CHAPTER VIII
REICHENBACH’S PROBABILITY MEANING

0. Introduction

The way in which Hempel gradualised the theory of dispositions is closely akin to the way in which Reichenbach gradualised the theory of meaning. In the preceding chapter we saw to what Hempel’s gradualisation amounts: sentences by which dispositions are described - reduction sentences - are given a probabilistic shape. In the present chapter we shall see in what Reichenbach’s gradualisation consists: the sentences by which scientific terms are defined - so-called direct sentences - are only probabilistically related to the definiendum. Reichenbach’s gradualisation and its resemblance to Hempel’s approach are discussed in the first two sections of this chapter. Section 3 contains an excursion on Reichenbach and Carnap. In Section 4 Reichenbach’s views are applied to beliefs and desires. In the final chapter it is shown that the gradualisations of both Hempel and Reichenbach suffer from the same flaw, and an attempt will be made to remedy the defect.

1. Reichenbach’s gradualisation:
probability meaning

In Experience and Prediction Hans Reichenbach distinguishes between direct and indirect propositions (Reichenbach 1938, 46-47). The distinction is an unalloyed neo-positivistic product. Direct propositions are the familiar observation sentences capable of direct verification; indirect propositions are indirectly verified, which means that they are reducible to other propositions capable of direct verification. Among Reichenbach’s examples of directly verifiable sentences are ‘There is a table’, ‘This steamer has two funnels’, ‘The thermometer indicates 15° centigrade’. Examples of indirectly verifiable propositions are ‘The temperature at the center of the sun is forty million degrees’ and ‘There are craters on the invisible half of the Moon’.

As might be expected, the difference between direct and indirect verification is far from absolute. Not only does it presuppose a certain
idealisation (in the sense that strict verification is forever impossible), it also depends on our decision to use either logical or physical meaning (Reichenbach 1938, 40-41). Physical meaning is defined by the demand of physical possibility of verification; that electrons have a spin is strictly speaking physically unverifiable. Logical meaning, on the other hand, is a much wider notion. A certain statement about the world in the year 2003, for example, is in 1996 physically meaningless although it does have a logical meaning. In the end every sentence that does not entail a contradiction is logically meaningful.

The distinction between physical and logical meaning is a matter of decision rather than of truth-character. The same goes for the question as to what the direct propositions are about - that question too is decided on practical grounds. They might be about "concreta" (physical, observable objects), impressions (perceptions and other sensations), atoms, the elementary particles of physics, or about yet something else. As is well known, Reichenbach chooses the first option. I will follow him in making that choice. Concreta, I take it, constitute the foundations upon which the scientific edifice is erected; scientific propositions that resist reduction to sentences denoting concreta should at least arouse suspicion.

The interesting question, of course, is what ‘reduction’ exactly means here. What does it mean to say that a proposition about an event horizon, i.e. the border of a black hole where the escape velocity equals the speed of light, ‘is reducible to’ a class of observation sentences? Cosmologists in the wake of Stephen Hawking detect an event horizon by measuring electromagnetic radiation emitted from a shrinking star, and by comparing the measured signals with the predictions of quantum field theory and general relativity. The cosmologist’s claim that in an event horizon the photons ‘hover’, i.e. neither escape from the hole nor fall back into it, is based on various sentences concerning outcomes of measurements made with miscellaneous instruments. Each of those instruments, we assume, is placed on our planet, thousands of millions of miles removed from what they are observing: the happenings in an event horizon. What is the relation between the (indirect) statement that the photons in an event horizon hover, and the (direct) statements about results of measurements? Reichenbach emphasised that his own answer to this question differs from that given by early positivists. Below I explain both kinds of answer and their differences; in doing so I stay close to Reichenbach’s phrasing and notation.

Early positivists have regarded the relation between direct and
indirect statements as an equivalence, expressed in the following definition:

\[
(VIII.1): IS \equiv \{ds_1, ..., ds_n\}.
\]

(VIII.1) states that the indirect statement, \(IS\), has the same meaning as the set of direct sentences, \(\{ds_1, ..., ds_n\}\) - I will call that set \(Z\). Although Reichenbach does not say so, \(IS\) is a propositional function of \(Z\). Each \(ds_i\) (\(1 \leq i \leq n\)) contains, as its descriptive terms, only terms that refer to concreta. (VIII.1) does not imply that \(Z\) consists in a conjunction of \(ds_1, ..., ds_n\); \(Z\) may contain disjunctions, implications, negations, et cetera. In a simple case of temperature measurement, for example, \(Z\) contains primarily disjunctions. In Reichenbach’s words: ”for measuring the temperature of our chamber we may use a mercury thermometer, or an alcohol thermometer, et cetera. This "or" will be transferred into the class of direct propositions equivalent to the statement concerning the temperature of our chamber.” (Reichenbach 1938, 48). In this case (VIII.1) could take the form of:

\[
(VIII.2): IS \equiv [(ds_1 \land ds_7 \land ... \land ds_k) \lor (ds_{k+1} \land ... \land ds_n) \lor (ds_2 \land ... \land ds_9)],
\]

or any other disjunction of conjunctions of \(ds_i\) (\(1 \leq i \leq n\)).

Although (VIII.1) may thus be indifferent to the \textit{shape} of \(Z\) (that is, to the form of the propositional function), it cannot be indifferent to \(Z\)'s \textit{size} (i.e. to the number of direct sentences). For (VIII.1) makes sense only if \(Z\) is finite. It thus implies, first, that the number of direct sentences from which we infer \(IS\) is finite, and, second, that the non-equivalent sentences which can be inferred from \(IS\) also constitute a finite class. Now Reichenbach argued that whereas the first implication could be correct, the second is not. In order to illustrate this asymmetry, he takes as an example of \(IS\) the statement ‘At the interior of the sun the temperature is forty million degrees’, abbreviated as \(A\), and declares:

"It is true that the class of propositions from which we start in order to infer \(A\) is a finite one, and even a practically finite one; for what we have is always a finite number of propositions. But the class of propositions which we can infer from \(A\) is not finite. We may infer from \(A\) that the temperature of a certain body, brought
within a short distance $r$ from the sun, would be $T$ degrees; we cannot perform this experiment ... There is an infinite class of such sentences; by making $r$ run through all possible numerical values this class would be infinite. It is therefore a grave mistake to think that the right side of [(VIII.1)] can ever be practically given." (Reichenbach (1970 (1938), 50).

Thinking that the right side of (VIII.1) can be given amounts to overlooking the fact that in the typical cases $IS$ has a surplus meaning compared to the meaning of the propositional function of $ds_1, ..., ds_n$: the consequences inferred from $IS$ cannot all be inferred from $ds_1, ..., ds_n$. Hence Reichenbach concludes that (VIII.1) is false, whereby the rigid positivistic theory of indirect meaning loses its foundation.

