

# Mechanical explanation of nature and its limits in Kant's *Critique of judgment*

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## Abstract

In this paper I discuss two questions. What does Kant understand by mechanical explanation in the *Critique of judgment*? And why does he think that mechanical explanation is the only type of the explanation of nature available to us? According to the interpretation proposed, mechanical explanations in the *Critique of judgment* refer to a particular species of empirical causal laws. Mechanical laws aim to explain nature by reference to the causal interaction between the forces of the parts of matter and the way in which they form into complex material wholes. Just like any other empirical causal law, however, mechanical laws can never be known with full certainty. The conception according to which we can explain all of nature by means of mechanical laws, it turns out, is based on what Kant calls 'regulative' or 'reflective' considerations about nature. Nothing in Kant's *Critique of judgment* suggests that these considerations can ever be justified by reference to how the natural world really is. I suggest that what, upon first consideration, appears to be a thoroughly mechanistic conception of nature in Kant is much more limited than one might have expected.

Immanuel Kant is known for presenting a scientifically oriented view of nature, a nature strictly conforming to principles, rules and laws. Thus, Kant is often characterised as the Newtonian philosopher who attempted to give a philosophical account of nature in accordance with the laws of Newton's physics. Much in tune with this picture, Kant writes in the *Critique of judgment*,

It is of infinite importance to reason not to let the mechanism of nature in its productions be dropped out of sight and be bypassed in its explanations; for without this no insight into the nature of things can be attained. (Kant, 1908, p. 410).<sup>1</sup>

Without the 'principle of the mechanism of nature', Kant argues, 'there can be no science of nature at all' (ibid., p. 418).

Hence,

the study of nature according to its mechanism [is] restricted to what we can subject to our observations or experiments, so that we could produce it ourselves.. .; for one understands completely only so much as one can oneself make and bring about in accordance with concepts ... (Ibid., p. 384).

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<sup>1</sup> All translations of Kant are my own, but are guided by translations in Kant (1929, 1970, 2000).

Our knowledge of nature, Kant claims, is based on cognition of the mechanism that governs natural processes. Knowledge of nature is presented as intrinsically connected to mechanical explanation. We can therefore understand about the world only that which, through our knowledge of mechanical laws, we can in principle reproduce.

As concern for the issues relating to our understanding of organic nature has grown also within philosophy, purely mechanistic conceptions of nature have come under severe attack. They have been criticised for reducing nature to the laws of science and for being unable to account for the seemingly organized and organic aspects of nature. In the present paper, I aim to investigate in how far it is correct to attribute to Kant a mechanistic and reductionist view of nature. I examine how precisely we should understand Kant's conception of the 'mechanical mode of explanation' (ibid., p. 409) referred to in the *Critique of judgment*. And I ask what justifies Kant's claim that we can satisfactorily explain nature *only* by reference to its mechanism.

In the *Critique of judgment*, Kant does not give an explicit definition of 'mechanical explanation'. Kant speaks of a part of nature, however, as mechanical when it is 'possible according to mere laws of nature' (ibid., p. 370). We thus explain nature, Kant argues, by reference to 'mechanical laws' (ibid.).<sup>2</sup> Kant associates these laws, in turn, with an efficient causality which, as the connection of a cause to its effect, he contrasts with the final causality of means to an end.<sup>3</sup> Kant's concept of a mechanical explanation of nature thus essentially involves the notions of 'causality' and 'natural law'. In order, therefore, to illuminate Kant's understanding of mechanical explanation I shall, in Section 1, have a closer look at these two concepts. In particular, I will investigate Kant's transcendental causal principle as it is developed in the 'Second analogy of experience' of the *Critique of pure reason*. And I shall examine the relationship of this principle with empirical causal laws of nature. The investigation will show that although we can know a priori that nature is determined causally, our supposed knowledge of empirical causal laws will never gain full certainty. Yet, due to the character of the rational creatures that we are, we cannot but consider nature as ordered according to causal laws and will therefore always search for such laws for the explanation of nature. These considerations suggest that mechanical laws of the third *Critique* should be understood as particular empirical causal laws.

In Section 2, I point out, however, that Kant in fact provides a rather different characterisation of mechanism in the *Metaphysical foundations of natural science*. Mechanical laws are here described as 'pure' laws of science concerned with the interaction between the fundamental powers of matter, that is, the powers of attraction and repulsion. A consideration of this account and of that found in three of Kant's early writings will lead to the proposal that, instead of conceiving of mechanical laws as empirical causal laws, they should be understood as dealing with an empirical application of the pure laws of mechanics of the *Metaphysical*

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<sup>2</sup> Cf., for example, Kant (1908), pp. 387, 409 and 419.

<sup>3</sup> Cf., for example, ibid., pp. 360, 369-370, 387 and 406.

*foundations* to particular objects of nature. In Section 3, I discuss how Hannah Ginsborg's appraisal of this proposed account of mechanism seems to be at odds with Kant's association of mechanical laws with efficient causality. Ginsborg's account is therefore contrasted with yet another approach to mechanism. Peter McLaughlin's account characterises mechanism as a form of causality, dealing not with the interaction of forces but with the relation of material parts and wholes. McLaughlin thus takes the mechanical laws of nature to present a form of causal laws which refer to the determination of material wholes by their parts.

After having discussed three different approaches to mechanism in Sections 1-3, Section 4 will tackle the question how these approaches are related to one another. Do they present accounts that mutually exclude one another? Or can they be taken to illuminate different but compatible aspects of Kant's conception of mechanism in the *Critique of judgment*? I shall propose an interpretation of mechanical laws that takes account of all three approaches. I thus aim to give a reading of Kant's conception of mechanism in the third *Critique* by reference to considerations of causality, the forces of matter and the relationship of material parts and wholes. Mechanical explanations in Kant's *Critique of judgment*, I shall suggest, may be understood as referring to empirical laws that deal with the causal interactions between the forces of the material parts of natural objects. I will conclude, in the final section, that the implications of this Kantian conception of mechanism are somewhat unexpected. For what, upon first consideration appears to be a thoroughly mechanistic conception of nature, will turn out to be very limited indeed.

