boundaries determine or demarcate. The theory is applied first of all in the areas of geography and of administrative and property law. Indications are then given as to how the typology may be applied also in other fields where physical and fiat boundaries are at work, including the field of cognitive linguistics and the related field of the ontology of truth.

Dividing Reality

Thomas Jefferson famously called into being the states of the so-called Northwest Ordinance by drawing lines on a map.¹ A number of issues are involved in understanding the peculiar creative magic at work in such a performance. These have to do with the nature of Jefferson's politico-geographical authority and with the practical and legal problems of translating ink-lines of a certain thickness on paper into working territorial borders on the ground. To deal in coherent fashion with these issues, however, it will be necessary first of all to consider certain more fundamental ontological questions relating to such creative actions and their products. What sorts of entities are these, which can be brought into being simply by drawing lines on a map? What are the forms and limits of such creativity, and how do the created entities relate to entities of the more humdrum sort? The remarks which follow, offered in answer to these questions, relate to a body of axiomatic work on what has come to be called 'mereotopology', an alliance of topological methods with the ontological theory of part and whole.² I shall here confine myself to informal consideration of the

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When Jefferson first draw his map in 1874, drawing off 14 neat checkerboard squares between the boundaries of the Atlantic colonies and the Mississippi River, his map was sufficiently inaccurate that it did not even have the Great Lakes in the right place. In the end, 10 states were nonetheless created in this area, having boundaries which follow Jefferson's lines in large degree.

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This work is summarized in Smith 1993, in Eschenbach, *et al.* 1994 and in Casati and Varzi (forthcoming). For a useful overview of related formal work by geographers on these issues, which however does not include a treatment of mereological ideas, see Herring 1991.

basic problems. The topological machinery will allow us to do justice to the fact that Jeffersonian delineations are effective in the geographical sphere only if the boundaries one creates are, in the jargon of topology, Jordan curves (broadly: the boundary of a geopolitical or administrative entity must be free of gaps and must nowhere intersect itself). Constructing topology on a mereological basis, rather than on the basis of set theory as is standardly done, will allow us further to do justice to the fact that there are no (or no obvious) candidate ‘atoms’ or ‘elements’ in the geographical world from out of which a universe of sets could be constructed. Rather, geographers deal with fields or regions of different shapes, sizes and functions, with sub-fields of these regions, and with the ways these fields and sub-fields overlap or fail to overlap. They deal, in other words, with a mereologically structured world.

Some of Jefferson’s delineations correspond to what we might call *bona fide* boundaries: river-banks, coastlines, and the like. These are boundaries *in the things themselves*. They would exist (and did already exist) even in the absence of all delineating or conceptualizing activity on our or Jefferson’s part. *Bona fide* boundaries are boundaries which exist independently of all human cognitive acts – they are a matter of qualitative differentiations or discontinuities in the underlying reality. You, too, possess *bona fide* boundaries of this sort (which correspond, roughly speaking, to the outer surface of your skin and to the boundaries of your internal organs). As is clear, however, if we examine the borders of practically every single political and administrative unit of the North-American continent, there are delineations which correspond to no genuine heterogeneity on the side of the bounded entities themselves. There are, in other words, not only *bona fide* joints in reality, but also pseudo-joints, of a type which are to be found also outside the geographical sphere, for example in the medical divisions, such as that between the upper, middle and lower femur, so extensively documented in atlases of surgical anatomy (see Fig. 1).

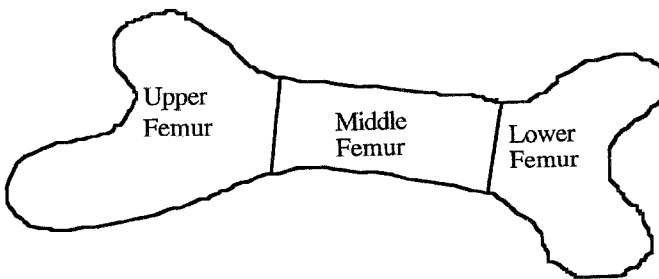


Figure 1.

