For want of a VP: a study in semantic bootstrapping

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Abstract

Given inherent meta-cognitive development, infants from 18 months can raise to awareness and attempt to express complex events involving the collation of events manifest in the 'here and now', alongside a potential state of affairs, contrasting in some way with the hear and now. These utterances express intentions or desires either for object change or new occurrences of events. This paper makes the novel claim that it is in this context that infants acquiring English begin to form a conventional VP construction. An empirical study described here supports this claim. Exemplification from diary evidence shows the surprisingly powerful bootstrapping effect of intentional utterances, the possibilities of which appear to have received too little attention in the literature.
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1 Introduction

Around 18 months of age Travis makes her first two word utterances. Travis is the daughter of Michael Tomasello and the subject of a diary corpus supporting his study of infants' first verbs (Tomasello 1992). Typically, among her first two word utterances are what might be analysed in adult terms as two nouns in juxtaposition, for example 'eggs mouth'. Tomasello gives a brief interpretive comment for each of Travis' utterances and in this case his comment is:

(1) a. 17mo 25days Eggs mouth – *wants eggs in her mouth*.

It appears that on this occasion Travis seems to be expressing a desire to have some egg in her mouth, presumably to eat. On subsequent occasions she is recorded to have said (with Tomasello's comment):

b. 17m27 Candies mouth – *wants candy at store*
c. 18m30 Berries mouth – *emphasizing to us to get her some*
d. 19m00 Ketchup mouth – *eating it*
e. 19m15 Pills mouth – *copying my action of taking a pill*
f. 19m28 Potato mouth – *it is in it*
g. 19m02 Cracker mouth … eat-it … mmm – *as she eats*

Tomasello also indicates that from 18-19 months Travis has been using the utterance: 'eat-it' accompanying eating events. The interpretations given to the above utterances (1a-g) vary considerably: describing desires, directing the actions of others, describing current actions, describing imitated actions of others, describing affect. By conventional analysis these utterances have a [N]+[N] construction, and the words she uses are conventionally considered to be the result of having learned the labelling of Object[N]'s through a 1:1 mapping either with the object category or with the object concept. Is Travis, by a linguistic juxta-positioning of two discrete object category names, really meaning to express the implicatures evident in the interpretative comments? Or, is there a more straightforward account?

This paper is based on the view that there is much greater flexibility, particularly at word level, than is usually attributed to infants acquiring their first language. Concomitant

with this view is the claim that in the earliest phases of language acquisition words do not have inherent grammatical or functional category membership apparent in adult grammar. (cf. Braine 1992; Tomasello 2000; Barner & Bale 2002; Cristoforo 2009, Siddiqi 2010). Although this claim might appear to conflict with theses related to the idea that knowledge of grammar is innate, we believe that it is not inconsistent with the idea as it is manifested in recent Minimalist versions of generative grammar – as we suggest in 2.3 below.

Such a claim, however, raises an obvious query. Where does the infant find any stability or foundation for language learning? The process is clearly not a random and haphazard drive to adult conventionality. As a human infant may be born into any environment, culture or language, having a maximally flexible approach is necessary, but cannot be sufficient.

There are, to be sure, two fundamental principles, incontrovertibly species universal and innate, which can be claimed to drive the process and provide the required stability and constraints. Firstly, only humans communicate complex thoughts and ideas verbally. Human communication requires not only a speaker but a comprehending hearer. Thus speaking to be understood is a strong constraint on the production of conventionally appropriate utterances. Secondly, human cognitive and meta-cognitive growth is universal, and as will be shown, influences the communication process fundamentally. While these two important principles are taken for granted in many mainstream language learning accounts, they receive little attention. An attempt will be made in this paper to redress the balance.

Section two will set the context for the study by identifying and drawing a distinction between two key event types: manifest events and complex events. Section three reports and discusses a series of empirical studies, drawing on corpus data, which reveal, often surprisingly, how attempts to communicate complex events appear to provide a bootstrap into early verb phrase construction in English. Section four will conclude by highlighting some implications of the findings.

2 Event types

By way of preparation for the analysis presented in the study below, it is necessary to draw a distinction between what will here be termed manifest events and complex events. Each is considered in turn.

