

Motion & the Affection Argument

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Abstract

In the *Metaphysical Foundations of Natural Science*, Kant presents an argument for the centrality of <motion> to our concept <matter>. This argument has long been considered either irredeemably obscure or otherwise defective. In this paper I provide an interpretation which defends the argument's validity and clarifies the sense in which it aims to show that <motion> is fundamental to our conception of matter.

Kant's 1786 *Metaphysical Foundations of Natural Science* (MFNS) presents a sustained analysis and exposition of the concept <matter> in order to show that *matter* (the thing) is essentially movable, fills space, possesses motive force, and is a (possible) object of experience.

However, as many commentators have noted, Kant's argument for the centrality of <motion> in his exposition of <matter> appears to be at best a highly compressed and potentially dogmatic empirical claim and at worst is wholly specious.¹ Kant argues that,

The fundamental determination of something [*eines Etwas*], such that it should be an object of the outer senses, had to be motion, because only thereby can these senses be affected. The understanding traces back [*zurückführt*] all other predicates of matter belonging to its nature [*Natur*] to this, and so natural science, therefore, is either a pure or applied *doctrine of motion*. (Preface, 4:476)

The argument attempts to show two claims. First, that the “fundamental determination” [*Grundbestimmung*] of <matter> is <motion>.² Second, that <motion> is a (so to speak) “fecund” predicate, in that all of the other determinations belonging to the nature of matter must be connected to <motion>.

Though the argument raises many questions, in this short discussion I focus primarily on the first claim of Kant's argument, concerning the fundamentality of <motion> to our concept <matter>. I construe Kant's argument as enthymematic but plausibly valid, drawing on auxiliary premises that he could have easily assumed as background to the project he outlines in the Preface of the MFNS. In §1 I present some initial interpretive background to the affection argument. §2 constitutes my argument for my preferred interpretation. §3 presents some further considerations concerning the sense in which <motion> is a fundamental determination of <matter>.

¹ Friedman (2013, 43) calls the argument “especially obscure and cryptic.” Watkins considers it “dogmatic,” and states that the argument “hardly amounts to a satisfactory justification” of the fundamentality of <motion> (1998, 578). Other commentators (e.g. (Hoppe 1969, 42–43, 63–66); (Walker 1971, 123); (Dahlstrom 1991, 271–90, 285)) have taken the argument to at best show that motion is empirically necessary for human beings to have experience.

² Here and throughout I take a “determination” [*Bestimmung*] to denote a predicate, which itself is ambiguous between a conceptual item and the worldly feature which the concept picks out. I will use corner brackets to indicate the concept and italics the worldly feature.

1 The Affection Argument

Kant clearly seems to think the affection argument sufficient to establish the centrality of <motion> to our understanding of <matter>.³ How does it accomplish this task? I take the affection argument (4:476) thusly:

1. Affection by an outer object requires motion
2. ∴ The fundamental determination of matter, as an outer object, is *motion*

By a “*fundamental* determination”, I take Kant to mean here a predicate which picks out some feature that is constitutive of a thing being the kind of thing that it is. In this case, the thing in question is an object of the outer senses—i.e. a thing in space.⁴

The notion of a “constitutive feature” is itself ambiguous between a *metaphysically* constitutive feature—something that is part of the *essence* of the thing, and a merely *epistemically* constitutive feature—something that is merely part (perhaps integrally so) of our concept of it. A useful working example of the kind of distinction I have in mind is that illustrated by the difference between the molecular structure of water—viz. its being H₂O—and its stereotype—viz. a (mostly) translucent, tasteless fluid that fills rivers, lakes, and oceans, etc.. These two notions can in principle come apart, even if they might also coincide (partially or entirely). At this point I leave open which notion (or perhaps both) Kant has in mind. We will return to this issue in §3 below.

If Kant’s aim is indeed to pick out a constitutive feature of *matter* (or its concept) then it is not immediately clear what basis he could have for choosing *motion* and its corresponding concept. A central worry, raised by a number of commentators, is that Kant is merely stating an empirically necessary precondition of human experience—viz. that our sense organs require excitation via local motion for an experience to occur. Indeed, this might seem the only way to read Kant’s argument if it is to be plausible at all.⁵ Moreover, the empirical status of the importance of <motion> might seem to be required by Kant’s claim, made earlier in the introduction, that the concept <matter> is an empirical concept (4:470).⁶ Problematic for this reading, however, is the fact that if the claim concerning the centrality of <motion> is merely an empirical one then it is difficult to see how Kant could have thought it could possess the requisite universality and necessity needed to ground a “pure” a priori metaphysics of nature.⁷

³ Concerning its centrality see (Watkins 1998, sec. 2a) for discussion; cf. (Pollok 2001, 149–65).

⁴ This is slightly more specific than what Kant might mean, which is merely that of an outer thing, a thing whose individuation conditions are subject to principles of externality and exclusion. Perhaps such a thing could exist without existing in space, but it could not be an object of outer sense for human beings, and perhaps not for any finite epistemic subject.

⁵ There is also the issue that Kant seems to regard <motion> as a determination which merely *possibly* rather than *actually* applies to matter—i.e. all matter need not actually be in motion. This point is abetted by Kant’s subsequent claim, in the Phoronomy, that matter is the movable in space (4:480). This modal feature is not something that could be given to the senses. See (Watkins 1998, 579). Part of the confusion here stems from the fact that Kant construes modal language in such a way that the modal term makes no contribution to the content of the judgment (A74/B99-100; cf. JL 9:115). For discussion see (Leech 2012). I shall use <motion> rather than <movable>, with the understanding that Kant is concerned with the real possibility of an object with this determination.