Fiat Objects

Let us call boundaries of this created sort *fiat* boundaries, a terminology that is designed to draw attention to the sense in which the latter owe their existence to acts of human decision or fiat, to laws or political decrees, or to related human cognitive phenomena. Fiat boundaries as here understood may come into being either via deliberate choice, as in the Jeffersonian case, or as it were automatically, as when, by looking out across the landscape, I create, without further ado, that special type of fiat boundary we call the *horizon*. Clearly, national and state borders, and county- and property-lines provide a wealth of examples of fiat boundaries of the former, deliberate type; we shall see that the realm of human vision is a happy hunting ground for fiat boundaries of the latter, non-deliberate, type.

Fiat boundaries are boundaries which exist only in virtue of the different sorts of demarcations effected cognitively by human beings. Such boundaries may lie entirely skew to all boundaries of the *bona fide* sort (as in the case of the boundaries of Utah and Wyoming). They may also, however (as in the case of Indiana and Pennsylvania), involve a combination of fiat and *bona fide* portions, or indeed they may be constructed entirely out of *bona fide* portions which however, because they are not themselves intrinsically connected, must be glued together out of heterogeneous portions in fiat fashion in order to yield a boundary that is topologically complete. It is my intention that the opposition between fiat and *bona fide* boundaries should be regarded, modulo the existence of these mixed cases, as exhaustive and exclusive. Thus I do not wish to deny that there are types of spatial boundary which are difficult to classify under one or other of the two rubrics:

- exists independently of human cognitive acts
- does not exist independently of human cognitive acts.

And I do not wish to rule out, either, that it may be necessary to introduce at some later stage a categorization more detailed than the simple dichotomy here presented. Since, however, we do have many clear and important cases of boundaries which can be classified unproblematically in terms of this simple dichotomy, I will proceed in what follows as if the dichotomy itself is unproblematic. (And independent evidence for the coherence of this strategy is provided by the fact that almost everything which can be said in terms of the fiat-*bona fide* dichotomy in the spatial realm has an analogue in the realm of temporal objects (events, processes, states: see Smith 1994.)

Once fiat boundaries have been recognized, then we can apply the fiat-*bona fide* dichotomy also to the corresponding (bounded) *objects*. Objects, we can say, come in two sorts, the *bona fide* and the created, the latter being distinguished from the former solely in the fact that their boundaries arise, in whole or in part, through human cognitive operations of certain special sorts, in such a way that both boundaries and objects *exist* only in virtue of these operations.

The fiat-*bona fide* dualism can be contrasted with a range of alternative ontological options of *monistic* flavour which have played a role in the history of ontology and of related disciplines:

1. Some (we shall have occasion only later to press specific charges) would have it that *all* objects are fiat objects (for example that they are the result of human ‘conceptual articulations’) and that the very idea that there exists an underlying world of *bona fide* objects is merely the expression of an illegitimate ‘objectivist’ metaphysics, presupposing some notion of a ‘God’s eye view’ that is held to be inappropriate to our post-enlightenment age. (Lakoff 1987)

2. Some, at the opposite extreme – the friends of physics, as we might call them – would have it that *no* objects are fiat objects, that our talk of the latter is *mere talk*, of no further ontological significance. (Friends of *ultimate* physics would insist further that all *bona fide* objects exist on a level way beneath our everyday ken, so that they would reject, too, candidate meso- and macroscopic *bona fide* objects such as people and planets.)

3. Some, finally – we might call them geographical monists – would have it that fiat objects are not created but merely selected from the infinite totality of geometrically possible regions of space.

Against all of these positions (and their many variants) we adopt here a more general, less conceptually constricted, framework which will allow us to express not only what is coherent in the positions mentioned but also what we take to be the correct view, according to which there are not only fiat objects, certain peculiar

features of which demonstrate that they are products of genuine creation, but also *bona fide* objects, including *bona fide* objects of human scale such as, for example, you and me. And if it can be accepted that clear examples of fiat objects are provided by the Jeffersonian entities with which we began, then it will follow that not the least important reason for admitting fiat objects into our general ontology will turn on the fact that *most of us live in one* (or in what often turns out to be a nested hierarchy of such objects).

