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Pretending and Believing

Issues in the theory of ToMM

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ABSTRACT

Commonsense notions of psychological causality emerge early and spontaneously in the child. What implications does this have for our understanding of the mind/brain and its development? In the light of available evidence, the child's "theory of mind" is plausibly the result of the growth and functioning of a specialized mechanism (**ToMM**) *that produces domain-specific learning. The failure of early spontaneous development of "theory of mind" in childhood autism can be understood in terms of an impairment in the growth and functioning of this mechanism.* **ToMM** *constructs Agent-centered descriptions of situations or "metarepresentations." Agent-centered descriptions place Agents in relation to* information. *By relating behaviour to the attitudes Agents take to the truth of propositions,* **ToMM** *makes possible a commonsense causal interpretation of Agents' behaviour as a result of circumstances that are imaginary rather than physical. Two early attitude concepts,* pretends *and* believes, *are discussed in the light of some current findings.*

Consider the scenario in Figure 1. Numerous studies (e.g. Baron-Cohen, Leslie & Frith, 1985; Wimmer & Perner, 1983) have shown that, by about 4 years, children understand this scenario by attributing a (false) *belief* to Sally and predicting her behaviour accordingly. Premack and Woodruff (1978) coined the term "theory of mind" for the ability, illustrated by this scenario, to predict, explain and interpret the behaviour of Agents in terms of mental states. Such findings raise the following question. How is the preschool child able to learn about mental states when these are unobservable, theoretical constructs? Or put another way: How is the young brain able to attend to mental states when they can be neither seen, heard nor felt?

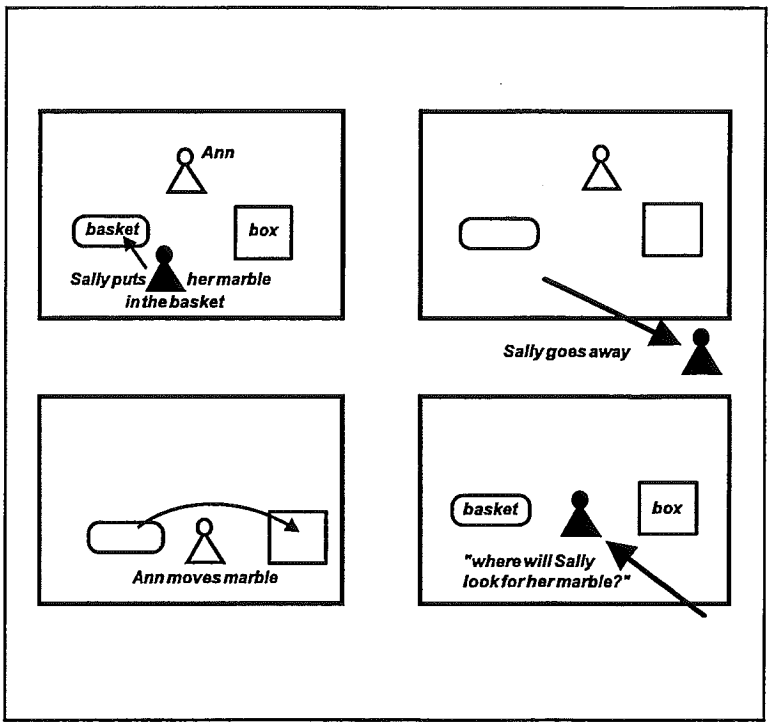

Figure 1. A standard false belief (FB) scenario that can be solved by four-year-olds (after Baron-Cohen, Leslie & Frith, 1985).

A general answer to the above question is that the brain attends to behaviour and infers the mental state that the behaviour issues from. For example, in the scenario in Figure 2, Mother's behaviour is *talking to a banana*. The task for a two year old watching her is to infer that **Mother PRETENDS (of) the banana (that) "it is a telephone"**. Mother's behaviour described as a physical event—as one object in relation to another—is minimally interesting. The real significance of her behaviour emerges only when mother is described as an Agent in relation to information. As an Agent, mother can adopt an attitude (of pretending) to the truth of a description ("it is a telephone") in regard to a given object (the banana). Entertaining this kind of intentional or Agent-centered description requires computing a certain kind of internal representation. I have called this the "metarepresentation" or "M-representation" (Leslie, 1987; Leslie & Thaiss, 1992).

