

Steps toward Origins of Propositional Thought*

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Last lecture I sketched constitutive conditions on having representational mind, specifically on having perceptual states. I also outlined what is known about the evolutionary origins of perception. Those origins lie in simple animals – bees, spiders, locusts. In this lecture, I discuss constitutive and empirical conditions on having propositional attitudes.

I argued that all perceptual representational content contains both context-bound singular (or plural) referential elements and general attributive elements that accompany and are applied by the singular elements, and function to be accurate of perceived particulars. We allude to such general elements when we count an individual as perceiving a particular *as* such and such. The key difference between perceptual representational content and propositional representational content is that all propositional content contains a main predicate, an attributive that functions predicatively without being applied to make an attribution by a singular or plural, demonstrative-governed, referential application.¹

Main predicates do not function in referring, and are not applied attributively by a referential element. This functional independence of singular or plural reference is most saliently marked by the main predicate's having widest scope – outside the scope of any identifica-

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¹ Aristotle noted that every proposition must have a verb *De Interpretatione* 17a9-12, 19b11-16. I follow Frege in interpreting verbs (or main verb phrases) as dominant predicates.

tional, referential structure, or other noun-phrase-like structure. In perceptual contents, there are no main predicates. *All* perceptual attributives accompany and are applied by context-bound identificational referential elements to make attributions.

It is important here not to conflate accompanying and being applied by demonstrative-like referential perceptual applications with being *essential* to successful reference. An attributive like brown or body can accompany and be applied by a context-bound, referential, perceptual application, but fail to be veridical of what the perceiver succeeds in perceiving. One can succeed in seeing something, seeing it as a brown body, even if the thing in the physical environment that is perceived is not brown or a body. One can have a perception with the representational content that, brown body, and the perception can succeed in picking out something (say, a hologram) – the perceiver can perceive the hologram – even though neither brown nor body is veridical of it. Then the perceptual attributives, brown and body, accompany and are referentially applied in a perceptual identificational reference. But neither attributive need be veridical of the seen hologram in order for the hologram to be seen. The representational success of neither attributive is essential to the success of the perceptual reference, or to the success of that exercise of a perceptual capacity. I think that only some topological attributive like connected within a boundary is essential to successful reference in such a case. The particular occurrence of successful perceptual reference could not have been successful unless the attributive were veridical, or accurate, of the referent. A fuller specification of the perceptual state than 'that, brown body' would include such a topological attributive. To accompany and be applied by the occurrent demonstrative-like referential application, a perceptual attributive need not be an essential to successful reference by the application.²

The idea, rather, is that perceptual attributives *function* to be ap-

² Although I believe that there being *some* veridical attribution is essential to the success of perceptual reference – and have argued it more generally in 'Five Theses on *De Re* States and Attitudes', *op. cit.*, section III – I do *not* reduce reference to satisfaction of the attributive. Perceptual reference essentially depends also on causal connection. Moreover, I do not think perceptual reference is reducible to satisfaction plus causal connection. I doubt that there is any general, independent specification of what a "good", "non-deviant" causal connection would be. I take reference to be a fundamental and unreducible notion.

plied by the context-bound, singular (or plural), identificational reference, and to make an attribution to the purportedly perceived entity. Functioning to make an attribution to the perceived entity involves the sub-function of being veridical of – accurate of – the entity that the referential application functions to identify. In perception, this attributive function always serves and is subordinate to the larger perceptual function of identificational reference. The sole representational function of perceptual attributives is to effect an attribution as part of an identificational reference. Their scope is governed by a demonstrative-like, context-bound referential application: they are applied *by* the referring element. They fail their function in the identification if they are not veridical of the perceptually referred-to (perceived) particular, or if nothing at all is perceived. A given perceptual attributive need not be essential to the success of the identificational perceptual reference. All perceptual attributives are, however, applied within the scope of a context-bound, identificational, referential application in this way. Although attributives that function in propositional structures – *conceptual attributives* – can, of course, function within context-bound identificational or other noun-like referential structures, and can be applied by demonstrative-like referential applications, they can always also function outside the scope of such structures. Indeed, they can always function as main predicates. Thus, for example, although the conceptual attributive body can occur in that_i body is spherical – within the scope of a context-bound identificational, referential application – the same attributive can function outside such scope. It has this additional function because it marks competencies to employ it outside such scope, in particular, as the main predicative concept in a propositional structure. Thus the conceptual attributive body can occur not only in that body_i is spherical, but also in that_i connected shape is a body.

Further, conceptual attributives can always function predicatively – and not within the scope of a referring expression – but *not to make an attribution to any purportedly demonstratively identified entity*. They can occur in predicative position, but not function to be veridical of any *de re* identified entity. There are at least three ways in which conceptual attributives – as distinguished from perceptual attributives – can function in this way.³

³ I will illustrate this point with predicates that occur outside the scope of a context-bound identificational, referential singular (or plural) application – or outside

First, the conceptual attributive body can function predicatively to make an attribution while not functioning to make an attribution to, or be veridical of, any (purportedly) *de re* identified entity or entities. For example, in every planet is a body the attributive body functions predicatively to make an attribution; but the attribution does not function to be to any particular identificationally (*de re*) referred-to entity.

Second, the attributive body can function predicatively as part of a larger attribution, while not itself making any attribution at all. For example, in the beliefs

that_i smudge on the hill is not a body,
if that_i smudge is a body, it is a large one, and
some shape on the hill is either a body or a shadow,

the attributive body functions predicatively; but it does not function to make an attribution.⁴ One can see this by reflecting on the fact that in a committal attitude (say, a belief) with any of those representational contents, the belief can be true, and the occurrence of body can be representationally successful, even if the attributive is not veridical of any entity referred to or quantified over in the propositional content. It therefore does not by itself function to make an attribution to any entity, much less a contextually identified entity.

Third, the attributive body can function predicatively but not be

the scope of any noun-like representational structure. But the point applies to predicational occurrences within such scope. For example, in that_i non-body_i body_i is not a main predicate; it occurs within the scope of a context-bound referential singular application; but it does not function to make an attribution to a contextually identified entity. I believe that in perception there are no negations as logical operators, either as predicate negations or as propositional negations. There are contraries – attributives that elicit opposing responses. But true logical negation is absent from perception.

I focus, in my illustrations, on predications outside the scope of identificational, referential applications because I am interested, ultimately, in explaining the existence of dominant predicates in propositional structures. Such predicates, outside the scope of any referring structure, are the mark of propositional structure. Ultimately, I intend to explain the structure of dominant predicates in terms of representational functions and representational competencies that are independent of identificational references.

⁴ What is predicated in these three cases is not the attributive body, but the complexes: – is not a body; if – is a body, then – is a large body; and – is a shape on the hill, and – is a body or – is a shadow.

part of any attribution, much less itself make an attribution. For example, in a belief it is not the case that anything non-spatial is a body, the conceptual attributive body functions predicatively; but given that the negation is wide-scope, body makes no attribution. Indeed, no predicate in the propositional content makes an attribution. Since body functions predicatively without functioning to make an attribution, it does not function to make an attribution to a contextually identified entity.

