DISPOSITIONS, REDUCTION SENTENCES AND CAUSAL CONDITIONALS *

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In this paper I shall argue that reduction sentences (henceforth called 'RS') are not an adequate device for introducing dispositional predicates, *if these predicates are going to have the same meaning as in our language*, and that, for similar reasons, causal conditionals are not logically equivalent to dispositional statements. The openness of dispositions is the reason why neither RS are adequate nor dispositional statements are logically equivalent to causal conditionals; any satisfactory theory of our use of dispositional predicates will have to take into account this feature.

If we want to introduce in a language a predicate 'Q_3' (which may be dispositional) this may be done, according to Carnap, by using four predicates 'Q_1', 'Q_2', 'Q_4' and 'Q_5' in the following pair of sentences

$$(R_1)\quad Q_1 \supset (Q_2 \supset Q_3)$$
$$(R_2)\quad Q_4 \supset (Q_5 \supset \sim Q_3)$$

'Q_1' and 'Q_4' describe experimental conditions and tests and 'Q_2' and 'Q_5' the results of the test. In consequence, if the point a reacts in the way Q_2 when the test Q_1 is performed, a will have the property Q_3, but if a reacts in the way Q_5, when the test Q_4 is performed, it will *not* have the property Q_3. Carnap thinks that one of the advantages of RS is that they are more in accordance with scientific procedure be-

* I am indebted to Messrs. D. F. Pears and D. Wiggins who read earlier versions of this paper.

cause for the points belonging to class $\sim Q_1$ the predicate 'Q_3' has no meaning:

"Now we might state one of the following two definitions:

$$(D_1)\quad Q_3 \equiv (Q_1 . Q_2)$$
$$(D_2)\quad Q_3 \equiv (\sim Q_1 \vee Q_2)$$

If *c* is a point of the undetermined class, on the basis of D_1 '$Q_3(c)$' is false, and on the basis of D_2 it is true. Although it is possible to lay down either D_1 or D_2, *neither procedure is in accordance with the intention of the scientist* concerning the use of the predicate 'Q_3' . . . If we now were to state a definition, we should have to revoke it at such a new stage of the development of science, and to stage a new definition, incompatible with the first one. If, on the other hand, we were now to state a reduction pair, *we should merely have to add one or more reduction pairs at the new stage; and these pairs will be compatible with the first one.* In this latter *case we do not correct the determinations laid down in the previous stage but simply supplement them*".[1]

But as we shall see Carnap's suggested procedure for a further determination of the meaning of 'Q_3' by adding new RSs (e.g. by adding $Q_6 \supset (Q_7 \supset Q_3)$ etc.) is not the only possible one; sometimes it is necessary to *correct* the determinations laid out in the previous stages and not merely to supplement them. Another difficulty that Carnap does not take into account is that there are different sorts of dispositional predicates and that the application of RSs to them presents different problems. We shall consider first this latter point which will lead to the former. I shall analyse three dispositional predicates representative of three different groups: 'soluble', 'fragile' and 'magnetic'.

[1] "Testability and Meaning" *Readings in the Philosophy of Science*, Feigl and Brodbeck eds., New York: Appleton, 1953, p. 59 (my italics).

(a) The happening of the occurrence expressed by the occurrence-word 'dissolves' is a sufficient condition for the truth of the statement asserting that the object which is undergoing the occurrence possesses the disposition; in other words, if an object is dissolving we can conclude that it is soluble for it cannot be the case that something is dissolving and it is not soluble. This allows us to use an RS like R_1 stating that if test Q_1 is carried out (e.g. if we put the object into water), then if 'Q_2' is true (e.g. if it dissolves), we will conclude that 'Q_3' is true. (i.e. that it is soluble).

But against what Carnap thinks, in the examples of this group no necessary condition for the determination of when an object *is* soluble can be afforded, or, what is similar there cannot be a sufficient condition for the determination that an object is *not* soluble. The reason for this is simple: if an object fails to dissolve it is always possible that the explanation of this fact was not that the object is not soluble but rather that some relevant condition was not present; for example the water may be at a very low temperature or pressure, etc. Then if we introduced an RS like R_2 stating a sufficient condition for the absence of the disposition (or a necessary condition for its presence) when we realise that the thing can fail to dissolve even if it is soluble, we will need to *correct*, and not as Carnap says merely to supplement, the original R_2 by adding the required relevant condition and so we will have another RS R'_2 instead of R_2. But R' is not in a better position than R_2 itself and it is also possible that at a later stage we should correct it again. Therefore it is always possible —if the term 'soluble' has the same meaning as in our current language— that the antecedent 'Q_4' and 'Q_5' should also be true and '$\sim Q_3$' *false* instead of being true as Carnap assumes.