I shall explore the following assumption. Native to our mental architecture is a domain specific processing stream adapted for understanding the behaviour of Agents. A major component of this system is a mechanism which computes the M-representation. I call this mechanism **ToMM** (theory of mind mechanism). Here are five guiding ideas in the theory of **ToMM**:

1) *The key to understanding the origins of theory of mind lies in time-pressured, on-line processing to interpret an Agent's behaviour in terms of underlying intentions.* Early in development, human beings undertake the information processing task of understanding the behaviour of Agents, not simply as a sequence of events, but as instantiating intentions in the broad sense, that is, as issuing from mental states. This processing task is time-pressured because Agent-centered descriptions must be arrived at fast enough to keep up with the flow of behaviour in a conversation or other interaction. This pressure will constrain the amount and types of information that can be taken into account and has had an adaptive evolutionary influence on the architecture of theory of mind processing.

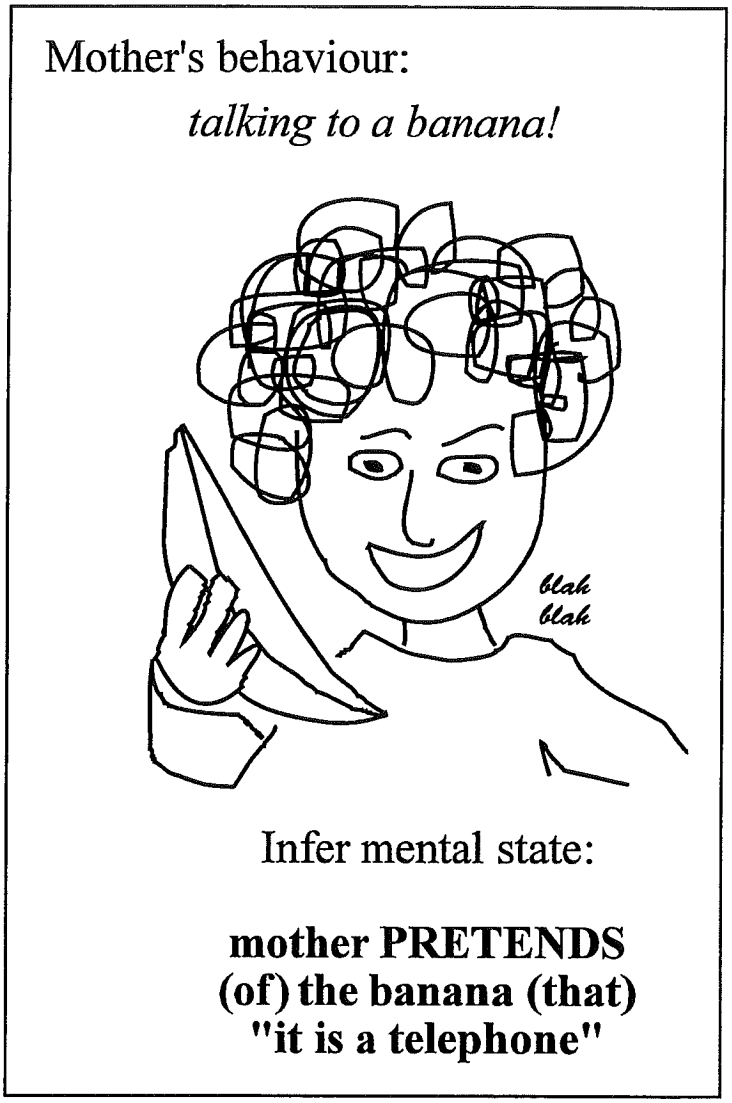

Figure 2. A pretend scenario that can be solved by two-year-olds.