⁶ See (Walker 1971, 123) for this argument; cf. (Watkins 1998, 579).

⁷ For this objection see, e.g., (Pollok 2006, 571, note 30).

This worry is ultimately unfounded. Kant is not making an empirical claim concerning the causal antecedents of human experience. He is making an a priori claim concerning the conditions under which a finite, receptive being whose sensibility consists of two basic forms—viz. space and time—might have experience. Moreover, crediting Kant with making such an a priori argument does not threaten his conception of the empirical status of the concept *<matter>*. I take these two points in turn below.

2 Change, Motion, & Affection

Kant's claim that motion is a necessary condition of affection sounds like an empirical claim about local motion and the excitation of the senses. But there is another possible interpretation. Kant may not be making an empirical claim about the conditions for sensory experience, but rather an a priori claim about the conditions under which affection is possible for beings whose outer form of intuition is space.⁸

I thus take Kant's claim connecting motion and affection to depend on three other claims that he could reasonably have assumed to be in the background to the presentation of his project in the introduction to the MFNS. In making good on this interpretation I shall make use of remarks Kant makes in a variety of places other than the introduction to the MFNS. But this is an aid to exposition of the argument only. I consider the content of the argument to ultimately be constituted by these three background claims. The first claim derives from his transcendental idealism, and states that all the properties of the objects of outer sense are composed ultimately of relational properties. The second claim, a corollary of the first, states that any change in outer sense is or supervenes on (in a sense discussed below) a change of spatial relations, which Kant understands as the occurrence of a motion. I discuss the third claim, concerning our sensible receptivity, towards the end of §2.

Kant's commitment to the first two claims I have in mind is illustrated by his argument in the *Mechanics*, Remark to Proposition 2. There he argues that

Matter, as mere object of the outer senses, has no other determinations except those of external relations in space, and therefore undergoes no change except by motion. With respect to the latter, as change of one motion into another, or of a motion into rest, or conversely, a cause must be found (by the principle of metaphysics). But this cause cannot be internal, for matter has no essentially internal determinations or grounds of determination. Hence every change in a matter is based on external causes (that is, a body persists, etc.). (MFNS: *Mechanics*, Remark to Proposition 2, 4:543; cf. CPR: *Aesthetic*, A49/B66-7; *Amphiboly*, A265/B321, A277/B333, A285/B341)

The passage is part of Kant's proof of the second law of mechanics—viz. that every change in matter has an external cause (MFNS: *Mechanics*, Proposition 3, 4:543). In the first sentence of

⁸ One might object here that this is already an empirical claim, for the knowledge that one has an outer sense whose form is space is itself empirical. This objection seems to confuse conditions of acquisition with conditions of warrant. This is precisely the distinction that Kant emphasizes at the beginning of the Introduction to the B edition of the first *Critique* (B1-2).

the quoted passage Kant makes an inference from the determinations that matter can possess to a conclusion concerning the nature of change in matter—viz. that it occurs via motion. Let's examine both parts of this inference.

The first part of Kant's inference consists of the claim that, considered as an object of the outer senses, whatever else it may be, a thing will have no other determinations than those involving relations in space. This claim is a wholly general one. It is not specific to his argument in the MFNS. Instead, it is a view that Kant clearly endorses in both the Aesthetic and the Amphiboly of the first *Critique*. Concerning what can be given in intuition Kant there says that,

everything in our cognition that belongs to intuition (with the exception, therefore, of the feeling of pleasure and displeasure and the will, which are not cognitions at all) contains nothing but mere relations, of places in one intuition (extension), alteration of places (motion), and laws in accordance with which this alteration is determined (moving forces). (CPR: Transcendental Aesthetic, A49/B66-7)

We can cognize only pure relations in matter (that which we call their inner determinations is only comparatively internal); but there are among these some self-sufficient and persistent ones, through which a determinate object is given to us. (CPR: Amphiboly, A285/B341)

Kant also explicitly advocates the position that the properties of matter are one and all relational in the well-known claim in the *Prolegomena* that all qualities or determinations of matter are “secondary” in Locke's sense (*Prolegomena*: §13, Note II 4:289).⁹ Kant does not seem to treat this position as an empirical discovery but rather as one entailed by the adoption of the view that space and time are subjective forms of intuition. In the first *Critique* Kant admits that “[i]t is certainly startling to hear that a thing should consist entirely of relations,” but attempts to qualify his position by emphasizing that “such a thing is also mere appearance” (A285/B341).¹⁰

⁹ For discussion of the *Prolegomena* passage see (Allais 2007). For discussion of the status of phenomenal substance as consisting of relational properties see (Van Cleve 1988); (Pereboom 1991); (Langton 1998; 2006); (Warren 2001, ch. 2); (Pereboom 2011, chs. 5-6). Kant's position that matter consists only of extrinsic qualities or relations is not a denial that matter has qualities which *play the role of intrinsic qualities*, as it were. These are the “comparatively internal” qualities Kant speaks of above, which are “self-sufficient and persistent”. But the qualities so picked out in the MFNS are not ones which denote *absolutely intrinsic* qualities, because these are unknowable to us (Letter to Reinhold, 1789 11:36-7; cf. CPR: Amphiboly, A277/B333; *Notes on Logic*: R2999 (c. 1770-1), 16:609; *Mrongovius Metaphysics* (1782-3), 29:820-1; *Dohna-Wundlacken Logic* (1792) 24:728). I discuss this point further in §3 below. Note also that in making the claim that matter is composed only of extrinsic relations, we need not, with Langton and Warren, endorse the claim that the thing-in-itself/phenomenal distinction maps cleanly onto the intrinsic/extrinsic distinction. See (Ameriks 2001) and (Watkins 2002) for criticism of such a claim.

