Conceptual-Intentional bootstrapping in the acquisition of the English verb

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Abstract

In the thesis I argue that intentionality, infant subjective knowledge and metacognitive growth, all interact to constrain and focus language acquisition to an inevitable and successful outcome. Neither innate UG, nor emergent usage based theories adequately address these elements and the literature review reveals that some or all them are either assumed, side-lined or left unconsidered by standard bootstrapping hypotheses. When foregrounded however, these elements can be demonstrated to provide a bridge between the conceptual and syntactic systems.

I show that initially, infants' utterances focus on the 'here-and-now' in joint attention, and they express infant subjective knowledge about how dynamic properties are attributive of substantive objects/entities. Uses of apparent nominal and verbal forms lack their typical grammatical function. Infants around 18months old, experience an inherent meta-cognitive development, which enables them to collate representations of Manifest Events, alongside a contrasting, constructed representation of a desired or intentional state of affairs. These Complex Events involve sub-events which are **not** currently in shared attention. Associated utterances involve intentions and desires, which require them to be understood by others. The acquisition of a conventional means of expression is therefore paramount.

The research presents three sets of corpus studies based on 22,000 infant utterances, and includes exemplification from diary evidence, to show the inevitable bootstrapping effect of such intentional utterances. Complex Events require a predicate that describes an intentional state change and also a means to refer to a theme object that 'measures out' the change. In effect, it requires the use of Verbs and DPs. In contrast to other theories I show that it is only Complex Events that are the locus for the advent of grammatical categories [V] and [DP] and that a surprisingly simple, minimalist Merge process licensed by a selectional feature afforded by 'it', effectively bootstraps the syntactic system for English.

Acknowledgements and Declaration:

Many years ago, I gained my first academic degree in Linguistics, and have since devoted my career in local authority education services, to a focussing on children's first and second language learning and literacy development, as teacher, trainer, manager and school improvement officer. A rare opportunity arose which provided time and funding for me to become more fully informed and gain new insights through academic research; a long held but unrealised ambition.

I am grateful to Professor Deirdre Wilson whose research, publications and on-line Pragmatics course was initially so new to me and such a revelation that I determined to undertake a journey which, it turns out, has taken me far from my starting point. It has been a remarkable process of realising that the more I got to know, the more I became aware of what I did not know. I now know considerably more and simultaneously less than I thought I knew when I began this journey! I am indebted to Professor Robyn Carston for accepting me for the MA Pragmatics course where I had the great fortune to benefit first hand from her teaching, and her expertise as a world class academic. Moreover, I consider it to be a great privilege to have undertaken my PhD research in the Linguistics Research Department at UCL, populated as it is with the most remarkable and expert group of staff and students I have had the good fortune to meet. My greatest gratitude is reserved, however, for Richard Breheny, who set the bar very high as my supervisor, and has provided robust challenge throughout. Many a time he rescued me from some of the pointless cul-de-sacs that I managed to get myself into during this research. His guidance and insight has been indispensable.

Needless to say, those misunderstandings, false assumptions and errors in this thesis are all of my own doing.

I, Neil Parr, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signed……

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Abbreviations

CDS	Child Directed Speech
CIB	Conceptual-Intentional Bootstrapping proposal
MLU	Mean Length of Utterance
P&P	Parameters and Principles approach
SeB	Semantic Bootstrapping hypothesis
SyB	Syntactic Bootstrapping hypothesis
VEKI	Very Early Knowledge of Inflection
VEPS	Very Early Parameter Setting
VIH	Verb Island Hypothesis

Chapter 1
Scope and overview of the thesis

Introduction

This thesis explores the nature of infants' initial acquisition of verb phrase constructions in English (VP and DP) to present a new bootstrapping hypothesis. In overview, the hypothesis proposes that there is an inevitable developmental or cognitive growth process which arrives at a meta-cognitive shift for an infant at around age 18 months of age. Prior to this, infant utterances can be shown to map to events manifest in the here and now. The new meta-cognitive ability enables infants to consider and collate representations of manifest situations with new mentally constructed, non-occurrent situations. The collations result in being able to express changes of state, that is, either a desired situation differing from a current state (e.g. mend this toy), or alternatively expressing a prior event which results in a current situation (e.g. Nana bought this toy). These will be termed complex event representations, in contrast to manifest event representations. I will show that infants, when expressing linguistic descriptions of manifest events, refer to observed objects and actions in terms of the dynamic properties of those objects according to the infant's individually developing subjective experience. Infants share their understanding of a perceived situation by offering what can be interpreted as generic propositions about the dynamic properties of participating objects. The nature and structure of infant subjective experience has hitherto not been considered to play such a role in linguistic expression. Linguistic expression of complex event representations, however, demands a differing approach. Utterances about Complex Events, as will be defined, involve the infant describing an intentional change of state of an object. For this to be understood by an adult, the intended change of state must be made explicit and the participating object must be referenced and tracked through to the intended changed state. In English, this requires a verb to predicate over the change event and DPs which can 'measure out' (Dowty 1991) the change. The hypothesis predicts that infant utterances about Manifest Events will differ substantially from those about Complex Events. Infant utterances involving Manifest Event representations are predicted to show a greater use of bare nominals and attributives as infants express the properties known (to them) to apply to the substantive objects participating in the observed manifest situation. In contrast,

utterances involving Complex Event representations will exhibit significantly greater use of referential DPs. This prediction is the focus of the empirical study in support of my hypothesis. Arriving at a new bootstrapping proposal, however, has been motivated by the desire to find a compromise or resolution between existing, differing and sometimes conflicting acquisition theories.

For a long time, accounts of language acquisition have been categorised into one of two opposing camps - rationalist or empiricist, with long standing debates on the merits of each. When describing modern representative positions, i.e. generative or emergentist theories, a neutral 'no man's land' between them is exposed, and is open for exploration.

On one side, the generative approach focuses on the child as an individual where language knowledge is a specialised aspect of cognitive growth, which is generally held to be innately or genetically motivated. This approach is best illustrated by the work inspired by Chomsky's vision of language, what it is and how it may be acquired. Chomsky's work has developed over a protracted period from Chomsky's (1957a) review of Skinner's Verbal Behaviour, where he challenged the behavioural conditioning model of language learning, and argued against the then view of a simple Stimulus – Response learning mechanism for language acquisition. He showed that there is no evidence of the intricate types of stimuli which would need to be available to an infant to result in the complex, creative responses characteristic of language. Thus behavioural conditioning cannot be a valid learning mechanism. Poverty of stimulus, in a different sense from that of conditioning however, has become an iconic argument in support of the nativist approach and against empirical learning models in general. The nativist claim is that there is insufficient evidence from the linguistic input to be able to derive the complex characteristics of language, and syntax in particular. From his earliest writings to the present day with the development of the Minimalist Programme of research, Chomsky has emphasised language as knowledge where syntax holds a central role. Considerations of real time communication - speech production and comprehension – are essentially aspects of how this knowledge is used in specific and varying contexts for various purposes. Study of these aspects of performance, it is asserted, depends on there being an established core of language knowledge.

On the other side, an emergentist approach stands in opposition to this. Language is considered to be a system of communication geared towards social interaction and cultural transmission, and motivated by adaptations of general cognitive and physical mechanisms over evolutionary time. Language conventions need to be learned from the language input. Generalisations and analogies, formed as a result of this learning, provide the basis of language knowledge. Although considered here as if a single empiricist approach, there are many different theories and accounts which constitute it. For ease of this introduction, I will consider Tomasello's work as representative of emergentist theories, as it is acknowledged to present a lead in current developments from this perspective. Selecting Tomasello's approach in opposition to that of Chomsky, is reinforced by his detailed refutation of Chomskyan generative grammar (Tomasello 2000a, 2000b, 2005, 2006) and his championing of what he refers to as Cognitive-Functional grammar (Langacker 2008), although Tomasello himself speaks from a position facing Psychology rather than Linguistics.

My research has not been designed to support nor be led by any single linguistic or psycholinguistic theory. In adopting a theory neutral approach, the research is not, however, a-theoretical. Rather, it represents an attempt to identify aspects of the acquisition process that have been assumed or ignored by all theoretical accounts or are simply problematic for these accounts. By exploring such areas, I develop the new hypothesis which should be capable of incorporation in any approach. The central claim is that 'missing links', found in the role of infant intentionality; the nature of infant subjective experience and knowledge; and meta-cognitive abilities in the acquisition process have been uncovered. This introductory chapter will define in broad brush the territory and range of the research.

1. Bootstrapping

To maintain the metaphor of the opposing battle lines, I intend to highlight the highly productive, no man's land of neutral territory which can be viewed from either camp. In this territory, lies evidence informative of how language learning gets started. This will be known as the bootstrapping process.

In learning a language infants must be equipped to be able to engage with a wide range of possibilities. Infants may experience and acquire any of the world's

languages, used in any cultural and social environment, for any intentional purpose. This would indicate that a high degree of flexibility is needed in the learning process. At the same time, this flexibility must be constrained to achieve an inevitable result. Given any physical social and linguistic environment, infants will inevitably learn to communicate linguistically, and their linguistic communication will exhibit the intricate and specific syntax of the ambient language.

Infants experience a vast amount of linguistic activity around them, either directed towards them or not. Any type of learning system, innate or emergentist, would be inefficiently constructed if it were to make available too much information for the infant to process. Such inefficiencies are not usually attributed to innate mechanisms, and the suggestion that infants learn a limited number of initial constructions, suggests a similar concern for emergentists. Indeed, any kind of inefficiency would be a challenge to the undeniably high success rate of language acquisition. The learning system must be flexible but predicated on success, as without it the learner would be at a severe disadvantage. Overloading the infant with processes which are not of immediate relevance cannot be viable, and as such there must be a series of natural and inevitable constraints on the learning which guarantee the result. There are a number of areas where a system of 'constrained flexibility' which limits the learning space sufficiently, provides inevitable access to the acquisition of the syntax of the ambient language. I will show that a bootstrapping process does this and, crucially, involves addressing the following questions (which will be collectively labelled the Research Areas):

- **Intentionality:** What is the place for an infant's active learning and creative intentionality in the acquisition process? How independent are infant conceptual and linguistic systems?

- **Initial language experience:** How does a start-up mechanism or bootstrap, operate? How does the infant exposed to a potential infinite input of social/cultural and linguistic information inevitably break into the syntactic system of the ambient language? How is linguistic experience constrained?

- **Word learning**: How are the difficulties of word learning, and verbs in particular, addressed and resolved to provide a seamless transition into language knowledge and use?

- **Meta-cognitive growth**: What is the role and effect of general meta-cognitive growth on initial language acquisition?

The evidence, which accrues from answering these questions, is in itself novel and interesting but available and usable by any approach. I will illustrate here, how this evidence appears from each of the 'camps', and then give an outline of how I will argue for a new initial acquisition model, which I name the Conceptual-Intentional Bootstrapping proposal.

2. The generative viewpoint

On Chomsky's account, language is a uniquely specified aspect of human cognition, defined as the faculty of the mind within which knowledge of language grows, based on a universal blueprint present from birth. He likens language growth to the way vision develops in typical infants. Given limited visual sensory input, the infant unconsciously develops a 3-D vision system capable of discriminating fine detail, changes through motion and so on. The input is limited, because the infant clearly has no access to all she will see in her life. The system, however, is capable of effectively working with future eventualities, and has adaptive ability should true novelty occur.

Transposing this example to language, an infant's linguistic experiences are limited, and, as generally held by this model, relatively impoverished, yet it is from this linguistic input that she develops a system enabling her to speak and understand an infinite variety of sentences per learned language. Grammatical development is unconscious, and as for the vision system, is not accessible to awareness. To demonstrate this last point it will suffice to recall that after 2000 years of language study, maybe more, a full specification of a grammar of any language, which can generally be achieved by infants in the first three years of life, is still elusive. In many ways, this quest is at the heart of Chomsky's program. If an infant born into any speech community in the world can quickly and seemingly effortlessly develop the knowledge of her ambient language there must be two basic potentialities.

Firstly, any language however varied or different from any other must be learnable by humans; and secondly, humans must have the wherewithal to learn any language which may apparently vary in substantial ways from any other.

These requirements suggest two implications for the language acquisition process. There must be some commonality between languages and there must be some common process available to learners. These commonalities are posited as Universal Grammar, which consists in overview of a finite collection of parameters which can be set with values which vary for specific languages according to a finite set of fixed principles. By these means, the natural language variants of the Universal language blueprint can be derived.

Identification of the parameters and principles has been at the heart of research in the Chomskyan tradition.

> "we hope to find that complexes of properties differentiating otherwise similar languages are reducible to a single parameter fixed in one way or another." (Chomsky 1981 p6)

The following description of the Head parameter will serve to exemplify the term, in anticipation of further discussion of very early parameter setting (VEPS) in the next chapter.

Paraphrasing Cook and Newson (2007 p 44): the definition of Head Parameter is held to be a parameter of syntax concerning the position of Heads within the phrase, for example determiners in DPs, verbs in VPs and so on. A particular language consistently has its Heads on the same side of the compliments in all its phrases whether Head-first or Head-last. So English is Head-first e.g. 'in the bank' (Preposition Head before complement DP in a PP) or '(the story) amused the man' (Verb Head before a complement DP in a VP). In contrast, Japanese sets the parameter to Head-last. E.g. 'Nihon ni' (Japan in) Preposition Head (ni) last in the PP, and exhibits a general SOV structure, verb last. Thus by setting the Head parameter once, the outcome will hold true throughout the language in areas that, by traditional description, might not be equated. Therefore an important generalisation is established: preposition / postposition versus (S)VO / (S)OV. This and further parameters will be addressed in relation to models of verb acquisition in Chapter 2.

Principles on the other hand, are constants expressing general conditions that must hold in establishing different constructions, to the extent that human languages can be considered to consist of principles with no construction specific rules. So the Locality principle is a property that restricts the application of a linguistic process to a limited part of the sentence. Chomsky (1981, 1995) lists subsystems of principles

to include bounding theory, government theory, θ-theory, binding theory, case theory and control theory, all of which have been established over many years of Generative Grammar research. The detail of the theory and its continuous evolution is essentially a theory internal matter and not immediately relevant to this overview, but there are significant questions that arise that are important to this study and should be carried forward. In general, the proposition is that humans are endowed with a language faculty that in its 'raw' state consists of a number of parameter variables with a potential value setting as yet unrealised, and a series of fixed principles which must hold true, which allows language knowledge to grow based on partial and limited linguistic input. One question that suggests itself is how can parameter setting get started?

Chomsky suggests that experience, presumably hearing language spoken around the child, will provide:

> "… Limited evidence, just sufficient to fix the parameters of UG, will determine a grammar that may be very intricate and will in general lack grounding in experience in the sense of an inductive basis." (Chomsky 1981 p4)

Chomsky maintains a firm focus on the centrality of the syntactic form which has hegemony over Phonetic Form and Logical Form from which both derive their input. Actual speech production and language comprehension are dependent on PF and LF but involve additional mechanisms and influences outside of the language faculty. These are considered under the label of Performance. Chomsky maintains that study of externalised and perceivable language performance is an inadequate means of accessing the unconscious processes of I-language, the internal system where syntax is the heart. This presents new problems. Paradoxically, core grammar is a product of parameters set in permitted ways, and experience is a construct based on an internal state either given or already attained, which serves to fix the parameters. Chomsky (2002 p96) seems to be prepared to introduce more flexibility by suggesting that Parameters and Principles is now better thought to be more an approach rather than a theory. Nevertheless, languages (as opposed to grammars) are not determined solely by fixing parameters in UG. Chomsky suggests:

> "it is reasonable to suppose that UG determines a set of core grammars and that what is actually represented in the mind of an individual … is an artefact resulting from the interplay of many idiosyncratic factors" (ibid p8)

On this Chomsky further states:

> "..It is not clear how important [these] are, or whether it is worthwhile to try to settle them in some principled way." (ibid p4)

The suggestion is that the divergence between core grammar and language artefact is due to the

> "… heterogeneous character of actual experience in real speech communities." (Ibid p8)

Although Chomsky has always maintained his account focuses on an idealised situation, there is nevertheless an interesting query about the nature of the infant's initial experience. As primary linguistic data is inevitably drawn from the heterogeneous speech community, does an infant have a means of differentiating experience for core purposes as opposed to peripheral structure? On this Chomsky offers that marked structures within a periphery outside of core grammar…

> " have to be learned on the basis of slender evidence too, so there should be further structure to the system outside of core grammar" (ibid p8)

How these structures are to be differentiated is not immediately clear.

The nature of the initial linguistic experience of infants and the role it plays in acquisition is of fundamental importance and is one of the Research Areas, listed above, that will need to be further clarified. Another problematic area concerns the development of the lexicon.

Chomsky's Minimalist Programme relies on a well specified lexicon whose entries provide features which interact with the operational principles – this is known as the projection principle. The lexicon consists of a set of lexical elements as an articulated system of features:

> "the lexicon should provide just the information that is required for CS.. [the computational system],,, without redundancy and in some optimal form, excluding whatever is predictable by principles of UG or properties of the language in question. Virtually all items of the lexicon belong to the substantive categories, which we will take to be noun, verb, adjective, and particle, putting aside many serious questions about their nature and interrelations. The other categories we will call functional (tense, complementizers, etc.)." Chomsky (1995 p.6)

And further:

> "It must specify, for each element, the phonetic, semantic, and syntactic properties that are idiosyncratic to it, but nothing more; if features of a lexical entry assign it to some category K (say consonant initial, verb or action verb), then the entry should contain no specification of the properties of K as such." (Chomsky 1995 p130)

But how such a complex lexicon is initially formed is not clear. In discussing a specific example, Chomsky suggests:

> "Someone learning English must somehow discover the sub-categorisation features of 'persuade', one aspect of learning its meaning. Given this knowledge, basic properties of the syntactic structures in which 'persuade' appears are determined by the projection principle and need not be learned independently". (Chomsky 1981 p.31)

How an infant 'somehow' discovers the necessary additional features is an important question. Learning the meaning of words is a fundamental issue for any acquisition model, and whether grammatical categorisation is an aspect of word meaning is a controversial point. Clearly this is an area of interest to carry forward for further consideration.

The formation of the lexicon, or more generally, word learning would appear to be an essential element of linguistic experience, and is closely tied to an infant's experience of the world generally. Chomsky accepts this when discussing word learning. He agrees that the meanings of words are difficult to describe, exhibit great intricacy and involve the 'most remarkable' assumptions, yet infants learn many words each day on very few exposures.

He states:

> "This would appear to indicate that the concepts are already available, with much or all of their intricacy and structure predetermined, and that the child's task is to assign labels to concepts, as might be done with limited evidence given sufficiently rich innate structure." (Chomsky 2000 p60)

> "There is, it seems rather clear, a rich conceptual structure determined by the initial state of the language faculty (perhaps drawing from the resources of other genetically determined faculties of mind), waiting to be awakened by experience." (ibid p64)

It is of some importance that 'word learning as concept labelling' is explored as one of the Research Areas, to provide some clarification of the relation between rich conceptual structure and the language faculty's initial state. Chomsky, himself, in the same paragraph as the quotation above, suggests that the 'whole matter requires extensive rethinking', and, although the treatment here might fall short of what Chomsky envisages, the interface between the conceptual and the syntactic systems is at the heart of the proposal I will be presenting.

A further Research Area, closely associated with experience, is the role of the infant herself as an active, intentional participant in the learning process.

Grammar acquisition, as described in the Chomskyan tradition, implies the unconscious operation of genetically specified (physical) growth which inevitably 'happens' for, what might be considered to be, a linguistically passive recipient. Might there be more active, intentional elements involved?

For instance, in the realm of physical growth, when an infant begins to move independently (crawling and walking) it is a moot point whether the ability to walk prompts the infant's intention to change physical position or perspective, or whether the intention for change has a bootstrapping effect on the ability for independent movement.

Are there instances of active intentionality which might prompt language growth? When an infant says 'juice' or some such, which can be interpreted as expressing the desire to have juice rather than the identification of the substance, is she simply communicating a perceived internal state? If so, then this will be an example of language used for communication and be subject to performance issues of social interaction – which on Chomsky's account, will be outside core syntax.

If, however, this utterance is not simply such a communication but is more pointedly about a change of state of the world, namely, that juice is not present within the infant's immediate surroundings a situation which she wants altered, then it becomes an extension of physical development which involves exploring and changing the environment. On this basis the development from the pragmatically motivated 'juice' to the grammatically distinct 'I want to have some juice' has its grounding in meta-cognitive growth. The infant has achieved a level of cognitive growth enabling her to collate a representation of her physical surroundings in the here and now where there is no juice present, with a contrastive, constructed cognitive representation where juice is potentially present; that is, something she wants to occur. That this request is intentional and relevant to the infant could provide an experience which influences and prompts linguistic growth but is seemingly sourced from a cognitive domain outside of the language faculty. Intentionality and active participation by the infant in her development, is clearly a key Research Area for further consideration.

2.1 Summary of issues prompted by the generative viewpoint

This brief overview of Chomsky's approach has raised a number of queries, relevant to the defined Research Areas:

i) How do the infant's early linguistic experiences and linguistic input contribute to linguistic growth?

ii) Does word learning equate with concept labelling involving innate conceptual and categorical specifications? The nature of the lexicon required by the generative model exhibits great complexity. Can this complexity be achieved in early acquisition?

iii) Does the intentional infant play any direct part in the linguistic growth process?

iv) What role can be attributed to meta-cognitive growth in language acquisition?

The answers to these questions do not appear to be directly given in this overview, but they have exercised researchers in generative grammar over time. A more detailed review of such research will be reserved for Chapter 2. The intention, now, is to consider whether the opposing theory provides some answers or simply adds to the list of queries.

3. The emergentist viewpoint

The generative approach, arguably placing language acquisition at the centre of linguistic theory, presents a radical departure from the empiricist tradition which has widespread representation in Psycholinguistic research. By Chomsky's definition empirical study of corpus data, although important, is defined as the study of linguistic performance, which he argues depends on prior acquisition of language competence. Gaining Linguistic competence involves the child as an individual with the mental facility to use impoverished (i.e. limited) linguistic input from the surrounding physical environment, to trigger the language appropriate configuration of parameters honouring given principles to grow linguistic knowledge.

In contrast to this, opposing views describe the infant as a member of a complex human social and cultural structure, where linguistic communication is an

important and necessary instrument for social cohesion and the transmission of knowledge (Tomasello, Kruger & Ratner 1993, Tomasello, Carpenter, Call, Behne & Moll 2005); for social interaction and communication of intentions (Snow 1999); and pragmatic development (Bruner 1975, 1983; Bates 1976; Ninio & Snow 1996). Language is considered to be a conventional means of communication shared and owned by the speech community (Akhtar & Tomasello 2000). On this account, human language is thought to have evolved in tandem with social developments, and is a product of physical evolution – (upright stance, development of the larynx and articulatory apparatus) – and cognitive evolution, where sophisticated communication processes develop to ensure the community benefits from an increasing ability for complex thinking and co-operation (Tomasello 2008, 2009).

So languages adapt and change according to the level of contact between speech communities, and language families, independently developed, vary considerably from each other. Languages have to be learnt, and the mechanisms for learning are largely domain general involving abilities in generalisation and analogy. Language knowledge can be said to emerge as greater linguistic complexity is learned to accommodate greater communicative demands.

As Snow (1999) points out, if language is to emerge, where does it emerge from?

> "Any argument that language emerges as a natural product of development … must specify what the preconditions are for that emergence, or the domains of accomplishment that make the emergence of this powerful new system possible." (Snow 1999 p257)

Snow claims that it is human social interaction and the socially precocious child, which provides the motivation for language acquisition. Infants from birth establish communicative inter-subjectivity with their mothers and seem to engage in conversational turn taking through facial expression and non-linguistic vocalisations (Trevarthen & Aitkin 2001; Reddy & Trevarthen 2003; Trevarthen 2004).

Because language is a human adaptation for the sake of communication, meaning and how meaning is shared is a central concern for this approach. Words and word combinations appear in a limited number of constructions which can be learnt as a repertoire. Words evoke meanings, but constructions may also convey more abstract meanings which interact further with words, providing a meaning–

form relation. Goldberg (1995, 1999) proposes that five key argument structure constructions can accommodate a significant range of communication requirements.

These are:

Construction	Meaning	Form
1. Intransitive motion	X moves to Y	Subj V Obl_{loc}
2. Transitive	X acts on Y	Subj V Obj
3. Resultative	X causes Y to become Z	Subj V Obj XComp
4. Double object	X causes Y to receive Z	Subj V Obj Obj2
5. Caused-motion	X causes Y to move Z	Subj V Obj Obl_{loc}

Given the motivation resulting from the requirements of social interaction and inter-subjectivity, there remains the question of how such constructions are accessed, abstracted from the speech stream, and put to productive use. The nature of this initial linguistic experience, as the context for learning, requires further explanation and will be addressed through the Research Areas.

Tomasello (2000a) presents a detailed challenge to the generative approach which he claims to be too ‘mathematical’ to reflect the naturalistic nature of human behaviour. He claims that rather than the triggering of an innately specified range of parameters, language learning makes use of children's very powerful skills of intention-reading and cultural learning; analogy making; and structure combining. He takes the view that language competence consists of mastery of linguistic symbols and constructional schemata each of which consists of one or more linguistic form (signifier) each with a communicative function (signified).

> "Competence with linguistic symbols and constructional schemata are very general cognitive abilities that manifest themselves in many domains of human activity, although they may take on some special characteristics in the domain of linguistic communication" Tomasello (2000a p.236)

Universals from this viewpoint are commonalities that can be observed between languages, a view which contrasts with the notion of Universal Grammar where it is possible that some parametric values are not used by some languages at all.

Within the approach being currently considered, Language is a by-product of general cognitive abilities, put to work in service of communicative requirements.

Tomasello espouses the usage based approach developed fully in Tomasello (2005), which in sum, proposes that all linguistic knowledge derives from the comprehension and production of specific utterances on specific occasions of use. In support of this, he notes that early on, infants do not use verbs in constructions which have not previously been heard. It is not until much later (3-4 years old) with sufficient experience and increased generalisation ability, that infants will use verbs in previously unheard constructions.

So a verb heard used in a passive construction will be used as such, but verbs not heard in this construction will not. Tomasello's Verb Island Hypothesis which develops this line of thinking will be considered in more detail in chapter 2.

Tomasello claims that as there is no universal grammar, there is no linking problem between local learning and knowledge of grammar. He claims that only generative grammar needs to do this. There is reason to question this claim. Rather than pre-empt the fuller discussion of Tomasello's hypothesis in Chapter 2, it will be noted here that there remains the question of how infants access constructional schemata in the first place, and then how they effect the change from only reproducing elements from within heard constructions, to creatively producing novel utterances. Tomasello considers analogy to be a powerful enough mechanism but this is open to challenge, which will be addressed in the next chapter. How productive language acquisition and learning result from constructions linked to contextual understanding is problematic for usage based approaches as much as it is (although for different reasons) for generative approaches, and these issues are addressed by the Research Areas.

Learning words and learning the meanings of words, and how they combine to provide structurally acceptable and semantically appropriate constructions, is fundamental to the emergentist approach. How children learn words and particularly how they acquire verbs is a long standing problem extensively represented in the literature. Many studies (reviewed and discussed by Braine 1976) have shown that the first words acquired, tend predominantly to name/label objects and entities in the child's environment. Although there is some dispute about the statistical ratio of nouns to verbs in the child's early lexicon, most studies show that nominal terms predominate. Indeed word learning studies generally show greater success when the task is object labelling rather than verb learning (Gentner 2006; Gleitman, Cassidy,

Nappa et al. 2005; Brandone, Pence, Golinkoff et al 2007). Experiments that require the learning of a label for specific novel actions are particularly inconclusive. This difficulty is generally assumed to be attributable to a greater ease in mapping a word to a concrete object or person. The concept-word mapping approach to word learning is confronted by special difficulties and controversy in the realm of verbs, thus how words are learned is again as important an area to clarify for emergentists as well as it is for generativists.

It was suggested above that the generative approach does not overtly consider the child as an active learner. In fact both broad-brush approaches being considered here have the tendency to suggest the child as a passive recipient of linguistic information and language learning processes which are largely unconscious. Although the usage based approach lays emphasis on language production, it also strongly implies an element of passivity by initially restricting the infant's linguistic production to what she has heard. Although creativity is a high premium for the generative approach and over time for the usage approach, the intentional child who may take some responsibility for her learning is essentially missing, or at least given little emphasis.

3.1 Summary of issues prompted by the emergentist viewpoint

Once again some queries have been raised by the emergentist proposals which occupy the same general territory as those raised by the generativist approach. These appear to repeat those already highlighted in 2.1:

i) How do infants' early linguistic experiences and linguistic input contribute to productive language learning?

ii) Does word learning equate with concept mapping? What is the nature of early conceptual experience and its interaction with language learning?

iii) What role does the intentional infant play in the language learning process?

iv) What role can be attributed to meta-cognitive growth in language acquisition?

4. Further important considerations

There are more general concerns which neither of these theories directly addresses but which inform my bootstrapping proposal. These are:

4.1 The conceptual and syntactic systems, are they independent or mutually dependent?

Both approaches recognise that conceptual understanding is a necessary precursor to language production. For generativists, an established complex conceptual system awaits to be 'woken' by the language faculty. The syntactic system is independent of the conceptual system. For emergentists, an acquired conceptual understanding of the environment prompts the learning of closely matched linguistic constructional conventions. The conceptual system is at the heart of the language learning process and the syntactic system is dependent upon it. These positions seem to be pointing in different directions. The Conceptual-Intentional Bootstrapping proposal will be shown to conclude that an independent syntactic system is bootstrapped by independent development/growth evident in the conceptual-intentional system.

4.2 Comprehension and production

The much debated relation between comprehension and production concerns whether infants can (verbally) understand what they cannot as yet produce for themselves. The generativist view is that infants' underlying knowledge of language enables understanding which, due to performance limitations, infants are unable at that time to produce for themselves; the other viewpoint argues that exposure to semantically motivated grammatical constructions conveying a generalised meaning supports understanding and this in turn contributes to grammatical development.

Chomsky (2010) has offered the opinion that language use for social communication is of a lesser proportion than use for organising thought and inner speech, which is then available to be processed for speech production. From an emergentist perspective, social language use might be described as a means of bringing thought to external social scrutiny. For the former, comprehension and production are performance processes dependent on an established language competence (knowledge) and independent of the conceptual system. For the latter, learning linguistic conventions grows from a (socially motivated) conceptual system.

In both cases it can be argued that language provides a means for converting internal representations, consisting of complex overlapping networks of personal meanings and associations, into a linear (essentially auditory) stream. Production and comprehension, however, do not only work within the individual. Language production has to be comprehended by others in a communicative exchange. The differing perspectives can be illustrated by the following example, drawn from infant corpus material (CHILDES/UK-Eng/Manchester/Gail15a).

Context: Gail who is 28months old is looking through a printed catalogue of children's toys with her mother.

(1)

Gail: Gail's like that house, my got.
MOT: it's like your one already, isn't it?
Gail: I just like another one, Mummy.
MOT: I don't think you need another one, do you?
Gail: yes.
MOT: you do?
Gail: we got that at playgroup.
…….
Gail: just like that bicycle
Gail: and that dolly go in
Gail: I like that bicycle, Mummy
Gail: I like that bicycle
Gail: want sit on it
MOT: well

In production, Gail's opening statement is clearly not well formed syntactically, and becomes a source of misunderstanding between her and her mother. The continuation of the dialogue shows that Gail is probably focussed on a topic of things she likes. Her mother interprets the initial utterance in a different way, as Gail indicating that she possesses a similar house. What could be the communicative intention behind Gail's opening statement?

(2)

a) Gail likes that house …
b) Gail has a house like that …
c) Gail likes the house which is like the one she has at playgroup?

Gail's mother opts for (2b), but as the conversation continues on the theme of 'liking', it is probable that Gail intends (2c). If this is the case, then a generativist might suggest that Gail's initial utterance lacks linguistic competence and her utterance resembles linguistic labelling of conceptual chunks, lacking syntactic organisation. An emergentist may suggest that Gail is expressing her conceptualisation of her intention using two constructions representing (2a) and (2b) from which a subordinate clause structure will emerge, a process recognised by construction theory in acquiring complex sentences (Diessel 2004).

Gail's reply to her mother's doubt that Gail needs a second house, shows a lack of comprehension of the mother's utterance. If Gail's intention is the equivalent of (2c) then her mother's question is not relevant to her. It is generally accepted that when infants do not understand questions they either ignore them or answer 'yes' (an approach also available to adults). The mother's question is syntactically complex "I don't think you need another one, do you?", and arguably beyond the competence of a 28 month old. It also lacks an interpretable context for Gail, particularly if as suggested, it lacks relevance for her. She therefore opts for a reply based on the general heuristic – 'agree'. Both generativists and emergentists agree that understanding linguistic utterances depends to some extent on existing language knowledge. Neither recognises the extent to which the syntactic form can be supplemented or enriched by contextual evidence for pragmatic interpretation. Given such recognition, comprehension becomes a complex process of relevant conceptual and linguistic interaction (Sperber and Wilson 1984/96) which on the face of it, production does not replicate. Examples of infant comprehension ability are best drawn from those displaying where the process goes wrong, i.e. through misunderstandings.

One such example will serve at this stage to illustrate a glimpse of the pragmatic abilities of the young infant.

(The example is drawn from CHILDES/UK-Eng/Manchester/Dom10b, where Dominic, who is 26 months old, and his mother are engaged in an activity playing with model animals):

(3)

MOT: that is a rabbit.
Dom: rabbit.
MOT: yes.
MOT: it's an albino rabbit.
MOT: it's got pink eyes.
Dom: not ribena rabbit.
MOT: not a ribena rabbit.
MOT: no.
Dom: no no.
MOT: and the +...
Dom: xxx.
Dom: not ribena rabbit.

Ribena is a black current drink, very common in British households particularly with young children. In its diluted form it has a pinkish colour. Clearly Dom does not understand the word 'albino', yet the context shows the talk is about a (model) rabbit and Dom is told it has pink eyes. The last two syllables of al-BINO prompt Dom to retrieve a word he does know that sounds similar and has the pink colour associated with it. For him this is Ri-BENA. He is aware of the contradiction this presents and attributes this to his mother's utterance. The script does not give the type of information usually apparent to indicate that Dom is making a deliberate joke – adults generally make some sort of comment acknowledging the joke. Instead, it seems that Dom is making a declarative, directly contradicting what he has understood from his mother's utterance. The topic of the conversation is relevant to Dom and his understanding is fully pragmatically derived.

The conclusion to be taken forward is that comprehension and production of linguistic utterances depend on language knowledge but linguistic comprehension also utilises contextual, pragmatic processes, which has been shown, by extensive research, to be available to pre-linguistic infants. This research will be reviewed in later chapters. The basic principle adopted throughout this thesis is the strong view that it is only when infants have productive control over syntax that it can be said to have been acquired. That is, language acquisition will be measured only in terms of infants' productive use of language, rather than their comprehension, because the additional contextual evidence available to infants enables them to form understandings apparently in advance of their productive ability. Chapter 8 will address the nature of comprehension testing in relation to already acquired syntax.

4.3 The effects of meta-cognitive growth

Infants while acquiring language are also subject to extensive natural cognitive and meta-cognitive developments. Acquisition theories tend to assume these developments as background effects. At 18 month or so, infants undergo a meta-cognitive development enabling them to collate representations of the 'here and now' (Manifest Events), with secondary representations of events not in the 'here and now', (Complex Events). I have identified meta-cognitive growth as one of the central Research Areas. It turns out that this meta-cognitive development will play a crucial role in the acquisition of syntax and as such becomes a defining moment for the proposal I am putting forward in this thesis.

4.4 Time span

It is generally held that by three years of age children appear to have achieved a reasonable grasp of either core syntax or productive language constructions (depending on the viewpoint). All evidence generally suggests that infants are producing their first words by 12 months and two word utterances by 18 months, or so. For generativists language acquisition is innately specified as are complex conceptual abilities, for emergentists infants from birth are engaged in social communicative relationships and have rapidly developing conceptual abilities. All evidence shows that very young infants within a few months of birth are perceptually aware of the nature of the language they are to acquire (Jusczyk 2000; de Boysson-Bardies 2001), and are in continuous contact with spoken language through all waking moments. The question which arises is why it takes so long, just on 3 years, for infants to acquire productive use of language. Is the language learning process simply dormant until the infant has undergone a requisite amount of maturation, or is the process working in the background awaiting the moment to make its work apparent? Either way, the infant is communicating in one way or another to adults from birth, and it would be more efficient and advantageous to all concerned if infants could use language earlier than they do.

My claim is that there are specific reasons, essential to ensure the inevitability of language acquisition, that demand this time span, and are integral to the acquisition of syntax generally, and [V]erbs in particular. The factors contributing to this inevitability will be shown to be essential elements of the bootstrapping process,

building towards the inevitability of successful language development/growth which becomes apparent over the twelve month period, when infants are 18 to 30 months old.

4.5 Are Verbs 'hard words'?

Neither the generativist nor emergentist overviews outlined above identified any major inherent problems with the notion of 'verb', but some researchers have suggested that verbs are 'hard words' (Gleitman, Cassidy, Nappa et al. 2005).

Gleitman (1990) deemed verbs to be difficult principally because they are used to express relations between entities, presenting the following problems, amongst others:

i) Conceptually, the actions verbs express do not stand alone and are not discrete; their expression is integral to an event which can only occur in relation to entities that are interacting in some way. Thus no verb can be meaningfully uttered or understood devoid of participants in an action or change/state relation. It could be argued that it is what the participating entities are capable of doing that is made more explicit by the verb use.

ii) Action verbs are not labels. A label freezes or nominalises an action and loses the fact that an action is going to happen, or is on-going, or is over and frequently has results. To illustrate: a simple action of someone opening a door, generally involves a person turning the doorknob, pulling or pushing the door and this action results in an open door. This result can be reported from the person's viewpoint: 'she opened the door', or from the perspective of the result of the several actions: 'the door (was) opened'. Gleitman points out that although children can readily appreciate dynamic events, in order to learn verbs they need to know what aspect of the event to attend to. For example a single scene of a dog running behind a cat is both 'a dog chasing a cat', and 'a cat running away from a dog'. The verb in each case highlights a different perspective.

iii) Verbs have a structural role in a sentence, which functions to support the expression of time of the communicated event relative to the utterance; aspect relations involving outcomes and processes; perspectives and attitudes of the speaker/hearer as well as the roles of participants in the event.

iv) Dual category issues. There is a large and productive set of words, in English in particular, which can be categorised essentially as nouns but which also can be used as verbs: as in ‘hand me the book’ or ‘milk the tea’ and ‘milk the cow’ (Nelson 1995, Clarke & Clark 1979).

v) Languages lexicalise events in different ways. A much explored area at present concerns the manner/path distinction for motion events (Talmy 2003). In Spanish and Greek the path is lexicalised through the verb, but in English it is usual to lexicalise the manner of the movement, and state the path using prepositions.

For instance, compare ‘she ran into the house’ versus ‘she entered the house running’. The former is the usual means of expression in English, the latter in Spanish.

Consideration of how these difficulties are overcome will provide a fairly constant backdrop to the research here presented, foregrounded when relevant. Many of the difficulties listed above are semantic and rely on an existing identification of a word as a verb. The general approach in this research will be to challenge the view that words have inherent grammatical category membership, and it is only when words are in the structural role of [V]erb in syntax, that they so become. This separation of the semantic and syntactic properties of words will be shown to go a long way to obviating most of the apparent ‘difficulties’.

4.6 Innateness debate

A central issue which divides the two main theories of language acquisition is the nature and extent of innate endowment for language learning. To maintain neutrality in this issue for the time being, the following position will be taken.

Language is species specific for humans. A human baby is destined to acquire and speak a language. Languages themselves differ, and the words they all use are arbitrary, yet languages and word combinations must be learnable and deliverable and capable of being understood. The nature of language is therefore maximally limited by human physical and mental capabilities. That all infant humans learn and use at least one language for effective survival, underlines that they are equipped with the capacity to do so. This is essentially a truism and in these terms should be generally acceptable, and as such the debate about innateness will be set aside, in favour of an exploration of how the massively flexible language learning

environment is naturally constrained to provide inevitability. In this way, neutrality over the innate or not nature of the specifics of language acquisition can be maintained. I will show, however, (Chapters 5 and 7) that there are grounds to suggest that certain processes, like Merge, and what appear to be prototypical grammatical categories, are quite possibly examples of innate elements in the language acquisition process.