2) *Descriptions of intentional states are computed by a specialized theory of mind mechanism (**ToMM**) which is post-perceptual, operates spontaneously, is domain specific, and is subject to dissociable damage—in the limit, modular.* Information about behaviour arrives through a number of different sensory channels and includes verbal utterances, so **ToMM** should operate post-perceptually. **ToMM** should be able to function relatively spontaneously since it has the job of directing the child's attention to mental states which, unlike behaviour, cannot be seen, heard or felt. **ToMM** should also be able to function as a source of intuitions in reasoning about Agents and thus be addressable centrally. **ToMM** is specifically concerned with "cognitive" properties of Agents and employs specialized notions for this task. Finally, **ToMM** can be damaged or impaired independently of other processing systems (see below).

3) **ToMM** *employs a proprietary representational system which describes propositional attitudes.* This property of **ToMM** is discussed in the theory of the M-representation to which I return below.

4) **ToMM** *forms the specific innate basis for our capacity to acquire a theory of mind.* Perhaps the most important job **ToMM** has to do is to produce development within its designated domain and to produce it early, rapidly and uniformly without benefit of formal instruction. To this end, **ToMM** introduces the basic *attitude* concepts and provides intuitive insight into mental states early in life while encyclopedic knowledge and general problem solving resources are limited.

5) **ToMM** *is damaged in childhood autism resulting in its core symptoms and impairing these children's capacity to acquire a theory of mind.* Leslie and Roth (1993) have recently reviewed evidence supporting this idea (see also Frith, Morton & Leslie, 1992; Leslie & Frith, 1990).

Pretending and **ToMM**

One of the earliest easily observed products of **ToMM** the capacity to pretend. The ability to pretend emerges between 18 and 24 months of age. Around this time, the child begins to entertain deliberate suppositions about simple imaginary situations: for example, she pretends that a banana is a telephone or that an empty cup contains juice. The ability is productive and does not remain limited to a single or to a few special topics, is exercised playfully and communicatively without ulterior motive (e.g. to deceive), permits sharing of information about imaginary situations with other people, and encompasses the ability to understand other people's communicative pretence. Due regard must be paid to the question of distinguishing pretence from other phenomena which are superficially similar at a behavioral level (e.g. functional play, acting from a mistaken belief, play in animals). I discussed some of the more important of these distinctions in Leslie (1987) and pointed out that the aim of previous workers to develop a *behavioural* definition of pretence was unattainable. I proposed instead a theoretical definition in terms of underlying cognitive processes.

There are four critical features of early pretence that a cognitive model must capture. The first requirement is to account for the fundamental forms of pretence. There are three of these, one for each of the basic (external) semantic relations between a representation and what it represents (viz., reference, truth and existence). In object substitution pretence, a given real object, e.g. a banana, is pretended to be some other object, e.g. a telephone. Such pretence requires a decoupling of the internal representation for telephones from its normal *reference* so that it functions in context as if it referred to a member of some arbitrary class of object, in this case a banana. Second, in properties pretend, a given object or situation is pretended to have some property typically it does not have, e.g., a dry table is pretended to be wet. Here the pretence decouples the normal effects of *predicating* wetness in the internal representation. And thirdly, imaginary objects can be pretended to have *existence*, e.g., that there

is a hat on teddy's head. Here the pretence affects the normal existence presuppositions in the internal representation. A cognitive model of pretence has to explain why there are exactly three fundamental forms and why there are exactly these three.[1]

Leslie (1987) argued that the fundamental forms of pretence reflect the semantic phenomena of *opacity* (Quine, 1961). Opacity may be roughly described as the result of the "suspension" of the semantic relations of reference, truth and existence that occurs when a representation is placed in an intentional contexts, such as a mental state report or counterfactual reasoning. To explain the isomorphism between the three fundamental forms of pretence (behavioural phenomena) and the three aspects of opacity (semantic phenomena), I proposed the existence of a certain kind of internal representation. Representational structures, having whatever properties give rise to the opacity phenomena of pretence, must be a property of the human mind/brain from its infancy onwards.

