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Hypothetico-Deductivism: Incomplete but not Hopeless

ABSTRACT: Alleged counter-examples deployed in Park (2004) against the account of selective hypothetico deductive confirmation offered in Gemes (1998) are shown to be ineffective. Furthermore, the reservations expressed in Gemes (1998) and (1993) about hypothetico-deductivism are retracted and replaced with the conclusion that hypothetico-deductivism is a viable account of confirmation that captures much of the practice of working scientists. However, because it cannot capture cases of inference to the best explanation and cases of the observational confirmation of statistical hypotheses, it is concluded that hypothetico-deductivism cannot supply a complete theory of confirmation.

Traditional accounts of hypothetico-deductivism (H-D) claim that

(H-D1) evidence e confirms T relative to background evidence b if (T&b) ├ e and b ├/ e.[1]

A key problem for this notion of H-D, as argued persuasively in Glymour (1980), is that it generates arbitrary confirmation relations, since it has the consequence that where e confirms T relative to b then for any arbitrary T', e also confirms T&T' relative to b. This has become known as the problem of irrelevant conjunctions.

Gemes (1998), after rehearsing this and some of the other known problems of traditional versions of H-D, such as H-D1, offered a version of H-D that allows for more selective confirmation. In particular, the axioms selected for confirmation from a given theory would be just those needed in the derivation of the evidence from a natural axiomatization of the theory combined with the background evidence. To explicate this notion Gemes needed to first explain what constitutes a natural axiomatization of a theory.[2] This in turn required recourse to a notion of logical content developed in Gemes (1994) and Gemes (1997)[3].
According to the new definition;

(S.H-D) Where N(T) is a natural axiomatization of theory T and A is an axiom of N(T), evidence e hypothetico-deductively confirms axiom A of theory T relative to background evidence b iff e and (non tautologous) b are content parts of (T&b), and there is no natural axiomatization N(T)' of T such that for some subset s of the axioms of N(T)', e is a content part of (s&b) and A is not a content part of (s&b). (Gemes (1998), p.10)

Parks (2004) claims that

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[1] In cases where b is a tautology we may simply speak of e confirming h.

[2] T' is a natural axiomatization of T iff (i) T' is a finite set of wffs such that T' is logically equivalent to T, (ii) every member of T' is a content part of T' and (iii) no content part of any member of T' is entailed by the set of the remaining members of T'.

[3] α is part of the content of ß iff α and ß are contingent, ß ├ α, and every α-relevant model of α has an extension which is a ß-relevant model of ß. An α-relevant model of α is a model of α that assigns values to all and only those atomic wffs relevant to α. In the case of quantificational wffs the quantifiers are treated substitutionally in order to determine content parts. So, 'GbvFa' is not part of the content of '(x)Fx' since that 'GbvFa'-relevant model of 'GbvFa' that assigns 'Fa' the value F and 'Gb' the value T cannot be extended to a model of '(x)Fx. 'Fa' is a content part of '(x)Fx', since the sole 'Fa' relevant model of 'Fa, namely that which makes the single assignment of T to 'Fa', can clearly be extended to a '(x)Fx'-relevant model of '(x)Fx', by assigning T to 'Fb', 'Fc', 'Fd', etc.

> Gemes (1998) declared that his revised version completely overcame the difficulties of Hypothetcio-Deductivism without generating any new ones.
> (p. 229)

In fact, what Gemes (1998) does say is that

> H-D can be given a precise formulation that avoids the longstanding technical problems such as (1), (2) and (3), however it relies on a philosophically unsound intuition. (p.2)

(1) is Glymour's problem of irrelevant conjunctions outlined above.

(2) is the problem of tacking by disjunction: a sound version of H-D should not entail that where e confirms T for any e', e've confirms T.

(3) is the problem of instance conjunction: a sound version of H-D should allow that instances confirm their generalization.