5. The structure of the thesis

In the 18-30 month window identified above, infants are learning words which will function as verbs, and acquiring the complex interrelation between word meaning and syntax. I have identified a number of Research Areas which will inform this thesis and which will be addressed in the following way:

In Chapter 2, four documented models of verb phrase acquisition will be reviewed, representative of the two theoretical approaches already discussed. These are Semantic Bootstrapping (SeB); Very Early Parameter Setting (VEPS); Verb Island Hypothesis (VIH); and Syntactic Bootstrapping (SyB). It will be found that contradictions remain both within and between theoretical positions.

Chapter 3 will focus on the input for language acquisition. This will review the nature of Child Directed Speech (CDS), and how infant intentionality and the structure of infants' unique subjective experience serve to constrain the learning space resulting in the inevitability of language acquisition.

Chapter 4 will address differing views of word learning and word meaning to show that constraints must also be applied to this task. I question the validity of concept mapping as a learning process and conclude that word learning is most efficient within a constrained learning environment if, initially, words are considered to be grammatically unspecified and semantically underdetermined.

Chapter 5 will directly address the effect of meta-cognitive growth on language acquisition and demonstrate that a specific change around age 18 months enables infants to draw a critical distinction between Manifest and Complex events. I will claim that it is the expression of Complex Events which provides the locus for bootstrapping into a productive syntactic system.

Chapter 6 will present a series of original empirical studies based on an extensive corpus to test the predictions made by the proposal. The proposal will be shown to be empirically sound.

Chapter 7 will characterise the new Conceptual-Intentional Bootstrapping proposal, and show how syntax may be derived, for English, utilising a simple Merge principle. Further developmental implications of the model will be considered, including new insights into phenomena like null subject expression, the root infinitive option, acquisition of modals, aspect and tense.

In Chapter 8, the model will be tested in the context of published comprehension studies. These espouse the syntactic bootstrapping hypothesis and make specific predictions about infant syntactic ability. In contrast, I will demonstrate how the Conceptual-Intentional Bootstrapping model (CIB) can explain the various outcomes of these experiments, based solely on the syntactic knowledge that my bootstrapping proposal expects infants to have acquired.

Chapter 9 will provide a summary conclusion of the thesis, and suggest possible ways forward.

Chapter 2
Approaches to verb acquisition

Introduction

The introductory chapter considered in broad-brush two opposing views of language acquisition. Four crucial components of the Conceptual-Intentional Bootstrapping proposal were identified as Research Areas summarised as: Intentionality; Initial language experience; Word learning; and Meta-cognitive growth. These, together, provide the necessary constraints on the learning space and will be shown to constitute the bootstrapping mechanism.

In this Chapter a representative sample of four models of language acquisition, with a particular emphasis on verb constructions, will be reviewed. Each will be described to assess how far they address the Research Areas, if at all, and to gauge what insights they provide, or equally what further questions they raise.

The chapter is structured with the following sections, (each given an abbreviated coding for ease of reference):

1. Semantic bootstrapping hypothesis **[SeB]**, which explores Pinker's proposal which relies on a high degree of innate knowledge. Alongside this, Braine's challenge to Pinker and his alternative suggestion will be described. These proposals will be found not to shed much light on the Research Areas.

2. The Very Early Parameter Setting model **[VEPS]** attributed to Wexler and based on the Principles and Parameters hypothesis will be outlined. Challenges and revisions proposed by Rizzi and Fodor will be presented as they attempt to constrain the VEPS model which appears to over-generate. Issues of the null subject parameter (NSP) and optional infinitive (OI) stages are relevant to the Research Areas, and will provide a focus for the discussion in this section.

3. Tomasello's Verb Island Hypothesis **[VIH]** an Item/usage based model will be addressed in this section. Additional versions of this hypothesis from McClure et al. and Ninio will be presented. These proposals will be found to address some of the Research Areas but also present new difficulties to resolve.

4. The Syntactic Bootstrapping account **[SyB]**, developed variously by Gleitman, Fischer, and Naigles, stands in contrast to the other proposals in that it suggests that infants access the meaning of verbs through syntax. This proposal will be seen to be relevant to the Research Areas from a differing perspective.

1. Pinker's semantic bootstrapping hypothesis [SeB]

Pinker's Semantic Bootstrapping Hypothesis addresses the problem of how a child can break into the grammatical rule system of a language given only an input consisting of strings of speech sounds.

Pinker (1984/96) argues his case from the point of view of Lexical Functional Grammar. Although he states that the specific linguistic theory is not critical, he maintains that acquisition theories should align with established linguistic theories to maintain continuity from infant acquisition to adult competence. Pinker adopts this rationale as a challenge to treatments which account for infant speech data by developing linguistic theoretic elements which apply only to the infant data and which do not contribute to the final grammatical characterisation of the language. Pinker supports a generativist approach.

According to Pinker, there is a consensus in all linguistic theories that there exists a large domain of rule types which include: small sets of grammatical categories and relations, phrase structure rules, inflexional paradigms, lexical entries, lexical rules and grammatical features. An acquisition theory, therefore, needs to provide an account of how an infant learns the ways these elements are realised in her ambient language. He argues that these rule types are task specific in that they are of use only in the domain of language knowledge and are central to the language acquisition process. The task specific learning mechanism should provide the infant with a maximally simple set of minimal rule schemata with parameters whose values may vary from language to language. Pinker concedes that the language learning mechanism may not be discrete and could be sourced from some prior general learning process. He concludes, however, that it would be logically more parsimonious if language learning, task specific elements were already present rather than derived. Although this argument is designed to side-step the innate status of the language mechanism, he does not resolve what prior mechanisms would be required to derive the language learning mechanism.

Either way, his assumption is that an infant comes to the language acquisition task with a prior knowledge of language (the rule types). The task for the infant is to abstract from the heard speech stream a set of correspondences between the ambient language and the available rule types. Pinker also makes five fundamental assumptions about the linguistic input and the infant's relation to it:

i) The infant is able to segment the speech stream heard from parental input into useable variables – words, phrases.

ii) Not all sentences, or parts of sentences produced by parents are used or understood by the infant, but infants make use of parts of the input without having to know all the words the adult uses.

iii) Negative evidence is largely unavailable to the infant, as feedback and correction is not generally noted in adult child speech in terms of syntax at least.

iv) Infants are able to infer meaning from adult utterances using physical and discourse contexts, and the meanings of individual words in the sentence input. Thus the infant is assumed, within context, to be able to pair a sentence and its meaning. In support of this, Pinker notes that parental speech often refers to the 'here and now' with a limited number of propositions for the infant to comprehend. Sentences of this kind he terms basic, the semantic relations and meaning of which are highly predictable from the meaning of individual words independent of ordering or affixation.

v) A strong assumption is that infants are able to extract the meaning of predicates and arguments, the relation of arguments to predicates, the grammatically relevant semantic features of sentence participants (number, person, sex), the proposition of the whole sentence (tense, aspect, modality) and discourse features (declarative, interrogative, negative, suppositional).

Acquiring a specific language requires fixing parameters of variation in the universal rule schemata which have the properties of linguistic symbols like Noun, Verb, Subject, Object, constituent structure branching, inter alia. These

symbols are not overtly marked in the input which for the infant provides only information of linear ordering, prosodic qualities and meaning. The bootstrapping problem is how to establish a correspondence between the overt input and the properties of the symbolic system. Pinker rejects a distributional analysis of the linear ordering information available to the infant, reasoning that linguistic symbols are largely opaque to linear distributional analysis. He also rejects prosodic information input as being unreliable. Instead, he favours the semantic input as the more direct means. Because of this he terms his hypothesis Semantic Bootstrapping.

1.1 The bootstrapping hypothesis

Semantic bootstrapping proposes that the semantic content of a word/contextual situation perceived by the child, may initially link to grammatical categories; grammatical functions; cases; grammatical features and tree configurations. The semantic inductive bases, without listing them all, are of the following types: names of persons or things correspond to [N]oun, actions or changes of state to [V]erb, agents to [S]ubject and patients or themes to [O]bject.

Pinker's exemplification of how this might work is as follows: a child experiencing a scene, accompanied verbally by "The boy threw rocks" will be able, by linking rules, to know that 'boy' refers to a person who is agent of an action and therefore can assign 'boy' to [N]oun/[S]ubject; that 'threw' is the action performed and therefore assigned to [V]erb and 'rocks' refers to things undergoing the action and therefore assigned to [N]oun/[O]bject, which would provide an entrée to the abstract tree structure:

(4)

The boy	threw	rocks
Name of person/agent	action	name of thing/patient
Noun / Subject	verb	Noun / Object
S[[$_{NP}$[det + N] +	[$_{VP}$[V+	$_{NP}$[N]]]]

This parse aligns with the Phrase structure rules:

(5)

S→NP + VP
VP→V + NP
NP→Det + N

The example Pinker chooses is surprising, because it appears to violate his own initial assumption (1iv above) as this sentence is not characteristic of the 'here and now'. If the boy threw rocks, then the boy's action is completed. 'Throw' will have to have been learned at some other time. Presumably the infant's knowledge of proposition structure (assumption 1v) about tense and time will need to be brought into effect.

Having correlated a sentence input with a grammatical structure appropriate for the language variant being acquired, the prediction is that the construction can be readily applied to a significant number of noun-verb-noun inputs. Pinker suggests the phrase structure rules, once acquired, may be extended to analyse input sentences where semantic support for syntactic categorisation is missing. He gives the example of a child armed with correspondence rules, being able to adduce the syntactic structure of 'the situation justified extreme measures', which has the same constituent tree structure as 'the boy threw rocks'.

This outcome may seem to be an odd example to suggest for a young infant, (not being able to assign much meaning to the abstract sentence, the infant may be tempted to simply ignore it). At a theoretical rather than practical level, however, the bootstrapping process is assumed to be being applied by a passively listening infant and as the process is sub-personal to the infant it will require no conscious involvement. As such, phrase structure rules should be established before the infant speaks. The prediction is that, given early lexical items, assigned grammatical categories and triggered rules, the sentences children do first utter should exhibit an appropriate syntactic consistency in a short span of time if not instantaneously, although, as Pinker concedes, within the bounds of performance restrictions.

Pinker's proposal has come under sustained challenge, as empirical evidence tends not to support the prediction. There is little evidence of consistent and rapid development of verbs which an acquired rule would provide. Diary evidence (Bowerman 1973; Tomasello 1992) tends to show that some verbs develop well before others and the expected outcome that all verbs show consistently rule governed behaviour is elusive.

1.2 Revisions

Pinker's hypothesis in its early guise (1984/96 first edition) is very inflexible particularly in the specification of the elements constituting the task-specific mechanism which he maintains are in fact innate. Pinker (1987, and 1984/96 second edition commentary) considers the various challenges to his hypothesis which include:

i) Semantic regularities are not universal – ergative languages do not have agents as subjects. Non-basic sentences are not invariably filtered out of the input by adults, and in parental speech semantic interpretation is not always available which might result in agents and patients becoming confused. Thus applying the linking process in these cases would yield a wrong analysis for the infant.

ii) The hypothesis makes no allowance for individual differences, nor offers any criteria for which input is critical for an infant to attend to, or which is to be ignored. If the choice is wrongly made then there is potential for false analyses which would pervade the whole linguistic system of the infant. That this does not happen needs to be accounted for.

Pinker's (1987) response to these challenges is to employ a constraint satisfaction model, which in effect suggests that initial conclusions made through the semantic hypothesis are open to confirmation or otherwise utilising additional information drawn from distributional analyses and further prosodic evidence. The end result should be the formation of a network of mutually predicting attributes. Pinker (1984/96 second edition commentary) suggests that the infant uses a set of multiply uncertain cues (semantic, distributional, prosodic and syntactic) which converge on the most globally consistent analysis of the input. In this way, the bootstrapping mechanism which formerly provided a clear link between innate language knowledge and input variation has changed radically. It is now more loosely providing what Pinker calls 'fuzzy labelling' of innate grammatical categories.

1.3 Gaps and queries

There are a number of issues for the bootstrapping process that arise as a result of Pinker's formulation.

i) He suggests a large battery of innate grammatical and functional categories which are difficult to substantiate. The Principles & Parameters paradigm argues against some of these, most notably the functional categories of Subject and Object. Extensive innate categories as Pinker describes can be viewed with some scepticism.

ii) Category membership is discovered initially based on semantic definition: Nouns = names of things, Verbs = labels for actions and so on. But the semantic definitions do not always hold true, as Pinker has had to admit in response to wide-spread challenge, through his revision to the required 'fuzzy labelling'.

iii) His foundational example - 'the boy threw rocks' - despite claiming that initial talk with children is of the here and now, cannot have been used to accompany the action event of a boy throwing rocks, as it refers to a past or completed series of actions (assuming the rocks were thrown singly). There is an interesting and important effect which can be derived from the speaker's perspective. The sentence in the example invites the interpretation that the speaker is largely uninvolved in the scene. It is as if the scene is viewed from a third party perspective. If, however, the rock thrown is in the 'here and now', i.e. the result of the throwing is a rock in the presence of the speaker: 'the boy threw this rock', then this utterance would be of a Complex Event type (with two sub-events, one in the here and now and the other constructed and not of the here and now). It is precisely this kind of utterance that, according to the Conceptual-Intentional Bootstrapping proposal, makes a critical contribution to bootstrapping. Pinker's hypothesis, however, does not recognise Complex Event utterances. A fuller discussion of Complex Events will be given in Chapter 5.

A revision of Pinker's bootstrapping proposal has been put forward by Braine to overcome the difficulties presented in (1.3i) and (1.3ii) above. The following section will consider this alternative.

1.4 Braine's semantic bootstrapping revision

Braine (1992) proposes a revision to reinforce the semantic element of the bootstrap. His concern is based principally on Pinker's claim that grammatical categories (Noun, Verb, Verb Phrase and so on) are primitives. As there exists to

date no conclusive means of demonstrating that such categories are innately specified, Braine explores a bootstrapping process which enables grammatical categories to be formed by an assimilation process from primitive, semantic categories. This contrasts with Pinker who held that grammatical categories are primitive, each with particular semantic categories as canonical members. So in Pinker's terms, for instance, a Noun Phrase has argument(agent) and argument(patient) as members. Braine's reformulation would set argument(agent) or argument(patient) as primitives with objects (object-words) as members. Braine suggests 2 main types of primitives: a learning mechanism and categorical. These will be described in turn.

1.4.1 A learning mechanism

The mechanism employs an 'old-rules-analyse-new-material' principle. Braine attributes this principle to Schlesinger (1982) enabling new material to be assimilated into existing categories, and as a result the category expands beyond its original semantic core. For Schlesinger, this principle contributes to the development of the functional category 'Subject', extended from an original designation of 'Agent'. Braine cites Schlesinger's proposal that an original semantic agent-action schema (assumed to be readily derivable from observed events) is used to analyse novel NP-VP input and progressively agent and action categories expand so agents come to include experiencers, and actions expand to include experiences.

1.4.2 Primitive Semantic categories

Braine claims that certain semantic framework categories are innate. In these he includes ontological categories like object, place, time, event, and proposition. He also includes predicate and argument as additional framework categories on the following basis:

> "The term 'predicate' comprises concepts (including properties) and relations; the term 'argument' refers to instances of concepts or entities related by relations."

It follows that:

> a concept is a predicate with one argument, and so to predicate a concept or property of an object is merely to say of the object that it is an instant of the concept." (Braine 1992 p80)

So a relation is a predicate with 2 or more arguments, the entities related being the arguments. Braine suggests there is good reason for the predicate-argument distinction to be primitive, since all theories of concept formation take for granted the distinction between a concept and its instances. On this basis, an infant's comprehension system is equipped to understand input sentences and encode events perceived, assuming the infant encodes events as having objects related to other objects. So, a scene depicting a dog biting a cat, would be perceived as an action relation (biting) between an object argument (dog) and another object argument (cat). The infant, therefore, may analyse the sentence accompanying this scene ('The dog bit the cat') as:

(6)

Argument-object	predicate	Argument-object
Object-word	action	Object-word

By analysing the predicate as an action relation, Braine claims a phrase structure comparable to Pinker's can be derived, but differently labelled. The use of Noun, Verb, NP and VP and so on is avoided. Braine's phrase structure rules appear as:

(7)

S → object-argument phrase$_{agent}$ + action phrase
Action phrase → predicate + object-argument phrase
Object-argument phrase → Det + object word

Once such a structure is established, Braine, like Pinker, assumes, by the old-rule-new-material principle, that 'the situation justified extreme measures' will receive the same analysis. The claim is that the innate specification of Noun, Verb, NP and VP is unnecessary, as they are category labels which are applied to semantic primitives fulfilled by semantic information, and not categories in their own right. Braine finds support for this position from, what he claims to be, a widely shared assumption that there is some basic similarity between the structure of a semantic representation and phrase structure. As such, he concludes that there is no reason to posit grammatical categories like Noun, Verb and the like as primitives.

1.5 Discussion

Braine's proposal is not without problems. It rests on the universality of semantic relations, which appears well motivated but the direct syntactic

representation of semantic categories and relations is open to question, particularly in the generative tradition, where the syntactic component is considered to be independent from meaning (Chomsky 1957b). In addition, Braine describes his exemplar scene as 'a dog biting a cat', and then exemplifies what is uttered as 'the dog bit the cat'. As such, it suffers from the same problem as Pinker's example, described in 1.3iii above.

Neither Pinker's nor Braine's semantic bootstrapping hypotheses appear to contribute to the Research Areas. Infant intentionality is not addressed. What appears to be required of the infant is to engage with a scene and unconsciously parse an accompanying utterance, but it remains unspecified on what basis an infant attends to the relevant input. The important elements of infant interest and relevance are assumed, but not included in Pinker's background assumptions (1i-v). These assumptions themselves have been difficult to substantiate as shown by Pinker's willingness to revise them fundamentally (1.2).

A problem for both Pinker and Braine is the extent to which infants need to have learned the words before experiencing the scene. Both assume that the words and their meanings can be derived from the scene at the same time that the structural learning, which depends on knowing the meaning of the words, takes place. It leaves an open question for the Semantic Bootstrapping hypothesis as to how much infants should know before the bootstrap can begin. These are specific issues addressed in Chapters 3 and 4 below in relation to the Conceptual-Intentional Bootstrapping proposal being developed here.

I turn next to a somewhat different approach, very early parameter setting, VEPS.

2. Principles and Parameters: Very Early Parameter Setting. [VEPS]

Pinker's semantic bootstrapping model assumes that grammatical and functional categories and phrase structure rules are part of the innate endowment for language learning. The problem as he sees it is how the child links what she has heard spoken around her to these categories. His solution is the child's identification of these categories through semantic links provided from observation of real-world events associated with a given appropriate utterance.

Once the categorical membership of words is established then participation in given phrase structure rules follows for specific language variation. Thus, although based on an array of proposed innate elements, an infant builds up her language by developing a rule system from sentence constructions she experiences. Once the rule for a construction is established other input examples conform. Infant grammars grow from the formal organisation of grammatical and functional categories. The Principles and Parameters approach (P&P) adopts a different starting point.

Universal Grammar (UG) provides the fundamental set of grammatical parameters and computational principles underlying all languages. The infant, at birth, is equipped with this blueprint, and through experience of positive evidence provided from the language spoken around her, the parameters are set which match with this evidence. Language variation is therefore accounted for by differential parameter settings. There are a number of implications of this theoretical approach which set it out as radically different from others, but the following two areas are particularly relevant to this work: the learning mechanism, and the status of infant language production.

2.1 A learning mechanism

In contrast to Pinker's model, P&P presents a different approach to the learning process. Infants are born with a specification of UG and the task is simply a matter of setting the available parameters to reflect the language variety spoken around them. Crain & Lillo-Martin (1999) in their introductory text offer the following:

> "The main conclusion to draw is that language development seems to be internally driven. It comes from the child rather than from anything parents provide from outside. It seems that children are just built to learn." (Crain& Lillo-Martin 1999 p14)

Any hypothesis an infant makes about language is constrained in advance by UG. If it is right, as Gibsen & Wexler (1994) and Wexler (1998) maintain, that parameters are set before infants make two word utterances, then learning need not be behavioural. The infant does not need to make active use of language to learn it. He suggests the language learning process is an instance of perceptual learning. That is, learning is achieved through input only as for the visual system,

which is an input system without output. As such only positive evidence is used to set parameters and no overt behavioural response is required:

> "The assumption is that the learner attempts to generate an input sentence with her current grammar (i.e. parameter settings) and if she can't generate it she changes the setting of the parameter" (Wexler 1998 p32)

Recent experimental evidence questions this assumption. In response to claims by manufacturers that infants can learn language from watching DVDs, DeLoache, Chiong, Sherman et al. (2010) examined how many new words 12- to 18-month-old children learned from viewing a popular DVD several times a week for 4 weeks at home. They found that infants did not learn any more words from their month long exposure to it than did a control group, and the highest level of learning occurred in active interaction with adults. This would imply that perceptual learning as espoused by Wexler necessitates more than simply undifferentiated linguistic input. There must also be a mechanism that focusses infant attention to discriminate relevant input from what might be relegated to background noise.

2.2 The status of language production

On the VEPS account, the status of infant language production is a reflection of what has already been learnt. In many research programs, infant linguistic production provides the bedrock evidence for defining the developmental progress in language learning. On the P&P account, UG is a given. Infant production must mirror this, as the interaction between UG and linguistic input is the only basis for language acquisition. Infants, however, are not adults and thought to be subject to performance limitations because of their immaturity. UG parameters therefore are not identified by researchers from infant production, but made from idealised adult data, which has long been Chomsky's claim. Thus by establishing universal principles and parameters which can account for all human languages, there will be evidence to define the nature of the genetic endowment to the new-born. Language acquisition, from this standpoint, concerns the successive setting of given parameters in tune with the requirements of the ambient language experience of the infant. As such, language acquisition research is focussed on how infants go about setting parameters, not how infants discover them in the first place.

There is extensive research that claims that even the earliest infant utterances fit a parametric analysis. Snyder (2007, 2011) asserts that the majority of infant errors are ones of omission and very few may be viewed as errors of (what he terms) co-mission, or in P&P terms, wrongly set parameters. Given universal grammar as a characterisation of the parameters underlying all languages, a related assumption is that infants should have a full competence of clause structure, awaiting definition according to the language variety being experienced. As research into the nature of UG is a central target for this branch of Generative Linguistics, a specification of what parameters comprise UG is still very much a work in progress. When research outcomes identify potential UG elements, acquisition research then focuses on how the infant data reflect these elements. This leads to a level of frustration in Psycho-linguistic research in having to be led by advances in theoretical Linguistics, and this is especially so when advances in Linguistics pay little heed to infant linguistic data. Wexler has attempted through much of his work to show that study of infant production from a parametric point of view can make valuable contributions to the overall Generative project.

2.3 VEPS

Wexler (1998) suggests some of the early set parameters are:

i) Word order (Head parameter) VO versus OV (e.g. Swedish versus German)

ii) Verb raising parameter (French vs English)

iii) V2 parameter (German vs French or English)

iv) Null Subject parameter (Italian, Spanish vs English, French)

Problematic, however, is the observation that infants generally present in their language production, utterances which appear to mask evidence that the parameters have been set. Utterances using non-finite verbs forms (where adult language would require finite verbs) are typical of this. It is well documented that infants tend to use finite or non-finite (Root Infinitive) verb forms optionally in main clauses and it is this context –which Wexler calls the Optional Infinitive stage (OI) – which masks parameter setting.

Wexler claims for the OI stage that:

> "a. Root infinitives are possible grammatical sentences for children in this stage, (around two years old).
> b. Those infinitives coexist with finite forms.
> c. Children nevertheless know the relevant grammatical principles e.g. head movement, checking etc." (Wexler 1998 p.28)

2.3.1 Finite Verb raising

Poeppel and Wexler (1993) explored evidence for the systematic distinction between finite and non-finite verbs for infants acquiring German. German (in common with other languages like Swedish) is a V2 language, where the finite verb appears as the second constituent in the main clause, but in contrast to Swedish, non-finite verbs appear last, including the non-finite element of a compound verb. In a subordinate clause in German the finite verb appears last. For instance:

(8)

a). Ich habe das Buch gefunden
I have found the book
b). Als er nach Hause kam, sah er seinen Onkel.
When he came home he saw his uncle.

In studying infant corpus data, it is clear that this distinction is apparent from the earliest age (2 year olds):

(9)

a). Ich hab tein Bürse
I have [a] small brush
b). Thorsten Caesar haben
Thorsten has [the doll] Caesar

The implication is that infants recognise that German has an underlying SOV structure and that in main (matrix) clauses the finite verb is raised to a second position (V2). In Swedish both the finite and non-finite verb occupies the second position, and so is correctly identified as SVO. In Japanese where there is no verb movement, the early state is for the verb to occupy the final position after an object and therefore SOV. In English, where main verbs similarly do not undergo movement the early structure is SVO. The correct order SOV or SVO can confidently be assumed to be established early.

In French, however, where finite verbs do undergo raising, it is found in infant data that a finite verb will precede 'pas' (negative) but when a non-finite verb is selected it is not raised and therefore follows 'pas'.

For instance:

(10)

a). (Il ne) mange pas

versus

b). Pas manger

The value of the verb raising parameter is set very early to 'raise' but it is the effect of the OI stage which masks the fact that infants have this as part of their linguistic competence.

2.3.2 Null subject parameter

One widely explored area is the Null Subject Parameter (NSP), which will be considered here in some detail.

Some languages tolerate the non-expression of an overt grammatical subject (e.g. PRO drop languages - Spanish, Italian, Korean) whereas others require an obligatory grammatical subject to be overtly expressed (e.g. English, French). So for the former the NSP is set as positive (allowing the non-expression of subject) and for the latter, set negative (ensuring the expression of the subject). It is, however, well documented that infant speech is typically characterised by the omission of the subject whatever type of language is being acquired. What implications does this have for the infant parameter setting process?

There are three possible settings available to the child. Firstly, the parameter may initially be in a neutral state (unset) and becomes set either positive or negative given evidence of the ambient language. If this were the case, then infants would correctly set the parameter from the beginning and the discrepancy (where infants omit subjects when the language they are acquiring requires the subject) would be an error. This eventuality would require a later process of corrective resetting, a theoretical position which should be avoided. Because parameters are thought to have quite wide-ranging affects e.g. the Head Parameter (outlined in the introduction in Chapter 1), there would be equally wide-ranging

consequences if ad hoc parameter resetting were allowed. Also there is little evidence for a widespread resetting process.

A second option is for the parameter to be set initially as negative which would imply obligatory subjects. This cannot be entertained because of the prevalence of evidence showing that subjects are dropped.

The third option is one that Hyams (1992) and Hyams and Wexler (1993) support which is the proposal that NSP is set as if positive in UG. Infants acquiring null subject languages need not set this parameter as it accounts for their languages in its initial state. Infants acquiring English or French eventually need to set this parameter to negative, to ensure the obligatory requirement to express a subject. To account for the apparent discontinuities in parameter values, suggestions have been made that parameters are set at different times, and the time lag may be due to performance limitations on the part of the infant, which in the case of NSP is typically complete by the time the infant is three years old. This gives rise to different researchers favouring a distinction between Early and Late set Parameters.

It is not clear, however, how infants come to set this parameter so late, when all positive linguistic evidence in English signals an obligatory subject. As there is little contrary evidence, an infant acquiring English should be expected to correctly set this parameter very early. Wexler (1998) is a strong supporter of very early parameter setting (VEPS), and suggests that key parameters are set probably before infants produce two word sentences. On this view, the NSP is set correctly from the beginning, but the production data is reflecting the effects of the Optional Infinitive (OI) stage of language acquisition. Finite verbs are subject to the NSP but non-finite verbs are not. This would explain the apparent differential application of the parameter. That is, non-finite forms have no overt subject and mask the infant's established knowledge of NSP. Once again empirical evidence would appear to confirm the claim. A survey of child language production reported in Wexler (quoted in Wexler 1998 based on a conference presentation by Wexler 1990) shows that null subjects occur 70 to 95% with OI and 15 to 30% with finite main verbs, suggesting that the OI stage licences a null subject. He suggests that those fewer null subjects occurring with finite verbs in the data are pragmatically influenced as a form of topic drop when the infant

assumes (rightly or wrongly) that the subject is salient enough from the context, and therefore the need to express it overtly is lessened.

2.3.3 VEKI

It would seem that parameters are correctly set early on, but they may not be correctly realised due to grammatical, contextual or pragmatic reasons. Wexler maintains that not only parameters are set early, but morphological inflexion variation is also well established early. (Very Early Knowledge of Inflection – VEKI). He cites experimental evidence (Rice & Wexler 1996) where children (average age 3 years and further extended to 2 year olds) do not confuse examples like:

'She paints pictures' vs 'she painted pictures' (although either can also be expressed by the child in the IO stage as 'paint pictures').

From the survey, it appears that children never use –s form for past or –ed form for present.

> "There can be no question that these children knew that '–ed' is +past and '–s' is -past" (Wexler 1998 p42)

Wexler argues strongly for no late learning of parameters on the basis that infant linguistic errors can be traced to maturational features rather than performance errors. For this to be so, Wexler assumes that grammatical and functional categories are known (there can't be V-raising without V being in some way identified), as Pinker also does. The difference is that Pinker's innate elements are in effect an inventory of categories and initial phrase structure rules; whereas Wexler's full competence model provides infants with innate knowledge of grammatical and functional categories and construction parameters which relate them in predefined, possible ways. Language is acquired without using it. Language by this description is the structural organisation of grammatical elements, in line with Chomsky's view (1995 p227) that Generative Linguistics is concerned with the "narrow study of mechanisms".

2.4 Revisions to the Full Competence model

Wexler is committed to VEPS and VEKI, in support of the full competence hypothesis which he espouses. There are, however, other researchers who do not agree and are concerned that even if infants have available the full linguistic

blueprint from UG, there should be a built-in means for enabling the infant mind to manage this powerful innate resource, given known limitations of physical and cognitive maturation.

2.4.1 Late set parameters

Bloom (1990) had suggested that subject omission may simply be due to the infant's limited memory capacity, which prompts the omission of the subject as it is generated late in the derivation. Empirical evidence tends to oppose this view: subjects appear in WH-constructions where more complex computations follow from subject specification in the derivation. Similarly there is evidence of object omission. Objects are specified early in the derivation, and so object-drop cannot be explained through memory limitations. Memory capacity alone cannot be a deciding factor.

There must, however, be some strategic limitations imposed if only for the trivial reason that infants are not as competent as adults. Rizzi (2002) proposes a strategy that can account for the indisputable limitations of the infant, yet preserve grammatical principles.

> "When production begins, the child initially assumes all parametric values which facilitate the task of the immature production system by reducing the computational load, and which are consistent with her current grammatical knowledge." (Rizzi 2002 p20)

Such a proposal would suggest two types of parameter setting: VEPS and those that need to occur later.

Rizzi offers an adult example of how parameters may not be set until needed. Null subject languages tend to be those that have a rich morphological agreement system. As Wexler has pointed out through VEKI, infants have a well-developed inflexional system, and so it would be expected that the NSP will be set positive where a language exhibits a rich agreement system. From a study of language change in Brazilian Portuguese, it was found that due to the simplification of personal pronouns, second person 'tu' and 'vos' have been replaced by 'voce(s)' (your Grace) demanding a third person agreement, and first person plural pronoun 'nos' has been replaced by 'a gente' which also requires third person agreement. This has had the effect through the 20th century of reducing the six person verb paradigm to 3 forms. In parallel with this, the option

of null pronominal subjects has shrunk. Rizzi reports a calculation by Duarte (2000) that overt subjects have shifted from 20 to 25% at the beginning of the century to 67 to 74% in the second half. If it is accepted that the base state of NSP is positive in Brazilian Portuguese, then the setting of this parameter to negative over time has been motivated by grammatical factors (i.e. the option to set NSP as positive or negative is an available option in UG), but occurs for reasons prompted from outside the grammar per se.

There are languages which do not have a rich morphological agreement system yet have null subjects (Chinese, Japanese). These languages are subject to the pragmatically motivated topic drop as discussed previously. Infants do, however, drop subjects in production even when a language has NSP set to negative (as in English). Rizzi suggests that Root Subject drop is an option unaffected by the NSP. Where languages have overt subject expression NSP is set, as VEPS would suggest, to negative, but this evidence would neither contradict nor support a Root Subject drop option. This is paralleled by other 'drop' options including copula drop, as well as the OI effect. Research into adult written English use shows that diary register acceptably allows for subject drop. Similar phenomena are noted in non-standard colloquial dialects of German and Dutch. Root subject drop, then, seems to be an option available to language learners particularly in terms of economy but is grammatically motivated and fittingly appears to be more prevalent in infant speech than in adult use.

Rizzi concludes that

> "it seems to be the case that some parameters are correctly set when syntactically relevant production starts, while others are not, and give rise to observable developmental effects…If this is correct, language development is grammatically based, but performance driven: non-target consistent properties ... correspond to genuine UG options, but the factors determining their temporary adoption ... lie in the growth of the performance systems, outside the grammatical system proper." (Rizzi 2002 p24)

Performance systems outside the grammatical system proper may be affected by many means, but early maturation and growth of the infant will surely play a significant role, as Wexler, himself, concedes, noting that

> "..developmental constraints often take much more time to work themselves out" (Wexler 1998 p74).

2.4.2 Fodor's Treelets

Further support for a constraint on the extent of parameter setting in initial acquisition comes from Janet Fodor (1998) who has argued that the approach to defining whole sentence triggers for VEPS (Gibson & Wexler 1994, and Wexler 1998) presents the infant with a vast array of ambiguous triggers which necessitate a trial and error approach. In turn this can result in wholesale parameter resetting to derive the correct syntax. Her solution is to constrain the infant to unambiguous triggers which tend to mark structures within sentences or 'treelets' rather than whole sentence structure. She concedes that information from ambiguous constructions may form stored information, but conclusions are not made (in her terms, parameters not set) until the structure is certain. This element of certainty accords with Snyder's (2007, 2011) claim for infant conservatism, discussed in 2.2 above.

2.5 Metamorphosis

From a different perspective, Gleitman (1981) writes of the tensions evident in acquisition research between the linguistic environment providing the necessary input and the innate machinery which operates on it. She forms the opinion, based on her own extensive research programme that a sort of egg/tadpole/frog hypothesis might be appropriate, which she illustrates in the following way.

In the earliest stage, the learner is incapable of representing language. In a succeeding period, the incoming language stimulation is represented as a conceptual system and linguistic units are semantic/relational. Finally, there is a jump to a different state whose outcomes are grammatical relations partly independent of semantic categories and relations. She suggests that mechanisms of change are more akin to metamorphosis than learning. She suggests that different rules and representations become available successively as a result of internal changes in learners. She ends her speculative paper with this statement:

> "… it is clear that language learning cannot be satisfactorily described simply as an environment-driven process. Rather, creative activities in the child, specific to language, do the lion's share of explanation." (Gleitman 1981 pp112-3)

Through this, Gleitman provides a differing perspective on the language growth model, suggesting additional lines of enquiry complementing those proposed by Rizzi above. The full competence model may constitute the final stage metamorphosis of the learner into a syntactic organiser, but, as Gleitman and Rizzi, caution there are other aspects to infant growth and maturation which may play an influential role.

2.6 Discussion

This section has described in overview the P&P and VEPS approach to language acquisition, and highlighted some of the difficulties that arise when infant data appear to contradict a smooth parameter setting process. VEPS and the suggested revisions present important points to inform the Research Areas.

The infant as an intentional participant in the language learning process is apparently denied by VEPS. Although the view that the syntactic organisation of linguistic material is largely unconscious, may be right, there is a case to be made, as Gleitman and Rizzi suggest, that there may be extra-grammatical elements driving the process. The interaction between growth in the language faculty and general cognitive growth and maturation may be a contributing factor. Wexler's suggested perceptual learning process is somewhat speculative, and in the light of the de Loache (2010) research outlined in 2.1 above, there is an undeniable human interaction, or inter-subjectivity effect to be accounted for.

In terms of the Language experience of the infant, it may be tempting to suppose that perceptual learning, as Wexler describes it, makes any bootstrapping requirement redundant. If it is true, that an infant can attempt to generate an input sentence from given or newly set parameters based only on the perception of the speech stream around her, there is a genuine question about the relationship between physical sound perception and the essential properties of the perceived sound which trigger the mechanism operating with UG. Accepting that P&P claims only to represent an idealised situation, there is something less than ideal about considering infant perception as a purely mechanical operation. Visual perception parallels sound perception as input-only operations, but these are different from language perception where the source input is a human performance created (more often than not) with more than just organised human

sound production in mind. Put more succinctly, there is still the problem of how the infant identifies the linguistic features necessary for parametric setting. How does she know what is a verb for the verb raising parameter, or a non-subject for NSP?

An important observation provided by Wexler is the suggested OI stage. What makes infinitive use optional and how are choices made? The fact that OI is regularly observed in young infants acquiring a range of languages makes this a feature of acquisition that any account should explain.

The OI frequently appears to express utterances that the Conceptual-Intentional Bootstrapping proposal, under development here, recognises as those of Complex Events: an intentional event not occurring in the present or an event where results are apparent in the present.

Compare the following examples from Dutch and Russian

(11) Dutch

a) drink e(n)! (Niek 2;7)
drink INF
'I want to drink.'

b) [eendje] [zi en]. (Matthijs 2;5.1)
[duck DIM] [see INF]
'(I want to) see the ducky.'

(Quoted in Gavruseva 2003)

(12) Russian

a) Carevna xoxotat
'Princess to-laugh'
'The Princess started to laugh, right after something funny happened'

b) Zriteli applodirovat
'Spectators to-applaude'
'The spectators started to applaud right after something exciting was done'

(Quoted in Rizzi 2002)

The Conceptual-Intentional Bootstrapping proposal can and does account for the OI stage, but specifies that it is not optional nor random. It identifies two types of infinitive use: one syntactically, and the other morphologically motivated in English. This issue will receive detailed discussion in Chapter 7.

Rizzi and Gleitman suggest that there may be influences on language acquisition from extra-linguistic cognitive development. A major development of this kind is at the heart of the bootstrapping model under development and will be addressed in Chapter 5, when a significant and decisive aspect of meta-cognitive growth will be described.

Lastly, Gleitman's description of linguistic metamorphosis is important because she brings a vast amount of experience of actual infant data to the observation. The Conceptual-Intentional bootstrapping proposal accounts for such a change, where infant speech appears to transform from the conceptual to the syntactic, which is mirrored in properties of utterances of Manifest and Complex Events. Again Chapter 5 will address this in some detail.

The next section describes a very different approach to acquisition, which resides in the emergentist tradition and focuses on Tomasello's Verb Island Hypothesis.

3. Tomasello's Verb Island Hypothesis [VIH]

In 'First Verbs', Tomasello (1992) presents a detailed case study of his daughter's (Travis) gradual acquisition of language and logs her 2+ word utterances from 15-24+ months old. It has the specific advantage of being a diary based on audio and video evidence. It provides contextual information as well as an indication of the adult interpretation of what Travis is thought to have meant by her utterances. The log also briefly suggests the supposed adult input which may have prompted Travis' learning. One of Tomasello's aims is to provide strong support for an emergentist, empirical approach to acquisition, to show the development of syntactic structure from (lexical) item-based combinations.

3.1 Cognitive Linguistics

Tomasello's linguistic theoretic stance is based on Cognitive Linguistics, which he claims is an approach which describes linguistic structure as psychological (cognitive, social-cognitive) processes, and is therefore more amenable to a developmental analysis. Following Langacker (1987, 2008), Tomasello suggests that linguistic competence is based on cognitive symbols and a range of cognitive processes which operate on them. Cognitive symbols, on this

account, are semantic conceptualisations. Based on shared experience and cognition, for the purpose of communication, humans create an inventory of symbolic devices and integrate them into larger symbolic wholes.

> "There is nothing else in human language other than the symbolic inventory and general cognitive processes using it." (Tomasello 1992 p3)

He supports his view citing a wide range of linguistic and psycholinguistic analyses (principally Lakoff 1987 and Bates and MacWhinney 1982, 1989) that suggest that linguistic categories of all kinds – including words and syntactic categories like subject of sentence – are prototypical. Prototypical categories are characterised as having graded content with category members showing central or peripheral qualities, no one of which is essential. Prototypical categories, rather than essential categories, are by their nature more open to change and development. It is this developmental process over time which constitutes language learning, and is, for Tomasello, the key area for study. Langacker (1987) had proposed that the meanings of linguistic expressions are divided between nominal and relational predications. (He refers to semantic structures of any size as predications characterised relative to cognitive domains. Cognitive domains may be cognitively irreducible e.g. experience of time or space or colour, but most domains of linguistic relevance are not primitive and involve indefinitely complex cognitive structures).

