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Waismann's Lectures on Causality: An Introduction[1]

Waismann's writings can be divided into three periods.[2] The first corresponds to his early work in Vienna under the aegis of Schlick, thus mainly to his collaboration with Wittgenstein on the first drafts of *Logik, Sprache, Philosophie*,[3] out of which came not only the book itself many years later but also transcriptions of conversations with Schlick and Wittgenstein[4] and numerous dictations reworked by Waismann, now published under the title *The Voice of Wittgenstein. The Vienna Circle*.[5] Waismann also did at that stage independent work, albeit largely influenced by Wittgenstein, on probability and identity.[6] The second period runs roughly from the moment relations with Wittgenstein were severed – towards the end of 1934 – to his arrival in Oxford, where he started lecturing in Michaelmas Term 1939. During this period, Waismann published his only book, *Einführung in das mathematische Denken*[7] but, while he completed his *Logik, Sprache und Philosophie* and even had it translated in English, plans for publication did not materialize and he chose instead to publish parts of it in *Erkenntnis* and *Synthese*.[8] The third period, extending until his death in 1959, saw the publication of a number of papers that established his reputation in England, collected since in *How I see Philosophy*[9] – a volume which contains Waismann's only published piece on causality, 'The Decline and Fall of Causality' (hereafter DFC).[10] Although usually perceived as one of logical positivists, Waismann clearly distanced himself from them in his last writings; the summary of his 1947 lecture at the Socratic Club on 'The Limits of Positivism' being evidence to this. He was also at pains to distance himself from Wittgenstein, as one can see for example from the posthumous piece

1 References are to the page numbers of this edition of the typescript 'Causality'. This is M 13 in Schulte's Catalogue (Schulte 1979).

2 (Quinton 1977, xi-xii), (Schulte 1979, 109), (McGuinness & Schulte 1994, ix).

3 The manuscript *Logik, Sprache, Philosophie* and an English translation were destroyed during the war. A reconstructed version was published as (Waismann 1976). An English version had already appeared in 1965 which is now in its second edition (Waismann 1997). For details of this story, see (Baker 1997).

4 (Wittgenstein 1979).

5 (Wittgenstein & Waismann 2003).

6 These papers are collected in (Waismann 1977).

7 (Waismann 1936).

8 Some of which are collected in (Waismann 1979).

9 (Waismann 1968).

10 (Waismann 1968, 208-256). References for 'The Decline and Fall of Causality' are, however, to this new edition.

B.F. McGuinness (ed.), *Friedrich Waismann – Causality and Logical Positivism*,
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'The Linguistic Technique',[11] written largely in reaction to *Philosophical Investigations*.

Waismann's lectures in post-war Oxford were a source of intellectual stimulation for philosophers as diverse as Michael Dummett, Stuart Hampshire, Herbert Hart, John Lucas, and Anthony Quinton. Among his posthumous papers from that period now at the Bodleian Library, his lectures notes on the philosophy of mathematics, mainly from the 1950s, were published in 1982,[12] and a long typescript from the early 1940s entitled 'Willensfreiheit' appeared in 1983,[13] with an English translation in 1994 under the title 'Will and Motive'.[14] The typescript on 'Causality', which is the last substantial piece in Waismann papers that has remained unpublished, can be seen as a companion to 'Will and Motive', although internal evidence suggests that it dates from the late 1940s, perhaps even the early 1950s. Indeed, they each approach the problem of determinism from one of its two traditional angles: 'Causality' deals with the topics of causality, induction, and determinism in physics but ends on short chapters on motives and desires as causes of our actions, while 'Will and Motive' begins by a rejection of the problem of determinism, opening the door to his theory of action. It looks almost as if the purpose of 'Causality' was to clear the field for the examination of issues covered in 'Will and Motive'. Although in earlier phases Waismann's thought was moving within a frame largely provided by Wittgenstein and Schlick, in these two pieces he seems to have set his own agenda. This is not to say that his mentors had nothing to say on these issues or that Waismann did not weave in some of his earlier ideas taken from them, but simply that he seems to have recomposed his philosophy around a theme, determinism, that was not central to their concerns.

Although Waismann's lectures on causality were steadily attended, his thoughts on this topic had in the end little influence. This is partly caused by the fact the typescript on 'Causality' remained unpublished and also by the fact that his sole paper on the topic, 'The Decline and Fall of Causality', has been perceived as presenting a form of 'eliminativism', i.e., the view that causes have been evacuated from modern science and that one should therefore do away with talk about them. Indeed, Waismann believed that "causality has definitely come to an end" and even claimed that the year 1927 saw its obsequies (DFC, 53).[15] This view had

11 (Waismann 1977, 150-165).

12 (Waismann 1982).

13 (Waismann 1983).

14 (Waismann, Schächter & Schlick 1994, 53-137).

15 Waismann is referring here to meetings at Como and Brussels in the Autumn of 1927 were physicist such as Heisenberg, Bohr, and Einstein discussed the new interpretation of quantum mechanics that had emerged in the previous months, when Heisenberg presented his uncertainty principles and, in its wake, Bohr introduced his complementarity principle. These two had discussed complementarity in Copenhagen, hence the name usually associated with that interpretation. The meetings of 1927 are indeed usually considered as a turning point as adversaries of the 'Copenhagen interpretation' never since regained the upper hand. The story is told in many places, e.g., in (Bohr

