

# Innate Cognitive Capacities

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**Abstract:** This paper attempts to articulate a dispositional account of innateness that applies to cognitive capacities. After criticizing an alternative account of innateness proposed by Cowie (1999) and Samuels (2002), the dispositional account of innateness is explicated and defended against a number of objections. The dispositional account states that an innate cognitive capacity (output) is one that has a tendency to be triggered as a result of impoverished environmental conditions (input). Hence, the challenge is to demonstrate how the input can be compared to the output and shown to be relatively impoverished. I argue that there are robust methods of comparing input to output without measuring them quantitatively.

## 1. Introduction

Attacks on the very notion of innateness have come from researchers in various sub-disciplines of biology, particularly developmental studies, for around half a century.<sup>1</sup> More recently, some philosophers have also had foundational qualms about the concept of innateness and have explicitly proposed substitutes, either by way of saying what we really meant by innateness all along, or in the spirit of suggesting an alternative notion that would play a similar, but less objectionable, role in science. Other philosophers have heaped scorn on substitute notions of innateness, calling instead for rejecting the concept altogether.<sup>2</sup>

Yet, for all that, in the cognitive sciences, including those cognitive sciences with a large biological component, innateness is still pressed into service and continues to have a great deal of useful application. In this paper, I will attempt to defend an understanding of the notion of innateness that accords with the concept as I believe it is usually used in cognitive science. This is not meant to be a blanket defense of innateness as a theoretical concept in science, but rather an argument

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<sup>1</sup> For an early critique, see Lehrman, 1953; for some recent accessible statements of this position by some of its main advocates in biology, see Lewontin, 1993; Oyama, 2000; and Bateson and Martin, 2000.

<sup>2</sup> For some philosophical proposals concerning alternative notions of innateness, see for example, Sober, 1998; Ariew, 1999; Wimsatt, 1999; Cowie, 1999; Samuels, 2002; for an outright rejection of all such attempts, see Griffiths, 2002.

for accepting its utility when applied to cognitive science. Admittedly, delimiting the scope of the 'cognitive' is not an easy matter, but for these purposes, it seems adequate to specify that cognitive states, structures, and capacities are mental entities with representational content. Before putting forward this account of innateness, I begin in section 2 by responding to a philosophical call for jettisoning the concept of innateness altogether. Then in section 3, I consider and reject a recent philosophical attempt to redefine the notion of innateness, the primitivist proposal of Cowie (1999) and Samuels (2002). In section 4, I put forward and explicate an alternative proposal, the dispositional account of innateness. Finally, in section 5, I defend this proposal against a few prominent objections.

## 2. Philosophical Critiques and Reinterpretations

It would be presumptuous for philosophers to advocate rejecting a theoretical concept that continues to play an important role in some area of science. This should not be taken as a *carte blanche* for conceptual extravagance, since the role played by any particular concept may admittedly be that of contributing to the confusion rather than helping to organize and explain the phenomena. However, prudence suggests that one would need to show quite decisively that a scientific concept is not earning its keep before one can recommend purging it entirely.

Griffiths (2002) largely concurs with developmental systems theorists in arguing that the innateness concept has outlived its usefulness in science and should be rejected altogether. Like them, he claims that the concept of innateness has come to stand in for a number of disparate traits or properties, and that these are misleadingly associated and entangled when one uses the catchall term 'innate'. Griffiths' three disparate notions can be summarized as follows (2002, p. 71):

- *Developmental fixity*: hard to change; changing it impedes development.
- *Species nature*: reflects what it is to be an organism of that kind; universal, or at least, typical.
- *Intended outcome*: how an organism is meant to develop; by extension, how an organism is designed or programmed.

He also holds that the term allows researchers to make illicit inferences from the incidence of one of these attributes to another. Scientists will sometimes pass, for example, from a finding of developmental fixity to one of species nature without sufficient warrant. Moreover, he goes on to argue that this confusion in some of the scientific literature can be traced back to our folk-biological notion of innateness, which is closely associated with a discredited essentialism in the biological sciences.

I have no quarrel with Griffiths' analysis insofar as it applies to the concept of innateness as it figures in biological science or in folk-biology. However, it should

become clear in due course that the cognitivist notion of *innateness* that I will be explicating below does not correspond to any of the three conceptions that he identifies. As for the purported link between innateness and essentialism, Griffiths does not make a decisive case that the connection is inevitable. Of the three notions that he identifies as being involved in *innateness*, that of *species nature* is the one most clearly connected to (a variety of) essentialism. However, he does not demonstrate decisively that the concept of *innateness* always carries the implication of *species nature*. Indeed, he acknowledges that our folk-biological theory recognizes that something can be innate, e.g. a disease, without being part of human nature. In any case, even if essentialism is sometimes part of our scientific or folk-biological baggage, it should soon become apparent that it is not implicated in the cognitivist concept of innateness that I will be defending in this paper.<sup>3</sup>

Before proceeding to investigate the concept of *innateness* as it is used in cognitive science, a couple of caveats are in order. First, we should bear in mind that this area of science is quite different from, say, mathematical physics, in that many of the concepts in use are not precisely quantifiable and do not admit of measurement. This should not be regarded as an indictment of the theoretical concepts of the cognitive sciences, since only an eliminativist would take this as a sign that such concepts must be discarded. Second, in the cognitive sciences, as in some other branches of science, many concepts have been inherited from the folk, and innateness is not worse off than a range of other such concepts in this respect (cf. *emotion, concept, learning, perception, reasoning, knowledge, consciousness*, and so on). However, as is often the case in science, such borrowed concepts need to be reinterpreted and made more precise when put to use in scientific contexts. With these two points in place, we can now go on to take a closer look at the concept of *innateness* in cognitive science.

### 3. Against Primitivism

In this section, I will consider a bold philosophical attempt to redefine or reinterpret the concept of innateness, which identifies innate mental structures with what is *psychologically primitive*. But before embarking on a discussion of the ‘primitivist account’, it may be useful to review a widely-held rival to primitivism, namely the ‘invariance account’ of innateness. This view, or family of views (variants include the ‘implasticity’ and ‘canalization’ accounts) holds that an innate trait is one whose development is relatively invariant over a broad range of developmental environments.<sup>4</sup> There are two prominent problems for this view: developmental

<sup>3</sup> Some recent psychological research has questioned the extent to which our folk theories (chemical, biological, etc.) are unequivocally essentialist in nature; see for example Malt, 1994 and Strevens, 2000. For a response, see Ahn *et al.*, 2001.

<sup>4</sup> For two recent philosophical statements of the view, see Sober, 1998 and Ariew, 1999.

invariance is neither necessary nor sufficient for innateness. It is not necessary because something could be innate without being invariant over a wide range of environments, simply because it requires rare circumstances for it to be manifested. For example, a certain disease might be largely innate but may manifest itself only in relatively rare environmental conditions. The fact that it does not show up in a broad range of developmental circumstances would not seem to preclude it from being innate. An example from cognition might be exceptional aptitude at chess, which may be partly or largely innate but require exposure to the game and very specific training in order to become manifest. Moreover, invariance is not sufficient for innateness because a trait could be invariant over a wide range of environments, yet not be innate. As has been widely noted, a case of this kind in cognition would be beliefs that are formed in a wide variety of environmental conditions, e.g. the belief acquired by the overwhelming majority of human beings that water quenches thirst (mentioned in Stich, 1975, p. 9). Though this cognitive state is liable to arise invariably across a wide range of environments, we would not ordinarily want to consider it an innate belief.