We could of course try to repair things by postulating that the class of direct sentences is not finite. Accordingly, we could transform (VIII.1) into (VIII.3):

\[
(VIII.3): IS \equiv \{ds_1, \ldots \},
\]

where the infinite $\{ds_1, \ldots \}$ might be called $Z^*$, in order to distinguish it from the finite class $Z$. But this manoeuvre is of no help. Since the verification of all the sentences in $Z^*$ is physically impossible and logically possible, the manoeuvre would entail that the members of $Z^*$ have only logical, and no physical meaning. Such an entailment is of course not what we had in mind: "we must realize that with this interpretation of indirect sentences most propositions of physics are endowed with meaning only because it is not logically impossible to count, term after term, an infinite series. I do not think that such reasoning will convince anyone. Nobody would take such a formal possibility into actual consideration; it is not this logical possibility which leads us to accept the indirect sentences as meaningful." (Reichenbach 1938, 53). For these and other reasons (such as that the very existence of $Z^*$ is dubious), Reichenbach rejects (VIII.3) together with (VIII.1). Consequently, he also rejects what (VIII.3) and (VIII.1) embody, namely the concept of truth meaning. The latter concept, which bifurcates in physical truth meaning and logical truth meaning (analogues of physical and logical meaning - cf. above), is defined in the truth theory of meaning (TTM). TTM is based on the following two
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principles:

\[TTM_1\]: a proposition has a meaning if, and only if, it is verifiable as true or false;
\[TTM_2\]: two propositions have the same meaning if they obtain the same determination as true or false by every possible observation;

(Reichenbach 1938, 30-31). As distinct from the truth theory of meaning, Reichenbach devises his probability theory of meaning (\(PTM\)), in which \(TTM_1\) and \(TTM_2\) have been replaced by their probabilistic counterparts, \(PTM_1\) and \(PTM_2\):

\[PTM_1\]: a proposition has meaning if it is possible to determine a degree of probability for the proposition;
\[PTM_2\]: two propositions have the same meaning if they obtain the same degree of probability by every possible observation;

(Reichenbach 1938, 54). Jointly, \(PTM_1\) and \(PTM_2\) define the concept of probability meaning. In Reichenbach’s view, probability meaning is always physical probability meaning; for in contrast with truth meaning, probability meaning cannot be divided into physical probability meaning on the one hand and logical probability meaning on the other.\(^{76}\)

\(^{76}\) I quote Reichenbach’s justification without comment (“weight” is Reichenbach’s word for the unknown truth value of a proposition; it is “a quantity in continuous scale running from the utmost uncertainty through intermediate degrees of reliability to the highest certainty”; the measure of weight is probability, cf. Reichenbach 1938, 23):

"Such a distinction [between logical and physical meaning - JP] turns out to be superfluous because the combination of logical possibility with weight does not furnish a concept distinct from logical truth meaning; if it is logically possible to obtain a weight for an sentence, it is also logically possible to obtain a verification. Only physical reasons can exclude verification and at the same time permit the determination of a weight; if we disregard the laws of physics, we are in imagination free from physical experiments and need not distinguish the possibility of a determination of the weight and of verification. Thus logical probability meaning and logical truth meaning are identical. Probability meaning, therefore, is always
The counterpart in PTM of (VIII.1) is (VIII.4):

\[(VIII.4): \text{IS} \bigcirclearrowleft \{ds_1, \ldots, ds_n\},\]

where \(\{ds_1, \ldots, ds_n\}\) is a finite class, to be called \(Z\) again, and where IS is again a propositional function of \(Z\). The sign ‘\(\bigcirclearrowleft\)’ takes the place of ‘\(\equiv\)’; it denotes a mutual probability relation, which Reichenbach names the probability connection. (VIII.4) is equivalent to the conjunction of the following two statements:

\[(VIII.5): \text{IS} \implies \{ds_1, \ldots, ds_n\}\]
\[(VIII.6): \text{IS} \iff \{ds_1, \ldots, ds_n\}\.\]

(VIII.5) expresses that IS probably implies \(Z\); it says that there are inferences from IS to \(Z\), which are not absolutely sure, since it may happen that IS is true while \(Z\) is false. (VIII.6) claims the opposite; it says that \(Z\) probably implies IS. Since both statements express probability inferences which pass beyond observations, (VIII.4) can also serve as a counterpart of (VIII.3). Moreover, (VIII.1) and (VIII.3) both are special cases of (VIII.4), whereby TTM becomes a special case of PTM.

Reichenbach talks about the probability relation at many places, but he discusses it at length in his *Wahrscheinlichkeitslehre* (Reichenbach 1935). There he starts by investigating the nature of what he regards as a standard probability statement (and thus, one might say, a standard IS), namely ‘the probability of getting a face showing 6 when tossing this die is 1/6’. According to Reichenbach this statement expresses a quantitative correlation between members of different classes: it says that a member denoted by ‘a face of this die is showing 6’ (belonging to the class of tosses yielding a 6) is quantitatively related to members denoted by ‘a face of this die is shown’

**physical probability meaning.” (Reichenbach 1938, 55).**

Reichenbach adds that "the probability theory of meaning may be considered as an expansion of the truth theory of physical meaning in which the postulate of verifiability is taken in a wider sense, including the physical possibility of determining either the truth-value or a weight." (ibid.). Reichenbach therefore decides to include both TTM and PTM under the name verifiability of meaning. The narrow sense of verification is then referred to as ‘absolute verification’. 

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(belonging to the class of all tosses). The relation is a probability implication; it means that for every pair of events \(<x_n, y_m>\), such that \(x_n \in X\) and \(y_m \in Y\) where \(X\) is the class of tosses and \(Y\) is the class of tosses resulting in 6, \(x_n\) implies \(y_m\) with degree of probability \(1/6\). On the basis of these implications Reichenbach then re-establishes the ordinary classical probability calculus.

2. Probability meaning: implications and resemblance to Hempel’s probabilistic reduction sentences

In the present section I pursue Reichenbach’s notion of probability meaning in greater depth. First, in 2.1, I compare probability meaning with Hempel’s probabilistic reduction sentences; this comparison is only preliminary and will be further developed in Chapter IX. Next, in 2.2 and 2.3, I discuss some implications of probability meaning. They involve the distinction between projection and reduction (2.2) and that between abstracta and illata (2.3).

2.1 Resemblance to probabilistic reduction sentences

From a formal point of view, the probability implication as conceived by Reichenbach (cf. Section 1) closely resembles the way in which Hempel gradualised the reduction sentences (cf. Chapter VII). Only two substitutions (together with the corresponding adjustments) are required to obtain the latter from the former: (i) the substitution of the reason sentence \(R(x)\) for the indirect sentence \(IS\), and (ii) the substitution of the set of pairs \(\{<S-1, A-1>, <S-2, A-2>, ..., <S-n, A-n>\}\) for the set of direct sentences \(\{d_{s1}, d_{s2}, ..., d_{sn}\}\).

In addition to these formal similarities, there exists another resemblance between Hempel’s approach and Reichenbach’s. Both Hempel and Reichenbach champion the relative frequency interpretation of probability. At the end of the preceding section I pointed out that Reichenbach erects the classical probability calculus on the basis of his newly conceived probability implications. This calculus is in need of an interpretation, and Reichenbach bestows that of relative frequency on it, in which probability is construed as a relation between events. The probability of an event is then formally defined as the relative frequency in the long run of that type of event within an infinite sequence of events. Hempel, for his
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part, also espouses the frequency interpretation. For in talking about
reduction sentences that are only probabilistic Hempel explicitly refers to
*statistical* probability. Let us recall what we saw in Chapter VII, namely that
Hempel’s reading of the broad probabilistic reduction sentences (VII.12) and
(VII.13) is respectively:

For ... individuals that have the property \( R \) and are under
test conditions of kind \( S_1 \) \((S_2, \ldots)\), the *statistical probability*
of responding in manner \( A_1 \) \((A_2, \ldots)\) is \( r_1 \) \((r_2, \ldots)\);

For ... individuals that are under test conditions of kind \( S^l \)
\((S^2, \ldots)\) and respond in manner \( A^l \) \((A^2, \ldots)\), the *statistical*
probability of possessing the property \( R \) is \( r^l \) \((r^{2}, \ldots)\).