There is no claim in Gemes (1998), or the earlier Gemes (1993), which presented a similar reformulation of H-D, that the formulations of H-D presented overcome <u>all</u> problems. Rather, the claim made is that they overcome longstanding canonical technical problems and better represent the spirit of H-D then do previous formulations.

Moreover, and against Park's implicature, Gemes (1998) does not even endorse H-D, but, in fact, concludes, "the basic intuition behind H-D is itself unsound" [Gemes (1998), p. 2]. This echoes the conclusion of Gemes (1993) that H-D is "misguided in spirit" [p.487]. Presumably, the claim that H-D is basically unsound precludes the claim that Park attributes to Gemes, without any textual citation, that the new version "completely overcame the difficulties of Hypothetico-Deductivism". There is a world of difference between the claim that a version of a theory overcame longstanding difficulties and the claim that it overcame all difficulties.

Park also claims that since

> Gemes's revised version encounters new difficulties… it cannot be a true alternative to Bootstrap theory of confirmation and classical Hypothetico-Deductivism [Park (2004), p. 229]

This is simply a non-sequitor. Even granting that the new version encounters new difficulties, this would not show that it is not a true alternative to bootstrapping and traditional versions of H-D such as H-D1. That the theory of evolution encounters difficulties not encountered by the theory of divine creation does not show that the former is not a true alternative to the later. The question is, do the difficulties encountered by the new version of H-D outweigh the advantages it has over the traditional versions and bootstrapping?

In fact, I have now come around to a more sympathetic attitude to H-D than that evidenced in Gemes (1993) and Gemes (1998). But before coming to that I need to deal with the heart of Park's objections

These boil done to basically two cases; one allegedly shows that the new version of H-D is too restrictive; the other shows that it is too permissive.

Let us consider the first case.

T: Ma
b: Ma → Sb
e: Sb.

Here the new version of H-D does not yield the result that e confirms H relative to background b.

Park takes this to be a valid case of confirmation, where a is the name of an individual, b is the name of another individual and 'M' is the property of being a mammal and 'S' is the property of suckling milk at the breast. Now why this should count as a valid case of confirmation is far from clear. That one individual suckles milk from the breast should not give confirmation of the claim that another is a mammal, even relative to the strange background claim that the first is not a mammal or the second suckles milk. Note, if this counts as confirmation then we have confirmation from a true evidence statement and a true background theory for the claim that any given individual is a mammal. Thus let b be my brother's puppy Bronte. Then for any individual c it is true that if c is a mammal, Bronte suckles milk from the breast. So we would then have confirmation, by the true evidence statement Bronte suckles milk from the breast and the true background theory that it is not the case that c is a mammal or Bronte suckles milk from the breast, of the claim that arbitrary individual c is a mammal. In Park's paper the individuals given in this schematic example are referred to by 'Lassie' and 'Lassie II', thereby suggesting some kind of direct relation between the two animals. It is this that lends credibility to the claim that if one individual, Lassie is a mammal, then the other individual, Lassie II, suckles milk. In fact, what is being illicitly appealed to here is the unstated information that if an individual x is a mammal and is the parent of another individual y then y suckles milk and that Lassie is the parent of Lassie II. Without appeal to this unstated information there is little reason to take this as a genuine case of confirmation. If we make explicit and include this information we have the following case which S-H.D recognizes as a valid case of confirmation:

T: Ma
b: (x)(y)(Pxy & Mx)→Sy) & Pab
e: Sb.[4]

[4] It is perhaps worth noting that where the more general b in this example is replaced by the more particular statement '(Pab & Ma)→Sa) & Pab', S-H-D does not take this as a case of confirmation. But note, in Park's case, as in

Here is Park's second case

Theory T: A1: $(x)(Dx \rightarrow Mx)$
A2: $Ma \rightarrow Rb$
b: Da
e: Rb

S.H-D does, as Park claims, entail that in the above case e confirms axiom A1 of theory T relative to background b.