2.1 Manifest events

Verbal communication takes place between at least two participants, and early communication between infant and carer takes place in what has been termed joint attention. Joint attention is being used here to describe a carer and infant both focussed on a shared event: playing with toys, preparing food or some other event where both are actively involved. A key characteristic of this context is the shared understanding of the event. This shared context enables a great deal of intentional labelling of objects by the adult, and this is usually accompanied by additional information supporting the infant's development of generic knowledge about the objects. For instance, an adult rarely simply labels a novel item but gives additional information about it: "This is a courgette. It's good to eat. We'll have it today" (mother/infant interaction overheard in a supermarket). Csibra & Gergely (2009) propose that human communication is specifically adapted to allow the transmission of generic knowledge between individuals, particularly in adult-infant interaction, as a form of natural pedagogy. Bearing in mind that infants have quite limited knowledge of the world, various experimental work by Mandler and McDonough (2000, 2002, 2004) has suggested that gaining knowledge of objects and entities builds on how these entities act within actual

dynamic events. Objects and entities are indivisible from the events within which they take part, and the predictability of events and how they unfold provides stability, until new information is acquired. Objects have generic event attributes and events have generic performers. For instance, potato can be eaten and eating can involve potato. Two word utterances descriptive of events in the here and now, suggest that one word serves to make more explicit the generic event potential of the category of the other. Infant utterances about manifest events might therefore simply highlight some feature or features of the event (e.g. there being a baby, and/or there being crying occurring) with the communicative intention to focus on generic propositions (e.g. that babies cry).

In the corpus data (used for the study in Section 3), dolls can be in two states either sitting or standing, and comments on this are recorded as: 'doll sit' or 'doll stand'. In a similar vein (toy)trains appear either to fit (on the track) or crash, expressed as 'train fit' or 'train crash'. Word order does not appear to be critical, although many examples place the reference item first.

Note that what adults interpret as verb-like words do appear in this structure, although it would seem in infant terms that they function more like adjectives. Examples include:

(2) a. Baby crying (there is a crying baby and crying is what babies do)
b. Swimming hippo (there is a swimming hippo and swimming is what hippos do (?))
c. Potato mouth (there is potato in the mouth and potatoes are edible)
d. Doll sit (doll is sitting and sitting is what dolls do)
e. Coffee hot (Coffee is hot and hot is what coffee is)

In this kind of utterance, word forms, classed as verbs (category [V]) in adult grammar, do not partake in the syntactic relations necessary to perform the role required of adult verbs.
The events forming the basis of communication in this context will be termed Manifest Events: single, shared events which may well be quite protracted but have the key feature of being entirely in common ground. Perner (1993) uses the term Primary Representation (PR) to label this context – a generalised representation which supports and is supported by perceptual representations of the 'here and now'. In contrast to PR, Secondary Representation (SR) is used to label a representation constructed from memory of a situation not apparent in the here and now. It is the interaction between these two types of representation that constitutes complex events.

2.2 Complex events

From the age of about 15-18 months infants achieve a new cognitive ability, and are able to hold two contrasting representations in mind at the same time. To borrow terminology from Perner (1993), these consist of a Primary Representation – (PR) a mental representation of the 'here and now', and a Secondary Representation (SR) constructed from memory representing an alternative event or state. This meta-cognitive shift is well attested in the literature: Perner & Dienes (2003); Zelazo (2007) - second level infant consciousness, or Suddendorf & Whiten (2004) - Primary/Secondary representational collation, or can be supposed to be what prompted Piaget's well known observations described as Sensorimotor Phase, stage 5/6.

Whereas previously infants communicated with others through raising a Manifest Event to awareness, their abilities now could be characterised as being able to collate primary and secondary representations 'side-by-side' when engaged in communicative interactions. This means an infant can now hold in memory a representation of a complex event, part of which is not in the present environment. Thus an infant can communicate a 'wanting' or 'intention'

towards an absent object/entity or change of state. In this paper, such an act is termed **Intentional** (INT). The second ability is for an infant to construct from memory a means, which contributes to an event or state which is actual in the present environment. This is being termed **Resultative** (RES). These utterance types can be exemplified by utterances as follows:

(3) a. I want the juice – Intentional (juice is not present and is a goal)
b. Mend it train – Intentional (the state of the toy train is to be changed from its present broken state to the goal of it being whole again)
c. I found the spoons – Resultative (the finding process is not of the present and is the means by which the spoons are present).
d. Nana bought this car – Resultative (Nana's purchasing of the train is the means by which the car is present)

Utterances of these types are all telic. They vary in significant ways from the utterances considered so far, not only in telicity, but also in informativeness. The constructed representations are not entirely in common ground, and as such linguistic devices need to be acquired for effective verbal expression. In these instances the PR utterance type is no longer viable as a means of linguistic expression because the inherent event potential of the object is no longer the focus. The object has to be referenced and the reference needs to persist through both sub-events, the shared PR and the private SR event (non-manifest goal or means). In English, predicates with related and marked argument structure would meet this requirement. Words learned and used initially exclusively in these constructions exhibit properties more like adult verbs.

2.3 Some consequences for infant grammar

For the purposes of this discussion, we will be describing adult grammars in terms of the ideas found in recent Minimalist versions of generative grammar. Although nothing at all about our theory hinges on this choice, and although any of the syntactic frameworks that are broadly lexicalist (such as HPSG, LFG and so forth) would equally suit our purposes, we want to emphasise that our proposals about infant language are not inconsistent with a kind of continuity approach to acquisition, according to which infant language use does not diverge from the principles of adult syntax.

In lexicalist approaches to syntax, the specific properties of a grammar are captured in terms of rules or constraints that make reference to syntactic features attributed to lexical items. In minimalist-style frameworks, there is a basic operation, merge, which can apply freely to lexical items and phrase markers but which is normally driven or constrained by the grammar-specific requirements imposed on the features of the items or markers involved (see Adger 2003). We assume in particular, that selectional properties of lexical items (e.g. that a certain verb selects for a DP) are accounted for in terms of constraints on features occurring in complex expressions. We assume that, in this framework, it is conceivable that if items have no features, then there are potentially no constraints on their merging.

As mentioned above, when children use language to describe Manifest Events, their intention seems to be to highlight features of these events, often with the further intention of implying something generic. However, utterances of 'baby crying' or 'potato mouth' do not seem to be explicitly expressing generic propositions. Rather they seem to be a juxtaposition of predicates of aspects of the on-going situation. The idea then is that children acquire predicates like, 'baby', 'crying' and 'mouth' initially as predicates of on-going events. These predicates are applied to Manifest Events, not to entities which feature in these events. By

contrast, in adult grammars, predicates play two important roles in the characterisation of events or situations. One is the 'noun' role of characterising entities which feature in the event and the other is the 'verb' role of characterising the event in terms of properties that could be attributed to the entities involved. In broad terms, clauses in adult grammar are built around 'verbs' and 'noun phrases' (DPs), the latter quantify over, or refer to entities which figure in the events described by the verbs. Thus part of our claim is that in describing Manifest Events, children are not necessarily employing nominal forms like 'baby' as noun phrases referring to some particular baby but simply as a predicate of the on-going event. Similarly, children do not necessarily use verb forms like 'crying' as lexical items that select for noun phrases but, again, as forms that pick out aspects of an on-going event.

When children begin to be able to describe Complex Events, then there is motivation to find linguistic means to denote an event that occurs partly in shared attention and partly outside of the here and now. Moreover, a need forms to track 'objects' over the course of this event as things which mark the progress of the event. For example to describe putting potato in a mouth as an intended action, it is the change of location of the potato that marks out the successful completion of the event. The proposal is that, under these conditions children begin to become aware of the function of noun phrases to pick out particular referents and verbs as linguistic forms that select for noun phrases and that denote event types involving the referents.

In summary, the proposal is that, in part due to changes in meta-cognitive limitations, children's communicative abilities develop over this critical period in terms of the types of events they can communicate about. In the earlier phase, it is conceivable children use forms like 'baby' and 'crying' as simple predicates and their juxtaposition is simply the product of a merging of two featureless items. When communicative intentions become more sophisticated, children become aware of the fact that nominal predicates feature in noun phrases, which refer, while verbal predicates select for noun phrases and can be used to denote complex events. In this way, children tune into the restrictions of the grammar of the language they are acquiring.