## 1. The transcendental causal principle and empirical causal laws

The transcendental principle of causality, set out in Kant's 'Second analogy', is introduced by Kant as an a priori judgment of the understanding. Anything that can be experienced, and hence nature itself understood as 'the object of all possible experience' (1998, p. A114), results from the ordering of particular impressions on our senses according to these judgments. Thus, according to the transcendental principle of causality, '[a]ll alterations take place in conformity with the law of the connection of cause and effect' (*ibid.*, p. B232).

In the following 'proof' of the causal principle Kant explains that in any experience, whether it be the experience of an event or that of a stationary object, we are confronted with a succession of perceptions. Both the experience of a ship moving down the river and that of a stationary house consist of a sequence of impressions on our senses. In the case of an event, by contrast with the case of an object, however, we conceive of the succession of our perceptions as necessarily ordered. The different states of the ship's moving down the river could not have been perceived in reverse order, whereas the successive perceptions of different aspects of one and the same house could have been ordered differently. We thus take the event, but not the object, to consist of a determinate succession of

different states in the world, an objective succession which is to be distinguished from the merely subjective order of our perceptions. Kant concludes that the objective order of processes in the world ‘remains undetermined through mere perception’ (ibid., p. B234). The ground of the difference between the successive perception of an objective sequence of event states, on the one hand, and the successive perception of different simultaneous aspects of an object, on the other hand, lies rather

in the understanding, not in perception; and in this case it is the concept of the *relation of cause and effect*, of which the former determines the latter in time, as the consequence, and not as something that could precede solely in the imagination. . . . (Ibid.)

We thus consider the experience of an event as the experience of a necessarily ordered succession in time, Kant argues, by conceiving of the event states as causally connected. The principle that events are causally determined is presented as a transcendental principle of the understanding which makes possible our experience of objective succession in the world.

And yet, what exactly does this causal relation entail? In particular, what are its implications for the status of the causal laws found in experience? The precise content of the transcendental causal principle and its relation with empirical causal laws has been the object of extensive debate and varying interpretations. In the literature, two approaches are commonly distinguished. According to a ‘strong’ reading, Kant’s goal in the ‘Second analogy’ is to establish the lawfulness or uniformity of nature. Kant’s ‘Second analogy’, it is claimed, proves not only that every event has a cause but also that the same types of cause have the same types of effect.<sup>4</sup> A ‘weaker’ reading disagrees in claiming that the ‘Second analogy’ establishes merely the modest thesis that in an event there is *some* antecedent condition A which ensures that the subsequent state B necessarily ensues.<sup>5</sup> Kant’s argument for the causal principle, according to this reading, entails only what Lewis White Beck has called the ‘every-event-some-cause’ principle, but not the ‘same cause same effect’ principle.<sup>6</sup>

For the present enquiry, the question of whether to adopt the strong or the weak reading seems to be of secondary importance.<sup>7</sup> I shall not therefore engage in the dispute between the two approaches but shall simply take for granted what may be classified broadly as a weak interpretation of the ‘Second analogy’. By

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<sup>4</sup> Different versions of the strong reading are defended, for example, by Paul Guyer (1987), Michael Friedman (1992) and Arthur Melnick (1973).

<sup>5</sup> The weak reading has been proposed by commentators such as Gerd Buchdahl (1969, 1992), Lewis White Beck (1973, 1978, 1981) and Henry Allison (1983, 1994). Cf. also Allison’s revised edition of his 1983 book from 2004.

<sup>6</sup> Beck (1978), p. 120.

<sup>7</sup> Thus, although taking a weak interpretation for granted, the results of my argument in this section are compatible, for example, with Watkins recent strong reading of the ‘Second analogy’. Cf. Watkins (2005), especially p. 290.

following Gerd Buchdahl's distinction between 'two altogether different contexts in Kant's frequent description of the place of causality in nature',<sup>8</sup> my aim is rather to stress the distinction between an empirical and a transcendental level of Kant's conception of causality. It is this distinction which will help to understand the relationship of the transcendental causal principle with empirical causal laws of nature.

What, then, distinguishes the transcendental from the empirical level of causality? Kant introduces the transcendental causal principle as that principle which makes possible the experience of an objective sequence. After watering the mint plant in my kitchen, for example, I may experience a strong smell of mint. In order to experience my watering of the plant and the diffusion of mint aroma as an objective sequence, however, I must have already conceived of the two events as causally connected. The question of whether the events are in causal connection is, on the transcendental level, settled a priori.

If this is correct, what does the transcendental causal principle entail? What does Kant need to presuppose in order to guarantee the possibility of the experience of objective succession? Does he have to include the notion of regularity or lawlikeness in his understanding of causality? It seems that Kant's argument for the causal principle entails neither that we need to know a particular causal law, nor that we have to assume the regularity of nature in general, in order to know of objective sequences. It seems obvious that we cannot assume an empirical causal law before experience since, being empirical, knowledge of this law is itself dependent on experience. The experience of objective sequences therefore cannot rely on previous knowledge of particular causal laws. But neither do we have to assume the principle that nature is lawlike in order to distinguish an objective from a merely subjective sequence in time. In order to experience, first, my watering the plant and, second, the diffusion of mint aroma as an objective sequence it may be sufficient that I take the two events to be related by some kind of necessary connection. As long as event A is related to event B in a necessary manner, such that B follows upon A and not vice versa, the sequence A-B seems to be objectively ordered in time. The causal connection of A and B can be understood as necessarily connected without being an instance of a regularity. The objectivity of a sequence, it seems, can thus be guaranteed without knowledge of the lawlike structure of nature.