We added the qualification that this is possible "if the term 'soluble' has the same meaning as in our current language" because if we consider RS as devised to intro-

duce predicates *without any previous meaning*, the suggested attribution of truth-values cannot occur merely because we have decided by definition that this is so; but in the present analysis we are not concerned with the introduction of predicates with no previous meaning but with the different question of whether the dispositional predicate used in our language can be adequately introduced by RS or, what is similar, whether the predicates introduced thus can be logically equivalent to those used in current language. Our conclusion has been that in our current use of dispositions like 'soluble' the forbidden assignment of truth-values is possible. Therefore in this case there is no R_2 which fulfils the requirements laid down by Carnap. Finally let us observe that these are by no means peculiarities of the term 'soluble'; other words like 'penetrable', 'breakable', etc. share with it the features pointed out, and consequently, present parallel difficulties to an account based on RS.

(b) Another group of terms presents difficulties of a different sort; to analyse them I shall take as example our use of the term 'fragile'. While dissolving is a sufficient condition for considering that the dissolved thing was soluble, a breakage is *not* a sufficient condition for the thing being fragile as it is for the thing being breakable; a fragile object is not one which can break in certain circumstances, but rather one which can break *easily*.[2] Against what happened in the case of 'soluble' an RS R_1 merely stating a condition in which the associated occurrence happens will not do because in such a case 'Q_1' and 'Q_2' could be true and 'Q_3' false. It may be argued that perhaps we can determine in 'Q_1' a test which only fragile things meet, for example 'Q_1' could state a very small pressure under which only fragile objects break. But this procedure for solving the difficulty just pointed out does not appear to be entirely successful; sometimes it happens that pressure or similar circumstances which could have broken a fragile object does not break

[2] This was brought to my attention by Mr. D. F. Pears.

something; we may regard this as a stroke of good luck but not a ground for regarding the object as non-fragile; by asserting that something is fragile we are not merely saying that there is a specifiable pressure such as if we apply it to the object, it will break, but rather that we can find a wide variety of circumstances in which the thing can break (or in other words that it can break easily). There is another reason why the above solution will not do: if we are asked what is the minimal pressure that can break a fragile thing, the likeliest answer will be that this depends on the sort of thing under consideration. So, it does not appear possible that we could specify an RS R_1 stating a sufficient condition for the application of the disposition; if we were to introduce a predicate by means of R_1, its meaning would be different from that of the term 'fragile'.

In contrast with what happened in the case of 'soluble', it is very likely that we can determine a *necessary condition* for the thing being fragile: for example if 'Q_4' is equivalent to 'to put the object under the highest pressure it has been possible to obtain so far' and 'Q_5', 'the object does not break', then it does not seem possible that we could find inadequate instances of R_2 parallel to those observed in (a), for it is practically impossible to find circumstances in which an object is put under the highest possible pressure obtained so far and does not break, and yet is regarded as fragile. Here again there are other terms which behave thus, for example 'mobile', 'flexible', etc.

(c) There is a third group of dispositions for which —unlike what happens in the two cases previously discussed— we can neither determine sufficient nor necessary conditions for their application. Let us consider our use of 'magnetic' and its introduction by an RS R_2. If we put a piece of iron (Q_4) in a place with intense friction near *a* and the piece of iron does not move towards *a* (Q_5), by using R_2 we should conclude that *a* is not magnetic ($\sim Q_2$). However we may prefer to think that the test is not relevant in spite of

the fact that it belongs to Q_4; this point is not one of mere detail because it is possible that 'Q_4' and 'Q_5' should be true and in spite of this 'Q_3' should be true instead of being false as we should conclude using R_2. The reason for this is that the piece of iron was in a place with intense friction and so the explanation of the lack of movement towards *a* was the friction and not the absence of the disposition. As soon as we discover this, we may introduce explicitly this additional factor, in which case the antecedent of R_2 will no longer be 'to put a piece of iron near *a*' (Q_4) but 'to put a piece of iron in a place without intense friction near *a*' (Q_4^+). In this case we need to correct a first reduction pair and not, as Carnap thinks, merely to add new ones compatible with the first laid out. But here again new relevant conditions could have been left out and so it is again possible that at a later stage we should correct Q_4^+ and so introduce new conditions changing it into Q_4^{++} and so forth. There fore a term like 'magnetic' cannot be partially analysed by an RS like R_2 which fulfils Carnap's requirements.