One attempt to remedy these worries with respect to the invariance account appeals to *normal* circumstances. What is innate to a certain organism is identified simply with what the organism would acquire in all, or a wide range of, normal environments, not in a wide range of environments full stop. But this does not help for the worry about necessity, since the circumstances required to trigger a certain innate capacity or condition may not arise in all or even most normal environments; they may be relatively rare, as with some innate diseases or exceptional ability at chess. Similarly, normalcy does not help with the worry about sufficiency because even if a condition or capacity arises in all normal environments, that does not guarantee that it is innate. Surely, the belief that water quenches thirst arises in all circumstances that we would want to consider normal.<sup>5</sup>

In the remainder of this section, I will attempt to show that even though primitivism has been proposed as a superior account of innateness, similar problems

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<sup>5</sup> It may be thought that the notion of normal conditions could be refined to meet these objections, but normalcy seems to be a red herring in this context. To see this, note that some species of birds acquire birdsong even in a condition of deafening (though other bird species do not); the fact that they do so is generally cited as evidence that birdsong in these species is more innate than it is in those that do not. However, the psychological structures in question are acquired in a context that is decidedly *abnormal* for these birds, since they are not normally deafened in the wild. Similarly, depth perception develops in many animal species (e.g. rats) in the absence of visual experience, for example if members of that species have been reared in dark labs. This is taken as evidence that such capacities are innate, developing as they do even in highly abnormal circumstances. Thus, many innate cognitive capacities are thought to be innate precisely because they are acquired (even) in highly abnormal circumstances, rather than because they arise in the normal case or in a wide range of normal environments. For more on this issue, see Khalidi, 2002. It should be noted that in my explication of the dispositional account in section 4, I will be using a very different and less contentious notion of normalcy: circumstances necessary for the proper functioning of the organism.

of necessity and sufficiency plague the primitivist account. As represented by Cowie (1999) and Samuels (2002), primitivism consists in equating the innate contents of the mind with what psychology is incapable of explaining. Thus, primitivism concerning the innate contents of our minds holds that what it is for a psychological structure to be innate is for it to be explanatorily primitive in the sense that the proper explanation of its acquisition lies outside psychology. More precisely, according to Samuels (2002, p. 246), a psychological structure *S* is primitive just in case: (1) *S* is a structure posited by some correct scientific psychological theory; and (2) there is no correct scientific psychological theory that explains the acquisition of *S*. Moreover, acquisition is understood quite straightforwardly: a psychological structure *S* is *acquired* by an organism *O* just in case *O* fails to possess *S* at all times prior to time *t* but possesses *S* at *t* (Samuels 2002, p. 240). Thus, innate structures are such that psychology cannot provide an explanation of how they are acquired or (equivalently) come to be possessed. Samuels (2002, pp. 246–7) admits that this is not to say that there is *no theory* of their acquisition, but he maintains that the explanation will be provided by some more basic science, e.g. neurobiology or molecular biology, not psychology.

I will now argue that this account of innateness fails to specify either necessary or sufficient conditions on what it is for a psychological structure to be innate, even when qualified in certain ways. It does not provide a sufficient condition on innateness because a range of non-innate cognitive phenomena also seem to call for non-psychological explanations of their acquisition. Samuels is aware of this flaw in his analysis, which he dubs the ‘over-generalization problem’. Before offering a remedy, he mentions some prominent counterexamples to his theory, both hypothetical and real, all of which are psychologically primitive but not innate: ‘Latin pills’ (fictional tablets that lead to the acquisition of a language when ingested by an individual), diseases (e.g. Ross River fever, which causes distinctive psychological hallucinations), and environmental insults leading to brain lesions (e.g. brain damage leading to memory loss). But these cases do not exhaust the range of counter-examples. One could also mention: strokes (e.g. aphasia in left-hemisphere stroke victims), surgical operations on the brain (e.g. surgery on the orbitofrontal cortex resulting in ‘acquired sociopathy’),<sup>6</sup> the ingestion of certain brain-altering chemicals (e.g. opiates and hallucinogens), electrical stimulation of the brain (e.g. inducing panic or anxiety attacks by electrical stimulation of the dorsal half of the periaqueductal gray matter),<sup>7</sup> as well as some kinds of formative or traumatic experiences (e.g. physical changes to the hippocampus that result from post-traumatic stress disorder or sexual abuse in childhood<sup>8</sup>). To be sure, what is acquired in such cases may not always be aptly characterized as a psychological or cognitive *structure*, but as Samuels (2002, p. 258) admits in

<sup>6</sup> See e.g. Eslinger and Damasio, 1985.

<sup>7</sup> See e.g. Schenberg *et al.*, 2001.

<sup>8</sup> See e.g. Bremner *et al.*, 1995 and Stein *et al.*, 1997.

considering this problem, it is not a good idea to 'put too much weight on the notion of cognitive structure,' since 'it is unclear how we ought to characterize this notion ...'. In all these cases, it appears as though a mental item is acquired by an organism in such a way that a complete explanation of its acquisition is not psychological, but the item thus acquired is clearly not innate by anyone's standard. The upshot is that there is a wide range of phenomena pertaining to the mind/brain that call for a non-psychological explanation of their acquisition, and many of them have nothing to do with innate psychological structures.

Samuels (2002, p. 259) addresses this problem by attaching an additional 'normalcy condition' to his theory: a (token) cognitive structure *S* possessed by an organism *O* is innate *only if* *O* would acquire *S* in the normal course of events. He admits that a full account of normalcy is hard to provide but he points out that the counterexamples that he mentions all involve *abnormal* events in the life of the organism (e.g. diseases and environmental insults). This strategy seems to work with the counterexamples that he mentions and perhaps with some of those I have listed, but it is possible to adduce others that are not so easy to dismiss. Consider some forms of adolescent depression, the complete explanation of which may not be psychological (e.g. the explanation may allude to a reduction in the levels of neurotransmitters in the brain, such as serotonin and norepinephrine), but which can arise in (arguably) normal circumstances. Clearly, not all such forms of depression are innate; indeed adolescent depression is thought to be less heritable than other forms of mental depression. If such cases are to be dismissed as being *abnormal*, then the normalcy condition needs to be spelled out in more detail.<sup>9</sup> Until this is done, one cannot determine whether this condition actually succeeds in ruling out all and only counterexamples to the primitivist account of innateness, and one cannot conclude that primitiveness is indeed sufficient for innateness.