> "A nominal predication presupposes the interconnections among a set of conceived entities, and profiles the region thus established. By contrast, a relational predication presupposes a set of entities, and it profiles the interconnections among entities." (Langacker 1987 p68)

Relational predications are not distinguished by inherent conceptual content, but by profiling interconnections, and may be simple or complex. For instance, consider these two examples:

(13)

a) There is a bridge across the river
b) The hiker waded across the river

In (13a) the relation expressed by 'across' is simple and stative (the bridge spans one side to the other). In (13b) the relation is complex because 'across' designates a series of stages the hiker undertakes to travel from one side to the other.

Relational predications also profile processes versus a-temporal relations. For Langacker, the set of processural predications is co-extensive with verbs, whereas a-temporal relations correspond to traditional categories like preposition, adjective, adverb, infinitives and participles. Langacker also distinguishes 2 types of cognitive processing – summary and sequential. The former involves a complex conceptualisation built up from successive scanning of a whole 'scene'. The latter involves the successive transformation from one 'scene' to another, non-cumulatively and dynamic. Summary scanning is suited to the conception of static situations; sequential scanning lends itself to conceptual changes and events.

Tomasello re-interprets Langacker's complex adult formulation, for the purposes of analysing infant utterances and differentiating nouns and verbs. He suggests that words like 'parade' or 'skiing' when used as nouns refer to temporarily extended events where processes are treated as things with no sequential scanning. When used as verbs, the words require processural sequential scanning:

(14)

a) He paraded around the house
b) He is skiing

In brief, Tomasello offers this summary: the noun is the snapshot and the verb is a moving picture. Because not all verbs can be likened to moving pictures, he also explains that verbs such as 'remain' or 'know' involve durative states which cannot be identified from a snapshot.

These cognitive, as opposed to structural, criteria drawn from Langacker's work, are used by Tomasello to identify children's early verbs:

> "I call a verb any word that the child uses to predicate a process of something, regardless of that word's status in adult language" (Tomasello 1992 p11)

By this token, words like 'off', as in 'hat off', are recorded as verbs.

3.2 Data analysis

Tomasello's analysis organises his extensive diary data into a number of themes that provide samples of development over the period of the case study. Not surprisingly, the focus of Travis' talk is on relations and actions between and about people and entities in Travis' everyday experience: family members, pets, food, toys and so on. Also recorded are uses of words indicating motion which are not usually analysed as verbs (in the adult sense): up, down, in, out. This tends to emphasise that children may well be operating with categories different from adults (Bowerman 1973), that is, a child's category of verb, if they do in fact have such a category, may include a wide range of relational terms.

Accepting that children may not have an abstract verb category, Tomasello analyses Travis' word combinations – one 'verb-like' word plus a word which, in the main, describes an object or entity – into sets of conceptual categories, which he illustrates diagrammatically to show how the processural events might be conceptualised.

The classification includes (with a selection of example verbs given in italics):

- Presence, absence or recurrence of objects: *whereda ; find-it; more; another*
- Presence, absence or recurrence of actions: *again; do-it; finish*
- Exchange of possession: *thanks; here-go; get-it; hold*
- Location of object: *up; down; on; off; in; out; here; there*
- Movement of object: *stuck; go; come; off; bring; take*
- State of object: *open; close; fix; break; tear; crack.*
- A much smaller category indicates actions of objects: *sweep; brush; hammer*

Lastly, a category that Tomasello labels as actions without objects (although many examples seem to involve objects in some way), which he subgroups into:

- Physical activity: *run; jump; swim*
- Perceptual activity: *see; taste; listen*
- Emotional activity: *scared; love; hurt*

- Epistemic activity: *talk; remember*.

Through this organisation, Tomasello is attempting to establish that the lexical items designated as verbs are a symbolic label for processural conceptualisations which are readily available to the infant. With the focus on the process, arguments are designated as being the substantive elements of the process. So, the verb 'hit' is associated with a 'hitter' and a 'hittee'. The functional role of the argument is semantically integrated and defined by the symbolic representation of the verb.

3.3 Verb Islands

Tomasello observes that Travis' extended knowledge of a verb develops individually. The most commonly heard terms develop more complex uses and participate in increasingly more complex constructions. Development is therefore word/item specific, dependent on heard usage and does not at this stage appear to provide a model or rule for other verb item development. For instance, Travis' use of 'get-it':

The case study records that parental use of this expression is of 3 kinds: for the telephone 'I'll get it'; telling someone to 'go get it'; or telling Travis 'you can get it' in response to her request for something. It is assumed that Travis learned 'get-it' as a single word expression in relation to objects that are perceived but inaccessible. Her earliest uses appear to be holophrastic in nature: 'Phone, get-it' and 'Ball, get-it' around 17mo. By 18mo Travis appears to put this in a 2 word combination structure resembling VO 'Get-it silk'. 'Get-it puppet'. By 20mo Travis is indicating the retriever 'Mummy get sauce' or 'Daddy get-it bottle'. By 21mo she utters 'Get raisins to me', and by 23mo Travis is specifying actor and intention as in 'I'm gonna get more ice-cream'.

The development seems to be specific to this verb, as the same complexities do not transfer or appear in similar words. Thus at 19+months Travis says 'balloon, have-it' and 'have-it cards' and at 20 months she asks 'give-it pencil' and at 23months 'give it to me'. In another instance Travis uses 'keep-it' to imply she will not relinquish an object and this remains a single word assertion past 20months.

Tomasello concludes from these and many further examples that if the developments of 'get-it' were rule governed then it should be possible to discern comparable developments for 'have-it', 'keep-it', 'find-it', 'want-it' etc. He claims that evidence for this, however, is not apparent in the corpus. Tomasello's Verb Island Hypothesis proposes that grammaticalisation of verbs derives from learning combinatorial possibilities and argument roles for each verb individually as they are heard in the input.

Verb expressions that are heard and used more frequently develop more extensively than less frequently used verbs. Tomasello's principle argument is that this would not be predicted if it were the case that a single rule developed for one verb was applicable to others. From experimental evidence, Tomasello & Olguin (1993) and Olguin & Tomasello (1993) which tested for infant knowledge of morphological paradigms, Tomasello concluded that infants have a category Noun but no category Verb at 25 months. This conclusion was based on infants productively forming plurals of novel nouns, but not being able to form past tense '-ed' forms for novel verbs.

How, then, do verb islands become generalised verb constructions? Tomasello (1992, 2000a, 2000b, 2005, 2006) suggests that, given a critical mass of verb island constructions, a process of analogy enables the child to generalise to an abstract verb phrase structure.

> "Children begin to form abstract utterance-level constructions by creating analogies among utterances emanating from different item-based constructions." (Tomasello 2006 p45)

His argument is that the learner gains an understanding of the interrelationship of the structures, aligned through analogy. He cites the work of Gentner and Markman (1997), and Gentner and Medina (1998), to provide evidence of the young child's ability to make analogies. A closer look at Gentner and colleagues' work raises doubts about this assertion, as the empirical evidence for analogous learning by young infants, in this context, is far from conclusive.

3.4 Analogy

The main objective of Gentner and Markman (1997) is to explore the psychology of a long discussed philosophical problem: the relation between similarity and analogy. They indicate widespread evidence from child

development where children make comparisons in order to draw conclusions. One example quoted, attributed to Lise Menn whose 2year old son, fascinated by the way ducklings eat, mimicked them and concluded: 'have no hands' to explain why the ducklings' and his own eating behaviour differed. But this is not necessarily defined as analogy in Gentner's terms, rather as comparison within a common context (eating). Gentner and Markman present 3 types of comparison and give rather quirky illustrative examples, reported here for completeness:

i) Literal similarity where objects and relations are shared (e.g. comparing prison and jail);

ii) Mere appearance similarity, where objects but not relations are shared (comparing a zebra and prisoner)[1]; and

iii) Analogy, where relation but not objects are shared (comparing prison and a job).

The key element of this research, for present purposes, is that in true analogy, only relational elements are shared. Experimental work has been conducted with children (from 2years old to 14years old) and adults to explore when and how such relational alignments are made between objects (Gentner and Medina 1998), or events and scenarios (Gentner and Markman 1997; Richland, Morrison and Holyoak 2006). Across all these studies, where young children are participants, the experimental presentation involves concrete items or visual scenes for children to compare and draw analogies. One simple example is to show a loaf of bread alongside a slice of bread. Children are asked to select from a range of pictures the appropriate entry to place alongside a lemon within this experimental context (they are expected to select a slice of lemon). More complex input involves comparing abstract object shapes and shading or complex scenarios containing distractors. The outcome important here, is that it is not until children are 4 years old that they can perform these experimental tasks successfully, and then only just above chance level. It is not until children are 5-6 years old that they become secure in forming basic analogies, and even then it is with concrete items or visual representations.

[1] The comparison is assumed to be between a zebra's stripes and a striped prisoner's uniform.

Tomasello, however, is suggesting that children not yet 3 years old might have the ability to draw analogies from inventories of abstract linguistic constructions. Thus a collection of verb islands may present the infant with relations that do not comfortably meet the criteria for analogy making which according to Gentner & Markman (1997) demand that there is a relational element in common rather than shared objects. In the examples below (drawn from Travis' most used verbs) the relations do not seem analogous:

(15)

a) hitter -- (hit) – hittee
b) drinker – (drink) – substance
c) drawer – (draw) – location
d) maker – (made) – made object

The problem revolves around what comes first. Can an overall structure be derived from disparate parts, or is it more likely that the overall structure comes first and the disparate elements are fitted to it. So, assuming that the target analogous relation is something like a SVO structure; can it be derived from examples (15a-d)? If it is relations rather than objects that are critical then presumably (15c) would wrongly pattern with the others.

Usually analogy appears to work in another way, that given an 'umbrella' structure new items that occur under this 'umbrella' can be inferred to take on comparable properties exhibited by the others. So, given an already acquired SVO structure, new 'islands' exhibiting Xer and Xee relations would be drawn together comparably under the pre-existing SVO umbrella. However, this also assumes that the Xer and Xee relation has already been abstracted. But many of the verb islands appear not to have these relational elements regularly present (so for the verb 'X', the 'Xer' and/or 'Xee' elements are not systematically stated).

Although Tomasello suggests that the process of analogy is established by 3 years of age, it is generally held that it is only by that age that the 'Xer' and 'Xee' elements become more systematically part of language production. This may lead to the conclusion that the 'Xer' and 'Xee' roles have a prior, more abstract designation like Subject/noun or Objet/noun which Tomasello explicitly denies, alongside doubts that infants have even an intuitive notion of verb. It would appear that the item specificity of constructions they use can enable them to form

a conceptual/semantic alignment based on prior subjective knowledge/experience of how objects interact, rather than a structural/syntactic alignment which on this account appears to have no source.

The literature on analogy (Ratterman and Gentner 1998) proposes a 'relational shift' after 4years of age which enables children more readily to draw analogies. The conclusion reached here is that analogy cannot play with any certainty, the role Tomasello suggests. Gentner and Markman (1997) even suggest that it is the acquisition of language itself, which supports and prompts the ability to form analogies.

Even if this view of analogy is wrong and there is some specific type of analogy available to infants as Tomasello suggests, then there is a further problem. Tomasello says that given a critical mass of verb islands then analogy becomes active. What constitutes a critical mass? What prompts the inevitability of analogy formation? It might be possible to develop a functional linguistic ability based only on extensive sets of verb islands, but there appears to be no research into what might constitute a tipping point.

The notion of structural alignment is, however, an important one. Gentner and Markman point out that comparison is more easily performed when the items being compared have a structural or category alignment. Experiments with adults showed that participants could produce similarity and difference judgements more easily and in greater quantity when comparing, for instance, a cat and a dog (category linked 'animals') as opposed to a cat and a magazine (no category link). For structural alignment to be possible there needs to be some super-ordinate category/context within which items/elements can be compared. The collection of verb islands, however extensive, would appear to lack this higher order category to provide some unified context within which island instances can be compared and analogies drawn.

3.5 Alternative proposals

3.5.1 McClure, Pine & Lieven

McClure, Pine & Lieven. (2006) conducted an investigation to establish whether the evidence for verb islands derived from Travis, generalises to a larger

group of infants, by comparing her acquisition data with a longitudinal study of 10 children. They found the experience of all the infants to be largely in line, and so the data from Travis may be considered typical. The investigation also set out to explore 2 further aspects: the extent that infants' knowledge grows gradually around specific lexical items and also to what extent verb-general knowledge is evidenced in the early stages of acquisition. McClure et al analysed infants' utterances into Stage 1 (Mean length of utterance [MLU] 1-1.99 morphemes) and Stage 2 (MLU 2-2.49 morphemes).

The investigation assumed that a strict interpretation of the Verb Island Hypothesis would predict that:

i) few verbs would first appear in multi-argument structures;

ii) utterances with 'old' verbs (previously acquired at stage 1) would at stage 2 have more complex structure than utterances with new verbs at stage 2;

iii) utterances with new verbs at stage 2 would be no more complex than verbs at stage1.

Having applied a common coding to the data for all the infants, the results suggested that the infants do tend to use their verbs initially in single argument structures; that old verbs at stage 2 do tend to occur in more complex structures than new verbs at stage 2, confirming that the longer an infant has known a verb the greater the complexity of its use. The third prediction, however, was not supported. New verbs learned at stage 2 had a more complex argument structure than new verbs learned at stage 1.

This result may suggest that some learning is carried over to new verbs and that knowledge of argument structure is not entirely verb specific. Further analysis of the productive patterns within the infants' utterances, however, showed that they were composed of high frequency nominal elements which could pattern as subjects and objects within an utterance. For example, across three of the infants a structure 'Mummy X' (where X stands for a verb) became a frame for new verbs as a slot filler. There were no counter examples from these infants of the type 'X mummy'. The general conclusion drawn is that infants develop a notion of high frequency Subject (or Object) which patterns semantically with a new verb.

McClure et al. suggest that there is an advantage in this approach which allows for lexically specific patterns to be made around items other than verbs, with the possibility of developing S+V and V+O as abstract structures, with the nominal element as the driver, although no suggestion is made how the notion of Subject or Object of sentence is derived. This is an interesting extension of the Island notion, but makes the leap without explanation from conceptual to syntactic relations.

Tomasello's position is that the conceptualisation of a process specifies the participants, and as more participants are known to play a part in the process (from the infant's growing experience) then the verb island forms e.g. a range of hitters and hittees consolidating 'hit'. On the McClure account infants' growing experience of entities defines the range of processes in which they can participate, thus boys, girls, bats and so on can 'hit', or boys, girls, balls and so on can 'be hit'. This raises an interesting contrast: an action with a range of generic participants versus a participant having a range of generic actions. Infant generic knowledge of events and how this is expressed verbally will be addressed in Chapter 3, and forms a precursor to utterances of Manifest Events according to the Conceptual-Intentional Bootstrapping proposal under development here.

3.5.2 Ninio's Path breaking verbs hypothesis

Ninio (1999) summarises various approaches to the acquisition of verb syntax. Ninio, firstly, dismisses Pinker's Semantic Bootstrapping hypothesis, based on her empirical data showing that the first verbs infants utter are essentially stative, typically 'want' and as such do not meet Pinker's criterion of the triggering effect of an initial action verb. She then discusses Tomasello's Verb Island Hypothesis which she describes as each verb developing a mini syntax for itself and after a considerable number of verbs are acquired the isolated syntactic elements are later integrated, at a time well beyond early word combination.

Ninio's review of evidence from 15 children learning Hebrew, along with Tomasello's data, prompts her to suggest a third possibility which is most succinctly expressed from the original:

> "when children start to learn to combine individual verbs in various positional patterns, they also begin to consolidate some more general or abstract knowledge about the verb form class, about different complements verbs take and about the positional patterns involved." (Ninio 1999 p623)

Ninio justifies this proposal through her data analysis showing that in early verb combinations the initial pattern is a single VO structure. There is then an appreciable time gap before the production of a new verb in a new VO construction. Across all the children in her study, this time gap averages 44 days (span of 17 -104 days) thereafter the number of new verbs appearing in this pattern speeds up. Ninio notes that an SVO pattern occurs consistently after VO development and exhibits the same kind of time lag: the second verb in a SVO pattern appeared an average of 42 days (span 12 -150 days) after the first occurrence. Further novel verbs appear in the pattern with an increasingly shorter time gap. Significantly also, VO and SVO appear to develop independently with different verbs. According to Ninio, Tomasello's data showed a considerable number of verbs appearing in a VO pattern before Travis used a SVO construction. Another child Rudi showed a parallel developmental curve of VO to SVO with the SVO trajectory beginning over a month after the VO.

Ninio attributes the gradual speeding up of the learning curves to 'facilitation, generalisation and transfer' from existing verbs that infants already know how to combine. She claims that this type of development cannot support a verb island hypothesis. If verbs develop independent syntax without influence from other verbs, then this would not explain the speeding up effect over time, and there is, in the Travis data, clear evidence of a dramatic increase in new but item specific verb combinations. The major problem that Ninio glosses over is why she designates the VO structures as V+O rather than some other designation, as previously, Ninio (1988) had argued that infants do not have abstract grammatical categories like verb or noun, which emerge gradually over time.

Ninio clarifies this as follows: initial word combinations are semantically motivated rather than reflecting syntactic knowledge. Given a growing store of word combinations, she suggests (Ninio 1999 p116) that infants gain a 'growing realisation' or 'insight' into which words require arguments and therefore function as predicates. Given a growing stock of predicates, an infant gains insight into what words function as arguments. For example, a noun 'apple'

becomes an argument when entering into a predicate relation with an adjective in the 2 word combination 'big apple'. This combination in turn becomes an argument of a further predicate: 'want [big apple]'. On this account, infants' abstract categories change dramatically as new combinations are successfully made.

There remains however the major problem of what constitutes, motivates or guarantees, what Ninio terms, a 'growing realisation' or 'insight'. Ninio's path-breaking hypothesis suggests that the first verbs infants acquire are prototypically transitive, and based on infant data, she claims that initial transitivity is reflected in terms of two cognitive processes firstly objects being drawn to/into the self (possession or consumption) or secondly object creation. This is explained by the observation that the first SVO constructions involve 'want' 'take' 'eat' 'hold' 'get', or 'make' which Ninio terms 'path-breaking verbs' upon which verb phrase construction is based. How far they contribute to a 'growing realisation' becoming an inevitable outcome is not clear. Why are notions of possession and creation so central? In Chapter 5, the powerful effect of a meta-cognitive development enabling infants to express intentional outcomes and results will be described. It is the expression of such Complex Events, which may include possession and construction as well as other intentions, which provides the motivation for Ninio's identified verbs.

As previously noted subjects are regularly omitted in infant speech. So, developments from VO to SVO over time may be due to a range of possible influences. Travis does not include a subject in her utterances consistently until 20+months for some verbs and even then where subjects are made explicit they appear to be pragmatically motivated (age is indicated in months and days):

(16)

a) as vocatives to gain attention:
Daddy look over there 20;06

b) consciously included because the agent is not present and therefore not immediately derivable from the context:
Timothy gave that necklace for me 22;11

c) the subjects specified are more significant than the object acted on ('I' has specific significance and is addressed in Chapter 7 below):
I like it 23;0
I want to get in your lap 24;28

d) as entities which contribute to a habitual event (intransitives):
Maria go 17;14
Daddy working real hard 20;15
Pajama falling down 21;14

Although a subject is obligatory in English constructions it seems that Travis in common with other English speaking infants, does not have the structural flexibility to reflect this formal requirement. Conceptually, she has no need to, when subjects can be readily derived pragmatically from the context of use.

3.6 Discussion

To summarise the VIH: structural knowledge develops from individual instances of words which focus on generally, dynamic events, learned from adult input. Through frequency of use, the verb gains more possible and explicit event participants whose thematic roles are inherently defined by the verb. So, 'a hitter' is an agent of 'hit'; and 'a drink' is a theme of 'drink'. The collections of verbs plus participant groups form verb islands. With sufficient numbers of islands known to the infant, an alignment is effected by analogy to provide a generalised notional/syntactic structure (S)V(O). Analogy, in the generally accepted sense was shown to be problematic, casting doubt on the plausibility of his account. Extensions to the theory suggest that the habitual actions of entities drive the island construction as in the case of 'Mummy+ V_1, V_2, $V_3 \ldots V_n$', and that initial verbs which develop as path breaking examples involve significant events, particular to the infant – eat, make, get, have – which Ninio generalises as a process of taking (in)to the self or construction.

As for the previous approaches, it is instructive to explore how this approach contributes to the Research Areas.

The usage based approach, unlike the others so far considered, recognises a role for infant intentionality in language acquisition, at least at the level of learning being based on interactional use. Situations that frequently engage

infants in hearing and using language are those that contribute most to language learning.

Tomasello's usage-based approach appears true to its label. After initial learning from adult input, further development rests on frequency of use by the infant. The diary evidence would suggest that there is no watershed moment and infants do not assume grammatical properties for verbs until exemplified in the input. This has implications for the nature of the input upon which infants on this account have an obligation to rely. The inevitability of language acquisition is arrived at from what must be inferred as a dependency on involvement with the speech community. The nature of the linguistic input and how infants relate to it is addressed further in Chapter 3.

On word learning, Tomasello's identification of verbs presents lexical items which on most accounts would not be classified as verbs. It has been shown (Talmy 2003) that motion events are comprised of a number of components – means of motion and path of travel being two. Languages differ in how they lexicalise these elements, and English tends commonly to express the means of motion through a verb, and the path through a prepositional satellite construction. Given the usage based assumption that there is an alignment between what words represent conceptually and the role they play grammatically, Tomasello's identification of the prepositional satellite as the verb is problematic, as it selects the wrong element of the semantics of motion to lexicalise as a verb in English. The preposition will not function as a verb in the target syntax. Word learning, particularly verbs as lexical items is addressed in Chapter 4.

The final approach described in this chapter is Syntactic Bootstrapping, which differs in approach from all those so far considered.

4. Syntactic bootstrapping [SyB]

The fourth approach to verb learning to be considered is termed Syntactic bootstrapping, which has developed from work undertaken by Landau and Gleitman (1985), whose monograph presented a study of language acquisition by a blind child. As it has been generally held that words are learnt as a mapping process between the word heard and an observed event or object in the world, the study of a child for whom crucial sensory information is unavailable is very

revealing. Although it was found that haptic information plays an active role in identifying objects close to hand, such information is deficient in the context of distant objects and particularly in the recognition and labelling of relations between objects. Despite this, blind children do successfully learn language, and the research suggested that the available syntactic information from verbal input appeared to play an important role.

Landau & Gleitman noted that early learned verbs were differentiated by the type of syntactic construction where they appeared. One area of focus for their research was how the words 'look' and 'see' were learned and used by the blind child. Although it was found that the visually neutral, haptic, meanings of these words were acquired by the child ('look' signifying searching, and 'see' signifying identifying), it was also clear that verbs like 'give', 'put', 'get' and 'hold' were also learned. Landau & Gleitman suggest these are all verbs implying transfer of objects to and from people or locations. The relationships expressed by these words are not so easily determined by sensory means. These verbs, however, appeared in a different syntactic (essentially di-transitive) frame from 'look' and 'see'. The research concluded that additional syntactic information was available to the child to develop verb meanings.

It is reasonable to assume that the role syntax could play is equally available to sighted children, and as such additional research programmes were put in place to explore this issue. Although SyB would appear to focus on how the meaning of verbs is acquired, the hypothesis has been extended to a wider application, and as such complements the approaches so far considered.

On the surface, SyB is the reverse of Pinker's Semantic bootstrapping, which employs contingent linking rules to access clause structure information from the meanings of words within a sentence context. In overview, SyB uses the sentence structure to identify the argument structure and reverse build verb meaning, based on the supposition that verbs with similar argument structures convey a similar generalised meaning. The number of arguments is recognised as the number of participating objects/nouns in the sentence. Thus, in general terms, one argument tends to signify self-directed motion - 'Ann arrived'; two arguments causation or contact - 'Ann threw the ball'; and three arguments transfer or exchange - 'Ann gave Tom the ball'. The effect of the number of arguments on

the meaning of the verb is apparent when considering the example ‘Ann threw the ball to Tom’, where in this case ‘threw’ now takes on an additional transfer meaning, compared to ‘Ann threw the ball’. (It is a moot point, however, whether the meaning of ‘threw’ which encodes the manner of motion, has changed or not).

4.1 Contributing research programmes

This section will track some of the experimental research contributing to the evidential base informing the model. Naigles (1990) famously conducted an experiment to show the influence of syntax on how infants access verb meaning. The ages of the infants involved were 1;11 to 2;4 (average 2;1) and all were producing two or three word utterances. The experiment made use of novel actions and a nonsense word, to ensure that no prior learning about the scene or target word could be brought to bear. Infants were seated before two separated video screens, and initially experienced, replicated on both screens, a video depiction of an action event accompanied by one of two voice-overs. The video showed two characters (a duck and a rabbit) performing a simultaneous, novel set of actions. One action was causative – the duck forcing the rabbit into an odd bending position; the other action was non-causative – the duck and the rabbit making the same arm gestures. Both actions were happening simultaneously in the scene. One set of infants watched the scene and heard an accompanying audio track of the sentence containing the target nonsense word ‘gorping’: ‘Look! duck is gorping bunny’ – a transitive/causative frame. The other set of infants heard the sentence: ‘Look! duck and bunny are gorping’ – an intransitive action frame. After 6 or 7 exposures as a ‘teaching’ phase, the control phase consisted of the actions separated with both duck and rabbit making the arm gesture only on one screen and the duck bending the rabbit only on the other screen. The infants were invited to respond to ‘Oh look they are different now’ and the looking time to each screen was recorded. The test phase maintained the two depictions but the infants were asked ‘Where’s gorping?’ or ‘Find gorping now’. Preferential looking time was recorded. The infants who had experienced the intransitive frame looked significantly longer at the arm gesture depiction, and the infants who had experienced the transitive frame looked significantly longer at the duck bending the rabbit depiction, than in the control condition. The conclusion is that

infants assigned meaning to ‘gorping’ based only on the syntactic frame of the prompt sentence in the teaching phase.

This research methodology – novel action, novel word and preferential looking time – has been employed a great deal in verb learning research. In Chapter 8 this and other experiments will be challenged from the viewpoint of the Conceptual-Intentional Bootstrapping proposal, but in anticipation of this fuller treatment, one key issue will be mentioned here.

The causative/transitive encodes both cause and effect, and conceptually involves two linked but discrete action events: the duck gorping (pushing) and the rabbit gorping (bending). The intransitive sentence encodes a single action event: duck and rabbit gorping (arm waving). Thus simply resolving event complexity may have provided the successful outcome. In the first there are two differing sub-events. In the second there is a single event. Both of these scenes involve the same number of participants. ‘Gorping’, therefore, might be a meaningless tag, or as the subjects are not required to differentiate the word ‘gorping’ from any other word, it may simply not figure at all for the infants. Leaving these considerations aside, however, for the time being armed with an apparently clear link between verb meaning and sentence construction Fisher, Gleitman, and Gleitman (1991) explored in more detail the relation between verb meaning and the syntactic structures in which they appear.

A number of experiments were conducted each designed to refine potential shortcomings in the others, but in overview 2 processes can be extracted for the present purpose. Adult subjects were asked to group sets of verbs according to semantic similarity. Specifically cognition and perception verbs, motion verbs, location verbs and symmetrical verbs were in the source corpus. With sets of verbs grouped by semantic similarity, a second set of experiments asked subjects to sort the verbs according to which syntactic frames they thought the verb could appropriately appear using their syntactic judgement. It was found that there was a close correlation between the verbs grouped by semantic and syntactic criteria. To provide cross-linguistic evidence, the core experiments were repeated using Italian speakers and Italian verbs. The findings were upheld for this group.

Fisher, Hall, Rakowitz & Gleitman (1994) worked with 3-4 year olds. The experiment involved a puppet 'describing' a number of scenes using novel words and the children were asked to offer what they thought the puppet meant. When the puppet offered only a single (neutral for structure) word to describe a scene (e.g. pilking) then the answers from the children were quite wide ranging. When the puppet described the scene using the same words in a sentence frame, there was more agreement about the proposed meaning of the nonsense word. Agreement increased with the age of the children. Fisher et al. conclude that the supportive effect of the sentence structure acts as a zoom lens on to the meaning of the verb. The structural context only shows global semantic properties and provides only semantic implications, the verb provides further meaning.

4.2 Analogy

Fisher (1996, 2000) extended this thinking, to suggest that analogy can play an important role in furthering children's verb learning, by providing a structural alignment between verbs. Those that appear in the same frames will have similar meanings. A widely accepted constraint on word learning is that different words are assumed to signify different meanings. The structural similarity provides a support mechanism to zoom into the specific differential meaning of individual verbs. So, 'break', 'shatter', 'crumple' will align generally to signify causative events, but their differences can be gradually learned from the context where differing entities fill the argument slots. Thus in an SVO structure, the way V is interpreted will depend on what type of entity is referenced by S and O. Vases can be broken, glass shattered, and paper crumpled. Although in the previous section it was argued that analogy is an unlikely learning process without some superordinate relational category within which to compare elements, it can be seen in this case that a sentence/sub-categorisation frame can, in fact, provide such a category.

This does not, however, explain how the infant breaks into knowing the significance of the sentence frame in the first place. Fisher argues that as infants are known to learn nouns first and as these nouns are always presented in a sentence frame in adult input, access to the argument structure is mostly a case of 'counting' the nouns represented. In support of this, it could be noted here that conscious counting is not required, as it is agreed that knowledge of precise

quantities from 1 to 3 is an innate ability shared widely through many species (Xu 2003). Fisher suggests that using the conceptual participants and an observed context and knowledge of the noun phrases used:

> "The outcome would be a rough semantic structure for the sentence, with semantic content derived from the specifics of the observed event" (Fisher 1996 p46)

Across three sets of experiments, Naigles, Fowler and Helm (1992, 1995), Naigles, Gleitman and Gleitman (1993), infants from 2;6 to pre-schoolers, children at school, adults, and children with Downs Syndrome were tested to gauge the effect of structural meaning versus verb meaning using an enactment test. Given a set of toy animals, subjects were presented with a number of sentence statements which they then were required to enact according to their understanding of what they had heard. The sentences were presented as grammatical or ungrammatical, the latter formed by placing an intransitive verb in a transitive frame, or vice versa: 'the zebra brings' or 'the lion puts the arc' or 'the elephant comes the giraffe'. It was found that the younger groups followed the generalised meaning apparent from the sub-categorisation frame, but as the age of the subject was greater, so the meaning conveyed by the verb took precedence. So a 2 year old presented with 'the elephant comes the giraffe' would portray an enactment as if the sentence were 'the elephant brings the giraffe' a transitive event. Older children enacted the sentence meaning following more closely the meaning of the verb, as in 'the elephant comes, and so does the giraffe'. It was concluded this work supported the syntactic bootstrapping hypothesis in that the initial meanings of verbs appeared to be driven by the sentence frame, and that it required greater age experience for the verb meaning to take precedence.

4.3 Challenges and developments to the model

Pinker (1994) questioned the viability of SyB, doubting that semantic information could be drawn from the syntactic properties of verbs. He claims that the apparent syntactic cuing device is in fact semantic, as the sub-categorisation frames are not different for every verb. He maintains that verb meaning can be derived from observation and that the first task is for the child to make basic syntactic discoveries, and verbs with already learned (root) meanings are incorporated in the phrase structure. The detail of the root meaning of a verb

cannot be derived from the sub-categorisation frame, and it is the root meaning of the verb which is what the acquisition of word meaning is about. He maintains that linking rules which connect semantic roles to thematic roles are not reversible:

> "A grammar is a mechanism that maps a large set of semantic distinctions onto a small set of syntactic distinctions" (Pinker 1994 p397)

So, syntactic frames cannot distinguish the root meaning of verbs. He points out that experiments conducted in support of the hypothesis involve children who have already learned about English structure, and the experiments say nothing about how the structures are acquired in the first place. Fisher (2000) tackles Pinker's criticisms, and presents a proposal for a learning process, outlined as follows.

Fisher assumes a principled relation between verb syntax and semantic structure on the basis that semantic content has a generalised semantic structure and this semantic structure is reflected in the syntactic structure. Verbs occurring in similar sentence structures are judged to have similar meanings, as established by Fisher, Gleitman & Gleitman (1991) outlined above. Verb meanings are realised in the context of a sentence and so the contextual effect is just as important at any age or stage of development, adults or children. Pinker claims that linking rules for thematic roles depend on prior knowledge of the meaning of verbs, but, Fisher suggests otherwise, and shows that Pinker's linking rules are not viable where the agents/patient roles are obscured, as follows.

Fisher (1996) had tested infants (2;11 to 4;0) on their understanding of the match to a video scene of transitive and intransitive nonsense verbs with thematic roles ambiguously marked by pronouns. So, one test sequence had a scene depicting one person (A) using the crook of a cane to pull another (B) seated cross-legged on a wheeled dolly. The scene was accompanied variously with 'she's pilking her over there' or 'she's pilking over there'. In answer to the question 'which one is pilking her over there?' versus 'which one is pilking over there?' the children interpreted the verbs differently depending on the sentence structure, as pulling or sitting, even though neither sentence explicitly identified one participant in the event as subject. Fisher concludes that sentence structures, themselves, are meaningful, and sentence structures are considered to be an

analogue of the semantic structure attributed to a scene. Structural alignment between a scene and sentence structure can be arrived at without prior knowledge of the verb. Fisher suggests, based on her experimental evidence, that there are two main elements when infants learn a new verb.

The first is that infants can infer something about the perspective of the scene (action, causative, or transfer) based on the number of available participants mentioned in the sentence.

Secondly, infants assume that in an asymmetrical semantic structure, the more dynamic participants should be more prominent than the less dynamic. As a result the more prominent role becomes linked to subject position in the sentence. In sum, once children can identify any nouns within the utterance, they can align the utterance with a conceptual representation, and identify the subject by aligning the prominent participant:

> "At this point, the hearer will have been led to view the situation from the perspective encoded by the verb, and is therefore more likely to assign appropriate properties of a specific situation to the relation encoded by a novel verb." (Fisher 2000 p38)

This emphasis on identification of the subject appears to answer one of the problems Gleitman (1990) had posed, namely, how to differentiate 'the dog chased the cat' from 'the cat fled the dog', when the observed scene is essentially the same for both. Identification of the grammatical subject disambiguates the perspective on the scene, and this perspective is differentially encoded by the verb. Fisher also claims that infants assume an animate, frequently human participant will fulfil the subject role.

Because the SyB model focuses on comprehension, no guidance is offered regarding the means infants employ to process this information for their own sentence production. Subject identification appears to be a crucial element for comprehension, on this account, but, as previously discussed (section 2.3.2 above), infants habitually omit the subject in their own production. It is an open question why subject prominence becomes diminished so dramatically across comprehension and production.

All of the research involves older children or infants who, as Pinker has suggested, could be thought to have some grammatical grounding. Fisher's model

does not uncover very early knowledge of syntax. Tomasello's alternative as discussed above (section 3) in common with Goldberg (1995), proposes that argument structures for verbs are established through learned examples of individual verbs on a verb-by-verb basis, and repertoires of such constructions are accumulated and aligned through the semantic commonalities which Fisher recognises. That is, constructions have meaning but these are accessed through having learned a large number of verbs and their argument structures.

Lidz, Gleitman and Gleitman (2003) conducted an experiment to differentiate between these two approaches: the universalist which suggests universal properties for mapping syntax and lexical semantics, as opposed to the emergentist which claims that relations are learned through categorisation and generalisation over input.

The experiment uses the same methodology as that in Naigles, Gleitman and Gleitman (1993) outlined above, utilising an act out measure to gauge sentence interpretation. The experiment involved speakers of Kannada, a language of south west India. Kannada has a number of means of expressing causativity; through transitive constructions, through periphrastic constructions (as in English: 'The sun melted the ice' and 'the sun made the ice melt') and through use of a morphological causative. The morphological element is apparently easy to recognise in Kannada, and has this single function. Input sentences both grammatical and ungrammatical were constructed and children (aged 3;2 to 3;10) were asked to act them out. The prediction, for emergentists, would be that the causative morpheme would prompt a causative response even when it appears in a grammatically inappropriate context as it only has one function and would be unavoidably learned as such. A universalist prediction would be that argument number would take precedence. The latter result was in fact found to be the case for the children but not for adults. Lidz et al. argue that noun phrase number is a privileged source of information as to the semantic structure of predicates, and that

> "early in life certain universal cues at the syntax semantics interface are pre-potent for acquisition of the verb lexicon" (Lidz et al. 2003 p168)

It could be argued that the children involved were not that early in life (all were over 3 years old), and when presented with sentences known to them to be ungrammatical, noun phrase number would be a useful strategy towards compliance with the test. Goldberg (2003) replied to the paper suggesting that the children found pragmatic solutions to the comprehension problem, and questioning whether noun phrase number is a feature of UG, or simply a product of resolving indeterminacy.

4.4 Discussion

As for other sections, this review will indicate how this approach contributes to the Research Areas. Other than Landau & Gleitman's (1985) early work with a blind child, the approach is developed from behavioural experiments focussing on comprehension studies. Infant intentionality in a natural setting is not represented.

Older children, around 3+ years, provide most of the experimental evidence for the principles underlying SyB. Because of this, the hypothesis is open to the criticism that it is not addressing the complexities of infants' initial experience of syntax acquisition. The proposal, that argument structure of verbs is obtained by calculation of the number of entities involved in a semantic representation which is then linked to the syntactic structure, assumes that infants have some prior syntactic knowledge. No proposal is made whether infants have an innate knowledge of lexical specifications, like Noun or Verb and without such knowledge the alignment required by the theory between semantic and syntactic structure would not result in analogous generalisations. Instead, there could only be a growing repertoire of semantic/syntactic pairings. A problem already encountered with VIH.

Clearly, the focus of SyB is on learning the meaning of verbs, assuming as stated that infants can recognise a verb in the first place. In this area, SyB appears to make a strong contribution. That SyB may be revealing pragmatic strategies for comprehension raises the question whether the experimental evidence shows strategies for acquiring verb meaning, or strategies for sentence interpretation. In case of the latter, the approach offers interesting evidence about the relationship between syntactic knowledge and sentence comprehension. What the hypothesis

does not do is define the extent of syntactic knowledge necessary to achieve success in the experimental setting. This will be directly addressed in Chapter 8 when it will be shown that the experimental results can be achieved by the expected outcomes of the Conceptual-Intentional Bootstrapping proposal, where infants rely on an early acquired and productive syntax.

5. General discussion

The four models of verb acquisition have been discussed which overlap yet differ from each other in various ways.

SeB: Semantic Bootstrapping, (Pinker). This hypothesis assumes an extensive battery of innate categories, functions and rules that are accessed through a semantic interpretation of heard sentences accompanying an observed scene. Nouns are names for things, verbs are labels for actions, and the organisation of the identified linguistic categories is defined by preordained phrase structure rules. The hypothesis had the advantage of presenting a sense of inevitability for acquisition. But, there are no means at present to verify the innate elements available. The semantic identification of categories and functions had been successfully challenged, and Pinker's reformulation introduced the notion of fuzzy labelling drawing on a wider range of input information than the semantic interpretation. The hypothesis would seem to be unravelling. Learning the meaning of words is required to occur at the same time as the bootstrap which relies on the meaning of words being known. There is no direct treatment of infant intentionality, nor the effects of meta-cognitive development. Braine suggests a learning mechanism that includes the useful heuristic 'old rule to analyse new material'.

VEPS: Very Early Parameter Setting, (Wexler). This hypothesis proposes that infants through a type of perceptual learning are able to metaphorically overlay the heard linguistic input over the UG template of parameters, which are set appropriately to match. Janet Fodor pointed out that given the nature of the performance features in the input it is likely that an infant will be faced with a number of ambiguous triggers occasioning parameters to be wrongly set, with a later requirement for whole-scale parameter resetting. The focus on only unambiguous triggers possibly involving 'treelets' or partial sentence structure,

and Rizzi's proposal for some late set parameters based on cognitive developments or other factors are useful, and will be seen to inform the Conceptual-Intentional Bootstrapping proposal. A further important contribution is Wexler's insistence on considering the properties of infant production. His observation of the Optional Infinitive stage is important because it appears to be common in the acquisition of a number of languages. Although Wexler sees OI as having a masking effect on underlying parameter setting, it would appear to be worthy of consideration in its own right. How optional is it? The Conceptual-Intentional Bootstrapping proposal addresses the OI stage and suggests it is syntactically motivated and not in fact optional (Chapter 7). The Conceptual-Intentional Bootstrapping proposal fully accounts for Gleitman's observation about metamorphosis as infant utterances before and after the advent of Complex Event utterances demonstrate the dramatic changes she describes. VEPS, however, gives no attention to infant intentionality, and does not seem to need any semantic input, and apart from Rizzi's general suggestion, does not recognise the specific effect of meta-cognitive developments.