But the position is not better with respect to R_1. It is also possible that 'Q_1' and 'Q_2' should be true and, nevertheless, 'Q_3' should not be regarded as true (let us assume that $Q_1 = Q_4$ and $\sim Q_2 = Q_5$). This is possible because even if a piece of iron moves towards *a* we may think that *a* is not magnetic; perhaps we think that the presence of the disposition was not the *cause* or explanation of the movement of the piece of iron, probably the inclination of the surface, or some other circumstance was the reason for it. It seems that the same sort of difficulties will arise whatever other tests and results were introduced in 'Q_1', 'Q_2', 'Q_4' and 'Q_5', therefore the predicates of this third group can neither be adequately introduced by R_1s nor by R_2s. Something similar may be said of many other words like 'poignant', 'bitter', 'sweet', etc.

Summing up the results reached so far, we can say that while Carnap thinks that the development of science does

not make it necessary to change the reduction pairs associated with a disposition, but merely to add new ones, we have found that in (a) no necessary condition is provided because it is always possible that the development of our knowledge would make us change R_2; the same may be said of the sufficient condition provided by R_1 in (b) and of both types of conditions in (c).

From a Carnapian point of view, there is an answer to the objection that RSs do not constitute an adequate account of dispositional predicates because they exclude as self-contradictory assignments of truth-values that we can make in our ordinary use of these terms. The answer would be that in refusing to regard a test stated in 'Q_1' or 'Q_4' as adequate to determine the presence or absence of the disposition, we are using the predicate with a different meaning from that which the predicate had when the presence or absence of the corresponding property was determined on the basis of R_1 or R_2 respectively; this means that there are two different concepts associated with the predicate. Let us see how the Carnapian explanation would work: for example in case (c) when we considered that an object is magnetic in spite of the fact that the piece of iron does not move towards it, we took into account more conditions than those stated in Q_4, so if we formulate explicitly the conditions, we would have a new RS the antecedent of which would no longer be Q_4 but Q_4^+, and the disposition thus introduced may be thought of as different from Q_3, let us call it Q_3^+; the troublesome assignment of truth-values seemed to be possible because we failed to distinguish between Q_4 and Q_4^+. On the other hand, if we had distinguished between them the position would have been different because Q_4^+ was *false* in the earlier experiment — not true as Q_4 was — and so we could not have concluded anything about the truth-value of Q_3^+. For example when we said that it is possible that 'Q_4' and 'Q_5' were true and '$\sim Q_3$' false we committed a mistake be-

cause what actually happened according to this interpretation was that what was false was 'Q_3^+' but not 'Q_3'.

There are several reasons which suggest that this line of defense is not successful: firstly, the only reason why we should think that there was a change of meaning appears to be the belief that RSs are an adequate device to analyse our current use of dispositional predicates, and the clearer framework in which this has to be done; it is difficult to think that there could be an independent argument to demonstrate that for example 'magnetic' means something different before and after more reliable tests were introduced which were to change our usual ways of detecting magnetism (indeed it would be odd if the introduction of new and more reliable tests were to change what we are detecting!).

Another reason why this defense of RS does not take us very far is that it does not appear to be in agreement with our current use of dispositions. According to Carnap it is better not to be give a complete definition of dispositions which at a later stage would have to be changed; instead we may specify partially the meaning of the dispositional predicate leaving it "open". This procedure is supposed to be more in accordance with the intentions of the scientist; what is meant by saying that the intention of the scientist is not to lay down a complete definition is, among other things, that if different tests are used as criteria for the application of a predicate at different moments of time, this does not imply that the meaning of the predicate is different in each case, i.e. we are not in front of different concepts; all that we are allowed to say is that the same concept has been more completely specified. But by the same line of reasoning which has led to the introduction of RS we are also led to think that when considering a test as inadequate we are specifying an "open" concept and not introducing a new one because in our ordinary use of dispositions we do not think that in those cases we introduced a new concept; rather we refuse to think that a test is inadequate because this is more in

agreement with the intended meaning of the dispositional predicate. There is no special reason why we should follow current procedures in case we have to *add* new tests and not in those we have to change our system of tests formerly used as criteria for the application of the predicate.