The second critical feature of the development of pretence that a cognitive theory must account for is related to the first. Rather than appearing in three discrete stages, the fundamental forms of pretence emerge together in a package. Given a *single* mechanism with the right properties, a cognitive model can capture both the fact of the three fundamental forms of pretence and their emergence as a package (see Leslie, 1987 for discussion).

The third crucial feature of pretence to be explained is, when the child first becomes able to pretend herself (solitary pretence), why does she also gain the ability to understand pretence-in-others? Traditional investigations overlooked this startling fact. Understanding another person's behaviour as a pretence can be studied as an information processing task the child undertakes. For example, when mother says, "The telephone is ringing", and hands the child a banana, the two year old, who is undertaking a number of complex information processing tasks simultaneously, such as, building a catalogue of object kinds, analysing Agents' goal directed actions with instruments and acquiring a lexicon, is in general neither confused about bananas, nor about mother's strange behaviour, nor about the meaning of the word "telephone". Instead, in general, the child understands that mother's behaviour—her gesturing and her use of language—relates to an imaginary situation which mother pretends is real. Again, we can account for the yoking in development between the capacity to pretend oneself and the capacity to understand pretence-in-others if we assume that a single mechanism is responsible for both.

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[1] For reasons which are not clear, Perner (1991) writes as if the fact that the fundamental forms can be combined into more complex forms—for example, pretending that teddy's imaginary hat has a hole in it—should be a source of embarrassment to my theory. In fact, the possibility of "complex" pretence springs readily from the assumed combinatorial properties of metarepresentation. A further misunderstanding is to suppose that the only way the child could possibly handle the three aspects of opacity is by explicitly theorizing about reference, truth and existence—i.e., by theorizing about the general nature of representation. Leslie (1987) did not propose any such thing for understanding pretence. Indeed the whole thrust of my proposals was to avoid such a commitment by describing processing machinery that would achieve a similar result implicitly.

Finally, a cognitive account must address the fact that pretence is related to particular aspects of the *here and now* in specific ways. This is true both for solitary pretence and in understanding the pretence of other people. For example, it is *this* banana that mother pretends is a telephone, not bananas in general nor *that* banana over there. The truth of the pretend content, **"it is a telephone"**, is anchored in a particular individual object in the here and now. This is another critical feature of the early capacity for pretence that a cognitive model must capture.

These four critical features of pretence—the three fundamental forms, their emergence as a package, the yoking of solitary pretence with the ability to understand pretence-in-others, and the anchoring of pretend content in the here and now—can be succinctly explained as consequences of the data structure called the "metarepresentation". This representational system provides precisely the framework that is needed to deploy another attitude concept closely related to *pretending*, namely, the concept of *believing*. Thus, the same representational system is required if the child is to interpret mother's behaviour in terms of **mother** BELIEVES **(of) the banana (that) "it is a telephone"**. *Pretending* and *believing*, though closely related attitude concepts, are, nevertheless, different concepts and their successful deployment can make rather different demands on problem solving resources. I shall consider the emergence of the concept, *believing*, in the second part of this article.

The Metarepresentation

Leslie (1987, 1988c; Leslie & Frith, 1990) outlined some general ideas on how a mechanism like **ToMM** could achieve the above solution. Three different types of representation were distinguished. "Primary" representations are literal, transparent descriptions of the world. "Decoupled" representations are opaque versions of primary representations. The decoupling of a representation allows a processor to treat the representation as a "report" of information instead of merely being reacted to it. This in turn allows the (decoupled) representation to be placed within a larger relational structure in which an attitude to the truth of the "report" can be represented. This larger relational structure is built around a set of primitive relations—the *attitude* concepts or "Informational Relations". These relations tie together the other components. This entire relational structure is the third type of representation and is referred to as the "metarepresentation" (or, to distinguish it from Perner's later use of the term, the "M-representation").