Types of Boundaries

As already pointed out, geographical fiat objects will in general have boundaries which involve a combination of *bona fide* and fiat elements. The shores of the North Sea are *bona fide* boundaries, but we conceive the North Sea as a fiat object nonetheless, because where it abuts the Atlantic it has a boundary of a non-*bona fide* sort. The status of the latter boundary is somewhat peculiar, since there seem to be few practical consequences which turn on the issue as to where, precisely, it lies. The case is similar in regard to many geographical boundaries of what we might call the purely qualitative sort (as contrasted with legal, political and administrative boundaries): consider, for example, the boundary between a hill and an associated valley. As such examples make clear, it is necessary to draw a further opposition between what we might call *crisp* and *indeterminate* boundaries (Cohn and Gotts 1994). For many geographical objects (deserts, valleys, dunes, etc.) are delineated by boundary-like *regions* which are to some degree indeterminate.³ Moreover, political boundaries were once themselves standardly created in places (mountain ridges, middles of rivers) where there is little human activity and thus little chance or occasion to look into their exact location.⁴

We must bear in mind also that many national and property boundaries do in course of time come to involve boundary-markers: border-posts, watch-towers, barbed-wire-fences, garden-posts, and the like, which will tend in cumulation to convert what is initially a fiat boundary into something more real (tangible, physical). Moreover, there are often reasons of a non-arbitrary sort why these and those fiat objects are

³Indeterminacy is first of all an epistemological issue, a reflection of the fact we can establish no clear line where the fertile region ends and the desert begins. The difficulties in moving from an epistemological to an ontological concept of indeterminacy are legion, and must here be left aside. A complete treatment of these matters must take account also of the fact that the objects with which we have to deal as cognitive agents are often cognized in terms of fiat boundaries (as inscribed, for example, on maps) which are sharp, even where such sharp boundaries are not genuinely present in the physical world (the world as it exists independently of human cognitive demarcations).

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See Prescott 1979, e.g. p. 112 on the way in which boundary disputes arise because of incomplete boundary evolution: 'Positional disputes will usually arise at one of two stages. Most of them will arise during the demarcation of the boundary, because the commission will be faced with the problem of matching the boundary definition to the landscape. However, it is also possible that positional disputes will arise at a much later date if the demarcation commission makes an error.' On the role of maps in boundary-disputes see also *op. cit.*, pp. 127ff. On boundary-impermanence and the histories of boundaries over time, see pp. 171f., 178f.

created rather than others. Thus it seems to have been a complex medley of considerations relating to shipping, trade, harbours, climate, markets, etc., which led our ancestors to create the fiat object "North Sea" in a way which could not, just as well, have motivated them to create, say, a "Middle Sea" stretching between the Bermudas, the Azores, and Gotland. Fiat objects thus in general owe their existence not merely to human fiat but also to associated real properties of the relevant factual material (they are functions of *affordances*, in J. J. Gibson's terms). As demarcated in mesoscopic (geographical) reality they are in every case linked to *bona fide* objects of comparable scale, without which the relevant demarcations could not be effected at all. It is already for this reason a confusion to suppose that *all* objects (or all mesoscopic objects) might be of the fiat type. As the reports of boundary commissions make abundantly clear, the very possibility of fiat demarcation presupposes the existence of *bona fide* landmarks in relation to which fiat boundaries can be initially specified and subsequently re-located.

Note that the admission of fiat objects into our ontology is at least in one respect unproblematic: all fiat objects are supervenient on *bona fide* objects on lower levels in the sense that the fixation of relevant traits at the lower levels suffices to fix the values of traits at higher levels. The interiors of fiat objects are in this sense autonomous portions of autonomous reality. Only the respective external boundaries are created by us; it is these which are the products of our mental and linguistic activity, and of associated conventional laws, norms and habits. The relevant underlying thingly factual material (*unterliegende sachliche Tatbestandsmaterial*, as the German lawyer says) is in every case unaffected thereby.