In sum, all *perceptual* attributives function to be applied by context-bound identificational, referential structures, and function to make an attribution to (and be accurate of) a perceptually identified entity. They are within the scope of demonstrative-like identificational, referential applications. *Conceptual* attributives – attributives that occur in propositional structures – may function in the way that perceptual attributives do. But they differ from perceptual attributives in that they have additional representational functions associated with further representational competencies and uses. Every propositional structure contains an attributive that does not function in the way that perceptual attributives do. Every propositional structure contains an attributive that functions as the dominant predicate, outside the scope of any representation that functions in identificational reference. Every conceptual attributive can function as dominant predicate. Further, conceptual attributives can function in predicative positions, whether or not as dominant predicates (see note 3) – without functioning to make an attribution to, or be veridical of, any contextually identified entity.

I define ‘*purely predicative occurrence*’ of an attributive as follows. A *purely predicative occurrence* of an attributive is one in which the attributive functions predicatively but does not function to make an attribution within the scope of a context-bound, identificational, referential structure to the entity that is (purportedly) identificational referred to. Such occurrences are *purely predicative* inasmuch as they function predicatively, but are either outside the scope of a context-bound, identificational referential structure, or are inside such scope but do not themselves function to make an attribution to the entity that the referential application of the relevant context-bound structure functions to refer to.⁵

⁵ In *Origins of Objectivity*, *op. cit.*, 539, 541-547, 550, I wrote that conceptual attributives that function as dominant predicates engage in ‘pure attribution’. Pure

In determining that the representational content of an individual's psychological state is *propositional*, one must find an attributive in the content that has a purely predicative role. Indeed, one must find an attributive that functions predicatively outside the scope of a context-bound identificational, referential structure. This role is always filled by the dominant predicate (corresponding to a dominant verb phrase) in a propositional structure. (Other elements in a propositional content that are not the dominant predicate may also have a purely predicative role.) One must be able to separate a purely predicative role – for example, the role of F in that_i G is F – from a role in being applied in a context-bound, identificational reference – the role of F in that_i F, or in that_i (F, G), or in that_i F is G. In all propositional representational content, some occurrence of an attributive, a *purely predicative occurrence*, is freed from functioning to be applied in con-

tribution is attribution that does not function to be applied by a demonstrative-like identificational reference. I have come to think that it is better to focus on pure predication, because it is more general in propositional contexts. Dominant predicates that are governed by widest scope propositional negation do not make any attributions at all. Moreover, even when conceptual attributives are sub-parts of predications that do make attributions that are not dominated by context-bound referential applications, the conceptual attributives themselves can occur predicatively without making an attribution.

The predicative function is more general than the attributive function in propositional contexts. Perception and conception both engage in attribution. Both pure attribution and pure predication are distinctive roles for concepts. Predication is always effected by representational elements – conceptual attributives – with attributive functions. The attributive functions include functions to make attributions that are outside the scope of context-bound, referential singular (or plural) applications. But conceptual attributives can carry out predication even if they do not function to make any attribution at all. Since I am primarily interested in explicating what makes conceptual attributives *conceptual* – as functioning elements in *propositional* structures – I focus on occurrences of pure predication, whether these involve attribution or not.

Another change in usage from *Origins of Objectivity* is that there I used the term 'guides a referential application' where here I use the term 'is applied by a referential application'. I found that the talk of guidance in this context led to a persistent misunderstanding – the mistaken idea that I think that when an attributive guides a referential application, it is essential to the successful reference of the application. I explain the point above in the third through fifth paragraphs of the text. For the original uses of 'guides', which I still stand by, see, my 'Five Theses on *De Re* States and Attitudes', *op. cit.*.

text-dependent identificational reference. An attributive is *conceptual* in an individual's psychology if and only if it can function in pure predication – including as a dominant predicate.

The simplest conceptual attributives are conceptualizations of perceptual attributives. They can function also to make attributions within the scope of context-bound, identificational referential representation. But what makes them conceptual is having functions, and marking representational competencies and uses, that are purely predicative. First and foremost, they have purely predicative functions as dominant predicates.⁶

I think that in determining that the representational content of an individual's psychological state is *propositional*, one must also find a capacity for propositional inference. I will argue for this point in later work, but assume it here. So there are two marks of states with propositional representational content – a capacity for pure predication, particularly pure predication as main predicate, and a capacity for propositional inference.

⁶ In sophisticated repertoires, conceptual attributives function in referential structures – such as in pure definite descriptions (the one and only tallest tree ever whichever that tree is) – that are not governed by context-bound, referential applications (that). All occurrences of attributives in such structures are purely predicative. Reference is effected through predication and the uniqueness operator (the one and only), not through identificational reference. I take the notion of pure predication to be that of a use of an attributive element that does not function to make an attribution that is applied by a context-bound, identificational singular or plural application. Purity lies in the attributive's functioning predicatively independently of being applied by a context-bound, identificational (*de re*) referential application.

There is non-inference-based identificational (*de re*) reference that is not context-bound. Reference to natural numbers via small numerals is an example. That-clause-like reference to representational contents is another example. See 'Five Theses on *De Re* States and Attitudes', *op. cit.*, section V, and 'Postscript to "Belief *De Re*"' in *Foundations of Mind* (Oxford: Clarendon Press, 2007). These cases are, I think, made possible by pure predication. They are posterior to the development of propositional capacities. But it may be that there are other types of non-context-dependent reference, through memorizations of lists, that are pre-propositional. This interesting issue bears on relations between non-context-dependent reference and pure predication. See E. M. Brannon and H.S. Terrace, 'Representation of the Numerosities 1-9 by Rhesus Macaques (*Macaca mulatta*)', *Journal of Experimental Psychology: Animal Behavior Processes*, 26(1) (2000), 31-49; H.S. Terrace, L. Son, and E.M. Brannon, 'Serial Expertise in Rhesus Macaques', *Psychological Science* 14 (2003), 66-73.

How is one empirically to locate attributives with purely predicative roles? How is one to determine empirically that a transition between psychological states with representational content is a propositional inference? I cannot yet offer satisfying answers to these questions. I will discuss considerations – both conceptual and narrowly empirical – that bear on the questions.

Before discussing these empirical questions, I want to make some terminological points. And I want to recall territory in the mind that is neither perceptual nor propositional.

The terms ‘thought’, ‘knowledge’, ‘inference’, and ‘reasoning’ are often used very loosely. There is scope for terminological choice here. But I believe that common usage often blurs distinctions among psychologically distinct kinds. I shall apply each of these terms only to *propositional* capacities.

There are many non-perceptual representational capacities that are not propositional. Let me give some examples. Every perceptual system is associated with perceptual memory, usually various types of memory. Every perceptual system is associated with anticipatory representation, primarily representation of actions and goals for actions. So perceptual systems are associated with representation of past and future conditions.

