In Defence of Nativism

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Abstract
There is considerable evidence for innate knowledge furnished by psychology & linguistics, yet widespread disbelief amongst philosophers in particular that there is any such thing. Empirical and conceptual arguments given in support of this scepticism are considered here and rejected.

Many areas of cognitive science ascribe knowledge to various sorts of agents — apart from adult human agents: infants, young children, animals of different kinds. Thus psychologists ask whether newborn infants with no previous visual experience represent occluded objects as continuing behind barriers or distinguish faces from other visual arrays; they ask whether dark-reared rats perceive depth on first exposure to light. Linguists likewise ask how children come to know the structural rules governing question-formation ignoring simpler serial rules from the outset, how children come to learn the complex constraints governing pronominal cross-reference. Often the knowledge ascribed seems as if it could not have been learned from the available data.

There is evidence that both infants and animals do have innate knowledge: Spelke, Carey, Hauser, Wynn et al have investigated animals’ and children’s representations of (I) inanimate objects, (II) agents, (III) agent-centred spatial relations, and (IV) numbers & sets. These researchers discovered some striking commonalities that led them to posit Core Knowledge systems that are domain-specific, encapsulated, fast and which exhibit signature limits. In regard to (I): By 4 months old, infants represent centre-occluded objects as connected. Even more impressive is the performance of newborn chicks in representing occluded objects as continuing behind their occluding barriers — imprinting experiments first presented a centre-occluded triangle to 2 day old chicks then subjected them to a stressful situation moving them into another cage. When presented with a choice between a complete triangle and a partial figure matching what they’d seen, chicks imprinted on the complete triangle even though they’d never seen one before. Some innate mechanism in chicks represents objects as continuing behind occluding barriers.

The same research has shown principles of Cohesion, Contact & Continuity underlie infants/animals cognitive representation of inanimate objects. These principles do not apply to representations of non-solid objects such as sandpiles: representations are domain-specific. Infants represent number n of objects behind occluder for n≤3 [a signature limit beyond which judgments are unreliable]. Representations are task-specific: applying to occlusion but not implosion. This object-representation system is also found in adult rhesus monkeys and survives in adult humans. This system also handles object-tracking, which has been found to be impervious to changes in object colour/shape etc.

Evidence for (III): Disoriented agents have 2 systems for locating objects: (1) a modular system attuned to the geometry of the spatial layout, and (2) an associative system linking landmarks to specific locations. Disoriented animals & young humans rely exclusively on (1) to reorient, and cannot incorporate (2) information in a Reorientation-task; landmarks are used only as direct cues to object location.

Rats & children (≤ 6y/o) will search for an object at a spatial location (e.g. north east corner of room) or near a landmark. But it was found they cannot combine (1)-styled information with (2)-styled information to locate cheese north east of the ball. Some elegant experiments by Hermer-Vasquez, Spelke and Katsnelson (1999) showed spatial language allows disoriented adults to easily reorient using landmarks. But by interfering with language-processing through use of a verbal shadowing task, this ability is lost.

Consider now some evidence for innate knowledge from linguistics. Take question-formation: Chomsky had noted that whilst the child can readily observe a simple declarative such as (1) transformed into the Yes/No question (2), the means by which this transformation is effected is not obvious.

(1) Philosophers are garrulous
(2) Are philosophers garrulous?
Two rules are compatible with such transformations:

Rule A: Move first occurrence of the word are to the front
Where Rule A is structure-independent, Rule B is structure-dependent. Fed initial data of same form as (1) which rule would we expect children to adopt? Clearly, Rule A. So using this Rule, for (3) below children should predict its Y/N question-form will be (4).

(3) Philosophers who are sedentary are garrulous
(4) *Are philosophers who sedentary are garrulous?
But (4) is ungrammatical (marked by an asterisk). Chomsky predicted & Crain & Nakayama subsequently confirmed [Crain, S. and Nakayama, M. 1987 “Structure dependence in grammar formation” Language, 63, 522-543] that children do not make this kind of mistake.