Some Special Features of Geopolitical Boundaries

Boundaries in general exist as a matter of necessity only in consort with (as dependent parts or moments of) the higher-dimensional entities they bound. (Brentano 1988, Smith 1992) Geopolitical boundaries, or at least the paradigm examples thereof, are distinguished further in being infinitely thin. All political and legal boundaries must, it seems, enjoy in the long run the sort of geometrical perfection that is associated with infinite thinness: they must take up no space. For otherwise disputes would constantly threaten to arise in relation to the no-man's-land which the boundaries themselves would then occupy. If a wall or river separates two distinct portions of land, then either the wall or the river must be split equally down the middle, or it must be assigned as a whole to one or other of the two parties, or it must be declared common property (and then there will exist *two* infinitely thin boundaries separating each of the two distinct parcels of land from the commonly owned region which divides them).

Each adjacent pair of geopolitical boundaries (say: on the Franco-German border) manifests in addition the phenomenon of *coincidence* of boundaries.⁵ The boundary of France is not also a boundary of Germany: each points inwards towards its own respective territory. Contrast, in this respect, the Western boundary of the old German Democratic Republic: here, exceptionally, no coincident twin was established, since the Federal Republic did not institute a boundary in that location at all. Moreover, as the case of Texas and the U.S.A. makes clear, distinct geopolitical boundaries may also coincide from within. That is, they may coincide for a part of their length along which they serve as boundaries *on the same side*.

⁵See Brentano 1988; compare also Smith 1995 and (forthcoming) for an axiomatic treatment of this notion.

One important reason for conceiving fiat objects and fiat boundaries as created entities (rather than as entities picked out or discovered within the pre-existing totality of all relevant geometrically determined possibilities) turns on the fact that there are fiat boundaries which coincide (occupy an identical spatial location) throughout their total length. The name 'Hamburg' refers on the one hand to a certain German city, on the other hand to one of the constituent states of the German Federal Republic. As it happens the boundaries of Hamburg *Stadt* and of Hamburg *Land* coincide exactly, and both point (serve as boundaries) in the same direction. But they are for all that not identical, as is seen in the fact that the two might in principle diverge (as is currently true, for example, in relation to the analogous case of the city and state of Bremen).

Note that even though political boundaries exist as full-fledged denizens of reality, and even though such boundaries exist always as parts of the things they bound, the coincidence of boundaries yet falls short of identity. France and Germany share no common parts. The border of France is, after all, *French*.

Scattered Objects

The examples of fiat objects mentioned above were in almost all cases examples of proper parts which are delineated or carved out (by fiat) within the interiors of larger (for example continent-sized) *bona fide* wholes. As the case of Japan or New Zealand makes clear, however, the restriction to such cases is by no means necessary. Boundaries (like the things they bound) can be *scattered* (Cartwright 1975); they can be built up mereologically out of separate and disconnected bits. The drawing of fiat boundaries can thus create not merely – Montana-style – fiat parts within larger *bona fide* wholes, but also – Hawaii-style – fiat wholes out of smaller *bona fide* parts. And then, while *bona fide* objects are in general connected, the fiat objects which are circumcluded by fiat boundaries in this way are non-connected.

Interestingly, there are cases where the two distinguished factors – on the one hand the carving out of fiat parts, and on the other hand the gluing together of fiat wholes – operate in tandem, so that geographical objects are created via the fiat unification of disconnected parts within larger *bona fide* wholes: the Holy Roman Empire (of sometimes non-connected principalities, bishoprics, city-states, etc.) will serve as a nice example in this regard, but so will all coastal nations in whose territory islands are included.

Note that there are also scattered fiat objects outside the strictly geographical domain. Examples might be: the Polish nobility, the constellation Orion, the species *cat*. Following Meinong (1899) we might refer to such entities as 'higher-order' fiat objects. Objects of this sort may themselves be unified together modularly into further fiat objects (say: the genus *mammal*, the Union of Pacific Island Nations). Set theory is a general theory of the structures which arise when objects are conceived as being united together *ad libitum* in this fashion on successively higher levels, each object serving as member or element of fiat objects on the next higher level.