VIH: Verb Island Hypothesis (Tomasello). This hypothesis claims that infants learn and use verb constructions as they are heard. The more frequently used verbs develop syntactic complexity not mirrored in the less frequently used verbs, constituting verb island developments. Given a critical mass of such islands, infants are able to form generalisations, although how this happens is problematic for Tomasello. His research, however, makes available a rich corpus of infant data which will be drawn on extensively through this research. Although it reveals Travis' intentionality in her utterances and gives very clear evidence for Complex Event utterance types, Tomasello does not recognise these signs in his research. It will be shown that the Conceptual-Intentional Bootstrapping proposal can account for Tomasello's and other VIH researchers' observations of infant acquisition, without the need to posit an island effect.

SyB: Syntactic Bootstrapping (Gleitman/Fisher). This hypothesis approaches verb learning from a different direction and claims that the meanings of verbs can be learned from the role they play in syntactic constructions which by their nature are claimed to provide general semantic interpretations. The specific meaning of a verb is derived from its relation with the semantic content

of those elements in argument role. The hypothesis tends to rely on infant's having already acquired some knowledge of syntax, although the proposal assumes that an argument count would give access for infants to a basic set of constructions. The underlying process is that a verb heard in a range of differing constructions will give more access to its meaning. This hypothesis is supported by extensive experimental evidence, but as will be shown in Chapter 8, the experimental results are effectively explained by the assumptions of the Conceptual-Intentional Bootstrapping proposal.

5.1 Cross cutting differences

Although the four approaches differ from each other in some ways, they do line up with each other in other ways. Evidence from the overlap will inform the discussion in subsequent chapters.

5.1.1 SeB/VEPS versus VIH/SyB

Firstly, there are clear groupings between approaches. SeB and VEPS are firmly based in Linguistics and VIH and SyB are developed from Psychology. A significant difference between these two sets is the place of meaning.

SeB and VEPS focus on syntax and SeB only involves semantics as a means of identifying lexical categories. Both involve a commitment to unconscious innate specifications either of categories and rules, or a more extensive whole language specification of UG.

VIH and SyB focus on meaning and how derived structure provides a means of conveying meaning. There is no commitment to innate syntactic machinery, and there appears to be an assumption of more conscious involvement in the derivation of structure through comprehension and production.

5.1.2 SeB/VIH versus VEPS/SyB

A second grouping shows that SeB and VIH propose synthetic processes which can be defined as 'bottom up', i.e. building from items or categories which must be acquired before larger creative units of language are available.

VEPS and SyB propose analytic or 'top down' processes where specific language is analysed out of a larger context either full competence - seeking an

alignment between the UG blueprint and syntactic input; or conceptual universals seeking alignment between semantic and syntactic structures.

5.1.3 SeB/SyB versus VIH/VEPS

A third grouping shows that SeB and SyB share a commitment to meaning/form correspondence. SeB as a brief start up process, and SyB more extensively. VIH and VEPS make no claim for direct meaning/form correspondences. VIH makes verb meaning alone central whereas VEPS makes no use of meaning at all.

5.2 Route forward

Based on the survey of the field in the first two chapters of this dissertation, it is now possible to set out the principles guiding the thesis.

In the introduction, I claimed that the inevitability of language acquisition relies on a series of constraints. When an infant acquires a language, she needs to be equipped to learn any of the world's languages, in any of the world's social/cultural settings. She needs to be able to relate her unique personal experience and growing subjective knowledge of how the world operates, and her relationship to others, and how her individuality and personal intentionality is expressed in this context. She is also undergoing physical, emotional and cognitive growth and development. Within this highly complex environment she must inevitably acquire a language. There is no option. Stating that language acquisition is inevitable does not confirm that language acquisition has innate properties. Proponents of UG have had to propose constraints of various sorts to overcome what are described as ambiguous triggers. I will show that these are not sufficient to achieve the level of inevitability required.

This will be the objective of Chapter 3. It will consider the nature of the linguistic input to reveal the unexpected purpose and design of Child Directed Speech, infant intentionality, and how infants may efficiently structure their subjective experience. I will show that it is the interaction between these elements, intentionality and subjective experience promoted and supported by CDS, that constrains an infant's engagement fully to put her on an inevitable course to language acquisition under her own control and direction on an 'acquire-as-required' basis.

Language acquisition will be considered to be a process which is highly contextualised and ‘top down’, because it derives from the extensive flexible context outline above. Any type of synthetic, ‘bottom up’ process cannot achieve an inevitable outcome without that outcome being known in advance. Or put another way, completing a thousand piece jigsaw without any idea of the final picture is impossibly difficult. I will describe how this comes about, in Chapter 3, and show that both generative and emergentist theories depend on this prior eventuality.

Chapter 3
The input for language acquisition

Introduction

Chapter two reviewed four discrete approaches to language acquisition concluding that differing emphases are placed on the nature and function of the linguistic input that infants experience, and that the active role of the intentional infant is generally side-lined, assumed or omitted. The infant while acquiring language must be prepared to do so in the context of extensive variation: language, culture and social expectations. For herself, she is undergoing physical, emotional and cognitive growth and development, and her subjective experience of the world is unique to her. Yet, she in common with all human infants will acquire a language. Generativists focus on the fact that the linguistic input underdetermines the output. Emergentists claim that a great deal is learned from the input, and that linguistic output correlates with it. Yang (2004) who considers the extensive evidence of statistical learning, particularly for the phonological system, concludes that

> "Language acquisition can … be viewed as a form of 'innately guided learning', where UG instructs the learner 'what cues it should attend to'. Both endowment and learning are important to language acquisition" (Yang 2004 p455).

In this chapter, I address the nature of the linguistic input and language experience of infants, and consider the infant as an intentional learner within this context. Drawing on documented experimental evidence, I will show that the way infant subjective experience and knowledge is organised as events provides a 'contextual funnel' for her engagement with language. I also show that adult carers' intuitive actions support this fundamental process. My conclusion, however, will challenge Yang's proposal above, and doubt that UG is the instruction manual, in favour of a different source of innately guided learning, to which either UG or emergence is responsive.

Section 1 will consider the nature of the linguistic input, devoting consideration to what is known about the actual linguistic input from adult carers.

Section 2 will address the infant as an intentional learner, exploring Bloom's Intentionality Model (Bloom & Tinker 2001); extracting from it the notion of Relevance to the infant, and its effect on placing the infant in control of her learning, following an 'acquire-as-required' principle.

Section 3 will propose a simple model of how the organisation of infants' subjective experience inevitably funnels infant engagement to the degree that language acquisition occurs in an established environment of rich and relevant contextual meaning.

1. Child directed speech (CDS)

Cursory observation of the verbal interaction between a carer and infant makes it apparent that the talk differs from that between adults; trivially and obviously through the subject matter, but significantly in the way an adult addresses a child. This talk-type formerly known as motherese and now more appropriately Child Directed Speech (CDS), has been thought to contain the intuitive elements of language instruction, which would show graded syntactic exposure and simplifications appropriate to an infant's needs in acquiring language. One of Pinker's assumptions (Chapter 2 section 1vi above) is that adults address infants using 'basic' sentence types, but research into the nature of CDS has established that this is far from the case. Syntax is largely opaque to most adults, and although adults can readily make judgements about the grammatical acceptability of sentences, how they derive such judgements is frequently difficult to make explicit. There can be no expectation that adults adopt a conscious structuring of syntax with a pedagogic intention.

Pine (1994) in his survey of CDS research, notes that early studies comparing CDS structural elements with infant utterances very often found unusual correlations that could be given conflicting interpretations. Studies found that far from exhibiting false starts, hesitations and other degradations, CDS is largely clear, well-formed and semantically and syntactically simpler than speech addressed to adults. But the simplifications do not amount to a graded exposure to syntax for infants, as in fact, it was found that declaratives are used sparingly at the beginning and increase in use as infants develop their facility with language. Questions are more frequent, and adult syntax does not appear to be tuned to the

infant's linguistic ability. Instead it seemed to be adapted to the infant's limited comprehension abilities, where adaptations accord with communicating with a

> "..cognitively and linguistically naïve child in the here and now".
> Newport, Gleitman & Gleitman 1977

So, language teaching gives way to trying to ensure understanding on the part of the infant including a fair degree of social organisation and behaviour management. Syntactic simplicity becomes an artefact of semantic simplification, with adults focussed on word choice and comprehension of content, rather than syntax. Adult adaptations to ensure comprehension on the part of the infant are motivated by feedback judgements on how well the infant appears to have understood. The infant, therefore, receives a range of linguistic information largely within her comprehension abilities but exhibiting a spread of ungraded syntactic complexities. Adults encourage spoken responses from infants to further support their judgements about effective comprehension, with the outcome that carers are not simply trying to impart information, but actively attempting to engage infants in conversation. This conversational relationship helps balance out the evident inequality of roles – adult vs infant – to create the context of conversation partners, where the infant's interests and preoccupations can provide a lead. Snow (quoted in Pine 1994) suggests

> "..mothers do not talk at children, but with them."
> (Snow quoted in Pine 1994 p18)

Trevarthen has made several studies of the communicative relationship between primary carer and infant. Trevarthen & Aitken (2001) summarise some of this research and propose a developmental process of primary inter-subjectivity, which Trevarthen & Aitken state contributes to infant development from birth to the first half of the second year. This entails the baby paying close attention to the mother's face, reacting to small changes in expression, reacting to her continuous talk which accompanies the exchange. Trevarthen's descriptions underline the intensity of this relationship, and the elements of turn taking in maintaining and enhancing the joint experience. He suggests this turn taking interaction is proto-conversational, with imitations of expressions, smiles to voice, mouth and tongue imitations giving way to vocal and gestural imitations. Through a period to 6 months of age the interaction includes 'person-person'

games, imitation of clapping and pointing, to ‘person- person- object’ games. By 9 months children are co-operating in joint tasks and make use of language-like utterances, - a proto-language. Throughout all this inter-subjective interaction, the mother’s voice provides a familiar backdrop. As the infants get older, the games present tasks which provide more emphasis on the routines of events.

Bruner (1983), in particular, noted the importance of the emphasis carers place on routines or familiar and well understood event structures, enabling a shared context which demands little attention. The infant is freed to focus on the mapping of linguistic elements within this known context. This was generally considered to provide an active scaffolding effect on the part of the adult to support the infant while learning.

To demonstrate the scaffolding effect of adult talk, Bakeman & Adamson (1984) made longitudinal video recordings of middle class mother-infant interactions, as well as incidental interactions with siblings, and infant initiated interactions. Subjects were informed of the purpose of the study, to gauge the supportive nature of adult input for infant language acquisition. The results showed that, the majority of the times in mother infant settings, the infants were in a highly passive listening state with the parent talking, and initiating topics of conversation, largely based on shared picture book reading. In the other settings, however, the infants appeared to be more active and take more of a lead. Bakeman & Adamson concluded that the strong scaffolding effect of mother-infant interaction was supported.

Bloom, Margulis, Tinker, & Fujita (1996) replicated this study but involved urban, multicultural families who were informed that the interest of the study was focused on the children. In this case it was found that infants predominately initiated conversations and provided topics for conversation, with the adult following the lead, but making major informational input to support infant understanding. This contradicted the Bakeman & Adamson result. It almost appeared that the infant scaffolded the mother-infant interaction.

The key difference between the experiments, apart from the socioeconomic background of the participants, was that Bakeman & Adamson had given the adults involved the idea that the study was focussed on the type of input the adult

gave. So, the adult participants may have felt just as much under scrutiny, and opted for emphasising one aspect of their interaction with their child which they thought most appropriate to the study. Bloom's study was presented more neutrally, and might be claimed to record more natural interactions. There is no reason to discount either conclusion, as both types of interaction are available to adults. Both, however, are limited by the infant's interest and willingness to be involved in the interaction. Neither study identified any specific linguistic content that could be thought to provide a direct scaffolding support for syntactic development.

Cameron-Faulkner, Lieven & Tomasello (2003), however, analysed an extensive corpus, exhibiting both adult and infant initiated talk, to establish the influence of adult language usage from a different viewpoint, employing a (lexical) item-based analysis (frequently identified as 'word frames' in other accounts). They predicted that linguistic support is provided not from complete syntactic constructions but from fragments and item-based constructions that are repeated frequently. The corpus used, from the CHILDES database, is the same corpus used for the study in this thesis to provide empirical evidence (Chapter 6). Cameron-Faulkner et al. found that only a small percentage of adult utterances were SVO, the majority being questions, imperatives, copulas and fragments. 51% of adult utterances, however, began with a limited number of item-based phrases, which the infants also frequently used. These included elements like: 'who's..'; 'are you..'; 'what did…'. Cameron-Faulkner et al. suggest that CDS analysis should take specific item-based constructions as well as general constructional categories into account, on the understanding that item-based constructions contribute a large part to human linguistic competence.

Although this work introduces a new (lexical) item-based perspective on CDS analysis, which will be considered presently, it nevertheless seems to underline the general conclusion reached from all CDS studies, that the principal purpose or function is not to provide a graded pedagogic support for syntax acquisition. Problematically, analysis is usually limited to an attempt to make apparent the formal relations between CDS and syntax acquisition, but as the research evidence seems to show, adults are actually concerned with something else.

As part of a larger study, Tomasello & Kruger (1992) analysed corpus data to establish how adults introduced new verbs to infants. They found that adults predominantly used an impending model 'Now I'm going to roll it', or 'Can you spin it', or a completed action model 'I found it', or 'you rolled it', as opposed to an on-going model: 'Look the ball is rolling' or I'm sweeping it'. In a follow up, infants (average age 15 months and 21 months) were observed in natural settings and their responses were analysed to include any kind of response, verbal or non-verbal, that indicated whether they acknowledged the utterance. It was found that infants gave a greater response to the impending model, than any other. The research concluded that infants are particularly responsive to carer's intentions. An additional observation can be made that the impending presentation describes a whole event with an overt outcome, a process that will be seen to be particularly meaningful to infants.

Although this study did not analyse the data in terms of the syntactic content of what adults were making available to infants, it will become apparent, through the course of this dissertation, that this type of utterance is in fact axiomatic in the bootstrapping process. It seems, however, that neither carers nor researchers attribute the impending event presentation to overt syntax instruction. The key aspect noted from the research is that infants do respond positively to such utterances in terms of understanding or engagement. The nature of infant vocal responses was not reported, and so the link between this type of linguistic input and productive language acquisition was not made.

Recorded dialogues show adults to be extremely tolerant of infants' syntactic errors, and will accept (as Braine 1976 has termed it) 'syntactic spaghetti' provided they are able to derive some pragmatic understanding of what the infant is communicating. Studies of speech error and repair (Golinkoff 1986; Shatz & O'Reilly 1990; Marcos 1991; Fagan 2008) show that error repair and adult recasting does make alternative syntactic constructions available to the infant as a type of negative feedback, but the focus of attention for the 'correction' is on comprehensibility rather than grammaticality.

If comprehension, rather than syntactic form is important to adults, then it is tempting to accept that syntax must be derived from an innate specification. An obvious observation from a standpoint of generative linguistics would be that

adults evidently recognise that infants are endowed with linguistic competence and it is linguistic performance that requires such careful support. It would, however, be negligent not to attempt to discern if the non-syntactic focus of adult input does contribute, however obliquely, to syntactic development particularly to a bootstrapping process. Such a review will show that performance features provide the experiential context for shaping linguistic competence, and that adults are intuitively supplying essential information for the bootstrapping process, which is the claim I make here. An indication of the range of information available from adults is listed below.

1.2 What does CDS offer?

From works already cited, and from primary data from the corpus already mentioned, it seems uncontroversial to summarise that adult CDS focuses on:

i) Providing a conversational context, where the infant's ability in understanding/comprehension establishes the main constraint on what is said. If an utterance is not understood then either an alternative needs to be provided, or the topic abandoned. Studies on conversational repair appear to show that infants do have access to some form of negative evidence, through recasting and paraphrase, but the outcome is intended to target comprehension not syntax.

ii) Providing routines and event sequences. Trevarthen & Aitken, Bruner, and others have pointed out that babies and carers are involved with two-way engagement as proto-conversations very early. The emphasis on demonstrating event sequences will help infants to build knowledge about what entities/objects can do, how they function and their generic properties, providing important additional information for categorisation and word learning (Bruner 1975; Clark & Wong 2002; Clark 2003). Event sequences introduce sequencing, causation and result, and predictions about dynamic generic properties of objects/entities. Conversations within a pretence scenario require instruction in and the recognition of conventional event sequences. (The role of event representations for language learning will be discussed in more detail in section 3 below). For instance the corpus commonly shows adult utterances providing generic information:

(17)

MOT: you're not throwing eggs .
MOT: you know eggs break, Becky .
MOT: they make a mess, don't they ?

(18)

MOT: What do sheep eat? They eat grass, don't they?

iii) Adults focus infants on intentions to act: 'I'm going to …', Can you …?' and results of actions 'I've spilled it', 'Nana bought this for you'. These utterance types will be seen to hold the key to the bootstrapping of syntax, and will be discussed frequently in subsequent chapters. Adults also focus on internal mental states: 'I like…'; 'do you like…'; 'do you know what happens…'; 'do you remember…' Many item-based constructions appear to serve this purpose. The significance of this will be addressed in more detail in Chapter 7, when it will be proposed that this focussing makes a significant contribution to the bootstrapping process particularly for grammatical subject, as well as the understanding of first and second person pronouns.

iv) The provision of imitable phrases. These are largely holophrastic or word frames utilising a slot-filler process. These essentially make little demand on comprehension as they are highly context specific: 'please'; 'thank you'; 'what's happening'; 'what's X doing'. These contribute to the range of item based constructions that Cameron-Faulkner et al identify, and will be considered in more detail in Chapter 4 when reviewing initial language use in Manifest Events.

v) Within this complex context, it should be noted that well-formed sentences displaying 'correct' syntax come to the infant for free. It should, however, be emphasised that infants experience this range of syntactic constructions in a meaningful and involving linguistic context.

1.3 Other sources of input

Much of the evidence of the purpose and outcomes of CDS is drawn from a Western cultural tradition which exhibits a carer hierarchy with a primary carer, often the mother, operating in a 1:1 interaction with the infant. Clearly an infant even in this tradition has access to other people - secondary carers comprising fathers, siblings, grandparents and other family relations and friends, as well as

those in institutional (day care) settings. A significant verbal input is also available through various communication media – visual, sound and a growing range of digital resources.

Tomasello, Conti-Ramsden & Ewert (1990) studied the contrast between primary and secondary carers (in this case exclusively mothers and fathers respectively) in how they responded to infant errors and attempts at repair. When infant utterances were not understood, it was found that mothers tended to offer time for the infant to repair what she had said and also offered various interpretations as feedback to the infant for further support, allowing for an average of 3 attempts. Fathers on the other hand would generally give just one request for infant repair signalled by 'what?', and if the infant's second attempt was unsuccessful, would change the focus of conversation. Tomasello et al venture that this is a useful feedback mechanism for infants who need to know that not all adults will offer the kind of support generally given by the mother. In turn this gives further impetus for the infant to perfect comprehensible production abilities.

Akhtar, Jipsen & Callanan (2001) conducted a series of experiments where infants from a range of ages were in a third party role in a discussion between adults using novel words either to refer to novel objects or to novel actions. It was found that the younger group (2 year olds) on test gave evidence of having learned words to label novel objects but not actions. From a different perspective Roseberry, Hirsh-Pasek, Parish-Morris, & Golinkoff (2009), and a similar study by DeLoache (2010), demonstrated that infants watching television programmes did not reliably learn new words for actions from the experience. It would appear from these studies that a degree of direct involvement from the infant is required for the acquisition of relational terms, and verbs in particular.

1.4 Discussion

The nature of the linguistic input and an infant's linguistic experience is an area of conflict between acquisition accounts. Does it supply what is needed to acquire syntax by induction, supporting an emergent approach? Or is the input too impoverished requiring syntactic growth to be innately specified?

From this overview of CDS, it seems that there is no evidence to suppose that syntax is directly taught, and in this regard Crain and Lillo-Martin's view that: "It comes from the child rather than from anything parents provide from outside" may have a grain of truth. However, this would be to ignore the wealth of information, direction and guidance that is available from parents, particularly the high premium placed on comprehension. This context cannot be discounted as making no contribution to syntactic development. Crain and Lillo-Martin's overly strong position needs to be tempered, but first a significant barrier to further progress needs to be lowered.

Gleitman and Wanner (1982) say that Chomsky's work is continuing the tradition of American Structural Linguistics. A cornerstone of the tradition is a commitment to the structural description of language with no account, in fact specific exclusion of considerations of meaning.

This tradition emanated from a guiding principle established by one of the founders, Bloomfield:

> "The statement of meanings is … the weak point in language study, and will remain so until human knowledge advances very far beyond its present state" (Bloomfield 1935/1967 p140)

Chomsky, in Syntactic Structures (1957b), his initial launch of generative linguistics, states:

> "I think that we are forced to conclude that grammar is autonomous and independent of meaning" (Chomsky 1957b p17)

It appears, as Pullum & Scholz (2002) observe, that Chomsky 'shuts the lid' on the influence of meaning. Within the generative tradition, the architecture of the language faculty is suggested to have a central syntactic component with two interfaces: the articulatory-perceptual and the conceptual-intentional. Of the latter Chomsky states:

> "Problems relating to the C-I interface are still more obscure and poorly understood. I will keep to these fairly conventional assumptions, only noting here that if they turn out to be correct, even in part, that would be a surprising and hence interesting discovery." (Chomsky 1995 p3)

Although obscure and poorly understood, there seems to be a strong intuitive message, from the evidence presented by adult-infant interaction, that the 'C-I interface' is extraordinarily important, and the CDS input focusing on

conceptual understanding and knowledge development is making an important contribution. Section 3 below will discuss how the organisation of infant knowledge makes use of the CDS contribution, and with considerations of infant intentionality (section 2 below) the combination acts to constrain infant linguistic acquisition experience.

Given that syntax, for infants under 2 years old, is still to be learned or awaiting growth, then there is a question whether 'interface' between syntax and conceptual/intentional components is an appropriate description for this early stage. To indulge the metaphor, it may be more appropriate to explore the possibility that C-I presents an initial bootstrapping portal to the syntactic system. This would appear to be consistent with the direction of current Minimalist thinking (Chomsky 2002).

Making this assumption not only recognises the intuitive contribution from adults, but means that conceptual/intentional bootstrapping is essential. This does not overturn the autonomous nature of syntax, but prompts serious consideration of an initial interdependence which will be shown to be evident and necessary for bootstrapping the syntactic system. On these grounds adult input cannot be dismissed. It will be seen that the germination and growth of syntax requires precisely the type of input that CDS provides.

But the input is not to a passively receptive infant. The next section turns to establishing the infant as an active participant in the language learning process, picking up on a key feature of the Conceptual-Intentional Bootstrapping proposal: the infant as an intentional learner.

2. The infant as an intentional learner

Bloom (2000, 2001) and Bloom & Tinker (2001) make the following observation in introducing their work on infant intentionality:

> ".. in most theories of language acquisition, the child is often an object and essentially a passive receiver of physical or social cues, or the locus of brain mechanisms or hypothetical constraints, biases, or heuristic principles that filter available information for the child. Missing in such theoretical accounts…is the authority of the child." (Bloom & Tinker 2001 p5)

Their claim is that language acquisition depends on a close relation between cognitive, social and emotional representations which impinge on infant

consciousness. Acquisition accounts which do not recognise the importance of the influence of this interrelation leave aside the intentionality of the infant. Intentionality for Bloom, takes the form of unobservable, yet influential representations in the mind. Bloom & Tinker suggest that although such representations are unobservable, they are not mysterious:

> "… because the child constructs them and owns them. And they are not mysterious to other persons either, because the child acts to express them." (ibid p6)

Consequently, for Bloom, a child's expressions, be they physical, emotional or linguistic are sourced from representations of intentional states.

Bloom & Tinker's proposed Intentionality Model accounts for infants' involvement in cognitive development. It is based on the notion that it is the child, not some unconscious or automatic process, who constructs the intentional state, which in turn is individually owned by the child. Social influences and social constructions are viewed as meaningful only insofar as the child forms a personal mental representation of them. On this account,

> "Language is, necessarily, the convergence of content, form and use. Including language content and use in addition to linguistic form… ensures that what the child knows and is learning about language at any point in time is intimately connected to other things the child knows and is learning about the social and physical world." Ibid p14

This puts the child very much in the driving seat, taking responsibility for the pace of learning, insofar as it is within the context of her growing experience and knowledge of the world. This view is supported by the study outlined in the previous section by Bloom, Margulis, Tinker & Fujita (1996) showing that talk between adult and infant is seemingly led by infant interests and the need to share intentional states.

The Intentionality model as described has two major components: engagement and effort. Engagement defines the extent of the child's personal involvement with encounters, be they social, physical or linguistic. The degree of engagement achieved results from a trade-off with the amount of effort required for that accomplishment.

The model identifies three underlying principles which act simultaneously to resolve the cost-benefit dilemma of the degree of engagement and amount of

effort required. These are: relevance, discrepancy, and elaboration. Because of simultaneity, they become mutually defining:

i). Relevance to an infant establishes whether an encounter is worth the effort of engagement. Bloom & Tinker invoke Sperber & Wilson's (1986/95) First Principle of Relevance – cognitive relevance, in support:

> "When we claim that human cognition tends to be geared to the maximisation of relevance, we mean that cognitive resources tend to be allocated to the processing of the most relevant inputs available, whether from internal or external sources. In other words, human cognition tends to be geared to the maximisation of the cumulative relevance of the inputs it processes. It does this not by pursuing a long-term policy based on computation of the cumulative relevance achieved over time, but by local arbitrations, aimed at incremental gains, between simultaneously available inputs competing for immediately available resources." (Sperber & Wilson 1986/95 p261)

So, Relevance for the infant, is more than salience which may result in simple noticing rather than a fuller engagement.

ii). Discrepancy between what the child and others have in mind, or between new information and existing knowledge, contributes to judgements of relevance, and also provides the basis for adding to, or adapting existing knowledge.

iii). Elaboration of intentional states describes the process of adaptation of current knowledge in accounting for discrepancy. The effort required for elaboration contributes to judgements of relevance to maintain engagement with an encounter.

The operation of these guiding principles, yielding intentional states, although not under conscious control, does, however, provide a constraint on how limited intentional resources are deployed. Given that the young infant has a great deal to learn about the social, emotional, cognitive and linguistic environment they inhabit, the model proposes the means by which the content of an encounter is brought to awareness.

The outcomes of the Intentionality model are the expressions of resultant intentional states. These may be physical, emotional or linguistic in form. The pre-linguistic infant will utilise physical and emotional modes of expression which will be replaced (or enhanced) by linguistic expression as linguistic abilities develop. Bloom speaking from an emergentist position, sees linguistic

development as a process of continuous elaboration, enabling more effective expression of intentional states to result from social and cognitive interactions.

In support of Bloom's position, it must be agreed that the intentional participatory role of the infant in the language learning process is only an assumption in most experimental design. The methodology of psychological testing and scientific research requires that variables are restricted to those that are the target of testing and as such the wider context within which these variables operate is excluded or factored out. Whilst experimental design always includes a settling in process, and practice tasks to encourage engagement, the effect of engagement is not then measured as a variable other than to exclude subjects who appear 'fussy' (do not find relevance in the task). The presence of a conscious human being, should however not be ignored. The drawback in a focus on the child as passive recipient, or locus of brain mechanisms geared towards adult competence and proficiency, invites the odd conclusion that infants are in some way deficient adults, with immature performance abilities. Bloom's stance provides a valuable reminder that an infant is a developing human with identity, thought, intentions and motivations of her own.

The balance, Bloom proposes, between attending to a relevant discrepancy and responding through elaboration, suggests that, at any one time in development, the infant defines the pace of her learning, and develops means of expression, including linguistic abilities which are sufficient and effective for her needs at that time.

This is an important observation, which begins to provide a compromise between the full, versus no, linguistic competence debate. On Bloom's account, an input activates linguistic development according to need as perceived by the infant in a real-world context. Be it parameter triggering or construction learning, the infant has some control over structuring or pacing what is acquired. On this basis, an 'acquire-as-required' criterion is an important element of the Conceptual-Intentional Bootstrapping proposal.

Infant intentionality cannot be excluded particularly when, as has been noted, adult CDS input places such emphasis on conscious involvement and engagement. The Intentionality model, however, apart from describing a

disposition to learn, does not necessarily explain how syntactic processes, which are largely outside of consciousness, are acquired.

An infant may have the intention prompted by the components and principles of the model, to walk across the room, yet the mechanics of walking are largely sub-conscious, and although learning to do so requires practice effort, the neural and muscular process is outside of consciousness. Although the Intentionality model introduces the important element of the infant's active involvement with her learning, and provides a motive for communicative intention, I contend that it does not restrict the learning space enough for linguistic acquisition. Engagement with an encounter or an event of some kind may focus attention on gaining knowledge about the event, but as there is no apparent direct correspondence between unfolding events and formal linguistic input from CDS, something further is required. Whether language competence grows from innate specification or social interaction, either of which could be argued to be present from birth, why does it take so long for an infant to make adult-like utterances in form (if not in content)? I suggest that there is a structure underlying infant subjective experience and cognition that provides a guiding context which emphasises precisely those areas most amenable to interfacing conceptual/intentional knowledge and early language acquisition. Clarifying this position requires a brief consideration of how infant subjective experience may be organised in terms of Events.

3. Generalised Event knowledge

No two events in the world are ever exactly the same. To provide some stability and predictability in the world, any living entity needs to have a system for representing the perceptual world around it – minimally to find and recognise food or avoid danger and threat. In an ever changing world, it is generally accepted that the perceptual system interprets sensory input to construct sensory representations of the physical environment of living entities. There is evidence that infants may have innate core knowledge as a foundation, which may be an endowment shared with other species.

Spelke 2002 and Spelke & Kinzler 2007 suggest core knowledge consists of four systems for representing objects, actions, number, and space. Spelke

(1988) established that core knowledge includes spatiotemporal continuity of objects (as a perceived object moves around it is considered by babies to be unchanging in its composition and form) and relational effects such as containment or occlusion. Extensive research (Baillargeon 1993; Needham & Baillargeon 2000; Hespos & Baillargeon 2001; Wang, Baillargeon & Brueckner 2004; Song & Baillargeon 2007) has been undertaken to establish that very young infants have a good grasp of object permanence and how objects are expected to interact with each other; Bonatti & Frot (2002) suggest that infants are genetically endowed to recognise humans first before objects; and Xu (2003) shows that infants have a detailed innate knowledge of number to three, and general quantification knowledge of large and lesser amounts.

Being able to make perceptual representations of the immediate surroundings, based on core knowledge is limiting unless the organism can learn from them, to enable a level of familiarity, continuity or predictability when encountering repeated or similar surroundings. Clearly, this can be accomplished by storing all prior perceptual representations for future use. This may be appropriate for organisms that exist in very limiting environments, but is indisputably inefficient for humans. Thus a means of generalising subjective experience effectively is necessary. Nelson (1986) suggests that subjective experience of events is organised within a specific structure taking account of a variety of data sources, and contributory sub-events. Her study was conducted with 3-8 year old children recounting their knowledge of general events. Although, the age of the subjects is outside the range of current concern, the nature of this proposed structure is a useful starting point, and will provide an outcome to build back from giving some insight into how younger infants may organise their subjective experience.

Nelson and colleagues focus on the Event as the most basic unit of representation of knowledge. A key reason for a focus on events is that children's knowledge of the real world comes to them from personal experience within a wider physical, social and dynamic context. Nelson proposes that knowledge of the world is developed largely from representations of new experience, although cognitive processes may derive new knowledge by operating on existing mental

representations through inference, categorising, pattern analysis and transformations of various kinds.

The context of an infant's experience and knowledge, however, unavoidably reflects the embracing social-cultural influences of her (speech) community. My claim will be that the organisation of subjective experience of events is represented in a social/cultural/locational context, with participants and objects interacting (verbally or non-verbally) in predictable and intentional ways to achieve ends. Steps towards substantiating this claim begin with consideration of what constitutes an event in Nelson's research.

3.1 What constitutes an event?

A ball can be argued to be a stative event. A simple single bounce of the ball can be a dynamic event. However, Nelson's research, with 3-8 year olds adopts a macro approach, involving a range of successive actions and sub-events bounded overall by an agent's purposeful activity. An event (both macro and micro) can therefore be considered as a goal oriented bounded activity or set of activities. Events in these terms have structure with a temporal-causal sequence, with embedded and hierarchic sub-events.

For instance, a description, say, of what to do to buy potatoes from a supermarket, will explicitly include – finding the vegetable section and taking the potatoes to the checkout. Implicit sub-events include: identifying the supermarket; opening the door; entering the building; recognising potatoes in their packaging; finding the means of paying; and so on. Each of these sub-events has a detailed event structure and sequence in its own right and has representational elements that are largely inaccessible to awareness. The specific intentional actions in particular, in opening a supermarket door, say – identification; manipulations; and body movement - remain completely sub-personal.

In brief, Nelson's research involves analysis of children's verbal accounts of common events; e.g. a day in school, or a birthday party. A birthday party event (as per western cultural norms) included for all research subjects a recount of birthday cake eating, games playing, and present giving/opening, the order not being critical. Within sub-events, the order can be critical - birthday cake eating was always preceded by blowing out candles. On further questioning, children

were always able to place additional sub-events, which they had omitted to recount, in the appropriate sequence. It was found that causal connections reinforced temporal structures (cut the cake before eating it), where order is important, and changes in spatial location played a role in segmenting event structure into discrete scenes (cake eating versus games playing). From their reports, it was apparent that children formed general representations rather than gathering specific fragments of event experience. Nelson's conclusion is that the generalisation of events seems to be a natural product of mind, even to forming a generalisation from a single experience. So a visit to McDonalds may form a 'restaurant event' representation, and be assumed to apply to all restaurants (until disabused). It is generic schemata of events that are stored, which Nelson terms Generalised Event Representations (GERs)

Although based on concrete experience, GERs differ from memories of specific events, as the schemata are generalisations about possible specifications rather than specific values. For instance it seems the birthday GER has obligatory cake, games, and presents slots but the types of games or presents are optional, so too the order of games playing, present giving, or cake eating. Event representations, then, are essentially generic. Nelson states:

> "The representation system functions through activation of relevant cognitive representations in situations in order to make possible the interpretation of activity in that situation. Event Representations are instantiated in familiar situations to guide actions and interaction, both verbal and non-verbal. They make it possible for a child (or adult) to predict what will happen next and to organise their own actions and verbalisations accordingly" (Nelson 1986 p239)

The central finding of Nelson's study is that children as young as 3 years old are sensitive to the temporal structure of events, which are always goal oriented, and report action sequences of familiar events without error. As Nelson's research involved verbal reporting, her subjects were necessarily adults or children of 3-8 years. Nelson emphasises that GERs by their generalised nature, are less detailed than actual experiences, and the verbal accounts are even less detailed than GERs. She concedes the results of her research programme do not involve infants below the age of 3 years, but she makes the assumption that comparable ability will be available to the young infant. There are, however, significant and obvious differences. Infants (around 18 months) have much more

limited experience, and are more constricted in the type of new experiences they can access, both developmentally and physically. Infants have very limited episodic memory abilities, as exemplified by the phenomenon of infant amnesia characterised by the universal lack of ability for anyone to recall specific events occurring in early life (Tulving 2002). So, most experience needs to be stored generically, although children over 4 years appear to be able to store and recall specific instances of significant experience, which might have an influence on their GERs. Lastly, the greater experience of older children will make more active use of hierarchic and complex GERs in terms of sequences and qualifications.

Accessing generalised event knowledge of preverbal or very early language learners cannot be achieved by recount. The question remains, however, how infants under 2 years of age organise their subjective knowledge, which, as has been shown, carers find so important to support.

3.2 Infant event representations

A quick way into this question can be found in the use of differential looking time as a measure in many psychological experiments with preverbal infants. This measure is based in the assumption that an unexpected, or surprise occurrence in the experimental context will receive greater looking time from the subject. For an occurrence to be unusual or unexpected requires that the infant has some representation of the usual or the expected, for the occurrence to appear divergent. That some kind of generalised event representation is available to the very young infant is confirmed, as degrees of surprise or the unexpected are incorporated in experiments involving infants as young as 3 months.

Baillargeon & Wang (2002) in their review of occlusion and containment event research conclude that infants in watching an event categorise it and use their knowledge of the event category to make predictions about how similar events unfold. Events from different categories (like containment, occlusion, and so on) are thought by the researchers to be treated by infants as novel and discrete, presenting them with the difficulty of mapping objects between events. An object, therefore, appears to be interpreted as a unique property of an event. Object specific properties, initially, do not appear to carry over into new events. Hespos & Baillargeon (2001) tested 4-7 months old knowledge of single

occlusion or containment events. The experiments consisted of lowering an object behind an occluder or into a container. The height of the occluder or container was either the same as or less than the object being lowered. This height difference acted as the test variable. The expectation therefore would be that part of the object would remain visible when lowered behind / into the shorter occluder / container. 4 month old infants were tested and their reactions, measured by differential looking time. The findings in this case confirmed that 4 month old infants expected a tall object to protrude over a short occluder (and were surprised when it was fully occluded). But this expectation did not apply to the containment condition, where looking time did not imply surprise at the unexpected outcome (the taller object fitting into the shorter container without protruding). It was only at 7 months of age that the infants demonstrated the expectation that a tall object would not fit into a short container.

Hespos & Baillargeon explain their results in terms of the child approaching scenes as event specific and not, at the earlier age, being able to generalise across the two types of events until they had gained more subjective experience of objects and containers. Commonly, 4 month old infants will have had experience of seeing objects side by side, in everyday life, enabling some comparison of size. They will also have frequently experienced occlusion, having seen objects being moved behind other objects, on the table for instance or being moved in front of or behind furniture in a room. But containment events conducted by adults only allow for the experience of seeing the object being placed in the container without prior side by side comparison, and such events performed by an adult are generally geared to complete containment. The adult places objects (or more likely fluids) in a container with the goal that they are contained and not, that they overflow the container.

Strong evidence that early experience is organised as events arises from a series of experiments designed to challenge proposals from Xu & Carey (1996), further discussed in Carey & Xu (1999). Their experiment was designed to demonstrate that children first recognise objects as object sortals at 10 months and only begin to perceive object attributes at 12months. Xu & Carey's experiment will be described first, followed by Wilcox & Baillargeon's (1998) critique.

In brief, a screen is set up in front of a passively watching infant (10months -12months) who is habituated to a ball emerging and returning from the left of the screen and a toy duck emerging and returning from the right of the screen. The test displays the duck movement twice followed by two examples of the ball movement. At the time when the ball and the duck have both returned behind the screen, it is lowered to reveal either a ball and a duck (which would be the expected result as both items had emerged and returned behind the screen) or just the duck (which would be an unexpected result). By a preferential looking measure 12months infants showed the expected result (longer looking time at the single item behind the screen), but 10months infants showed the opposite: looking longer when 2 objects were revealed, indicating that, for them, the two item display was an unexpected result. Xu & Carey explain this in terms of a 10month old having only the notion of object sortal. The ball and the duck are not differentiated. By 12months it is assumed that infants have a greater ability to discern object properties and therefore can differentiate the ball and the duck and so having seen each emerge and return behind the screen, expect that 2 different objects will be present when the screen is lowered.

Wilcox & Baillargeon (1998) pointed out that the actions of the ball (or duck) emerging and returning behind the screen may be interpreted by the infant as a coherent event. The experiment is therefore a display of two discrete events to the infant: ball emerging and returning or duck emerging and returning. This is a significant observation on the experiment. For Xu & Carey the emergence and return of the object was mainly a methodological necessity to show the infant the object beside the screen and enable the infant to maintain the image of the object being behind the screen. No account was made for the possibility of subjects regarding the object as a participant in a moving event.

Wilcox & Baillargeon observed that if the 10month old infant either entertains each object event as discrete or only has memory capacity for one event, then the result (when the screen is lowered) would be expected to comply with the last seen event, i.e. one object would be behind the screen. 2 objects is surprising because only one object was involved in the last seen emerge/return event. By 12months it may be that the infant has the cognitive ability to appreciate the nature of the experiment as a two event display. If the infant can

retain both events as salient sub-events then the infant would expect the result of both emerge/return events to be displayed when the screen is lowered. A series of 8 differing experiments were devised to support this conclusion, the gist of which will be described.