ToMM employs the system of metarepresentation. Following Marr (1982), we can say that this system makes explicit four kinds of information. Descriptions in this system identify:

1) an Agent
2) an Informational Relation (the attitude)
3) an aspect of the real situation (the anchor)
4) an "imaginary" situation (the description),

such that a given Agent takes a given attitude to the truth of a given description in relation to a given anchor. The Informational Relation is the pivotal piece of

information in the sense that it ties together the other three pieces of information into a relational structure and identifies the Agent's attitude. The direct object of the identified attitude is (the truth of) a proposition or description (typically of an "imaginary" situation) in relation to a "real" object or state affairs. Not counting the implicit truth value, Informational Relations are thus 3-place relations (Leslie, 1987).

What does an Informational Relation represent? Perner (1991) has made a great deal of the fact that I borrowed the term "metarepresentation" from Pylyshyn (1978) for whom it meant a "representation of the representational relation". This seemed an innocuous enough phrase to me then, and still does, as long as one leaves it as an *empirical* issue exactly how a given "representational relation" is represented. But for Perner the term can only mean that the child possesses a certain kind of "representational theory of mind" (RTM) in which mental states are individuated by form rather than by meaning. I see no reason to accept this stricture. In any case, Leslie (1987) simply assumed that very young children did *not* have access to a RTM in this sense. The model of metarepresentation I outlined was designed to account for the very young child's capacities by attributing more modest knowledge in which, for example, "representational relations", such as reference and truth, are handled implicitly, while "representational relations" such as *pretending* and *believing* are handled explicitly. As we shall see later, there is no evidence available to suggest that preschool children have a RTM in Perner's sense.

The critical point about what Informational Relations represent is that they denote the kind of relation that can hold between an *agent* and the truth of a *description* (applied to a given state of affairs). This immediately determines a class of notion different from other kinds of relation that feature in early cognition, for example, spatial and mechanical relations, and forms the conceptual core of commonsense theory of mind.

My assumption is that there is a small set of primitive Informational Relations available early on, among them BELIEVE and PRETEND. These notions are primitive in the sense that they cannot be analyzed into more basic components such that the original notion is eliminated. While one can paraphrase "John believes that *p* is true" in a number of ways, one does not thereby eliminate the notion *believes*. For example, one can say "p is true for John", but that just gives another way (an alternate set of sounds for) saying "John believes that *p* is true".

Perner (1991) adopts part of the above theory of pretence, namely the notion of decoupling, though he discusses it in terms of "models". According to this view, pretence emerges when the child can entertain multiple "models" of the world instead of just the single model that is possible during the first year. Representations of different times and places apparently constitute different models. It seems unlikely that infants during the first year cannot relate past states of affairs to present ones but, in any case, Perner's notion of "model" is does not say much about pretence. The opacity properties of pretence are not illuminated by tense and location "models" because the content of pretence is opaque *in the here and now*. This kind of opacity is also what is relevant to *believing*. By contrast, in a "Zaitchik photograph" (one that has gone out of date), the photograph is only a representation of a past situation and not of the

current situation. Compare this case to the case in which someone assumes (wrongly) that the photograph is a photograph of the current situation. This is quite a different matter. The critical feature in this latter case is clearly not the representation itself which remains the same, but the fact that an Agent *believes* that the photograph depicts a current situation.

What Perner's model notion fails to address is the relationship of the agent to the "model". Perner (1988) says that for the child the agent is simply "associated" with the model, though an associative relationship can also hold between, for example, can-openers and kitchens without the child ever thinking that can-openers pretend anything about kitchens. Perner (1991) at times seems inclined to attribute a behaviourist notion of pretence to the young child such that the agent who pretends that *p* is understood as *acting as if p* were true. This proposal is only useful if we are also told how the child views the relation between *p* and the agent's behaviour in the case in which *p* actually is true. If the relation between circumstances and behaviour in the normal case is causal, is it also causal in the case of pretence? If so, how can imaginary circumstances be viewed as causal? How could the child learn about the causal powers of imaginary circumstances? The only solution to this dilemma, as far as I can see, involves some kind of mentalistic rather than behaviouristic interpretation of the relation between the agent and *p*, that is, some kind of *attitude* notion. Finally, parity of argument demands that if we insist upon a behaviouristic construal of pretence-understanding in the child, then we should also insist upon a behaviouristic construal of false-belief-understanding. After all, falsely believing that *p* demands the interpretation *acting as if p* every bit as much (or every bit as little, depending upon point of view) as pretending that *p*. The fact that one child is a bit older than the other does not in itself constitute a compelling reason for treating the two cases in radically different ways.