Unlike connectionist systems, children can only hypothesize structure-dependent operations. Whence, the

Article DOI: 10.5096/ASCS200929
signature trajectory of learning by abduction — trying out simpler hypotheses before settling on the correct one [i.e. learning by trials] — is absent in the case of learning how to form questions in English.

In spite of the psychological and linguistic evidence for the intelligent use of innately encoded information, some cognitive scientists and many philosophers suspect Nativism is either empirically false or else incoherent. Let’s first review the empirical grounds for the allegation of falsehood. The two most dominant reasons derive from (I) genetics and (II) connectionist models of learning:

(I) Genetics: If children or animals possess innate knowledge this must be because the knowledge is somehow encoded in the genome. But genes are inert without the right environmental triggers. So no claim of innateness can be defended — any allegedly innate trait must have been acquired in a particular learning environment.

(II) Connectionism: Innate Knowledge requires storage of propositions by appropriate symbols: sentences. Connectionist systems do not require symbolic representation. Connectionist systems exposed to ‘noisy’ (probabilistic, fragmentary) data abstract rules representing all possible relations between exemplars without symbolic storage of rules/propositions.

With regard to (I) Genetics: As Spelke has observed, the dispute between Nativists and Empiricists is not about how genes interact with the environment.¹ It is about how agents interact with the environment in acquiring information about it, i.e. the environment’s role in an agent’s knowledge-formation: does knowledge of objects and events in the world only develop as a result of associationist or abductive learning that occurs through encounters with those objects and events? Do infants only learn about the continuity of objects behind occluders by touching/exploring them as learning-theorists from Skinner to Piaget have thought? Can children only learn the meanings of logical expressions by observing their deployment in communication by competent speakers as a majority of philosophers and linguists contend?

These are questions about the origins of knowledge and the nature of information acquisition, they are not questions about genetic encoding. Indeed, the Nativist/Empiricist dispute would survive the discovery that there are no such things as genes, as it would survive the discovery that no truths about the world can, strictly, be encoded in the genome, as discussed below.

With regard to (2) Connectionism: Innate Knowledge requires storage of propositions by sentences. The claim is that Connectionist systems do not require symbolic representation. ‘Noisy’ data used to abstract rules represent all possible relations between exemplars WITHOUT symbolic storage of propositions. Let’s start with what is and is not in dispute between Nativists & Empiricists. Nativists hold:

(N) Some truths about the world are innately encoded.

(N) does not mean such truths must be or even are present from birth. The position is consistent with emergence of the relevant truths only with (physical and) psychological maturation.

Empiricists can and should accept the existence of innate cognitive mechanisms: (I) Innate sensory transducers & (II) Innate general learning mechanisms (GLM), which include imitation, association, abduction. We can add: innate dedicated neural machinery for depth perception, face processing etc to (I). Further, empiricists can also accept that certain types of information can be innately encoded in one species & learned via GLM in another: e.g. birdsong. Empiricists simply reject (N): the Nativist idea that truths about the world can be innately encoded.

The reason for this is because empiricists reject the idea of a priori empirical knowledge: Any truth about the world, any ‘contingent truth’, has to be learned, it cannot be stored a priori. To the extent that information can be coded into the neural circuitry of some organism it a fortiori cannot be known, empiricists aver. So this is the context within which relevance of Connectionist systems to Nativism has to be assessed:

Suppose some connectionist system SRN₁ can be trained up to learn question-formation in English, that another SRN₂ can learn the meaning of ‘ka’ in Japanese, and that a third, SRN₃, can learn to recognize faces. Through discerning the distributional properties in exemplars these SRNs have learned to correct form questions in English, the meaning of ‘ka’ & how to recognize faces respectively. Would such SRNs refute Nativist thesis that in humans question-formation, logical word meaning, face recognition are innate?