Wilcox & Baillargeon propose that the problem presented to infants by the Xu & Carey experiment is one of contrast between event mapping and event monitoring, and not one of perceiving object properties. So, while watching the scene during habituation (the appearance and disappearance of objects behind the screen) the infants observe and form an understanding of the event (monitoring). When the screen is lowered the infants are presented with a new non-occlusion event and need to compare their previous understanding with the new observable event (mapping). They need to map the event as they understood it to the new revealed event; a task which evidently presents difficulties for the younger subjects. Wilcox & Baillargeon's experiments are designed to show firstly that younger infants can successfully perform quite complex monitoring tasks and that younger infants given support in the mapping process can successfully perform in those tasks too.

Monitoring experiments involved infants viewing the same kind of scenes as in the original tests but the difference was that in one condition objects moved behind a screen wide enough to accommodate both objects side by side; in another condition the screen appeared to be too narrow to occlude the objects completely. The screen was not lowered, so infants were required to monitor the event to its conclusion. Infants as young as 7.5 months old showed surprise (by looking time) that the narrow screen could accommodate the two objects. They had monitored the events to an expected outcome.

The mapping experiments in this series, tended to replicate Xu & Carey's experimental results, despite efforts to simplify the amount of movement of the objects. It was found generally that infants (9.5 months old) have difficulties in retaining a representation of the monitored occlusion event to map on to the test non-occlusion event (the scene revealed when the screen is lowered).

Wilcox (2003) tested whether prior experience of the events to be mapped might support a more successful outcome. Infants of 7.5 months participated. One

group in a pre-test phase witnessed the emergence and return sequence in full view, that is the screen was lowered throughout to reveal in effect what 'happens' behind the screen. On test, it was this group that showed surprise when a ball-box emerge-return event resulted in a single ball being revealed when the screen was lowered. Thus infants at 7.5 months were able to perform the task successfully given the support of prior experience of an outline of the events involved.

A clear conclusion, in contrast to Xu & Carey who attributed difficulties to infants being unable to discriminate attributive properties of objects, is that young infants are focussed on monitoring events and how they unfold, and that difficulties arise from the complexity of comparative mapping of different event types. This confirms that quite young infants do in fact form representations of discrete events punctuated by goals and expected outcomes. Around 12 months old, infants can form sub-sequences of an event, defined by sub-goals. This again is supported by experimental evidence: 11 month olds discriminate single events by goal versus no goal (Woodward 1998; Woodward & Somerville 2000); 12 month old infants discriminate extended sequences and respond positively towards freeze framing a video sequence at sub-event boundaries, as opposed to mid sub-event. (Baldwin, Baird, Saylor, & Clark, 2001; Baird & Baldwin 2001).

It appears that infant subjective experience can be characterised initially as being organised as discrete telic events. Around 11 to 12 months old, there appears to be a meta-cognitive development enabling infants to map discrete perceptual events together (with the presumed proviso that they find it relevant to do so). It is probably no accident that it is around this time that linguistic events, continuously available in the environment, may be subject to a mapping process in relation to other perceptual events. This process will be the focus of the next chapter, and in preparation for that, the relation between intentional engagement, subjective event knowledge and meta-cognitive mapping needs to be considered. Perceived language to perceived event mapping is not random, and occurs within a rich, but tightly constraining context, which results from how events are structured.

3.3 A simple model of contextual constraints

Telic events are experienced within social/cultural and locational contexts, and involve the physical and observable interaction between agents and objects. It is how these contexts interact, which funnels infant intentionality towards meaningful and relevant linguistic events. As shown in the previous section, objects may have differently understood properties in different contexts. Some means of fixing or stabilising contexts needs to be available to enable the required types of generalisation across contexts to occur.

I wish to suggest that for infants less than two years of age, generalised event representations exhibit at least 5 interacting inclusive layers of contextual influence, which will be described in this section. The order presented shows a contextual funnelling effect, which is perhaps more clearly presented in diagrammatic form as in fig1 below.

Any outer layer includes all those within it. The principle followed is that new learning at any layer is in the established context of those that surround it. Any novelty in an outer layer changes or disrupts established knowledge in the inner layers, which is demonstrated when considering the workings of this model. This will be exemplified from a range of available experimental evidence. The layers I will discuss are as follows: the social/emotional/cultural; the locational; the telic; the intentional; the dynamic substantive.

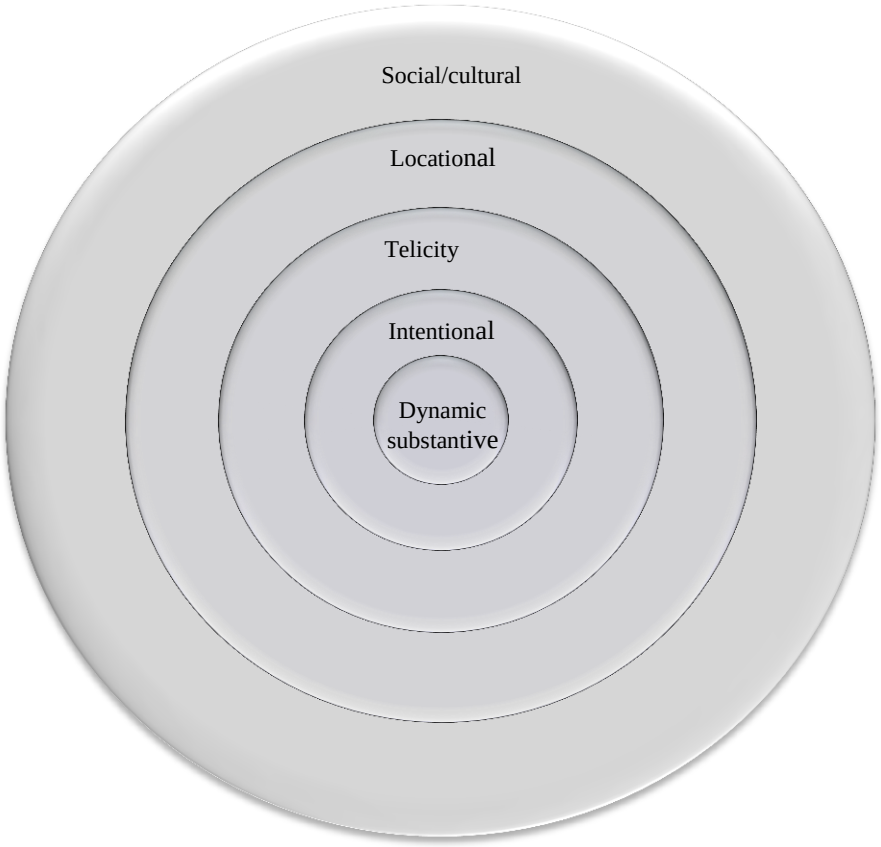


Fig 1 Schematic diagram of the potential contextual funnelling effect of infant subjective experience.

For example, social/emotional/cultural familiarity provides a high degree of stability, on the basis that it provides an encompassing context for all infant learning. Young infants are in inter-subjective relationships with a limited number of carers who (in most cases) share a social/cultural backdrop for all new infant experience. Any changed experience in this layer, is likely to require either a widespread re-learning of events in subsequent layers, or the infant will simply not find it relevant, as illustrated in 3.3.1 below. The outer layers once established make no further demand on effort or engagement, enabling the infant to engage with inner layers. At the centre the components are the more changeable dynamic substantive events and therefore more relevant for the infant to attend to, but engagement will be subject to a contextual funnelling effect from the other layers. Engagement with any layer is informed by and dependent upon the contextual properties of the enclosing layers.

I will provide support for this proposal by considering each layer in turn calling on evidence from available research, which highlights the disruptive effects of changes at different layers.

3.3.1 Social/cultural/emotional layer

The infant, typically experiences an all-encompassing cultural/social context, defined reciprocally with her carers. This involves those aspects of Social Cognition which have become the focus for many researchers notably the work of Rochat (2007), Tomasello, Kruger & Ratner (1993) Tomasello (2005, 2009), Trevarthen & Aitken (2001), and Trevarthen (2004) who have highlighted the complexity of the early carer baby relationship and levels of attachment, to establishing a stable intersubjective foundation. This is apparently effortful for the infant, as it demands her total attention, and is intensively supported by the adult.

But for the young infant, the social/cultural context becomes a given and acts as a filter for all other aspects of event structure. In general, the wider social/cultural context is stable and encountering new or novel cultural contexts can be highly disruptive to established subjective knowledge, as the folk psychology term 'culture shock' implies. A clear and small scale (not psychologically damaging) example of this can be found in an experiment conducted by Meltzoff (1988).

The experiment was designed to test whether an infant having seen an adult perform a successful event with a novel object, could recall and imitate the adult after a time lapse (typically 24 hours). The experiment included 6 elements. It is the last (which Meltzoff dropped in his later 1995 follow up experiment) which is of interest here. A panel on the table could be illuminated when touched by the experimenter's forehead. In the experiment the infants (18months old) imitated the forehead touch to illuminate the panel, and did so again on retest.

A follow up experiment by Gergely, Bekkering & Kiraly (2002) replicated the forehead touch illumination event, but this time the experimenter's arms were wrapped in a blanket, which prevented her using her hands to touch and illuminate the panel. When children imitated this event, they used their hands rather than their foreheads. The conclusion drawn by the experimenters was that the children rationally inferred that the experimenter would have used the most

direct means to touch the panel had her hands been free to be used. This conclusion is not in dispute. As there is no mention that the children attempted to use their hands to illuminate the panel in the Meltzoff experiment, the question arises as to the essential difference between the two events which led to such different responses from the infants.

I suggest that the difference lies in the first experiment event being truly, culturally novel. The novel goal was 'illuminate the panel with the forehead', which the infants viewed as culturally unusual. As such the means and ends are imitated without reference to prior generalisation. The second experiment however, provided a clear disassociation between the means and the end. The hands were unavailable and so the goal in this case could simply be a culturally familiar 'illuminate the panel by touching' event. The second experiment aligns with possible existing event knowledge, (infants may have seen carers achieving goals in unusual ways because their hands are full), and so reasoning can be based on a known context. The first experiment provides no such basis. Imitation is the only option because there is insufficient information in the novel event on which to base a reasoned response. There is no report that infants had learned a new way of turning on lights outside of the laboratory (if they had it would surely have been mentioned), so this event remained a feature of the novel lab-culture, and remained a discrete event.

To demonstrate this further, speculating why Meltzoff did not include this task in his follow up experiment (Meltzoff 1995) is instructive. The follow up is described in section 3.3.4 below, and involves experimenters trying but failing to achieve a goal – putting a peg in a hole and so on. How would the experimenter demonstrate failing in the intention to illuminate the panel with the forehead? Presumably she would have to approach the panel and only succeed in banging her head on the table. With no prior knowledge that in the experimental culture panels are illuminated by forehead touch, what could an infant (or anyone) make of this bizarre activity?

My claim is that the social/cultural component of subjective experience provides a stable and for the infant largely unchanging, background context, and as such makes no on-going claim on conscious effort for engagement, once established.

3.3.2 Location layer

Locations in themselves are often highly predictive of events. A kitchen is a location, characterised by objects and actions which can take place within it. These possibilities are also culturally/socially influenced. So, in a western culture, a kitchen may be exclusively for food preparation or socially defined as having a wider function as a family room where play, eating, food preparation and entertaining may be considered usual. Thus, rooms, the home, and so on become identifiable locations for predictable events. Encountering new or novel locations can have dramatic effects on event predictability, as most people who start a new job, or move to a new town or country are aware. For the very young infant, the range of locations is usually highly restricted: frequently just a few rooms in the home, or nursery. Explicit familiarisation with this restricted set of locations needs to be established early and once in place provides stability. Experiments that explore how this component can be disrupted can be found in disorientation studies.

Hermer & Spelke (1996) explored orientation systems shared by animals and humans. They found that after familiarisation with a room with fixed attributes (coloured walls or fixed objects) and a toy hidden while being observed, infants under 2 years of age when disoriented (spun round) used only geometric information to orient in the room even if it meant going to the wrong place to find the toy. The response was the same for rats. The experimenters concluded that infants rely on primitive, inherent, systems for re-orientation despite there being additional information (fixed attributes) in the room. This appears to show that any representation of the room and its contents that the infants had formed became unusable by them under disorientation, an effective change in the location layer of their prior subjective experience.

3.3.3 Telicity layer

Within the stable social/cultural and locational contexts, goals have been shown to be important. A goal or outcome can be considered to be an event or sub-event boundary, and as such performs a key function in defining an event, and providing purpose or relevance to an event.

As it is rare that any two similar events are exactly the same, a representation that is built by simply stringing together successive actions will not only be misleading, but actively work against generalisation, and become unmanageable. But using relational information to link actions overcomes the difficulty of finding connections between co-occurring actions and provides a rationale for linking any two actions that may occur in a sequence. Experiments which establish the importance of goals have been indicated in 3.2 above. For an event to be relevant it must have a goal. Meltzoff, reiterated by Csibra & Gergely (2007) suggest that infants are 'obsessed with goals'. A goal is a given for event representation as it provides a necessary boundary, and I suggest it is also a given for infants.

3.3.4 Intentional action layer

Most salient events for an infant have an aspect that must be attributed to an agent of some kind, usually people or entities who are always present in an event. The infant in a natural learning environment is generally in familiar surroundings with people/entities that are also well known – carers, family members, and family pets. As such, agents are also relatively stable, and may be considered to be implicit in event structures. Events are generally about agents acting in some way towards an intentional goal. Do infants recognise the actions of agents as intentional?

Following Searle (1983), a distinction can be drawn between intention in action and prior intention, (or the planning of intentional action). A question addressed by many researchers is: given an infant's ability to recognise intention in action (goal directed action) do they also have the ability to undertake more complex 'mind reading' to discern the prior intention of a volitional agent? Experimental work has focused variously on the relations between the following types of events: a sequence of events that has an intended outcome; a sequence that does not have an outcome; a sequence that does not achieve an intended outcome; or a sequence with an accidental/unintended outcome.

Carpenter, Akhtar and Tomasello (1998) showed that 14 month old infants would neither imitate an accidental action to achieve a goal nor an action which accidentally achieved a goal. For the experiment some accidental acts were

accompanied by the experimenter uttering ‘whoops’ as opposed to ‘there!’ when the goal was successfully achieved. The results showed that 18 month old infants were twice as likely to imitate an intentional (signalled as non-accidental) rather than a non-intentional (signalled as accidental) action by an adult.

Meltzoff’s (1995) investigation sought to establish whether 18 month old infants re-enacted what adults actually do as opposed to what they intend to do.

4 groups of infants were presented with a series of (5) novel objects. 2 of the groups were controls: one was left to play freely with the objects the other played with them after watching an adult simply handling them. Of the remaining 2 groups, one watched an adult perform an intentional action with the objects successfully achieving a goal (e.g. pulling a dumbbell shaped object apart, or inserting a wooden block in a slot in a larger wooden object). The last group saw an adult performing a purposeful action with the objects but failing to achieve a goal. Infants in these last two groups were invited to handle the objects the only instruction being ‘it’s your turn’. All the children were scored positively if they performed the intended successful action, regardless of their priming.

As might be expected, the groups that had not observed the relevant purposeful activity by the adult scored quite low with few examples of the children performing the (unseen) model goal. Both groups that had seen the intentional action of the adult achieved the appropriate outcome with the objects whether they had seen successful or unsuccessful attempts by the adult. Thus the full demonstration or intentional but failing demonstration had a significant effect.

In ‘correcting’ an adult’s failed attempt, infants can draw on their knowledge of what is an expected outcome without resorting to any intervening mind reading. Meltzoff (2007a,b), Meltzoff & Brooks (2001) draw the same conclusion paraphrasing the event more like ‘the adult intends to act as I would in the circumstance’ – the ‘like me’ hypothesis. This hypothesis introduces directly the role of the infant as (co-) intentional agent in the event. This is a proposition curiously unremarked in much research, where the infant is considered to be a passive observer, rather than active participant. It has already been shown that where the experiment is at odds with an infant’s GERs, she is unable to apply her event knowledge to ‘correct’ actions (illuminating the light panel). Where actions

alone, or ends without actions are displayed to infants (Bellagamba & Tomasello 1999) they are unable to perform a whole action-goal sequence.

Actions are attributed to intentional agents, who for the infant in a natural setting are a limited number of identifiable individuals, including themselves. Actions considered relevant to the infant are performed by these agents as a means to an identifiable end. As such, actions are not discrete or stand-alone elements of an event, but are essentially dynamic properties of agents. For actions to be understood, an intentional agent and a goal are required. This has significant bearing on verb learning, as will be shown in the next chapter.

3.3.5 Dynamic substantive layer

A static object with no apparent purpose will not be relevant to an infant (or anyone). Objects that can be manipulated, moved, have specific purposes or achieve outcomes are relevant for engagement. The quantity of objects in the infant's environment are plentiful, and of interest. Although this layer appears the most open, there is interdependence between objects and social/cultural situations, locations, goals, and intentional actions. Empirical research into infants' conceptual development and naming of objects frequently factors out these important influential levels. Objects in the natural learning environment of the infant are integral to the wider context of an event and are conceptually influenced by Event representations. So for infants, object affordances and understanding of such, is claimed to be contingent on a given social/cultural, locational, goal focussed, intentional context.

Within this established context, objects have predictable dynamic properties. Cups and balls act in different but predictable ways, for instance. This has significant bearing on word learning and word meanings, as will be shown in the next chapter.

3.3.6 Summary

The model presented here proposes a simple structure and suggests a measure of the engagement-effort relation, in that, the more inner layers are more accessible for engagement due to the stabilising effect of the context and predictability derived from the outer layers. Engagement in the outer layers requires more effort because change here affects all the others. So, for instance in

wholly new environments the predictability of agents' actions and object dynamics are less certain.

The way an infant is exposed to early experience, appears to honour the structure. Social/cultural/emotional foundations are made early, locations with which to engage are limited, and events are purposeful. The number of agents is limited and involves specific known individuals, but objects in dynamic events are many and require and can receive the appropriate effort for on-going engagement. It is in the last layer that early productive utterances operate: objects and their dynamic properties.

The importance of this proposed structure to the unfolding Conceptual-Intentional Bootstrapping proposal is that engagement with and developing knowledge of intentional action and object dynamics are always set within a wider context. Or, put another way, infant attention and engagement is contextually funnelled towards objects and dynamic events which exist within given social/cultural, locational, teleological and intentional contexts. It is to establish this context that carers devote so much of the attention reflected in CDS. The additional necessary ingredient is an early meta-cognitive change enabling a mapping between perceptual events. The implication of this for word learning is addressed further in the next chapter.

Reference has variously, and appropriately, been made to Event representations, GERs, Event knowledge and subjective knowledge. As all these terms figure in the construction of the model, there is the possibility of confusion arising from further use of these terms in other contexts. As such I will consolidate the discussion so far by using the term Infant Generic Knowledge to refer to infant event knowledge, and incorporate the four terms above. By this means, Infant Generic Knowledge signifies what is stored as a result of an infant, generalising representations of her subjective experience of events of the world.

Generic Knowledge of this kind, is applied to new experiences and may be elaborated over time, nevertheless it provides the infant with stability to the world. It also appears to be actively supported and promoted by carer interaction with the infant. Generic Knowledge as defined here, contributes to what is traditionally called 'semantic memory' in psychology, and also provides the

means of understanding and comprehending the world, which will make a contribution to linguistic semantics.

4. General discussion

In this chapter I have focussed on the linguistic environmental experience of the infant to clarify the nature of the linguistic input, which was considered from a practical viewpoint by reviewing research into CDS. I concluded that linguistic stimulus appears not to provide a direct route into syntax, but does provide an extraordinarily rich input for Generic Knowledge. This input is considered intuitively important by adult carers in engaging with their language learning infants.

By focussing on the infant as an intentional agent in the acquisition process, I have shown that the development of Generic Knowledge, important for organising infant experience and understanding the world, also provides a guide for engagement by the infant, bringing object dynamics to the fore. Infant engagement, guided by relevance, provides the lead and focus of infant/carer interaction. It is in this way that Crain and Lillo-Martin's statement can be justified, that language development is internally driven. I therefore propose that it is precisely this area of infant engagement, object dynamics, which will be productive for infant word learning, guided by an 'acquire-as-required' criterion, and enabled by a meta-cognitive development of perceptual event mapping.

I claim that Generic Knowledge and Intentionality in engagement and meta-cognitive ability characterise the main contributory components to language acquisition. At this stage however, it is only preparatory; (a kind of 'Conceptual-Intentional Boot-lacing' - to extend the metaphor), which enables linguistic events and Generic knowledge to become intentionally related.

With these foundations having been laid, the discussion will now be able to focus more clearly on the acquisition of language and linguistic form, starting with word learning in Chapter 4. The final stage, where intentionality and generic knowledge have undergone further elaboration facilitated by a further metamorphic meta-cognitive development, will be introduced in Chapter 5. This later interaction will be shown to be responsible for awakening syntax through the

C-I interface, confirming the efficacy of the new Conceptual-Intentional Bootstrapping proposal.

Chapter 4
Word meaning and word learning

Introduction

The previous chapter reviewed the nature of the linguistic input which infants experience from carers and those around them. It picked up on intuitive processes that adults employ in supporting their children to acquire language. The conclusion was that there is a main focus on comprehension rather than syntax to help infants build and understand their subjective experience. The fundamental building blocks were shown to be generalised events which constitute infant Generic Knowledge. The way Generic Knowledge can be organised imposes contextual constraints acting as a 'contextual funnel' from the global to the particular. Three elements were proposed to set the conditions for the interaction between language and an understanding of the world:

(i) Infant intentionality geared towards relevance;

(ii) Generic Knowledge providing a meaningful context for understanding dynamic substantive aspects of experience; and

(iii) a meta-cognitive development enabling perceptual, including linguistic, event mapping.

Establishing this foundation takes time, and thus it is not until around 9-12months that an infant is in an inevitable position to begin to learn/acquire language. This chapter continues on this route.

In section 1, I will consider the linguistic outcomes which can be expected to be a product of the initial state described above, and conclude that these initial outcomes do not qualify as productive language acquisition.

Section 2 will consider the relationship between event mapping and concept mapping, and show how the top down analytic approach makes word learning contextual. By comparing word-event mapping with other word-concept mapping proposals I show that the latter are wanting and cannot account for what is required for verb learning.

Lastly section 3 will consider whether knowledge of grammatical properties of words (categorised as nouns, verbs, adjectives and so on) is a necessary requirement for infants in word learning. The conclusion will be that it is not.

The overall outcome for this chapter states that words learned are semantically underdetermined and lexically/grammatically unspecified.

1. Infants' first utterances

In all waking moments from birth, maybe even before, typically developing babies and infants will be conscious of the fact that humans are a very noisy species. Two or more humans must make speech sounds to each other, and feel very uncomfortable in silence. Speech is an integral part of the human environment and is likely to have a presence in infant organisation of experience. From this point of view, there is a sense of inevitability about infants coming to make human speech sounds, but I would maintain that this is a different consideration from the inevitability of infants acquiring productive syntactic knowledge. The last chapter established a Generic Knowledge structure providing contextual stability, and a new meta-cognitive ability which enables infants to map perceptual events to each other according to relevance. It was suggested that this would provide the means to be able to map perceived linguistic events to other perceptual events within the confines of the 'contextual funnel' afforded by the organisation of Generic Knowledge. If this is so, then it should be apparent in early infant utterances. It is generally accepted that early infant talk is imitative. In reviewing corpus material, many infant imitations reveal their contextually bound nature and can be grouped into 3 large classes: mimicry; imitation; and word frames.

1.1 Mimicry

Mimicry provides a ready and cognitively effortless means to participate in a conversational situation, characterised by the inter-subjective relations between infant and carer, already described. Throughout the CHILDES/UK-Eng/Manchester corpus of infants in their second year, there are examples from all the infants of mimicry of an adult's prior utterance. Such utterances appear to be focussed solely on participation in a conversational exchange and show little

sign of either comprehension of the adult's utterance or overt communicative content. These are of two general kinds:

i) Repetition of the last word(s) uttered by the adult: e.g.

(19)

MOT: Did you have some fish as well?
CHI: fish as well

ii) Repetition of the main stressed elements of an adult's utterance: e.g.in the context of talking about different aspects of grapes and strawberries:

(20)

MOT: They're **not** as **nice** as **strawberries**
CHI: not nice strawberries

These appear to be linguistic event monitoring not mapped to any context, but simply explored within a secure inter-subjective social/cultural context.

1.2 Imitation

It is well documented that infants learn a repertoire of holophrastic expressions, which can be defined as unanalysed utterance tokens tied to specific contexts. These are of various kinds, but their close adherence to specific contexts leaves them open to being described as integral to event experience: metaphorical deposits on the 'contextual funnel'. Once again there is a sense that these, as givens from adult utterances, do not convey conceptual content, but are more word or phrase types which are completely context dependent. These are generally of three kinds, showing an increase in complexity, from event monitoring (i), to event mis-mapping (ii), to full event mapping (iii), between perceptual and linguistic events.

i) Utterances of greeting and politeness which adhere closely to social/cultural events, and have no currency outside of them. These include: 'hello', 'please', 'thank you', 'bye bye'.

ii) Use of phrases in an appropriate context, but the meaning of which is not immediately relevant. This could imply that the child is repeating a contextually appropriate word/phrase without having any real understanding of its meaning potential, other than the context of use. This might be a kind of deferred

repetition: using a phrase heard uttered by an adult in a similar context. Such utterances tend to exhibit greater complexity than all other utterances:

(21)

a) CHI: I warn you cat (said to pet cat)
b) CHI: Bring it to mummy (said to baby brother)

iii) Uttering a word or phrase in an appropriate context which does convey appropriate meaning, and learned from frequent use by adults. Three such utterances appear to be commonly used by all infants in the corpus:

(22)

a) What doing?
b) What happening?
c) Where gone?

1.3 Word frames

A third type of imitation appears to be more productive. This is the development of fixed phrases as in 1.2iii above into unanalysed word frames with an additional variable slot. These seem to be commonly restricted to questions in the corpus:

(23)

a) What X doing?
b) What happened to X?
c) Where X gone?

It can be argued that the item-based constructions that Cameron-Faulkner et al (2003) identified in CDS (Chapter 3 section 1.2) as 'who's..'; 'are you..'; 'what did…' are unanalysed word frames of this type. Most examples allow for a variation in object/entity reference but little else: 'what [you, he] doing'; 'what happened to [entity]'. Linguistically, this may show the infant exercising a process of substitutability, which could be evidence of syntactic knowledge. But, as these utterances continue through the corpus in the same form even when the infant is exhibiting a greater control over more complex construction types, it would be equally valid to conclude that these form a closed class of highly useful utterance types. They, therefore, may not be making a long term contribution to syntactic development, if any at all.

Emergentists, by tracking such utterances through to ever more complex word frames, tell only part of the story, and do not address how infants can

productively make their own new contexts for communication. This can be achieved through one word utterances without reliance on given phrases and leads to a greater personal control over linguistic form. Productive utterances like these will be addressed in Chapter 5.

Holophrastic or imitated word frames are of a fixed structure and essentially unproductive. There has for long been the assumption that infants' first productive words are object-focussed, and that initial learning follows lexical principles; namely, that infants learn nouns first which encode basic category items before superordinate categories, and verbs before adjectives and adverbs, and so on. When considering infant word knowledge, it is clear from all data (for example Braine 1976) that infants appear to learn more than just 'nouns' first.

Bloom, Tinker, & Margulis (1993) longitudinal study of word acquisition by infants, found that object labels contributed to only a third of the infant lexicon, and if proper nouns (names) were included this rose to around 40%. They acknowledged the difficulty in making judgements of word types emphasising that it is unlikely that infant words are specified by grammatical category, their analysis therefore grouped object words against all others. The research established that infants have a potentially varied vocabulary resource available to them at the time of constructing more than one word utterances, although the actual words acquired vary considerably across subjects and within languages, as naturally, they are experienced relative to differing physical, social and functional contexts. Non-object words commonly included get, in, out, no more, open, woof, moo, yum, there. Markman (1992) established the 'whole object constraint', by which infants, in hearing a word which refers to an object, assume that the whole and not part of the object is the target of naming, and that learning relational words and verbs in particular requires that constraint to be over-ridden. Bloom et al propose that:

> "..associating *gone* with the disappearance of juice, or *more* with the recurrence of juice in the glass, is more likely the result of the same factors which contribute to associating *juice* with the liquid that disappears and reappears, gets poured, drunk, spilled, and so forth." (Bloom, Tinker & Margulis 1993 p446-7)

This proposal aligns with my view that a word maps to an object and its generic involvement with events, an aspect of what I have called the 'dynamic

substantive'. The next section will seek to resolve controversy over whether words label or map on to concepts, or whether generic events are the target for mapping.

2. Word mapping: concepts or events?

On my account, engagement with particulars is always within a wider embracing, and importantly, already understood context. The development of this kind of organisation for experience of events appears to be promoted and nurtured by adults. The support comes from interaction and inter-subjectivity in a communicative, conversational context licensed by infant engagement available as a result of infant intentionality prompted by infant representations of relevance. This is conceived as a top down analytic approach to the construction of knowledge of events, very much under the control of the infant herself.

It is in this context that word meaning and word learning is claimed to be an analytic rather than synthetic process. Synthesis assumes words map on to discrete concepts rather than events and appears to be a characteristic view of word learning, prevalent in much empirical research. There are also interpretations of the mapping process which imply that word mapping in some way encodes conceptual meaning.

A code model of language assumes that thought, described as combinations of concepts, can be represented by sentences formed through words which encode those concepts combined in a similar way, but adhering to syntactic principles. Thus, code models of language are based on the assumption that thoughts that are communicable will have a matching sentence identical in meaning, and that communication of a complete thought requires only the utterance of such a sentence. Opposition to such accounts has been presented through Relevance theory (Sperber & Wilson 1986/95, Sperber 1994, Sperber & Wilson 1998) on the basis that linguistic communication is largely inferential, and what is linguistically encoded is a skeletal conceptual frame which has to be added to and enriched to arrive at a speaker's intended meaning.

The bootstrapping proposal, being developed here, will be seen to favour the latter view as its outcome - language as inferential, over the former – language as a complete code system. As the discussion unfolds, I will show that theories of

word learning that assume a fixed code model, present considerable problems to any bootstrapping proposal, as a result.

A starting point for this topic will come from a replay of Chomsky's view of word learning as described in Chapter one:

Chomsky observes that word learning seems to be quick and effortless, therefore:

> "This would appear to indicate that the concepts are already available, with much or all of their intricacy and structure predetermined, and that the child's task is to assign labels to concepts, as might be done with limited evidence given sufficiently rich innate structure." (Chomsky 2000 p60)

On this account a word labels a concept, which has innate properties, and which will need in some way to be a discrete unit to enable labelling. Once a label is assigned, the label is presumably capable of being converted back to a concept. Words therefore appear to package concepts. Words form the lexicon and need to have associated grammatical features, which Chomsky suggests are substantive categories like noun, verb, adjective, and so on.

A word then is required to encode a concept and grammatical properties, particularly substantive category membership and certain other sub-categorisation features. It is assumed here that this generally represents what constitutes word meaning and word learning for Chomsky.

Although geared towards the requirements of generative theory, this view of word learning and word meaning is one commonly held in many theoretical traditions. Such traditions have focussed almost exclusively on concepts of kinds or artefacts:

> "Some have said that those interested in categorization think that concept is spelled 'N, O, U, N'" (Medin & Smith 1984)

There is, however, no agreement about what a concept is and theories range from definitional categories (Keil 1987, 1996), to prototypical categories (Rosch 1978, Lakoff 1987), to a syndrome of innately specified conceptual primitives (Fodor, J.A. 1998, Margulis 1998).

All of these assume a learning process from the particular to the general. Experience of exemplars enables a clustering together of definitional, prototypical

or innate conceptual primitives into coherent categories which indicate a concept, and which can be labelled by a word. But words are known to be notoriously imprecise and open to much pragmatic interpretation (Carston 2002). For instance, the word 'red' can be thought to label a colour concept. An object described as a red apple, should therefore be decoded as an object – apple – that is red. But red apples may not be completely red, the skin may be green in part, and its flesh may not be red at all. A set of books organised by colour coding marked by a red adhesive dot, may be referred to as the red books even though their covers may be any colour other than red. Further, Carston points out that the word 'open' may encode a single general concept but more specific concepts, like the manner of opening, must be derived from context.

The following is a selection of Carston's examples (Carston 2002 p325):

(24)

a) Jane opened the window.
b) Bill opened his mouth.
c) Sally opened her book to page 56.
… …
g) The carpenter opened the wall.
h) The surgeon opened the wound.

The flexible use of words is particularly noticeable in various tropes:

(25)

a) You're a parrot (Mother to 2 year old son who frequently repeats what she says) - Metaphor
b) I've got millions of examples – Hyperbole
c) A gift from the government (a tax demand) – Irony.

To account for this apparent flexibility a code model needs to propose massive polysemy, i.e. a word encodes many differing concepts. The alternative is to propose that a word does not encode but indicates a conceptual content, contextually derived from existing knowledge and experience.

There is little evidence that infants under 2 years old have an understanding of tropes as in (25) above even though adults use such in addressing them. Infants do, however, have daily experience of words used in differing contexts, which demands that meanings be interpreted flexibly. The process of labelling or

mapping words to concepts will result either in a range of entries of the same ostensive word mapped to different concepts or a single word which can point towards conceptual content which itself is subject to contextual flexibility. The former would honour the labelling or mapping process but be very uneconomic in terms of memory; the latter would be economic but present potential problems for a mapping process, and could be thought to present the infant with too much potential flexibility to arrive at any certain semantic value for the words she acquires. The problem can be resolved by extending the notion of 'contextual funnelling' further to the dynamic substantive layer of the organisation of subjective experience (Chapter 3 section 3). This demands that words are initially learned as mapping to events (and their participants). Clarifying how this may work will entail considering concept development from an analytic rather than synthetic viewpoint.

2.1 Global categories

Mandler (2008) pointed out that experimental work on object category/concept development frequently focuses on a passive, watching child skewing the results towards perceptual differences between objects in vaccuo.

A great deal of early psychological research into word learning took a referential mapping process for granted and concentrated on how infants form categories from instances, and what aspects of objects or entities are critical for category/concept formation. Properties of various kinds have been found through experimentation to contribute to infant categorisations including perceptual cues: shape, texture (Krojgaard 2004; Jones, Smith & Landau 1991; Jones & Smith 1998; Markman 1987; Wilcox 1999); functional cues: uses, affordances (Jaswal 2004, 2006); intangible cues: creators' intentions (Bloom 1998), essences (Gelman & Wellman 1991).

An alternative is presented by Barsalou (1983, 1987) who showed that, concepts as categories are not stable enough to enable a secure mapping process. Stereotypical membership of a category can vary according to different contexts. From a number of experimental studies, he cites 3 key contextual conditions which affect judgement of stereotypical or 'most typical' category membership:

i) He found that different determinants may be used by respondents in deciding the typicality of category membership, depending on how respondents stereotype exemplars, or if they apply ideals which can vary from context to context. For instance (Barsalou 1985), respondents were asked to select characters, described by their interests, their occupations, and other features, as appropriate for performing certain unrelated tasks e.g. 'Choose the person who would be the best programmer of Q.' then 'Choose the programmer of Q who would be better able to teach how to cook Indian food'. There was no consensus between respondents.

ii) Linguistic context has a strong influence on decisions of typicality. He cites the example of typicality decisions for the category ANIMAL. When most typical category members are elicited in the context of 'milking' then 'cow or goat' come to the fore. When considered in the context of 'riding' then 'horse' or 'mule', become more typical.

iii) The third contextual effect he considers is point of view and respondents' cultural or occupational background. Experimental evidence showed that when asking for typical membership of the category BIRD, American respondents cited 'robin' and 'eagle', whereas Chinese respondents cited 'swan' and 'peacock'.

> "such flexibility indicates that graded structure does not reflect some invariant property of categories--there do not appear to be invariant structures that underlie categories. Instead such flexibility suggests that people's perception and structuring of categories is a highly dynamic and context-dependent process." (Barsalou 1985 p646)

From this range of research, he concludes that

> ".. Invariant representations of categories do not exist in human cognitive systems" (Barsalou 1987 p114)

Ad hoc categories can be formed which are highly personal or temporary and would not readily be accorded the status of concept. For instance a temporary ad hoc category of 'things I can use to keep open the door of my non-working refrigerator placed in the garden' might yield an idiosyncratic category set. This presents a problem for the 'mapping to category' process, if words are to map to a moving target.

Barsalou (1999) promotes the notion of a modally coded conceptual/knowledge system based on perceptual elements. Partial generalisable perceptual information is stored along with contextual and attitudinal information drawn from experience of instances. Aspects of this information (perceptual, attitudinal, contextual) can be called forth as required.

He presents empirical evidence of the close coupling of perceptual and conceptual information in adults (Barsalou 2003). One such set of experiments involved fMRI scans showing that when participants are invited to form concepts of tools there is a neural response in the same area as when actually handling the tool, this response can also sometimes be observed physically. In another experiment participants were asked to list features (not word association) which relate to a given concept (presented as a word). When given 'lawn' the features offered were different from those when given 'rolled up lawn' as the stimulus, in that the latter included features that are generally occluded. So participants were more likely to mention roots and soil in the latter case, as if given access to otherwise hidden features, which could only become available from a perceptual representation. This and other experiments appear to show that responses seem to be to the image of the given stimulus rather than any logical properties. In another set of experiments (reported in Barsalou 2003) on feature reporting, half the participants were asked actively to visualise from a given stimulus sentence, and the other half were given neutral instructions. The expectation might be that visualisation would require greater processing time. The finding of response times showed no difference between the groups. A possible conclusion is that all respondents formed images. Image making or perception based conceptualisations are not constructed consciously, but they provide a wealth of useable information to include object perception, possible contexts, uses and potential actions, and therefore generate a wide range of inferences.

If Barsalou is correct for adults, then studies with infant participants should exhibit evidence of this at its inception, but as Mandler (2008) has said, the way infants organise their wider conceptual knowledge is frequently hidden by the design of experiments which seek to reveal infant responses to object reference. It is therefore inevitable that much research finds that (visual) shape differences contribute to or form the basis for object concept formation, when that is the only

strategy available to subjects to achieve the goal of the experiment. Inevitably, concomitant concept/word mapping is limited to the same degree, and results in a view that words reference static objects, and the dynamic properties of objects within an event are to be discretely conceptualised as actions or activities and therefore lexicalised as verbs.

In over a decade of research, Mandler (2004a, 2004b, 2006,) Mandler and McDonough (1993, 1996, 1998a. 1998b, 2000) and also McDonough (2002) and Nelson (1985, 1996) have been presenting an alternative, and for the present purposes, highly relevant, approach. Their hypothesis is that object recognition and conceptualisation occurs within a wider context of experiential knowledge and that global categories form first, from which constituent categories or subsets are distilled. Their research is of the following type.

By using a different test measure to ensure infant involvement and active participation in experiments, Mandler and McDonough claim that infants' productive knowledge becomes more accessible for investigation. An experimental design which no longer simply focussed on static objects and passive observation was developed, and a participatory and purposeful event structure was introduced, more in tune with an infant's daily experience. Over the period of the research, experiments were conducted with 7-14 month old infants.

The model adopted is one of deferred imitation. An event is demonstrated to the infant in a play-type environment, the infant is then left to play freely with the toys. Infants willingly, with little prompting, attempt to imitate the actions they have seen. So, for example, the infant is presented with an array of model animals, vehicles and a cup. The demonstration is to act out one of the animals drinking from the cup. The model animal used for the demonstration is removed and the infants are left to play and invited to copy the experimenter if they wish. Across all participants the choice of model to enact the drinking event was chosen from the set of toy animals and not the vehicles.

By the same token, when fuelling events were demonstrated, involving the vehicles and the cup, infants chose vehicle models to replicate the event, not animal models. The conclusion drawn from this and other control experiments is that these infants have a global concept of animate versus inanimate, which brings

with it expectations of certain generic properties – animates can drink, vehicles do not, although they do take on fuel. Experiments with progressively older infants show that they gradually make functional distinctions between the animal figures attributing different generic activities to four-legged animals, birds then fish. Quite expert distinctions are quickly made between vehicles which are four wheeled, two wheeled, boats and so on, depending on the infant's experience and cultural norms. The researchers suggest that the Californian infant participants had extensive experience with vehicles which they did not have with birds or fish.