¹⁰ If one finds the claim that a material object consists of relational properties perplexing, then one could put Kant's claim this way: all the facts about material objects supervene on facts concerning their relational properties. No non-relational properties are part of the supervenience base. Given Kant's distinction between phenomena and things as they are in themselves, it is plausible that he would deny that the relevant phenomenal supervenience base is itself fundamental. Presumably then, the relational properties in this supervenience base must themselves depend on relational and/or non-relational properties of things in themselves. As Kant says in a late metaphysics lecture, “A phenomenon is in itself no substance, with respect to our senses we call the appearance of substance itself substance. But this phenomenal substance <*substantia phenomenon*> must have a noumenon as substrate. This can be called transcendental idealism.” (*Dohna Metaphysics* 28:682). Thanks to an anonymous referee for encouraging clarity on this point.

What about the second part, or conclusion, of Kant's inference, that outer objects undergo no change except by motion? How does this follow from the fact that their properties are entirely relational? A first step towards understanding the connection Kant makes between the relational properties of outer objects and motion depends on our properly grasping Kant's conception of a motion. To accomplish this we need only look to his definition of motion in the Phoronomy chapter of the MFNS. There he says that "Motion of a thing is the change of its outer relations [äußere Verhältnisse] to a given space" (MFNS: Phoronomy - Explication 2, 4:482).¹¹ So any change of the outer relations of thing to a given space is a motion. What are "outer" relations? In the Amphiboly Kant says "that which is inner in their state cannot consist in place, shape, contact, or motion (which determinations are all outer relations [äußere Verhältnisse])" (CPR, Amphiboly, A274/B33). Kant says something similar in his discussion, in the A-Paralogisms, of the dangers of regarding outer appearances as things in themselves.

There [in outer sense] we have no other external effects except alterations of place, and no powers except efforts that result in relations in space as their effects. But in us the effects are thoughts, among which no relations of place, motion, shape or spatial determination occur, and we wholly lose the guidance of causes in the effects which they are to exhibit in inner sense. (CPR: Observation on the sum of the pure doctrine of the soul, following these paralogisms, A386-7)

The list Kant provides of relations which cannot appear in inner sense is sufficiently close to that which he provides in the Amphiboly passage to indicate that he thinks of "outer" relations as those which include determinate properties of extension, location, and motion.

Kant's inference to the conclusion that outer objects undergo no change except through motion would then be straightforward if he thought that the properties of an outer object are all specifically kinds of spatial relational properties. For if this were the case then any change in an object's properties would *ipso facto* be or involve (i.e. supervene on) a change in the spatial relations of the object or its parts. This would trivially entail the occurrence of some motion.

However, one might object that even if we accept that Kant takes phenomenal objects to possess only relational properties, this doesn't obviously entail that he construes all the relational properties such objects possess as themselves (types of) spatial properties. In particular, one might object that the "moving forces" present in intuition that Kant discusses at A49/B67 (cited above), and which form the centerpiece of his conception of matter in the MFNS, are not obviously *spatial* relations, but rather (e.g.) dispositional properties of some kind, which *cause* or *explain* changes in spatial relations.¹² This is certainly correct.

Importantly, however, Kant does also repeatedly state that we are aware of such forces only through their effects, and in particular, that the fundamental forces of attraction and repulsion

¹¹ While Kant construes motion as change or alteration of place in the *Critique of Pure Reason* (A32/B48), in the MFNS he is careful to distinguish his conception of motion from that of *alteration of place*. There can be motion in the sense with which Kant is concerned without there being an alteration of place (e.g. as with the rotation of a point). See MFNS 4:482.

¹² Thanks to an anonymous referee for encouraging clarification on this point.

are themselves to be understood in terms of the motions which are their effects.¹³ For example, concerning repulsion, in the MFNS Kant says that,

Resistance to motion is the cause of its diminution, or even of the change of this motion into rest. Now nothing can be combined with a motion, which diminishes it or destroys it, except another motion of precisely the same movable in the opposite direction (Phoron. Prop.). Therefore, the resistance that a matter offers in the space that it fills to every penetration by other matters is a cause of the motion of the latter in the opposite direction. But the cause of a motion is called a moving force. (Dynamics, Proof to Proposition 1, 4:497)

For our purposes, the central points in Kant's proof here are (i) penetration into a space is a motion; (ii) this motion is diminished or destroyed (brought into a state of rest) by the opposing body's resistance (i.e. its impenetrability); (iii) such diminution or destruction is a combination or composition of opposing motions (in the sense at issue in the Phoronomy); (iv) the cause of this contrary motion is a moving force (here of repulsion). Crucially, we are not (and cannot be) aware of any force *per se*, but rather only of the effects of this force (i.e. the opposing motion), for which the force is posited as its cause. Indeed, the moving forces of A49/B67 are not specifically said to be determinations in matter but rather "laws in accordance with which this alteration is determined." What this means is that we cannot posit the presence or exercise of any such force without the manifestation of some effect, and specifically, the manifestation of some *motion*. This then suggests that any change in an object (or its parts), which is not itself a motion, is nevertheless cognizable only through the existence of some motion as its effect, which is to say that cognition of any change in an object, at the very least, *epistemically* depends on a change in the motion of the object or its parts.