And of course, statistical probability is just another word for probability as
relative frequency, as Hempel himself acknowledges (Hempel 1965, 386ff).
The consensus between Hempel and Reichenbach about relative frequency
as the most suitable interpretation of probability is not all-encompassing:
there exist two minor differences.\(^{77}\) However, these differences do not undo

\(^{77}\) The first difference pertains to the scope of relative frequency. In Reichenbach’s
view, each probability statement should be interpreted as a statement about relative
frequency; any other interpretation is either nonsense or derivable from the frequency
interpretation (this is Reichenbach’s famous identity conception of probability). But
whereas for Reichenbach the relative frequency interpretation covers all probability
statements, Hempel’s view on the interpretation of probability is less polarised. Hempel
leaves room for other interpretations of probability, notably for inductive probability, i.e.
probability as a logical relation between hypothetical and evidential statements (Hempel
1965, 60; 282ff; 385ff). According to Hempel, the frequency interpretation is suitable for
some probability statements, but by no means for all.

The second difference concerns the length of the sequences by means of which
the relative frequency of an event is determined. Reichenbach frankly allows these
sequences to be infinite (reconstructing the probability of an event in this case as the
limit of its relative frequency). Hempel, on the other hand, displays some caution:

"... infinite series of performances are not realizable or observable, and the
limit-definition of statistical probability thus provides no criteria for the
application of that concept to observable empirical subject matter. In this
respect the limit-construal of probability is an idealized theoretical concept,
and criteria for its empirical application will ... have to involve some vague
the important similarity, namely that both philosophers bestow the relative frequency interpretation upon probabilistic reduction sentences. In Hempel’s case this is clear from his reading of (VII.12) and (VII.13), in Reichenbach’s case it follows immediately from his unconditional consent to the frequency interpretation. For clearly, if one applies the frequency interpretation to each probabilistic sentence, then a fortiori one applies it to reduction sentences.

2.2. Reduction and projection

By far the largest part of indirect sentences, Reichenbach argues, is connected to sentences about concreta merely through probability relations. However, some indirect statements are related to direct statements through (VIII.1). Those statements are completely reducible to direct ones. Reichenbach’s example of a completely reducible statement is:

(VIII.7): The race of negroes has its home in Africa

(Reichenbach 1938, 94). (VIII.7) is an indirect statement, for it contains indirectly verifiable terms: ‘the race of negroes’ does not denote a concretum, and neither does ‘home’. But (VIII.7) is equivalent to:

(VIII.8): All negroes descend from forefathers who lived in Africa,

which contains, besides logical terms such as ‘all’, only terms that refer to concreta (‘descend’, ‘forefather’). Since the meaning of (VIII.7) is the same as the meaning of (VIII.8), (VIII.7) is completely reducible to (VIII.8). Reichenbach calls the relation between (VIII.7) and (VIII.8) a reduction;

terms ... In particular, a statement specifying the limit of the relative frequency of the result $G$ in an infinite sequence of performances of random experiment $F$ has no deductive implications concerning the frequency of $G$ in any finite set of performances, however large it may be.” (Hempel 1965, 387-388).

Hempel therefore concludes that statements about relative frequencies in finite runs can never take the place of statements about limits of relative frequencies in infinite runs. By that conclusion he separates himself from Reichenbach, who treats the two sorts of statements as being interchangeable.
(VIII.7) denotes a reductive complex and the expressions in (VIII.8) refer to the internal elements of this complex (Reichenbach 1938, 110). An even better example of a reduction is the relation between a wall and the bricks of which it is built. Every statement about the wall (the reductive complex) can be translated into a statement about the bricks (the internal elements). "The wall has a height of three meters", for instance, can be translated as "there are bricks stuck together by mortar and piled upon one another to the height of three meters" (Reichenbach 1938, 105). However, we should bear in mind that the wall is not dependent upon just bricks, but upon a certain configuration of the bricks. In that sense, the reductive complex is more than the whole of the internal elements. If all the bricks are hacked out and distributed over the ground, the wall no longer exists but the bricks still do; but if the bricks are cut to pieces, then neither they nor the wall can continue to exist. This indicates that the relation of reduction, although based upon logical equivalence, harbours a certain asymmetry:

"the existence of the complex is dependent on the existence of the elements in such as way that the nonexistence of the elements implies the nonexistence of the complex. ... the latter statement is ... to be distinguished from the converse relation according to which the nonexistence of the complex would imply the nonexistence of the elements ... this converse relation does not hold" (Reichenbach 1938, 105-106).

Of course, if the bricks are arranged in certain ways, then the existence of the bricks does imply the existence of the wall: although the internal elements alone are not sufficient for the existence of the complex, they become sufficient when they are related in a particular manner. Reichenbach calls those relations constitutive relations. Together with a constitutive relation, internal elements are equivalent to a reductive complex.

On the other hand, if indirect statements are not connected to direct statements through (VIII.1) but through (VIII.4), then the former statements denote projective complexes and the latter statements refer to external elements. The probability connection itself is called a projection instead of a reduction. Reichenbach gives the following example of a projection:

"We imagine a number of birds flying within a certain
domain of space. The sun rays falling down from above project a shadow-figure of every bird on the soil, which characterizes the horizontal position of the bird. To characterize the vertical position also, let us imagine a second system of light rays running horizontally and projecting the birds on a vertical plane which may be represented by a screen of the kind employed in the cinemas. We have, then, a pair of shadows corresponding to every bird ... every proposition concerning the movement of the birds is co-ordinated with a proposition about the changes of the pairs of shadows." (Reichenbach 1938, 108).

In the example, every single bird is represented by a unique system of marks, in the sense that each movement of the bird corresponds to a movement of the shadows. The birds are not identical to the shadow pairs, however, no matter how the pairs are arranged with respect to each other. Instead, the birds are only projected unto the screen and the soil: they constitute projective complexes of which the shadows are the external elements. This means that no proposition about a bird is completely reducible to a proposition about a shadow pair. Any talk about constitutive relations is nonsensical here, for between propositions about the birds and propositions about the shadows only probability connections exist:

"if we see the marks only, we may infer with a certain probability that they are produced by birds, and if we see the birds only, we may infer with a certain probability that they will produce the marks. ... there is no strict relation between the truth values of the co-ordinated propositions. The proposition about the birds may be true, and that about the marks may be false; conversely, the proposition about the birds may be false, and that about the marks may be true." (Reichenbach 1938, 109).

Reichenbach related his distinction between reductive complexes and projective complexes to the time-honoured question of existence: see 2.3.
2.3. Abstracta, illata and the question of existence

Projective complexes such as the birds referred to in Section 2.2 are called *illata*, i.e. ‘inferred things’ (Reichenbach 1938, 212) - other examples of illata complexes are radio waves, atoms, and all sorts of invisible gases. Reductive complexes, on the other hand, are *abstracta* (Reichenbach 1938, 93; Reichenbach 1951, 263). Thus the race of negroes and the wall are both abstracta, as are the political state, the Bodleian Library, and the American army. We have seen in 2.2 that, since abstracta coincide with a particular configuration of their elements whereas illata do not, the elements connected to illata are called external while the elements that constitute abstracta are dubbed internal.78

The difference between abstracta and illata has an interesting significance for the traditional question of existence. Consider again the term ‘the race of negroes’. We have seen that this term denotes an abstractum, but does this abstractum exist? May we say of the race of negroes that it has an existence of its own? According to Reichenbach, we may and we may not:

"We may say: ‘The race of Negroes exists.’ We know, then, that this means the same as, ‘Many Negroes exist, and they have certain biological qualities in common which distinguish them from other people.’ We may also say: ‘The race of Negroes does not exist.’ Then we have to add: ‘Many Negroes exist, and any proposition containing the term ‘the race of Negroes’ can be translated into propositions concerning those Negroes.’ (Reichenbach 1938, 96).