The proposal is that global categories form first, in relation to early acquired generic knowledge. Animals drink but vehicles drive. Further work tested how infants grouped household objects, and found that global categories of objects found in a specific location like 'kitchen-things' or 'bathroom-things' formed before children fine-tuned their distinctions to narrow object classes, like cups, or cloths.

Mandler maintains that infants form global categories first, in line with their subjective experience and elements or objects within these global categories are recognised and distinguished initially by perceptual re-description. The formation of subcategories becomes increasingly refined dependent on added knowledge from their subjective experience. Refinement is made, however, within a context of shared generic properties, e.g. kitchen implements can be individually perceptually distinguished but categorised as (say) 'visually distinctive kitchen things', before sub-categorisation into, knives; forks; spoons; cups and so on. The implication is that word learning may provide an anchor not only for object identification but also relevant generic (event) information. By this means a word like 'potato' could be constrained initially to the context of food/eating, and as the infant gains further experience of additional possible contexts like food preparation, then the vegetable in its raw state may be added, and also be included as being indicated by the word 'potato'. The global-to-particular process bestows many advantages. Words that are learned invoke not only an object but contextual information too, enabling the infant to use the word with communicative intent to convey a wider range of meaning (reliant on a hearer being able to infer contextual meaning). Without this facility, word learning and use could only function as retaining and reciting inventory lists.

2.2 Generic utterances

Much of the above discussion has been directed towards making the case that infants' learn about, and form concepts of objects in, and reflecting experiential contexts. Objects in such a context are not simply part of a static display but are integrated with associated activity and actions, a notion supported by adult input during CDS, (as shown in Chapter 3 section 1.2). Infants appear to assume that adults are providing positive evidence, when they develop their event knowledge and are flexible in how they relate words they learn to this knowledge, to the extent that they will trust an adult's designation of an event over prior object word mapping. Grassman & Tomasello (2010) found that 2 year olds (in common with 4 year olds in the study) were willing to disregard lexical reference in favour of adult ostensive pointing in responding to requests. The infants were shown two objects, one familiar (a car), and one unfamiliar, and asked by an adult pointing and looking at the unfamiliar object to give her the car. The unfamiliar object was selected. When the experimenter pointed to the car and asked for the 'modi', then the car was offered. Grassman & Tomasello conclude that the infants used pragmatic strategies to identify the required object which overrode their lexical knowledge. This would not be the outcome if there was a tight and exclusive mapping between the word 'car' and the concept CAR, the infants would simply have been confused.

So, my claim is that if words map to concepts, it is a very flexible process. This can be achieved if concepts emerge from infant global categories, mapping will then include associated contextual information relevantly defined from within infant Generic Knowledge.

A comparable type of conceptual knowledge is operative in adult cognition and made evident through generic utterances. This may well have its origins in early infancy.

Leslie, S-J. (2007, 2009, 2010) has conducted research into the semantics of generic statements like 'ducks lay eggs' or 'tigers have stripes'. In most settings, adults judge them to be true even though on reflection it is clear that they are not true at all. So, not all ducks lay eggs (male ducks do not) nor do all tigers have stripes (albino tigers do not).

Her account of generic statements suggests that a quantifier GEN would provide the appropriate contrast with 'all' or 'some' or numerical quantifiers. But no known language has a GEN quantifier. Leslie draws on psychological evidence in support of her account claiming that the way infants organise their knowledge involves generic type generalisations. She suggests that GEN is a default quantifier and therefore requires no overt marking. She cites Hollander, Gelman & Star (2002) whose research showed that 3 year olds tend to interpret the quantifiers 'all', 'some', 'most' as generic whereas 4+year olds do not. Her conclusion is that GEN is learned before other quantifiers and is an intuitive means of organising knowledge, i.e. that the most basic means of forming a judgement is not 'how many' but more a focus on how striking or important information appears to be. Generic information does not stand up to scrutiny, but provides an intuitive organisational strategy to capture what might be useful information, even for sophisticated adults. The sun neither rises in the east nor sets in the west, yet this is a common means of dealing with complex scientific material on a day to day (sic) basis.

For young infants at a very early stage of organising their limited but quickly growing knowledge of the world, basic rather than statistical judgements appear to be necessary. They lack the experience to make reflective quantifiable judgements. The implication is clearly that infant generalisations have a generic quality, based on syntagmatic rather than paradigmatic relations, and also exhibits abilities in event mapping.

Examples from the CHILDES/Manchester corpus show both infants, and adult CDS, investing in generic information around objects/entities

(26)

a) CHI: cake … nice party … a party …yum …yum on birthday (comment on a model cake)
b) CHI: daddy's up (comment on a picture of a ladder)
c) CHI: fireworks go bang
d) MOT: daddy comes home for dinner
e) CHI: not eat boys (of snakes)
f) CHI: dustmen take that (of rubbish)
g) CHI: Ooo … Chocolate … mess … clean it (comment on a toy bar of chocolate)

These and examples already made (Chapter 3 Section 1.2.1), show infants and adults focussing on generic expected processes and outcomes to events. In (26g) the object is a plastic toy, but the infant expresses not only her view that chocolate can be eaten "Ooo" but also explicates from her experience the expected aftermath: "mess … clean it". It could be that for this infant this collection of relevant generic events contributes to her understanding, i.e. this is what chocolate means for her.

As Mandler has proposed, objects are conceptualised because they are associated with actions, which provide a focus not only on the object, but also on an object's dynamic potential. This potential may also be considered an integral attribute of that object, and words therefore may 'label' the whole. Perhaps the closest example from adult English is the word 'drink' which is attributive of a substance but also expresses a generic, associated action event (or alternatively indicative of an action event with a generic, associated substance).

Remembering that infants approaching 2 years of age have limited experience, and also mindful of the 'contextual funnelling' effect of subjective experience, it would appear to be inevitable that early word learning would focus on objects and actions. I am claiming that word mapping is less a matter of traditional concept labelling, but more one of generic object-event mapping. This proposal is reinforced when considering the traditional notion of word / action concept mapping.

3. Mapping words to action categories

Although the category labelling approach can be unsatisfactory for object categories, when it comes to stand alone categories of movement (let alone other conceptual elements that verbs are used to express) they become extraordinarily difficult to identify.

Consider the following version of Pinker's bootstrapping example (previously discussed in Chapter 2 Section 1 as the basis for SeB), where a child observes a scene accompanied by the utterance:

(27)

'the boy threw rocks'

It is assumed that the infant will identify 'the boy', 'rocks' and 'threw', and the proposition throw(x,y) is evoked where x=boy and y= rock. The word 'throw' is assigned by linking rules to the verb category as the predicate. If, however, the meaning of 'threw' is based on observation, an immediate Quinean problem presents itself: how does 'threw' relate to the elements of the action. (4 elements are identified here but there could be many more depending upon the degree of detail):

(28)

a) The boy picks up the rock with the intention of throwing it.
b) The boy draws back his arm and moves it forward rapidly.
c) The boy moves his arm forward rapidly and releases the rock.
d) The rock travels through the air away from the boy. It is at this stage that throwing can be confirmed by backward projection i.e. the rock has been thrown.

What becomes problematic is the identification of which of the above 4 stages, each with perceptual event boundaries, define 'throw':

- The boy's initial actions and intention? - (a)
- The boy's posture and arm/hand movement? - (b / c) or
- The rock's eventual movement and trajectory? - (d)

'Throw' in this context seems to involve all 4 stages as a complete event. Thus the meaning of 'throw' depends on (following Tomasello Chapter 2 Section 3) a 'thrower' and a 'throwee' and the relation between the two describes 'throw'. Unlike Tomasello, however, who assumes that the conceptual content of 'throw' is separable from the participants, it must be noted that 'throw' indicates two events: a causative intention in action from an agent (28a) (the boy), and a resultative action on a Theme (28d) (rocks). The meaning of the word is closely bound to the context provided by the participants and their capabilities in contributing to the event. In fact, it is extra-ordinarily difficult (perhaps impossible) to visualise the action 'throw' without any participants. Attempts

have been made to discern the nature of action concepts, which become the target for a mapping process.

> "It is important to note that achieving insights into the verb learning process is tantamount to achieving insights into the acquisition of grammar because so much of the sentence revolves around the verb... Discovering how children extract categorize, and label actions in their environment is crucial to unmasking how word-to-world mappings take place" (Golinkoff Chung, Hirsch-Pasek, et al. 2002 p613)

In addressing the problem, Golinkoff, Chung, Hirsch-Pasek, et al. (2002) transposed movement and action events into point light displays. They then researched whether 3 year olds could recognise the movement types and attribute similarities. Their motivation followed Mandler's (1992) proposal that infants build image-schemata of objects, based on preverbal concepts of motion, path, containment and force which are continuous rather than discrete features of their movement. Where Golinkoff et al. differed was to suppose that image schemata could be formed without reference to objects.

From their experiment, Golinkoff et al. proposed that the 'essence' of movement events is recognisable, which would contribute to category formation of movement events on to which words (verbs) could be mapped. Indeed the 3 year old participants in the experiment could recognise similarities and differences between displays. Point light displays, however, are subject to a Gestalt effect in that they can be elaborated to appear as stick figures performing actions, - i.e. the object/entity is inferred and imposed on perception, as Golinkoff et al. appear to note:

> "… the word "run" refers to movement of the limbs (the manner of motion) on a forward path. When a child recognizes that "run" can be used to describe Fido and Daddy, the child has abstracted the invariants of running, namely, movement of the feet (whether two or four and in a particular way) on a forward path". (ibid p605)

What is problematic for this proposal that an infant will have, without doubt, been told that her 'nose is running' and also have experienced a physical realisation of the intention behind the utterance (she gets her nose wiped). She may also know about or have heard reference to a running tap, and equally her carer may go and run the bath for her. So 'run' does not always refer to movement of the feet, but rather some kind of relatively 'smooth, continuous flowing', which

can be effected in legged animates by movement of their legs/feet, otherwise other dynamic properties come into play. That 'run' generally has a first stop interpretation involving legs and feet is another matter, but so does 'walking', 'jumping', 'hopping', 'skipping' and other leg dependent actions. With an account that supports word/concept encoding, it might be argued that the word 'run' maps to a range of different meanings (polysemy), or that 'run' is in fact different words with the same pronunciation (homophony). However, a more likely, and economic proposal is the probability of a core meaning enriched by contextually drawing on knowledge and experience.

The fundamental question is whether action events can be defined as conceptually discrete from those objects/entities performing in them, and if not, how can the lexicalisation process be one of mapping, when, as will be shown, different languages frequently lexicalise the same event sequence in different ways. It appears that there is a real disconnect between how action events are structured conceptually and how they are described linguistically. That such variation is evident suggests that conceptual category mapping is probably not the correct process at work here.

3.1 Manner and path

Golinkoff, Chung, Hirsch-Pasek et al's (2002) example identifies manner and path as two variables (movement of feet; forward path) for the motion event, and these variables have become the subject of a great deal of research. Talmy's original research in the 1970's (and also reported in Talmy 2003) provided a more detailed characterisation of motion events, including figure/ground, and cause/enablement and agency, dynamic force amongst others. Golinkoff et al's 'feet' should ideally be considered under source of dynamic force, rather than manner. The reason why manner and path have found such currency, is the observation that many languages (Spanish and Greek have been the subject of much of the research), generally lexicalise the path of movement in the verb and the manner is frequently left to be inferred, or specifically stated through an additional (adverbial) construction. English, on the other hand, frequently lexicalises the manner of movement and specifies the path through a prepositional satellite. So for example:

(29)

[V] coding manner:

a) She ran in (the shop);
b) he hopped up (the stairs);
c) we shuffled in (to the college).

(30)

[V] coding path:

a') She entered the shop (running);
b') he ascended the stairs (hopping);
c') we approached the college (shuffling)

(It should be noted that there is an optional element here for English where examples in (30) go through felicitously when the manner is irrelevant or can be inferred).

Gennari, Sloman, Malt & Fitch (2002) found similar evidence for manner/path distinctions. Spanish, Greek and English subjects conceptualised manner/path sequences similarly when reported non-verbally (through similarity judgements), although they differed as predicted when reporting scenes linguistically.

Papafragou, Massey & Gleitman (2006) showed that Greek speakers were more likely to include manner information if it was highly relevant or could not be inferred from the path only utterance. They conclude:

> "Information encoded linguistically… is simply a pointer to much richer conceptual representations; rather than being constrained by the linguistic content of utterances, hearers can complete, expand, or otherwise enrich this content to arrive at what speakers meant" (Papafragou et al. 2006 B78)

Pulverman, Hirsh-Pasek, & Golinkoff, et al (2006) on the other hand note the range of elements that Talmy identifies for motion events, and recognise that very young infants can conceptualise fine distinctions and conclude that verbs do not label whole events but a subset of many semantic subcomponents of motion events. Given variation across and within languages, Pulverman et al. suggest that the acquisition process:

> " requires that the verb learning problem be solved anew for each verb learned and the most reliable solution varies depending on the language being acquired." (Pulverman et al. 2006 p138)

This item-based solution appears to be quite laborious and very far divorced from the type of fast mapping proposals made for object labelling. The problem appears to be deciding what subset of conceptual elements of a whole motion or action event should be mapped. It may not be beyond the infant learner to apply this effort, but a different line of enquiry will offer a better cost-benefit outcome. The question to pose appears to be: do verbs map to discrete concepts? It can be argued that what they indicate are relations (between objects/entities) and the assumption that the task is to conceptualise a relation without accounting for the related items is at the root of the problem.

Some researchers working on the acquisition of languages which are 'verb rich', (i.e. in CDS, verbs seem to predominate over nouns) have claimed that infants in this context first acquire more verbs than nouns. This proposal has been investigated by Imai, Haryu, Okada et al (2006) focussing on Japanese infants (learning a language with a high incidence of verbs without explicit arguments and distinctive verb morphology); Chinese infants (a language with high incidence of verbs but non-distinctive morphology) and English infants (high object focus and restricted verb morphology). The results showed that all children were able to name and acquire a novel word for a novel item before they were able to learn a novel word for an action conducted with the novel item. That is, the first assumption by all infants was that novel words label novel objects before novel actions.

Tardif (2006) considered verb learning in a more natural context. In the Chinese language learning context, the emphasis on verbs in CDS is apparent and infants seem to acquire more verbs than nouns in early acquisition compared to English learners. To explain this, Tardif explores the differing nature of verbs in English and Chinese (Mandarin and Cantonese). According to her analysis, Chinese verbs are more specific of an object context than English verbs. For example, there are distinct words for several aspects of carrying. The distinction is made by implying the types of objects carried: on the back; held in the arms; flat on two hands; dangling in one hand. English distinguishes this information with an explicit object focus as in 'back pack'; 'shoulder bag'; 'hand bag'; 'clutch bag' and so on. They might well be two sides of the same coin supporting further

the claim that objects and attributed actions seem closely bound. This effect appears to apply as may be expected to other relational terms, like adjectives.

Waxman and Lidz (2006) suggest that a child's interpretation of a novel adjective is tied to the properties of the specific nominal element it modifies, and further that children's initial tendency is to extend adjectives very narrowly, as has been supposed of verbs. So, 'white' when applied to a cat, is extended to other cats but not generally to milk, snow etc. In fact, colour terms are notoriously difficult to 'detach' from specific items to form a generalised category. Sandhofer and Smith (1999), in a set of experiments to test the mapping of colour words to colour properties of objects, found that 2 year olds could answer successfully comprehension questions like "Show me the red one" which relies on word to property mapping and they could use colour words in answering "What colour is this?" whether their answer was correct or random. However, the infants had greater difficulty in abstracting colour in a property to property matching test, in effect answering the question "What matches this?" In this case, infants were more likely to match by similar objects (a series of different red cups for instance), than dissimilar objects (red cups and red blocks). One conclusion to the study is that infants have difficulty abstracting the colour property from the objects which have that property, and it is only after a period of time of actively labelling object sorts that property to property mapping becomes possible, matching red cups and red blocks.

It would appear that the conceptualisation of objects and their relational attributes are closely intertwined. Lexicalisation demands that this tight conjunction is in some way separated. The conceptualisation of a [coloured object] needs to be lexicalised as a [colour] and an [object]. This separation would appear to present difficulties to young infants, yet 'mapping' and coding rely on this ability. The problem is magnified when considering verbs; a [thrower] and [throwee] need to be an [entity + $action_1$] (causer and causative action) and an [entity + $action_2$] (undergoer and resultant action). The two distinct actions [$action_1$] and [$action_2$] then need to be merged and lexicalised together as 'throw'.

Verbs, however, are predicates over events which involve objects and entities, expressed as arguments. This is a linguistic device. The experimental approach has been to focus on observable, perceptual events, requiring a relation

to be abstracted from the object participants. If, as claimed, conceptualisation is based on experiential knowledge organised as objects/entities and the generic dynamic potential that can be attributed to them, then there is a mismatch between infant conceptualisation and linguistic requirements (English in this case). Thus mapping processes between conceptualisation and linguistic, syntactic devices cannot be direct. This underlines the difficulty of treating language as a conceptual coding system. A verb is a grammatical device, not a semantic category,

As introduced in Chapter 3, Tomasello and Kruger (1992) showed that new verbs were frequently presented to children by adults prior to or after performing an action. Tomasello & Barton (1994) conducted follow up studies and found that 24 month old infants could acquire the meaning of verbs used in an impending action (I'm going to plunk the doll) without prior knowledge of the nature of the event itself. Infants disregarded accidental, unintentional acts and only attended to the experimenter's intentional action, gauging intention from what the experimenter had said. This in effect is an event monitoring task for the infant and well within their ability at this age.

Although these experiments were designed to indicate the strong social effect of speaker's intention, these model utterances more importantly demonstrate word learning integrated with a whole event and not simply selected parts. That infants responded well to being given a global event from which they could distil/analyse out component elements, would be predicted by favouring an analytic approach rather than the synthetic approach generally adopted by mapping theories. In Chapter 5, I will show how utterances like those described in Tomasello & Kruger reflect the bootstrapping process for infant acquisition of verbs, not derived from adult intentions but from infant intentions.

But before doing so, there remains the problem of the status of the [V]erb category for the infant. Does she have such a category requiring a further mapping process, or is such a category not necessary for initial acquisition?

4. Grammatical categories and lexical under-specification

A standard assumption in linguistic analysis is that different languages and constructions within languages can be described with the same small set of

grammatical categories. Lexical categories including noun, verb, adjective, preposition amongst others, and functional categories like subject or object, are commonplace acting as a shorthand reference for descriptive purposes. As discussed in Chapter 2, Pinker based his semantic bootstrapping hypothesis (SeB) on the assumption that such categories are innately mentally represented and accessed through canonical meanings: nouns indicate objects and verbs indicate actions, although he had to adapt his view to account for categories being more 'fuzzy'. The view commonly held by generative linguists including VEPS is that such lexical categories are components of UG, and in the lexicon, words carry features identifying their category membership.

Other researchers, Ninio (1988) and Tomasello (1992, 2000a) simply deny the proposition, and Tomasello & Olguin (1993) and Olguin & Tomasello (1993) conclude across two sets of experiments that infants develop a category [N] by the time they are 23 months but by 25 months still do not have a category [V]. Valian (1986) presents similar evidence from a corpus analysis for the acquisition of Noun, Adjective and Preposition Phases. Valian's position, however, is that infants do have innate knowledge of such categories but lack the ability to assign the appropriate morphology.

These experiments rely on evidence of infants' use of morphological inflection to establish how categories are differentiated, which may indicate more about acquisition of inflection paradigms than the presence of mental categories. Langacker (1987) suggests a cognitive/conceptual basis where bounded entities are typically represented by nouns and processes by verbs although his approach allows for extensive overlap. The supporters of SyB (Syntactic Bootstrapping) identify verbs as those words occupying a defined slot in a syntactic construction. A wide range of word learning studies assume that (frequently nonsense) words will be interpreted as nouns or verbs as the experimenter intends. Given this diversity of viewpoints, the question posed for this subsection is how universal should grammatical categories be considered to be?

Cristofaro (2009) presents a detailed literature review to define how grammatical categories are generally considered. She concludes that traditional categories like noun, verb and so on, are not reliably defined across languages, a position supported by Baker (2003). His wide ranging review of world languages

makes him conclude that the only aspect that unites what can be defined as verbs across all languages is that they are licensers of subjects, and that nouns are bearers of referential index. No evidence exists that these categories have universal mental representation, and if they do not have a universal mental representation then their status as innate categories must be considered doubtful, until further research in neuroscience is conducted. Nevertheless, even as social constructs for metalinguistic discussion, grammatical categories are useful descriptive devices, and are by definition grammatical. Perhaps such categories are truly grammatical rather than conceptual and therefore acquired other than as the meaning of the word. Help in resolving the problem of whether lexical categories can be considered this way comes from a generative theory-internal debate between lexicalists and non-lexicalists.

As already described, Chomsky's generative linguistics and specifically the present Minimalist programme requires that items in the lexicon are specified for grammatical category (as well as for a range of other grammatical and semantic features necessary to establish a syntactic derivation). There are those who argue that this demands too much of the lexicon per se, but particularly it presents the infant learner with the problem of how words and their full feature specifications are learned. Although Pinker used semantic considerations to trigger innate categories, on the basis that nouns predominantly appear to be used to indicate objects or entities, and verbs to indicate actions, it is clear that these designations are not definitional. Nouns do not always denote objects and verbs do not always denote actions or motion. Particularly problematic are nouns which denote actions (destruction, movement, education) and verbs which denote states (think, want, reside).

As designation of grammatical category for words is so difficult, and as understanding the world, experiences and learning words, and developing physically and emotionally arguably occupies an infant extensively, do infant words really need initially to be fixed in grammatical categories at all? A key reason for assuming lexical categories is that nouns and verbs, for instance, exhibit different morphology, and have privileged insertion rights into the syntactic structure. Indeed, it is largely morphological evidence that Valian and Tomasello, and others, have used to define an infant's knowledge of lexical

categories. Current work on Distributed Morphology theory (Marantz 1998, Siddiqi 2010), suggests that the lexicon consists of a vocabulary (inventory of vocabulary items) and encyclopaedic knowledge (which may be stored elsewhere), and that word function and morphological form are provided from the syntax at insertion. The arguments for and against are theory internal and beyond the scope of the present work, but observations made by Barner and Bale (2002) from this standpoint are relevant and helpful.

Barner and Bale suggest that for an infant to learn the word 'water' she would need, within a lexicalist theory, to have at least five entries, which would represent an unnecessary complexity for the learning process:

Water – n. mass
Water – n. count
Water – vb. trans
Water – vb. intrans
Water(y) – adj.

The alternative is for the child to store the root word – 'water' - in the lexicon representing a sound/meaning relation and therefore having appropriate linkage to encyclopaedic knowledge. The alternative uses and any morphological changes are created in the syntax. The implications are that the evidence researchers find for lexical categorisation through morphological change (Valian, Tomasello inter alia) may be an artefact of the role a word is playing in the syntax, rather than any inherent properties of the word itself. Syntactic development is sufficiently underway by 25 months, so the data used for the category research is in fact already subject to the influence of an established syntax. The lack of verb inflection on words is licensed by syntactic principles recognised elsewhere as the optional infinitive stage.

In this research, I assume that grammatical categories are syntactic. That words used to indicate conceptual representations initially do not need to be subject to such categorisation, and that categories like [V]erb and [N]oun, [D]eterminer and so on designate roles words play in syntax. In this way, words are grouped into such categories courtesy of the role they play in syntax where categories are defined, not as an inherent specification of the word as it is acquired. This will also free the infant from any discomfort from having to know

that ‘drink’ is a noun or verb, or even a verby noun. Words learned are initially lexically unspecified.

This position does not preclude the development of categories of word types over time, nor, that adults may come to form some kind of mental representation of them. But analysts involved in initial word learning research have frequently had a mix and match approach to lexical specification, which provides conflicting and confusing results, requiring different means of accounting for noun and verb learning. By denying that infant words have grammatical category membership at the start, a unitary approach becomes available, which, as will be seen, is necessary when considering single and two word utterances, in the next Chapter.

5. Discussion

This chapter has considered four key areas:

i) The outcomes from simple initial abilities to map linguistic events to contexts.

ii) The relation between generic knowledge and word learning, drawing distinctions between analytic and synthetic views of word learning, and concluding that progressing from the global to the particular provides contextual relevance for words. As words are contextually sensitive in adult use, it is advantageous to infants that the words they acquire have similar properties from the beginning.

iii) When considering verb learning, the concept-mapping process does not appear to stand up. Objects/entities have integral dynamic properties.

iv) Grammatical categories are derived from syntax, and are not (initially) aspects of word meaning. By removing the need to distinguish between grammatical categories for initial word learning, the effects of the ‘contextual funnel’ can be seen more clearly. Infants have the contextual understanding to focus on objects/entities and their integral dynamic properties.

The conclusion drawn from Mandler & McDonough’s work is that knowledge of objects and entities builds on how they act within actual dynamic events. Objects and entities are conceptually indivisible from the events within which they take part. The predictability of events and how they unfold provides

stability for meaning attribution. Objects have generic event attributes and events have generic participants.

The overall conclusion, therefore, is that words when first learned are semantically underdetermined and lexically unspecified.

An implication is that utterances consisting of words so learned are without productive syntax, (holophrases and learned constructions have fixed structure). The point is now reached when the question of how syntax is acquired can be answered. What resources do infants bring to the problem of structuring a rich cognitive content into productive intentional utterances capable of being understood by others? How infant utterances become more productive in this way is the topic of the next chapter when talk in Manifest Events will be explored. A further highly significant metacognitive development occurring around 18months will be described. This development enables the collation of primary and secondary mental representations. This ability, in effect a much more elaborated and abstract type of event mapping, enables infants to express Complex Events, which demand conventional, linguistic devices for them to be communicable. The interaction between intentionality, elaborated generic knowledge and advanced metacognitive ability will be shown finally to bootstrap the syntactic system.

Chapter 5
Manifest and Complex Events

Introduction

The discussion in Chapters 3 and 4 set out some of the important elements contributing to a bootstrapping process which promotes infant language acquisition. Chapter 3 explored the nature of adult input through CDS and showed a focus on helping infants as intentional beings, to develop their knowledge of the world. A characterisation of Infant Generic Knowledge was presented describing what is stored as a result of infant generalisation of representations of her subjective experience of events of the world. Knowledge of this kind, is applied to new experiences and may be elaborated over time, nevertheless it provides the infant with stability to the world. It provides predictability. Infant Generic Knowledge as defined in Chapter 3 contributes to what is traditionally called 'semantic memory' in psychology, and also provides the means of understanding and comprehending the world, which will make a contribution to linguistic semantics. Knowledge of objects and entities builds on how they act within actual dynamic events. Thus, objects and entities are conceptually indivisible from the events within which they take part. The predictability of events and how they unfold provides stability for meaning attribution. For the infant, objects have event potential and events have expected participants, both derived from infant generic knowledge. It is this knowledge that infants drawn on when describing predictable situations which unfold in the here and now.

The outcome is such that the perceptual world of the infant presents itself as objects and kinds and their dynamic interaction within a human social/cultural and locational context with which the infant engages when relevant to her. Infants organise their experience of the perceived world as generalised goal focussed events and based on these, by event monitoring, have expectations about how events should unfold. In Chapter 4, I proposed that speech events are similarly monitored, enabling infants, from babyhood, to hear and organise speech sounds from the ambient language. These speech events, however, are assumed to be discrete and not correlated with other perceptual events. A meta-cognitive development, before 12months, enables infants to map together different types of

perceptual events and form generalisations between them. I have claimed that this prompts the mapping of speech events to other perceptual events. Evidence for this, is to be found in imitations, holophrastic expressions and word frames, which are tightly bound to specific contexts. These include greetings, and other social expressions, often strongly promoted by adults: 'hello', 'please', 'thank you', goodnight', as well as fixed frames like 'what you doing?', 'what's happening?' and 'what's this?' and so on. These expressions are a direct result of mapping CDS and perceived events. These utterances lack the productivity required for infants to create intentionally new or related contexts for personal expression.

In this chapter I discuss the beginnings of infant initiated, productive speech, and highlight a further meta-cognitive development which prompts a distinction between what will be called Manifest and Complex event representations and the utterances associated with them. Manifest Event utterances concern the 'here and now' and show how infants apply infant generic knowledge to become productive in intentional communication about perceived events. I will show that the new meta-cognitive development enables infants to collate two contrasting mental representations - the perceived with the mentally constructed and non-occurring, and that to make utterances about these Complex Event representations, demands that, linguistic devices specific for this task, are acquired. It is the productive syntactic system that meets this requirement. I will show through qualitative corpus analysis, exemplars of the contrast between utterances of Manifest and Complex event representations, identifying those grammatical properties which appear only in Complex event utterance types. This observation will be confirmed by an original empirical study reported in Chapter 6.

1. Utterances about Manifest Events

Verbal communication takes place between at least two participants, and early communication between infant and carer takes place in joint attention, which describes 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 'common ground' which includes the common knowledge of salient features of the event. Infants represent information from

shared events as common knowledge between infant and adult (Moll & Tomasello 2007; Moll, Carpenter & Tomasello 2007). This shared context provides the conditions for much of the support and input from CDS for infants to organise subjective experience as described previously as infant generic knowledge.

The shared nature of the interaction reduces the inequality between infant and adult. As shown by Trevarthen & Aitken (2001), the establishing of inter-subjectivity with pre-linguistic infants is marked by interactions typical of conversational exchanges, which were termed proto-conversations. As the adult is vastly more linguistically competent than the infant, this inter-subjective context not only allows for the sharing of events, but also enables a level of common ground where the infant derives an indication of how the adult talk is mapped to an appropriate event. Infants are very sensitive to adult intentionality (Baldwin 1991). Intentional labelling of objects by the adult is frequently accompanied by the provision of additional information which supports the infant's developing generic knowledge about those objects, through profiling of events within which objects/entities can participate.

For instance (from a conversation between a mother and her infant overheard in a supermarket)

> "This is a courgette. We'll buy some of them and cook them up for dinner. That will be nice, won't it?"

Csibra & Gergely (2009) propose that human communication is specifically adapted to allow the transmission of generic knowledge between individuals, as natural pedagogy, at this early time.

So, from any theoretical standpoint, this close level of inter-subjectivity provides a compelling context for imitating adult talk either to build a repertoire of constructions or, as supporters of generative linguistics agree, employ imitation as one of several strategies towards parameter setting (Crain & Lillo-Martin 1999).

The communicative outcome of infant talk in this context is frequently descriptive and confirmatory of both participants' shared experience, in the here and now. The following examples from the CHILDES/UK-Eng/Manchester

corpus illustrate infant utterances accompanying adult/infant engagement with toys.

(31)

a) sheep
b) red teddy
c) big truck
d) man here

The contextual basis of this type of communication will be termed a Manifest Event: single, shared situations in the here and now, as perceived and mentally represented as actuality. Comprehension of utterances made in this context stands a good chance of being successful, as the situation is shared in common ground, although it may require greater pragmatic effort on the part of the adult to derive the infant's meaning, as these examples show:

(32)

a) cuddle juice biscuit
b) sky skip balloon
c) here's baby's the basket

Experience of the context of these utterances is necessary to be able to interpret the infant's communicative intentions in these instances.

Adults also typically expend effort in ensuring that what they say has relevance to the infant and is within her ability for understanding. These kinds of utterance were seen to be the hallmark of CDS in Chapter 3. The key feature of Manifest Events is that they occur entirely in the 'here and now'. The infant is forming, what Perner (1993) terms a Primary Representation, of the perceived present, which involves the infant drawing on her infant generic knowledge to interpret and represent actuality: the current on-going events with which she is engaged. A striking feature of utterances, within this context, in the corpus material (Travis – Tomasello's diary data; and CHILDES/UK-Eng/Manchester) is that they depart rapidly from imitation, and infant two word combinations quickly exhibit features which are seemingly unlike adult utterances. There appears to be a general kind of productive utterance about Manifest Events: namely a focussing on the participating object/entity modified by expressing the dynamic or stative attribute which the infant finds relevant relative to her generic knowledge of that

object/entity. In adult terms, such utterances appear to be a combination of noun+noun or noun+adjective. The nature of such utterances is clarified below and my claim is that these, unlike the adult analysis, have a single syntactic structure.

1.1 Travis' earliest two word utterances

From 17 months Travis makes her first two-word utterances. Typically, they involve what might be analysed in adult terms as two nouns in combination, for example 'potato mouth'.

In the diary corpus, Tomasello gives a brief interpretive comment for each of Travis' utterances and in this case his comment is:

(33)
Potato mouth – it is in it.

Presumably Travis is commenting on putting potato in her mouth, and further, that she is probably commenting on eating a piece of cooked potato.

By conventional analysis the utterance is constructed as [N]+[N], and by conventional word-concept mapping, the words she uses are the result of having learned the labelling of the category POTATO by 'potato' and MOUTH by 'mouth'. But 'potato mouth' is not a well-formed syntactic construction in English. It is highly unlikely that she has heard this uttered by adults before, yet she offers this utterance as a serious expression of her intention to communicate that she is eating (a/some) potato.

There is no information about what motivated Travis to combine these two nouns. Tomasello gives no suggestion of the possibility that Travis is imitating stressed elements of the adult utterance:

(34)
(Don't) put that **potato** in your **mouth**

One conclusion is that Travis has created this utterance on her own, and the sentence structure appears to be productive, in that she also says around this time: 'ketchup mouth'; and 'cracker mouth'. Each time the use apparently describes her involvement in an 'eating event', so the combination is not randomly produced.

According to the analysis I have been developing, 'potato' and 'mouth' are not nouns for Travis. Rather, each word might be thought to map to conceptualisations derived from Travis' infant generic knowledge. 'Potato' is possibly indicative of a substantive object with edibleness properties, and 'mouth' a body part typically involved with edible things. The combination of these two words may be motivated by inferential association with 'edible'. But Tomasello's interpretation in (33) above does not suggest that he interprets Travis' utterance as referring directly to an eating event.

My account, however, suggests that synthetic combination might not be the process at work, i.e. the simple conjoining of discrete items. Rather, by supposing that Travis goes through an analytic process, from the general to the particular, yields more insight. On this account, 'potato mouth' expresses at least the following conceptual content, (which has to be expressed in words here but is obviously mentally represented in other ways reflecting the 'contextual funnelling' effect, previously discussed):

(35)

a) I am eating a potato which is typical for my social/cultural context
b) I am eating a potato in a typical location for potato eating.
c) That I am eating a potato is the event I wish to share
d) It is me who is the intentional instigator of the eating and the speaking events
e) To convey this experience verbally, 'potato' signifies the type of edible thing concerned and 'mouth' provides a contextual modification by indicating a location where things that are edible go, elaborating on the fact that the edible nature of the potato is being realised in actuality.

These five areas represent the important contextual understanding for the utterance. Travis then describes the experience she wishes to share in terms of the infant generic knowledge of the substantive object and its dynamic properties. She therefore undertakes to describe the substantive object participant in the perceived event – potato - which conveys its concomitant properties (socially acceptable edible thing), and to emphasise that the edibleness of the potato is manifest, a location is specified through 'mouth' (body part socially acceptable for receiving edible things).

'The eater' is herself and not relevant to make explicit and 'eating' is an action which can be inferred from the properties of 'potato' and 'mouth'. In this

way, Travis is not building a sentence from constituent parts, but indicating participants relevantly modified to express the whole event she is conceptualising.

Many of Travis' object-object utterances about Manifest Events exhibit a similar approach, a selection of these are exemplified below (Tomasello's interpretation is given and Travis' age at the time of the diary entry is indicated in months and days):

(36)

(a) Mommy chair – *mommy is painting chair* (17.15)
(b) Ball mommy – *throwing ball at mommy* (17.18)
(c) Mommy dirt – *mommy is shovelling dirt* (17.22)
(d) Apple pillow – *a piece of apple is stuck in the pillow* (18.0)
(e) Hands water – *washing hands* (18.02)
(f) Ketchup mouth – *eating it* (19.00)
(g) Sugar coffee – *Mama is putting sugar in coffee* (19.04)

For each of these examples, the first word suggests the topic or the focus of the perceived experience and the second a modifying location which complies with Travis' infant generic knowledge. The type of activity involved between these two conceptual elements must be inferred either directly from the perceptual context (all utterances accompany Manifest Events and are therefore in physical and cognitive common ground with the adult) and/or from the generic properties of the objects/entities concerned. This makes it unnecessary to express actions explicitly, and enables utterances to be made with a limited vocabulary, or limited understanding of the processes involved in the event described. For instance it is not until 19 months that Travis acquires the word 'eat' when she says

"cracker mouth …… eat-it ….. mmm"

In this case as Tomasello's transcription implies these are 3 discrete utterances. (The nature of 'eat-it' and other such expressions will be shown to be significant for the bootstrapping process and is a feature of Complex Events.) This account favours an inferential model of language. To indicate an object participant and location of culmination, while leaving the adult to infer the infant's meaning from what is said along with the available context, is a highly efficient means of communication with limited linguistic knowledge, especially when about Manifest Events.

1.2 Dynamic and stative attributes of event participants

As discussed in Chapter 4 (section 1.3), Bloom, Tinker, & Margulis (1993) found that object labels contributed to about a third of the infant lexicon. Apart from holophrastic expressions, and set word frames, the infant lexicon has a number of words expressing relational concepts. Travis is no exception.

At 17 months Travis makes two similar utterances on different occasions. These are: 'coffee hot' and 'hot coffee'. The word order appears not to be critical, as her meaning seems to be identical. (Travis will most probably have heard 'hot coffee' and 'coffee's hot' spoken by adults). It would be reasonable to assume that coffee is a regular feature of this (American) household, and that adults may have drawn her attention to coffee being hot for safety reasons. Travis should, therefore, have a generic understanding that coffee is a hot substance. If that is the case, her utterance serves to make explicit and share her understanding of the properties of coffee according to her infant generic knowledge. If, on the other hand, Travis has the additional knowledge that coffee can be a hot substance which can become cold, then her utterance serves to make explicit which of the two (for her) generic properties of coffee is applicable in the present.

As infants expand their infant generic knowledge of the world around them, it is apparent that objects/entities may have more than a single generic event potential and there becomes a need to make more explicit which one is intended in a communication. For instance, from the Manchester corpus data, the dolls they use appear to be known by several infants to be in one of two states either sitting or standing. It is assumed that these figures, provided by the researchers, are such that they are articulated at the waist to adopt one of two positions – bent at 90 degrees or straight. To differentiate and make explicit which generic state an infant wishes to indicate, infants use two expressions, recorded as: 'doll sit' or 'doll stand'. In a similar vein the (toy)trains infants are using appear either to fit on the track or come off the track, expressed by several infants as 'train fit' or 'train crash'.

In cases such as these, the event being described focusses on a substantive object and additional descriptive information about its properties is made available. This additional information is sourced the infant's generic knowledge of that substantive object. As proposed in Chapter 4, objects and entities are

conceptually indivisible from the actions or dynamic processes they are known to perform. The closest example to adult thinking may be (in British English), ‘a spinning top’ which describes a traditional toy both in its static and dynamic state. When it is made to spin, it can equally be described as ‘a spinning top’. This toy, then, is an object which has the potential to do the only thing that it is known to do, and the expression ‘spinning top’ captures this.

For an infant, this type of expression frequently appears in utterances about Manifest Events, and uses adult verb-like words, although they are non-finite and function more like adult adjectives. Dynamic action is conceptually identified as a generic property of an object/entity. I propose that the conceptual integration of objects/entities with their generic dynamic potential implies that infant syntax as yet does not accommodate a verb category. At this early stage, it appears that infants have a substantive word class and modifiers, which explicitly express properties available to the infant from her infant generic knowledge in the context of a Manifest Event. Many examples place the substantive item first possibly supporting a topic/comment utterance type. In this way the infant is capable of uttering a large and productive set of expressions which signify that, according to an infant’s generic knowledge, an object that has the property X, is exhibiting that property at present. In the context of these early Manifest Event types, the two word utterances that adults might analyse as noun-verb combinations are in effect representing a substantive-modifier relation. The structure represents an on-going inherent relation between an object/entity and its dynamic properties. This differs substantially from adult usage, as examples from the Manchester corpus show. Although the content for the infant is sourced from her generic knowledge, she is not making generic statements in the adult sense of ‘babies cry’ tout court. Rather, her styatements have a generalised semantics signifying: ‘what is happening with X here is an example of what I know about Xes’

(37)

(a) Baby crying (babies cry, and that is happening)
(b) Swimming hippo (hippos swim and that is happening)
(c) Juice drink (juice is drinkable, and that is happening)
(d) Doll sit (dolls sit and that is happening)

The same relationship obtains for these examples from Travis, as in the following examples:

(38)

(a) coffee hot – *reaching for coffee (17.14)*
(b) hot coffee - *looking at it (17.14)*
(c) Turtle pillow – *pillow in shape and colour of turtle* (18.07)
(d) Ice-cream milk – *to a bowl of melted ice cream* (18.17)

What unites the utterances in these examples (37 and 38) and those above in (36) is that they are each describing a Manifest Event and involve the infant recognising that the object is functioning as expected and sharing what she knows about this functioning relative to her infant generic knowledge.