Moreover, though the texts support the view that Kant holds the strong claim that all properties of a thing consist in spatial relations, he in fact need only be understood as making the somewhat weaker claim that all alterations in a thing require an alteration in its (or one or more of its parts) spatial properties. This is relatively trivial to show with respect to change of quantity of matter, qua outer object. Since Kant construes all change of quantity in terms of a change in extensive magnitude (see the Axioms of Intuition in the first *Critique*), and extensive magnitudes come in two forms, spatial and temporal, any change of extensive magnitude requires a change in spatial or temporal relations. Since we're just concerned with *matter* qua outer object, any change in quantity of matter is *ipso facto* a change of some spatial relation.

What about change in intensive magnitude? One might further object to the supervenience claim on the following textual basis. In the Anticipations of Perception of the first *Critique* Kant argues that,

the intensive magnitude in different appearances can be smaller or greater even though the extensive magnitude of the intuition remains identical. (A173/B214)

¹³ Kant makes such a claim in the first *Critique* as well. For example, he says that "For this [viz. the representation of alteration] acquaintance with actual forces is required, which can only be given empirically, e.g., acquaintance with moving forces, or, what comes to the same thing, with certain successive appearances (as motions) which indicate such forces" (Second Analogy, A207/B252; see also the Refutation of Idealism, B277-8). For discussion of the point that Kant construes our awareness of forces in terms of awareness of their effects see (Warren 2001, 50); (Watkins 2004, 476).

While this text may well tell against an interpretation of the proposed supervenience claim as it applies to intensive magnitudes (or forces more broadly), it does not tell against the supervenience claim understood in the epistemic terms suggested above. To see this we need to first appreciate the context of Kant's remark. He is here arguing for the possibility that differentiation between kinds of matter may be the result of real differences in the nature of that which fills space, and thus real differences in their intensive magnitude, and is not simply the result of a uniform kind of matter which is distributed in non-uniform ways through space. Kant is thus arguing that "mathematical and mechanical students of nature" make an ungrounded assumption,

for they assume that the real in space (I cannot call it here impenetrability or weight, since these are empirical concepts), is **everywhere one and the same**, and can be differentiated only according to its extensive magnitude, i.e., amount. (A173/B215)

The claim that the real in space can differ (e.g. in density) without differing in extensive magnitude (e.g. in volume) is not a general denial that variations in intensive magnitude supervene on variations in extensive magnitude. The claim Kant is denying is one which holds that different types of matter of (e.g.) different densities (e.g. the density of a cubic foot of water vs. that of a cubic foot of lead) nevertheless ultimately consist of a single uniform type of matter of *absolute density* interspersed with regions of empty space.¹⁴ Kant is also clearly committed to construing intensive magnitudes, such as density, as a function of combinations of extensive magnitudes, such as quantity of matter (mass) and volume.¹⁵ While density can vary with respect to a constant volume, it cannot vary with respect to constant volume and constant mass, understood as the quantity of matter filling a space.¹⁶ At least one of the latter two extensive magnitudes must change if there is to be a change in density (as intensive magnitude).

So what is important for Kant in these passages is that the intensive magnitude of the real not be *reducible* to some extensive magnitude. While irreducibility is compatible with a variety of supervenience claims, it is certainly compatible with the claim that, as an intensive magnitude changes, the assignment of some specific quantity to that magnitude—in Kant's terms, the determination of the magnitude of the intensive magnitude—itsself depends on an alteration of spatial relations of an object or its parts.

Perhaps the most well-known objection to Kant's claim that all change involves motion is that it seems conceivable that there could be change—e.g. qualitative change—without motion.

¹⁴ Kant discusses "interstitial" views of density in the General Remark to Dynamics (4:523-4). He also takes Lambert and other "mathematical students of nature" to task in the MFNS, Remark to Proposition 1 of the Dynamics chapter (4:497-8), concerning their conception of the "absolute" manner in which matter occupies space, using precisely the assumption from the Anticipations discussed above. For extensive discussion see (Friedman 2013, 121-30). See also Friedman's (2013, 234) point that the "concept of an intensive (as opposed to a purely extensive) filling of space can, in the end, be given the structure of a mathematical magnitude only by reference to a spatio-temporal quantity (motion) and not by reference to merely geometrical quantities (such as volume) alone."

¹⁵ For discussion of the relationship between intensive and extensive magnitudes see (Brittan 1986, 66, 77-78) and especially (Friedman 2013, chs. 2-3).

¹⁶ Kant also indicates in the Remark to Proposition 1 of the Mechanics (MFNS 4:539-40) that changes in intensive magnitudes, such as velocity, cannot float free of changes in extensive magnitude. While this falls short of a general claim, it seems plausible that he takes the supervenience claim to hold for all intensive magnitudes of outer objects and not just velocity.

For example, an object might change color without thereby moving.¹⁷ However, I take this possibility to be ruled out by Kant's view, just discussed, that we can have no cognition of an alteration of an outer object without an alteration in the extensive magnitude of it or one or more of its parts. Since the extensive magnitudes of outer objects are one and all spatial there would thus have to occur, even in cognition of qualitative changes such as those of color, some change of spatial relationships, either in the object or its parts. As we have seen, Kant takes this to entail the occurrence of motion.