Is primitiveness necessary for innateness? If it were true that all innate psychological structures were primitive, then no such structure could receive a correct psychological explanation for its acquisition. But this seems to preclude explanations for the acquisition of innate mental modules that are often advanced by evolutionary psychologists. To rule out such explanations, Samuels introduces another crucial condition, the *ontogeny constraint*, which effectively classifies

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<sup>9</sup> The primitivist may concede that the phenomenon of adolescent depression arises in normal circumstances, but object that this purported counterexample betrays confusion among levels of explanation. Although adolescent depression can and does receive an explanation that is pitched at the non-psychological level, it also receives an explanation pitched at a higher, more psychological level, which avoids the appeal to neurophysiological facts. Thus, this phenomenon is capable of receiving a psychological explanation and need not be deemed innate (though it arguably does arise in normal conditions). The problem with this response is that most current explanations of depression (adolescent or otherwise) seem to combine the two levels to some extent. Although this may lead the proponent of primitivism to suggest segregating such explanations into a psychological component, which would explain the non-innate aspects of depression and a non-psychological component, which would explain the innate aspects, it is clear that scientific explanations cannot be neatly parsed in this fashion.

explanations of the acquisition of psychological structures in evolutionary history as non-psychological. Rather, he considers psychological explanations to pertain only to ontogenetic acquisition, acquisition in the life history of the individual organism. He claims that 'it is almost invariably assumed—even among evolutionary psychologists—that evolutionary theories are *not* psychological ones ...' (2002, p. 251; emphasis in original). Samuels offers no evidence for this claim, which would disqualify evolutionary psychology from being considered a branch of psychology at all. But even if one accepts Samuels' ontogeny constraint, it can be shown that the *ontogenesis* (not just the phylogenesis) of innate structures is often capable of psychological explanation. Innate psychological structures are generally thought to be 'triggered' by certain stimuli that have the effect of making them manifest or active. Though many philosophers think of triggering as a 'brute-causal' process, it is by no means obvious that cognitive psychology has no interest in explaining how or why such triggering takes place. For triggering to be truly unexplainable by psychology, there would have to be no interesting psychological relationship between the trigger and the structure acquired. But that would be to conceive of triggers as bolts of lightning or bumps on the head. In fact, there is almost always a non-arbitrary, psychological relationship between the trigger and the acquired structure. And it is often of great psychological import to determine and explain which types of triggers activate innate structures, in what contexts, upon how much exposure, and so on. Consider recent discussions of what kind of exposure to language is needed for learning language. Psychologists, linguists, and other cognitive researchers take a considerable amount of interest in the quality and quantity of evidence that children must be exposed to in order to activate the allegedly innate psychological structure that is responsible for language acquisition. Participants to this debate draw conclusions concerning the degree of innateness of our language-learning capacity based on the nature and amount of the information that we are exposed to during the critical period of language-learning. Indeed, it is precisely because such a capacity is thought to be innate, or at least partly innate, that the nature of the trigger is of explanatory interest to psychology. In a recent critique of the evidence for nativism, Pullum and Scholz (2002, p. 17) go so far as to distinguish two types of language learning:

Let us distinguish two ways children might in principle learn languages. The first, *innately primed learning*, calls upon inborn domain-specific linguistic information (called here innate priming). The second, *data-driven learning*, does not; rather, it relies entirely on generalization from experience by the ordinary methods that are also used for learning other (nonlinguistic) things from experience.

The fact that these cognitive researchers consider both modes of acquisition to be types of *learning* is a clear indication that they are interested in exploring the psychological mechanisms and processes by which each proceeds. In fact, Pullum and Scholz (2002, p. 47) go on to speculate that there may be no neat demarcation

line between the two types of learning. These remarks serve to show that the debate between nativists and non-nativists is not about how much is explainable by psychology, but rather what sort of psychological explanation is in play in each of these two types of learning. An explanation of acquisition in terms of innate priming is still a psychological explanation even though it does not appeal to the formulation of hypotheses, collection of evidence, and so on.

I conclude that primitiveness is not sufficient for innateness since it applies to a range of other ways in which psychological structures can be acquired, and the proposal to modify it by adding a 'normalcy condition' amounts, at best, to a promissory note in need of elaboration. Nor is primitiveness necessary for innateness, since it deems some genuinely psychological explanations to be non-psychological, even if one accepts the 'ontogenetic constraint' on what makes an explanation truly psychological.

#### 4. Innateness Revisited

The understanding of innateness that I will be defending is not particularly original or novel, since I would argue that it has been implicit in the discussion of our innate mental capacities ever since Socrates' fateful encounter with Meno's slave boy. It also seems to have been the working concept of many cognitive scientists since the appearance of Chomsky's work in linguistics. Moreover, it was given philosophical articulation around three decades ago by Stephen Stich, who, however, noted certain problems with it and stopped short of endorsing it.<sup>10</sup> But I would argue that the hackneyed quality of this account serves to give credence to it, since it suggests that it is precisely the conception that has figured in many of the historical and contemporary debates surrounding the issue.

The dispositional account of innateness says that a cognitive capacity *C* (output) is innate for a particular organism *O* just in case *C* would become manifest in *O* as a result of environmental conditions *E* (input) that are impoverished relative to *C*. Such an impoverished input is said to be a *trigger* for the resultant output. Like all dispositional accounts, this analysis contains a crucial subjunctive element: it states that the cognitive capacity *would* become manifest if triggered. Therefore, it cannot be made equivalent to a material conditional:

*C* is innate for *O*  $\equiv$  (*E* is impoverished  $\rightarrow$  *C* becomes manifest in *O*).

This would lead to the result that a capacity *C* would automatically be considered innate if the environmental condition *E* is not impoverished. Clearly, however, if the manifestation of a cognitive capacity occurs as a result of conditions that happen

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<sup>10</sup> For details, see Stich, 1975; for an attempt to remedy some of the main problems noted by Stich, see Khalidi, 2002.



not to be impoverished, that should not guarantee its innateness.<sup>11</sup> Accordingly, a more promising way of understanding what it is for a cognitive capacity C to be innate for an organism O is to explicate it in terms of a subjunctive conditional, as follows:

If O were exposed to E, then O would manifest C.

To determine whether conditions are indeed informationally impoverished, we would need to undertake a comparison between the informational content of those conditions and the resulting cognitive capacity; that issue will be addressed later in this section. But before tackling that issue, some remarks are in order on the subjunctive conditional. There is no widely accepted way of evaluating the truth conditions for such conditionals, and some assignments appear to work better for some subjunctive conditionals than for others. I propose that this subjunctive conditional is to be considered true for a particular organism O just in case O manifests C in some impoverished condition E, false in case O fails to manifest C (a capacity cannot be considered innate if it is neither manifested in impoverished conditions nor in rich conditions), and undetermined in case O manifests C in relatively rich environmental conditions. It might be objected that the organism may fail to manifest the capacity in impoverished conditions, not because the capacity is not innate, but rather because of intervening circumstances that prevented its manifestation, for example severe depletion of resources that would threaten the organism's survival, or brain damage that would harm the neural basis for the cognitive capacity in question. This shows that we need to add a clause referring to 'normal circumstances' to the initial proposal:

If O were exposed to E in normal circumstances, then O would manifest C.