Noun+Noun constructions are permitted in adult English and are highly productive – cake tin, newspaper cutting, knife attack and so on, in this case one noun mirrors an infant-type modifier. My claim is that infant apparent noun+noun utterances also involve a substantive-modifier relation. The possible syntax of all utterances of Manifest events is explored next.

1.3 The syntax of two word utterances in Manifest Events

All these productive construction types exhibit a semantic relationship with what Perner (1993) terms a Primary Representation of the perceived event, but they are also linguistically two-word utterances, as opposed to two one-word utterances. They should therefore have some principled internal linguistic structure.

In acquisition studies of two word utterances, word order has received a great deal of attention, in proportion to the theoretical background of the researcher. Those from a generative standpoint wish to demonstrate that due to full competence two word utterances will reflect the roles the words would play in a well-formed syntactic structure, with discrepancies explained by performance limitations (Pinker 1995). Emergentists tend to describe infant grammar as discrete in itself and track how constructions develop towards the adult target as the infant gains more experience. An immediate problem for the latter group, as Braine (1976) has found, is that corpus material, however widely sourced, can only provide a snapshot in time, and the detail of developmental changes tends to

be masked. Comparison between corpora is difficult because of the differential development and experience of infants. Matching by age and experience, both cognitive and linguistic, is necessary, but extraordinarily difficult when using corpora from a wide range of sources. This presents no problem to the committed generativist, as the target language is known (to a degree) and so any corpus data can be scanned for evidence of the effects of UG.

The reliability of the data for analysis is an important issue: is infant data a valid source? Wexler proposes (discussed in Chapter 2 section 2) that insight can justifiably be gained from analysis of infant utterances; Rizzi and Fodor suggest that partial syntactic development can come on stream as required (Chapter 2 section 2), accommodated in my account as the 'acquire-as-required' criterion put forward in Chapter 3. What makes this a particularly relevant issue, is that not all infant two word utterances perform the same function. By simply analysing all two word utterances formally as two word sentences certain information is lost. Braine's (1976) detailed overview of different theoretical positions (at that date) shows that analysis of infant grammars could also be couched in terms of communicative intention. Braine groups the constructions that infants used, into 'pattern' types, which are suggested to express the following functions, among others:

(39)

actor/action relations: Kimmy running
locations of objects: juice here
possession of objects: mummy juice
negation: no juice
recurrence: more juice
disappearance: allgone juice
requests: want juice

Braine abstracts from this a pattern type, which he terms 'grope pattern' and which he sees as productive, developing from a freely ordered starting point, (groping) towards a combination having a fixed order, mirroring an adult-type construction. But this does not focus on the clear differences between function and structure. The adult constructions that should result from the utterances above vary. Compare for instance:

(40)

a) actor/action relations: Kimmy running > **Kimmy is running**
b) locations of objects: juice here > **the juice is here**
c) possession of objects: mummy juice > **this is mummy's juice**
d) negation: no juice > **there is no juice**
e) recurrence: more juice > **there is more juice (?), can I have some more juice, please?**
f) disappearance: allgone juice > **the juice is finished/ I have finished my juice**
g) requests: want juice > **I want (would like) some juice (please)**

The examples in (40a-d) seem to be different in kind from those in (40e-g), and seem to be 'groping' towards quite different constructions. Greenfield & Smith (1976) studied a detailed diary corpus of two children, each around 2 years of age, and showed that even one-word utterances reflected different functional relations. They showed that infants can communicate reasonably effectively using one word utterances, which frequently appear to pick out objects participating in an event experienced with an adult, but also express less manifest intentions.

Consider the following examples of the different uses of the single word 'mummy':

(41)

a) requesting something from her mother
b) giving something to her mother
c) identifying a coat as her mother's in the absence of the mother
d) indicating who gave the child an object in the absence of the mother
e) vocative to attract attention.

All research indicates, however, that infants go through a two word utterance phase however short-lived, with no available evidence that this phase is missed out. It is reasonable to suppose that this phase has a purpose. The conclusion follows that the two word utterance phase is indicative of the beginnings of some sort of syntactic growth, and worthy of description, in its own right.

The scope of published analyses of two word utterances generally assumes that the two word utterance 'stage' is uniform. In section 4 below, I will show how a significant meta-cognitive development enables a broadening of communicative intention which changes the nature of two+ word utterances.

Indeed, in comparing the functions of two word utterances identified above by Braine (very young infants) and one word utterances from Greenfield & Smith (two year olds), it is clear that they differ significantly, in the communicative intentions being attempted. As two word utterances are used for differing purposes, it may be advantageous to consider their underlying structure in different ways.

Given that a distinction between utterance types can be made, the immediate discussion will focus on the context of Manifest Events and utterances which express infants' primary mental representations of the here and now.

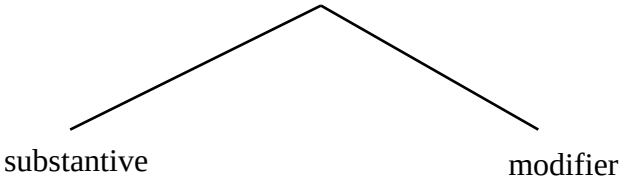
In a Minimalist generative framework, there is a basic operation, Merge, which can apply freely to lexical items and phrase markers but which is normally driven or constrained by the grammar-specific requirements imposed by lexical features of the items or markers involved (Adger 2003). It is assumed that, in this infant oriented framework, it is conceivable that if items have no grammar-specific features, then there are potentially no lexical constraints on their merging. Infants do not, however, combine words randomly in two word utterances.

When infants use language to describe Manifest Events, their intention seems to be to highlight features of these shared events. Utterances like 'baby crying', 'coffee hot' and 'potato mouth' appear to provide additional modifying information relevant to the dynamic or inherent properties of the substantive object involved in the event being described. Such entities are understood within infant generic knowledge to have contextually defined dynamic (and other) properties. It has been suggested (Chapter 4), that a word which indicates a substantive object/entity also makes these properties conceptually available. So coffee is hot and babies cry. Utterances like 'coffee hot' or 'baby crying' make explicit this knowledge. Interestingly, in the examples (38a and 38b) above, Tomasello's interpretation for 'coffee hot' and 'hot coffee' imply that Travis is reflecting on her knowledge of coffee states – in one instance she is reaching, in the other she is looking, and her communication may be to share or confirm her knowledge about coffee.

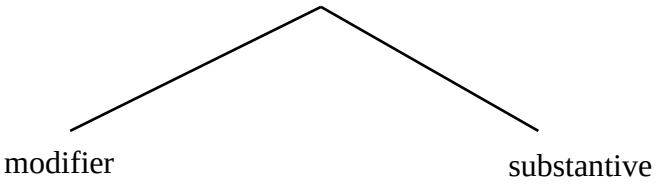
Thus words like 'hot' and 'crying' appear to semantically modify, or highlight conceptual properties of the substantive item which holds the focus of

attention. In all such cases there seems to be a strong motivation, to suggest that, early two word utterances involve a conceptually motivated merge operation.

This would result in a syntactic sister relation between [substantive] and [modifier], the word order apparently not being critical:



or



This raises three important questions:

1. What is the origin of these prototypical syntactic categories? And

2. Is the relation between [substantive] and [modifier] subject to free ordering?

3. What is the nature of the unifying node?

The first question is most easily addressed by recalling that the underlying conceptual structure is directly drawn from infant generic knowledge where (ref Chapter 3) infants are inevitably drawn to consider objects and their dynamic properties (the dynamic substantive layer). Substantives are perceptually recognised and knowledge of their dynamic properties is acquired. The suggested categories preserve the distinction between substantive and associated attributes, and it might be that infants replicate this distinction by establishing prototypical syntactic categories. Categorisation is recognised as a pervading human ability, and therefore the establishing of these two functionally different categories may owe something to innate endowment.

The second question involves discovering whether the changing word order presents a semantic difference between utterances.

Although ‘hot coffee’ and ‘coffee hot’ may be interpreted in a very similar way, there remains the question whether ‘potato mouth’ and ‘mouth potato’ have similar interpretations. There are no instances of Travis’ use of utterances like ‘mouth potato’ which could be due to a gap in the corpus collection. Alternatively it may be that for some reason this combination is not viable. There are, however, examples of productive utterances like ‘ketchup mouth’ and ‘cracker mouth’ which are recorded and have a similar ‘eating’ connotation. Nevertheless, intuitively, ‘mouth potato’ and ‘potato mouth’ appear to express different meanings (although the meaning of ‘mouth potato’ is elusive). Because there is a difference, it is questionable whether the word order is as free as it seems. Further examples help to clarify the position and suggest that word order is significant, but this rests on the proposal put forward in Chapter 4 that lexical items are unspecified for grammatical category in early acquisition, and that grammatical categorisation is derived from the syntax. Consider for example the following two recorded utterances from the Travis corpus (Tomasello’s contextual interpretations appear in italics):

(42)

(a) Mommy chair – mommy is painting chair (17.15)
(b) Mommy chair – pointing to empty chair (17.17)

(42a) has been considered earlier and was suggested to be a [substantive][modifier] construction, where ‘mommy’ is substantive and ‘chair’ the modifier expressing a known dynamic attribute of mommy (it is assumed that Travis has earlier seen her mother painting a chair).

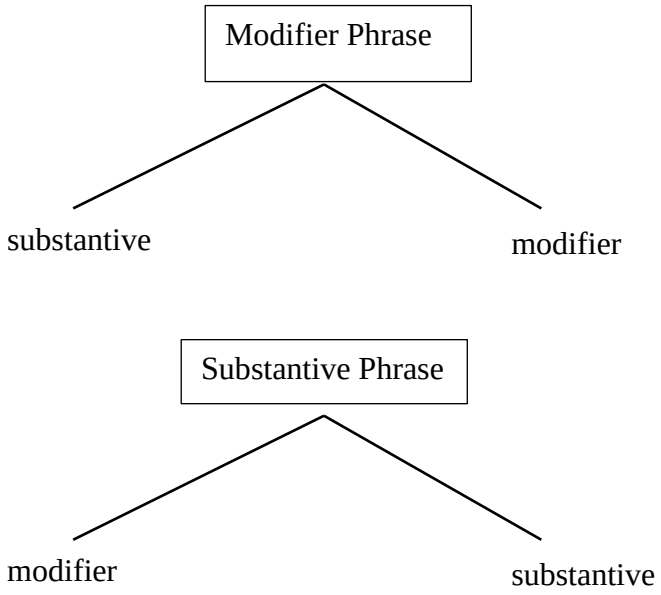
(42b) is a very different utterance. Travis appears to be conveying that the chair she is pointing to has a property which is attributed to mommy, i.e. the chair is mommy’s. In this instance ‘chair’ is substantive and ‘mommy’ is the modifier.

The two utterances can be syntactically differentiated as follows:

(42a') [substantive] [modifier]
Mommy chair

(42b') [modifier] [substantive]
Mommy chair

These examples provide compelling evidence for the substantive/modifier relation not to be one of free ordering. In suggesting a structure which captures the appropriate relation an answer to the third question is provided. (42a) is an example of a modifier phrase and (42b) a substantive phrase suggesting the following generalised structures



Thus all examples in (36) are of the [$_{mod}$[substantive][modifier]] type (repeated here for convenience)

(a) Mommy chair – *mommy is painting chair* (17.15)
(b) Ball mommy – *throwing ball at mommy* (17.18)
(c) Mommy dirt – *mommy is shovelling dirt* (17.22)
(d) Apple pillow – *a piece of apple is stuck in the pillow* (18.0)
(e) Hands water – *washing hands* (18.02)
(f) Ketchup mouth – *eating it* (19.00)
(g) Sugar coffee – *Mama is putting sugar in coffee* (19.04)

Consider the following examples:

(43)

a) baby crying
b) coffee hot
c) hippo swimming
d) crying baby
e) hot coffee
f) swimming hippo

The utterances (43a-f) are differentiated such that 43(a-c) are modifier phrases [$_{mod}$[substantive][modifier]] and 43(d-f) are substantive phrases [$_{sub}$[modifier][substantive]].

Although word forms that are considered verb-like in adult language ('swimming') occur in such utterances, these seem to be in the same kind of structural relation with the substantive as 'adjectival' forms like, 'hot'. As discussed further in Chapter 7, following Borer (1990), these can all be assigned to an inchoate modifier category.

The majority of productive utterances about Manifest Events fit this structure, which exclude those learned holophrastic expressions and word frames discussed previously (Chapters 3, 4 and the introduction to this chapter). This analysis cannot easily be applied to example (40g) above: 'want juice'. This belongs to a very different type of utterance, that about Complex Events. The distinction will be addressed fully in section 4.

The nature of Manifest Event utterance types are, however, highly limiting. This provides both advantages and disadvantages to the infant language learner. On the plus side, by talk being restricted to shared ostensive events as they unfold before the adult and infant in joint attention, the important elements of inter-subjectivity are reinforced. An easy conversational environment will typically provide emotional well-being and security for the infant, and the shared activity promotes mutual understanding. Importantly, it provides support for the infant in extending her knowledge base about what people do and the predictable functions and actions associated with objects. As has been shown, infants also have the opportunity for intentional linguistic expression, developing early use of the prototypical syntactic categories [substantive] and [modifier] and the basic syntactic principle of Merge.

On the downside, however, the communicative content is generally not descriptively informative. Even a cursory look at infant utterances shows that from 18 months or so, their expressions exhibit functionality beyond simple descriptions of the 'here and now'. They express intentions to do or obtain things not apparent in the 'here and now'. Having access to these increasingly complex intentions and unearthing the conventional means of expressing them linguistically necessitates further syntactic development.

2. Primary and Secondary representations

This section will begin to describe the elements which contribute to a significant growth in cognitive ability. This ability involves the interaction between Primary and Secondary representational abilities, which will be exploited fully in section 3. Prior to that a brief discussion of the difference between these two representation types will clarify what is meant by them.

Perner (1993) proposes that discussion about representation should draw a distinction between the representational medium and representational content. Using a military example he illustrates a scenario where, generals overseeing a battle, but not present on the battlefield, draw up a model in a sand tray displaying the relative positions of the soldiers, resources, terrain and other relevant elements. The model depicts the current state of play based on information received and is up-dated as new information arrives. In planning battle strategy, an additional model may be constructed to depict possible movements of troops or to present hypothetical outcomes. Equally the model may be altered to reflect either an earlier depiction or a desired end result. In each case the representational medium is the same (the battlefield) but the modes of presentation or models of the representational content are different. The models need to be kept discrete to prevent confusion between a hypothetical layout and the actual 'reality' of the state of the battle. Perner proposes that young children are able to develop and maintain such representational models in contexts appropriate to them.

Following Perner, two types of representational content can be identified as available to the young infant:

i) Primary representation which was identified as central to the discussion of on-going Manifest Events above, referring to the infant's updating model of the

'here and now'. Its construction relies on perceptual input, and existing infant generic knowledge. Primary representation captures an infant's awareness of actuality.

ii) Secondary representation will be used to characterise models constructed by the infant solely from infant generic knowledge. The outcome contrasts with Primary representation in that it does not directly mesh with the here and now.

Although the majority of interactions within Manifest Events involve Primary Representation as described in the previous section, there is a type of Manifest Event which involves only Secondary Representations. This is found in pretence scenarios and discussion of such will help to illustrate how Primary and Secondary Representations contrast.

2.1 Secondary Representations and Manifest events - pretence

Compare the following two scenes: two glasses are placed between an adult and infant, water is poured into each from a jug. The adult drinks one, and invites the infant to have a drink too. She chooses the glass with water in it, rather than the one the adult had just drunk from and emptied. The scenario takes place in real time in the 'here and now', and the conclusion is that the infant's awareness of the scene is a Primary representation.

Bosco, Friedman & Leslie (2006) used this scene with 16+ month olds to test for infant responses to pretence scenarios. The only difference was that there was no water. So the adult pretended to fill the glasses, pretended to drink from one glass, and invited the infant to drink also. Infant participants significantly chose the glass the adult had not used, and pretended to drink. In this instance the pouring-drinking event is brought to the child's awareness as a Secondary representation. It is constructed from infant generic knowledge and played out in the present, but is not a representation of actuality, as there is no water, nor anything to drink.

Research into pretence is wide and varied, and although the detail goes beyond the scope of this dissertation its fundamental structure relies on making Secondary representations manifest.

Bretherton (1989), for example, sees pretence as a precursor to socio-dramatic play, as a preparation for creating imaginative scenarios and directing others or being directed in various roles. Leslie (1987, 1994) sees pretence as the beginnings of attaining Theory of Mind and particularly being able to gauge the beliefs of others. Lillard (2001) suggests that pretence is comparable to the Twin Earth process from philosophy where children can try out potential scenarios and events. Nichols and Stich (2000) see pretence as establishing a mental possible world box. Clearly, pretence may serve all these purposes, but it is infants' linguistic responses which are of interest here.

Leslie's (1994) famous example of a child's mother pretending to use a banana as a telephone in the presence of her child seemingly presents a linguistic puzzle. Leslie illustrates the example pictorially. The image of a stylised drawing of a 'mother' smiling and holding a banana to her ear is bracketed by these labels (as if thought by the child):

(44)

<<Mother's behaviour - talking to a banana!>>
<<Infer mental state - mother PRETENDS (of) the banana (that) it is a telephone>>

Leslie's description of the pretence presents a problem. He focuses the nature of the pretence on an object, requiring the infant to find a non-existent substantive relation between a telephone and a banana. This has the result of suggesting that the scene challenges the infant's understanding of bananas and telephones. If the infant has a lexical item 'banana' for a banana and 'telephone' for telephone, then it is highly unlikely that properties of either would overlap enough for the scene to be comprehensible. The fact that infants usually understand such scenarios, has exercised researchers. Using the terminology developed here, Leslie is assuming the event to be in primary representation, and the banana/telephone (bananaphone) to be in secondary representation for the adult. Part of Leslie's solution is to suggest that the infant has a developing theory of mind enabling a 'mind-read' of the adult's intention. Without this sophisticated ability, the infant would not appreciate the banana as a telephone, it would remain a banana. Although it is increasingly shown that infants as young as 13 months old can be attributed with early Theory of Mind capabilities (Surian, Caldi & Sperber 2007) it is not clear how these capabilities are used in pretence scenarios.

There is an alternative approach which does not rely on speculative mind reading abilities in young infants. The fact the pretence appears to work is based on the event having scope over the object, not the object itself. The whole 'making a telephone call' event, not just the 'bananaphone', is in secondary representation, shared between adult and infant. Thus in Leslie's pretence example the labelling should more likely be:

(45)

<<Mother's behaviour – like a talking on the telephone event>> Secondary Representation
<<Infer mental state - mother PRETENDS to be talking on the telephone >>

The telephoning event is accessed from infant generic knowledge and requires a telephone object variable, which can be filled with any surrogate object, in this case a banana. The banana is a telephone in the pretence but (irrelevantly) remains a banana in actuality, with no confusion. This effect dramatically underlines the contextual influence on word meaning and word use discussed in the previous chapters. Experimental evidence in support of the notion of contextual effect can be found in Lillard & Witherington (2004) who studied the relationship between carer and child during pretence sequences. Their aim was to discover what communicative signals are given to the child to establish pretence rather than an actual event. Apart from smiles, specific eye gaze and body postures, a key element was that mothers repeatedly made an exaggerated showing and verbal explanation of the event sequence even though the events pretended were very familiar to the children. So, in a tea drinking pretence the preparing, making and layout of the scene was exaggerated and repeated several times, which served to reinforce the context of the pretence, and its relation to Generic Knowledge, which the infant either already has, or is developing. Thus it is the nature of the familiar event which defines its content. This provides additional support for the claim that conceptualisation proceeds from the global to the particular (discussed in Chapter 4). The global context defines the particular. This important support for infant learning was noted as an aspect of the input from CDS (Chapter 3 section 1.2.1ii). This ability to monitor events in secondary representation will be seen to be important in the discussion of Complex Events where the innovation will be the ability to monitor events across both primary and secondary representations.

As the pretence is a shared Manifest Event, utterances made need only be the same as those used to describe other Manifest Events. There are very few examples given of Travis' speaking in pretend play, although the following show clearly that the same expression can be used for Manifest Events both actual (Primary) and pretence (Secondary). Both examples exhibit the same [$_{sub}$[modifier] [substantive]] structure explored above.

(46)

Cooking dinner - *she is (pretend)* (19.26)
Cooking dinner – *she is* (21.01)

3. Collation of Primary and Secondary Representations

Around the age of 15-18 months, a meta-cognitive development enables infants to maintain two contrasting representations in mind at the same time. These consist of a primary representation – the mental representation of the 'here and now', and a secondary representation constructed from infant generic knowledge representing an alternative event or state change. The advent of this meta-cognitive ability is well attested in the literature including Piaget's well known observations described as Sensorimotor Phase, stage 5/6.

Zelazo (2004) proposes 5 levels of infant consciousness which gradually become available to infants each year, from unconscious action to various degrees of self-awareness. It is Zelazo's second level, during the second year of life, which accords with this collative ability. He terms this level Recursive Consciousness, and it functions largely as a means for comparison between representational elements recursively raised to awareness (Perner & Dienes 2003; Zelazo, Gao & Todd 2007).

Suddendorf & Whiten (2001) directly explore the ability to maintain Primary and Secondary representations in mind, and compare representational abilities of children, great apes and other animals. Infants are found to differ significantly from the other comparators. Eight unique developments of the 2nd year of a child's life are discussed and each attributed to Primary / Secondary representational ability, becoming more complex as the infant gets older. These are listed as:

Hidden displacement; Pretence; Means-end reasoning; Interpreting depictions; Mirror self-recognition; Attributing emotion; Attributing intention; Synchronous imitation.

The process Suddendorf & Whiten identify involves a Primary representation, a Secondary representation and a potential outcome from comparing the two. They term the comparing process 'collation' to emphasise that a 'side by side' comparison, rather than a higher level evaluation, is achieved. To illustrate, they analyse means ends reasoning in the following terms:

Primary representation: Perception – problem state

Secondary representation: Imagination – desired goal state

Collating mind: Means-ends reasoning – hypothetical path that can lead from one state to another.

A practical illustration of this facility in action can be found in an experiment by Liebal, Behne, Carpenter, & Tomasello (2009) Although the experiment was actually designed to illustrate infants' interpretation of pointing and common ground, I maintain that the success of the experiment is based on the 18 month old infants' ability to maintain two contrasting events in mind.

In the experiment, participants were 14 and 18 month old infants. An infant worked with 2 experimenters. The first experimenter (E1) played an insert tray game, encouraging the child to place objects in cut out sections on a tray. There was a piece missing (by design), and despite searching the table and the floor, it was not found.

The same infant then took part in a different activity in a different part of the experimental lab with a second experimenter (E2). E1 was not present. This activity involved a tidying up game, where objects on the floor were to be put in a large receptacle. As this activity was drawing to a close (no more objects on the floor) E1 returned to the room and unknown to the child, E2 placed an object behind the child.

For a significant number of older infants, if E2 indicated the presence of the object, the infant placed the object in the receptacle, but if E1 indicated the

presence of the object then the infant took the object to the insert tray in the other part of the room.

This response was significantly established for the 18 month olds but not 14 month old infants, who were successful when the experiment was redesigned to enable the adults' differing foci to be contained within the same event. The experiment was interpreted as showing the power of common ground in prompting an understanding of agent intention.

This is not, however, the full story. The experiment involved two distinct event sequences, in distinct locations, with distinct participatory objects and entities, for the infant: insert tray event vs. tidying up event. The difference between the younger and older infant participants rests on being able to maintain two events in mind at the same time: one manifest and the other constructed from memory. The experimenter E1 or E2 served to enable the infant to identify the events. That the 18 month old could maintain this two-event representation - one manifest and one constructed from memory - is a product of this cognitive growth – primary/secondary collation, resulting in what will be termed a Complex Event. The evidence that 14 month old infants could perform positively when the experiment involved two manifest events of primary representations supports this conclusion.

4. Complex Events

From the age of around 18 months, infants achieve a new cognitive ability, and are able to hold two contrasting representations in mind at the same time. Whereas previously infants interacted with the world through raising to awareness a single primary representation as a Manifest Event, or secondary representation as pretence, they can now collate contrasting primary and secondary representations 'side-by-side'. The collation of contrasting representations constitutes two sub-events which together form a Complex Event representation which contrasts with the previous single or sequenced Manifest Event types.

The ability to bring Complex Event representations (henceforth Complex Events) to awareness gives rise to two important developments in cognition each of which has a dramatic effect on infant intentionality and language development.

These will be termed the Intentional (INT) and the Resultative (RES) and each will be defined in turn.

4.1 Complex event type one: INT

An infant can now construct a representation of a complex event, part of which is not in the present environment. For instance, an infant may for whatever relevant reason form a representation of a particular toy which she wants to have (or play with), which is not manifestly present in the here and now. With this complex event in awareness, the infant's intentionality is confronted with a series of discrepancies:

i). The mentally represented toy is physically absent.

ii). Any reference to the toy must simultaneously refer to mental 'presence', but physical absence of the object.

iii). An adult is not privy to the complex event, as it is the product of an internal mental process.

This type of Complex Event forms the conceptual basis for an intention towards an absent object/entity or for some kind of change of state, equivalent to 'I want to have the toy' or 'this broken toy is to be mended'. Because this event type lines up with wanting some sort of change to the here and now, I will term this type of complex event as the **Intentional** (which will be abbreviated to **INT** for convenience).

There is a similar Manifest Event which may provide the generic knowledge or event experience necessary to construct the secondary representational component. This involves infants monitoring the continuation or cessation of a Manifest Event, most usually expressed by 'more X' or 'allgone X'. For instance, when an infant is involved in a juice drinking event which finishes prematurely in her view and utters 'more juice', her intention is to maintain a continuation of the Manifest Event. This utterance can only be (easily) understood in the context of an on-going juice-drinking event. The conceptual content of INT differs significantly from this kind of Manifest event (the on-going Primary representations of the 'here and now') in the following ways:

i) The event consists of two contrasting sub-events, where the object has a dual reference across the public, perceptible present and a private, mentally constructed, intentional goal state.

ii) The infant is not concerned about the generics of the typical object, but focussed on a specific identifiable object-state as a goal to be achieved. As such, the communication needs not to be about object attributes, affordances or dynamic properties.

iii) The mental goal state is to be made actual. In other words, a toy, for example, is no longer simply something that can be played with, but is a thing to be obtained. The dynamic element of the event is different from the inherent dynamic properties of the toy. In fact the dynamic element of the event is focussed on a state change involving the object, e.g. absent to present, or broken to mended, or some such.

iv) The event represented is goal-directed and telic, the end point being the achievement of the relevant state change of the object.

Communication about Complex Events presents new challenges for the infant. Whereas, for Manifest Events, an object is present and provides the infant with the option to point or touch it, or use a word to indicate its presence, these options are removed in the context of a Complex Event. Either the object is absent, or not in the required changed state, i.e. the object may be broken and the intention is for it to be in an unbroken state. To communicate her intention, physical expression will generally not be available to the infant, or be difficult for others to understand (pointing will not do, as the object to be referenced may not be present, or the change of state may not be apparent); emotional expression is possible but not effective (crying or whimpering may not be interpreted by the adult to yield the desired result); linguistic expression is the only means available to the infant to make manifest what is mentally represented. Although uttering ‘toy!’ or ‘more toy!’ when no toy is salient, will give the adult some idea of what the infant has in mind, a great deal of pragmatic interpretation is involved, and the intended response cannot be guaranteed. The infant is required to acquire a more effective means of communicating her intention.

What is required is a structural innovation where there are words which can distinguish the overall event and others that can make reference to the objects involved. The referred object then 'measures out' the event to its conclusion, - the goal outcome (Tenny 1987, cited in Dowty 1991 p570). In adult (English) syntax, verbs perform the former role and noun phrases (or DPs) the latter.

Some general illustrative examples of typical and commonly recorded infant INT type utterances include:

(47)

a) I want the juice – juice is not present and is a **goal**
b) Mend it train – the state of the toy train is to be changed from its present broken state to the **goal** of it being whole again
c) Build a house – **goal** state to be achieved

From these examples, 'want', 'mend', and 'build' can be argued to fulfil the role of verbs as described above, and 'the juice', 'it train', and 'a house' perform the role attributed to DPs in adult syntax.

Chapter 2 (section 3.5.2), described that a component of Ninio's path-breaking verbs hypothesis identified infants' first verbs as expressing a 'bringing into the self' or 'construction', which presented some difficulty in explaining precisely why such conceptualisations should be so important. The present notion of the Complex Event INT, captures Ninio's intention, but also provides an explanatory rationale. All of Ninio's pathbreaking verbs ('want' 'take' 'eat' 'hold' 'get', or 'make') and more can be accounted for when they play the required role in INT type expressions, which indicate an intentional change of state for an identified object.

To unpick this further, a clearer picture of INT utterance use can be shown from recorded examples in the Travis corpus, which also seems to show a possible developmental progression.

4.2 INT utterances in the Travis corpus

The earliest examples appear when Travis is around 16 months (examples are given as previously with the interpretation and age). This seemingly consists of a word frame format 'whereda X'

(48)

(a) whereda bottle – *looking for and demanding it* (15.20)
(b) whereda spoon – *searching, no discernable reminder* (16.00)
(c) whereda Maria – *looking out of window for her friend* (16.20)
(d) whereda flower – *to an empty bush (she had picked flowers there before)* (16.24)
(e) where's baby – *has bowl and spoon, wants to feed baby-doll* (17.26)

In adult terms 'where's the X' most usually implies a query about the location of an object, but for Travis the focus is upon the object. The interpretive comments indicate each time that it is the object that Travis wants, not information about the location. There is no recorded evidence of use from 19 months until 23 months when she does use this construction to accompany her own searching for items, which may indicate that she has refined the meaning she assigns to the construction to focus more appropriately on locations.

A large number of examples of use around 18-19 months involve what can be identified as verbs with an accompanying '-it' component, initially examples show 'get-it' to be most frequently used:

(49)

(a) block get-it – *wants block* (16.25)
(b) get-it hat – *going to pick up hat* (17.01)
(c) Lulu get-it – *wants picture of Lulu* (17.12)
(d) Get-it bird – *looking out window* (18.14)
(e) Me get-it brown book – *she wants it* (20.09)

From 19 months, her INT utterances include, 'find-it', 'have-it':

(50)

(a) Find-it Weezer – *heard meow, looking for* (18.08)
(b) Find-it ball – *she wants to* (18.28)
(c) Balloon have-it – *wants it* (19.20)
(d) Have-it cards – *she wants them* (19.20)

In each of the examples in (49) and (50) above, Travis is making utterances that are productive, intentional and, importantly, are in a form that she will not have heard uttered by adults. At this stage it unclear what function Travis is attributing to 'it', this will be addressed more fully in Chapter 7. Presently, there are several possibilities. The word might be being use to maintain the link

between the two sub-events of the Complex Event, ensuring that the object reference persists throughout, although the use cannot be considered a conscious decision on Travis' part at her age. Alternatively, it might be a structural device, either representing an overt voicing of a sub-categorisation feature of the verb - 'get-it' selects a complement that has a specific referent (which 'measures out' the event). A further alternative is that 'it' is an early determiner. The latter is encouraged by examples, which increase in frequency as Travis gets older, where 'it' is replaced by a recognisable adult type determiner, establishing a very clear [DP] structure:

(51)

(a) Get the flowers – *wants them* (19.29)
(b) Find the stick – *stick in popsickle, pulling away ice* (19.03)
(c) Hold this blocks –*wants to (I have them)* (19.11)

(Data from the Manchester corpus will suggest that this may not be the case. This is discussed in Chapter 7 when a proposed syntax of Complex event type utterances is presented).

From 20 months or so, 'want' and 'need' become apparent in some INT utterances:

(52)

(a) I want the cup – *telling daddy* (23.00)
(b) I want my bottle – *not a cup* (23.00)
(c) Need this up here – *wants book off shelf* (20.21)

These types of constructions (48 through 52) are used exclusively for INT type utterances, and appear to be undergoing some development, particularly in the establishment of a recognisable DP. Travis also utilises utterances which she has used for Manifest Events, relying on context to provide pragmatic interpretation. This may be a case of use what you already know in new situations (a rule favoured by Braine and discussed in Chapter 2 section 1.4). Utterances of Manifest and Complex Events are differentiated by Aspect. Complex events have culmination, Manifest Events are on-going:

(53)

(a) Crying mummy - *wants to see picture of Mommy crying* (19.04)
(b) See Linda – *wants to* (19.20)
(c) See Stu - *wants to be where she can see Stu*

These examples contrast with 'crying mummy' where that is manifestly happening, and 'see Stu' or 'see Linda' where Travis is indicating that she can see Stu or Linda. As Manifest Event utterances they have a [$_{sub}$[modifier][substantive] structure: Linda/Stu are visible, but as utterances about a Complex Event, there is a different interpretation suggesting that there may be a contrasting syntactic structure involved.

Utterances expressing the Complex Event type INT (henceforth INT utterances), appear from the Travis data to be an important environment for language growth. They have distinctive properties different from those utterances of Manifest Events. They are goal focussed. In terms of Aspect, they are in semantic terms Achievements, and appear, for Travis, to provide for the (birth and) growth of syntactic categories like [V]erb and [DP]. INT utterances are also intentional and initiated by Travis herself, and it seems unlikely that anyone has taught her to want things, nor how to express this mental state in these ways. Clearly, conclusions cannot be drawn based on a single infant's experience. A general conclusion can only be reached by empirical testing, the outcomes from which are presented in Chapter 6. There is, however, a further influential utterance type which flows from Complex Events, which is discussed next.

4.3 Complex event type two: RES

The second complex event type again involves simultaneous primary and secondary representations as for INT, only this time the infant constructs from infant generic knowledge a means, which has contributed to an event or state outcome which is actual in the present environment.

An illustrative scene would be, having a toy in front of the infant (manifestly present), and a mental representation that her grandmother (say) gave it to her. More commonly in infant utterances, an infant has hurt herself, (current primary representation) as a result of falling down at some earlier time (secondary representation) as in:

(54)

a) Nana bought this toy
b) I hurt my leg

This complex event type will be termed the **Resultative** (abbreviated to **RES** for convenience). In many ways, RES is the counterpart of INT, although this utterance type appears not to be as commonly used as INT.

A parallel Manifest Event type may provide the generic knowledge or event experience necessary to construct the secondary representational component. This can be exemplified by the 'mummy chair' type utterances, exemplified in (36) above, which indicate event boundaries. The crucial difference is that for RES utterances the event onset is prior to the 'here and now', and therefore differs in the following ways:

i) The object is actually present or in the desired state, but how this came about is mentally represented.

ii) Any reference to the current object state is linked to a contributory non-manifest event frequently involving a responsible agent.

iii) Again, as for INT, the adult is not privy to the complex event, as it is a product of an internal mental process.

The conceptual content of RES is similar to that of INT but differs from it in significant ways highlighted **bold**:

i) The object has a dual reference across the public, perceptible present and a private, mentally constructed **prior event**.

ii) The infant is not concerned about the generics of the typical object, but focussed on a specific **means** through which a goal has been accomplished. The communication is not focussed on object attributes or affordances but on **how the condition or state of the object has come about** in the perceptible present.

iii) The dynamic component in this complex event performs a function ranging over the whole event, describing how the present state has been achieved. It would appear to provide a bridge between conceptual representations of the **physically present and the mental previous**.

iv) Additionally an **agent role is generally required** to identify the performer of actions in the dynamic event, providing responsibility for the present goal state.

v) The event represented is completed, the current object state being the **achieved goal.**

Some general illustrative examples of typical infant RES type utterances include:

(55)

'I found the spoons':	the finding process is not of the present and results in the presence of the spoons.
'Nana bought this car':	Nana's action towards the car results the car has been made present
'Danny made this':	Danny did something to make 'this' manifest

Once again, examples can be found in the Travis corpus, but there are far fewer than the INT utterances, suggesting that they are more likely to come on stream after INT utterances. This can be supported by observation of the syntax used for their expression. RES, like INT, also appears to need a [V]erb and [DP] to be established, as shown in many of the following examples.

4.4 RES utterances in the Travis corpus

Travis seems to use 'made', 'buy' or 'ate' as her verbs of choice for RES utterances.

(56)

(a) Maria made this duck – *picture Maria drew earlier* (18.29)
(b) Mommy made that table – *table mommy had painted* (19.16)
(c) Mail-box made this – *a doll that came by mail* (20.10)
(d) Buy this plum – *Mama bought at store 20 minutes earlier* (19.29)
(e) Buy this sponge - *Mama did at store, unpacking groceries* (19.29)
(f) Weezer ate the roach – *he did* (20.21)

In each case, the utterance describes the means which results in an object being present (except in (f) where its manifest absence it significant).

Other examples show the means which have resulted in events with emotional outcomes:

(57)

(a) Danny hit tennis – *got hit in the mouth with t-racket by Danny, crying* (19.05)
(b) Fall down chair - *it did* (19.22)
(c) Spill-it leg - *telling Daddy about spill* (19.23)
(f) Weezer hurt the leg - *he hurt her leg* (20.06)
(g) Spill something over mommy's coat - *sees stain* (22.05)

The utterances are initiated by Travis and are intentional and informative. It would appear that RES utterances are providing an important environment for language growth. They are means focussed. In terms of Aspect, they are generally interpreted as semantic Achievements, and in most cases (except when Travis herself is involved) an agent is explicitly stated.

5. Discussion

In this chapter a distinction has been made between two kinds of events that provide the context for infants' early linguistic expressions. Foundational for these events is infants' growing subjective experience of the world, how this is organised as generic knowledge, and the contextual relevance for an infant in promoting the intention to communicate verbally. Two types of contextual event have been identified, defined as Manifest and Complex Events. Manifest Events are characterised as those on-going, unfolding events of the 'here and now', and formed through Primary Representation which in turn is defined as the updating representation of reality. Linguistic expression of Manifest Events is typically conducted in joint attention and common ground with an adult carer.

In the context of Manifest Events, apart from the social/cultural/emotional contact in maintaining inter-subjectivity, adult talk is focused on supporting infants' growing generic knowledge of the world. Infant initiated talk is descriptive of the shared event and is confirmatory of the infant's generic knowledge by identifying verbally, those aspects of the shared scene where 'entities do what entities are expected to do'. In this way, entities have integral dynamic properties, and infant expressions would appear to reflect this.

For two or more word utterances of Manifest Events, the basic syntactic process of Merge appears to be operating with general syntactic categories suggested to be [substantive] and [modifier]. Novel infant utterances not heard

before and seemingly different from adult constructions are apparent. As there is no evidence at all that Merge is a learned process (nor that any adult attempts to teach it), the inevitable conclusion is that this basic, and really quite simple, syntactic process can be innately specified, and that two word utterances descriptive of Manifest Events appear to provide a conceptually focussed interaction with syntax. They are, however, severely limiting.

A major cognitive ability is achieved during the second year of life, around 18 months, when infants can raise two contrasting representations to awareness at the same time. This has been characterised as a collation between a primary (updating model of actuality in the here and now) and a secondary representation (a constructed model of an intentional change of current state, or prior event resulting in the present state). This context has been termed Complex because two interdependent sub-events are involved. Two kinds of utterance about Complex Events have been identified: INT (intentional) and RES (resultative).

Events which these utterance types express contrast with those of Manifest Events and this contrast is diagrammatically represented in fig 2 below.