prominent supporters, from Russell, who called the law of causality a "relic of a bygone age surviving, like the monarchy, only because it is erroneously supposed to do no harm",[16] to Quine, for whom "the notion of cause has no firm place in science",[17] but it has become increasingly unpopular since the 1950s and it is now virtually without supporters. Russell himself had moved away from it by the time he wrote *Human Knowledge. It Scope and Limits*.[18] With his lecture notes, we are now able better to understand Waismann's views on causality, to see how they fit within their epoch and to which extent they may or may not contribute to modern discussions of the topic. He had distanced himself in 'The Limits of Positivism' as well as in 'How I see Philosophy'[19] from the crude anti-metaphysical agenda of the Viennese positivists. In his lectures notes, he points out that Hume did not wish to deny causation, but to analyze it (p. 94) and this point, to which I shall come back, obviously applies to his own work. For this reason, his thoughts on causality (and determinism) cannot be reduced to an inquiry into their evanescent role in modern physics and his notes contain contributions to the metaphysics of causation although, for obvious reasons, these do not display the level of sophistication which we would expect today, nor do they cover all aspects of the question. For example, J. L. Mackie's claim that a cause is an insufficient but necessary part of an unnecessary but sufficient condition or the claim that statements such as '*A* caused *B*' are entailed by counterfactuals of the sort 'If *A* had not occurred, *B* would not have occurred' have considerably renewed the discussion since the late 1960s, but he could not have foreseen them.[20]

The typescript on 'Causality' has 12 sections of unequal length and it can be divided into three parts. In sections (1)-(4), Waismann summarizes the views of Hume and Mill on causality and induction.[21] Using these as a starting point, he then examines in sections (5)-(8) the situation in modern physics in order to conclude to the disappearance of causality and that the problem of determinism is a 'pseudo-problem'. These sections are written for the non-scientific reader and their content can usefully be supplemented with that of the equally clear and non-technical 'The Decline and Fall of Causality'. So far, Waismann dealt only with the view that causal relations are established through the observation of regularities. In sections (9)-(11), he examines the thesis that one could discover causal relations through an 'understanding' of the relation between the cause and the ef-

1958, 38f.).

16 (Russell 1917, 173).

17 (Quine 1976, 242).

18 In that book, Russell introduced the notion of 'causal lines', through which he believed to be able to show that "laws of the form 'A causes B' may preserve a certain validity" (Russell 1948, 316).

19 (Waismann 1968, 1-38).

20 See, respectively, (Mackie 1974) and the essays collected in (Sosa 1975).

21 As can be expected, Waismann's brief mentions of Kant's view that the law of causality is a condition of possibility of experience are dismissive (p. 154) (DFC, 59-60).

fect. This leads him to further criticisms of views by A. C. Ewing and of Wolfgang Köhler's claim that he can perceive the cause of his states of mind. The lecture notes conclude with a critique, in section (12) of Russell's claim that a desire is a "causal law of our action".

We speak variously of *A* causing *B*: 'Smoking causes lung cancer', 'The extra weight caused the shelve to collapse', 'The repeated blows to the head caused death', 'The flood caused the famine' or 'Mr. Baldwin's speech causes adjournment of House'.[22] What does it meant to say that *A* causes *B*? What is this 'causal' relation between *A* and *B*? Waismann assumed throughout without argument that causation is a relation between two[23] events and not, e.g., facts or tropes.[24] He also argued for a coarse-grained notion of events:[25] if events are too finely individuated, then it becomes impossible to talk of causes.[26] The position he defends throughout is a 'regularity account' according to which there is only a succession or chain of events that we may perceive but no such thing as a cause as a 'linkage' or 'bond' between events that could be either perceived or understood (pp. 157 & 163). We can only base our judgements about causation upon observation of regular succession between types of events. It should be clear from the outset that, although Waismann discusses in these lecture notes topics as varied as Heisenberg's uncertainty principle in quantum mechanics and Köhler's notion of 'insight', his purpose is clearly not to give a full discussion in each case but to provide an overall view of a 'regularity account' of his own and the *prima facie* case for its soundness.

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Belief in the causal nexus was shaken by David Hume's celebrated critique in *A Treatise on Human Nature*, Book I, part III.[27] As Waismann recalls (pp. 93-94), Hume found four characteristic points in the ordinary notion of causality, which he wishes to analyse: cause and effect are contiguous in space and time, the cause precedes the effect, the effect follows the cause with regularity, and there is a necessary connexion between the cause and the effect; this last being the sole target of his critique. This alleged necessary connexion is indeed not logical, since '*A* causes *B*' would then be of the same nature as '*p* follows from *q*', in which case it would be self-contradictory to assert *p* and deny *q*; however, affirming *A* and denying *B* does not imply a contradiction (p. 95). (The point is also made by Hume in

22 This last example, a newspaper headline, is taken from (Collingwood 1940, 290).

23 That causation is a binary relation is an assumption that has been criticized. For example, see (Hitchcock 1996).

24 For a defence of causation as a relation between facts, see, e.g, (Mellor 1995).

25 His position is thus in the same ball park as, e.g., Davidson's in 'Causal Relations' (Davidson 1980, 149-162).

26 See the remarks on p. 109 and in section 6, especially pp. 139f. on the necessary vagueness of the ordinary concept of 'cause'.

27 Alternatively, in *An Inquiry into Human Understanding*, section 4.

his examination of the maxim that 'whatever begins to exist must have a cause of existence', which is discussed at length by Waismann (pp. 96-98).) Nor can this necessary connexion be found in experience since we can only observe the succession of events, not the connexion itself.[28] As is well known, Hume assumed that the idea of a necessary connexion must therefore rest on a psychological mechanism: 'habit' is at work.

That '*A* causes *B*' *always* is thus neither logical nor verifiable save for a finite number of cases. Therefore, how could we derive a general law, covering a potentially infinite number of cases, from a finite number of cases? This is the problem of induction as uncovered by Hume, "the problem of justifying an inference from the past to the future" (p. 102).[29] Again, there is no contradiction to be inferred from supposing false generalisations such as 'All swans are white', so they are not logical and they are never completely verified either. They could always turn out in the future to be false, they are not certain. Can we prove that such empirical generalisations will hold good, i.e., that a law which has been fulfilled in all past experiences will be fulfilled in the future? In other words is there any ground for our belief in induction? Again, logic is powerless here, since to suppose that a law will not be fulfilled in the future is not self-contradictory (p. 109). An appeal to a 'principle of causality' such as 'equal antecedents always bring about equal consequents' or 'same cause, same effect' is circular since such principles are in turn supported merely by induction (p. 110). In other words, "we can never use experience to prove the inductive principle without begging the question" (p. 111).