Sometimes integration among these systems is constitutive of having specific attributives that figure in perception. To perceive something as a body, an individual must be able to track it and anticipate its forms of continuity. Tracking requires memory. Anticipation involves representation of a body’s future state and position. There are *body* attributives produced in perceptual systems, such as the visual system. Thus in contrasting perception with propositional capacities, one must not neglect the fact that perception itself is implicated with representational capacities that do not function to produce perceptions.⁷ I count perception, perceptual memory, and perceptual anticipation in a given modality *perceptual capacities in the broad sense*.

Nearly all animals equipped with a perceptual system have perception in more than one modality. Where there are plural perceptual modalities (vision, hearing, touch), there are intermodal representational capacities. For when perception guides action, a representa-

⁷ For discussion of the perceptual attributive *body*, see *Origins of Objectivity*, *op. cit.*, Chapter 10, the section ‘Perception and Body’.

tional system must coordinate inputs from different perceptual modalities to yield a summation representation that guides action. Such actional representation and the capacity that leads to it are amodal or intermodal. Intermodal representation is not perceptual, even in the broad sense. Yet it need not be propositional.

There are also representational systems – in most mammals and possibly in some arthropods – that take input from different perceptual modalities, as well as sensory information registration, and yield an allocentric spatial map-like representation as output. This representation is held in memory, and it is used in guiding navigation. The map-like representation is neither propositional nor perceptual. There seem to be various other intermodal systems – for example, systems for representing ratios among aggregates of entities, and systems for representing agency and causation. These systems occur in various animals and in young children. They appear not to be propositional.⁸ Again, these capacities are not perceptual even in the broad sense. I call them simply ‘*intermodal, non-propositional cognitive capacities*’. Although products of such capacities can often be explained in terms of principles very similar to those governing perceptual capacities, the additional abstraction away from a particular modality marks, I think, an important natural psychological kind.

I turn now to issues that bear on distinguishing propositional psychological states from the various non-propositional states, including perceptual states. I begin by raising five considerations that complicate the question of how one is empirically to identify propositional states, pure predication, and propositional inference. Then I discuss some considerations that free up answers from restrictions commonly imposed by philosophers and psychologists – perhaps making finding answers less difficult than one might think. Finally, I sketch considerations that may point toward answers. I seek constitutive and phylogenetic origins of propositional attitudes. I am interested in exploring the idea that propositional attitudes originate in higher, non-linguistic

⁸ For an extensive treatment of several of these systems, see Susan Carey, *The Origin of Concepts* (Oxford: Oxford University Press, 2009). Although Carey calls these systems components of core knowledge, and takes them to involve use of “concepts”, she believes that these systems of representation are iconic, not propositional. So her terms ‘knowledge’ and ‘concept’ are terminologically different from mine. I think that she is probably right that these systems are, at the ground level, not systems of propositional representation.

animals.

So, first, five points that show that separating the propositional from the non-propositional is a delicate matter. The first three are implicit in what I have already said.

First, the fact that a representational capacity does not function to yield perception does not show that the capacity is propositional. So understanding the separation of pure predication from perceptual attribution is complicated by the inadmissibility of a simple inference from a representational content's being non-perceptual to its being propositional or conceptual.

Second, psychological processing, even computational processing, that falls under complex quantitative principles, and that in no way is reducible to traditional laws of association, is not *ipso facto* processing of propositional attitudes, or even non-propositional *representational* states. The *non-representational* states involved in homing and in path integration, discussed last lecture, are governed by complex, quantitative, non-associative principles. Our issue is the form of representational organization. That issue does not necessarily coincide with the mathematical complexity of principles that explain psychological transformations.

Third, one cannot infer from a representational content's having both singular referential and general attributive elements that it is propositional. All non-propositional representational systems that I know of have both types of elements in their states' representational contents. Since the mid-twentieth century, philosophy has tended to hold that singular reference cannot emerge until perception is supplemented by conceptual-propositional capacities that make singular reference *intelligible for the individual*. Quine insisted that singular reference is possible only if an individual can formulate in language, with quantifiers, *criteria* for identity. Strawson and Evans held that singular reference is possible only if an individual *knows which* particular is singled out, and has propositional knowledge of criteria of identity.⁹

⁹ See *Origins of Objectivity*, *op. cit.*, chapters 5-7, for extensive discussion and criticism of Quine, Davidson, Strawson, Evans, and many other philosophers on this point. Some philosophers have concluded from the fact that there are general, "classificatory" elements in perception that all perceptual representation is conceptual. Such a deflated notion of the conceptual does not connect with any serious debates about the format of perceptual representation. Such usage cannot yield insight into where *propositional* representation begins.

Such requirements over-intellectualize singular reference. Reflection on the nature of perception, as well as empirical knowledge about perception, indicate that both singular referential elements and general attributive elements occur in the representational contents of *all* perceptions. Animals as simple as arthropods – which lack language, criteria for identity, and knowing-which capacities – have perceptual states with singular referential elements. Such states single out particulars. So distinguishing between the perceptual and the propositional cannot hinge on showing that a representational state functions to pick out particulars and attribute attributes to them.

Fourth, the distinction between modular and non-modular processing does not mark the divide between sub-propositional states and propositional states. A *modular process* is one that is fast, automatic, driven by severely limited input, relatively (though never completely) encapsulated, and inaccessible to consciousness.¹⁰ It is true that all processing that yields perceptual states is relatively modular. The most salient propositional inferences are non-modular. However, conscious non-propositional images are subject to non-modular control – for example, in pictorial rotations by geometrically skilled individuals. And it is far from obvious that all *propositional* inference is non-modular.¹¹

The fifth cautionary point requires elaboration. I characterized the problem of distinguishing propositional structures as that of understanding the separation of a general attributive element that does not always function to be applied by context-dependent identificational

¹⁰ For a fine, classic discussion of modularity, see Jerry A. Fodor, *The Modularity of Mind* (Cambridge, Mass.: MIT Press, 1983). A process is *encapsulated* if it operates on a confined range of input and is impervious, or relatively impervious, to information outside this confined range, even if that information is relevant to the operation involved. Actually, nearly all “modular” processes in perceptual systems are cross-modally affected by information processed by other perceptual systems. Fodor’s early characterization of the modularity of perceptual systems overstated the insularity of processing within them.

¹¹ The evidence here is tenuous and disputable, not least because it can be disputed whether the relevant “inferences” are propositional. I cite the possibility mainly to keep empirical options open. It is certainly not conceptually necessary, and not a good criterion for propositional representation, that propositional processing be non-modular. Some very primitive practical propositional reasoning may be modular. Our competence with syntax may be a modular competence with propositional inferences about syntax.

referential applications. Thus, in propositional structures, there is always an attributive element – an element with attributive potential – whose role is *purely predicative*. Indeed, there is always a purely predicative, dominant predicate that is not within the scope of any referential application. The issue here is that in perceptual memory and perceptual anticipation, and in non-propositional intermodal states, there are general attributive elements that may *seem* not to function to be applied by singular applications. These general elements must be distinguished from conceptual attributions that are capable of purely predicative uses.