Here intuitions are a little harder to sought out. Park gives two different interpretations of the predicates and terms in this case and argues that in one case it is not a case of confirmation whereas in the other it is. In the interpretation which allegedly does not provide a case of genuine confirmation 'D' stands for the property of being a dog, 'M' for the property of being a mammal, and 'R' for the property of raining at Seoul, 'a' stands for 'Lassie' and 'b' for 'Seoul'. So according to S.H-D, it is raining in Seoul confirms that all dogs are mammals relative to the background theory that Lassie is a dog. This does seem odd.

However it would not be odd to say that it is raining in Seoul confirms all dogs are mammals relative to the background information Lassie is a dog, and the theory that all dogs are mammals and if Lassie is a mammal then it is raining in Seoul. Any sense of oddness here comes from the theory which contains the strange claim that if Lassie is a mammal then it is raining in Seoul.

What Park's example shows is that though S.H-D was framed in terms of e confirming axiom A of theory T relative to background b, it should have been framed in terms of e confirming axiom A of theory T relative to background b and theory T. This is in no way ad hoc but rather brings out a central feature of the new version of H-D. That version allows that axioms of a theory may be used in conjunction with background evidence to generate new data, which if true, bears positively on certain, but not necessarily all the axioms of a theory. In such cases it seems naturally to say that the confirmation of a given axiom is relative to both the background evidence and the theory.

On this reading, then, both of Park's interpretations of his second case count as cases of confirmation.

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real examples of such cases, the background information is invariably of a general kind. It would be wildly idiosynratic to hold as background information that where particular individual a is a mammal and is the parent of partiucular individual b then p is a suckler, but that this relationship did not hold more generally between mammals and their offspring. Finally, if one is of a mind to insist that this should nevertheless count as a case of confirmation then we must allow that it is better for a definiton to be too exclusive than too inclusive.

This solution seems perfectly adequate to me. However suppose one is of a mind to strongly reject the claim that in the above case that e confirms A1 relative to b and T. There are still principled ways of excluding this case.

For instance, fixing on the idea that the new version of H-D, like the old version, and such rival accounts of confirmation, as Bootstrapping, is primarily concerned with the confirmation of theories which consist of unrestricted universal, or law-like, generalizations, we could put a restriction on theories to include only such generalizations. In the above case A2 then could not be part of theory T. Now suppose one tries to resurrect the counter-example by deleting A2 from T and adding it to the background evidence 'Da', where, incidentally, it seems most suited in the first place. Then S.H-D's condition that b is a content part of (T&b) would be violated.[5] A similar effect could also be achieved by demanding that, the not just that e and b be part of the theory (T&b), but that T itself be a content part of (T&b).[6]

Amending S.H-D in either of these two ways may yield an account of H-D that excludes some prima facie acceptable cases of confirmation. But, first, as Glymour observes, it is better to be too restrictive than too permissive; and second, as we shall soon see, there are whole classes of much more important cases of confirmation excluded by all versions of H-D. So no version of H-D can cover all cases.

For the rest of this paper let us take 'S.H-D' to refer to the above given version with the emendation there where the original contains the clause 'evidence e hypothetico-deductively confirms axiom A of theory T relative to background evidence b', we shall read this as shorthand for evidence 'e hypothetico-deductively confirms axiom A of theory T relative to background evidence b and theory T'.

Now as to my change of attitude to H-D, that comes from my realization that my former claim that H-D precluded inductive confirmation needs emendation.[7] On the formal side it is true that if H-D is offered as a necessary and sufficient account for all cases of confirmation it precludes genuine inductive confirmation. For instance, to consider the simplest

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[5] 'Da&(Ma→Rb)' is not a content part of '(x)(Dx→Mx)&Da&(Ma→Rb)) ' since that 'Da&(Ma→Rb)'-relevant model of 'Da&(Ma→Rb)' which assings 'Da' the value T and 'Ma' and 'Rb' the value F cannot be extended to a model of '(x)(Dx→Mx) & Da&(Ma→Rb)) .