The result of this analysis of RS is undoubtedly that they are not an adequate device for "introducing" dispositional predicates if these terms are going to have the same meaning as in our language.

Similar difficulties to those which beset the characterization of dispositional predicates in terms of RS also arise in non-extensional characterizations such as those based on the use of "counterfactual" conditionals or casual conditionals. I shall analyse whether there is logical equivalence between disposition-statements and causal conditionals expressed in the subjunctive. The notion of entailment I shall use here differs from the usual one; since we are dealing with sentences which are supposed to receive only inductive confirmation, the entailment used will be based on the impossibility of having confirmative evidence for the antecedent (i.e. the entailing proposition) which is not confirmative for the consequent (i.e. the entailed proposition) *and* having confutative evidence for the consequent which is not confutative for the antecedent. The minimal conditions for the application of the extended notion of entailment is that both analogies of Modus Ponens and Tollens hold; one of these conditions will not suffice because of the asymmetries between confirmation and refutation.[3]

[3] The notion of entailment used in the text has not been investigated in detail from a logical point of view; nevertheless it may be suggested that this entailment is similar to the intuitionist interpretation of entailment. $a \supset b$ is interpreted in intuitionist logic as expressing that from the construction of a demonstration for a we can always derive a demonstration for b (see Heyting, "Intuitionism. Théorie de la Demonstration", *Les Fondements des Mathématiques*, IX). Intuitionist axiomatics of propositional calculus might be applied to the entailment used in our analysis because, as has been shown by Kolmogoroff, Heyting's axiomatics may be regarded as a *calculus of problems* i.e. being possible to consider the evidence of empirical hypotheses as partial solution to problems. I owe this point to Prof. G. Klimovsky.

Let us first take into account the entailment between the particular statement ascribing a disposition and expressed by using '*a* is magnetic' and the conditional 'If someone had put a piece of iron near *a*, it would have moved towards *a*'. It is not difficult to see, using the above characterization of logical equivalence, that these two statements cannot be logically equivalent because parallel difficulties to those rised in (c) arise here.

If there appears the case, previously discussed, in which in spite of the fact that the antecedent has a high degree of confirmation, the piece of iron does *not* move towards *a*, we may partially confute the conditional without necessarily confuting the antecedent (e.g. we may discover that there was friction and that this is the explanation of the lack of movement, not that the object is non-magnetic). Therefore here again it is possible that because some relevant condition which was not explicitly stated in the conditional was not present, the conditional may be confuted, but we do not want to confute the disposition-statement on the strength of that evidence alone. Sometime we need to reformulate the original conditional and to make reference to the relevant condition, and so we avoid the possibility of independent confutation of the conditional. A similar case is that in which the "answer" to the conditions stated in the subjunctive conditional is not merely negative but different from the expected result. If these "answers" follow a regular pattern it is likely that we will add a new "counterfactual" to analyse the dispositional predicate. Again there was a confutative instance but we did not want to disregard the novelty of the situation and consider that the disposition was not present.

The converse entailment has to face similar objections; we can have confirmative evidence for a conditional which is not confirmative for the correlative dispositional statement. For example an object may not be magnetic but in spite of this fact a second object moves towards it because of the inclination of the surface on which it has been placed; the

conditional would be confirmed but as obviously the cause of the movement is not the existence of the disposition, it may be reasonable (and not contradictory) to confirm the conditional without confirming the disposition. Therefore in this sort of case neither of the two entailments considered holds and as a consequence of this *statements ascribing dispositions belonging to type* (*c*) *are not logically equivalent to causal conditionals.*

Let us consider dispositions belonging to (a). For similar reasons a dispositional statement containing a term like 'soluble' does not entail the correlative causal conditional. As we saw in the previous section, it is possible that even if we put a thing into a liquid and it does not dissolve, the thing is nevertheless soluble in that liquid: for we can also explain the non-dissolution by making reference to the absence of some relevant condition; therefore it is possible that we could confute the conditional without confuting the dispositional statement; using the characterization of entailment outlined before we should conclude that disposition-statements of this group do not entail causal conditionals.