For example, in perceptual memory, the attributive element may remain as residue of a perceptual state, even as the perceived particular is forgotten. An animal may often see a hand unlock a feeding station, forgetting the particular occasions and hands. A perceptual memory as of hand making such and such a motion may remain. The attributive residue may show up in priming effects. The individual acts quickly on a newly presented hand making the motion, because it has seen past instances. But it has forgotten each past instance. Similarly, in perceptual anticipation, an individual represents an attribute, indicated by an anticipatory attributive, even though no instance is yet represented in a singular identificational way.

These cases do not constitute separation of pure predication from attribution that functions in context-bound identificational reference – the separation that marks propositional structure. In both memory- and anticipation cases, the attributive elements, though not actually engaged in an attribution within a present singular perceptual reference, *function entirely*, when activated, to be applied by, or to connect with, singular reference in perception. Although attributive elements in *memory* can be separated from past singular perceptual applications and remain in dispositional form, they function to be applied in recognition of newly perceived particulars, when they are activated. Attributives in perceptual *anticipation* are not yet attached to singular perceptual applications. Yet they serve, anticipatorily, to be applied in singular perceptual capacities to particulars.

An analogous point arises in non-propositional intermodal representation. An allocentric spatial map, held in memory and updated by perceptual and non-representational inputs, contains a constant general attributive representational content – the topological and metrical relations in the map – that remains in memory, even while the individual is not locating its position on the map, or using the map

to identify particulars located in the relevant space. It may seem that here there are general attributive elements that do not function to be applied in singular representation.

I believe, however, that map-like representation, like perceptual memory and perceptual anticipation, is, constitutively, functionally singular. In the first place, the whole map's representational content is singular. A map is a singular representational content that refers to a particular space. A bird that carries a map of its terrain in its memory does not just carry a geometrical structure. Its map specifies a particular space, with particular spatial positions, and relations among those positions.¹² In the second place, the components of the map are singular. Attributives for spatial relations apply to particular, instantiated relations between particular spatial positions. Third, the determination of spatial positions – in fact, the singular character of the whole map – depends on establishing singular perceptual, referential relations to entities on the map. And these entities on the map must be referred to in context-bound, identificational ways. The map might single out a location in terms of a distance and direction with respect to the allocentric origin of the map – perhaps the nest. The nest is singled out through a context-bound, identificational singular application of some perceptual attributive in perceptual memory. Thus particular, mapped locations, and relations among those locations, are fixed through perceptually determined references to particulars other than spatial positions. For example, a map's singularity might depend on perceptual reference to a nest, or some landmark, or the sun or stars. All such perceptual reference is context-bound and identificational.

It is possible, in fact likely, that the geometrical structure of maps in animals is fixed innately. But the function of attributive elements is to be applied by singular elements in mapping a particular physical space.

The preceding five points complicate the task of separating propositional from non-propositional structures. I want now to discuss some points that make the task less difficult than some philosophers and psychologists have claimed it to be. Freeing the task from these

¹² Kant held that spatial intuition is inherently singular: for him it specifies the one and only space. Although no non-human represents all of physical space, non-human spatial maps do represent the particular spatial area that is relevant to an organism's life.

constraints makes it more plausible that some non-human animals have propositional attitudes.

First, it is important not to *assume from the armchair* that having propositional attitudes amounts to having a language.¹³ Often propositional structure is simply conflated with linguistic structure.¹⁴ Language is the most salient, detailed, impressive expression of propositional structure. But linguistic symbols have uses, meanings, functions, that express propositional and logical structure. It is the cognitive use and representational function associated with the symbols that determines their propositional, logical-grammatical forms. It takes an argument to show that features characteristic of language – in particular, perceivable symbols – are constitutively necessary to the cognitive use and representational function that is the source of propositional form.¹⁵

In the history of philosophy, propositional structure or form was originally, and dominantly, conceived as a feature of judgment, belief, thought. Language was considered an optional expression of these psychological states. Judgment, belief, and thought were regarded as antecedent and, in respect to their most primitive propositional form, independent. The view that propositional structure is fundamentally linguistic gained some prominence primarily in the analytic tradition. This view cannot be had for free. It must be argued.

Propositional structure helps type-individuate not only linguistic entities, but psychological states – perceptual beliefs, for example –

¹³ Here I am not concerned with “languages of thought”. For present purposes, I use ‘language’ to apply to a system of propositional representation that includes syntactical items that are perceptible for its users. The postulated syntactical items in the language-of-thought hypothesis cannot be perceived by users of the “language”. Here, I intend languages to comprise the ordinary spoken and written languages of human beings. The spoken and written words of such languages are audible, visually perceptible, or subject to tactile perception.

¹⁴ See for example H.S. Terrace, L. Son, and E.M. Brannon, ‘Serial Expertise in Rhesus Macaques’, *op. cit.*; R.Vigo and C. Allen, ‘How to Reason Without Words: Inference as Categorization’, *Cognitive Processing* 10 (2009), 77-88.

¹⁵ I believe that even the logical structures of languages of thought are not determinable independently of representational competencies. See the discussion of the language-of-thought hypotheses in the previous lecture, ‘Origins of Perception’.

that are not obviously linguistic. Even in identifying a symbol as linguistic, one must consider the psychological competence that underlies the symbol's use. No utterance counts as an assertion if it is not associated somehow with a propositional psychology.

Some sub-elements of propositional structure unquestionably have structural analogs in pre-linguistic perceptual psychology. The singular elements and general attributive elements in perceptual representation have analogs in propositional structures. Perceptual representation is unquestionably pre-linguistic. Given that perceivable linguistic symbols are not necessary for either singular representation or attribution in perception, it is unclear why they should be *necessary* for predication – pure predication – that is not a matter of making an attribution in being applied by context-dependent identificational reference.

It is epistemically possible that perceiving symbols is psychologically necessary for separating out pure predication. But it is unobvious that this is so, independently of empirical investigation. I think that one should not even antecedently *expect* empirical investigation to show that *propositional* capacities in perceptual *belief* depend on use of linguistic symbols. If the best explanation of a creature's behavior is that it engages in pure predication or primitive propositional inference, that explanation establishes that the creature has propositional capacities.

Second, most arguments given by prominent philosophers since the mid-twentieth century that *reference* to the physical environment depends on sophisticated conceptual devices, often including linguistic devices, are manifestly unsound. For example, Quine's arguments that objective reference, depends on mastery of linguistic devices for quantification, identity, pronouns, and sortal predicates fail. Criticizing these arguments is not in place here. But the mere existence of pre-linguistic perception shows that singular reference (successful, singular intentionality) does not depend on language. Perceptual reference stands as a difficulty for many other arguments – by Strawson, Evans, Davidson, Sellars – for the view that reference to the physical environment depends on criterial background knowledge.¹⁶ These arguments cannot show that propositional thought depends on language, or on types of knowledge that non-human animals cannot be expected to have. Propositional thought grows out of perception.