Decoupling

The role of decoupling in the metarepresentation is to transform a primary, transparent internal representation into something that can function as the direct object of an Informational Relation. In the case of Informational Relations, as in the case of verbs of argument and attitude, the truth of the whole expression is not dependent upon the truth of its parts. This is a crucial part of the semantics of mental state notions and what gives rise to the possibility of pretends and beliefs being false. The decoupling theory was an attempt to account for this feature without supposing that the *child* had to devise a theory of opacity. Leslie (1987) suggested that one way to think about the decoupling of an internal representation from its normal input/output relations vis a vis normal processing was as a report or copy in one processing system (the "Expression Raiser") of a primary representation in another (e.g. general cognitive systems). This suggestion drew upon the analogy between opacity phenomena in mental state reports and reported speech. Subsequently, Leslie (1988c) and Leslie and Frith (1990) developed this idea in terms of the relationship between decoupled representations and processes of inference. The basic idea is that decoupling introduces extra structure into a representation and that this extra structure affects how processes of inference operate, ensuring that the truth of the part does not determine the truth of the whole. The

simplest illustration of this is that one cannot infer **it is a telephone** from **"it is a telephone"**.

Normally, the truth of a whole expression is determined by the truth of its parts. For example, "Mary picked up the cup which was full" is true *iff* the cup Mary picked up was full. This same principle is involved in the detection of contradiction. Consider the following: **the cup is empty** and **the empty cup is full**. Suppose the whole-parts principle was implemented in a spontaneous inferencing device that carries out elementary deductions. The device will quickly produce the conclusion, "the cup is full & not full", revealing a contradiction because this whole and all of its parts cannot be simultaneously true. Despite the surface similarity to the foregoing, however, the device should not detect a contradiction in **I pretend the empty cup is full**. One might think at first that contradiction is blocked by the element, **pretend**, but contradiction returns in **I pretend the cup is both empty and full**, despite the presence of the element, **pretend**. We can think of decoupling as controlling the occurrence of contradiction:

(1) **the cup is empty**
(2) **the empty cup is full**
(3) **I pretend the empty cup "it is full"**
(4) **I pretend the cup "it is both empty and full"**.

Decoupling creates extra structure in the representation—an extra level to which the inferencing device is sensitive. Thus, in (2), with no decoupling, there is a single level within which a contradiction is detectable. In (3), there are two levels. The inferencing device first examines the upper level where it encounters **I pretend the empty cup X** and registers no contradiction. Next, it examines the lower level where it sees **X "it is a telephone"** and again detects no contradiction. On the lower level of (4), however, the device encounters **X "it is both empty and full"** and registers contradiction within the level as in (2). Contradiction is detected within but not across decoupled levels. This is exactly what is required by informational relations.

Similar patterns can be seen in causal inferences. For example, **I pretend this empty cup "it contains tea"** can be elaborated by an inference such as: *if a container filled with liquid is UPTURNED, then the liquid will pour out and make something wet.* This same inference works in both real and pretend situations; it also works for both own pretence and for understanding other people's pretence (Leslie, 1987). Of course, in pretend situations, we do not conclude that pretend tea will really make the table wet. The consequent is decoupled because the antecedent was. So, if I upturn the cup which I am pretending contains tea, I conclude that **I pretend the table "it is wet"**. The conclusions of the inference are again closed under decoupling; or we may say that the inference operates within the decoupled level.

If pretend scenarios—both one's own and those one attributes to other people—unfold by means of inference, then we could predict another consequent based on a variation of the above inference: *if the liquid comes out of the container, then the container will be empty.* This leads to pretending something that is true, namely, that the empty cup is empty. At first glance, this may seem ridiculous. But there is, of course, an important difference between **the empty cup is empty** and **pretending (of)**

the empty cup "it is empty". Later I will present an empirical demonstration that young children routinely make this sort of inference in pretence.