What, then, does the argument of the 'Second analogy' establish? Wherein lies the 'genuine universal validity' (ibid., p. A196/B241) which Kant ascribes to the causal principle? Kant's causal principle seems to be describable as establishing not only that every event has a cause, but that anything which may be experienced *at all* is caused. As Kant elaborates in the 'Transcendental dialectic',

it is a universal law, even of the possibility of all experience, that everything which happens has a cause, and thus that also the causality of the cause that

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<sup>8</sup> Cf. Buchdahl (1992), p. 196.

has *itself happened*, or come to be, has a cause in its turn; and thus the entire field of experience, as far as it may extend, is transformed into the general concept of nature as such [*Inbeg- riff blofier Natur*], (Ibid., pp. A533/B561)

Nature, as the sum of all possible experience, is thus presented as thoroughly causally determined, where this determination means that anything in nature is caused by something else in nature, even though we may not know what that other aspect is.

Let me now turn to the empirical level of the concept of causality. In this context, claims about causal relations between states in the world do not seem to be a matter of a priori knowledge. In the empirical context, when, after watering my mint plant, I experience a strong smell of mint, I may ask whether the two states, my watering of the plant and the spreading of the mint aroma, are related causally. Nothing in the experience tells me for certain that it was my watering, rather than some other cause, that brought about the diffusion of mint aroma. In order to know whether it really was my watering of the plant that brought about the spreading of mint aroma, I therefore need to collect empirical evidence. And, again in contrast with the transcendental context, it seems that in order for my experiences to be evidence for the causal connection of the event states, they will have to be evidence for a causal *law*. For only if I have experience of some causal regularity that connects the watering of mint plants with their diffusion of mint aroma, do I seem to be justified in concluding that my watering really was the cause of the spreading of the mint aroma. On the empirical, rather than the transcendental level, knowledge of causal relations thus appears to entail knowledge of causal laws.

However, on the empirical level there is no secure guarantee for our supposed knowledge of causal laws and hence of particular causal relations. We can be mistaken about the causal law that we take to hold for a particular event in nature and further observation may show that in fact a different law seems the more plausible candidate for subsuming the case under investigation. Moreover, Kant argues that we may not only be mistaken about a particular causal law, but we may even fail to find any kind of regularity of which the given case under consideration is an instance. Thus, in the Appendix to the ‘Transcendental dialectic’ Kant argues:

If among the appearances which present themselves to us there were so great a variety, I do not want to say according to the form (for in that respect they might resemble one another), but according to the content, that is, according to the manifoldness of the existing entities, that even the acutest human understanding could not by comparison of them detect the slightest similarity (*a case which is quite conceivable*), then the logical law of genera would have no sort of standing, and there would not even be a concept of genus, or indeed any other universal concept. . . . (Ibid., pp. 653-4/ B681-2; my italics)

According to Kant, it is thus *conceivable* that we fail to recognise any kind of similarity between different appearances. Similarly, in the ‘Introduction’ to the *Critique of judgment*, Kant argues that ‘it may certainly be thought that ... it would be impossible for our understanding to discover in [... nature] an order that we can grasp, to divide its products into genera and species in order to use the principles for the explanation and the understanding of one for the explanation and comprehension of the other as well’ (Kant, 1908, p. 185). This is equivalent to saying that the transcendental principles of the understanding do not guarantee that we can classify *kinds* or *types* of appearances. And from that it follows that the transcendental principles do not guarantee the existence of empirical regularities, or general laws, either.

The nature of empirical causal laws is thus underdetermined by the causal principle. The transcendental principle does not say which particular preceding event A determines which particular succeeding event B. Only through experience can we know about empirical sequences. And yet, in order to make singular statements about objective successions, we need to formulate laws about empirical regularities. The transcendental principle of the understanding, however, also underdetermines whether we can discover any kind of regularity in the world. Although we know that any natural state is determined by something in the state preceding it, we may not know what precisely it is in the preceding state that causes change, nor may we know whether this change is an instance of some regularity.

Although we may not know what regularities hold between kinds of things in nature, however, we nevertheless approach nature as if it displayed some such regularity. In the Appendix to the ‘Transcendental dialectic’, Kant presents our understanding of nature as systematically connected by necessary laws as a regulative idea of reason. According to the idea of a systematic unity reason presents our experiences of nature as a ‘system connected by necessary laws’ (Kant, 1998, p. A645/B673). Due to this idea of reason we thus cannot but consider nature as ordered according to necessary and systematically connected regularities that classify natural objects into kinds and genera.<sup>9</sup> The laws we find convincing at any time may therefore never be more than well confirmed conjectures. And yet, when subsequent experience shows that they do not hold for all cases, we will always look for more accurate formulations that explain our experiences of nature. Thus anticipating a very modern debate about the status of scientific laws, although Kant may not be able to guarantee knowledge of the regularity of nature, he shows why we nevertheless have to search for such regularity.

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<sup>9</sup> In the *Critique of judgment*, the maxims of reflecting judgment take over the role played by the regulative ideas of reason in the *Critique of pure reason*.

## 2. Mechanical laws as doctrine of motion

According to Kant's conception of causality, we humans cannot but consider nature as determined by particular causal laws. Does this mean that, when Kant claims that we have to explain nature by reference to mechanical laws, he is referring to the empirical causal laws discussed in the previous section? Does a mechanical explanation of nature, according to Kant, present nature as it is determined by the particular causal laws that, while falling under the transcendental principle of causality, make a claim about regular connections in nature? And should the mechanical laws of the third *Critique* therefore be identified with empirical causal laws a set of which, while underdetermined by the 'Second analogy', is required by the character of human reason?