¹⁶ See *Origins of Objectivity*, *op. cit.*, chapters 5-7. See note 8 above.

This point is the flip side of the third cautionary point made above. The existence and nature of perception show that one cannot infer from the presence of singular and attributive representation that propositional structure is present. But the existence and nature of perception also show that one cannot argue that singular reference to the physical environment requires distinctively human linguistic or conceptual capacities.

Third, we should reject philosophical arguments that propositional thought requires metacognitive capacities that non-human animals cannot be expected to have. Some arguments of this kind claim that having the relevant meta-cognitive capacities hinges on having language. Such arguments claim from the armchair, I think unpersuasively, that meta-cognition depends on language; hence, animals cannot have meta-cognition.¹⁷ But the *root* mistake is the claim that propositional inference constitutively requires meta-cognition.

Here is an example of the kind of argument that I have in mind: To be able to have a thought with a compound logical structure, such as a thought of the form *A* or *B*, an individual must be able to understand that a certain disjunctive relation holds between the two thoughts *A* and *B* – the relation of their not both being false. The disjunctive thought, though not about its respective component thoughts, cannot be entertained by any creature not capable of thinking about how the truth value of one thought is related, according to the familiar truth table, to the truth value of the other.

The implicit assumption is that understanding a disjunctive representational content well enough to think it requires being able to understand the truth table or some semantical account of the truth conditions (or “reference rule”) of the thought, and perhaps the

¹⁷ I do not claim that meta-cognition in non-human animals is likely to occur. Most empirical arguments for this view – even those that claim that some animals represent other animals as seeing things – have been unpersuasive. Simpler explanations seem to explain the evidence equally well. For a similar critical view, not all of whose claims I accept, see D.J. Penn and D.C. Povinelli, ‘On the Lack of Evidence that Non-Human Animals Have Anything Resembling a “Theory of Mind”’, *Philosophical Transactions of the Royal Society*, B, 362 (2007), 731-744. On the other hand, I doubt even more strongly that there is any sound armchair argument (for example, from the premise that animals lack language) that shows that animals cannot have meta-representational cognition.

validity of basic inferential transitions that hinge on disjunction.¹⁸

The master argument behind this example aims at the conclusion that any propositional reasoning requires a meta-cognitive capacity. The argument goes as follows. To be able to carry out any argument, one must understand that the conclusion is supposed to follow from the premises. To understand that a conclusion follows from the premises, one must have metacognitive capacities. For such understanding requires being able to think about thought contents; and to understand the notion follows-from, one must understand a semantic relation between thought contents. So carrying out any propositional reasoning requires meta-cognitive capacities.

Both arguments should be rejected. They beg the question in the most blatant way. Both hinge on an unsupported assumption that object-level reasoning requires a capacity for metarepresentational thought. This is the very point at issue. For an individual to engage in deductive propositional reasoning, the individual's reasoning must depend on the form and content of the individual's thoughts. The reasoning must instantiate patterns of deductive inference, and be correctly explainable in terms of those patterns. But having a concept of truth, being able to think *about* contents, and being able to think a semantics for one's reasoning are further matters.

The arguments gain illicit traction by conflating two types of understanding. One is the minimal competence required to think the thoughts and connect them in logical reasoning. The other is the competence required to have a meta-understanding of what one is doing when one engages in logical reasoning. The fact that a thinker need not be able to explicate his concepts, or understand how they operate, in order to think them is familiar from work in philosophy of mind and philosophy of language. There is no armchair ground to hold that to reason deductively, one must be able to understand concepts and principles that help explain deductive reasoning – concepts of truth tables, or of particular inference rules, or of logical consequence, or even of premises and conclusions as such. To engage in propositional inference, an individual need not be able to think *about* thoughts or *about* steps in the inference at all. It is enough if an

¹⁸ This particular formulation is a paraphrase from José Luis Bermúdez, *Thinking without Words* (Oxford: Oxford University Press, 2003), p.178. Bermúdez also claims from the armchair, I think unpersuasively, that meta-cognitive capacities necessitate language.

individual's psychological transactions are correctly explained as propositional inferences under logical principles and inference rules.

The arguments just criticized again exhibit hyper-intellectualization of psychological capacities. The hyper-intellectualization proceeds by importing a requirement that the individual be capable of understanding a theory of those capacities, or general principles governing those capacities, if the individual is to have the capacities at all. But to engage in logical reasoning, one need not be able to think the inference rules that govern one's reasoning, even implicitly or unconsciously. Inference rules are meta-representational. They schematically represent formally valid relations between premises and conclusions. Inferring by the rules does not require a capacity to look up, cite, or understand the rules. Nor does it require a capacity to think representationally about the steps in the inferences. Reasoning is one thing. Thinking general rules or principles that the reasoning instantiates, by virtue of being reasoning, is another. Thinking propositional thought is one thing. Thinking meta-representationally about thought is another. No good conceptual or apriori reason has been given to show that reasoning requires meta-representational capacities.¹⁹

So much for considerations that make empirical isolation of propositional structure less constrained than many have claimed. I now discuss marks of the separation of pure predication from attribution applied within identificational reference. In particular, I discuss marks of dominant "wide scope" predication. It is this type of predication that is, I believe, constitutive of propositional structure and propositional competencies.

One plausible mark of propositional content is propositional deductive inference. Note that I characterize such inference as *propositional*. I am not trying to explain propositionality in more primitive terms. I hope to identify a network of constitutively connected elements. Recognizing such a network will, I think, help in empirically identifying propositional capacities.

There are many types of transitions among psychological states – formations of perceptual states from information registrations, formations of perceptual memories from perceptions, formations of antic-

¹⁹ For more on this point, see *Origins of Objectivity*, *op. cit.*, Chapter 9, 'Perception as Objectification'.

ipatory representations from perceptual memories, formations and updatings of intermodal states from perceptions. Many are transitions among contentful states that fall under representational norms. None of these transitions is *propositional* inference. I reserve the term ‘inference’ for propositional inference. I count the other types of transitions as formations, operations, processings, transformations, or transitions among psychological states. I think that by reflecting on inference, we can gain insight into the problem of recognizing empirical conditions for separating pure predication from attribution that is applied by (within the scope of) context-bound identificational reference. We can thereby gain insight into empirical conditions for recognizing propositional psychological states.

Psychological transformations and relations between individuals and a subject matter are the two basic sources of individuation of propositional representational content. Relations to a subject matter are more basic. Perception, and causal relations that underlie perception, are the original source of representational content. But in understanding pure predication – a function for attributives beyond that of being applied in identificational reference – it is plausible to look to propositional inference. In subsequent work, I expect to argue that propositional inference is a fundamental constitutive concomitant of pure predication, hence of propositional structure. Here I sketch considerations that suggest that pre-linguistic animals engage in propositional inference.