Waismann's clear and concise statement of Hume's views on causality and induction, summarized here,[30] does not make use of secondary literature and it is likely to mislead readers into thinking that it is merely a presentation of basic, uncontroversial material. On the contrary, it is heavily oriented and rather original, as Waismann weaves in his own views. Indeed, Waismann presents empirical generalizations as 'hypotheses' and argues for their scientific usefulness by quoting a well-known passage from Hertz's *Principles of Mechanics* (p. 106), which he interprets as meaning that hypotheses are rules:

> Another way of stating the same thing is to say that the hypotheses are rules which govern our expectation of future experience, or rules for forming particular statements about unobserved future events. (p. 106)

This is reminiscent of Wittgenstein, Schlick and Ramsey.[31] Waismann never mentions Ramsey, but the parallels with his notion of 'variable hypotheticals' are more than striking:

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28 Some arguments to the contrary are discussed in sections (9)-(10).

29 Of course, reference to the future is not essential (p. 111), but useful for expository purposes.

30 For Waismann's own summary, see p. 115.

31 Wittgenstein had indeed interpreted hypotheses are 'rules for the formation of expecta-

> Variable hypotheticals or causal laws form the system with which the speaker meet the future. […] Variable hypotheticals are not judgments but rules for judging 'If I meet a *f*, I shall regard it as a *y*'. (Ramsey 1990, 149)

Waismann even shares with Ramsey a form of behaviourism about beliefs, which he interprets as "patterns of behaviour" (p. 114). In everyday life, our actions are by instinct based on induction, they are not based on "discursive, argumentative thought" (p. 114).

Furthermore, Waismann rejects attempts at portraying the principle of induction as a statement about regularity or uniformity in nature or even the 'rationality of the universe', as being metaphysical statements that "say more than we can assert in good conscience" (p. 118) and variants of the principle in Keynes, Broad and Nicod, as well as Russell's attempt at justifying it on "intrinsic evidence", as being, once more, circular (pp. 115-117). Waismann's way out is to point out that the principle of induction has hitherto been understood as a 'factual statement' and this is why attempts at justifying it on the basis of experience are circular. In his account (pp. 117f.), it denotes a procedure:

> The principle of induction is neither factual nor an *a priori* statement, neither synthetic nor analytic, because it is *not a proposition at all*. In actual fact it is a *rule of procedure* that codifies our activity of generalizing. (I deliberately say "codifies" and not "guides" because we act according to it even before it has been formulated.)
> […] it is never used as a *substantial premise* in scientific reasoning: it is not a *premise from which we draw conclusions*, but the *scheme in accordance with which we actually proceed when making generalizations*. (p. 118)

In short, as a 'rule' or 'scheme', the principle of induction is not a proposition – again a point reminiscent of Wittgenstein –[32] therefore it does not assert anything and it is for this very reason that it needs no justification. That justifications of induction by an appeal to experience, regularity in nature, or success in practice are all circular was already urged in the early 1950s by Peter Strawson in his influential *Introduction to Logical Theory*.[33] But Waismann did not just argue this point

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tions' in the early 1930s. See (Marion 1998, chap. 4 & 5). Schlick explicitly referred to Wittgenstein when introducing that notion in 'Causality in Contemporary Physics' (Schlick 1979, 188). The idea is found in Waismann's 'Hypotheses' in (Waismann 1977, 38-59) and it is clear that he got it from Wittgenstein, at the time of their collaboration on *Logik, Sprache, Philosophie*.

32 In the *Tractatus Logico-Philosophicus*, Wittgenstein wrote that "The law of causality is not a law but the form of a law" and that "in physics there are causal laws, laws of the causal form" (Wittgenstein 1922, 6.32 & 6.321) and this may be taken to mean that the law of causality is not a proposition. (See (McGuinness 1969) for a discussion.) These passages of the *Tractatus* are also cited later on by Waismann, who concludes indeed that Wittgenstein held that "the law of causality would not assert anything" (p. 144).

33 (Strawson 1952, chap. 9, Part II).

with much clarity; his position is original, inasmuch as he brings into the bargain new ideas about the nature of the principle of induction.

Concerning Hume, Waismann makes three noticeable points of exegesis. First, he insists that "Hume has been accused of *denying* causation whereas in fact he was concerned only with analysing it" (p. 94) (DFC, 209). To my knowledge, this point was first made by William James' student, Dickinson Miller.[34] Secondly, Waismann quotes a letter from Hume to John Stewart to prove that Hume never wanted to assert that events are uncaused (p. 98).[35] Finally, Waismann is able, as an upshot of his discussion in sections (1)-(2), and in particular of the above claims, to conclude that Hume was not a sceptic (p. 113). This claim is of course not new – albeit still a matter of controversy – but, coupled with his analysis of scientific hypotheses as 'rules for the formation of expectations' and of the principle of induction as a 'rule of procedure', Waismann's defence is original.[36] Following Hume, Waismann claimed that "we must accept the inductive principle as a sort of *blind instinct* or *automatic device* acting on our mind, and forego all argumentative proof for our expectations about the future" (p. 112). That a proof is lacking should not be a problem. It would be "spurious" (p. 113) and this is a "pseudo-question" (p. 120). Precisely for this reason, Hume's arguments do not imply scepticism. It is only because the ordinary notion of causality contains the idea of a necessary connexion that we were drawn into these spurious problems, removing it does not lead to scepticism but to a better understanding of science:

> In fact, the credit of natural science is not impaired by the lack of such a proof. The only test that is required in science is the test of success in prediction. We are entitled to have faith in our procedure just so long as it does the work which it is meant to do. That is, as long as it enables us to predict future experience and so to gain control over our environment. Of course, the fact that a certain form of procedure has always been successful in practice affords no logical guarantee that it will continue to do so. But then it is a mistake to demand a guarantee where it is logically impossible to obtain one. This is not scepticism; for the fact that we are unable to offer a logical guarantee for an empirical generalization in no way entails that it is irrational for us to believe it. On the contrary, what is irrational is to *look* for a guarantee where none can be forthcoming; … (p. 113)

Hume's analysis is nevertheless incomplete in Waismann's eyes, because his account does not allow one to distinguish causal sequences from mere regular sequences. This is why Mill's methods for inductive reasoning and the canons

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34 Unless, of course, these lecture notes were written before Miller published this remark: "He was not intending to mutilate our idea [of causation] or deprive it of any of its features, not to modify but to analyse it" (Miller 1945, 593). I would like to thank David Raynor for pointing it out to me.