We thus have the material for the following argument:

1. The properties of all objects of outer sense consist of relational properties. [transcendental idealism]
2. Any cognition of an alteration of an outer object's (relational) properties is, or supervenes on, an alteration in its extensive magnitude, and thus an alteration of spatial properties of the object or its parts. [supervenience claim]
3. ∴ Any cognition of an alteration in an outer object requires a change of spatial relation(s) of that object or its parts. [1, 2]
4. Any alteration of spatial relations requires motion [definition].
5. ∴ Any cognition of alteration of an outer object requires motion (either of it or of its parts). [3, 4]

Kant's argument, as I have reconstructed it, has thus far proceeded from an analysis of <motion> and claims concerning the nature of outer objects based on his transcendental idealism.¹⁸ However, we need a further ancillary claim if we are to arrive at Kant's desired conclusion that *affection* requires motion. Here too Kant presumes familiarity with one of the central claims made in the first *Critique*—viz. the receptivity of sensibility. Since our sensibility is *receptive* we require affection from something other than ourselves in order to generate representations (A19/B33, B75/A51).¹⁹ Since our receptivity is *sensory*, the representations generated by such affection are dependent for their nature and content on the sense modalities of the being who has them. The occurrence of an outer sensory representation thus depends on some affection of (one or more sense modalities of) outer sense.²⁰ Since the affection of a subject's outer sense will entail, by definition, affection by something external to the subject, and the form of externality

¹⁷ See (Walker 1971, 122) for the most influential version of the objection; cf. (Watkins 1998, 579–82).

¹⁸ Kant's claim concerning the connection between alteration and motion is not unique. Baumgarten argues for a similar conclusion in his *Metaphysica*, with which Kant was well-versed. See Baumgarten's (2013) argument that "there can be no alteration in a composite world without motion" at §415. Of course, Baumgarten's specific argument for this conclusion differs significantly from Kant's.

¹⁹ What about mathematical representations? They lack sensation (they have form but no sensory "matter"), and thus do not count as sensory representations.

²⁰ What about changes solely in inner sense? First, Kant seems to deny that inner sense has its own "manifold" (B67, B158-9). See (Allison 2004, 279); (Valaris 2008); (Schmitz 2015) for discussion. Kant also seems to deny the existence of inner sense without outer when he says in *Metaphysik K₂* (1790s) that, "I would have no inner sense if I had no outer sense" (LM 28:771). There is also the argument of the Refutation of Idealism to consider. Kant is there concerned to show that the consciousness of one's own existence is "simultaneously the immediate consciousness of the existence [*Dasein*] of other things outside or external [*äusser*]" to one (B276). So I take it that, for Kant, the awareness of representations resulting from affections of sensibility ultimately depends on the occurrence of some affection of specifically outer sense.

(in us) is space, any such affection will *ipso facto* require an alteration of spatial relationships, either in the subject, the object, or both.²¹ Hence, the occurrence of any outer experience requires some external change. This gives us the final piece of our argument.

1. The properties of all objects of outer sense consist of relational properties. [transcendental idealism]
2. Any cognition of an alteration of an outer object's (relational) properties is, or supervenes on, an alteration in its extensive magnitude, and thus an alteration of spatial properties of the object or its parts. [supervenience claim]
3. ∴ Any cognition of an alteration in an outer object requires a change of spatial relation(s) of that object or its parts. [1, 2]
4. Any alteration of spatial relations requires motion [definition].
5. ∴ Any cognition of an alteration of an outer object requires motion (either of it or of its parts). [3, 4]
6. The affection of outer sense (and thus the occurrence of an outer sensory representation) requires the alteration of some object of outer sense [def of sensible receptivity]
7. ∴ Any affection of outer sense that could result in cognition requires the occurrence of a motion of some object. [5, 6]

So, given that according to Kant our senses, as receptive, must undergo change in order to produce representations, we can know a priori that this change must be due to motion.²² The argument does not presume that in order for the passive senses to be acted upon, the actor must be *local* to the sensing subject. Kant clearly denies that activity of agent on patient requires locality in his discussion of the nature of attractive force (MFNS: Dynamics, 4:513-14). Thus, all that Kant's argument requires is the claim that to be acted upon, that activity, or the patient so acted upon, must involve some change of relations in space.

The argument also does not show that affection in outer sense requires that the object affecting one also be the very object in motion. Whether this stronger claim is in fact what Kant intended is difficult to discern. But the stronger claim is not, strictly speaking, needed to provide Kant with what he wants—viz. a necessary connection between <matter> and the possibility of correctly applying <motion> to it as a fundamental mark.

Thus, Kant's argument—compressed though it may be—is neither a dogmatic assertion nor an empirical claim, but rather an a priori argument based on the nature of our receptivity and the presumption of the transcendental ideality of space and thus of all the objects appearing in it.²³

²¹ At the very least, such an affection would seem to require a change in the subject, since the subject changes from not being affected by the object to being affected by it. This doesn't require any further empirical commitment, on Kant's part, to the nature of this affection, e.g. whether it involves local motion.

²² Pollok (2006, 569) rightly says that the "possibility of such affection by matter presupposes that it can be determined through motion." He also seems to interpret Kant's argument in terms of motion as a condition of being given an object (see (Pollok 2001, 154)). However, Pollok ultimately seems to take this as an empirical argument since he says that "the spatial distance between the subject of cognition and the object of cognition must be somehow traversed." If my interpretation is cogent then Kant need not be understood as making any such empirical claim.