No more than the discovery that birdsong is learned in some species refutes fact that it is innate in others. Recall Empiricists reject Nativist thesis (N) that truths about the world can be innately encoded. Any truth about the world, ‘contingent truth’, has to be learned via GLM. Hence, to demonstrate Nativism is false, Empiricists must show that in each & every case relevant cognitive traits emerge purely as a result of learning. Have they attempted this task? No. Empiricists think Empiricism is somehow the default option — the most parsimonious/natural/simplest. They think

(A) Nativism requires extraordinary evidence.

Further, empiricists think:

(B) Whenever behaviour of O changes in respect R, O must have learned something causing this change.

Both (A) & (B) are false: With regard to (A), neither E nor N is the default option. E is no more ‘parsimonious’ or ‘simpler’ than N. Simplicity judges two complete theories for which there is a rich body of evidence. These conditions are not satisfied for any extent theories of cognitive structures for which N has been proposed. N concerns the initial state of O. Complete theory spans initial to mature theories.

¹ My comments on anti-nativist arguments based on genetics and connectionism draw extensively on Spelke (1998)
state. ‘Blank slate’ initial state theories require more complex learning stages to reach mature state.

The ‘change implies learning’ inference in (B) is fallacious, overlooking two alternatives:

(A1) Cognitive capacity remains constant throughout O’s development but ability to express it changes.

(A2) Cognitive capacity does emerge over development but cause of emergence is maturation or environmental triggering.

The upshot of these considerations is that Connectionism is no threat to Nativism, and neither is genetic theory. Nativism & Empiricism are both empirically testable. So why are so many theorists convinced Nativism is wrong? Some critics opine: “The whole idea of Nativism is incoherent!” — any information or rule that is pre-wired is a fortiori NOT known. How so? The dominant view in epistemology is that Knowledge entails belief. If you know that you are overweight you must also believe this. But in order to believe a proposition (such as you are overweight) you need to understand it.

But as some of the principles & rules deemed innate involve propositions too complex for infants or young children to possibly grasp, it is implausible to ascribe knowledge of these principles/rules to them. The situation is even worse when animals are ascribed innate (propositional) knowledge — knowledge that such and such is the case. For example, supporters of universal grammar (UG) in linguistics think children know Principle C and this knowledge explains their judgments of licit and illicit referential substitutions for pronouns:

(5) She danced whilst Alice strummed the guitar
(6) Alice danced whilst she strummed the guitar

Principle C rules that although ‘she’ can refer to Alice in (6) it cannot do so in (5): this is because the referring expression ‘Alice’ is C-commanded by the referring expression (R.E.) ‘she’ in (5) and R.E.s must be distinct in reference from any R.E. that C-commands them. So, as the dominant view in philosophy is that knowledge entails belief and belief requires understanding: K ⇒ B ⇒ U, the consequence drawn is that:

(K) No knowledge that p is possible without understanding p.

If (K) is true, young children cannot possibly know Principle C and neither can most adult speakers. And animals can have no (propositional) knowledge at all.

My (heterodox) response is that knowledge is the most general factive mental state FMS so that if Ø is a FMS, not only (1) but (2) holds below:

1. From S Ø' p can infer p
2. From S Ø' p can infer S Knows p

If I regret telling the boss he was a dang then I told the boss he was a dang. Worse, I also know that I told the boss he was a dang if I regret telling him.