35 This letter is quoted in Norman Kemp Smith's well-known commentary (Kemp Smith 1949, 411-413).

36 It has, e.g., nothing to do with Kemp Smith's grounds for making the same point (Kemp Smith 1949, 446-449).

they embody provide, according to Waismann, a definition: "we speak of a *causal connection*, whenever this connection can be established by means of any of the methods enumerated by Mill" (p. 60). Section (4) contains a lengthy defence of Mill against some objections. Waismann is thus far from 'eliminating' causation altogether. However, his conclusion is that it has a limited role in modern physics.

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Moving to physics, Waismann's arguments in section (5) are broadly along the line of Russell's 1912 paper 'On the Notion of Cause'.[37] First, he points out that '*A* causes *B*' implies that reality can be sliced into a temporal succession of discrete events but, since reality is in fact continuous, he concludes that the traditional notion of causality runs into allegedly insuperable difficulties (pp. 129-131). Amazingly, in speaking here of cause and effect in terms of "series of processes" (pp. 130 & 131), Waismann thus comes very close to but falls short of stating Russell's later concept of 'causal lines', which is in turn the ancestor to Wesley Salmon's 'causal processes'.[38] At any rate, Waismann's point is merely that it is the conception of causality as a relation between two discrete events which is not used in science (p. 131), a point hardly contested, but he does not enquire about the possibility that 'causal processes' may be used instead, because he insists that 'cause' and 'effect' are not to be contiguous if one is merely earlier than the other (as they are, e.g., in Russell's 'causal lines')[39], and thus that the traditional notion cannot be reframed in these terms (pp. 131-132).

Secondly, he argues that the notion of causality has been replaced by the notion of 'functional relation' or 'functional dependence', a point for which Russell is famous, and which was taken for granted among logical positivists. Indeed, through an elegant discussion of planetary motion, Waismann shows that physics deals with differential equations within which nothing is recognizably a 'cause' or an 'effect':

> […] a mathematical function, generally speaking, is simply a law governing the interdependence of variable quantities. […] Physical laws are nothing but statements concerning the way in which certain quantities depend on others when some of these are permitted to vary […] The task of the physicist is to determine the exact or approximate nature of this functional dependence. (p. 133)

This last argument is also supported by a discussion of Fourier's theory of heat (pp. 135-137). It could have been given support by other cases, e.g., the Lorentz transformations, but all this only shows that the traditional notion of 'cause' does not appear in the fundamental equations of modern physics. If 'eliminativism' is

37 (Russell 1917, chap. 9).
38 (Russell 1948, 316-317 & 453-460); (Salmon 1984) & (Salmon 1998).
39 (Russell 1948, 316).

taken to be the claim that for this very reason the notion of causality should be completely banned from our vocabulary, then it is open to the objection that the notion of 'cause' plays too central a role in the analysis of a host of other concepts, e.g., 'disposition', 'warrant', 'action', 'responsibility' to be eliminated. Furthermore, other notions such as 'law' or 'event' are here clearly in the same boat as 'cause' and philosophers of science may not wish to do away with all or even some of them. For example, Nancy Cartwright favours causes, not laws.[40]

At all events, one must delineate Waismann's position with care: as already pointed out, he merely intended to analyse our ordinary notion of causality (and enquire into its scope), not to deny it. He agreed with Hume that the element of necessary connexion has only a psychological basis, i.e., a psychological mechanism makes us expect an invariable conjunction of two events in our direct experience. It is only this last notion that he has found missing in modern physics and this is not a conclusion that has been much contested. It is not the same to declare that causality has no explanatory role to play in our theories about, say, physics or biology. Waismann does not wish to ban the idiom; he is merely an anti-realist about causes, as the above discussion of the principle of induction and law of causality should have made clear. He argues therefore in section (6) that the ordinary conception of causality that he has, following Hume, analysed, has "relevance to practical life" (p. 140) and that 'My hunger passed away because I had a good meal' is "a perfectly good description of a causal nexus" (p. 140). One feature that makes it so relevant is that 'cause', 'effect', and 'event' are *vague* terms and they should remain so, as attempts to make them precise will lead to difficulties (p. 141). Another concept causality must be introduced if vagueness is to be eliminated:

> In general, when you want to make your concepts precise, you must change the whole way of concept-formation. This you do when you pass to science. What is important to understand is that, when you study physics, you learn a new *method* of describing things. I might as well say that there are two *languages*, the language of science and the language of every-day life, and to each of them there corresponds a *particular scheme of causality*. That is, it is a mistake to suppose that there is just *one* idea of causality, which is analysed by philosophers. (p. 141)

Waismann is here not very far from Nancy Cartwright's view that there are various irreducible concepts of causality, each one with their own purpose.[41] Although he offers only the beginnings of a theory, he argues in this section in terms of his own doctrine of 'language strata':[42]

40 (Cartwright 1983), (Cartwright 1997).

41 (Cartwright 1997).