²³ Friedman construes Kant's motion argument in terms the establishment of a relative region of space, or reference frame, centered on one's own body, which "builds in" the concepts of movability and relative motion. See (Friedman

Moreover, Kant's a priori argument as I've presented it here does not threaten his claim that the concept <matter> is empirical. In contrast to interpretations which claim that the empirical status of the concept rests on the conditions of establishing its objective reality I take the empirical status of <matter> to rest on the fact that it contains the mark <impenetrability>.²⁴ According to Kant, the thinkable content <impenetrability> cannot be entertained without having had a particular kind of experience, and specifically, the experience of resistance in space. On this view <matter> cannot be thought wholly a priori, because it cannot be thought in terms of *filling* space (as opposed to the geometer's *space-occupying* conception) without a specific kind of experience, which we gain via the sense of touch.²⁵

Evidence that this is Kant's position is indicated by his statement in the Remark to Proposition 5 of the Dynamics that the awareness of repulsive force is acquired via the sense of touch (4:510). He also endorses this position in the *Anthropology*, which explains why he says there that touch is the "most important" of the senses (7:155) and, in the corresponding lectures, says that touch is even necessary for acquiring the concept of a substance (*Anthropology Friedländer* (1775/6), 25:494; cf. *Anthropology Mrongovius* (1784/5), 25:1242).²⁶ Hence, insofar as <impenetrability> is a constituent mark of <matter>, we cannot think the entirety of the content of <matter> a priori. Instead, we need a certain class of experience—viz. tactile experience.²⁷

Thus far I have presented an interpretation which gives us the necessary background to un-

2013, 43–44). However, this interpretation seems to presuppose a great deal more than the conditions of having an outer (spatial) form of sensibility and the relational constitution of the properties of spatial objects, both of which are points to which Kant is antecedently committed. For that reason I believe my interpretation is preferable.

²⁴ Prominent interpretations advocating the view that <matter> is empirical due to the fact that experience is needed to show its objective reality include (Plass 1966); (Watkins 1998); and (Pollok 2006).

²⁵ One might object here that no experience is needed for the grasp of <impenetrability>, since it consists only of concepts of force, resistance (force in the opposite direction of motion), and space. While Kant does not make his reasoning explicit here (far from it), it seems clear from his writings on negative magnitudes (e.g. *The Attempt to Introduce the Concept of Negative Magnitudes into Philosophy* of 1763, 2:171-2, 179-80 in (Kant 1992, 211, 218)) that he would not have regarded as a purely conceptual issue the cancellation of motion that comes with the real opposition between the repulsive force of a resisting object and the penetrating force of an approaching one (see (Warren 2001, ch. 1); (Chignell 2010)). For Kant, the relation between motions in opposite directions is a primary example of real rather than logical opposition. The rest that results from such opposition is thus a real state of an object, knowable only through experience, as opposed to conceptual (logical) opposition, which can be grasped independently of experience. If that is correct then we need to ask where the extra-conceptual element would come from. It cannot be simply space, since our intuitive grasp of space tells us nothing of cancellation of forces within it. Moreover, Kant goes so far as to deny, in the First Postulate of the *Critique of Pure Reason*, that we could generate a concept of force independently of experience (A222/B269). Such concepts would be mere "figments of the brain" [*Hirngespinnste*] unless they can "borrow the example of their connection from experience". So there must be something else, other than the a priori concepts and forms of intuition, in virtue of which we come to grasp the relevant cancellation. This is precisely what I take Kant to construe as the importance of the tactile sensation of resistance. Thanks to an anonymous referee for encouraging clarity on this point.

²⁶ For a similar take on the status of <matter> see (Friedman 2001); (Warren 2010, 240).

²⁷ I thus disagree with Plass, Watkins, and Pollok that the status of <matter> as empirical depends merely on the fact that we cannot know the concept to be instantiated without having had some outer experience or other. See (Plass 1966, 288–9); (Watkins 1998, 571, note 15); (Pollok 2001, 30; 2006, 570). It is not, as they claim, that we can think of matter as impenetrable but cannot know the *reality* of matter until we have sensation of it as filling a space. Rather, we cannot even *think* of matter as *filling* (as opposed to merely occupying) space, unless we have had sensations of resistance. So it is the *content* and not merely the issue of the instantiation of <matter> that makes it empirical.

derstand premise (1) of Kant's original argument:

1. Affection by an outer object requires motion
2. ∴ The fundamental determination of matter, as an outer object, is *motion*

I have not yet argued for how or why we should understand this necessary determination of matter as *fundamental*. It is to this issue that we now turn.

3 Fundamentality

Thus far, I've argued that the affection argument, properly supplemented by auxiliary premises, presents us with a valid argument for the fundamentality of <motion> as a determination of <matter>. At the outset I raised the issue of the sense in which <motion> is fundamental. Is it epistemically fundamental, in that it is only through our grasp of <motion> that we could grasp <matter>? Or is it metaphysically fundamental, in that it designates the essence of *matter* and its corresponding concept? There are two primary grounds for doubting that Kant could have the latter metaphysical notion in mind.

First, Kant explicitly denies that we have access to the metaphysical essence or nature of any thing.