Thus the question whether or not abstracta exist is settled by a decision. The

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78 Depending upon the viewpoint, one and the same ‘thing’ may function as a complex and as an element. Thus an atom may be called an internal element of concreta, or a projective complex of concreta. In the former case the concreta are abstracta, in the latter they are probabilistically inferred from the atoms. Since in this case the projection has a somewhat peculiar character ("it leads to things which are the internal elements of the things from which the inference started"), Reichenbach calls it an internal projection (Reichenbach 1938, 216).
decision may be an affirmation, or a denial, or neither of them. For example, of a family’s furniture we probably will say that it exists, of the height of a mountain that it does not, and in the case of human society the decision will be somewhat indeterminate. But whatever its outcome, it remains a decision and thus a matter of convention; on no account may the abstract term be taken to have a surplus meaning. The question of whether or not an abstractum exists therefore is a practical affair; regarding the matter as a theoretical topic is to raise a pseudo-problem.\footnote{This is exactly the reason why Reichenbach regards the traditional controversy between nominalists and realists as a pseudo-problem. According to Reichenbach, nominalists and realists disagree with respect to the existence of abstracta: nominalists deny, and realists assert that abstracta exist. Cf. Reichenbach 1938, 93-98.}

Illata, on the other hand, form a different kettle of fish. Illata do have an existence of their own, and terms denoting them have a surplus meaning which goes beyond the meaning of the terms for the (external) elements. Consider the term ‘atom’ (the example is Reichenbach’s, who after all wrote long before the quark era). The theory of the atom emerged as a pure speculation from the philosophy of Democritus in the fourth century B.C., after which it took another twenty-two centuries before it was subjected to an empirical test. About 1800 it was found that compounds (such as table sugar or sucrose) consist of chemical elements (carbon, hydrogen and oxygen), of which the weights make up a fixed proportion that can be expressed in whole numbers. The English chemist Dalton realised that these fixed and quantitative relations require an explanation at the microscopic level. It turned out that all macroscopic bodies are made of microscopic particles - atoms - which combine in fixed ratios; in the case of sugar, twelve atoms of carbon combine with twenty-two atoms of hydrogen plus twelve atoms of oxygen. Propositions about atoms can thus be connected to propositions about macroscopic bodies, albeit probabilistically: the propositions about atoms may be true whereas those concerning macroscopic bodies may be false, or vice versa.

Not all philosophers or physicists would endorse the claim that atoms exist. Reichenbach himself mentions Ernst Mach, who believed that the term ‘atom’ was only an abbreviation for certain relations between macroscopic bodies; hence Mach, in Reichenbach’s terms, would hold that the atom is a reducible complex of concreta as internal elements. On the other hand, Ludwig Boltzmann opposed Mach’s views by declaring that
atoms do have an existence of their own, or that, in Reichenbach’s words, "the atoms are a projective complex of concreta, and that it is no objection against the independent reality of the atoms if a ‘direct verification’ ... is impossible." (Reichenbach 1938, 213). Nowadays most people decide in favour of Boltzmann. For although still we cannot see atoms as we can see tadpoles, there is much experimental indication that their existence is as firm as that of amphibia in their larval state.

There is, I think, a problem attached to Reichenbach’s ideas about abstracta and illata. In Reichenbach’s view, the probabilistic character of their connections to concreta reveals that illata really exist: "The relation of the illata to the concreta is a projection ... The illata have, therefore, an existence of their own ..." (Reichenbach 1938, 212; my emphasis). Conversely, the existence of a non-concretum reveals that the latter is an illatum. This means that, if a given non-concretum has an existence of its own then it is a projective complex, and if it is a projective complex then it has an existence of its own: for Reichenbach these are two sides of the same coin.

But is it correct to infer existence from the fact that something is a projective complex? Being a projective complex is a linguistic matter; to say that $x$ is a projective complex only means that propositions about $x$ are made probable by propositions about concreta. Existence, on the other hand, is an ontological issue; to say that an $x$ exists is making a claim de re. Thus the question of whether or not $x$ exists differs from the question of whether or not statements about $x$ are probabilistically connected to statements about concreta. Strictly speaking, both questions are mutually independent. It is at least curious to infer the one from the other.

The problem on which I am trying to lay my finger is better perceived when we compare Reichenbach’s abstracta and illata with Carnap’s distinction between pure dispositions and theoretical entities. This comparison is established in 3, where I discuss the similarities in 3.1 and 3.2, and the differences in 3.3. Section 3 serves as a clarification of the difficulty described above; to that extent it is of no relevance to readers for whom the difficulty is clear enough, and they may as well skip the entire section. In Section 4 I examine the question whether psychological dispositions like beliefs and desires should be regarded as abstracta or as illata.
3. Reichenbach and Carnap

When in Chapter III I pondered Carnap’s definition of disposition terms in terms of reduction sentences, I referred to his writings of the mid-thirties. At that time Carnap distinguished between simple dispositions (defined by only one reduction pair) and broad or multiple dispositions (defined by sets of reduction pairs). For reasons that I shall explain soon, Carnap replaced that distinction twenty years later by a distinction that became much better known, namely that between pure dispositions and theoretical constructs, or, as Carnap prefers to call the latter, theoretical primitives (Carnap 1956).

As is generally known, the latter distinction concerns two kinds of scientific concepts; basically it relies on the much praised distinction between an observation language, $L_O$, and a theoretical language, $L_T$. Theoretical terms cannot be explicitly defined in $L_O$ and are thus introduced in $L_T$ by means of postulates. On the other hand, pure disposition terms occupy an intermediate position between observation terms and theoretical terms. They belong neither to $L_O$ nor to $L_T$, but are part of a language in between the two: Carnap’s extended observation language $L'_O$.

As do the terms that denote abstracta and illata, disposition terms and theoretical terms similarly signify non-observable or non-concrete complexes. Hence the question arises how these distinctions are related to one another. What exactly is the correspondence between Reichenbachian abstracta/illata and Carnap pure dispositions/theoretical primitives? I shall answer this question in 3.1 - 3.3. More particularly, I shall discuss three similarities and one difference. As we will see, it is notably the difference between Carnap and Reichenbach that may clarify the problem I described in 2.3. For whereas Reichenbach runs into the problem by inferring ontological from linguistic claims, Carnap does not.

3.1 Three similarities

Carnap’s distinction between pure dispositions and theoretical primitives can be explained as follows. A disposition $D$ ascribed to an object $X$ by an investigator $Y$ is a pure disposition if and only if there exist an $S$ and an $R$ such that:

(i) $S$ is a process that affects $X$ and is observable by $Y$, 
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(ii) $R$ is a reaction of $X$ and likewise observable by $Y$.
(iii) $D$ is identical to (a certain combination of) $S$ and $R$.

On the other hand, $D$ is a theoretical primitive or, as I shall call it, a theoretical disposition if $D$ is manifested by $S$ and $R$, but does not coincide with $S$ and $R$. This means that $D$ is a theoretical disposition if (i) and (ii) are true whereas (iii) is false. Consequently, theoretical dispositions are only probabilistically connected to concreta. It is precisely the existence of probabilistic relations that constitutes the difference between pure and theoretical dispositions:

"The decisive difference is this: on the basis of the theoretical interpretation, the result of this or of any other test or, generally, of any observations, external or internal, is not regarded as absolutely conclusive evidence for the state in question; it is accepted only as probabilistic evidence, hence at best as a reliable indicator, i.e., one yielding a high probability for the state." (Carnap 1956, 71; my emphasis).

That takes us to the first of the three similarities between Reichenbach’s distinction and that of Carnap. For illata too are only made probable by "the result of this or of any test": they too are separated from abstracta by their probabilistic connections to concreta. Thus both distinctions, the Reichenbachian and the Carnapian, are based on the absence or the presence of probability relations. Like theoretical constructs, illata are probabilistically connected to concreta. Like pure dispositions, abstracta coincide with structured sets of observable things or events.

The second point of similarity follows immediately from the first. Saying that entities are only probabilistically related to concreta entails that the terms by which those entities are denoted have a surplus meaning over terms that denote observabilia (see Section 1 for the notion of a surplus meaning). Thus terms signifying illata or theoretical constructs have a surplus meaning over terms that refer to observable things or events. On the other hand, neither terms denoting abstracta nor pure disposition terms have a surplus meaning; those terms can be completely translated into the vocabulary of observables.