42 This is the doctrine presented in eponymous papers that are reprinted in (Waismann 1968, chap. IV). The idea that the concept of causality is 'stratified', so to speak, is neither to be found in these papers nor in 'The Decline and Fall of Causality'; it is thus an original contribution from these lecture notes. In 'The Decline and Fall of Causal-

What we must understand is that there are two distinct *language strata*, and that the word "causality" accordingly undergoes an inflection of significance. You can only apply the term "causality" with reference to a language fit to represent things and processes; what you mean by causality will depend on the stratum of the language you use. (p. 141)

Now the point which I want to make is that the idea of causality is tied up with a certain way of describing things. And as there are different ways of describing thing – or, what comes to the same, different languages – the idea of causality adapts itself to the particular type of language. Thus scientific language has its own conception of causality, different from the idea we meet in common speech.

To put it slightly differently: *the idea of causality is a function of language, and it varies when you pass to a language of a new logical stratum.* (p. 143)

Waismann's discussion on quantum mechanics moves away from causality to determinism, which he defines along lines broadly similar to Laplace's well-known formulation (pp. 137-138, 145-146 & 146-147) (DFC, 57 & 64-65), only to point out that there is already something wrong with it, since our measurements are never infinitely precise and errors compound very rapidly (pp. 146-147).[43] This point is presented in greater detail in 'The Decline and Fall of Causality' (DFC, 65-68), where Waismann shows that very point from an example (the movement of a ball on a round board):

Even in classical mechanics the causal scheme does not always work, not under all circumstances. Whether it works or not hinges on one condition – that measurements can be made with unlimited accuracy. Causality stands and falls with this requirement. (DFC, 67)

Applications of the traditional conception of causality assume indeed that

[…] it is possible to measure precisely the state of a physical system and that there is no limit to the finiteness of our operations of measuring. Only if this condition is fulfilled, may we speak of causal laws enabling us to predict exactly the entire future of a physical system once its initial state is known to us. (p. 147)

Moving to quantum physics, section (8) contains an elegant presentation of Heisenberg's uncertainty principle (p. 148) and the related complementarity principle by Bohr (pp. 150-151). Although Waismann argues here against determinism, his

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ity', another approach is proposed instead: "while causality is thus indispensable for an interpretation of an experiment, it does not follow that it must also apply to the hidden reality which manifests itself in the experiment. The existence of causality on the macroscopic level together with acausality on the microscopic presents an inner tension which could be only be released when it was shown that ordinary mechanics is included within quantum mechanics as a limited case" (DFC, 72).

43 For a clear statement of this critique, see (Born 1958). The argument is also known through G. E. M. Anscombe (Anscombe 1981, 139).

position contains important nuances, since his claim is only that it is limited in its application:

> So far as experience is concerned we can only say that *some* domains of happenings *have actually been subjected* to laws of a causal type, *other ones have not*. (p. 145)

> Yet the most recent theories, adopted by physicists, almost against their will, to explain fact experimentally observed lead, not so much to a complete surrender of determinism in physics, as to the view that it is not complete nor universal, and that in fact it has limits. (p. 146)

The claim can be taken to mean that some theories are deterministic, while others are not or that theories might be partly deterministic and partly not.[44] Waismann actually argues succinctly that this is the case for quantum mechanics:

> The new physics is neither a causal, deterministic theory in the old sense, nor a completely indeterministic theory […] (p. 152)

> […] what is deterministic is the mathematical law for the propagation of certain waves; what is indeterministic is that what is really fixed by the wave is not the position of the electron, but only the probability of its position. (p. 153)

Of course, Waismann refers here to the 'uncertainty' phenomena first uncovered by Heisenberg.[45] If Δp denotes the range of values for the position of the particle and Δq for velocity or momentum, then:

$$\Delta p \cdot \Delta q = \frac{h}{4\pi}$$

where h is Planck's constant (p. 148). Roughly put, when trying to determine position with more precision, one looses information about velocity, and vice-versa. It might be useful here the supplement Waismann's comments with his lengthy discussion of the uncertainty principle in 'The Decline and Fall of Causality' (DFC, 69-82). These analyses led him to conclude that "there is no escape from the uncertainty principle" (DFC, 82) and thus that "there can be no determinism" here (p. 152). According to the lectures, the upshot is that

> […] *there is a limit to the finiteness of our powers of observation and the smallness of the accompanying disturbance – a limit which is inherent in the nature of things and can never be surpassed by an improved technique or increased skill on the part of the observer*. There is thus an essential indeterminacy in the quantum theory, of a kind that has no analogue in the classical theory. This indeterminacy can be said to have its basis in the wave properties of matter, and is therefore unavoidable. (p. 149)

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44 See (Earman 1986) for a thorough study of deterministic claims for a number of physical theories.

45 (Heisenberg 1927).

A common error about indeterminism is to refer to Δp and Δq, above, as errors of observation while it is in fact inherent to the mathematical formalism of the theory. In fact, Waismann makes neither of these claims but argues instead that the limit is "inherent in the nature of things", i.e., that "*nature itself is indeterminate*" (p. 154):

> […] in throwing dice we cannot predict the result of any throw; what we can predict is only the *probability* of throwing a certain number. We are prevented from predicting the result, because we have insufficient information as to all the minute factors which are of relevance in the matter. But we might still imagine an experimenter who has such subtle methods of observation at his disposal and at the same time such mathematical skill that he can predict with certainty the result of a particular cast. In this case the impossibility of predicting is only a *technical* one which, at least in thought, can be overcome. Not so in the case of the electron. For here we are prevented by the very laws of nature from predicting its future behaviour. The impossibility is not due to some lack of information on the part of the observer or to some lamentable inefficiency on the part of the calculator or to some limitations of human beings, but to the very order of things. (p. 154)