I can easily find the logical essence of a given concept, namely its *primitive constitutiva*, as well as the attributes, as *rationata logica* of this essence, by means of the analysis of my concepts into all that I think under them. But the **real** essence (the nature) of any object, that is, the primary *inner* ground of *all* that **necessarily belongs** to a given thing, this is impossible for man to discover in regard to any object." (May 12th, 1789; C 11:36-7)²⁸

Kant's notion of a "primary inner ground" here is that of a determination intrinsic to the thing, necessary for it to be the kind of thing that it is, and explanatorily foundational, in the sense that the other properties of the thing "flow from" or are otherwise derived (or derivable) from it (*Notes on Logic*: R2916 (either 1764-8 or 1778-9), 16:575; see also 16:576-607). This "real essence", Kant argues, is strictly unknowable to us. By contrast the logical essence of a *concept* consists of those marks sufficient for distinguishing its object from others. Since Kant's discussion here is wholly general, it strongly suggests that he takes the epistemic reach of our concepts to be limited, and thus that we should not take the notion of a "fundamental determination" to be one which discloses the real essence of matter.²⁹

Second, while we may be able to make the fundamental forces designated by <attraction> and <repulsion> ultimately intelligible only via a grasp of their relation to <motion>—this is why Kant says that it is the *understanding* that traces all predicates

²⁸ See also CPR: Amphiboly, A277/B333; *Notes on Logic*: R2999 (c. 1770-1), 16:609; *Mrongovius Metaphysics* (1782-3), 29:820-1; *Dohna-Wundlacken Logic* (1792), 24:728.

²⁹ It may be that Kant thinks that our ignorance of the essence of a thing is compatible with our knowing at least some of a thing's essential properties; see, e.g. *Metaphysik L₂* (1790/91) LM 28:553. What Kant seems most clearly to deny is that we have any cognition or knowledge of the fundamental ground, *as such*, from which all of an objects (non-accidental) properties spring. Thanks to an anonymous referee for encouraging clarity on this point.

back to <motion>—there would seem to be an important difference between <motion> as a determination of <matter> and other determinations such as <attraction> and <repulsion>. The difference is that it is the forces indicated by the latter two concepts which ultimately metaphysically explain the features of matter, including its motion, and more generally, its capacity to move and be moved, not the other way around. One way of putting this is that Kant’s argument for the fundamentality of <motion> provides us not with the *ratio essendi* of matter, but with its *ratio cognoscendi*.³⁰

For an example of the distinct roles of epistemic and metaphysical fundamentality we need look no further than the Dynamics, where Kant defines the filling of space by means of an appeal to motion. He says,

Matter is the *movable* insofar as it *fills* a *space*. To *fill* a space is to resist every movable that strives through its motion to penetrate into a certain space. A space that is not filled is an *empty space*. (4:496)

What it is to be matter is to fill space; what it is to fill space is not wholly intelligible without an appeal to <motion>. This is because the notion of filling space is, as Kant puts it above, one understood in terms of the resistance of a body to the intrusive *changes of location* (i.e. motions) made by other bodies.³¹ Nevertheless, it makes no sense to think of the force of resistance as “flowing from” motion, in the way that features of an object were traditionally thought to flow from, or depend upon the object’s essence. Rather, resistance is a power of the substance which fills that space. So there is an important sense in which the mark <motion> cannot be anything other than the logical ground of the concept and thus not a real ground of a material object’s features.³²

The fact that Kant seeks to base his metaphysics of nature on an epistemically rather than metaphysically fundamental feature, as well as his (at least implicit) recognition that the two kinds of feature can come apart, is (as one might say) a feature, rather than a bug, of his over-all view. Rationalist conceptions of scientific knowledge collapse epistemic and metaphysical fundamentality. For example, Descartes considers <extension> to be *both* metaphysically and epistemically fundamental (Meditations AT VII:63; cf. AT VII:423). The fundamentality of <extension> is derived, at least in part, from its epistemic centrality in our conception of matter (e.g. Principles AT VIII 30-31). This purely geometric conception of matter would lead to a conception of “absolute” impenetrability or solidity that Kant roundly criticizes in the MFNS.³³ Kant instead endorses a “dynamical” rather than “mathematical” conception of matter (MFNS: General Remark 4:524-5), which is in certain ways more limited than Descartes’s conception, since it does not allow for an a priori deduction of all the possible features a material body might possess. Nevertheless, Kant thinks the dynamicist conception of matter enjoys a certain

³⁰ See also (Pollok 2001, 151).

³¹ See the discussion of repulsive force and motion in the previous section above, as well as in (Warren 2010, nn. 56, 239–40).

³² For discussion of Kant’s views on real vs. logical grounds see (Watkins 2005, 162–5); cf. (Longuenesse 2005, 129–31).

³³ The difference is that between an “absolute” notion of space filling, which is all or nothing—i.e. admitting of no compression of any degree, and the dynamical view, which takes space filling to admit of a degree, measured as the extent of outward-directed force by which a parcel of matter opposed compression. For relevant discussion see (Warren 2010).

explanatory advantage—viz. it explains the existence of motion in a system by appeal to the more fundamental power of a material body to exert repulsive or attractive force.³⁴ In contrast, the geometric conception of matter must take the presence of some quantity of motion in a system as given, the ultimate explanation of which depends on an appeal to God's action in setting the system in motion (e.g. Principles AT II.36 VIII A:61-2).

This is not to say that Kant holds the dynamical view of matter *because of the fact* that it aligns with his view that we have a priori access to <motion>, but not to <impenetrability>, as determinations of <matter>. That would be a stronger claim than the one I make here. All I am pointing out is that the view of the fundamentality of <motion> that I attribute to Kant here is fully consistent with, and complimentary to, his broader dynamicist theory.