A positive answer appears plausible. And yet, in other writings, Kant seems to use the term 'mechanical' in several very different ways. Thus, Hannah Ginsborg<sup>10</sup> distinguishes between up to five different uses that Kant makes of the term 'mechanism'. They range from the most general definition of mechanism as contrasting with transcendental or noumenal freedom, in the *Critique of practical reason*, to the most specific definition of mechanical laws as determining the effects that moving bodies have on one another through the communication of their motion, as proposed in the *Metaphysical foundations of natural science*. An exhaustive analysis of Kant's different employments of the term 'mechanism' shall be deferred to another occasion. Here, I aim to shed some light on the specific concept of mechanism as it appears in the third *Critique* by taking a closer look only at those other passages in which Kant is concerned with mechanical laws as forming part of an attempt to mechanically *explain* nature.

Kant's most explicit definition of mechanical laws is found in the *Metaphysical foundations*. In this work Kant argues that any science proper requires a 'pure part' that can be known a priori and that is apodictically certain. One might take Kant to refer here to the a priori principles of the understanding established in the *Critique of pure reason*. These principles, Kant has shown there, express claims about nature that are known a priori and that, as the presupposition of any possible experience, are apodictically certain. And yet, the transcendental principles of the understanding are concerned with nature only in so far as they determine the possibility of something being an object of experience *at all*. Kant characterises these principles as part of the transcendental, or 'general', metaphysics of nature that investigates what can be known about nature *as such*, independently of any specific characteristics of particular objects of experience (Kant, 1903, p. 470). The laws of nature proposed in the *Metaphysical foundations*, by contrast, are supposed to hold for nature understood in a more determinate sense. They form part of what Kant characterises as 'special' metaphysics of nature (*ibid.*). Special metaphysics is concerned, according to Kant, with a particular nature that can be specified by means of an empirical concept. It deals with *corporeal* nature and thus

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<sup>10</sup> Ginsborg (2001), pp. 238 ff.

forms part of physics. The ‘pure part’ of a science of nature understood in this sense thus requires principles that are more specific than the transcendental principles of the understanding.

To discover the a priori principles of the science of corporeal nature, Kant argues, one needs to investigate what can be known a priori about the empirical concept of matter. The special metaphysics of nature requires ‘a complete analysis of the concept of matter as such’ (ibid., p. 472). This analysis is carried out by applying the a priori concepts of the understanding to the empirical concept of matter as the corporeal in space and time.<sup>11</sup> In particular, by applying the categories of relation—subsistence, causality and community—to the concept of matter, Kant establishes three laws of *mechanics* whose formulations are very close to Newton’s laws of motion. The first law states the conservation of mass: ‘[i]n all changes of corporeal nature the total quantity of matter remains the same, neither increased nor diminished’ (ibid., p. 541). The second law says that ‘[e]very change in matter has an external cause’ (ibid., p. 543). And, according to the third law, ‘[i]n all communication of motion, action and reaction are always equal to one another’ (ibid., p. 544). The mechanical laws of the *Metaphysical foundations* are thus concerned with change in matter. More specifically, they are concerned with the relation of the movement of one particular part of matter against another, where this movement has to be understood in terms of the attractive and repulsive forces of matter that Kant presents in the Dynamics chapter.<sup>12</sup>

As a first result, we should conclude that the mechanical laws of the *Metaphysical foundations* are certainly not the empirical causal laws of which some set is required by the regulative role of reason. Although they are principles that result from the analysis of an empirical concept, they themselves are not empirical but are known a priori. Furthermore, the mechanical laws of the *Metaphysical foundations* do not seem to be identical with the mechanical laws referred to in the third *Critique* either. For in the *Critique of judgment*, Kant is concerned not with an investigation into the pure part of material nature, but with the question whether it is possible to explain *particular* material objects of experience, such as living organisms and inanimate material objects.<sup>13</sup> And in order to explain particular objects of material nature we seem to require laws that are more specific than the a priori laws of pure science. In the *Metaphysical foundations*, Kant claims that all natural science is either pure or applied ‘*doctrine of motion*’ (ibid., p. 477). It is thus natural to conclude that while the *Metaphysical foundations* are concerned with the *pure* doctrine of motion, the *Critique of judgment* deals with a second sense of

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<sup>11</sup> It is a controversial question how precisely the empirical concept of matter can be analysed, by means of the transcendental categories, in order to yield a priori principles of corporeal nature. For differing conceptions about the empirical nature of the concept of matter and for the notion of ‘construction’ in this context see, for instance, Plaass (1965), pp. 83 ff., Falkenburg (2000), pp. 280 ff., and Friedman (2001).

<sup>12</sup> For details on Kant’s Mechanics chapter of the *Metaphysical foundations* see, for example, Buchdahl (1992), pp. 231 ff., Carrier (2001), and Pollok (2001), pp. 406 ff.

<sup>13</sup> This is so even though Kant does also at times refer to the ‘general mechanical laws’ of the *Metaphysical foundations*. Cf. Kant (1903), p. 382.

‘mechanism’, that is, the laws of an *applied* doctrine of motion.

This interpretation is supported by passages in the *Critique of judgment* in which Kant uses expressions such as ‘physical-mechanical’ (ibid., p. 388) and ‘physical (mechanical)’ (ibid., p. 389) interchangeably with the single term ‘mechanical’. As Kant explains in the ‘First introduction’ to the *Critique of judgment*, ‘physical-mechanical explanations of events in the corporeal world ... find their principles in part in the general (rational) science of nature, and partly in those sciences which contain the empirical laws of motion’ (Kant, 1942, p. 237). By the ‘physical-mechanical’ laws, which seem to be the mechanical laws as such, Kant thus appears to understand the laws that apply to empirical nature and yet instantiate the pure laws of science presented in the *Metaphysical foundations*. Furthermore, in the few and brief comments that Kant does make about the ‘mechanism of nature’ in the *Critique of judgment*, he not only refers to it as ‘mere mechanism’ and as causes acting ‘blindly’ (Kant, 1908, pp. 360, 377 and 381), but he also calls it the ‘capacity for movement’ (ibid., p. 374) and describes it as acting ‘in accordance with mere laws of motion’ (ibid., p. 390). And, in the ‘Doctrine of method’ of the ‘Critique of teleological judgment’, Kant speaks of the ‘raw matter’ and ‘its forces governed by mechanical laws’ (ibid., p. 419, cf. pp. 478 and 172).