[6] In the above case this condition is violated since {(x)(Dx→Mx),(Ma→Rb)} is not a content part of ({ (x)(Dx→Mx),(Ma→Rb)}&Da). Those {(x)(Dx→Mx),(Ma→Rb)}-relevant models of {(x)(Dx→Mx),(Ma→Rb)} which assigns the value F to 'Da' cannot be extended to a model of ({ (x)(Dx→Mx),(Ma→Rb)}&Da).

[7] The realization that H-D need not be seen as fundamentally opposed to inductive confirmation came me to through incredibly helpful conversations with Gerhard Schurz who pressed upon me the claim that Hempel and others who considered H-D where not in principle committed to an anti-inductivist stance.

illustrative case, if the core intuition of H-D is that for evidence to confirm an hypothesis it is necessary and sufficient that a deductive relation hold between the hypothesis and the evidence then, while this will allow that ‘Fa’ confirms ‘(x)Fx’, it will not allow that ‘Fa’ confirms ‘Fb’. But, I maintain, allowing for such inductive confirmation, is a sine qua non, for any adequate account of confirmation. Popper, as an early advocate of the hypothetico-deductive method, would of course disagree. In his hands hypothetico-deductivism would be a wholly deductive account of confirmation not allowing for any whiff of inductivism. But Hempel, around the time he considered hypothetico-deductive accounts of confirmation, also countenanced the consequence condition that

(C.C.) If e confirms h then e confirms any consequence of h.[8]

Now, if H-D is given as merely a sufficient condition of confirmation it may be combined with C.C. to yield an overall account that allows for genuinely inductive confirmation. The idea is that by H-D, ‘Fa’ confirms ‘(x)Fx’ and then by C.C. this confirmation is transmitted to ‘Fb’.

The big problem here has always been that canonical accounts of H-D, such as H-D1, when combined with S.C.C yield the result that anything confirms anything. Thus, consider arbitrary e and h and tautology b. According to canonical versions of H-D, e confirms h&e, since h&e entails e. Then by C.C., since e confirms h&e and h is a consequence of h&e, e confirms h. So it seems as if H-D can only be expanded to include inductive confirmation at a totally unacceptable price.

But note, with our new selective account of hypothetico deductive confirmation we can avoid this result. Indeed, the combination of S.H-D and C.C. yields the result that ‘Fa’ H-D confirms ‘(x)Fx’ and then by the C.C, ‘Fa’ confirms ‘Fb. Yet it does not allow that ‘Fa’ confirms ‘Gb’, for even though, for instance, ‘(x)Fx&Gb’ entails ‘Gb’, according to S.H-D, ‘Fa’ only selectively confirms part of ‘(x)Fx&Gb’, namely, ‘(x)Fx’.

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[8] Cf. Hempel (1965), p 3. Hempel actually proposed C.C. as an adequacy condition for any account of confirmation. Now presumably what Hempel had in mind was that if ‘Fa’ is to confirm ‘(x)Fx’, it must confirm such consequences of ‘(x)Fx’ as ’Fb’, ‘Fc’, etc. Presumably, he did not have in mind such consequences as ‘~Fav(x)Fx’. Note, ‘~Fa’ entails, and so clearly confirms ~Fav(x)Fx’. So to demand that for ‘Fa’ to confirm ‘(x)Fx’ it must confirm ‘(x)Fx’s consequence ‘~Fav(x)Fx’, would be to demand that both ‘Fa’ and its negation confirm ‘~Fav(x)Fx’. This suggests that the adequacy condition is better expressed in terms of the need to confirm all the content of a hypothesis rather than all its consequences. Basically, the adequacy condition should demand that were e confirms h that confirmation is transmitted to all the content of h. According to the account of content developed in Gemes (1994) and (1997), ‘Fa’, ‘Fb’, ‘Fc’ etc, but not ‘~Fav(x)Fx’, are parts of the content of ‘(x)Fx’