So we have (1) S Ø' p ⇒ p; (2) S Ø' p ⇒ S Knows p, which we can write as:

(1) Øsp ⇒ p; (2) Øsp ⇒ Ksp

Why reject the dominant view in epistemology that Knowledge entails Justified True Belief? There are principled theoretical reasons for doing so, but I shall not canvass these here. I wish to argue purely from empirical cases:

Case I: Linguistic Knowledge (A)

4-5 year old children seem to have tacit knowledge of Principle C. So consider once more (5) and (6) below:

(5) She danced whilst Alice strummed the guitar
(6) Alice danced whilst she strummed the guitar

Young children know that although ‘she’ can refer to Alice in (6) it cannot do so in (5): they cannot articulate the principle governing this, cannot assent to it when it is put to them etc. yet they know each of its logical consequences. So they know, albeit implicitly, that as R.E. ‘Alice’ is C-commanded by ‘she’ in (7), Alice ≠ she since, as we saw before, R.E.s must be distinct in reference from any R.E. that C-commands them.

4-5 year olds have Non-Articulable Implicit Knowledge NAIK of Principle C: as Principle C is coded into the Language Faculty, children (& adults) have no conscious access to its content, only to its output (the linguistic phenomena it governs) in the form of its logical consequences constraining pronominal cross-reference etc. The information contained in Principle C structures the young child’s linguistic judgments.

We might say that young children implicitly believe and implicitly understand Principle C even though they cannot grasp any statement of it. This may be acceptable, provided ‘implicitly believe’ is not taken to mean ‘partially believe’ or, worse, ‘inchoately believe’. But I think this description should be resisted if only because the type of implicit knowledge in play here seems sub-doxastic as our subsequent cases show.

Case II: blindsight

Consider blindsighted Alf who has no sight in his right visual field. Suppose a cricket ball flies towards Alf’s right temple & Alf automatically ducks. Asked why he ducked, Alf can give no explanation: He has no visual experiences on which to base any visual beliefs. Yet he received veridical visual information in his blindfield about the ball speeding towards his right temple. That’s why he ducked. If subsequently informed by an observer that he must have
known the ball was coming, Alf will protest his ignorance: this is because even though Alf implicitly knew a ball was speeding towards his head he did not believe this since he had no visual experience of the ball on which he could base such a belief. Alf knew the ball was coming towards his temple. He had no idea he knew this: he knew without knowing he knew.

Is this really knowledge, though? Indeed it is. The visual information Alf computed veridically and reliably tracked the path of the ball towards his head. There is no plausible reason for thinking that visual states comprised of information gathered through this older visual pathway are any less factive than ordinary conscious visual states. So if we accept that conscious visual states are factive, we should also accept such sub or pre-conscious states as these are too. Whence Alf knew the ball was coming because he visually detected it was.

Some complain that nothing about normal cases can be inferred from pathological ones like Blindsight. Christof Koch & others have recently managed to induce blindspot-like states in visually normal subjects using ‘Continuous Flash Suppression’: Using CFS visual images of certain things can be hidden from a subject gazing straight at them. So straight males recognize an image of a naked woman and attend to it whilst disavowing any knowledge of the image. Yet they do know what they see since they recognize the image as an image of a naked woman and recognition is factive. But as with blindsight, since these subjects have no visual awareness of the image, they form no beliefs about the image.

**Case III: Animal Cognition**

The snake $s$ sees the mouse $m$ hiding in its hole. Let $\mu$ be the proposition that $m$ is in its hole. From condition (2) above governing factive mental states, we have $S_\mu \Rightarrow K_\mu$. So the snake $s$ knows $m$ is in its hole. We do not (and possibly cannot) know how $s$ represents $m$ (Mouse? Prey? Food?). But some proposition must exist to specify the informational content of what the snake sees & it is that proposition which specifies the content of the snake’s knowledge. So $K_\mu$.

Does $s$ believe that $\mu$ <the mouse is in the hole> by virtue of knowing that $\mu$, though? Whether $s$ believes $\mu$ depends on the snake’s cognitive architecture: perhaps snakes have no hypothesis-formation facility or any other types of central processes at all? Perhaps they have sensory modules that function independently of one another & no ‘Panopticognitve’ mechanism to collate and weigh the data from each module? If this were so and snakes have no beliefs, even then I submit that they may still see what we see & therefore know what we know when we and they see a mouse disappear into a hole.