Our proposal makes some predictions that other approaches to grammatical category acquisition do not. Specifically, we can compare our approach to a richer innatist view according to which the full nominal/verbal system is in place from the earliest productions. Only our proposal predicts that children will tend not to use noun phrases (DPs) when characterising Manifest Events, while the use of noun phrases will emerge when Complex Events are being described. To see this, note that in child language, the most commonly used noun phrases are pronouns, definite descriptions and demonstratives. Each of these types would be equally felicitous in describing a Manifest Event (a baby crying in joint attention) or a Complex Event (putting some potato you have in front of you in your mouth). Thus the standard view would predict little difference in the occurrence of these definite noun phrase forms between manifest events and complex events. In fact, for many complex events described by children, the object is absent from joint attention and only appears in the goal state represented in the child's secondary representation. Thus, if anything, the preponderance of definite DPs would be found in descriptions of manifest events. Proposals that do not assume that category knowledge is innate, such as the verb-island theory of Tomasello (1992), similarly predict no difference in noun phrase occurrence between these two types of events.

3 Empirical study
3.1 The corpus data

The data for this study is the UK-Eng/Manchester corpus chosen from the CHILDES database. This corpus consists of a longitudinal record of 12 infants over the 20-35 month age range. The infants were visited in their homes roughly fortnightly over a year, and on each visit two half hour recordings were made of infant/carer interaction (in all cases the carer was the mother) while engaged in free play with an assortment of toys and props. Each child (barring very few missed visits through unavailability) has a record of 34 visits giving 68 half hour scripts (morning and afternoon) over the period. Each of these scripts records roughly 8-900+ child - adult exchanges.

These scripts were considered to be appropriate to use for the study because they cover a similar age range to the Travis diary data and therefore provide the possibility to match linguistic developments in comparable social/home settings. Because the computer technology available cannot as yet analyse the scripts for communicative intent, for purely practical reasons a sampling system was devised to make the 'longhand' analysis of the scripts manageable.

A feasibility study drawing on scripts from 6 infants sampled at regular monthly intervals over the age range 23-28 months, yielded encouraging yet confusing results, and it was clear by the infants' talk content that a simple age measure did not give comparability. This should be no surprise, as it is well known that infants develop at different rates, and it is usual practice to assume a $^{+}$/- 3 month leeway between subjects. As the study crucially concerns a limited window of linguistic development, an alternative sampling system was necessary which would preserve the evidence of linguistic as well as age progression. In keeping with Roger Brown's pioneering work (1973), Mean Length of Utterance (MLU) was considered. This is a well-documented and much used measure which is calculated, most usually from transcripts of spoken language, as a proportion of morphemes uttered to total utterances. It is most effective as a longitudinal within-subject measure confirming that over time, MLU increases with age. As a snapshot of development, however, it can be misleading as it depends on what the infant chooses to say at any time. Therefore a series of MLU readings are required to be able to average out a developmental process. A computer calculation of MLU for each half hour script was recorded, and a scatter graph with trend-line obtained. These revealed that all the infants had made typical progress.

The average MLU for each one hour day visit was calculated and recorded alongside the respective age of the infant in months and days. Brown (1973) had defined several MLU ranges for his research, and in keeping with this, three MLU bands were identified: Band 1 MLU 1.5 to 2.0; Band 2 MLU 2.0 to 2.5; and Band 3 MLU 2.5 to 3.0+. Samples for the 12 infants were then chosen to give two one hour samples per MLU band which also represented as far as possible a monthly progression for each infant. The aim here was to have comparable linguistic development alongside comparable age experience. Two infants were rejected because their profiles could not fit this requirement: one because nearly all of the scripts were in MLU Band 1, and the other because the scripts were disproportionately in MLU Band 3. All remaining infants fitted the criteria (MLU vs age progression) in a comparable manner. The resultant sample provided 6 hours of talk for each of 10 infants (5 boys and 5 girls), and a total of 22,104 infant utterances of two or more words. This was considered to be a sizeable and appropriate corpus for the purposes of this study.