Yoking. The emergence of solitary pretence is yoked to the emergence of the ability to understand pretence-in-others. The very young child can share with other people the pretend situations she creates herself and can comprehend the pretend situations created by other people. She is able to comprehend the behaviour and the goals of other people not just in relation to the actual state of affairs she perceives, but also in relation to the imaginary situation communicated to her and which she must infer. We can illustrate this in two different ways: first in relation to behaviour, and second in relation to language use. Mother's goal-directed behaviour with objects will be an important source of information for the young child about the conventional functions of objects. Likewise, mother's use of language will be a major source of information about the meanings of the lexical items the child learns. But in pretence, the child will have to know how to interpret mother's actions and utterances with respect to mother's pretence rather than with respect to the primary facts of the situation. When mother says, e.g., "The telephone is ringing" and hands the child the banana, it will not be enough for the child to compute linguistic meaning. She will have to calculate *speaker's meaning* as well as (cf. Grice, 1957). This double computation is inherently tied to the Agent as the source of the communication and is seamlessly accomplished through the metarepresentation.

Interestingly, Baldwin (in press) has provided independent evidence that children from around 18 months of age begin to calculate speaker's meaning. In the circumstances studied by Baldwin, the 18 month old calculates speaker's meaning, not in service of pretence, but in the service of calculating linguistic meaning. Baldwin showed that, from around 18 months, children do not simply take the utterance of a novel word to refer to the object they themselves are looking at but instead look round and check the gaze of the speaker. They then take the novel word to refer to the object that the speaker is looking at, even if this is different from the one they were looking at when they heard the utterance. This finding reinforces the idea that infants around this age are developing an interest in what might be called the "informational properties" of Agents.

Understanding pretence-in-others

In this section, I shall describe an experimental demonstration of a number of the phenomena discussed so far. This experiment was first presented in Leslie (1988a) and discussed briefly in Leslie (1988c).[2] The following hypotheses are tested. First, early pretence can involve counterfactual inferencing. Second, such inferencing can be used to elaborate pretence. Third, inferencing within pretence can use real world causal

[2] Harris and Kavanaugh (in press) have recently replicated and extended this study, though they draw somewhat different conclusions in line with their "simulation theory". The simulationist view of theory of mind phenomena raises a number of complex issues which I do not discuss here (but see Leslie and German, in press).

knowledge and that such knowledge is available to two-year-olds in a form abstract enough to apply in imaginary situations and in counterfactual argument where perceptual support is minimal or contradictory. Fourth, two-year-olds can infer the content of someone else's pretence and demonstrate this by making an inference appropriate to that person's pretence. Fifth, two-year-old pretence is anchored in the here and now in specific ways. Sixth, that pretend contents are not always counterfactual. Seventh, that one can communicate through action, gesture and utterance a definite pretend content to a two-year-old child, sufficient for the child to calculate speaker's meaning/pretender's meaning and to support a particular counterfactual inference based upon the communicated content.

Method

The child was engaged by the experimenter in pretend play. Toy animals and some other props were introduced to the child during a warm-up period. My assistants in this task were Sammy Seal, Mummy Bear, Lofty the Giraffe, Larry Lamb and Porky Pig. Other props included toy cups, plates, a bottle, some wooded bricks and a paper tissue. The experimenter pretended that it was Sammy's birthday that day, that Sammy was being awakened by Mummy Bear and was being told that there was going to be a party to which his friends were coming. This warm up period served to convey that what was to happen was pretend play and to overcome the shyness children of this age often and quite rightly have with strangers who want to share their innermost thoughts with them.

The general design was to share pretence, allowing the child to introduce what elements he or she wished or felt bold enough to advance but to embed a number of critical test sub-plots as naturally as possible into the flow of play. These sub-plots allow testing of pretence appropriate inferencing. Could the child make inferences which are appropriate to the pretend scenario he has internally represented, but which are not appropriate to the actual physical condition of the props?

The sub-plots.