The third resemblance between the Carnapian and the
Reichenbachian distinction concerns their pragmatic or time-dependent characters. Reichenbach’s example about atoms intimated that often the nature of a particular complex is not clear \textit{a priori}: it is on the basis of empirical findings that we decide to call something an abstractum or an illatum. As a result, previous decisions may be reconsidered in view of new evidence, so that an illatum can become an abstractum and vice versa. The same goes for the question of whether something is a pure disposition or a genuine theoretical primitive. Scientists have a certain liberty in regarding non-concrete terms either as dispositional or as theoretical terms; their ultimate decision is mainly guided by considerations of usefulness and efficiency. This goes not only for physical and chemical dispositions, but also for dispositions in psychology:

"In analogy to what I said in the previous section about physical terms, I wish to emphasize here for psychological terms that their interpretation as pure disposition terms is not in itself objectionable. The question is only whether this interpretation is in accord with the way the psychologist intends to use the term, and whether it is the most useful for the purpose of the whole psychological theory." (Carnap 1956, 71).

Hence Carnap concludes that the scientist of whatever persuasion "is free to choose this interpretation provided he is consistent in it and willing to accept its implications" (Carnap 1956, 71). One of the implications that Carnap is here referring to involves the closed character of pure disposition terms in contradistinction to the open nature of theoretical terms. Before I discuss the difference between Reichenbach and Carnap in 3.3, I take the liberty of an elaboration on open and closed terms in 3.2. The excursion on open and closed terms is of no relevance to my main argument, and might well be passed over by an uninterested reader.

3.2 An excursion: open and closed terms

What does it mean to say that a term is either open or closed? As a matter of fact, the younger Carnap answers this question differently than the older one. The change appears to be intimately linked with Carnap’s transition
from broad and simple dispositions to pure and theoretical ones. Let me therefore, as an aside, devote some words to the matter. In his early work, when he did not yet speak about theoretical terms, Carnap connected open and closed terms to broad and simple dispositions: simple disposition terms are always closed whereas broad dispositions terms can be either closed or open. A broad disposition is open if, and only if, to the set of reduction pairs by which the disposition is defined new reduction pairs can be added. These extra pairs describe newly discovered methods to measure the disposition in question (Carnap 1936-1937, 444-445). In the work of the young Carnap, it is essentially the manoeuvre of adding reduction sentences that constitutes the openness.80

80 Of course, openness is not the same as infinity, and neither is closure the same as finiteness. Not only in mathematics is there a difference between open and infinite sets (and also between closed and finite sets), but also in Carnap’s use of these concepts. Since the latter somewhat deviates from the ordinary mathematical use, it is perhaps a good idea to explain both uses here.

As for mathematics, the difference between open versus closed and finite versus infinite touches the difference between topology and set theory: ‘open’ and ‘closed’ are topological concepts whereas ‘finite’ and ‘infinite’ are set theoretical notions. The difference can be further explained as follows. A set of elements, \( S \), other than the null set (which contains no elements) is said to be finite if the elements of any proper subset of \( S \) cannot be put into one-to-one relation with the elements of \( S \). If, on the contrary, there exists at least one proper subset which can be put into such a one-to-one relation, then \( S \) is said to be infinite, i.e. to contain an infinite number of elements. On the other hand, a set, \( S \), is closed if it contains all of its limit points; \( S \) is open if its complement is closed. For example, take as sample space the set \( R \):

\[
R: \{x: 0 \leq x \leq 1\}.
\]

\( R \) is the set of all reals between 0 and 1, including 0 and 1 themselves. Let \( \rho \) be a proper subset of \( R \), such that:

\[
\rho: \{x: 0 < x < 1/2\}.
\]

\( \rho \) is an open set, since its complement, \( \rho^c \),

\[
\rho^c: \{x: x=0 \text{ or } 1/2 \leq x \leq 1\}
\]

is closed. (Being the sample space, \( R \) is by definition closed and open at the same time. The complement of \( R \), namely the null set, is also both open and closed.) According to these definitions, in mathematics, a finite set is always closed, and an open set is always infinite. However, an infinite set can be either closed or open. Thus a set can well be infinite and closed at the same time, as is illustrated by \( \rho^c \). For although \( \rho^c \) contains its limit points and hence is closed, it has a infinite number of elements.

In contradistinction to his use of the pair finite/infinite, Carnap’s use of the pair open/closed differs from the ordinary mathematical use. For Carnap, a set of
However, twenty years later Carnap appeared to have abandoned those early views on openness. He now no longer connects openness to broad disposition terms, but instead calls a disposition term ‘open’ if and only if it can never be fully defined in a set of reduction pairs, no matter how large the set may be. Looking back in placidity at his philosophy as a young man, Carnap writes in 1956:

"At that time I tried to do justice to this openness by admitting the addition of further dispositional rules (in the form of reduction sentences ...). I think now that the openness is more adequately represented in $L_T$; whenever additional $C$-rules (correspondence rules - JP) or additional postulates are given, the interpretation of the term may be strengthened without ever being completed." (Carnap 1956, 67).

Carnap’s new ideas about openness are accompanied by a new bifurcation of dispositions. The previous classification of dispositions in simple and reduction pairs is open if, and only if, new reduction pairs may be added; otherwise it is closed. Thus Carnap’s distinction between open and closed does not (as does the mathematical distinction) rely on the inclusion or exclusion of limit points; for Carnap, it is the operation of adding reduction pairs that constitutes the difference. However, in Carnap’s use too, a set can be infinite and closed at the same time.

It is interesting to note that mathematical openness implies the Carnapian idea of openness, but that the reverse does not hold. If $S$ is open in the mathematical sense, then there is a limit point, $z$, which is not contained in $S$. Because $S$ is open, it follows that:

$$\forall x \{ x \in S \rightarrow \exists y \ (y \in S \& y \text{ is closer to } z \text{ than } x \text{ is}) \}$$

which says that, for any element in $S$, one can always find (“add”) another element closer to $z$. To that extent mathematical openness entails Carnapian openness. However, the converse does not hold. The fact that a set of reduction pairs, $S^*$, is open in Carnap’s sense means that new pairs may be added to $S^*$. It does not entail that $S^*$ has a limit point, let alone a limit point not contained in it. As we shall see in the text, the elder Carnap altered his interpretation of ‘open’ and ‘closed’. He no longer believes that a set of reduction pairs is open if, and only if, new reduction pairs may be added. However, the important point is that Carnap still adheres to a conceptual separation of ‘open’ and ‘infinite’. For Carnap, there is no objection in principle against a set that is closed and infinite at the same time.
broad ones is declared to be ineffective, since it cannot clarify the new interpretations of ‘closed’ and ‘open’. The interpretations of those words are now given by the classification in terms of pure and theoretical dispositions. As we have seen above, the meanings of pure dispositions are given by sets of reduction pairs; if the pure disposition is in addition a simple disposition, then the set will contain one pair. On the other hand, the meaning of a theoretical disposition necessarily transcends any set of reduction pairs. No collection of reduction pairs, no matter how large it is, can ever be identified with a theoretical disposition. Like Reichenbach’s illata, theoretical dispositions are only made probable by a series of reduction sentences:

"Thus, if a scientist has decided to use a certain term ‘M’ in such a way, that for certain sentences about M, any possible observational results can never be absolutely conclusive evidence but at best evidence yielding a high probability, then the appropriate place for ‘M’ in a dual-language system like our system $L_O$-$L_T$ is in $L_T$ rather than in $L_O$ ..." (Carnap 1956, 69).