Does this mean that the combination of S.H-D and C.C provides a full and adequate account of confirmation? This is conclusion I would strongly resist. There are plenty of cases of confirmation, for instance, cases of inference to the best explanation, that are not captured by this combination. For example, let evidence e be the conjunctive statement ‘The gun used to murder Jones was owned by Jones’s business partner Smith, the gun only had Smith’s fingerprints on it and Smith had ample motive to murder Jones’. Let T be ‘Smith murdered Jones’. Here, prima facie, e confirms T, though clearly this is not a case of hypothetico-deductive confirmation. One cannot deduce that Smith is the murderer in this type of case. Rather, one induces that Smith is the murderer since that is the best explanation of the available evidence. Perhaps more importantly, with regard to the confirmation of scientific theories, the combination of S.H-D and C.C. does not allow for confirmation of statistical hypotheses from observational evidence, since in such cases the hypothesis does not deductively entail the evidence. Thus let T be ‘The probability of an electron fired from apparatus B having spin up is 50% and e be ‘According to accurate measurements, 50% of atoms fired from apparatus B between time t-1 and t had spin up’. Again, this is a perfectly acceptable example of confirmation though it is not sanctioned by the combination of S.H-D and C.C.

The example of inference to the best explanation points to a wider conclusion; namely, that no purely formal account of confirmation, that is, one that wholly relies on syntactical features of statements, and excludes recourse to the meaning of statements, can capture all cases of confirmation. This is in fact a key conclusion of Park’s paper and one I fully endorse. What Park and many others who scotch all notions of formal confirmation theory fail to notice is that for many paradigm cases of confirmation formal accounts are perfectly adequate and indeed perspicuous. Gemes (1994a) argued that there is no one account of explanation, be it explanation as subsumption under laws or explanation as unification, that captures all cases of explanation. Rather, there are different explanatory virtues that are held in different degrees by different putative explanations. Similarly I believe there is no one structural account of confirmation that can account for all cases of confirmation. Rather different accounts are applicable in different cases.

In this spirit, I submit, philosophically reflective scientists will welcome S.H-D as a partial account of confirmation. First, it allows for confirmation through natural expressions of theories, that is, it involves breaking theories into parts (axioms) in a plausible non-arbitrary way. S.H-D insists that theories have canonical representations that play an essential part in determining confirmational relations for the theory. Second, it allows for selective confirmation. That is, it allows that evidence entailed by a theory need not confirm the theory in toto, but may bear positively only on parts of the theory. Third, it accords with much of experimental practice. That is to say, scientists will recognize as good practice the process of (i) giving clear, non-arbitrary, formulations of their theories, (ii) teasing out of observational consequences from those theory formulations; (iii) checking those consequences for truth, and (iv) raising their confidence in the truth of the parts of the theory involved in teasing out those observational consequences if those observational consequences are in fact borne out.

REFERENCES

Gemes, K., (1993), "Hypothetico-Deductivism, Content, and The Natural Axiomatization of Theories," *Philosophy of Science*, 60:477-487.

_____, (1994), "A New Theory of Content I: Basic Content," *Journal of Philosophical Logic*, 23:596-620.

_____, (1994a) "Explanation, Unification, & Content," *Nous*, 28:225-240, 1994

_____, (1997), "A New Theory of Content II: Model Theory and Some Alternatives," *Journal of Philosophical Logic*, 26:449-476.

_____, (1998), "Hypothetico-Deductivism: The Current State of Play; The Criterion of Empirical Significance Endgame," *Erkenntnis,* 49:1-20, 1998

Glymour, C., (1980), "Discussion: Hypothetico-Deductivism is Hopeless" *Philosophy of Science*, 47:322-325.

Hempel, C.G. (1965), *Aspects of Scientific Explanation*, (New York: The Free Press.

Park, S-J., (2004), “Hypothetico-Deductivism is Still Hopeless”, *Erkenntnis,* 60:229-24.