I begin with some stage setting. The most primitive propositional structures seem to lack logical constants and seem not to occur in deductive inference unaided.²⁰ In logic, the simplest propositional structures have the form $\underline{G}\underline{a}$. They consist of a predicate \underline{G} conjoined with an individual constant \underline{a} . In psychology, it is more plausible to think that the singular representations in the simplest propositional structures derive from perception. Perceptual contents never contain individual constants. Singular reference in perception is always context-dependent, and partly determined by causes of the perceptual state. The singular element is the identificational application of a perceptual attributive to a particular, where the perceptual attributive functions, in the identificational reference, to be veridical of the identified entity.

²⁰ I lay aside inferences of the form $\underline{G}\underline{a}$; so $\underline{G}\underline{a}$.

As a simplifying assumption, let us conceive of the singular element as having the form $\text{that}_1 \underline{F}_p$.²¹ I take it that a context-bound identificational singular element is preserved in a perceptual belief formed from the perception. The simplest propositional structures that mark perceptual belief have the form $\underline{G}_{ci}(\text{that}_1 \underline{F}_c)$, or $\text{that}_1 \underline{F}_c \text{ is } \underline{G}_{ci}$.²² Our problem is to understand empirical and constitutive conditions under which the purely predicational role – and dominant predicate role – illustrated by the form $\text{is } \underline{G}_{ci}$ emerges.

Although there are, I think, other primitive levers for the emergence of pure predication, I will focus on deductive propositional inference. I will explore how simple propositional inferences might be defensibly attributed to non-linguistic animals.

Two *prima facie* methodological difficulties must be flagged right away. The inferences that I discuss are inferences studied in elementary propositional logic. I have in mind inferences that hinge on *modus ponens*, or *modus tollens*, or exclusion (*modus tollendo ponens*). Such inferences do not rely on predicational structure. One *prima facie* difficulty is that it may seem unclear how *they* could have any bearing on the emergence of pure predication.

²¹ All perceptual representational contents are marked ego-centrally. All or most perceptual attribution is within a framework that makes attributions to entities in the physical environment *relative* to an ego-centric anchor – for example, a spatial framework anchored in the position of the perceiver. Locations are perceptually attributed *relative* to this ego-centric position. So a perceptual attribution is never through a form as simple as the one that I shall set out. Here accuracy defers to expository purpose. The main point of the illustration is that perceptual contents are in the form of a noun-phrase-like structure whose scope is governed by a context-bound singular application.

²² The subscript ‘_p’ marks the first occurrence of ‘ \underline{F} ’ in this paragraph as a perceptual attributive. I take it that the singular applicational file established by the perception is inherited by the singular application in the perceptual belief. Their referential applications are bound to one another. That is why the subscript ‘₁’ remains the same. It would perhaps be more accurate to differentiate the perceptual application file from the conceptually guided one, but I shall not do so here. I assume that the perceptual attributive \underline{F}_p is conceptualized into a conceptual attributive, marked by the subscript in ‘ \underline{F}_c ’. The subscripts ‘_c’ and ‘_{ci}’ mark not only the conceptual nature of the attributives, but particular modes of presentation of the environmental attributes F and G . Similarly for the subscript ‘_p’ on the symbol for the perceptual attributive. Representational contents or modes of presentation are finer-grained than the environmental attributes that they represent. One can perceptually or conceptually attribute a given attribute in various ways.

Second, these inferences are easily mimicked in explanations that do not attribute propositional structure. Consider reasoning by *modus ponens*. One can mimic the premise p by postulating non-propositional state np_1 – perhaps a perceptual state or a non-propositional inter-modal state. Then one postulates, as analog of the conditional premise $(p \rightarrow q)$,²³ a tendency, with relevant contextual activation, for state np_1 to transition into a non-propositional representational state np_2 . Given np_1 and contextual activation, the psychological system yields np_2 . No conditional is the representational content of any state in the system. No propositional reasoning occurs. Most non-linguistic behavior that may appear to exhibit *modus ponens* reasoning can be modeled in such ways. I address these two methodological issues shortly.

I begin with cases that seem naturally explained in terms of propositional inference. Some non-human primates and a few other animals show a capacity that is naturally called ‘exclusion reasoning’, reasoning with the logical form of *modus tollendo ponens* – the form p or q , not- p , so q . The form has logical constants for disjunction and negation.

For example, a chimpanzee or great ape is shown that one piece of food is hidden in one of two containers. The food is shown; a closed hand reaches into one container, then, emerging closed, into the other; then the hand is shown to be empty. Next, one container is shown to be empty. The primate is invited to choose between the containers. Some types of animals do not immediately choose the non-empty container. They either continue to search the empty container; or they merely show an increase in the likelihood of searching the other container. But some non-human animals, including apes, show the sort of behavior that suggests deductive inference. They immediately choose the non-empty place, without needing to look into it.²⁴

Explanations in terms of associative learning and explanations that avoid appeal to representational states have been controlled for and

²³ I intend the arrow to represent the material conditional. I read ‘ $(p \rightarrow q)$ ’ as ‘if p , then q ’. There are, of course, complex issues about the relation between ‘if, then’ and the material conditional. I lay these issues aside here.

²⁴ Josep Call, ‘Inferences About the Location of Food in the Great Apes (*Pan paniscus*, *Pan troglodytes*, *Gorilla gorilla*, and *Pongo pygmaeus*)’ *Journal of Comparative Psychology* 118 (2004), pp. 232-241.

shown inadequate.²⁵ But *representational* explanations of such behavior that do not invoke logical structure have also been proposed. Such explanations may *seem* at least compatible with the behavioral evidence. For example, it has been proposed that the animal uses contrary attributives but no logical constants. The animal might use attributives absent from container A and present in container B, together with a disposition to anticipate presence in container B on not perceiving the food in container A. On this form of explanation, no negation, disjunction, or other logical structure is in the content of any representational state. No inference hinges on disjunction and negation. Only dispositions to make non-logical transitions are involved.

Alternatively, the behavior could be explained by postulating a map-like structure with an updating capacity that operates on Bayesian conditional probabilities. When the first place is perceived as empty, the probability associated with food's being in the other place rises. The animal acts on the higher probability. No logical, or even propositional, structure is involved.²⁶

Some explanations of this type are motivated by the bad arguments, discussed earlier, that in the absence of language or meta-representational capacities, animals cannot have propositional attitudes or engage in logical inference.

Some philosophers take the existence of alternative explanations to show that there is no saying what the representational capacities of non-linguistic animals are. I believe that generalized scepticism about representational explanations of non-linguistic creatures has been

²⁵ Josep Call, *ibid*; also Josep Call, 'Descartes' Two Errors: Reasoning and Reflection from a Comparative Perspective', in S. Hurley and M. Nudds eds. *Rational Animals?* (Oxford: Oxford University Press, 2006).