This jump to an ontological conclusion is certainly striking and in need of further support, but one should note that it is in line with Waismann anti-realism about causality: not only does he hold that the principle of induction is merely a 'rule of procedure', he also infers from quantum mechanics, as our best scientific theory about the world,[46] to the ontological thesis that the 'order' or 'nature of things' is non-deterministic. In short, when it exists, causality is not to be found 'out there' but in our theories, as a satisfactory explanation of observed regularities.[47] This is the opposite from a viewpoint such as Cartwright's, who is a realist about causes but somewhat anti-realist about laws.[48] In connections with this, it is worth noting that Waismann also makes a few interesting points about laws: a brief survey of the etymology of the word 'law' and of the origins of the expression 'laws of nature' (pp. 138-139) (DFC, 62-64) leads him to the conclusion that it brings about

46 There is, however, no discussion of the logic of quantum mechanics in the lectures on causality, as opposed to some lengthy concluding remarks in 'The Decline and Fall of Causality' (DFC, 88-90). This is in line with the sort of holism advocated by Quine and furthered by Putnam in 'Is Logic Empirical?' (Putnam 1979, chap. 10) and proponents of quantum logic.

47 Again, this is not far from Ramsey: "But may there not be something which might be called real connections of universals? I cannot deny it, for I can understand nothing by such phrase; what we call causal laws I find nothing of the sort" (Ramsey 1990, 160). It is interesting to note in this context that Waismann's anti-realism in these matters goes as far as the suggestion that "quantum physics […] presents a strong case against traditional logic" (DFC, 90).

48 (Cartwright 1983, 74 & 86). Cartwright has argued since for the introduction of 'capacities', so that causal claims are not seen anymore as 'reports about regularities', as Waismann continued to do, but as 'ascriptions of capacities' (Cartwright 1989, 3) and thus "it is not laws that are fundamental, but rather the capacities" (Cartwright 1989, 181).

misleading connotations of 'coercion' and 'prescription', "as if the planets, if left for themselves, would have chosen to run off in quite different directions and only these tiresome laws of Kepler's compel them to remain in orderly orbits" (p. 139). Instead, 'laws of nature' are merely descriptive (p. 139) and, furthermore, "no law is absolutely exact" (DFC, 86).

To come back to Waismann's discussion of quantum mechanics. It is, of course, always possible to re-establish determinism through the introduction of hidden variables or parameters. Although the possibility that quantum mechanics is 'incomplete' was argued forcefully already in the 1930s with help of the Einstein-Podolsky-Rosen Paradox, hidden variable theories were only really taken seriously when David Bohm introduced was is now known as 'Bohmian mechanics', in the wake of de Broglie's 'pilot wave' model.[49] Against the very possibility of an hidden variable theory, Waismann points out a theorem by von Neumann[50] that shows that the system of quantum mechanics is (mathematically) complete in the sense that "it permits no addition that would render it deterministic", because any such addition "will necessarily lead to internal contradictions" (p. 154) (DFC, 86). For Waismann, "the crack in the wall of determinism is definitive" (p. 154). As a comment on von Neumann, this is fine but insufficient by today's standards, as some assumptions necessary to derive von Neumann's theorem have been called into doubt. Nevertheless, Waismann stands on solid ground as hidden variables theories suffered instead repeated setbacks with the Kochen-Specker Theorem[51] and with a key theorem about Bell's inequalities that shows that hidden variable theories will make predictions that are at variance with those of quantum mechanics,[52] a result which was eventually followed by experiments that confirmed quantum mechanics.[53]

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49 See (Bohm 1952), (Bohm 1957). For as recent discussion, see (Albert 1992).

50 (von Neumann 1955, chap. 4, sec.2).

51 (Kochen & Specker 1967).

52 (Bell 1966).

53 (Aspect, Dalibard & Roger 1982). Of course, convinced 'Bohmists' will argue that the issue is still not settled. But it would be dishonest to insinuate that the ball is in the camp of defenders of quantum mechanics and the 'Copenhagen interpretation'. Furthermore, Bohmians are nevertheless keen to point out that Bohmian mechanics is supposed to make the same predictions as quantum mechanics, re-establishing determinism at the price of a more complicated mathematical structure (alas, of lesser interest for physicists for that very reason) and the introduction of newer entities, e.g., the 'guiding wave'. Waismann's *Gedankenexperiment* (p. 159), quoted below, is a good reason to believe that he would have dismiss Bohmian mechanics for similar reasons (basically an application of Ockham's Razor): if there were no empirical tests to distinguish it from quantum mechanics, then statements concerning extraneous entities such as 'hidden variables' would be meaningless.

In the last sections, (9) to (12), Waismann turns away from modern physics and the issue of determinism, towards the philosophy of mind and action. So far, he had discussed only the view that causal relations are established through the observation of regularities. He now examines the thesis, which goes against his own 'regularity account', that one could discover causal relations through an 'understanding' of the relation between the cause and the effect. This view is found in A. C. Ewing's 'A Defence of Causality'.[54] Ewing's case rests around four claims: first, cause and effect do not just happen to follow each other with regularity, they are somewhat intrinsically connected; this point being linked with the idea that one may actually perceive this connexion. Secondly, the cause is (at least part of) the reason for the effect. Thirdly, the cause is said to produce the effect. Fourthly, causality involves necessity. Against this 'efficacy account', Waismann makes a number of related points.