The mechanical laws of the *Critique of judgment* thus seem to be concerned with particular material objects in nature in so far as they are characterised by the forces of matter. This reading is supported further by a comparison with three earlier works that also deal with the mechanical explanation of natural objects. In the *Universal natural history and theory of the heavens* of 1755, the *Only possible proof of the existence of God* of 1763 and the *Dreams of a spirit-seer* of 1766, Kant discusses the possibility of explaining inorganic, as contrasted with the impossibility of explaining organic, natural objects in terms of mechanical laws.<sup>14</sup> In these works, Kant characterises mechanical laws, more explicitly and in more detail than in the *Critique of judgment*. He understands mechanical laws as explaining nature by reference to the instantiation of the properties of matter—properties which, in the *Metaphysical foundations*, Kant explains by means of the laws of mechanics. Thus, in the *Natural history*, Kant speaks of the mechanical origin of the universe as employing ‘no other forces than the forces of attraction and repulsion for the development of the great order of nature’ (Kant, 1902, p. 234).<sup>15</sup> Similarly, in the *Only possible proof*, Kant describes the principle that ‘the forces of motion and of repulsion act on one another until they present an impediment for one another’ as one of ‘the general rules ... that shed light on the relationship of mechanical laws to [the] order ‘of nature (Kant, 1905a, p. 129).<sup>16</sup> And, perhaps most explicitly, in the *Dreams*, Kant claims that ‘[d]ead matter, which fills space, is in one and the same state, according to its particular nature in the condition of inertia and persistence; it has solidity, extension and figure, and its appearances that are

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<sup>14</sup> A detailed study of the development of Kant’s argument throughout these works can be found in Ferrini (2000).

<sup>15</sup> Cf. Kant (1902), pp. 334 ff.

<sup>16</sup> Cf. Kant (1905a), p. 113.

based on all these grounds, allow for a physical explanation, which is at the same time mathematical, and together is called mechanical' (Kant, 1905b, p. 329).

Thus, by mechanical laws in these earlier works, Kant seems to mean the laws of an 'applied doctrine of motion'. Should we therefore conclude that Kant understands the mechanical laws of the third *Critique*, too, as applying the a priori mechanical laws of pure science to empirical nature? And how would this square with the previous suggestion according to which mechanical laws are empirical causal laws? In the following section, I consider Ginsborg's account of mechanism, which proposes a positive answer to the first question. Ginsborg's account, however, seems to have some problems with answering the second question. It shall therefore be contrasted with yet another approach to Kant's conception of mechanism, understood as a form of causality, as it is proposed by McLaughlin.

### 3. Ginsborg and McLaughlin on mechanism in the third *Critique*

Ginsborg argues that the earlier works discussed present us with 'our best clue'<sup>17</sup> to what Kant understands by mechanical laws in the *Critique of judgment*. Ginsborg takes the presented evidence to speak in favour of the view that, according to the *Critique of judgment*, 'we explain something mechanically when we explain its production as a result of the unaided powers of matter as such'.<sup>18</sup> A mechanical explanation in the third *Critique*, Ginsborg argues, explains a material object by reference to the 'attractive and repulsive forces which are fundamental to matter'.<sup>19</sup>

Ginsborg takes this reading as evidence for the claim that the suggestion, according to which mechanical laws should be identified with empirical *causal* laws, turns out to be a rather misleading characterisation. Ginsborg concludes: 'the general suggestion that we view it [i.e. mechanism] as a species of causality seems to me to be on the wrong track'.<sup>20</sup> This is supported further by the fact, Ginsborg argues, that in the *Critique of pure reason* causality was presented as a relation between events in time. In the *Critique of judgment*, however, Kant is concerned with the mechanical explanation of *things* rather than *events*: 'what requires explanation in the case of a bird or a hexagon in the sand', Ginsborg argues citing examples from the third *Critique*, 'is not that such-and-such a change took place in such-and-such a substance at such-and-such a time, but the very existence of the bird or hexagon'.<sup>21</sup> This shows, according to Ginsborg, that the mechanical laws of the third *Critique* cannot be understood as laws of causality in

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<sup>17</sup> Ginsborg (2004), p. 40. Ginsborg herself refers to the *Universal natural history* and the *Only possible proof*.

<sup>18</sup> Ibid., p. 42.

<sup>19</sup> Ibid., p. 40.

<sup>20</sup> Ibid.

<sup>21</sup> Ibid.

the sense of the first *Critique* but are concerned, instead, with the production of natural objects according to the fundamental forces of matter.

On Ginsborg's reading, we can thus account for Kant's claim that we have to explain nature by reference to mechanical laws. For, we could argue, any account of empirical and therefore also material nature must refer to laws which can be subsumed under the pure laws of corporeal nature presented in the *Metaphysical foundations*. The mechanical laws of the third *Critique* could thus be thought of as empirical *instantiations* of the a priori laws of pure mechanics. And yet, should we accept Ginsborg's claim that this type of the explanation of nature does not refer to causality as we know it from the first *Critique*? Why, then, does Kant repeatedly characterise the mechanism of nature as 'a causal connection' (Kant, 1908, p. 406)? If the mechanical laws of the *Critique of judgment* can be identified with empirical instantiations of the pure mechanical laws of the *Metaphysical foundations*, what is the relationship of these mechanical laws with the principle of causality? It seems that the contrast between mechanical explanations dealing with efficient causation and teleological considerations concerned with final causation is central to Kant's argument in the *Critique of judgment*. How is this to be understood if mechanism is not, as Ginsborg argues, a form of causality in the sense in which we commonly know it from Kant's writings?