3.2 Study 1 – the relation between utterance types and DP use

As outlined in Section 2, the analysis of the texts should involve the identification of utterance types expressing complex events, these are termed INT and RES. The remaining utterances are classified as expressing manifest events and these are termed PR. Because of the evident difficulty of confidently identifying communicative intent from a single word utterance, only utterances of 2 or more words were analysed. This had an added advantage in increasing the likelihood of including infant productive speech by excluding one word replies to an adult's closed questioning. These frequently appear as: 'what's this?' requesting/checking the infant's knowledge of vocabulary; 'what colour is it?' or 'how many are there?' or other pedagogic questioning, all of which are well represented in the corpus. Decisions about utterance types are essentially judgements, as formal cues are misleading. For infants with little facility with syntax or morphological distinctions and with a limited vocabulary inventory, what they say may only approximate in adult terms to what they mean. Judgements, therefore, need to be formed by taking into account the wider context of the talk, particularly the adult reply. This provides valuable insight into how the adult has interpreted the infant utterance. The infant response to the adult's interpretation gives a further measure of whether the infant considers the adult has got it right. To clarify:

INF: building house
MOT: oh, do you want to do some building? Let's get the bricks out.
INF: yeah

In this instance the infant utterance alone may suggest that she is in the process of building and might be classified as PR. The additional context makes it clear that the utterance should be classified as INT.

In the older age samples use of 'want', 'gonna', 'will', 'lemme' all appear to signal INT, although the use of these words differs from adult use. In the main, the rule of thumb established in 2.2 generally applies: the child is making reference to an object/ event, or change of state not apparent in the here and now. The Agent and means to effect the intention appear initially to be unimportant and not mentioned by infants, although utterances from Band 3 show that Agents and means are beginning to play a part in the semantics of the utterance. 'I' is much used, and always appears as the first word in an utterance. (There is an issue of what 'I' in this context in fact signifies. This is addressed further below.)

RES utterances are many fewer than the other two types, and again the rule of thumb is to consider if the end result is present in the here and now, and the infant is expressing her knowledge of how the current state of affairs has come about. Again, formal cues can be misleading, this is particularly true of the use of 'got'. Consider how the following two examples differ:

INF: got Thomas Tank (infant story book)
MOT: yes you have, shall we read this one now?

INF: got Thomas Tank
MOT: oh yes, did you find it in your box?

In the first instance, the decision is whether the infant is confirming possession of the book (PR), or whether she would like to have it read now (INT). The second appears to be a comment on the infant's having retrieved the book and therefore to be classified as RES. The various nuances and decision points will not be pursued further here.

All 2+ word utterances were marked as PR, INT or RES giving the following total numbers of utterances found across all data scripts:

Total utterances	22,104
PR utterances	13,827
INT utterances	6,994
RES utterances	1,283

All utterances marked PR, INT or RES, were calculated as a total for each sample script for each infant. The data carried forward for statistical analysis of utterance types was expressed as a proportion: total of each utterance type per script to the total of all utterances per script. Each datum therefore consisted of a number less than 1. To capture as much detail as possible, the proportion calculation was made to 3 decimal places.

For Study 1, a total count of DP use for each script was then recorded as a proportion of DP use to total infant utterances for each script. The table below displays the items counted for this study and the total instances across all scripts. Note that for Study 1, DP data were pooled, so individual DP use was not analysed at this stage.

Infant DP	Instances across all scripts
I	2561
it	2271
the/a	1912
Rigid Designators	1760
that/those	1378
this/these	657
You	635
He/she/they	398
me	241
him/her them	168
We	98
us	2
Total	**11736**

At the end of this analysis there were 60 data items for each element – PR; INT; RES; all DP use. Each of these items had been proportioned to a common base, namely total utterances per respective script. The infant's gender for each data set was also recorded. All analyses were then conducted using SPSS 17.