Lasting vs. Ephemeral Boundaries

We can distinguish further between enduring and transient boundaries. The boundaries of the Chinese Middle Kingdom and of the Island of Malta are (respectively, fiat and *bona fide*) examples of the former. A great wealth of examples of transient *bona fide* boundaries is provided by non-prognostic weather maps (where we are assuming, realistically, that such boundaries are discovered, and not created, by meteorologists.) Examples of transient fiat boundaries, on the other hand – of transient boundaries which are in truth created by human cognitive operations – can be taken from the

sphere of visual perception. The psychologist Ewald Hering defines the 'visible field' as the totality or region of real objects imaged at a given moment on the retina of the right or left eye. (1964, p. 226) The visible field is thus a *part* of the ambient environment of the visually perceiving subject. Yet the external boundary of this field is for all that a fiat boundary in the sense set out above – a boundary which exists only as a result of human cognitive activity – and moreover it is a fiat boundary which changes with every movement of the eye and head. Moreover, the interior of this field is itself subject to a complex and subtle fiat organization: it is built out of physical surfaces and other components which are structured in terms of an opposition between (1) entities in the focus of attention and characteristically manifesting determinate boundaries ('figures'), and (2) entities which have indeterminate boundaries and which are experienced as running on (as 'ground') behind them.

Linguistic Fiats

A veritable host of transient fiat boundaries comes to be drawn in reality through our use of language. Such carving out of linguistic fiat objects is in part a matter of sheer grouping together, for example of the sort that is achieved through the use of plural referring expressions such as 'Hannah and her sisters', 'Siouxsie and the Banshees', and so on (see Ojeda 1993). But it is in part also a matter of windowing or foregrounding (Talmy, forthcoming) and in part a matter of the articulation of external reality in terms dictated by our concepts: if I point to a group of irregularly shaped protuberances in the sand and say 'dunes', then the objectual correlate of my expression is a complex plurality (a higher-order fiat object with non-crisp boundaries) divided, via the concept *dune*, into constituent (non-crisp) parts or elements. (Smith 1987, § 15) Cognitive linguists such as Talmy, Langacker and Lakoff have rightly emphasized the degree to which language effects complex and subtle concept-mediated articulations of this sort. Unfortunately, however, they too often draw illegitimate epistemological conclusions from this insight.⁶ Moreover they come close to the position mentioned (and rejected) above (a position reminiscent of the fable of King Midas), according to which *all objects to which language refers are fiat objects*. (The error arises through an illegitimate passage from: 'object which we grasp linguistically through concepts' to 'object which exists only in virtue of our linguistically effected demarcations'.)

Certainly an important class of transient fiat boundaries is effected through our use of natural language. As Talmy and others have pointed out, our use of expressions such as 'this' and 'that' in relation to objects in space involves in each case the drawing of an imaginary planar boundary, lying in a plane in front of and parallel to the speaker, which is such that the objects labelled *this* and *that* lie on opposing sides, in roughly the following fashion:

⁶As Lakoff writes: "One of the cornerstones of the objectivist paradigm is the independence of metaphysics from epistemology. The world is as it is, independent of any concept, belief, or knowledge that people have. Minds, in other words, cannot create reality. I would like to suggest that this is false and that it is contradicted by just about everything known in cultural anthropology." (p. 207) Lakoff goes on to admit that the thesis that 'mind creates reality' does not in fact apply in relation to physical reality; it applies, rather, only in relation to the reality of human institutions. Even in regard to human institutions, however, in contrast to what Lakoff has to say, *our thinking does not make it so*.

speaker

this

that

Figure 2.

It is an interesting feature of this type of transient boundary-creation, that it is effected in exactly the same way independently of order of magnitude, from the tiniest ('this flea') to the grossest ('that galaxy'). And as Talmy has also shown (1995), boundaries of the given sort belong to a much larger family which includes also the fictive orientation paths which are created when we assert, for example:

I aimed the camera into the living room.

(think of an invisible line extending out from the camera into the room). Such orientation paths may further be dynamic in nature:

I slowly looked towards the door.

I slowly turned the camera around the room.

And fictive boundaries are at work also in cases of the following sort:

I offered her the book [creates a virtual sphere around the recipient].

She accepted the book [she allows the sphere to be broken].

She rejected the book [she maintains the sphere unbroken].⁷

As should by now be clear, however, it is illegitimate to move from the thesis that such boundary phenomena are pervasive features of our various modes of gaining linguistic access to the world, to the conclusion that the world to which we then have access is a world of fiat only. On the contrary, the very existence of fiat boundaries, here as elsewhere, presupposes a *bona fide* reality consisting of objects of roughly similar scale in and through which such boundaries can be drawn. Moreover, a thesis to the effect that language gives us access only to objects which we ourselves create through our linguistic fiats would imply the impossibility of all scientific investigation of a theory-independent world (including scientific investigation of language itself) and would thus saw off the very hand that feeds it.