Ginsborg presents her reading as an alternative to that proposed, among others, by McLaughlin.<sup>22</sup> McLaughlin, in contrast with Ginsborg, argues that mechanism is a particular species of causality. He bases his interpretation primarily on the following passage from the third *Critique*:

If we now consider a material whole, as far as its form is concerned, as a product of the parts and of their forces and capacities to combine by themselves (including in our consideration other materials which these parts add to one another), we represent a mechanical kind of generation of it [i.e. of the material whole]. (Ibid., p. 408)

As a particular species of causality, McLaughlin argues, mechanism is differentiated from causality in general by its reference to the relation between material parts and their combination as a whole. To explain a natural object mechanically is to explain the way in which the parts of an object determine the whole. A mechanical explanation thus 'means the reduction of a whole to the properties (faculties and forces) which the parts have 'on their own', that is independently of the whole'.<sup>23</sup> This determination of the whole by means of its parts, as McLaughlin puts it, gives order to 'an *inclusion in space*'. It is therefore not analytically entailed by the concept of causality as such which orders 'a *sequence in time*'.<sup>24</sup> 'There is no reason a priori', McLaughlin argues, 'why the parts into which a system can be divided must be conceived as temporally and thus causally prior

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<sup>22</sup> McLaughlin (1990).

<sup>23</sup> Ibid., p. 153.

<sup>24</sup> Ibid., p. 152.

to the system'.<sup>25</sup> Why, then, do we interpret causality mechanically? Why can we not explain nature without recourse to mechanical laws?

According to McLaughlin, the necessity involved in explaining nature mechanically follows from the special nature of our human understanding. In the *Critique of pure reason*, Kant has made it clear that it is due to the particular character of our understanding 'that in its cognition, e.g., of the cause of a product, it must go from the *analytical universal* (of concepts) to the particular (of the given empirical intuition)' (ibid., p. 407). The understanding thus works by subsuming *particular* given intuitions under *general* concepts. According to McLaughlin, in the *Critique of judgment* Kant refers to a further peculiarity of our understanding. That is the fact that the human understanding identifies the relationship between universal and particular with that between part and whole. The material parts of a natural object are thus considered to represent the universal cause that determines the particular, the material object as a whole. As McLaughlin puts it, '[o]ur understanding takes the parts and their properties (the analytical universal) as its point of departure; from the properties of these parts (the general grounds) various possible combinations and compositions to a whole result'.<sup>26</sup> It is because of this identification of the relation of universal and particular with that of part and whole, McLaughlin concludes, that, according to Kant, 'a real whole of nature is to be regarded only as the effect of the concurrent moving forces of the parts' (ibid.).

In contrast with Ginsborg, McLaughlin takes the mechanism of nature to present a form of causality which refers to the determination of material wholes by their parts. We should thus expect McLaughlin to be able to account, more successfully than Ginsborg, for Kant's association of mechanism with efficient causality. And yet, it may still be asked *why* it is that the human understanding identifies the relationship of general and particular with that of part and whole. It is true that, in the *Critique of judgment*, Kant characterises our own discursive understanding as one

which must progress from the parts, as universally conceived grounds, to the different possible forms that, as consequences, can be subsumed under them. (Ibid.).

Kant here equates the idea of going from the universal to the particular with that of proceeding from the parts to the whole. But why should our understanding make this identification? The first special aspect of the human understanding, the fact that it must go from universal concepts to particular experiences, could be explained by the epistemological account given in the *Critique of pure reason*. It could be accounted for by reference to the unity of consciousness and the way in which this unity presupposes the application to intuition of certain a priori concepts. Can an equivalent explanation be given for the second peculiar aspect

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<sup>25</sup> Ibid., p. 153.

<sup>26</sup> Ibid., p. 166.

of the human understanding, its mechanistic-reductionistic character? McLaughlin argues for a negative answer. On his account, Kant does not give any further explanation for the mechanistic character of our understanding. Rather, McLaughlin claims, it is simply *a subjective fact* about ourselves that we identify causality with mechanism. As a merely subjective aspect of our human understanding the necessity to explain nature mechanically therefore does not make any claims about nature but only about the way we think about nature. Hence, it is not a constitutive but only a regulative aspect of our experience of the natural world.

#### 4. Mechanical laws as a particular species of empirical causal laws

In Sections 1-3 I have explored three types of consideration that seemed relevant to Kant's concept of mechanism in the *Critique of judgment*. Section 1 discussed the notions of 'causality' and 'causal law' as proposed in the *Critique of pure reason*. This investigation prompted the question whether the mechanical laws of the third *Critique* should be understood as particular empirical causal laws. Section 2 then pointed out that Kant in fact provides a more specific characterisation of mechanism in the *Metaphysical foundations of natural science*. A consideration of this account and of that found in three of Kant's early writings led to the proposal that mechanical laws should be understood as an empirical application of the pure laws of science concerned with the interaction of the powers of matter. In Section 3, however, Ginsborg's appraisal of this proposal was contrasted with yet another approach to mechanism. Thus, McLaughlin's account characterised mechanical laws as dealing not with the interaction of forces but with the relation of material parts and wholes.