As a result of the probabilistic relations between reduction pairs and theoretical dispositions, we can meaningfully affirm that a certain object X has a disposition D, even if a test by means of a reduction pair shows a negative result. Conversely, we may go against positive results and deny that X has D. Of course, the same goes for Reichenbach’s illata. If certain sentences about concreta turn out to be false, the probability relations allow us to decide that the corresponding illatum term is applicable after all. Turning this around, we may pronounce the illatum term inapplicable even if the corresponding direct sentences about concreta are true.

Thus the present excursion anent open and closed terms has brought us back to the main theme of 3, viz. that Reichenbach’s abstracta and illata closely parallel Carnap’s pure dispositions and theoretical primitives. At least three points of contact have caught our eye. The first and major point is that both distinctions rely on the absence or the presence of probability relations. Second, and as a result of the previous point, theoretical terms à la Carnap and illata terms à la Reichenbach have a surplus meaning over sentences about concreta. We therefore are permitted to pronounce both theoretical terms and illata terms applicable even if the corresponding sentences about concreta are false, or not applicable if those sentences are true. Third, both
Reichenbach and Carnap

the Carnapian and the Reichenbachian distinctions are attained \textit{a posteriori}: the question whether something is an abstractum or an illatum is settled by an empirically guided decision, as is the question of whether something is a theoretical construct or a pure disposition.\footnote{There even seems to be a fourth common point. In the preceding footnote we have seen that Carnap’s distinction between open and closed differs from the distinction between infinite and finite: ‘open’ does not mean ‘infinite’ and neither does ‘closed’ mean ‘finite’. A difference between finite/infinite and closed/open remains effective, even after Carnap’s rejection of his early views on openness and closeness. Theoretical dispositions do not differ from pure dispositions in that they are defined by means of an infinite set of reduction pairs. The difference is rather that theoretical dispositions (as opposed to pure dispositions) are only probabilistically related to concreta. Whether the number of concreta is finite or infinite is of no relevance here. At first sight it looks as if Reichenbach’s distinction too does not coincide with the difference between finite and infinite. For the difference between abstracta and illata is not that the former are equivalent to finite sets of concreta, whereas the latter equal infinite sets. Rather, the difference is that illata (as opposed to abstracta) are probabilistically connected to concreta. However, there is more to say about the way abstracta and illata are correlated to finiteness and infinity. I recall that an abstractum \textit{à la} Reichenbach is a set of internal elements plus a constitutive relation: a reductive complex (such as a wall) is equivalent to internal elements (bricks) in a certain configuration (cf. Section 2.2). This equivalence has an important prerequisite, which, surprisingly enough, is not mentioned by Reichenbach. It is that the elements in question should be completely given. For only if we know all elements, can the constitutive relation be formulated with reference to those elements alone. Thus the bricks in a specific arrangement (internal elements plus constitutive relation) indeed make up a wall, but only if all the bricks are given. Similarly, the notes played in a certain manner on the piano (internal elements plus constitutive relation) indeed produce a melody, but only if all the notes are given. Apparently, and contrary to what Reichenbach himself suggests, internal elements always form a finite set.}

3.3 A difference

Despite the three similarities mentioned in 3.1, there is an important difference between Carnap’s view and Reichenbach’s. We have seen that Reichenbach connects the question of existence to the difference between abstracta and illata. In fact, Reichenbach makes the connection so strong that it looks like an equivalence: because illata are only probabilistically related to concreta they have an existence of their own, and because abstracta are
equivalent to concreta the question of their existence does not make sense. Carnap, on the other hand, does not hold such strong views about existence. The question whether or not something exists, Carnap argued repeatedly, can be answered either practically or theoretically. In the first case the answer is a decision, motivated by whatever purpose. In the second case it is related to a linguistic framework or conceptual scheme. According to Carnap, the only theoretical sense in which we can meaningfully state that an object $X$ exists is by saying that $X$ exists according to the vocabulary and the rules of a certain language system. Discussing existence apart from any linguistic framework is wasting one’s time on a problem that lacks theoretical or cognitive value - on a classical pseudo-problem, that is (Carnap 1950a; cf. Carnap 1963a, 44-45).

The difference between Carnap and Reichenbach might also be phrased in the following way. The Reichenbachian distinction between abstracta and illata is a distinction on two levels, the linguistic level and the ontological one. Accordingly, the notions of illata and abstracta have linguistic connotations and ontological ones: in calling $X$ an illatum you imply not only that the term ‘$X$’ has a surplus meaning over terms about concreta, but also that $X$ has an existence of its own, and is not merely composed of concrete things. On the other hand, Carnap’s distinction between pure and theoretical dispositions touches only the linguistic level. If we decide to call $X$ a theoretical disposition, then we do indeed imply that ‘$X$’ has a surplus meaning over terms about concreta: ‘$X$’ cannot be fully translated into the observational vocabulary. However, we do not imply that $X$ has an existence of its own. Such an implication would display a form of realism which is alien to Carnap. Not that Carnap is an anti-realist; it is well known that he is neither the one nor the other, since he deems such stances to be metaphysical attitudes without any bearing at all on matters of science and knowledge (Carnap 1950a; Carnap 1966). Thus whereas Reichenbach somewhat light-heartedly infers ontological data from linguistic ones (and vice versa), Carnap continuously opposes such inferences. According to Carnap, we should not reason from linguistic to ontological facts since there are no statable ontological facts per se. The only sense in which we can meaningfully speak about ontological questions is by relating those questions to certain linguistic frameworks, so that after all ontology itself becomes a linguistic issue.

The difference between Carnap and Reichenbach has brought us back to the question that I posed at the end of 2.3. Is Reichenbach’s move
allowed? May we indeed infer from a probability connection that a certain non-concretum really exists (and vice versa)? Or should we take the Carnapian viewpoint that any inference between a linguistic and an ontological level is void, on the ground that the very notion of an ontological level lacks meaning? Or is even a third position possible? For instance, is it possible to acknowledge inferences from one level to another, but to deny that they have the shape that Reichenbach gives them? The latter position would entail that an entity, X, may have an existence of its own although the term ‘X’ is completely translatable in terms denoting concreta. Also, it would entail the possibility that ‘X’ is only probabilistically related to terms about concreta, but nevertheless lacks a denotatum with an existence of its own.

I shall not dwell upon these three positions. After all that I said about the matter that might come as a disappointment, although some readers doubtless will find it a relief. The reason for my reticence is simple: whether or not dispositions have an existence of their own is not my problem. My problem concerns the possibility of akatic actions, and my solution is based on a reconstruction of beliefs and desires as dispositions. As we shall see, this reconstruction is entirely independent of the ontological status of dispositions. Both the existence of dispositions and their non-existence are compatible with my approach. Hence, I will cheerfully continue to talk about abstracta and illata in the linguistic sense of the word, without confusing myself with questions of existence by enunciating ontological claims.

As far as the avoidance of ontological matters is concerned, my approach of abstracta and illata resembles Carnap’s discussion of pure and theoretical dispositions. Like Carnap, I stress the linguistic implications of abstracta and illata (i.e. their probabilistic or non-probabilistic relations to concreta), while shunning their ontological colourings (i.e. questions about their existence). Yet I deviate from Carnap’s position in that I refuse to outlaw the inferences from the linguistic to the ontological or the inferences that proceed the other way around. Unlike Carnap, I hold that inferences from one level to another may well have a meaning, and that the same goes for the notion of an ontological level itself. The point is only that I make no attempt to scrutinise what those meanings are. I rather concentrate on the linguistic side of abstracta and illata and leave their ontological aspects to one side.

In 4 I examine the place of beliefs and desires in the framework of
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abstracta and illata. In accordance with my partiality to the linguistic rather than to the ontological, I concentrate on the semantic side of abstracta and illata: I focus my sights on the absence or presence of probability relations rather than on questions of existence. For me, abstracta and illata feature only in the linguistic sphere.

