Too Many Ways of Interpreting 'What Infants Know about Syntax'

Goal: In their influential article [1], Lidz, Waxman & Freedman (LWF) argue that the acquisition of anaphoric one in English can be explained only if innate syntactic knowledge of the learner is assumed. Following publication, [1] had sparked a lively debate resulting in a host of commentaries, [3], [4], [5], [6]. In their response [2], to attacks in [3], [4], [5], Lidz & Waxman (LW) dispel the weaknesses pointed out in the commentaries but in doing so, overlook a new line of attack which might be thought of as a compositional version of [3]. The goal of this paper is twofold: (i) present an alternate explanation of LWF's original results; and (2) argue that there are too many ways of interpreting LWF's results, and that determining which is correct is impossible without further experimentation. Crucially, it is not our intent to show that innate syntactic knowledge is not a prerequisite for language acquisition, but only that one must be extremely careful about evidence presented in support of such arguments, especially, when such arguments regularly come under attack by scientists employing general statistical models, [6], [8].

The original experiment: In [1], LWF present experimental results which they take as evidence that 18-month old infants have knowledge of the internal phrase structure of NPs. The experimental procedure was as follows. [All standard procedural precautions were taken, here omitted for reasons of space.] Infants first underwent a familiarization phase in which they were presented with a single labeled item (here's a yellow bottle). Following familiarization, two items (e.g. a yellow, and a blue bottle) were presented to the infants who were randomly assigned a control or an anaphoric condition. In the control condition, infants heard a neutral phrase (Now look. What do you see now?), while in the anaphoric condition, subjects heard a phrase using the anaphoric expression one (Now look. Do you see another one?). Results showed that in the control condition infants preferred to look at the novel item (i.e. the blue bottle in the example above), while in the anaphoric condition infants preferred to look at the familiar item (the yellow bottle). Assuming subjects prefer an item matching the linguistic stimulus (if available), LWF take these results as evidence that infants know that the internal structure of NPs is hierarchical, since reference to the familiar item is only possible assuming a nested structure for the NP (figure 1) (‘yellow bottle’ does not form a constituent in a flat structure). Crucially, LWF present a corpus analysis showing such knowledge could not have been gleaned by infants from the available input.

First generation responses: Two main lines of attack on [1] were launched in [3] and [5]. In [3], Tomasello argues that another one is an expression which is not decomposed, and that it refers to an object similar to an object already under consideration. In [5] Regier & Gahl (RG), argue that (a) knowledge that anaphoric one refers to an N' antecedent is not sufficient since bottle itself is an N' (fig. 1); and (b) that rather than innate syntactic knowledge, given available linguistic input, the upper N' solution could be learned by a simple Bayesian model.

LW's response to responses: In [2], LW dispel the arguments against their conclusion in [1]. Tomasello's arguments in [3] are dismissed by the experiment in [7], showing that in the absence of a linguistic antecedent, another one may refer to the less familiar item. RG's arguments in [5] are vitiated because their conclusion that the choice of the lower N' as antecedent should be precluded is too strong, as can be seen by, e.g. "I have a yellow bottle and you have a blue one" [2].

Second generation response & current state of affairs: In [6], Foraker, Regier, Khetarpal, Perfors, & Tenenbaum, concede that the model presented in [5] is limited in that it supports only the higher N' hypothesis. However, they point out that the original
[1] is limited in much the same way as it too does not demonstrate that infants learn the more general any-N' hypothesis. The desideratum of [6] is to show that assuming the knowledge of the hierarchical NP structure, a Bayesian model can learn the correct any-N' hypothesis, "without innately excluding the false N_0 hypothesis". [Note that the N_0 hypothesis must be excluded even if hierarchical NP structure is assumed, to explain the complement/adjunct contrast: *I'll have a piece of cheese and you can have one of apple. vs. I want the ball with stripes and you can have the one with dots.*] We are thus left with a rather tangled state of affairs. On the one hand [1] and [2] together provide substantial evidence that infants know how to resolve anaphoric one with a (higher) N' antecedent, which could not be gleaned from available input. On the other hand [5] later honed by [6] show that under certain assumptions, a simple Bayesian model could learn the correct (any-N') hypothesis without having the false N_0 hypothesis innately excluded. The question of whether or not the knowledge of NP structure is innate is left unresolved due to the symmetrical weaknesses of [1] and [5]: both fall short of showing that it is the false N_0 hypothesis that is rejected by infants. Additionally, [6] demonstrates that the correct hypothesis can be learned statistically, given a highly-constrained hypothesis space, namely one in which the hierarchical structure of NPs is innate.

A novel argument: We present a previously overlooked argument (as far as we are aware) in attempt to unravel the tangled state of affairs depicted above. Our argument follows Tomasello's intuitions in [3] in that another one refers to an item similar to that under consideration, but diverges from it in that we do not assume non-compositionality. Assume instead that another serves as a contextual trigger, interpreted along the lines of too and also. Thus, anaphoric one could be perceived by infants to allow both N_0 and N'-type antecedents, with another blocking resolution with the unfamiliar item (blue bottle), so that infants need not have any knowledge of NP structure to predict choice of a familiar item (yellow bottle). To explicate, even if infants assume a flat NP structure, they would prefer the familiar item (yellow bottle) if the unfamiliar item (blue bottle) is rendered disfavored by another, as both are consistent with the non-phrasal antecedent bottle. Clearly LW's response based on [7] no longer holds as a linguistic antecedent exists. Pertinently, [2] presents another condition not reported originally in [1], in which infants heard "do you see one now?" and still showed a reliable preference for the high N' antecedent. There are two problems with this. The first a technicality, namely the results are not presented, and so we cannot assess the statistics; even if significance obtains, it would be interesting to see whether confidence levels decrease. A second problem is that just as another could serve as a contextual trigger, so could now. Initial support for this is given by the following pairs: "I have a yellow bottle and you have (a/another) blue one"; "I had a yellow bottle and you have (#a blue) one now" [without contrastive stress]. Thus, in order to ascertain whether infants reject the false N_0 hypothesis the experiment has to be planned more carefully to eliminate possible contextual triggers.

Conclusion: Statistical models have not been able to learn the correct any-N' hypothesis without assuming prior structural knowledge. Still, the experiment in [1] shouldn't be seen as supporting innate knowledge of NP structure on its own, given the various interpretations of the results. Further experiments are needed to support innate knowledge of NP structure, obviating potential confounds such as the contextual trigger interpretation presented here.