²⁶ See José Luis Bermúdez, *Thinking without Words*, *op. cit.*; Bermúdez, 'Animal Reasoning and Proto-Logic' in S. Hurley and M. Nudds eds. *Rational Animals?* (Oxford: Oxford University Press, 2006) for the explanation in terms of contraries. For a sketch of the Bayesian account, see Michael Rescorla, 'Chrysippus's Dog as a Case Study in Non-Linguistic Cognition' in Robert Lurz ed., *Philosophy of Animal Minds* (Cambridge: Cambridge University Press, 2009); see also D.C. Penn and D.J. Povinelli, 'Causal Cognition in Human and Non-Human Animals: a Comparative Critical Review', *Annual Review of Psychology* 58 (2007), 97-118. For another non-propositional model for explaining cognitive transitions in animals, see R.Vigo and C. Allen, 'How to Reason Without Words: Inference as Categorization', *op. cit.*.

discredited by perceptual psychology. I see no reason to doubt that specific best empirical representational explanations of exclusion-type psychological transitions can be found. Empirical testing and theorizing simply must be reticulated and subtle.

There is a good methodological motivation for considering alternative explanations, however. Behavior should be explained by reference to less sophisticated representational structures – here, non-propositional structures – other things equal. *Are other things equal?*

So as not to pre-judge its nature, I call the process that *appears* to be logical inference by exclusion an ‘*exclusion transition*’. The experiments regarding exclusion transition show its application in a strikingly wide range of areas. The experiment that I first described requires visual competence with respect to *location* of a body when the body goes out of view.

Another series of experiments indicates that apes engage in similar exclusion transitions using a combination of visual and auditory perception applied to what is, at least arguably, *causal* cognition. Thus after the food is hidden in one of two containers, one of the containers is shaken. If the shaken container is noiseless, the ape chooses the other container.

Another series evinces a capacity to engage in exclusion transitions using cognition regarding effects of the solidity of unseen bodies on screens hiding those bodies. Thus, food is hidden behind one of two vertical wooden screens. One of the screens is rotated backward until it is parallel with a surface, while the other is rotated backward to an angle. The ape is invited to choose food behind one of the screens. The ape chooses the screen tilted at an angle. As between two screens tilted at different angles, the ape chooses the screen at the greater angle. Presumably the relevant cognitive competence takes body size into account, and is sensitive to the effect of the body’s solidity on movement of the screen. Here cognitions of solidity, (something-like) causation, and object permanence are engaged in the exclusion transition.²⁷

²⁷ Josep Call, ‘Apes Know that Hidden Objects Can Affect the Orientation of other Objects’ *Cognition* 105 (2007), pp. 1-25. Interestingly, apes choose on the basis of size alone. If a preferred object is smaller than a non-preferred object, and the ape is given information that objects of those two types are the hidden objects, the ape still chooses the screen at the larger tilt. Size trumps quality when the objects are not perceived.

The experiments show that exclusion transitions employ inter-modal capacities: hearing and vision are combined in some cases. This fact is, of course, compatible with both propositional and non-propositional modelings of the competence. What I want to emphasize, however, is that exclusion transitions occur across cognitively different systems dealing with different subject matters. The competence shows up in cognition regarding location, (something like) causation, object permanence. These are cognitive systems that are not only intermodal, but are commonly regarded as governed by different psychological principles.²⁸

Further, there is some evidence that exclusion transitions occur in some pre-linguistic higher mammals on arbitrary associations among properties. For example, a border collie fast-mapped associations between 200 sound signals and 200 types of objects. The collie fetched the object from a group given an appropriate sound signal. Then the collie was given a new sound signal and was confronted with 7 familiar objects each associated with a sound signal, and one new type of object unassociated with any of the familiar sound signals. The collie fetched the new object. Apparently, the collie engaged in exclusion transitions – ruling out the familiar objects and choosing the unfamiliar object to go with the unfamiliar sound signal.²⁹

Unlike border collies, which were bred for cooperation with humans, apes learn arbitrary associations laboriously.³⁰ It is not known whether apes can engage in exclusion transitions on all subject-matter domains that they represent – not just with regard to location, causation, and object permanence.

Breadth of applicability of exclusion transitions is relevant to choosing between propositional and non-propositional explanatory modelings of exclusion transitions.

Let us reconsider the approach that avoids postulating negation by postulating contrary attributives. On this approach, the ape uses the attributives absent from container A and present in container B, and has a disposition to apply the latter attributive when the former is

²⁸ See Carey, *The Origin of Concepts*, *op. cit.*.

²⁹ Juliane Kaminski, Josep Call, Julia Fischer, ‘Word Learning in a Domestic Dog: Evidence for “Fast Mapping”’, *Science* 304 (2004), pp. 1682-1683.

³⁰ Josep Call, ‘Inferences About the Location of Food in the Great Apes (*Pan paniscus*, *Pan troglodytes*, *Gorilla gorilla*, and *Pongo pygmaeus*)’ *op. cit.*, pp. 235, 240.

applied. This approach must postulate new pairs of attributives and new dispositions for every topic on which the exclusion transition shows up. This piecemeal form of explanation in terms of contrary predicates that lack logical structure would fail to explain a *pattern* of exclusionary cognitive transitions. It misses the generality of the competence underlying exclusion transitions.

Non-propositional explanations that appeal to maps and updating according to Bayesian probabilities are more sophisticated than the postulation of a series of contrary perceptual attributives. But a similar critical point applies. Such an approach treats the transitions as specific to particular domains. The transitions are modeled as principles specific to locational or causal map-like representations, for example. Inasmuch as a pattern of exclusion transition occurs over various subject matters, with a great variety of attributives, explaining the competence in terms of a several subject-matter specific maps would fail to capture the generality of the pattern of transitions.

Generality by itself does not favor propositional explanations over non-propositional explanations. Rules of conditioning and association were conceived as general over all behavior. I am assuming that explanations of exclusion-transitions are representational. So these sorts of rules are not relevant. The mathematics of Bayesian subjective probability itself is, however, just as domain general as the structures of propositional logic. On the other hand, there is nothing intrinsically non-propositional about Bayesian subjective-probability structures. Transitions among propositional attitudes, as well as transitions among non-propositional representational states, can be governed by such structures.

What is the relation between explanations in terms of updatings of subjective probability and explanations in terms of beliefs? This is a complex subject, beyond the scope of this lecture. I believe, however, that the two types of explanation are complimentary, not in competition. Strength of belief, like strength of desire, enters into the fine-grain of psychological explanation. But action and cognition explanations must attribute committal states, because at least action requires an all or nothing summation. I think that explanations in terms of beliefs, in addition to explanations in terms of probability assessment, have a place in psychological explanation.

In any case, reasoning subject to principles of subjective probability is certain compatible with, and may easily incorporate, formal deductive inference. Both types of transition can and do occur within

a single psychology. Let us return to the question of what considerations might favor *propositional* vehicles for deductive inference.

Suppose that apes are shown to engage in exclusion transitions in wider variety of contexts and a wider variety of subject matters. Suppose that the transitions are relatively automatic, and not particularly sensitive to risk-reward ratios, given that relevant perceptual beliefs are formed. Then there would, I think, be three considerations that jointly favor attributing deductive propositional inference.