One further problem with the work of cognitive linguists such as Lakoff and Talmy is an unclarity as to the question whether the fiat boundaries (including fictive motion paths) created through our uses of natural language are out there in the world (as Talmy's detailed descriptions of his specific examples would suggest) or rather – as the cognitive linguists' favoured methodological pronouncements would have it – somehow such as to exist only in what is referred to as the 'conceptual sphere', so that even space itself can be described as a 'conceptual domain'. If, as I have suggested, the fiat boundaries induced through natural language are of a piece with geographical fiat boundaries, then it is clear how this unclarity is to be resolved: the fiat boundary between things called 'this' and things called 'that' is out there, in the world, in a roughly planar region determined differently from context to context. Cognitive linguists are dealing primarily not, as they themselves often like to suggest, with *conceptual* structures, but rather, like geographers, with structures in the world, albeit with structures of a special, fiat type.

⁷A related type of fictive imposition of in this case temporal boundaries is illustrated in the difference between:

She saw him crossing the road [open interval with indeterminate boundaries].

She saw him cross the road [closed interval with determinate boundaries].

A Coda on Truth and Against Model-Theoretic Semantics

There is, if one will, a windowing of reality that is effected by our uses of language, especially of those descriptive uses of language which are involved in the making of true empirical judgments. The ephemeral fiat boundaries effected through declarative sentences are indeed, or so I will now argue, analogous to the ephemeral boundaries of the visible fields associated with acts of visual perception. This analogy in its turn suggests a new understanding of that relation between judgment and world we call 'truth'. This relation has classically been understood in terms of a 'correspondence' or isomorphism between a judgment or assertion on the one hand and a certain portion of reality on the other. The central difficulty standing in the way of this classical theory turned on the fact that reality evidently does not come ready-parcelled into judgment- or sentence-shaped portions that would be predisposed to stand in relations of correspondence of the suggested sort. It is for this reason that many practitioners of logical or truth-functional semantics have tended, disastrously, to treat not of truth as such (understood as truth *to* an independent worldly reality), but rather of what they call *truth in a model*, where the model is a specially constructed set-theoretic reality-surrogate whose relation to reality itself is left unspecified.

The theory of ephemeral fiat boundaries and of the windowing of reality in language can help us to avoid the need for this resort to surrogates by allowing us to treat judgment itself as a *sui generis* variety of drawing fiat boundaries around entities in reality of a precisely appropriate (truth-making) sort: veridical judgments then stand to fiat judgment-correlates as acts of veridical perception stand to the visible field. Each true empirical judgment can be seen, in this light, as effecting a division of reality in fiat fashion into two disjoint regions:

- a first, truth-making region, consisting of those entities that are relevant to the truth of the judgment in question,
- a complementary region, consisting of those entities not so involved

Truth itself can then be defined as the relation of correspondence between a judgment and its corresponding truth-making region, in such a way that a true judgment would be something like a map of the corresponding portion of reality. A Jeffersonian view of truth along these lines – for all its superficial strangeness – can be seen on inspection to enjoy a degree of phenomenological, linguistic and ontological adequacy that is higher than standardly available accounts. Its phenomenological adequacy derives from the fact that the account of windowing of reality via language is of a piece with an account of perceptual windowing, so that a theory of evidence, of verification and falsification in perceptual acts, is available from the start. Its linguistic adequacy derives from the fact that the view imposes no unitary logical form (the form of functional application) upon our judgments, but is sensitive, rather, to the wide range of different natural-language sentence forms which are utilized in making true judgments, forms whose corresponding demarcatory effects have been described in detail in the work of cognitive linguists (see especially Langacker 1987/1991). Its ontological adequacy, finally, derives from the fact that the view in question – which after all that has been said we might refer to as the Jeffersonian theory of truth – is able to do justice to the untidy, flesh-and-blood character of the reality to which our judgments are directed.

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