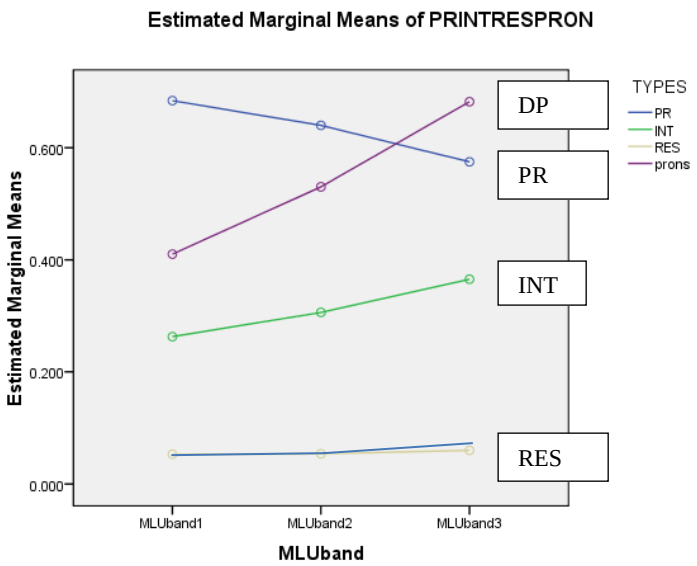
3.2.1 Study 1 Results

After checking for homogeneity of the data, a series of two way ANOVAs with MLU Band and Gender as fixed groups and utterance types as variables was run, to confirm whether or not there were any significant differences according to the gender of the infants. Gender was found not to be a significant variable, and as such was no longer considered in the study.

A series of Pearson correlation tests were then conducted, to confirm or otherwise the positive correlation between each utterance type and DP use. These gave the following results:

Correlations between:
PR and DP use were negative, significant r= -0.554 p<.001
INT and DP use were positive, significant r= 0.552 p<.001
RES and DP use were positive, non-significant r= 0.136 p=.302

These results show a positive, significant correlation between DP use and INT utterances. The strength of this relation was further tested by Regression analysis which showed INT to be a robust predictor of DP use, (regression was significant at the .001 level, significantly greater than chance: F(1,58)=25.464 p<.001). The linear relationship accounted for 31% of the total variance. This relation can be graphically presented through the following plot of estimated means against MLU bands:



3.2.2 Discussion

The results from Study 1 confirm the initial prediction that referring expressions bear a more significant relation to INT utterances (complex events) than PR utterances (manifest events). This is surprising because one would expect that object reference would occur more significantly for situations where objects were always actually present in the physical environment, rather than those where the object is often physically absent. Although there is a robust correlation between INT utterances and DP use, it should be remembered that correlation does not demonstrate causation. The result may simply be due to the case that infants make progressively more INT utterances and, in a coincidental way, also make more referring expressions as they attend to more objects in their environment. The significance of the Regression analysis gives encouragement that there is more information to be gained by drilling down further into the relationship between DP use and utterance types.

Studies 2 and 3 attempt to do this by considering the thematic roles the DP elements are performing. This requires the refining of the DP tally into two divisions: those performing a Theme role like (grammatical) Object and those that are not. The latter will simply be labelled as Subject. In keeping with the stated hypothesis (2.3), it is claimed that DPs in Theme role will head an endocentric DP, and will reveal the presence of a VP construction. Study 2 will explore the relation between utterance types and Object DPs (endocentric DPs). Study 3 will further explore the relation between utterance types and Subject DPs (exocentric DPs).

3.3 Study 2 – the relation between utterance types and endocentric DPs.

This Study requires the identification of DP use as either Object/Theme role, or Subject role (animate Agent roles were also abstracted from the Subject set). In the main, this is a straightforward task, in that the formal word needed to be used, and the judgement over the role is based on adult understanding. In case of doubt e.g. '**that**, Mummy' the designation is to Subject unless it is clear from the context that the communicative intention is otherwise (I want **that**, mummy). The items tallied from infant utterances were as in the following table (total tallies for the whole data set are given to record the profile of DP use overall)

Infant DP use	O/Theme role 'Os'	Subject role 'Ss'	Agent role 'Ag'
it	1506	765	
that/those	618	760	
this/these	291	366	
the/a	1567	345	
I		2561	2561
me	241		
Rigid Designators	654	1106	1106
He/she/they		398	398
him/her them	168		
You	138	497	497
We		98	98
us	2		
Totals	**5185**	**6551**	**4660**

As before, totals of 'Os', 'Ss' and 'Ag' uses were made for each script, and a data set derived as a proportion of these to the total number of utterances per script. Again all these calculations resulted in data values less than 1, recorded to 3 decimal places. Study 2 makes use of 'Os' data and Study 3 will make use of 'Ss' and 'Ag' data.