Thus, when we look at the argument as a whole, we see the following:

1. The properties of all objects of outer sense consist of relational properties. [transcendental idealism]
2. Any cognition of an alteration of an outer object's (relational) properties is, or supervenes on, an alteration in its extensive magnitude, and thus an alteration of spatial properties of the object or its parts. [supervenience claim]
3. ∴ Any cognition of an alteration in an outer object requires a change of spatial relation(s) of that object or its parts. [1, 2]
4. Any alteration of spatial relations requires motion [definition].
5. ∴ Any cognition of an alteration of an outer object requires motion (either of it or of its parts). [3, 4]
6. The affection of outer sense (and thus the occurrence of an outer sensory representation) requires the alteration of some object of outer sense [def of sensible receptivity]
7. ∴ Any affection of outer sense that could result in cognition requires the occurrence of a motion of some object. [5, 6]
8. ∴ <motion> is required to grasp the concept of being affected by an object of outer sense. [6, 7]
9. ∴ <motion> is an epistemically fundamental determination of <matter>, as an outer object. [8]

I note two things about this argument. First, its conclusion concerning the fundamentality of <motion> is more explicit than that which Kant provides in the Preface at 4:476. But I have given reasons above for thinking that Kant holds that <motion> is only epistemically rather than metaphysically fundamental.

Second, the argument is a progressive argument, which starts from positions that Kant has either argued for (i.e. transcendental idealism and the related supervenience claim) or otherwise committed himself to (our receptive sensible nature), and moves to a conclusion concerning the status of <matter>. I thus regard Kant's argument as a combination of substantive commitments from his critical philosophy plus conceptual analysis. I do not see him as engaging in a transcendental argument, which starts from some commonly accepted fact and regressively argues to a conclusion concerning the necessary conditions for the possibility of that fact.³⁵ This

³⁴ For an examination of this view as it appears in Kant's metaphysics lectures see (Warren 2010, 208–10).

³⁵ For discussion of Kant's argument as a form of transcendental argument see (Watkins 1998, 577–87); cf. (Cramer 1985). For discussion of a transcendental argument as regressive see (Ameriks 1978).

is not to say that Kant does not employ transcendental arguments in the course of elaborating his position in the MFNS, just that I do not see him as utilizing one in making this particular claim about the fundamentality of <motion>.

That Kant might present an argument in the MFNS which implicitly presupposes substantive commitments from his critical philosophy should not be surprising. He is clearly engaged in the elaboration of his critical system in the Preface to the MFNS.³⁶ So it is only natural that he might therefore draw on that system in his initial argument. My interpretation ties Kant's argument in the MFNS, or at least its initial stages, more closely to his commitments in the first *Critique* and the Aesthetic especially. This may not be welcomed by all.³⁷ But making this tie explicit has the benefit of presenting Kant's doctrines as importantly unified. It also makes Kant's transcendental idealism—specifically, his transcendental doctrines concerning space and time—a central aspect of his foundational physical theory. This seems only fitting given Kant's emphasis on the forms of intuition as the foundation of our a priori mathematical knowledge, and of the special metaphysics of nature provided by the MFNS as an explanation of how “natural science is either a pure or applied *doctrine of motion* throughout” (MFNS Preface, 4:477).

Hence, the sense in which <motion> is a fundamental determination of <matter>, to which all others are traced back is, as I have argued here, an epistemic rather than metaphysical claim. There is certainly more to say about the exact way in which this determination is fundamental, and perhaps even more about how and why it is “fecund” in the sense I articulated in the introduction, but that must wait for another time.³⁸ Here I aim to have shown only that Kant's affection argument for the fundamentality of <motion> in our conception of matter is neither dogmatic nor irredeemably obscure. It is an a priori argument that uses, as auxiliary premises, claims stemming from Kant's other general theoretical commitments—viz. the transcendental ideality of space, its corollary concerning the supervenience of (the cognition of) alteration on motion, and the receptivity of sensibility.³⁹

4 Abbreviations

Quotations from Kant's work are from the Akademie Ausgabe, with the first Critique cited by the standard a/B edition pagination, and the other works by volume and page. Where available, translations generally follow the Cambridge editions of the Works of Immanuel Kant, general editors Paul Guyer and Allen Wood. References to specific texts are abbreviated as follows:

³⁶ For example, there is a great deal of resemblance between the discussion of science in the Preface and the discussion in the Architectonic section of the first *Critique* (see A845-9/B873-7).

³⁷ For example, (Stan 2017) explicitly distances his interpretation of Kant's mechanics from the assumptions of the Transcendental Aesthetic. However, Stan also is explicit that his account is a neo-Kantian rational reconstruction.

³⁸ Such a discussion would need to show how <motion> has to (i) provide a basis from which other cognitions may be (asymmetrically) derived and (ii) do so in a manner that is consistent only with one particular way of exposing the concept, as Kant indicates in his discussion of exposition in the Transcendental Aesthetic (B40). With respect to (i), it is clear that at least one mark of <matter> is taken by Kant to be derived synthetically and a priori—viz. the mark <attraction>. Kant argues that attractive force is not an original part of the given concept <matter>. It is added to the concept via the complex “balancing argument” of the Dynamics, Propositions 5 and 6. I hope to pursue issues surrounding Kant's conception of the fecundity of <motion> in future work.

³⁹ Thanks to Michael Bennett McNulty, Lydia Patton, Konstantin Pollok, Nick Stang, Eric Watkins, and audiences at the 2014 UK Kant Society and 2015 Pacific APA for helpful comments and questions on this paper and related material.

- An: *Anthropology from a Pragmatic Point of View*
- C: *Correspondence*
- CPR: *Critique of Pure Reason*
- LM: *Lectures on Metaphysics*
- MFNS: *Metaphysical Foundations of Natural Science*

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