The idea that the cause 'produces' the effect, i.e., the idea of 'efficient causation' is very sharply dismissed. Waismann even claims that it has its sources in children's and so-called primitive people's animistic conception of causality (pp. 161-162). Instead of serving us a fallacy of 'poisoning the well', he could have referred to a philosophical pedigree, starting with Maine de Biran. More seriously, Waismann points out, quoting Hume, that 'to cause' and 'to produce' are synonymous and cannot be used to define each other in a non-circular way (p. 156). But this conception of 'efficient causality', 'productive power' (p. 158) or 'active power' (p. 159) comes in for further criticism. One should note that the view here is not completely unrelated with recent views about 'causal powers' or 'capacities'.[55] Here, Waismann remains close to logical positivism, finding the view simply unintelligible. First, it appears to be modelled on our own voluntary agency: against this, Waismann quotes Mill and Hamilton on the case of paralysis to the effect that "if observation cannot even show us the manner in which the will acts upon the limbs or our mind, it can still less discover any quality in an event which makes it *produce* another one" (p. 157). Furthermore, this 'productive power' or 'quality' cannot be derived from observation by reasoning, because this would render quantum mechanics self-contradictory:

> […] if the existence of such a productive power can be inferred from our sense experiences, on purely logical grounds, then it would be a self-contradiction to say that the motion of the second billiard-ball is *caused* by the first, that is, *regularly preceded* by it, without being *actively produced* by it. Present day physics, having dispensed with the idea of efficient causality, would, if this account were right, be self-contradictory – a very strange consequence. The existence of an active power in an event which produces the effect can neither be produced in, nor logically inferred from, observation. (pp. 158-159)

Waismann also provides an interesting *Gedankenexperiment*:

54 (Ewing 1933, 98f.).

55 (Harré & Madden 1975), (Cartwright 1987).

> Suppose there was a region of the world, say A, in which everything held good that Ewing […] tells us – that is, in which the events were "intrinsically" connected with each other, so that the cause "actively produced" the effect; imagine another region of the world B in which the events merely follow each other, without being connected in this way; and imagine that the observable laws are the same in A as in B. What then, I ask, could be the difference between these two regions of the world, as far as their causal structure is concerned? Or how can we tell whether this world of ours is more like the part A or the part B? There is no way which we can tell; for there is no conceivable observation which is relevant to establishing the existence of such a relation. (p. 159)

The point of this *Gedankenexperiment* is the dismissal of claims such as 'there is an inward activity in the events' (such that the cause 'produces' the effect) as "neither true nor false, since we ourselves cannot tell what the supposed difference is to be" (p. 160). Such claims are simply "*devoid of meaning*" (p. 160).

Moving to the *Geisteswissenschaften*, Waismann quotes Georg Simmel (p. 159) on the issue of singular causation: perhaps it would explain the impossibility of finding laws in that domain (p. 160).[56] To Waismann, singular causation could not apply to the physical world unless one would postulate 'inward activity' or 'connexion' and this is unsatisfactory for the reasons just expressed. Against this, one could claim to have an 'insight' into the causal nexus. This is further countered by pointing out that this 'insight' is either a case of logical reasoning, as in 'If I cut a man's leg off, then he will have only one left', or something that rests on observation of regularities (pp. 162-164). There are only events following each other and no 'glue' or 'link', that would hold events together and which could be experienced (p. 164).

But one could further argue that there is room for singular causation in the domain of psychology: one can have an immediate awareness, an 'insight', into the connexion between cause and effect, thus one would have no need to wait until one has observed regularity. Here, Waismann quotes (pp. 165-166) and criticizes at length (the whole of section 10) Wolfgang Köhler, who adduced an number of examples in support of this point.[57] One such example is that of hearing an *alto* singing at the concert-hall and realizing that one's feeling of admiration was caused by the hearing of the *alto*'s voice. One is thus immediately aware of a causal connexion between the voice and the feeling of admiration. Waismann's point is that in all these cases, Köhler "confuses the *object* of a wish, of a feeling of alarm, etc., with the *cause* of the wish, the feeling of alarm, etc." (p. 166). It may be that consciousness exhibits directionality or intentionality (Waismann quotes p. 166 a famous passage by Brentano)[58] but the object of which one is conscious can hardly be said to be a 'cause'. In admiring the *alto*'s voice, one is immediately

56 (Simmel 1977, 106f.).
57 (Köhler 1930, chap. 10).
58 (Brentano 1973, 88f.).

aware of what it is that one is admiring, but this does not mean that one is aware of the cause of the admiration. The two are simply not logically related:

> The first statement – that [Köhler] knows that his admiration is directed towards the *alto* voice – in no way entails the second statement, that the admiration *depends* upon that voice. There is no logical connection between the two: the one may be true, and the other false. For example, if Köhler had happened to take a dose of mescal just before he went to the concert, he may have been in the disposition to admire anything he came across in the concert-hall that night. In such a case we should judge that the cause of his admiration was the mescal, and not the singing; though, even in this case, the singing was the *object* of his admiration. (p. 169)

Köhler always slips in his discussion between 'object' and 'cause', and Waismann concludes that his "whole philosophy of causation rests on a somewhat slipshod manner of expression" (p. 170), a very interesting critique indeed.[59]

Discussion of a further example by Köhler brings out key distinctions between 'cause', 'reasons' and 'motive'. Here, Waismann is moving into territory covered by the typescript 'Will and Motive' and his discussion is limited to making a few important points against confusing these notions; points related to the central thread of the lectures, i.e., his defence of the 'regularity account'. Köhler relates an evening at the restaurant:

> After sitting for half an hour in a restaurant, full of smoke and of talk all around d me, I feel 'nervous' and ready to go. My 'nervousness' *refers to* those properties of my environment. I know this, not only because in past experiences I may have discovered the rule that under such conditions I shall feel uneasy after a time. I experience myself directly as disturbed and confused *by* these surroundings.[60]

Köhler claims that in this case he has an insight into the cause of his action (leaving the restaurant), namely his uneasiness in this situation and the dislike of smoke and talk. As Waismann points out, however, this is not the cause but the *motive* for his going: "the *real* cause may be some excitement growing on his nerves, but he need not be aware of this cause" (p. 174). The uneasiness and dislike of smoke and talk are to be invoked instead as the motive for his action, supposing that he had been asked, and not to be confused with the cause. Waismann provides here reasons of a general nature to avoid such a confusion. He argues in two steps. In section (10), he argues for the distinction between 'cause' and 'ground' or 'reason' and in section (11), he distinguishes between 'reasons' and 'motives'. The distinc-

59 It is a pity that Waismann did not take also into account here Michotte's experiments that supposedly show that his subjects perceived causal connexions (even in cases where there isn't one). The "slipshod manner of expression" is all over the place in the subjects' own description of their perceptions. See (Michotte 1963).