**Case IV: Linguistic Knowledge (B): Knowledge of meanings of logical expressions**

There is compelling evidence children have innate knowledge of meanings of logical expressions for their language and that the meaning of the expression for disjunction in any language is inclusive-or. As adults, they discover disjunction carries a pragmatic implicature of exclusivity, and many become convinced ‘or’ or ‘ou’ or ‘ka’ or ‘huohze’ means exclusive-or rather than inclusive-or whilst others think it is ambiguous between inclusive & exclusive.

However, these folk are wrong. OR means inclusive disjunction across languages & nothing else. … Why? One reason is that exclusive disjunction’s basic logical properties diverge markedly from any natural language disjunctive operator’s. Thus I tell ESL student to complete the following sentence frame by putting the initial sentence in passive form ‘Petr likes Maria or … ’ to get the disjunction ‘Petr likes Maria or Maria is liked by Petr’. Suppose now that Petr does like Maria. Is the disjunction true? Clearly yes. At worst, the second disjunct is just redundant. But if ‘or’ is exclusive, the disjunction is false!

Stephen Crain and his colleagues have produced some impressive empirical evidence of innateness of inclusive disjunction: One really striking piece of evidence is Takuya Goro’s prediction about how young Japanese-speaking children would interpret disjunction as it interacts with negation: Thus consider the sentence:

(7) The pig did not eat the pepper or the carrot

Goro reasoned that Japanese children would interpret (7) to mean that the pig did not eat the pepper and did not eat the carrot. To English speakers this seems unremarkable since this is precisely how we interpret (7) except for the fact that adult Japanese speakers do not interpret the Japanese translation of (7) in (8) below in this way:

(8) Butasan-wa ninjin ka pi’iman-wo tabe-nakat-ta

Adult Japanese speakers take (8) to mean that it’s either the pepper or the carrot that the pig didn’t eat, but I am not sure which one he did not eat. That is in Japanese disjunction takes scope over negation in sentences like (8) whereas in English negation takes scope over disjunction.

Prior to Goro, no linguist had suspected Japanese children’s usage of sentences containing negations and disjunctions would diverge so sharply and systematically from their adult counterparts’. Goro argued that whilst the meaning of disjunction was universally inclusive-or, the question of logical dominance of one operator over another (logical scope) was governed by a parameter. If children were to discover the correct setting of the parameter, they would have to start out assuming it was set so as to ensure a more restrictive interpretation rather than a more inclusive one since otherwise they might never discover their error. This is a principle in learning theory known as The Subset Principle. Goro predicted and subsequently confirmed that Japanese children would interpret (8) as English children (and adults) interpret (7). Subsequent work has confirmed

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2 Tsuchiya, N and Koch, C (2005)
In Summary:

(i) There is considerable evidence for innate knowledge furnished by psychology & linguistics. Yet widespread disbelief amongst philosophers in particular that there is any such thing.

(ii) Empirical reasons for disbelief (genes, connectionism) are beside the point, and methodological reasons (simplicity, parsimony) are misguided.

(iii) Conceptual reasons of any substance seem based on worries about how one can know that p without believing p or, worse, understanding p (a prerequisite for belief).

(iv) But a number of cases involving animal cognition, blindsight (& CFS), grammatical and semantic knowledge made it plausible that for diverse reasons different types of agents can know p even when they do not believe p (they have no beliefs at all, no belief/disbelief in p, or no understanding of p).

(v) These cases all relied on the modularity of the knowledge in question and its unavailability to central processing (or conflict with other more firmly-entrenched central processing conclusions).

(vi) Thus rich propositional content can be innately encoded even when we do not realize or accept that it exists.

(vii) Innate propositional content is manifested in its availability to agents to structure their thoughts and thus enter into judgments and decisions; what makes such innate content knowledge are the factive mental states that deliver this innate content to the agent.

References


**Citation details for this article:**