4. Are beliefs and desires abstracta or illata?

Reichenbach tells us that dispositions can be either abstracta or illata. But what about the psychological dispositions that we are interested in? What about beliefs and desires? Are they abstracta, illata, or can they be both?

Although philosophers hardly ever talk about abstracta or illata explicitly, their disparate opinions about beliefs and desires can be classified by setting them alongside Reichenbach’s distinction. The resulting classification is simple enough; philosophers end up in three different groups: some regard beliefs and desires as abstracta, others consider them to be illata, and still others believe that they can be either the one or the other. Below I take a look at representatives from each group. Representatives of the first two groups are considered in 4.1; examples of the third group are discussed in 4.2. As the reader may be well aware, the philosophers mentioned are often interested in the ontological side of abstracta and illata: they make claims about the existence or non-existence of beliefs and desires. However, that does not restrain me from adhering to my point; for reasons that I explained above, I continue to stress the linguistic rather than the ontological connotation of Reichenbach’s distinction.

4.1 The first two groups

Of the philosophers belonging to the first group, the most prominent one perhaps is Gilbert Ryle. As William P. Alston has intimated, The Concept of Mind can be regarded as a twofold project (Alston 1971, 360-361). On the one hand, it is an attempt to interprete mental concepts like beliefs and
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desires as dispositions rather than as as occurrences or private episodes,82 on the other, it aims to demonstrate that dispositional predicates are purely dispositional, in the sense that they "cannot also receive an occurrent interpretation, and vice versa" (Alston 1971, 360). Ryle appears to regard dispositional and occurrent predicates or statements as mutually exclusive.83 Nowhere does Ryle use the words ‘illata’ and ‘abstracta’. However, it is clear that when he speaks about "occurrences" or "states" or "processes" he has something like illata in mind. Also, when he bandies psychological dispositions about, he clearly refers to the phenomena that Reichenbach has tagged abstracta. The beliefs and desires discussed in *The Concept of Mind* fully coincide with sets of specific actions performed under specific

82 This can, for instance, be inferred from:

"It is being maintained throughout this book that when we characterize people by mental predicates, we are not making untestable inferences to any ghostly processes occurring in streams of consciousness which we are debarred from visiting; we are describing the ways in which those people conduct parts of their predominantly public behaviour. True, we go beyond what we see them do and hear them say, but this going beyond is not a going behind, in the sense of making inferences to occult causes; it is going beyond in the sense of considering, in the first instance, the powers and propensities of which their actions are exercises." (Ryle 1949, 50).

"To talk of a person's mind is not to talk of a repository which is permitted to house objects that something called 'the physical world' is forbidden to house; it is to talk of the person’s abilities, liabilities, and inclinations to do and undergo certain sorts of things, and of the doing and undergoing of these things in the ordinary world." (Ryle 1949, 190).

83 This is, for instance, clear from:

"To possess a dispositional property is not to be in a particular state, or to undergo a particular change; it is to be bound or liable to be in a particular state, or to undergo a particular change, when a particular condition is realized." (Ryle 1949, 43)

"To say that a person knows something, or aspires to be something, is not to say that he is at a particular moment in process of doing or undergoing anything, but that he is able to do certain things, when the need arises, or that he is prone to do and feel certain things in situations of certain sorts." (Ryle 1949, 112).
conditions. These sets completely exhaust the meaning of the corresponding
disposition term. Disposition terms à la Ryle lack any surplus meaning, and
hence denote abstracta.\footnote{Among the philosophers who argued that beliefs and desires are abstracta, we
oddly enough also find Reichenbach himself. Notwithstanding his claims that
dispositions can be either abstracta or illata, and that some mental states are illata,
Reichenbach argued that \textit{psychological} dispositions are always abstracta. Thus beliefs
and desires, being psychological dispositions, are abstracta too, albeit of a special kind.
For their internal elements are not only concreta but also illata. This can be explained as
follows. Reichenbach explicitly applied his tripartite division into concreta, abstracta, and
illata to psychology:

"Psychology is a science which infers illata from concrete objects. The
inferred objects are projective complexes of these concrete objects. Since some
of the objects of psychology such as bodily feelings are accessible to the inner
tactile sense, the inferred illata in such cases are internal elements of the
observed concrete objects; it is therefore the process of internal projection
which plays a role here. The ‘higher’ psychological objects, and just those
most frequently occurring in practical psychology, i.e., psychology as needed
for daily life, are abstracta, built up of concreta and illata." (Reichenbach
1938, 247).

Thus for Reichenbach the internal states of the human body (such as brain states) are
illata. They are inferred from concrete objects of the physical world, which stand to the
inner states as either stimuli or reactions (cf. Reichenbach 1951, 263-264). If the internal
states are "accessible to the inner tactile sense" (as is for instance the case with sense
impressions), then they are also internal elements of a reductive complex, viz., a
concretum; in this case we have to do with an internal projection (for the concept
‘internal projection’, see the footnote in Section 2.3). On the other hand, psychological
complexes like beliefs and desires are abstracta. Hence each reason, being a belief/desire
pair, is an abbreviation of an entire cluster. This cluster consists of concreta (observable
stimuli or reactions) and illata (brain states or sense impressions).}
power to behave in a certain way and something which does not have that power is not a difference between what they will do, since it is contingently the case that their powers are, in fact, ever elicited, but it is a difference in what they themselves now are. *It is a difference in intrinsic nature.*" (Harré 1970, 215; first emphasis by the author, second by me). According to Harré, the ascription of a power to a thing or a person should be analysed thus:

"X has the power to A = if X is subject to stimuli or conditions of an appropriate kind, then X will do A, *in virtue of its intrinsic nature.*" (Harré 1970, 215-216; emphasis by the author).

He then adds:

"The last clause is vital, and marks the difference between the ascription of powers and any other kind of description. ... [T]o ascribe a power to a thing asserts only that it can do what it does in virtue of its nature, whatever that is. It leaves open the question of the exact specification of the nature or constitution in virtue of which it has the power." (Harré 1970, 215-216).

Harré is far from being the only philosopher who denies that beliefs and desires are merely abbreviations for regularities between certain conditions and certain actions. Another example is Fodor, who considers beliefs and desires as internal states or events in mutual causal interaction. Still another example is D.H. Mellor, to whom I referred at the beginning of Chapter VII. Mellor’s claim that dispositions are properties which have not yet been identified entails of course that the same goes for psychological dispositions; beliefs, desires and other psychological dispositions are properties, although we do not know yet what sort of properties. In Reichenbach’s terminology, this means that Mellor, like Fodor and Harré, treats beliefs and desires as illata rather than as abstracta.
4.2 The third group

The third group probably is the largest one. It contains such disparate authors as Raimo Tuomela, Herbert Feigl, Willard V.O. Quine, Daniel Dennett, and Jaap van Heerden and Anton Smolenaars (Tuomela 1978b; Feigl 1958; Quine 1974; Dennett 1987; Van Heerden and Smolenaars 1989). According to these philosophers beliefs and desires are neither pure abstracta (as Ryle claims) nor full-blooded illata (as Harré et al. maintain), but something in between. As Daniel Dennett, one of the very few authors who talks about abstracta and illata explicitly, phrases it:

"The ordinary notion of belief no doubt does place beliefs somewhere midway between illata and abstracta ... The ordinary notion of belief is pulled in two directions" (Dennett 1987, 55, 57; emphasis by Dennett).