But the converse entailment does hold: a "counterfactual" entails the correlative disposition-statement of this group; for if we confute the consequent ascribing a disposition we will also confute the antecedent and if we confirm the antecedent we will also confirm the consequent.

Finally in the case of statements ascribing dispositions belonging to group (b) the former entailment holds but not the latter; for example the statement asserted by using '*a* is fragile' entails the corresponding conditional 'If *a* were to be put under the highest pressure obtained in laboratory conditions, it would break' because it is clear that by confirming the antecedent we can confirm the consequent, and equally clear that by confuting the consequent we will confute the antecedent. The other entailment does not hold because it is conceivable that we can confirm that something will break under the highest pressure obtained but that in

spite of this fact it is not fragile. As it happened in the examples belonging to (c), in the other two groups considered we may add more conditionals, or change those formerly associated with the disposition, and in doing this we may be said to be specifying the meaning of an "open" disposition-concept. The conclusion of this analysis is that the current belief that disposition-statements are equivalent to counterfactuals is a gross oversimplification: some dispositions can occur in statements which entail causal conditionals but are not entailed by them, and others in statements which are entailed by them but which entail them, and finally there are other disposition-statements which neither entail nor are entailed by causal conditionals (group (c)).

RESUMEN

Arguye que las oraciones reductivas (OR) no son adecuadas para introducir predicados disposicionales si esos predicados han de tener el mismo significado que tienen en nuestro lenguaje y que, por razones parecidas, los condicionales causales no son lógicamente equivalentes a los enunciados disposicionales. La razón de ello reside en el carácter abierto de las disposiciones.

Examina la postura de Carnap, según la cual para introducir un predicado disposicional 'Q_3' se pueden usar los predicados 'Q_1', 'Q_2', 'Q_4' y 'Q_5' en un par de oraciones como este:

(R_1) $Q_1 \rightarrow (Q_2 \rightarrow Q_3)$

(R_2) $Q_4 \rightarrow (Q_5 \rightarrow \sim Q_3)$.

'Q_1' y 'Q_4' describen condiciones experimentales y de prueba, y 'Q_2' y 'Q_5' los resultados de la prueba (test). De manera que si el punto *a* reacciona de manera Q_2 cuando se lo somete a la prueba Q_1, *a* tendrá la propiedad Q_3, pero si *a* reacciona de manera Q_5 cuando se lo somete a la prueba Q_4, *no* tendrá la propiedad Q_3. Carnap supone que su procedimiento es el que mejor cumple con los requisitos del procedimiento científico pues si tratásemos de definir un predicado disposicional, el resultado sería que cada vez que la ciencia avance habríamos de proveer una nueva definición, en cambio, si se establecen pares como (R_1) y (R_2) lo único que hay que hacer es aumentar otros pares compatibles con los primeros. No se trataría de corregir esas determinaciones sino de complementarlas con nuevas ORs.

Sin embargo esto resulta equivocado por dos razones:

(a) Porque algunas veces no basta con complementarlas, hay que *corregir* las determinaciones formuladas en estadios previos.

(b) Porque hay varias clases de predicados disposicionales y la aplicación a ellos de oraciones reductivas presenta problemas diferentes en cada caso.

Para probar esto, analiza el caso de los predicados 'soluble', 'frágil' y 'magnético' representativos cada uno de un grupo.

(a) En el caso de 'soluble' la ocurrencia de la disolución será condición suficiente de la verdad del enunciado que afirme esa disposición; de lo contrario, tendríamos el absurdo de algo que se disuelve sin ser soluble. Estaríamos en el caso de (R_1). Contrariamente a lo que Carnap piensa, no hay condiciones necesarias para la determinación de cuándo un objeto es soluble (R_2). La razón es simple: si el objeto no se disuelve esto puede deberse no a que

no sea soluble sino a la ausencia de una condición relevante, p. ej., que el agua estaba a muy baja temperatura. Pero si hemos introducido una OR como un R_2 que establece una condición necesaria de la presencia de la disposición y la cosa no se disuelve a pesar de ser soluble, tendremos que *corregir* y no sólo suplementar el original R_2 adicionado para ello, la condición relevante requerida y tendremos otra RS, a saber, R'_2 en lugar de la R_2 original siendo esta R'_2 corregible indefinidamente y esto porque se desea que 'soluble' tenga el mismo sentido que tiene en nuestro lenguaje. Otra cosa sucedería si RS introdujese predicados *sin significado previo*, pues en tal caso no se podrían asignar valores de verdad.