However, it must be stressed that 'normal circumstances' in this context simply refers to those circumstances necessary to the proper functioning of the organism. As long as these are in place, no further condition needs to be placed on the circumstances that need to obtain for an innate cognitive capacity to be manifested. (This point will be further justified in the next section, where a more direct contrast will be drawn with the appeal to normalcy that is made by other accounts of innateness.) Another objection might balk at assigning an undetermined truth value to the conditional in case an innate cognitive capacity is manifested in circumstances in which the organism is exposed to a relatively rich stock of information. However, the fact that a cognitive capacity C manifests itself in

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<sup>11</sup> Compare a material-conditional analysis for the dispositional property of water-solubility:  $\forall x [Wx \equiv (Ix \rightarrow Dx)]$ , where W: is water-soluble, I: is immersed in water, D: dissolves. The conditional within parentheses is true in case  $\sim Ix$  (x is not immersed in water), which is clearly not the intended result. The point is a familiar one and is clearly enunciated in Hempel, 1950.

organism O in a relatively rich environment, leaves us with no way of ruling on whether it would have manifested itself in an impoverished environment. That is why the truth value of the subjunctive conditional is considered to be undetermined in such a case, and it will therefore be undetermined whether or not C is innate for O. But, as I will explain below, if O belongs to a species S, for whose other members we have found (based on previous evidence) C to have been manifested in impoverished E, then we may have good reason to assert that C is innate for O, even if this particular organism has been reared in a relatively rich environment. Finally, in case O is not exposed to an impoverished environment, but a rich one, and C fails to be manifested, it seems clear that a capacity that fails to manifest itself even in a rich environment would a fortiori not manifest itself in an impoverished one (again, given circumstances necessary for the proper functioning of the organism). The subjunctive conditional is false in this case, and we can safely conclude that the cognitive capacity is not innate.<sup>12</sup>

Before explicating this account further and showing how it can be put into practice, it will be useful to say a few words about some of the central terms it contains, namely: *cognitive capacity*, *manifest*, and *environmental conditions*. *Cognitive capacities* are meant to comprise structures, mechanisms, modules, beliefs, and concepts, as well as related psychological items with a cognitive dimension. As I have already mentioned in the introduction, the account is not meant to apply to psychological states or structures in general, only cognitive ones, that is to say, mental states with representational content. This may be considered a limitation on the account, but it is a limit that has already been clearly advertised. When it comes to the question of *manifestation*, it must be observed that many psychological items are themselves dispositions or capacities of some kind, so innate items are doubly dispositional, in the sense that their manifestation is not necessarily an occurrence or an event but rather the emergence of a capacity. Even when manifest they are a matter of competence rather than performance, to use a distinction that has become canonical in cognitive science. There should be nothing troubling about this feature of innateness, since cognitive scientists have ways of judging that a certain cognitive structure—whether it is linguistic competence in humans or birdsong in flycatchers—is manifest or not. Finally, the account makes use of the

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<sup>12</sup> There are some points of analogy, as well as disanalogy, with a dispositional predicate such as *x is fragile*, which can be associated with the subjunctive conditional: *if x were relatively lightly stressed, then it would break* (cf. Mellor 2000, p. 758). This conditional can be taken to be true in case the object is lightly stressed and breaks, and false in case it is lightly stressed and fails to break. Moreover, at least some authors would allow that the truth value is undetermined in case the object is not lightly stressed and breaks. However, a disanalogy crops up in the case of an object that is not lightly stressed and does not break. Here, it is implausible to conclude that the subjunctive conditional is false and that the object is not fragile. That is because ‘not lightly stressed’ is usually taken to mean: ‘not stressed at all’ rather than ‘heavily stressed’. Whereas ‘not exposed to impoverished environmental conditions’ is taken here to be equivalent to ‘exposed to rich environmental conditions’.

notion of *environmental conditions*, which needs to be interpreted quite liberally. It should be considered vague enough to include various types of environmental input, including input from other organisms. Also, environmental conditions must be understood in this context as perhaps persisting over a long period of time and as sometimes being under the deliberate control of experimenters. Now that a few of the central terms in the account have been explicated, I will proceed to more substantive issues.

In criticizing primitivism, I argued that triggering should not be understood as a 'brute-causal' relation between environmental input and cognitive output. Rather, in cognitive science, environmental triggers are generally thought to bear some relation to the resulting psychological state of the organism. The dispositional account of innate cognitive capacities relies heavily on this basic insight. The main point about the triggering relation is that a comparison of the trigger (input) to the cognitive capacity (output) reveals that the former is relatively impoverished by contrast with the latter. This way of putting things immediately presents us with two challenges. The first is to say how one can effect a comparison at all between environmental conditions and a cognitive structure in such a way as to be able to rule that the former is impoverished relative to the latter. The second challenge involves stating *how* impoverished environmental conditions have to be in order to be counted as truly impoverished. In fact, one could say that these represent two types of relativity inherent in this account of innateness. The first type of relativity concerns the relation between input and output, since this theory of innateness maintains that the input must be impoverished relative to the output. The second type is relativity among inputs, since impoverishment is itself likely to be a relative matter, to be judged by comparing different environmental conditions.

The first question is clearly more fundamental than the second, but despite appearances, a preliminary answer to the second question can be ventured before addressing the first in detail (and eventually returning to the second). The kind of relativity involved in comparing inputs is no different in principle than that involved in deploying any qualitative property, whether dispositional or not, especially when one attempts to press it into service in more precise scientific contexts. To see this, it will be useful to call up another dispositional property, and one that is often used as a paradigm in the philosophical literature on dispositions, namely *fragility*. D. H. Mellor (2000, p. 758) points out that *x is fragile* 'means something like' the following subjunctive conditional: *if x were relatively suddenly and lightly stressed it would break*. In addressing the analogous issue of how to understand the term 'relatively' in this conditional, Mellor responds by saying that fragility, like most dispositions, comes in degrees. But he argues that this is not a problem specific to dispositional properties, since it is 'just an instance of the general question of how to map qualitative predicates onto corresponding quantities: how hot is hot? (2000, p. 758)'. As Mellor notes, the answer varies according to our interests, but as long as these interests are clearly enunciated there is no danger of ambiguity or misunderstanding. It might be objected that in the case of fragility our interests can be defined quite precisely and a quantitative

measure can be readily supplied, but that this is not the case when it comes to a dispositional predicate such as *is innate*. If one is involved in assessing the fragility of an object composed of some type of material, one could specify the type of stress (e.g. the impact of a certain hammer) and further spell out the force with which this impact is to be administered (e.g. 10 Newtons). If object A breaks as a result of this operational test, we may conclude that A is fragile, though in another test (dropping from a certain height, say 10 meters, onto a certain type of surface, say concrete) we may conclude the opposite. There is no risk of contradiction as long as one spells out the specific test in each case, perhaps stating explicitly that object A is fragile<sub>H</sub> (when struck with a hammer) but not fragile<sub>D</sub> (when dropped from a height). Furthermore, one could draw a line or set a standard for each of these two operational tests, for example, ruling that any object that breaks when it receives an impact from a hammer with a force of 10 Newtons will be considered fragile; anything that does not is non-fragile. The line that one draws in these cases may or may not be arbitrary, but the point is that one can draw it with any desired precision. Moreover, if the line *does* seem arbitrary in some cases, one can at least make comparative assessments of relativity for each operational test. Thus, if object A breaks when struck by a hammer with a force of 10 Newtons, but object B does not, then we can conclude that, *according to this operational test*, A is *more fragile* than B (or more simply, A is more fragile<sub>H</sub> than B). By contrast, when it comes to innateness, it may be objected that there are no such operational tests, and therefore there is no prospect of specifying a standard or limit to distinguish what is innate from what is not innate, or even of making comparative assessments of innateness. In order to address this objection more fully, we will need to elaborate on the first type of relativity discussed above, impoverishment of input relative to output.