First, if the transitions were relatively automatic and not particularly sensitive to risk-reward ratios, they would not show the fine-grain and sensitivity to the risk-reward balances that are the hallmarks of explanations in terms of Bayesian subjective probability. Such a result would not mean, of course, that the transitions could not be modeled with Bayesian structures, or even that they do not occur within a psychology dominated by Bayesian structures. It would, however, strongly suggest that there are occasions on which the more nearly all-or-nothing character of deductive inference is in play.

Second, the generality of application of a competence for exclusion transition is at least compatible with the subject-matter generality that is the hallmark of logic.³¹ Explanations, like those in terms of probability mappings on a specific subject matter, or in terms of contrary attributives, already appear to be incompatible with the evidence. Although non-propositional explanations are compatible with the generality of exclusive-transition behavior, no current non-propositional representational explanation seems equally natural.

Third, and perhaps most important, the exercise of the capacity instantiates directly, and structural-element-by-structural-element, the logical structure of propositional inference by exclusion. This situation contrasts with the role of the mathematics in principles governing perception formation and other pre-propositional states. The mathematical structure in principles governing exercises of distance constancies by disparity, for example, is not matched in the structure of the psychological states themselves. Mathematical structure is needed in explaining the psychology, much as the calculus is needed in explaining the movement of the planets. In the case of perception formation and other pre-propositional states, much of the

³¹ As Frege emphasized. See Gottlob Frege, 'Thought' in B. McGuinness ed., *Collected Papers on Mathematics, Logic, and Philosophy* (Oxford: Basil Blackwell, 1984).

mathematical structure lies only in the explanatory principles. The structure of the psychological states whose behavior is explained by these principles does not in any sense mirror the formal structure of the mathematics in the principles. A sign of this failure of mirroring is that numerous mathematically equivalent, but structurally very different, principles are equally simple and equally good in explaining transitions within the psychological system. Such failure of mirroring occurs in the perceptual system and other non-propositional representation systems.

I believe that explanations of exclusion transitions will turn out *not* to be like that. Aspects of the operations correspond very naturally to the propositional structure of exclusion reasoning. The propositional structure is very simple, and the exclusion transitions themselves seem to match that structure, element for element. The sequence of entertaining the alternatives, rejecting one, and choosing the other mirrors and matches the structure of the propositional inference by exclusion. Together with the first two considerations, it seems to me that this fact could favor – as best explanation – the attribution of logical structure to the psychological states of non-linguistic animals.

Logical structure just *is* the structure of valid propositional transitions that are general across subject matters. Insofar as valid exclusion transitions show this subject-matter-general character, show something of the certainty and automatic-ness of deductive inference, and mirror the structure in the transitions, there is empirical reason to take them to have propositional, logical structure. Not enough experiments have been done for my satisfaction. But I conjecture that attributing deductive inference with logical propositional structure will be a best, correct explanation of transitions that have already emerged in some pre-linguistic animals.

Let me return to the relation between *pure predication* and exclusion transitions modeled as deductive propositional inference. I hoped to gain insight into the separation of pure predication from attribution that is applied within context-bound identificational reference. In the simplest propositional structures, like that F₁ is G, one separates is G from any role in being applied in context-bound identificational singular reference. I noted that inferences that hinge on propositional connectives (here disjunction and negation) do not depend on the structure of predication. Such inferences depend entirely on connectives that operate on whole propositional structures. How might deduction by propositional exclusion inference illuminate the

emergence of pure predication in the simplest forms of propositional structure?

Consider, first, negation. Take a propositional structure of the form it is not the case that that₁ F is G or that₁ F is non-G.³² The presence of negation in the propositional structure blocks the attributive G from making an attribution to the singularly referred-to entity. G does not function to be veridical of the referent of the context-bound identificational singular element. It cannot be construed as applied attributionally within a context-bound identificational representation. For, in committal attitudes, it does not undergo representational failure if it is not veridical of a referent of the identificational application. Negation is one form that exhibits very clearly the liberation of attributives from a role in being applied by singular representation. In it is not the case that that₁ F is G or that₁ F is non-G, there is no way to construe the attributive G as occurring in anything but a purely predicative, even non-attributive, role.

Consider disjunction. In thinking either that₁ F_c is G_{ci} or that₁ F_c is H_{cii}, an individual is not committed to the F's being G and is not committed to the F's being H. The dominant-predicate attributives G_{ci} and H_{cii} each cannot be construed as being attributionally applied in the singular identificational reference that₁ F_c. For each attributive, G_{ci} and H_{cii}, does not undergo representational failure (say, in a committal attitude such as a belief in the disjunction) if it (alone) is not veridical of a referent of the identificational application that₁. So each occurrence must have a representational function besides that of being veridical of such a referent. This fact provides clear and sufficient reason for holding that the occurrences of these attributives do not function to make an attribution in a context-bound identificational reference. The occurrence of each attributive, as dominant predicate in its disjunct, is a clear occurrence of pure predication. Disjunction provides a clear role for pure predication. Similarly, for conditionalization.

³² I accept a distinction between propositional negation and predicate negation. But the distinction is not important here, either for understanding the relevant psychologies or for understanding the constitutive point that I am making. If there are empirical grounds for making the distinction at these primitive levels, there are obvious ways of explaining exclusion transitions as deductive inference involving either of type of negation. The constitutive point that I am making in this paragraph would still hold.

I write ‘clear role’ because in the simplest propositional form, $\text{that}_1 F_c \text{ is } G_{ci}$, G_{ci} already occurs purely predicatively. But in a committal attitude, say a belief, of that form, G_{ci} would function to be veridical of a referent picked out by the context-bound identificational representation $\text{that}_1 F_c$. Thus, at least *prima facie*, it is unclear why or wherein it is *not* applied by that context-bound identificational representation. In other words, it is not immediately obvious how to explain why a psychological state does not have the nominal form $\text{that}_1 (F_c G_{ci})$ rather than the propositional form $\text{that}_1 F_c \text{ is } G_{ci}$. In both cases G_{ci} fails its representational function, in committal psychological states like belief or perception, if it is not veridical of a referent of a context-bound identification. So it is not immediately clear why it should not be regarded as applied and as making an attribution within the scope of the referential identification. (The same point goes for what are intuitively the dominant predicates in basic conjunctive propositional forms like $\text{that}_1 F_c \text{ is } G_{ci} \text{ and } \text{that}_1 F_c \text{ is } H_{cii}$). I shall go into this matter in some depth in subsequent work. Here it is enough to indicate that negation, disjunction, and conditionalization do provide roles for pure predication that are clearly distinguished from attributive roles within the scope of identificational, *de re* referential constructions.

The connection between pure predication, on one hand, and negation, disjunction, and conditionalization, on the other, suggests a route for emergence of propositional structure from its perception-based, non-propositional structural predecessors. In further work, I shall develop this suggestion.

The border between propositional capacities and their predecessors is a momentous border. It is the border that marks the origins of a capacity to *reason*, in the full-blown, propositional sense of this term.