En la misma situación que 'soluble' encontramos palabras como 'penetrable' y 'rompible'.

(b) Términos como 'frágil' presentan dificultades de otro tipo. A diferencia de 'soluble', el que algo se rompa no es condición suficiente de que sea frágil como sí lo es de que sea rompible; un objeto frágil no es el que se rompe en ciertas circunstancias, sino uno que se puede romper *fácilmente*. Así, en el caso (R_1) 'Q_1' y 'Q_2' pueden ser verdaderos y 'Q_3' resultar falso. Alguien puede pensar que especificando una condición adicional en 'Q_1', v. gr., establecer que el objeto frágil se rompe sólo bajo una presión pequeña, se resuelve el problema. Pero surgen contraejemplos pues lo que afirmamos al decir que un objeto se rompe fácilmente es que hay una gran variedad de circunstancias en las que la cosa puede romperse. Además, para determinar la presión mínima que puede romper una cosa frágil, tenemos que recurrir al tipo de cosa en cuestión y en tal caso fracasamos al querer establecer una condición suficiente. Por tanto, la introducción del predicado por R_1 altera el significado de 'frágil'.

En contraste con 'soluble', podemos fijar una condición necesaria de que algo sea 'frágil' (R_2), v. gr., si ponemos el objeto bajo la máxima presión 'Q_4' y no se rompe 'Q_5' no diremos que sea frágil. La situación es similar para términos como 'móvil', 'flexible', etc.

(c) Un tercer grupo de disposiciones no permiten fijar condiciones necesarias o suficientes de su aplicación. Así 'magnético' introducido por una OR R_2 que dijese: si ponemos un pedazo de acero (Q_4) en un lugar de fricción intensa cercana a *a* y el pedazo no se mueve hacia *a* (Q_5), concluiremos que *a* no es magnético ($\sim Q_3$). Pero nuestra conclusión puede ser no la de que no hay tal disposición, sino la de que la prueba no es relevante, pues la explicación de la ausencia de movimiento hacia *a* puede ser la fricción. Si se modifica Q_4 de modo que incluya 'sin fricción intensa' Q_4^+ esta-

remos corrigiendo un primer par de reducción y no sólo completándolo, corrección que habrá que llevar a cabo en cada nueva situación que se presenta.

En el caso de R_1 la situación no es mejor, pues si suponemos, según el ejemplo anterior, que $Q_1 = Q_4$ y $\sim Q_2 = Q_5$, Q_3 no será verdadero. Esto es posible porque aún si un pedazo de acero se mueve hacia *a* podemos pensar que *a* no es magnético pues la causa puede ser p. ej. una inclinación de la superficie y no la disposición. Dificultades parecidas parecen surgir si se introducen pruebas o resultados distintos en 'Q_1', 'Q_2', 'Q_4' y 'Q_5'. Algo similar sucede con 'punzante', 'dulce', 'amargo'. El resultado es, así, contrario a Carnap ya que en los casos (a) no es posible establecer una concidión necesaria dado que el avance de nuestro conocimiento nos obliga a cambiar constantemente R_2; lo mismo puede decirse del intento de establecer una condición suficiente por R_1 en los casos (b) y de ambos tipos de condición en los casos (c).

Desde un punto de vista carnapiano la respuesta a esta objeción consistiría en decir que este modo de introducirlos es adecuado por cuanto excluye como autocontradictorias las asignaciones de valores de verdad que pueden hacerse en nuestro uso ordinario de esos términos. Si rehusamos admitir 'Q_1' o 'Q_4' como adecuados para determinar la presencia o ausencia de la disposición, estamos usando el predicado en un sentido distinto del que tenía cuando se determinaba esa presencia o ausencia sobre la base de R_1 o R_2 respectivamente. Así, en el caso (c) ha habido un cambio de Q_4 a Q_4^+ de modo que la disposición introducida no ha de ser Q_3 sino Q_3^+. De otra parte Q_4^+ era falsa en el primer experimento y nada podríamos haber concluido respecto al valor de verdad Q_3^+.