How do these approaches to mechanism relate to one another? Can all three of them be taken as contributing to an understanding of mechanical laws and mechanical explanations in Kant's *Critique of judgment* or do the different accounts exclude each other? In the present section, I argue that we should understand Kant's mechanical laws in the light of all three approaches. I thus aim to give an account of Kant's conception of mechanism by reference to considerations of causality, material forces and the relationship of parts and wholes. Thus, let me come back to the two competing approaches proposed by Ginsborg and McLaughlin. Ginsborg's account, on the one hand, can give an answer to the question why, according to Kant, we need to explain nature by reference to mechanical laws. Since we are concerned with *material* nature, it has to be explained mechanically, because material nature is determined by the forces of matter. Ginsborg, however, does not seem to account for Kant's association of mechanism with efficient causality. McLaughlin, on the other hand, can explain this association in so far as he presents mechanism as a form of causality. And yet, McLaughlin cannot explain why 'the mechanistic form of causality is ... binding

for us'.<sup>27</sup> would thus like to suggest that both Ginsborg's and McLaughlin's readings offer only a partial characterisation of mechanism in the third *Critique*. If, on an alternative reading, parts of their approaches are combined, we can understand mechanical laws more satisfactorily as referring to the causal processes of matter. Mechanical laws will thus turn out to be a particular species of empirical causal laws.

Thus, the textual evidence from the *Critique of judgment* discussed in Section 2, suggests that Kant in fact understands mechanical laws as referring to the forces of matter governed by the laws of motion. I therefore agree with Ginsborg's account according to which the mechanical laws of the *Critique of judgment*, like those of Kant's earlier works cited, deal with the forces of attraction and repulsion. The mechanical laws of the third *Critique* have to accord with the pure laws of science of the *Metaphysical foundations* insofar as they are empirical laws dealing with material objects which fall under the laws of matter and motion.

I disagree with Ginsborg's further view, however, that the mechanism of the third *Critique* does not present a form of causality, understood in terms of the transcendental causal principle. According to Ginsborg, causality in the sense of the first *Critique* is a relation between events in time whereas mechanism in the sense of the third *Critique* is a relation between things. As evidence, Ginsborg cites examples from Kant's early writings and from the *Critique of judgment*. She describes Kant's *Natural history* as arguing that

the attractive force *causes* clumps of matter *to form*, producing stars and planets; at the same time, the repulsive force generates lateral motions in the matter, which, combined with those motions generated by the attractive forces, *cause* these bodies to rotate around one another. In this way both the existence of the celestial bodies themselves, and their motions, can be accounted for in terms solely of the fundamental forces of matter.<sup>28</sup>

And, from the *Critique of judgment*, Ginsborg cites Kant's (rejected) hypothesis that a maggot 'is to be seen as a *product* of the mere mechanism of matter', where this mechanism is understood as 'the new *process of formation* which matter *brings about* on its own when its elements are set free by putrefaction' (Kant, 1908, p. 411; my italics).

It seems, however, that Ginsborg's examples prove the opposite of what she is trying to show. For they seem to prove precisely the *causal* nature of mechanical laws. The mechanical explanation of celestial bodies and the (attempted) mechanical explanation of a maggot are described as referring to *processes* in time in which the forces of matter *cause* or *bring about* the *formation* of material complexes. When, as Ginsborg argues, mechanical laws in the third *Critique* are supposed to serve for an explanation of the *existence* of material things in nature, this should therefore be understood as an explanation of the way in which the

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<sup>27</sup> McLaughlin (2003), p. 215.

<sup>28</sup> Ginsborg (2004), p. 41; my italics.

material things *came about*, or *were generated*, as well as their inner *workings*. The fact that, in contrast with the first *Critique*, Kant speaks of material objects rather than events as related by mechanical laws should thus not lead one to conclude that ‘Kant does not seem to have in mind causality in the sense of the first *Critique*’.<sup>29</sup> For, in the *Critique of judgment*, and in contrast to the *Critique of pure reason*, Kant is concerned with judgments about material nature rather than about the possibility of nature as such. When speaking of the forces of matter as acting on one another, I therefore suggest, Kant is concerned nevertheless with causal relations in time and, more specifically, with causal processes taking place in the material world.<sup>30</sup>

What, then, are the implications of this account for McLaughlin’s approach to mechanism? In particular, how does the characterisation of mechanism as referring to the causal interactions of the forces of matter square with Kant’s association of mechanism with the relationship between complex wholes and their parts? Kant does indeed characterise mechanical laws as dealing with the relationship between parts and wholes when he describes a material whole as ‘a product of the parts and of their forces and capacities to combine by themselves’ (Kant, 1908, p. 408). And yet, in contrast with McLaughlin, I am unconvinced that the mechanistic-reductionistic character of our understanding is merely an inexplicable and subjective fact about human nature. Rather, I believe that there is an important reason for Kant to claim the apparent necessity of interpreting causality mechanistically in this way. This reason, I propose, is precisely Kant’s interpretation of causality in the material world as ‘external causality’, proposed in the mechanics chapter of the *Metaphysical foundations*.

Thus, as Section 2 has shown, in the *Metaphysical foundations* Kant argues that, applied to the concept of matter, the causal principle is interpreted as the claim that all alterations in matter must have external causes. These external causes are understood in terms of the interactions between the fundamental attractive and repulsive forces of matter. Changes in matter are thus due to the external influence of one material part on another. If one aims to explain the change in a material object one can therefore refer to two things. Either one can refer to the influence of another material object acting on the first object. Or one can refer to the interactions between simpler material parts of the object exerting external causes on one another. In his discussion of the contrast between the explicability of organic and inorganic nature in the third *Critique*, Kant is particularly interested in the explanation of the generation and inner functioning of material objects. And in order to explain the generation and functioning of material objects, one seems to be interested particularly in the case of forces acting between simpler material components that are, or become, parts of complex material wholes.

It is thus due to the necessity of external causal relations in the material world that, to explain the generation and working of material wholes, one needs to refer

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<sup>29</sup> Ginsborg (2004), p. 40.