The first type of relativity has no apparent analogue in the analysis of standard dispositional predicates such as *is fragile*. That is because the dispositional analysis of innateness involves a comparison between input and output that is absent from the analysis of other dispositional predicates. Since an innate cognitive capacity is one that would become manifest as a result of an input that is impoverished relative to the output, there is a further type of relativity involved in the predicate *is innate* that other dispositional predicates lack. The question is, how is one to assess relative impoverishment between input and output? One natural way to proceed is by observing that certain types of environmental stimuli carry information, as do cognitive capacities. Therefore, one could attempt to quantify the informational content carried by the stimuli to be found in the environmental conditions (input) and compare it with that contained in the cognitive capacity (output), concluding that the input is impoverished if and only if the informational content of the input is greatly outweighed by the informational content of the output. This is not the line that I intend to take, for two reasons. The first is that I am skeptical of the ability of quantitative information theory as currently conceived to capture full-blown cognitive content for even the most rudimentary cognitive capacities. A contrast can be drawn between *intentional* information, which is hard if not

impossible to quantify, and *causal* information, which can be quantified but is not unambiguous enough for our purposes.<sup>13</sup> The problem is that the core tenet of the causal notion of information is that Y conveys information about X if and only if Y exhibits reliable causal covariation with X. But there are surely numerous aspects of the environment that covary causally with the acquisition of a particular cognitive capacity, not all of which convey information that is relevant to the information inherent in that capacity.<sup>14</sup> So this notion is not fine-grained enough to identify the particular stimuli that would be informationally relevant to a certain cognitive capacity. The second reason for not pursuing the strategy of trying to quantify information is that I will argue that cognitive scientists already have at their disposal certain reliable ways of assessing impoverishment without attempting to quantify informational content or to measure it with any degree of precision. Some examples will help make this case and will also be useful in addressing the objection considered above, namely that there are no operational tests that would enable us to make either absolute or relative assessments of innateness, as we seem to do with fragility.

Consider researchers who are interested in investigating the innateness of birdsong in a population of birds of a particular species, S. The standard approach is to take a population of birds of this species and to subject them to various conditions,  $E_1, \dots, E_n$ , observing in each case whether the competence for birdsong emerges upon maturity. These conditions are usually chosen precisely because they are thought to be relatively impoverished in terms of the input they provide (i.e. compared to the resulting competence). In the case of birdsong, such impoverished conditions might include: deafening, acoustic isolation, lack of contact with conspecifics, and so on. If, to use a simplified example, birdsong competence emerges at maturity when a population of birds from a particular species are reared in isolation, researchers tend to conclude that birdsong is innate in that particular species of bird.<sup>15</sup> Now this might be said to be an unwarranted conclusion, since there are other conditions that might have led us to qualify the judgment of innateness. But notice that this judgment is no worse off than our earlier judgment that an object A is fragile on the grounds that it broke when it received a blow from a hammer. Sure enough, we might be led to qualify that judgment, depending on the results we obtain in other conditions (when dropped from a height), but that does not necessarily invalidate the initial finding. For instance, if it turns out

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<sup>13</sup> The distinction between the causal and the intentional notions of information is made in Sterelny and Griffiths, 1999.

<sup>14</sup> For related and more extensive criticisms of the causal notion of information for these purposes, see Griffiths, forthcoming.

<sup>15</sup> One complication that I am ignoring for the sake of simplicity is that a population of birds of the same species may not all manifest the same cognitive capacities in the same environmental conditions. Members of a bird species are not identical in every respect, like wine glasses coming off an assembly line. When all members of the sampled population do not exhibit the same capacities, the result can be reported in statistical terms.

that birdsong emerges when the birds are reared in isolation ( $E_1$ ) but not when they are deafened ( $E_2$ ), we might say that it is innate relative to the first condition  $E_1$  but not the second  $E_2$ . We may even, as with fragility, rule that birdsong in species  $S$  is innate<sub>1</sub> (for isolation) but not innate<sub>D</sub> (for deafening). Furthermore, for each of these conditions, we may be able to delineate differences of degree, for example partial deafening as opposed to complete deafening. This is analogous to varying the force of the hammer blow or varying the height from which an object is dropped, when it comes to fragility. In the case of birdsong, another way of assessing degree of innateness focuses not on the environmental condition but rather on the extent to which the emergent song resembles that of birds reared naturally in the wild (which would be roughly analogous, in the case of fragility, to analyzing the extent of breakage rather than the force of the hammer blow).<sup>16</sup> If birdsong shows too many 'deficits' when it becomes manifest in the extremely impoverished condition that is being investigated, then researchers no longer consider it innate. This is tantamount to drawing a line that enables them to rule how intact this cognitive capacity would have to be to be considered innate.

Thus far, we have been concerned with discussing innateness in a particular organism or a particular population of organisms. In supplying the truth conditions for the subjunctive conditional associated with innateness, I claimed that the truth value of the conditional is undetermined in case an organism manifests the cognitive capacity under investigation in a relatively rich environment. However, we can still make a claim of innateness about such an organism if we have already found the capacity to be manifest in a random sample of individuals of that species in relatively impoverished environments, simply by generalizing inductively from the sample to the entire species. We conclude this inductively from a number of trials with individual organisms who have manifested  $C$  in the same environmental condition  $E$ , or similarly impoverished ones. As with other dispositional properties, much of the work of cognitive scientists consists in specifying which conditions  $\{E_1, \dots, E_n\}$  are especially pertinent to such a claim, and in justifying their choices. When it comes to any given cognitive capacity, researchers sometimes take one condition to be more decisive than others, as acoustic isolation seems to have been for a long time in birdsong studies. In a survey article, Ball and Hulse (1998, p. 39) note that early ethologists used what was called the 'Kaspar Hauser approach'. Birds were raised in isolation, especially acoustic isolation, and if they failed to produce normal song at maturity, this was taken as an unequivocal demonstration that song is learned, whereas if they did, the capacity for birdsong was held to be substantially innate. Later, such judgments were qualified as other species were tested and as different conditions were considered, for example deafening, tutoring by audiotape, and so on. In all cases, what seems operative in choosing the set

<sup>16</sup> For example, Ball and Hulse (1998, p. 43) state: 'When songbirds are raised in acoustic isolation, the abnormal song that is produced retains species-typical attributes such as the number of notes per song and the number of trilled syllables per song'.