1). CUP EMPTY/FULL. The child is encouraged to "fill" two toy cups with "juice" or "tea" or whatever the child designated the pretend contents of the bottle to be. The experimenter then says, "Watch this!", picks up one of the cups, turns it upside down, shakes it for a second, then replaces it alongside the other cup. The child is then asked to point at the "full cup" and at the "empty cup". (Both cups are, of course, really empty throughout.)

2) UPTURN CUP. Experimenter "fills" a cup from the bottle and says, "Watch what happens!". Sammy Seal then picks up the cup and upturns it over Porky Pig's head, holding it there upside down. Experimenter asks, "What has happened? What has happened to Porky?"

3) MUDDY PUDDLE. The child is told that it is time for the animals to go outside to play. An area of the table top is designated "outside". A sub-part of this area is pointed to

and Experimenter says "Look, there's a muddy puddle here!". Experimenter then takes Larry Lamb and says "Watch what happens". Larry is then made to walk along until the "puddle" area is reached whereupon he is rolled over and over upon this area. Experimenter asks "What has happened? What has happened to Larry?"

4) BATH-WATER SCOOP. Following the above, it is suggested that Larry should have a bath. Experimenter constructs a "bath" out of four toy bricks forming a cavity. Experimenter says, "I will take off Larry's clothes and give him a bath. Then it will be your turn to put his clothes back on. OK?" Experimenter then makes movements around the body and legs of Larry suggesting perhaps the removal of clothes and each time puts them down on the same part of the table top making a "pile".

Larry is then placed in the cavity formed by the bricks for a few seconds while finger movements are made over him. Larry is then removed and placed on the table. Experimenter then says, "Watch this!" and picks up a cup. The cup is placed into the cavity and a single scooping movement is made. The cup is then held out to the child and he or she is asked, "What's in here?" If the child does not answer, the scoop is repeated once to "Watch this" and "What's in here?".

5) CLOTHES PLACE. The child is told "It's your turn to put Larry's clothes on again" and handed Larry. Where (if anywhere) the child reaches in order to get the "clothes" is noted.

Subjects. There were 10 children aged between 26 and 36 months with a mean age of 32.6 months. Two further children were eliminated for being uncooperative or wholly inattentive.

Results

Table 1 shows the number of children passing each sub-plot plus the entire range of responses that occurred. The failures came from 2 children who answered "Don't know" or failed to respond despite the sub-plot being repeated for them.

Statistical analysis seems mostly unnecessary. The CUP EMPTY/FULL sub-plot could be guessed correctly half the time, so all ten children passing is significant ($p = 0.001$, Binomial Test). In the other cases it is difficult to estimate the probability of a correct answer by chance but it is presumably low.

Discussion

These results support a number of features of the metarepresentational model of pretence. They demonstrate counterfactual causal reasoning in two year olds based on imaginary suppositions. For example, in the Cups Empty/Full scenario the child works from the supposition **the empty cups "they contain juice"** and upon seeing the experimenter upturn one of the cups, the child applies a "real world" inference concerning the upturning of cups (see page ?). In this case the child was asked about the cups, so the conclusions generated were, **this empty cup "it contains juice"**, and, **that empty cup "it is empty"**. The last conclusion is, of course, an example of

Table 1. Number of subjects passing test sub-plots and the full range of responses obtained.

Test	*Subjects passing*	*Range of responses obtained indicating appropriate inference.*
CUP EMPTY/FULL cup	10/10	points to or picks up correct
UPTURN CUP	9/10	refills cup, says "I'll wipe it off him" and wipes with tissue, "threw water on him", "he's spilling", "he got wet", "poured milk over him...wet", "tipped juice on head".
MUDDY PUDDLE	9/10	dries animal with tissue, says "oh no, all the mud", "covered in mud", "got mud on".
BATH-WATER SCOOP	9/10	says "water", "water" and pours into other cup, "water" and upturns into bath, "bath-water".
CLOTHES-PLACE	9/9	picks up from correct place, points to correct place.

Failures were produced by two different children with "don't know" responses or no response after the test was repeated