<sup>30</sup> It might be argued, as Watkins does, that the continuity of the first and the third *Critiques* is due to the fact that already in the first *Critique*, Kant’s model of causality is not that of a relation of events but rather that of the interaction of forces. Cf. Watkins (2005), Ch. 4.

to the interaction between the forces of the material components of a complex whole. Ginsborg's examples concerning celestial bodies, on the one hand, and the maggot, on the other, should be understood in this context. Their (attempted) explanations refer to the process in which the forces of parts of matter act on one another and thereby cause each other to form a material complex. In the context of explaining material nature we thus interpret the transcendental causal principle as entailing the reduction of wholes to their material parts. Consequently, the identification of the relationship between general causes and their particular effects with the relationship between material parts and wholes is not merely a subjective fact about the peculiar nature of the human understanding. Rather, it is required by the pure laws of science that determine material nature. It is because of this, that 'a real whole in nature is to be regarded only as the effect of the concurrent moving forces of the parts' (ibid., p. 407).

According to the account proposed here, mechanistic explanations in Kant's *Critique of judgment* thus refer to empirical laws about the causal interactions between the forces of the material parts of natural objects. Hence, mechanical laws present a special case of empirical causal laws. So far, however, an important aspect about laws understood in this way has gone unnoticed. And that is their claim to regularity. Thus, when referring to the causal processes of matter, mechanical laws refer to the regularity of certain types of causal relations between material objects. In this sense, the mechanical laws of the third *Critique* describe regularities that hold with regard to the way in which the interaction between certain types of material particles determines the form and properties of certain complexes. Empirical laws about regularities in nature, however, face the same underdetermination problems as any empirical causal law in general. The mechanical laws are underdetermined both by the transcendental principles of the understanding and by the pure mechanical laws of nature. And they are underdetermined by these two types of law, firstly, with respect to the empirical content of the external cause and effect relations that they describe and, secondly, regarding the lawlikeness of the particular causal relation considered. While we know that there is some kind of necessary connection between the external cause and its effect, we can never be absolutely certain what exactly the cause and effect consist in. Nor can we ever have full certainty whether their succession is an instance of a regularly occurring type of sequence in nature. In the *Metaphysical foundations* Kant therefore argues that when 'the laws by means of which given facts are explained by reason are merely empirical laws, then they carry with themselves no consciousness of their *necessity* (are not apodictically certain .. )' (Kant, 1903, p. 468). Despite their uncertain status, however, empirical laws are the only means we have to explain the empirical world. This is why Kant does not conclude that the insight obtained through empirical causal laws should be rejected as a form of cognition. It is rather, he argues, an 'applied rational cognition' (ibid.). Due to our idea of nature as unified by means of necessary laws, we thus carry on looking for explanations of nature by means of mechanical laws.

## 5. Conclusion: mechanical explanation and its limits

My aim in this paper was to discuss two questions. First, what does Kant understand by mechanical explanation in the *Critique of judgment*? And, second, why does he think that mechanical explanation is the only type of the explanation of nature available to us? In Section 1, I was concerned to shed light on the notions of ‘causality’ and ‘natural law’ that seemed to be entailed by Kant’s understanding of mechanism. According to Kant’s transcendental principle of causality, we can know a priori that anything in nature has a cause. And yet, purely on the basis of the causal principle, we may decide to look for empirical laws of nature but we cannot expect this search to be necessarily successful. What makes us nevertheless approach nature as if it were lawlike is our idea, grounded in regulative reason and reflective judgment, that nature is systematically unified. On this account, particular causal laws will merely turn out to be more or less well confirmed conjectures. And yet, they are conjectures, a set of which we are bound to make because we are rational beings who think of the world as systematically unified.

The question whether Kant’s mechanical laws in the *Critique of judgment* should be identified with empirical causal laws was deferred, in Sections 2 and 3, by an investigation of Kant’s more specific concept of mechanical laws as laws of a doctrine of motion and of Kant’s association of mechanism with the relation between material parts and wholes. These considerations about Kant’s understanding of mechanism, I then tried to show in Section 4, do not form part of competing interpretations but should rather be viewed as two aspects that qualify mechanical laws as a particular species of empirical causal laws. Concerned with the regularities of the causal influences of parts of matter on one another, mechanical laws in the third *Critique* should thus be understood as a particular species of the empirical causal laws considered in Section 1.

The interpretation proposed shows that the mechanical laws of the *Critique of judgment*, just like any other empirical causal law, can never be known with full certainty. It will always be the case that the laws we find convincing at one time may be replaced by apparently more fitting laws at a later time. Nevertheless, and due to who we are, we will always attempt to formulate such laws in order to explain material nature. And that is why Kant says, without mechanical laws ‘there can be no science of nature at all’ (Kant, 1908, p. 419). Although, in Kant’s opinion, explanation of nature according to empirical laws is merely an ‘applied rational cognition’ and not part of ‘science proper’, a mechanical explanation is all we can expect from our scientific investigations into material nature.

What on a more superficial reading of Kant may have looked like a thoroughly mechanical conception of nature, I would thus like to conclude, is in fact rather limited. For the mechanical explanation of nature can never yield a cognition that is beyond doubt or future falsification. Furthermore, our hope that all of nature is nevertheless explicable according to mechanical laws is based on what Kant has called ‘regulative’ or ‘reflective’ considerations about nature. Nothing in Kant’s

*Critique of judgment* suggests that this hope can ever be justified by reference to how the material world really is. The implications of this limited character of Kant's conception of mechanical explanations in the third *Critique* for the consideration of the seemingly organized and living nature shall be left open here. Whether Kant's claim that we must explain nature mechanically leaves room for an alternative non-mechanistic, or teleological, conception of nature will have to be decided in another paper.<sup>31</sup> What can be concluded at this stage, however, is that Kant's conception of the mechanical explanation of natural phenomena in the *Critique of judgment* is more restricted than one might have expected.

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<sup>31</sup> In Breitenbach (Forthcoming) I suggest that we should indeed draw this conclusion.

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