$\{E_1, \dots E_n\}$  is the question: Are these conditions impoverished relative to the content of the cognitive capacity in question? However, it may not always be obvious which conditions are the impoverished ones, and this is often a subject of debate in cognitive science, sometimes leading to additions and revisions (in the process perhaps modifying and reinterpreting their basic assumptions).<sup>17</sup> But eventually, a consensus often emerges within the scientific community that one or a few impoverished conditions are particularly germane for the assessment of the innateness of a particular cognitive capacity. This effectively becomes enshrined as the standard for subsequent research, and it enables scientists to emerge with unequivocal judgments of innateness.

A complication needs to be mentioned at this point, namely that the environmental conditions  $\{E_1, \dots E_n\}$  cannot always be neatly ranked in terms of impoverishment. Because of the complex interaction of the causal factors (genetic, environmental, and so on) involved in the development of any organism, we cannot always expect that manifestation relative to some condition  $E_i$  can be taken to imply manifestation relative to some other condition  $E_j$ , which is intuitively less impoverished than  $E_i$ . To take a hypothetical example, it may turn out that members of a certain species of bird develop song even when deafened, but they do not do so when they are not socially reared and have not had contact with conspecifics (though their hearing is intact). Both are impoverished environments but they are impoverished in different ways and they cannot simply be ranked quantitatively. Moreover, in another species, the opposite could conceivably be the case (birdsong emerges when reared in isolation but not when deafened). That is why relativization to some condition is ineliminable from assessments of innateness.

Now that we have seen how impoverished conditions can be identified and used to serve as a standard or operational test for innateness, it is worth taking a closer look at how comparative assessments of innateness are made. *Prima facie*, it appears as though two main types of comparative claims can be made, among species and among cognitive capacities: (1) comparing cognitive capacity  $C_1$  in species  $S_1$  to the same capacity  $C_1$  in another species  $S_2$  (e.g. birdsong in flycatchers to birdsong in zebra finches);<sup>18</sup> (2) comparing cognitive capacity  $C_1$  in species  $S_1$  to another cognitive capacity  $C_2$  in the same species  $S_1$  (e.g. birdsong in flycatchers to nest-building in flycatchers). In the first case, the form of the claim might be: birdsong is more innate in  $S_1$  than in  $S_2$  relative to condition  $E_1$ . Thus, if  $S_1$  develops song when isolated but  $S_2$  does not, we can safely conclude: the capacity for birdsong is more innate<sub>1</sub> in  $S_1$  than in  $S_2$ . If both do, we may judge that they

<sup>17</sup> Johnston (1988, p. 626) mentions a number of non-obvious conditions that may be relevant to the acquisition of birdsong, for example whether the bird hears calls of siblings, calls of parents, has social stimulation, or hears song pre-natally.

<sup>18</sup> What constitutes the same capacity in different species may in some instances be contentious; but there are again rough-and-ready ways of making this judgment, and many cases that are quite uncontroversial.

are both innate (to some extent), but we need not leave it at that. As mentioned above, rankings can be instituted that depend on how closely the emerging song resembles the song of birds reared normally in the wild. In the second case, when it comes to comparing different cognitive capacities  $C_1$  and  $C_2$  for the same species  $S_1$ , things are much less straightforward, to the point that it is far from clear that such judgments are generally warranted. In these cases, it seems that we may have to cite two sets of conditions,  $\{E_1, \dots, E_n\}$  for  $C_1$  and  $\{F_1, \dots, F_m\}$  for  $C_2$ , since the fact that different cognitive capacities are under investigation implies that different conditions will be relevant to each. Hearing conspecific song is obviously more directly relevant to the capacity for birdsong than it is for the capacity for nest-building. This means that any comparison that one might draw will have to be effected relative to different conditions, making a judgment of relative innateness precarious at best. But in some cases the same or analogous conditions may be involved, especially if the cognitive capacities lie within the same general domain. For example, such judgments have been made in humans concerning different cognitive capacities within the domain of spatial relations. Infants have an earlier understanding of the continuity and solidity of objects (at least as early as 2½ months) than of the effects of gravity and inertia (6 months). Therefore, Spelke (1991) conjectures that infants have a more substantial innate endowment when it comes to the former than the latter. That is because she posits that infants are exposed roughly equally to these different aspects of the physical domain and that they have roughly equal perceptual evidence for each (so that the impoverishment of their natural habitat is roughly the same for both). In this case, earlier manifestation corresponds to a greater degree of innateness.

In the course of this discussion, it should have become clear that although there is no quantitative way of measuring the informational content of the trigger, there are still robust ways of assessing the informational content of different conditions relative to the resultant cognitive capacity in well-defined experimental or natural conditions. Cognitive scientists have no trouble isolating a set of relatively impoverished conditions  $\{E_1, \dots, E_n\}$  that are relevant to the acquisition of some cognitive capacity. In addition, they often fasten on to one or a few such conditions when studying any given cognitive capacity, so that judgments of innateness can be relativized to that condition, and it effectively becomes the operational test for the innateness of that capacity. For any given condition, a definite judgment can be made concerning innateness or lack thereof (and degrees of innateness may also be determined depending on the nature of the condition). Moreover, although relative impoverishment cannot generally be determined among these conditions, there are two main ways in which comparative judgments of impoverishment can be made. First, one can compare the same capacity in different species relative to a given impoverished condition. Second, in a more restricted fashion, one can compare different capacities within the same species provided they fall broadly within the same general domain (so that similarly impoverished conditions are involved). These judgments of innateness and comparative intra-specific and inter-specific assessments of innateness serve to



address the first challenge posed above concerning how input can be compared to output in order to achieve determinations of innateness with regard to specific cognitive capacities. They vindicate the claim that what I called the first type of relativity inherent in this account of innateness (impoverishment of input relative to output) can be dealt with scientifically without making a precise quantitative determination of informational content. Meanwhile, the second type of relativity is addressed when scientists single out one condition as a criterion for determining innateness, or when they draw a line pertaining to that operational test, which effectively serves as a benchmark for innateness.