60 (Köhler 1930, 273).

tion between 'cause' and 'motive' should be transparent from the discussion of Köhler's example:

> […] all his argument amounts to is that the motive is not discovered by induction: we are immediately aware of it. But this is precisely on of the differences between motive and cause. (p. 174)

To distinguish 'cause' from 'ground', Waismann makes three points. Here, Waismann is heavily indebted to Wittgenstein's discussion in the *Blue Book*, to which he keeps very close.[61] First, a causal explanation will appeal to processes situated in time, while a logical explanation will refer to timeless entities such as rules (p. 171). Secondly, contrary to causes, reasons cannot be discovered by observation (pp. 171-172). Here, Waismann appeals without reference to a version of what is known from Wittgenstein as the 'rule-following argument':[62]

> Let us imagine that someone writes on a board the numbers 0, 1, 4, 9, 16 in this order. We, watching him, may suppose that, in doing this, he is following a definite rule, e.g., that he is writings down the squares of the integers in order. Have we now found out this rule by observation? Not at all: our supposed rule is merely a hypothesis, which would account for the numbers he has actually written down. But the figures written down are always subsumable under an infinite number of mathematical laws. How are we now to tell which rule he in fact followed? By making him continue the figures? But even if he wrote a thousand figures, he still might have been obeying any one of an infinite number of rules. (p. 172)

However, should the man tells that he has been following the rule $y = x^2$ for the values 0, 1, 2, 3, 4, we would then have the 'ground' for his writing down these figures and this is distinct from the 'cause':

> So we must distinguish between *ground* and *cause*, for we learn of both in different ways. The *cause* for his writing down certain figures may lie in the fact that he was taught so in school and that this teaching has created a disposition, e.g. left definite traces in his nervous system and his brain; the *ground* for his procedure is the *rule* which he states when asked for the ground. (p. 172)

Thirdly, contrary to grounds, causes cannot be appealed to in order to justify an action (p. 173). In the above example, the appeal to the rule $y = x^2$ justifies the man's actions, but should he had made a mistake, giving the cause of his mistake would hardly count as a justification of it.

Waismann further distinguishes between 'reason' and 'motive' on similar grounds in the short section (11): a reason justifies an action, but a motive does not; motives "have no justifying power" (p. 178). In the above case of the man

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61 Waismann even lifts silently at p. 174 a sentence from the *Blue Book* (Wittgenstein 1958, 15).

62 (Wittgenstein 1953, §§ 198-242).

writing the series '0, 1, 4, 9, 16' on the board, the rule $y = x^2$ provides the ground but this has nothing to do with his motive to do so (p. 178).

Waismann also provides a central point in his discussion of the ambiguities of the words 'why' and 'because' (pp. 174f.). In the sentence 'I believe this mathematical proposition because I have just seen its demonstration', one is not referring to the cause of one's belief but to its ground. Similarly, in 'I made an effort because I decided to do so and so', one is referring to one's motive and not to the cause of one's action.[63] Waismann would say that in both cases the relation is 'intrinsic' as opposed to 'extrinsic' when 'because-' refers to a causal connexion. Wittgenstein would have spoken here of, respectively, 'internal' and 'external' relation.[64] What is meant here is that the motive is fully determined by one's expression of one's motive, not by some relation to be found by observation. The point is of importance since it is the source of our view that, although they might be wrong, motives are not to be doubted in the sense that, as in the above case,

> […] there is no sense in questioning the motive given. It would be preposterous to appeal to some inductive evidence in the past to confirm that I made the effort because I had decided to do so. (p. 175)

In making thus essential distinctions between, on the one hand, 'motive' and, on the other hand, 'cause' and 'ground', Waismann has set the stage to his 'Will and Motive' but he also undermined attempts at refuting the 'regularity account' by showing how the rival 'efficacy account' cannot be supported by an appeal to singular causation coupled with a confusion between these notions.

In the final section (12), Waismann looks at Russell's account of desire as a "causal law of our actions"[65], an account that he finds "unnatural and perverted" (pp. 159 & 163). Waismann's main critique of Russell's account, which is taken from Wittgenstein,[66] is that Russell sees the connexion between a desire and its object as

> […] established by *experience* and, note, *afterwards*, after we have observed what it is that will bring a certain restlessness or discomfort to an end. (p. 181)

This view leads to absurd consequences. As Wittgenstein would put it:

> If I wanted to eat an apple, and someone punched me in the stomach, taking away my appetite, then it was this punch that I originally wanted. (Wittgenstein 1975, § 22)

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63 Here, Waismann stands apart from the sort of theory set forth by Davidson in 'Action, Reasons and Causes' (Davidson 1980, 3-19). and closer to Collingwood (Collingwood 1940, 285-337). On Wittgenstein's conception, see (Schröder 2001).

64 (Wittgenstein 1975, § 21).

65 (Russell 1921, lecture 3).

66 (Wittgenstein 1975, §§ 21-22).

Russell's mistake is to see relation between the desire and its object as 'experiential', while it should be 'semantic' (p. 183). (Again, Wittgenstein would have said 'internal'.) Waismann's discussion might appear at first sight unrelated to the rest of the lectures but this is not quite the case. Not that Russell should be seen as also providing support for the rival 'efficacy account', but because his account brings about further confusions about a central point Waismann had been trying to make in the previous sections concerning the distinction between 'cause' and 'motive'. Here too, the object of one's desire wish, expectation, etc. is "determined, fully determined by the expression" of the desire (p. 182); "*desire is tied up with language*" (p. 183). This is a key point, which is further defended by Waismann against the obvious counter-example of children and animals in the very last pages (pp. 183-184). Again, Waismann is moving here into territory covered by 'Will and Motive' and does not provide a full discussion.

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