3.3.1 Study 2 results

A series of Pearson correlation tests were then conducted to confirm or otherwise the positive correlation between each utterance type and 'Os' DPs. This gave the following results:

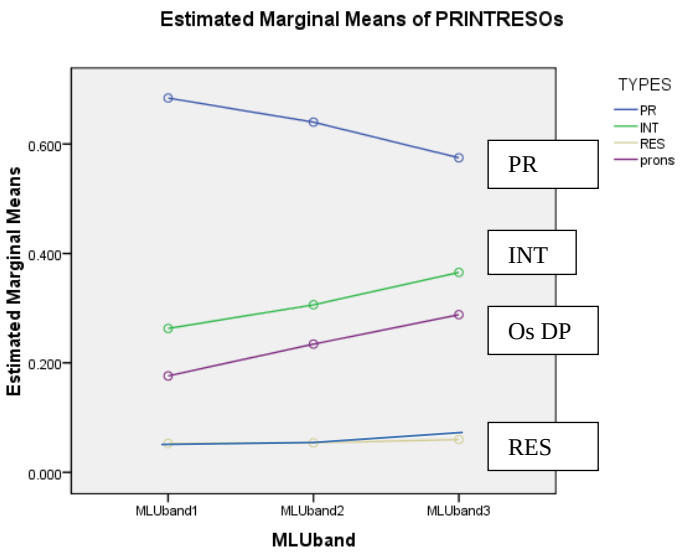
PR and Os negative, significant correlation $r= -0.632$ $p<.001$
INT and Os positive, significant correlation $r= 0.658$ $p<.001$
RES and Os positive, non-significant correlation $r= 0.066$ $p=.615$

These results show a positive, significant correlation between 'Os' DPs and INT utterances. The strength of this relation was further tested by Regression analysis which showed INT to be a robust predictor of Os, (regression was significant at the .001 level, significantly greater than chance: $F(1,58)=44.384$ $p<.001$). The linear relationship accounted for 43% of the total variance.

Given the frequency of 'it' and 'the' DPs in the raw data, the result might be prompted by the disproportionate influence of these DPs. To explore this possibility the raw data was recalculated to give separated proportions of 'it/the' DPs and 'Os'-DPs excluding 'it/the' and comparative correlation tests run.

INT and 'it/the' **positive, significant** correlation r=0.459 p<.001
INT and Os excluding 'it/the' **positive, significant** correlation r=0.599 p<.001

These demonstrate that the generalised conclusion that 'Os' DPs bear a significant relation to INT utterances is reliable and robust, as apparent visually from the means plot:



3.4 Study 3 – the relation between utterance types and exocentric DPs

As for the previous tests, a series of Pearson correlation tests were then conducted to confirm or otherwise the positive correlation between each utterance type and 'Ss' DPs. This gave the following results:

PR and Ss negative, significant correlation r= -0.381 p=.003
INT and Ss **positive, significant** correlation r= 0.362 p=.005
RES and Ss positive, non-significant correlation r= 0.149 p=.257

These results show a positive, significant correlation between 'Ss' DPs and INT utterances. The strength of this relation was further tested by Regression analysis which questioned whether INT is a valid predictor of Ss, (regression was significant at the .005 level, significantly greater than chance: F(1,58)=8.729 p=.005). The linear relationship accounted for only 13% of the total variance.

Given that the subject role is known to be problematic (Paul 2010, for overview), a further exploration was conducted to separate and compare the Agent role as distinct from the data here labelled as 'Ss' DPs. Correlations were calculated using Agent (Ag) data only compared to 'Ss' DPs excluding Agents (SxA). The following results were obtained:

PR and Ag negative, significant correlation r= -0.407 p=.001
PR and SxA negative, non-significant correlation r= -0.164 p=.210

INT and Ag **positive, significant** correlation r= 0.371 p=.004
INT and SxA positive, non- significant correlation r= 0.181 p=.167

RES and Ag positive, non-significant correlation r= 0.204 p=.118
RES and SxA negative, non-significant correlation r= -0.011 p=.936

It would appear from these results that it is the Agent role which might have been driving the positive result for the 'Ss' DPs and INT for the previous test. A further query arises, however, given the disproportionate use of 'I' in a seemingly Subject/Agent role. To test what effect this might have, further recalculation of the results was undertaken to separate and compare use of 'I' (Is) and use of Agent DPs excluding 'I' (AxI), giving the following results:

PR and Is negative, significant correlation r= -0.441 p<.001
PR and AxI negative, non-significant correlation r= -0.099 p=.451

INT and Is **positive, significant** correlation r= 0.373 p=.003
INT and AxI positive, non- significant correlation r= 0.123 p=.347

RES and Is **positive, significant** correlation r= 0.304 p=.018
RES and AxI negative, non-significant correlation r= -0.046 p=.726

It would appear from these results that neither 'Ss' DPs nor Agents show a significant correlation with utterance types and that it is in fact the pronoun 'I' which is a significant driver. Linear regression shows that INT and RES are predictors for 'I' use at a level greater than chance, but account for a small percentage of the variation:

INT and 'I' $F(1,58)=9.376$ $p=.003$ accounting for 14% of the variation
RES and 'I' $F(1,58)=5.926$ $p=.018$ accounting for 9% of the variation.

4 General discussion

The series of studies were set up to explore the relation between definite DP use and utterance types (INT, RES, PR). The first study found that total DP use correlated positively and significantly with INT utterances. The significant but negative correlation with PR utterances confirmed that the relation between INT utterances and DP use merited further exploration.

Study 2 confirmed the strong correlation between INT utterances and DP elements functioning in a Theme role in line with adult interpretation of grammatical Object. This relation was found to be so robust that correlation tests of sub-groups of Theme role DPs showed positive significant relations confirmed by Regression analysis.

Study 3 considered the relation between utterance types and Subject role DPs, and, by successive testing of sub-divisions of DPs, established that of all DPs it was only 'I' (first person singular) which is driving the positive relation with utterances expressing complex events (INT and RES).

These results appear to tell two separate stories. The first, which contributes to the focus of this paper, is that there is a very strong correlation between INT utterances and endocentric DPs. As endocentric DPs occur as components of Verb Phrases, INT utterances seem to play a significant role in the development of Verb Phrase constructions. As the study was designed not to rely on a prior definition of [V] or [N] in infant utterances, nor to follow a word/item-based analysis, the data suggests that INT is providing an interesting bootstrapping effect. That there are very few DPs used (maximum number for any single 'O'-DP is 1500 across 22000 utterances) invites the conclusion that a bootstrapping process is indeed being witnessed here.

The second point raised by the empirical testing, is more problematic. Although Subject role DPs were found to have a significant correlation with INT utterances, Subject DPs with (human)Agent DPs extracted (SxA) were not significant. Similarly, although Agent DPs were found to be significant, Agent DPs with 'I' (first person) abstracted from the data (AxI), were found not to be significant. This contrasts with the analysis for Object DPs where positive significant results were obtained however the data was partitioned. The isolated use of 'I' (first person pronoun) was found to be significant for both INT and RES utterance types, but not PR. A full consideration of the role of 'I', which has received controversial treatment in the literature, is currently beyond the scope of this paper. However, from the sample scripts, an analysis of adult use of 'I' in child directed speech, shows that the stressed form 'I' (as opposed to lesser stressed 'inflectional' forms: I'm; I'll; I've) almost exclusively refers to mental states (– think, know, want, like, remember) and provides a model for infant use. Rumsey (2003) and Wechsler (2010) in different ways argue that 'I' and 'you' are not referential or agentive, but attributive of mental states. It is tempting to speculate that use and acquisition of these pronouns helps focus infant attention on the cognitive as opposed to the physical environment and thus supports the infant as she moves away from the confines of the context of manifest events.

RES utterances, of themselves, do not appear to be a strong influence at this stage. They are much less frequently used in the selected scripts and their role is not clear cut in the current analysis. Treatment of their properties and use will be left for another time.

As INT utterances appear to be implicated in all positive significant test results, a clear question is raised: why are INT utterances such a productive powerhouse for development? INT utterances are highly informative. They express mental representations not necessarily shared in common ground and seemingly make reference to absent or not yet occurring intentional events. Because INT utterances involve intentions and desires, there is a high premium on having them understood by the adult. Miscommunication could result in failure for the infant to achieve what she wants/needs/requires. Thus the development of a conventionally acceptable means of expression is a high priority.

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