Now that we have seen how the dispositional account of innateness can be put into practice to deliver judgments concerning the innateness of cognitive capacities, with examples provided mainly from research concerning the cognitive capacity of birdsong, it is worth commenting on the paradigmatic case of a putatively innate cognitive capacity, namely the human capacity for language. In this case, mainly for ethical reasons, the only condition that is systematically examined is that of our natural habitat. Therefore, the debate focuses not so much on relative innateness in comparing a range of different conditions, nor for that matter, on comparative assessments with other species (many researchers would say that there is no analogous or homologous capacity in other species), but rather on ascertaining whether the natural environment of humans is indeed linguistically impoverished when compared with the resultant cognitive capacity of language mastery. Much of the debate revolves around what is known as the 'argument from the poverty of the stimulus,' a fact which fits well with the dispositional theory of innateness, simply because a finding of an impoverished stimulus relative to linguistic ability is generally taken as confirmation of innateness, the degree of impoverishment being generally correlated with the degree of innateness. To focus the discussion, the cognitive capacity for language is often broken down into various elements in order to compare the linguistic competence in each narrow area with the nature of the stimulus for that particular aspect of the resulting competence. Thus, for example, in a recent discussion Lidz *et al.* conclude that when children acquire linguistic knowledge about how to use 'one' in certain anaphoric contexts, such knowledge must be triggered rather than learned, on the grounds that 'anaphoric uses of *one* that are syntactically uninformative vastly outstrip the informative uses in the input, and the data that the infant would need in order to learn the syntax of *one* occur at a rate (0.2%) that is indistinguishable from noise in the input' (Lidz *et al.*, 2003, B68).<sup>19</sup> The statistical comparison of the number of occurrences of a certain syntactic element in the input with the mastery of the syntactic construction at issue is made possible by focusing closely on a single phenomenon of this kind, which is thought to be mastered thanks to the human capacity for language. This

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<sup>19</sup> This conclusion has not gone unchallenged; see for example Regier and Gahl, 2004. For a philosophical clarification and defense of the argument from the poverty of the stimulus, see Laurence and Margolis, 2001.

manner of assessing innateness may be unusual among cognitive capacities, given the nature of human language and its structural complexity, though there is sometimes an attempt to break down other cognitive capacities into certain component parts.<sup>20</sup> This has the effect of enabling scientists to make direct comparisons more readily between input and output, and drawing conclusions as to the impoverishment of the input.

## 5. Comparisons, Contrasts, and Objections

The dispositional theory of innateness that I have sketched out in the previous section can be criticized on various counts. But before raising some objections to it, I will expand further on the differences between this account and others, in particular showing how it is superior to the both the invariance account and the primitivist account discussed in Section 3.

The account proposed in the previous section is not meant to be an attempt to reduce (much less eliminate) any ascription of an innate cognitive capacity to the statement of a subjunctive conditional, but rather an attempt to provide a theoretical explication of this dispositional state in terms of a subjunctive conditional.<sup>21</sup> The account says that any claim that a cognitive capacity *C* is innate for an organism *O* is equivalent to a dispositional claim to the effect that *C* has a tendency to be triggered in *O* in a relatively impoverished environment *E*. That dispositional claim is in turn explicated in terms of (rather than reduced to) a subjunctive conditional that *O* would manifest *C* in (some) impoverished environmental condition *E* (given circumstances necessary for the proper functioning of the organism). *Prima facie*, there is a similarity between the invariance account (mentioned in section 3) and the dispositional account. If a capacity is invariant, manifesting itself in a wide variety of circumstances, then it is plausible to think that it will need relatively little triggering to be manifested. Also, if a capacity needs little triggering, then it is natural to think that it will be manifested in a variety of different circumstances and will therefore be relatively invariant. But the two conceptions are far from equivalent. To see this more clearly, notice that invariance is neither necessary nor sufficient for having a disposition to be triggered. A cognitive capacity can be invariant but not disposed to be triggered in case there is some stable feature of all (or many) environments that leads to the manifestation

<sup>20</sup> See note 17, above.

<sup>21</sup> Though I am not a reductionist about dispositions, I will not take a stand here on what dispositions are, ontologically speaking. Suffice it to say that attributions of dispositional properties are not analytically equivalent to statements of certain associated subjunctive conditionals, for the simple reason that there are generally no analytic definitions in empirical science. This is nicely illustrated by Sober, 1982, where some examples are put forward from scientific inquiry in which scientists reject the existence of a certain disposition, though they concede that the associated subjunctive conditional is valid.

of the capacity, but that feature makes a sizable contribution to the resulting capacity (e.g. the belief that water quenches thirst). Moreover, a cognitive capacity can be disposed to be triggered without being invariant. Consider the case of an innate capacity that is manifested only in the presence of a rare trigger (e.g. exceptional aptitude at chess); such a capacity would not be invariant across a wide range of environments. Though the range of environments in which an innate capacity is manifested may be exceedingly narrow (and highly abnormal), this is not a problem for the dispositional view, which simply needs to compare the informational content present in the environment with that of the relevant cognitive capacity in order to determine whether a capacity is innate.

Next, it is important to show that the worries about necessity and sufficiency, which caused problems for both the invariance account and the primitivist account, do not do so for the dispositional view. Is having a disposition to be triggered sufficient for innateness? Suppose that a certain cognitive capacity is disposed to be manifested in an organism in impoverished environmental conditions. It may be thought that the capacity may yet not be innate, since it might arise in that organism as a result of some other mechanism, say (in the typical philosophical fantasy) an evil scientist rewiring its brain. But such a case is clearly no longer one in which environmental conditions are impoverished; the rewiring process somehow encodes information in the organism that we would need to take into account in understanding how the resultant capacity was acquired. Similarly, if the capacity were manifested in impoverished conditions, though as a direct result of some food that the organism ate, that would have to be factored into the input. Whatever was ingested somehow contained the information, so the capacity would not have been merely triggered after all. However, if the objector insists that the food may not have informational value but yet might lead to the learning of the birdsong, then we would be tempted to conclude that the environment was indeed impoverished and the capacity was innate, after all.

Is having a disposition to be triggered necessary for innateness? In other words, could there be an innate capacity that, however, does not have a tendency to be manifested in impoverished environmental conditions? This may be thought to be more plausible. At first, it might seem that there could be an innate capacity that fails to manifest itself in some impoverished conditions simply because those conditions are simply too impoverished to trigger it. However, the account does not state that an innate capacity is one that manifests itself in *all* impoverished conditions, merely that it does so in at least *some* impoverished condition. But a follow-up objection might envisage that all the impoverished conditions that are sufficient for the triggering of the innate capacity may happen to be so impoverished as not to enable the proper development and functioning of the organism. In other words, it may be that an innate cognitive capacity is not manifested in any impoverished condition because all such conditions happen to be so impoverished as to render the organism hardly capable of surviving, much less of cognitive development. However, such a possibility is conveniently ruled out by the 'normalcy' clause incorporated into the dispositional account of innateness: this

would be a case in which conditions are inadequate for the proper functioning of the organism. This relatively uncontroversial notion of normalcy is all that is needed in order to rule out a case in which an innate capacity is one that fails to be manifested in any impoverished condition. Moreover, it is the same kind of normalcy condition or *ceteris paribus* clause that is routinely invoked in empirical science in stating generalizations and constructing explanations.