Thus beliefs and desires are supposed to have a mixed nature; they are neither plain flesh nor pure fowl. The reason for the ambivalent nature of beliefs and desires springs from the ambivalent nature of their niche, viz. folk psychology. For folk psychology has a dual constitution too. It is, in the happy locution of Dennett, "a mixed bag, like folk productions generally" (Dennett 1987, 55). In order to get things straight, Dennett suggests splitting messy folk psychology into two tidy theories, one in which beliefs and desires are abstracta and one in which they are illata:

"If we want to have good theoretical entities, good illata, or good logical constructs, good abstracta, we will have to jettison some of the ordinary freight of the concepts belief and desire. So I propose a divorce. Since we seem to have both notions wedded in folk psychology, let’s split them apart and create two new theories: one strictly abstract, idealizing, holistic, instrumentalistic - pure intentional theory - and the other a concrete, microtheoretical science of the actual realization of those intentional systems - what I will call sub-personal cognitive psychology." (Dennett 1987, 57).

The pure intentional theory deals with competence, whereas the sub-personal
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theory is about performance (Dennett 1987, 58ff, 61ff). Although folk psychology can never be reduced to neurology or any other sub-personal level, it is translatable into pure intentional theory. The latter theory in turn can be "legitimized". This means that its "mentalistic" vocabulary is provided with "rules of attribution", so that the "predictive powers" of the mental terms manifest themselves (Dennett 1987, 67).

Dennett does not tell us what the rules of attribution consist in precisely; instead, he calls his current views "woefully informal and unsystematic" (Dennett 1987, 67). I for my part take the rules to be reduction sentences. After all reduction sentences constitute an instrument for making beliefs, desires and other dispositions operational; they are rules that tell us how dispositions should be applied. But if Dennett’s attribution rules indeed are reduction sentences, they should have either a probabilistic or a non-probabilistic shape; and as we will see in Chapter IX, each of the two options has its own difficulties.

Dennett’s opinion is shared by Jaap van Heerden and Anton Smolenaars, although they do not mention him. However, they do cite Herbert Feigl and Raimo Tuomela. In their spirit they argue:

"... the scientific procedure in theory building can be characterized as an attempt to eliminate mere correlations headed under dispositional terms. ... where scientific progress is concerned, dispositional terms get closer and closer to mature, realistically conceived theoretical terms. ... To ascribe a disposition to an object is ... to issue promissory notes". (Van Heerden and Smolenaars 1989, 300-301).

The promissory notes might be redeemed; in that case the disposition is an illatum (in the ontological sense of the word). The promises might however also turn out to be illusory; in that case we have to do with an (ontological) abstractum. Quine, on several occasions, has taken a similar stance. His views on the issue were clearly expressed in the famous BBC interview that he granted Bryan Magee. During that conversation Quine declared that his behaviouristic attitude towards psychology has a signalling or anticipating function; it enables us to specify problems regarding mental states and
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events in such a way that neurology might some day solve them. Thus Quine expects that somewhere in the future psychological theories will gradually turn into neurological theories; by taking a behaviouristic outlook, Quine tries to anticipate this future state. However, it might turn out that some psychological dispositions resist reduction to neurological features. In other words, it might appear that some dispositions are not illata but abstracta.  

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85 Quine Behaviourism, mine anyway, does not say that the mental states and events consist of observable behaviour, nor that they are explained by behaviour. They are manifested by behaviour. Neurology is the place for explanations, ultimately. But it is in terms of outward behaviour that we specify what we want explained.

Magee What you’re really saying is that behaviourism is not a solution to the kind of problems with which the psychologist deals, but a way of formulating them. It’s a kind of model in terms of which the problems should be couched before we go on to seek solutions.

Quine Yes.

(Magee 1978, 174; emphasis by Quine; cf. Quine 1974, 8-15).

86 Quine’s behaviourism in psychology can be used to shed light on the difference between the indetermination of translation (IoT) and the underdetermination of theories (UoT). For UoT reflects Quine’s psychological behaviourism, and that behaviourism differs considerably from Quine’s linguistic behaviourism, which is mirrored in IoT. This can be clarified as follows.

After Quine’s introduction of IoT in Quine 1960, there has been a steady flow of articles on it. Many of the articles aim to demonstrate that IoT is not a genuine novelty compared to UoT. Whereas IoT implies that we may have logically incompatible translations without being able to determine which is the right one, UoT implies that we may have logically incompatible theories without being able to devise a crucial experiment. Thus IoT would at best be only a special case of UoT; indeterminacy would merely be underdetermination applied to the field of linguistics (Chomsky 1969).

Time and again Quine opposed such arguments by explaining that IoT does differ essentially from UoT (Quine 1969a, 47; Quine 1969b, 303; Quine 1970, 180; Quine 1981, 23; Quine 1987, 10). Notwithstanding the frequency with which they have been put forward, Quine’s arguments appeared to have been poorly understood (Bergström 1990; Gemes 1991). As I explained in the footnote to Section 3.2.2 of Chapter IV, I believe that these misunderstandings stem from the failure to distinguish between psychology and linguistics, between theories about the human mind and manuals of translations.

For Quine, there is a vital difference between linguistics and psychology,
Are beliefs and desires abstracta or illata?

What to think of the position occupied by the philosophers in the third group? What to think of the idea that some beliefs and desires are abstracta while others are illata? At first sight, I think, it sounds sensible enough. It is only natural to assume that some beliefs and desires are abstracta while others are illata. Examples are easy to find. Politeness and prosperity are both abstracta; it is unlikely that these dispositions ever will be more than abbreviations for a cluster of responses which appear under certain circumstances. Aggressivity and claustrophobia, on the other hand, between scientists and translators, between manuals of translation and mental theories.

The essential difference can well be explained in terms of the Reichenbachian distinction between abstracta and illata. Mental theories are about beliefs and desires, which, see the text, can be abstracta or illata. Translation manuals, on the other hand, are about meanings. According to Quine’s linguistic behaviourism, meanings are shorthand terms for clusters of observable events, notably stimuli and responses. Therefore, and in contradistinction to beliefs and desires, meanings must be abstracta. Consequently, two empirically equivalent theories can be rivals on the level of illata (they assume the existence of different illata), whereas two empirical manuals can be rivals only on the level of abstracta (they have different ways of ‘slicing’ the observable world). Therefore it does make sense to ask which of the two theories is correct, whereas it is pointless to ask which of the manuals is correct. In the Quinean nomenclature: in the first case there is a fact of the matter whereas in the second there is not.

Another way of saying this is by stating that Quine’s psychological behaviourism differs considerably from his linguistic behaviourism. His psychological behaviourism leaves open the possibility that mental theories turn into neurological theories; such a turn occurs when the beliefs and desires in question appear to be illata. His linguistic behaviourism, however, prohibits the transformation of translation manuals into neurological theories, for by Quinean lights it is impossible that linguistics will ever be replaced by neurology. Hence Quine’s linguistic behaviourism is his whole story about linguistics in general; in no way is it an anticipation of an ideal future theory, be it a neurological theory or a theory in which meanings as illata are assumed. On the other hand, Quine’s psychological behaviourism is an anticipation of an ideal theory, viz., a theory in which all kinds of arrangements and interactions of small bodies (i.e. illata) are assumed.

Still another way of explaining the basic difference between a translator and a scientist is by stressing the indispensability of the former. Even if we were to have an ideal neurological theory by which we could explain every utterance of every person in neurological terms, we would still be in need of a translation manual if we want to link sentences such as, for instance, "Willard aime bien les lapins, surtout avec une bonne sauce à l’ail" with "Willard liebt die Kaninchen sehr, besonders mit einer guten Knoblauchsosse".
presumably are illata; it is quite possible that future research will identify frequent aggressive behaviour as caused by a chemical substance or a physical entity (the pugnacity lobule? the truculence neuron?).

But again, on closer consideration difficulties occur. For the idea that reasons are abstracta or illata cannot circumvent the *akrasia* problem. No matter whether we decide to call all reasons abstracta, illata, or both (thus joining the first, second or third group), we will encounter the *akrasia* problem anyway. This will be explained in the next and final chapter.