Sin embargo, hay varias razones para suponer que esto no es así. En primer lugar, la única razón para pensar en un cambio de significado descansa en la creencia de que las OR son una manera adecuada de analizar nuestro uso corriente de los predicados disposicionales y el medio más claro en el cual esto ha de hacerse.

Otra razón es que esta defensa no parece estar de acuerdo con nuestro uso corriente de las disposiciones, pues aún cuando Carnap especifica solo parcialmente el significado de un predicado disposicional dejándolo 'abierto' a fin de que las aplicaciones que se hacen según diferentes criterios en diferentes momentos vengan a ser consideradas como especificaciones del sentido de un mismo concepto, por esta misma línea de razonamiento podemos llegar a pensar que en el caso de una prueba inadecuada estamos

especificando un concepto 'abierto' y no introduciendo uno nuevo puesto que en el uso ordinario no pensamos que se trate de la introducción de uno nuevo.

Así pues, las ORs no son adecuadas para introducir esos predicados si han de tener el mismo sentido que tienen en nuestro lenguaje.

Dificultades similares surgen si se quiere caracterizar a los predicados disposicionales en forma no-extensional usando condicionales causales o 'contrafácticos' expresados en el modo subjuntivo.

Para mostrar que no son equivalentes hace uso de una noción de implicación según la cual es imposible tener evidencia confirmativa para el antecedente que no lo sea para el consecuente *y* tener evidencia refutativa para el consecuente que no lo sea para el antecedente. (Esta noción de '$\supset$' no ha sido investigada en detalle desde un punto de vista lógico pero sugiere que es similar a la propugnada por los intuicionistas (Heyting). Las sentencias '*a* es magnético' y el condicional 'si alguien ha puesto un pedazo de acero cerca de *a*, éste se habrá movido hacia *a*' no son lógicamente equivalentes de acuerdo a la caracterización anterior, pues surgen dificultades paralelas a las de los casos (c) en que se refuta parcialmente el condicional sin refutar el antecedente. La cura será reformular el condicional haciendo referencia a la condición relevante para evitar la refutación independiente del condicional y si la 'respuesta' a las condiciones establecidas en el condicional subjuntivo es, no negativa, sino diferente del resultado esperado, tendremos que agregar un nuevo 'contrafáctico', que analice el predicado disposicional, si ha de seguir un patrón regular. Aquí de nuevo, a pesar de la instancia refutativa, consideramos que la disposición sí estaba presente y se manifestó en forma novedosa.

La implicación conversa ha de afrontar dificultades similares: puede haber evidencia confirmativa del condicional que no lo sea del enunciado disposicional correlativo como se advirtió en los casos (c). La equivalencia no se sostiene. Así vemos que los enunciados que adscriben disposiciones del tipo (c) no son lógicamente equivalentes a los condicionales causales.

En los casos (a) tampoco ocurre, pues 'soluble' no implica el condicional causal correlativo porque es posible que al poner la cosa en un líquido no se disuelva y sin embargo sea soluble en ese líquido y que expliquemos la no-disolución por la ausencia de una condición relevante. En tal caso, refutaríamos el condicional sin refutar el enunciado disposicional.

Empero, la implicación conversa se sostiene, el 'contrafáctico' implica el enunciado disposicional de este grupo correlativo, pues

si refutamos el consecuente refutaremos el antecedente y si confirmamos el antecedente, confirmaremos el consecuente.

En lo que toca a los casos (b), el enunciado disposicional implica el condicional pero no a la inversa, pues '*a* es frágil' implica 'Si *a* se sometiera a la más alta presión obtenida en condiciones de laboratorio, se rompería' porque confirmando el antecedente podemos confirmar el consecuente y refutando el consecuente refutar el antecedente. La otra implicación no se sostiene, pues algo puede romperse bajo la mayor presión pero no ser frágil. La conclusión de este análisis es, que la tesis de que los enunciados disposicionales y los contrafácticos son equivalentes es una simplificación burda.