Having defended the dispositional account against the charge that it does not provide necessary and sufficient conditions for innateness, I will go on to consider three additional objections to it. The first objection charges that this account of innateness is pitched at the wrong level. It may be thought that the dispositional property that has been sketched out in the previous section is merely a placeholder for a more fundamental underlying property. There is an extensive philosophical discussion of the relationship between dispositional properties and what is known as their categorical bases, the micro-properties that are supposed to underlie them. For example, when it comes to fragility, the categorical base is thought to be the microstructure of the material from which a particular fragile object is composed. There are widely varying philosophical positions concerning the precise relationship between the dispositional property and its categorical base. These range from the eliminativist position that holds that dispositional properties are not real and calls for dispensing with them in favor of their respective categorical bases, to the equally radical view that all properties in nature are at bottom dispositional (fragility no less so than mass or electric charge). The issues are involved and go far beyond the scope of this paper.<sup>22</sup> Generally speaking, I would venture that at least some dispositional properties will not be eliminated in favor of their putative categorical bases. But I will not try to defend the general claim here; it will be sufficient to give a brief justification as to why, in the case of this particular dispositional property, there is no prospect of elimination, or even reduction, to the categorical base. It might be thought that when a cognitive capacity has a tendency to be triggered as a result of relatively impoverished environmental conditions, this is an effect of a more basic (categorical) fact about that cognitive capacity, namely the fact that it is encoded in the genotype of that particular cognizer. Therefore, every time we judge that an organism has an innate cognitive capacity, we are judging not merely that that organism has a cognitive capacity that exhibits a tendency to be triggered, but rather that it has a cognitive capacity that has been antecedently specified in the organism's genotype. The instructions that produce or give rise to that capacity are literally encoded in the genes. Hence, the objection might conclude, the dispositional account of innateness should be eliminated in favor of a genetic account that explicates the innateness of a cognitive capacity in terms of what is encoded in the genes.

The problem with saying that the dispositional property of innateness is merely an eliminable or reducible placeholder for the property of being encoded in the

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<sup>22</sup> For a lucid survey, see Mumford, 1998.

genotype is that it rests on an overly simplistic account of the relationship between genotype and phenotype, particularly when it concerns complex phenotypic traits such as the possession of a cognitive capacity. As a great deal of recent biological research has shown, the biochemical reactions set off by genetic material bear a very distant causal relationship to any phenotypic features that are manifested in the mature organism. Therefore, because of the complex causal chain leading from genotype to phenotype, which makes it highly unlikely that we could identify any particular part of the genotype as encoding the information responsible for the production of a particular cognitive capacity, there is little prospect of eliminating the dispositional understanding of innateness or reducing it to its purported categorical base in the genotype.

There is another objection that can be thought of as originating from the opposite direction, as it were. This objection states that the dispositional theory of innateness does not take seriously enough the interactionist position in the nature–nurture debate. An objector might say that if one holds that an innate cognitive capacity is one that has a tendency to be triggered, then that is equivalent to saying that it was there all along, simply waiting to manifest itself, which is to commit a kind of preformationist fallacy. This, in turn, betrays a lack of attention to the complex developmental process that leads to the manifestation of any given phenotypic trait. The initial response to this objection is to deny that any preformationist claim is being made, and to insist that the dispositional theory merely presupposes that whenever there is an innate cognitive capacity in an organism, then there is a *potential* for manifestation in that organism, just as there is a potential for fracture in fragile objects. But (the objection might continue) in the case of fragility, the corresponding categorical property is present in a clear and straightforward sense (the molecular structure), but the capacity for birdsong is surely not simply present in the case of the newly-hatched bird (as I have just noted in response to the previous objection). Now admittedly, there is a difference between the case of the bird and that of the glass, in that development is required (with the environment contributing its share) before the innate trait will be ready to be triggered in the bird, whereas the glass is ready to be broken from the point of manufacture, as it were. By contrast, every organism is a work-in-progress. What this shows is that one cannot point to a newborn bird of some species and say: ‘Birdsong is innate in that bird,’ as one might point to a newly blown glass and say that it is fragile. Strictly speaking, unlike many other dispositional traits, innate cognitive capacities cannot be said to be in place before they are developed to the point that they are ready to be manifest. However, we often make predictions about the innateness of cognitive capacities in individual organisms, and we also make generalizations about innate cognitive capacities in an entire species. What we are doing in such cases is stating an expectation that a population of such organisms reared in (relatively impoverished) conditions would manifest birdsong competence at maturity. Such predictions or generalizations are made based on trials conducted with other organisms of the same type, as argued in the previous section. Therefore, any talk about innateness in an immature organism or an entire

population of organisms can be construed not in terms of a preformationist claim, but rather in terms of a prediction based on results obtained regarding similar organisms in a set of impoverished conditions. I have argued that, at the point at which the organism has become ready to manifest the cognitive capacity in question, the relative contributions of organism and environment can be teased apart, to some extent, by focusing on the informational content. This focus on informational content cannot be straightforwardly generalized to all traits, which is why it is applicable primarily to cognitive capacities.

Finally, there is an objection that raises a question as to whether the dispositional theory of innateness is an account of *innateness* as it is commonly understood, either in science or in common parlance. An objector might say that the fact that this theory only applies to cognitive capacities means, in effect, that the innateness of other phenotypic features or traits is not conceptually linked to that of cognitive features. This suggests that 'innateness' is an equivocal or ambiguous term, which means something different in cognition and in other domains (eye color, stature, congenital disease). It is difficult to reply to this objection in the absence of a widely accepted notion of innateness that is operative in other scientific domains. If such an account is eventually developed, then it may be possible to draw some connections between the two accounts, or to discover some features common to both. Until this occurs, one cannot claim that it is impossible. But if no such account is developed and the skeptics about innateness are correct (with respect to other domains), then we may have to conclude that while the concept cannot be rationally reconstructed in other domains, it can be given a respectable understanding in cognition. So it may be meaningful in this area of research but confused or meaningless in others. That is a conclusion that we might have to live with. As for the correspondence between this theory of innateness and our pre-theoretic or commonsense notion, the views cited from Griffiths in the first section have already cast some doubt on our possession of a clear and unambiguous commonsense notion of innateness. If that is indeed the case, then we should not expect this account to agree neatly with our naïve or lay concept.

## 6. Conclusion

The aim of this paper has been to articulate a concept of innateness that is both philosophically cogent and may be of use in empirical research in cognitive science. This account states that any claim that a cognitive capacity *C* is innate in organism *O* is equivalent to a claim that *C* has a tendency to be manifested in *O* in relatively impoverished environmental conditions *E* (i.e. it has a tendency to be *triggered*). That dispositional claim can in turn be given a theoretical explication in terms of a subjunctive conditional: If *O* were exposed to *E* in normal circumstances, then *O* would manifest *C* (where normal circumstances are simply those necessary for the proper functioning of the organism). The resulting dispositional theory of innateness has three principal virtues. First, by focusing on the notion of informational content,

it applies particularly to the concept of *innateness* as it appears in cognitive science, thereby avoiding the difficulties that have been brought forward against the concept in developmental biology. Second, it is capable of accounting for degrees of innateness and for making comparative judgments of the innateness of cognitive capacities. Third, it allows for certain aspects of the critique of innateness in the biological sciences, especially in taking into account the complex interactive relationship between genotype and phenotype and the non-additive aspect of the causal factors involved in the development of any biological organism.

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