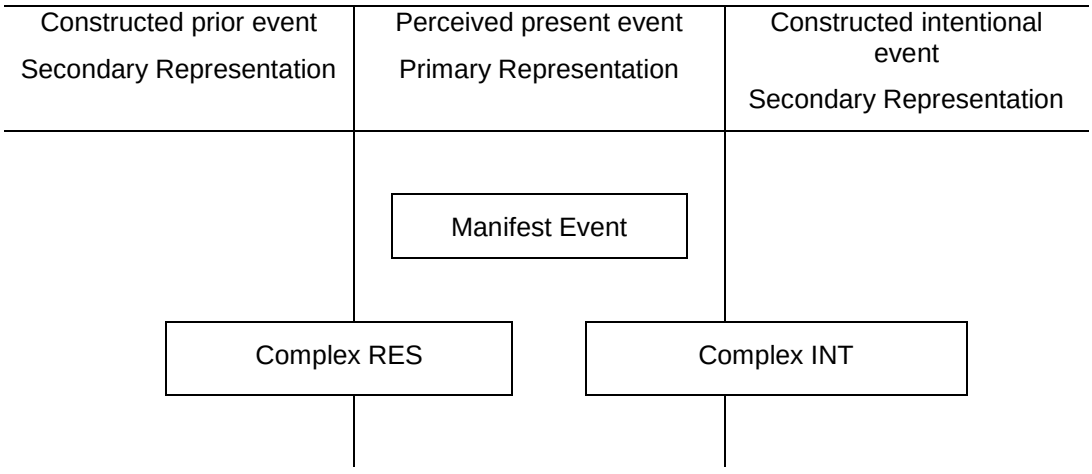


Fig 2 Schematic diagram showing the relation between Manifest and Complex Event types

Complex Event utterance-types have different properties from those of Manifest Events. As opposed to public Manifest Events, a Complex event is

constructed privately by the infant, and can only be expressed verbally. The infant must initiate the utterance, and acquire a new structural means to be able to express intentional change of state which utterances of Manifest Events do not do. Additionally, she has to ensure that her expressions are understood.

As Complex Events consist of two sub-events, one of which is constructed privately by the infant, the linguistic means must be acquired to maintain reference to the goal as it persists through each sub-event, and also to make explicit the nature of the event. 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 'noun phrases' (DPs) and 'verbs', the former refer to entities which figure in the events described by the latter.

In Complex Events, there should be evidence of words being used in [V]erb and [DP] roles, not evident in Manifest Events (this will be the focus of the empirical study in Chapter 6).

An infant's achievement of this inevitable syntactic outcome has depended on three important factors being in place:

- Infant intentionality: an infant expresses that which she has found independently relevant to mentally construct.
- Generic Knowledge of the world: essential for constructing predictable and supposed events for expression.
- Meta-cognitive developments: enabling productive relations between mental constructions, ranging from initial mapping of linguistic and perceptual events to later defining event boundaries outside of the perceptual here and now.

It is the interaction between all these, not any single factor, which provides the inevitability required for language acquisition. Thus an innate syntactic specification like UG cannot become operational without this interaction being in place; or for language emergence, once the interaction is in place it enables

productive syntactic constructions to be learned or acquired. Thus either way, approaches espousing innate syntax or learned constructions cannot occur without the Conceptual-Intentional Bootstrapping proposal described so far.

Discussion in this chapter has been exemplified from a single corpus; it remains to support the proposal by empirical study. The next Chapter presents such a study, and the chapters following will consider the implications for syntactic growth and why other bootstrapping proposals, particularly those outlined in Chapter 2, are challenged by this research.

Chapter 6
Empirical evidence from corpus studies

Introduction

The previous Chapter established that there are two key types of event influencing infants' early engagement and productive communication: Manifest and Complex Events. In Manifest events the linguistic expression the infant makes frequently forms a descriptive comment of the on-going event, with a focus on participating entities/objects and their dynamic properties. Because it is descriptive of an on-going dynamic state of an entity/object, the comment is of the form 'here is an entity I recognise doing something/being in some way that entities like this can do/be'. Utterances descriptive of, what the infant considers to be, the inherent dynamic properties of an entity or object, are on-going and involve a linguistic means of indicating inherent stative or dynamic properties of objects or entities. This has been exemplified in the previous chapter through use of a productive two word syntax, constructed by merging [substantive] and [modifier] in a sister relation as either $[_{mod}$[substantive][modifier] or $[_{sub}$[modifier][substantive]. On this account, [substantive] is a predicate over the event, and [modifier] provides additional descriptive information. [Substantive] is frequently expressed by a word which can be recognised by adults as a bare nominal, and [modifiers] have an essentially adjectival function. Some words used as [modifier] are recognisable by adults as verb-like, having a '-ing' suffix, but this is not the usual relation between [V]erb and noun phrase [DP] in English, and as such infant utterances about Manifest Events cannot be so analysed.

1. Hypothesis and prediction

The Conceptual-Intentional bootstrapping hypothesis proposes that there is an inevitable developmental or cognitive growth process which arrives at a meta-cognitive shift for an infant at around age 18 months of age. Prior to this, infant utterances can be shown to map to events manifest in the here and now. The new meta-cognitive ability enables infants to consider and collate representations of manifest situations with new mentally constructed, non-occurrent and contrasting situations. The collations result in being able to express changes of state, that is,

either a desired situation differing from a current state (e.g. mend this toy), or alternatively expressing a prior event which results in a current situation (e.g. Nana bought this toy). These have been termed complex event representations, in contrast to manifest event representations. In Chapter 5, I showed that infants, when expressing linguistic descriptions of manifest events, refer to observed objects and actions in terms of the generic dynamic properties of those objects according to the infant's individually developing subjective experience. Infants share their understanding of a perceived situation by offering generic propositions about the dynamic properties of participating objects, as they are perceived in the here and now. The nature and structure of infant subjective experience has hitherto not been considered to play such a direct role in linguistic expression. Linguistic expression of complex event representations, however, demands a differing approach.

Utterances about complex event representations, involve the infant describing an intentional change of state of an object. For this to be understood by an adult, the intended change of state must be made explicit and the participating object must be referenced and tracked through to the intended changed state. This might be characterised conceptually as expressing something akin to

$[\text{modifier}_1][\text{substantive}_1] > [\text{modifier}_2][\text{substantive}_1]$ as in

Broken toy > unbroken toy (i.e. mend the toy)

Thus a linguistic means needs to be acquired to convey the change of state while maintaining a reference to the object undergoing the change. In English, this requires a verb to predicate over the change event and DPs which can refer and 'track' the change to completion.

The hypothesis firstly makes a general prediction that infant utterances of Manifest Events will differ significantly from those of Complex Events.

Infant utterances involving Manifest Event representations are predicted to show a greater use of bare nominals and attributives as infants express generic properties known (to them) to apply to the substantive object kinds participating in the observed manifest situation. In English, bare nominal signify kinds and do not refer. Reference is achieved pragmatically from the joint attentional context.

In contrast, utterances involving Complex Event representations will exhibit significantly greater use of referential DPs, and in particular those appearing in Theme roles, as the change of state event is a change of the referenced object. Many verbs in English are words that need to be linked to their non-agentive themes.

Empirical testing is predicted to show the contrasting structures of utterances about manifest and complex events in three ways:

1. Bare nominals will tend to predominate in utterances about manifest events, whereas DPs will predominate in utterances about complex events.

2. DPs functioning in Theme-role in the utterance will be significantly present in utterances about complex events, but less so in utterances about manifest events.

3. Theme-role DPs imply the presence of a verb category, which prompts the prediction that DPs in agentive and grammatical subject role should also be significantly present in utterances about complex events in contrast to utterances about manifest events.

4. The null hypothesis is that there is no difference between utterances about manifest or complex events in the presence of bare nominals or DPs.

The proposal makes some predictions that other approaches to grammatical category acquisition do not. Specifically, this approach can be compared to a richer innatist view according to which the full nominal/verbal system is in place from the earliest productions. Only the current proposal predicts that infants will tend not to use noun phrases (DPs) when characterising Manifest Events and determiner-less nominals will predominate. The use of DPs will become apparent when Complex Events are being described. Note that in infant language, the most commonly used DPs 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 (wanting to have a specific toy not present in joint attention). Thus, in contrast to my proposal, 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 infants, the object is absent from joint attention and only

appears in the goal state represented in the infant's Secondary Representation. Thus, if anything, the preponderance of definite DPs might be thought to be found in descriptions of Manifest Events.

In contrast to the specifically innatist view, those proposals that do not assume that category knowledge is innate, such as the verb-island hypothesis of Tomasello (1992), claim that such knowledge is gained through acquiring constructions from adult input and forming analogies across a sufficiently large set of examples. As adults do have a functional noun phrase category, it is expected that infants will experience linguistic input that makes extensive use of DPs in utterances about any event. These theories do not draw a structural distinction between infant utterances of Manifest and Complex Events, and so would predict in a similar null hypothesis outcome to the standard theory that there would be no difference in DP occurrence between utterances about these two event types.

2. The corpus data

The source 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. When the data was gathered, the infants were visited in their homes roughly fortnightly over a year, and on each visit two half hour recordings were made of the spontaneous speech in 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 800+ infant-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 needed to be devised to make the 'longhand' analysis of the scripts manageable.

3. Preliminary feasibility study

An initial feasibility study drawing on scripts from 6 infants was undertaken.

The key aims of the study were to gauge the level of difficulty in identifying utterance types (ME, INT and RES); and given this, to explore whether a relation between utterance types, age and DP use was suggested. The null hypothesis would be that there would be no effect of utterance type or age on DP use.

Although the preliminary study was flawed in many ways, it is briefly reported here to explain the motivation for the organisational decisions made about the design of the final study.

3.1 The data

For the initial study the first six of the twelve infants were the focus, 3 girls and 3 boys – and the 23-28 month range was selected to give matched scripts. The reason for the cut-off point at 28mo for this initial study was to parallel as far as possible the age range presented in the Travis data.

There are, however, significant differences between these data sets. Tomasello's diary data is longitudinal and is claimed to capture all new utterances by Travis. This content cannot be replicated through the one hour fortnightly sampling regime of the CHILDES corpus. It is, however, assumed that the Manchester infants are exhibiting through their spontaneous talk, their established knowledge and productive use of language.

For each of the 6 Manchester infants, dialogues were selected as a monthly (one hour) sample for each child. This provided the gross data of 25,540 child utterances.

3.2 Method

Each dialogue was analysed into utterance types: ME, INT, and RES, to develop a viable coding system. This required a detailed consideration of the context of use and information from the apparent adult interpretation of the infant's utterance. For the trial, only decisions about INT and RES utterances were recorded when the judgement could be considered secure. Otherwise all remaining utterances

were defined as ME, which included a large number of one word utterances. The total breakdown was as follows:

ME utterances 20057
INT utterances 4549
RES utterances 934

Having defined the utterance types, the scripts were then viewed again and a tally of lexical items which were assumed to be definitional of DPs was made for each utterance. These items included pronouns, demonstratives, determiners and proper names (rigid designators). A distinction was also made at this time between grammatical 'object' and 'subject' reference, on the basis of the generalised categories of Theme role (O) or Agent/non-Theme role (S), using case marking on pronouns as a guide. Decisions were also prompted by the context of use.

The tally involved the 18 different items listed below:

(58)
I
me
it O
it S
that/those O
that/those S
this/these O
this/these S
the/a O
the/a S
Rigid Designators RD O
Rigid Designators RD S
he /she /they
him /her/them
you O
you S
we
us (there were no examples of the use of 'us')

The scripts were grouped into three age bands: 23/24mo; 25/26mo; and 27/28mo for each infant. The tally recorded the total number of each of the above DPs used in each utterance type for each infant within each age grouped script set. This meant that each DP had three tally scores reflecting occurrence in each of the three utterance types, and these were grouped into age bands.

The raw totals were converted into proportions: the number of each DP proportioned to the utterance type where it occurred for each infant for each age group. The data set therefore all contained values less than 1.

A two-way ANOVA, using SPSS 17, was run on each DP against (age group) * (utterance type). The REGWQ post-hoc test was used to reveal the nature of any significant interaction.

3.3 Results

The main outcomes of the ANOVA and post hoc tests appear in Table 1 below, which gives the result for each DP and an indication of any significant interaction with utterance type. Significant results appear in **bold**, (for all results df is the range 2,45).

DP	utterance type ME;Int;Res		Post hoc test result
I	**F22.02**	***p*<.0001**	**Int > Res**
itO	**F19.73**	***p*<.0001**	**Int> Res**
itS	**F9.317**	***p*<.0001**	**Res**
thatO	**F5.503**	***p*=.007**	**Res >Int**
thatS	F.551	*p*=.580	**-**
thisO	**F8.603**	***p* =.001**	**Int> Res**
this S	F.055	*p*= .946	**-**
theaO	**F6.909**	***p*= .002**	**Int >Res**
theaS	**F3.608**	***p*= .035**	**Res**
RDO	**F7.840**	***p*= .001**	**Res>Int**
RDS	**F9.481**	***p*<.0001**	**Res >Int**
youO	F2.214	*p*= .121	**-**
youS	**F4.113**	***p*= .023**	**Int>Res**
me	F2.085	*p*= .136	**-**
s/he/they	**F6.037**	***p*= .005**	**Res**
him/her/them	F2.345	*p*= .107	-
we	F1.531	*p*=.227	-
us	no data		

Table 1 ANOVA results for each DP and Utterance type only

These results appeared to show a significant main effect of certain DP use in INT and RES utterance types.

3.4 Discussion

A key aim of the study was to gauge whether utterance types could be identified from the written transcriptions. This was found to be relatively straightforward. Although some utterances required a judgement call, it seemed that from what the infant said, the context of the infant's engagement and adult prompts and responses, it was possible to make viable judgements. It was instructive that all infant utterances could be comfortably allocated to one of the three utterance types. This provided confidence that such judgements could be independently verified.

The results of the ANOVA also appeared to give a strong indication that the study was uncovering some interesting information about the relation between utterances of Complex and Manifest Events. INT and RES utterances seemed to have a significant effect.

The method, however, was somewhat flawed, and the results are difficult to interpret. The data used was subject to a great deal of preliminary analysis: DP use organised as grammatical subject or object, and then also allocated to respective utterance types, prior to the empirical testing. The results might simply be reflecting this preliminary analysis.

A further complication is that the infants, even from a cursory observation, seemed to exhibit different experience of language use, as should be expected. Infants develop at different rates. The age banding only emphasised this by grouping subjects on a false assumption of homogeneity by age. The data also did not discriminate for length of utterance; so many one word utterances were included, which skews the data giving a disproportionate amount of ME utterances. An alternative means of organising the corpus needed to be found to overcome these problems.

The preliminary study, therefore, was successful in some respects, confirming that scripts could be analysed into utterance types, which appeared to interact with DPs. It also revealed that a number of changes to the methodology needed to be made.

4. Revised corpus data

The corpus data and sampling was revised to address the problems found in the feasibility study: by introducing calculations of MLU (mean length of utterance); formalising the way utterance types are identified and commissioning independent verification; testing for gender differences between infant subjects; and finalising the items which would signal DP use. These adaptations are discussed in turn.

4.1 MLU banding and age matching

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 age experience as well as taking linguistic progression into account. In keeping with Roger Brown's pioneering work (1973), Mean Length of Utterance (MLU) was adopted. 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. Brown considers that this is an

> '"excellent simple index of grammatical development because almost every new kind of knowledge increases length" (Brown1973 p 77)

He also emphasises that it is most effective as a longitudinal, within subject measure which can confirm over time, how MLU increases with age. As a snapshot of development, however, it can be misleading, as what is measured depends on what the infant chooses to say at any time. Because of this, MLU readings can vary from day to day, therefore a series of MLU readings are required to be able to make a judgement about linguistic development.

Brown defines several MLU ranges for his research, which he equates to stages of grammatical development. His banding structure largely increases in 0.5 increments in MLU, giving ranges from 1.5 to 2.0; 2.0 to 2.5; and 2.5 to 3.0. This measure is generally accepted and has become common practice. Because of this, three MLU bands were identified for this study: MLU Band 1 incorporates MLU scores in the range 1.5 to 2.0; MLU Band 2 covers the range 2.0 to 2.5; and MLU Band 3 covers 2.5 to 3.0+.

A calculation of MLU for each half hour script was made for each of the 12 infants. As two half hour scripts represented a day's recording, an average MLU score was calculated and recorded for each 'whole day' visit. A scatter graph plotting the daily MLU score and a trend-line was constructed for each child, to help interpret the trajectory of the various MLU readings. An example based on one child's data, (Dom) appears in fig 3. (The results for all infants appear in Appendix 1).

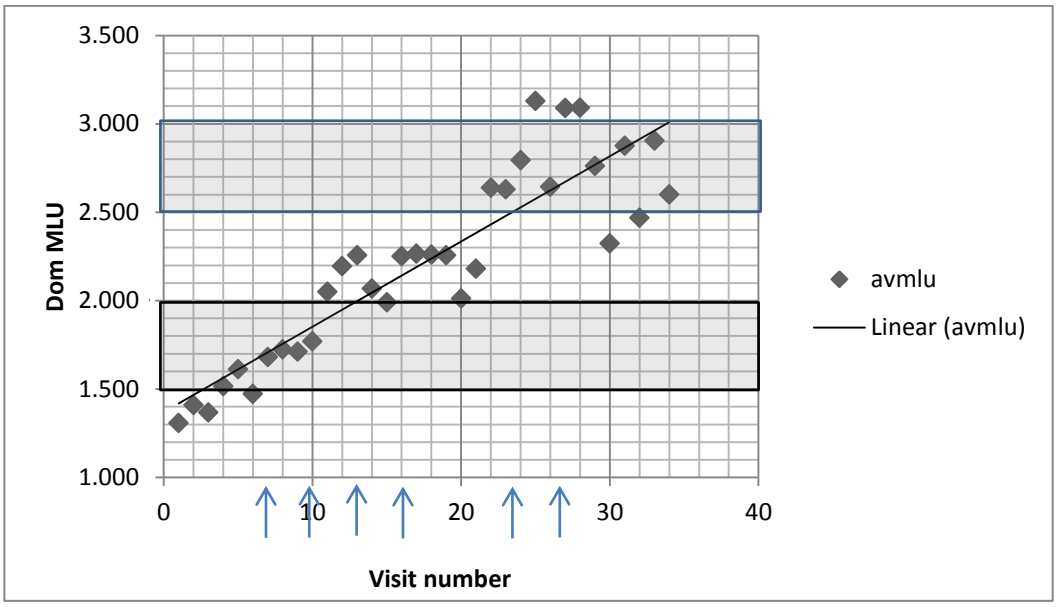


Fig 3 Showing the average MLU plot for each of the 34 days where one hour scripts were recorded from one infant (Dom). The trend-line and banding domains are shown. Arrows indicate the selected scripts.

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Inspection of the graph reveals a clear linear trend whereby MLU length increases with age, although on some visits, Dom's average MLU drops below trend. All the 12 infants in the corpus showed an upward trajectory in their trend-line, but the rate of development varied (as is expected from well documented evidence of differential developmental rates in infants).

The corpus study was to be based on a sample of scripts for each infant with the aim of sampling two one hour scripts, the average MLU across both scripts would define membership of each MLU band. The choice of script was made so that samples represented as far as possible a monthly progression in age for each infant; i.e. scripts were chosen so that the sample represented a progression in

both MLU score and age. The reason for this stipulation was to capture both linguistic and experiential development in comparable ways. The upper limit of 28 months was set as ideal, to establish some comparability with the Travis data, but this was not always possible.

So for instance, in the example illustrated in Fig 3 above, for Dom, the scripts are plotted on the graph, where they fall within each MLU band domain and correlate with the visits numbered 1 to 34.

Dom's age across this period ranges from 23 months for the first visit to just 2 days short of 35 months old for the last. To achieve the age progression (shown in Table 2 below for all the infants), the following scripts were selected for Dom (and indicated by arrows in fig 3): #7 (24 mo), #10 (25mo) for MLU band 1; #13 (26 mo), #16 (27 mo) for MLU band 2; and #23 (30 mo), #26 (31 mo) for MLU band 3. (The scripts numbered between 17 and 22 although representing the age 28/29 months, were all in MLU band 2).

Two of the twelve infants were rejected because their profiles could not fit the requirements of banding samples to give a MLU progression and age progression, comparable to the others.

The MLU plots for the two infants appear below figs 4 and 5. John's scripts exhibit great variability in MLU score, and the majority pattern in MLU band 2. Nicola, on the other hand has a disproportionate number of scripts in MLU band 1 and below.

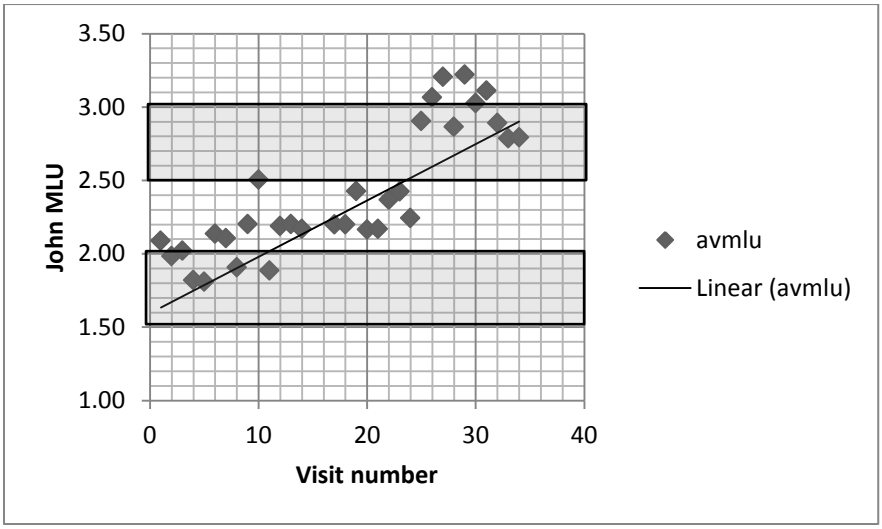

Fig 4 MLU banding for John's scripts

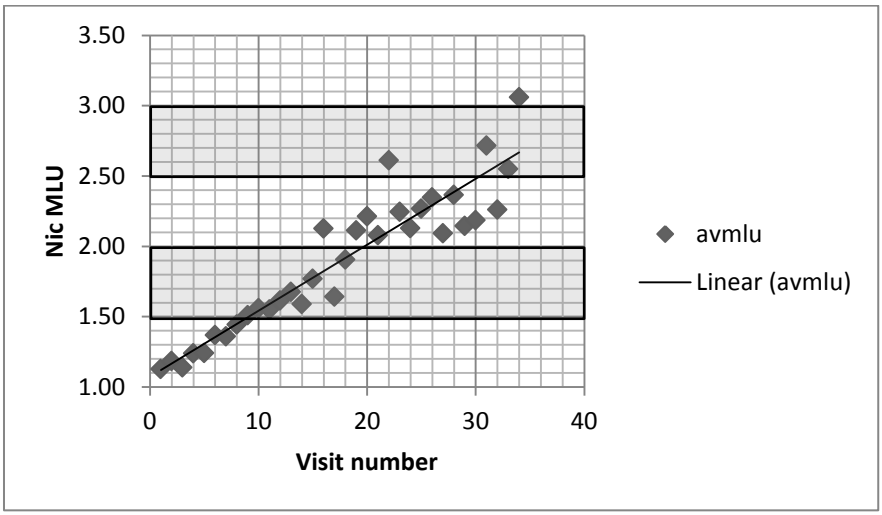

Fig 5 MLU banding for Nicola's scripts

Samples from the remaining 10 infants were selected, as set out in Table 2, which logs against each infant: age in months and the MLU calculation of the appropriately selected script. For each infant, then, two one hour scripts per MLU band showing an age progression were selected.

Name		MLU band 1		MLU band 2		MLU band 3	
Anne	Age (mo)	**22**	**23**	**24**	**25**	**26**	**27**
	MLU	1.791	1.863	2.082	2.180	2.861	2.750
Aran	Age (mo)	**23**	**24**	**25**	**26**	**27**	**28**
	MLU	1.476	2.066	2.133	2.331	2.697	2.742
Becky	Age (mo)	**25**	**26**	**27**	**28**	**30**	**31**
	MLU	1.502	1.888	2.433	2.485	3.046	2.976
Carl	Age (mo)	**20**	**22**	**23**	**24**	**25**	**26**
	MLU	1.865	1.986	2.380	2.491	2.627	3.089
Dom	Age (mo)	**24**	**25**	**26**	**27**	**30**	**31**
	MLU	1.680	1.769	2.257	2.252	2.630	2.643
Gail	Age (mo)	**23**	**24**	**26**	**27**	**28**	**30**
	MLU	1.142	1.981	2.350	2.433	2.676	2.662
Joel	Age (mo)	**24**	**25**	**26**	**27**	**28**	**29**
	MLU	1.780	1.848	2.121	2.151	2.530	2.802
Liz	Age (mo)	**23**	**24**	**25**	**26**	**27**	**28**
	MLU	1.662	1.793	2.075	2.156	2.510	2.783
Ruth	Age (mo)	**28**	**29**	**30**	**32**	**34**	**35**
	MLU	1.843	1.931	2.069	2.425	2.836	2.837
Warren	Age (mo)	**21**	**22**	**23**	**24**	**25**	**26**
	MLU	1.903	1.870	2.225	2.456	2.648	2.868

Table 2 showing MLU bands and infant ages of the selected corpus scripts

It is clear from the table that the infants fit the criteria (MLU vs age progression) in a comparable manner. Ruth would appear to be border-line in that she is older overall than the others. Her inclusion was considered important, however, for the data to have a gender balance. The resultant sample provided 6 hours of talk for each of 10 infants, 5 girls and 5 boys. The scripts presented 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.

4.2 Utterance types

The analysis of the scripts involves the identification of utterance types expressing Complex Events, termed INT and RES. The remaining utterances are classified as Manifest Events (ME). Only utterances of two or more words were classified for two reasons. Firstly, looking at the corpus, it was evident that

identification of communicative intent is much less clear for a single word utterance in a transcribed text. Secondly, excluding one word replies to an adult's closed questioning, ('what's this?' requesting/checking the infant's knowledge of vocabulary; or 'what colour is it?' or 'how many are there?'), provided the added advantage of increasing the likelihood of focussing on infant initiated, productive speech.

The following are some strong pointers towards INT utterances:

Infant use of 'where' or 'where's' generally signals INT.

Infant use of 'want'; 'wanna'; 'want to'. In general infants appear to use these words to signal intention (as do adults). Comparably the words 'need'; 'need to'; 'go'; 'gonna'; 'going to'; 'can'; 'will' and negative forms of these with 'no' or 'not' frequently appear in INT utterances. Note that this is not always the case. Compare the following:

(59)

CHI: wanna have train (**INT**)
MOT: OK. I think it's in the box over there.

and

(60)

CHI: wanna have train (playing with it in the **here and now**)
MOT: Yes that is always your favourite.

In these examples the context shows that the infant is expressing different meanings. In (1) she is expressing that she wants the train, in (2) she is merely expressing something (in a non-adult way) about playing with her favourite train at present. Note that it is the context and the mother's utterance which disambiguates this for the sake of the analysis.

Other decision points concern whether the required action has happened or not. Compare:

(61)

CHI: oh, broken…
CHI: Mend it train (**INT**)
MOT: Daddy'll mend it when he gets home

with

(62)

CHI: oh, broken…
CHI: Mend it train (**RES**)
MOT: So you have. You are clever!

Once again the adult response disambiguates the utterance. In the first instance (60) the train is to be mended. In the second instance (61) the mending has taken place and the fixed train is the result.

Decisions about utterance types are essentially judgements about infant communicative intentions. Formal cues can be misleading. For infants with limited facility with syntax and morphological distinctions, and with a limited vocabulary inventory, what they say may only approximate in adult terms to what they mean. As the study data is drawn from infants' intentional communication with adults, judgements can be supported by additionally 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:

(63)

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 would be classified as ME. The additional context makes it clear that the utterance should be classified as INT.

In the older age samples use of 'want', 'gonna', 'gotta, 'need' all appear to signal INT.

(64)

(a) INF: want a banana
(b) INF: dog gonna fall
(c) INF: gotta wear this on
(d) INF: I need my monkey

In the main, a rule of thumb generally applies to determine INT utterances: the infant is making reference to an object/ event, or change of state not apparent

in the here and now. Note that this may apply equally to utterances which are also functioning as possible questions or imperatives. For example:

(65)

(a) whereda toy
(b) get it toy

In both cases the toy is absent in the here and now, but present only as a secondary representation.

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:

(66)

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 (ME), 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.

All 2+ word utterances were marked as INT or RES where clear judgements could be made otherwise ME was the designation, providing a very conservative analytic position. The following total numbers of utterances were recorded across all data scripts from a total of 22,104 infant 2+ word utterances:

ME utterances 13,827
INT utterances 6,994
RES utterances 1,283

Given the careful matching of linguistic ability (through MLU analysis), age progression, and restricting the data to 2+ word utterances, the profile of the ratio of utterance types for all infants collectively (63% ME : 32% INT : 5% RES) can be assumed to be a better reflection of productive language use for young

infants than the data from the feasibility study (79% ME : 18% INT : 3% RES), which was disproportionately skewed to ME. (It is instructive to note that even with this bias, INT and RES utterances still exhibited an interesting relation to DP use in that study).

For each sample script the number of ME, INT or RES utterances were totalled and then divided by the total number of utterances in that script. Thus the data carried forward for statistical analysis of utterance types was expressed as a proportion: #Utterance types per script/#Total 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. (The data tables appear in Appendix 3).

4.3 Independent Verification

As analysis into utterance types using transcribed scripts is frequently based on a judgement call, it was important to institute some verification procedure to confirm or otherwise the reliability of the analysis. Because of limited time and personnel resources, a postgraduate student with no connection with the research was remunerated to make comparable analyses of a sample of scripts. The nature of the verification was therefore not to reanalyse all the 60 hours of infant dialogues, but to gauge from a sample whether the analysis was feasible and statistically verifiable. The independent judge was only provided with a guidance sheet (reproduced in Appendix 2). A random selection of two infants was made and available scripts were randomly chosen from within each MLU band. So, the verification task covered 3 x 1 hour scripts per infant (total 6 hours of infant interaction with 2352 infant utterances of two or more words).

Outcomes were collated with the original script analysis of this subset and subjected to a Cohen Kappa test, which showed the verification and research analysis had 89% agreement, (with a chance agreement rate calculated at 49%). The Cohen's Kappa value was calculated to be 0.78. For the current type of research, there seems to be general agreement that the Kappa score should be above .60 (Wood 2007). The result achieved for the verification task is therefore comfortably within the bounds of acceptability, and therefore my original analysis became acceptably the basis for the studies.

4.4 Gender effects

After checking for homogeneity of the data, a two way ANOVA with MLU Band and Gender as fixed groups and utterance types as variables, was applied 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:

Gender and ME utterances across all MLU Bands: F(1,54) 1.302 p=0.259
Gender and INT utterances across all MLU Bands: F(1,54) 2.560 p=0.115
Gender and RES utterances across all MLU Bands: F(1,54) 0.693 p=0.409

This is not an unexpected result. As it is an assumption that all typically developing infants undergo the cognitive growth necessary to make Complex Events available to them, this result simply reinforces that assumption (at least as far as the 10 infant participants are concerned). Boy and girl data were therefore not distinguished for any of the following studies.

4.5 Identifying DPs

For Study 1, a total count of DP use for each script was recorded as a proportion of DP use to total infant utterances for each script. (#DPs per script/Total Utterances per script). Table 3 below displays the items considered to be DPs. These comprised pronouns, articles, proper names (Rigid Designators) and demonstratives with or without nouns. The total gives a count of 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**

Table 3 Total instances of DP use across all scripts

At the end of this analysis there were a total of 60 data items for each category – ME; INT; RES; all DP use. Each of these items had been proportioned to a common base, namely total utterances per respective script. Raw data grids appear in Appendix 3.

4.6 Identifying bare nominals

As the hypothesis to be tested includes the proposal that there is a negative relation between bare nominal use and utterances of Complex Events, a tally of all such elements was made for two+ word utterances, and proportioned in the same way as the DPs to total utterances per script. The summary of frequency of bare nominal use across all scripts is:

MLU band 1= 1280 occurrences
MLU band 2 = 989 occurrences
MLU band 3 = 514 occurrences

4.7 Statistical calculations

All statistical calculations for the studies were made using SPSS 17, variously involving Pearson Correlation and Regression, ANOVA with REGWQ post hoc tests, and χ^2 and Φ tests.

5. Empirical studies

Three series of studies were undertaken to gain an understanding of the relation between DP use (as defined above in 4.5) and utterance type. The first explored the relation between bare nominal and DP use in ME and CE utterance types; the second explored the relation of endocentric DPs and utterance types; and the third involved the relation between exocentric DPs and utterance types. The original hypothesis and prediction made before the feasibility study remained, namely: infants will tend not to use DPs when characterising Manifest Events, while the use of DPs will emerge when Complex Events are being described. The null hypothesis in all cases is that there is no effect of utterance type on DP use. Conversely, it is predicted that the use of bare nominals will predominate in ME utterances.

5.1 Study 1. The relation between bare nominal use, DPs and utterance types.

For this first study the INT and RES data was initially amalgamated to divide all infant utterances into Manifest or Complex utterance types: ME or CE. Correlation tests were then conducted to reveal the relation between DP use and bare nominal use in ME or CE. All data had been proportioned to total utterances for each script, providing a common baseline.

The data below, shows trimmed mean values at a 95% confidence level for each MLU band, of the corpus data representing ME utterances, CE utterances, DPs, and bare Nominals.

Variable	Mean values		
	MLU band 1	MLU band 2	MLU band 3
ME	.684	.636	.574
CE	.316	.364	.426
DP	.404	.530	.680
Nominal	.230	.136	.063

This is presented graphically in Fig 6 below.

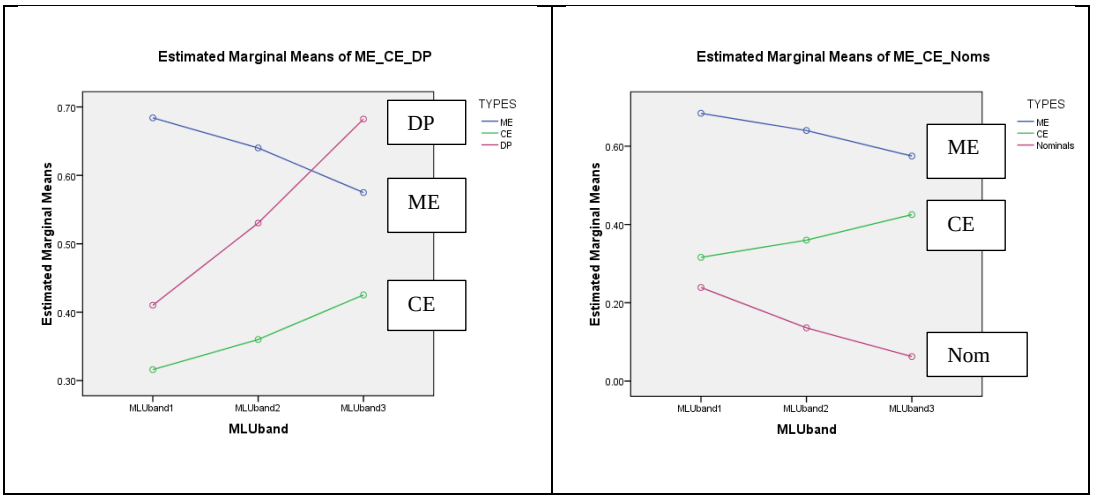

Fig 6 Plot of means for ME, CE, DPs or Nominals by MLU band

Pearson correlation tests were conducted giving the following results:

Pearson correlation analysis for Utterance types and DP

Utterance types	Correlation	Significance
ME	r = -0.696 p<.001	Negative, significant
CE	r = 0,696 p<.001	Positive, significant

Linear Regression F(1,58)=25.728 p<.001 (R^2=0.307). The linear relationship (CE:DP) accounts for 31% of the total variance.

Pearson correlation analysis for utterance types and bare nominals

Utterance types	Correlation	Significance
ME	r = 0.458 p<.001	Positive significant
CE	r = -0.458 p<.001	Negative significant

Linear Regression F(1,58)=15.406 p<.001 (R^2=0.210). The linear relationship (ME: Bare nominal) accounts for 21% of the total variance.

This analysis reveals a significant correlation between ME and bare nominal use and a strong correlation between CE and DP use. As the main focus of interest is DP use, this study was extended to examine the relation between DP, ME and each of the sub-components of CE utterance types: INT and RES. (The data utilised is the same as before but disaggregated).

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

Pearson correlation analyses for utterance types and DPs

Utterance types	Correlation	Significance
ME	r = -0.696 p<.001	Negative, significant
INT	r = 0.552 p<.001	Positive significant
RES	r = 0.136 p=.302	Non-significant

Linear Regression F(1,58)=25.464 p<.001 (R^2 = 0.305). The linear relationship (INT:DP) accounts for 31% of the total variance.

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.

This relation can be graphically presented (fig 7) through plotting the trimmed mean value data for 95% confidence level across each MLU band:

Variable	Mean values		
	MLU band 1	MLU band 2	MLU band 3
ME	.684	.636	.574
INT	.263	.310	.365
RES	.053	.053	.060
DP	.404	.530	.680

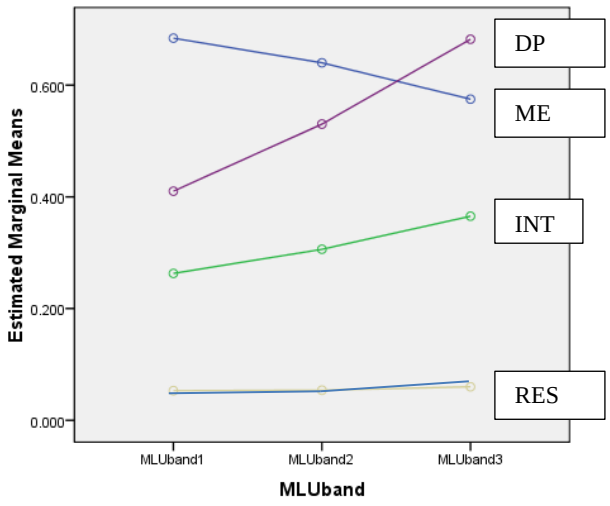

Fig 7 Plot of means for ME, INT, RES and DPs by MLU band

5.1.1 Study 1 discussion

Although many researchers have shown that infants use fewer bare nominal over time in favour of more full DPs, arguing that this reflects a grammatical development (the D position becomes obligatory), none have shown that the developmental process correlates with the meta-cognitive ability to defined here as the expression of Complex Events. The results from Study 1 confirm the initial

prediction that referring expressions display a significant relation to INT utterances (complex events) rather than ME 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 but present only in the cognitive environment.

Although there is a robust correlation between INT utterances and DP use, it is clear 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. Parsons (1994) suggests a means for identifying participant roles in an event, using the heuristic:

Events: **by** an Agent;

of a Theme;

for a Benefactive,

with an Instrument.

Parson's example is "Brutus stabbed Caesar with a knife". This involves a [stabbing event] of Caesar (Theme); by Brutus (Agent); with a knife (instrument).

There is no direct relation between thematic role and grammatical category, but frequently in English a Theme role is realised as grammatical Object. With infant speech of 2+ word utterances, young infants tend to describe events with limited participant roles, the type of complexity suggested by Parson's heuristic is generally not apparent in infant speech. Themes, however, appear to be an easily identified category, along with Agent. Just as there is no one to one relation between Theme and Object, so too is there no direct definition of Subject as Agent. Grammatical Subjects do not need to be functioning in an agentive role.

To begin to define working data sets with these provisos in mind, an initial analysis identified and noted those DPs used in Theme-role, coded as DPO. For instance, the following could be identified as DPs in Theme-role:

(67)

a) mend this toy (mending event of this toy)
b) the hat off (an 'offing' event of the hat)
c) where's Caroline (a locating event of Caroline)
d) Nana bought this toy (a 'making present' event of this toy by Nana)

All remaining DPs were coded DPS.

In keeping with the stated hypothesis, it is claimed that DPs in Theme role will be endocentric DPs, and will reveal the presence of a VP construction. Study 2 will explore the relation between utterance types and DPO. Study 3 will explore further the nature, and membership of the DPS category, defined here largely as 'non Theme-role DPs'.

5.2 Study 2 - Utterance types and DPO

Having identified a strong correlation between general DP use and utterances of cognitive Complex Events, this study examines the relation between DP use in a Theme-role. The prediction at this stage is that DPOs will similarly exhibit a stronger relation to CE utterances than ME utterances.

5.2.1 Testing the relation between all DPO and utterance types

This study requires the identification of DP use in Theme role (DPO). The tally of totals across the corpus is reported in Table 4 below:

Infant DP use	DPO
it	1506
that/those	618
this/these	291
the/a	1567
I	
me	241
Rigid Designators	654
He/she/they	
him/her them	168
You	138
We	
us	2
Totals	**5185**

Table 4 Total incidents of DPO use across all scripts

The proportion of DPO use to the total number of utterances was calculated for each script. All these calculations resulted in data values less than 1, recorded to 3 decimal places. As for the previous study, the first test involved the INT and RES data being amalgamated to divide infant utterances into Manifest versus Complex utterance types: ME or CE. The relation between ME; CE; and DPO can be seen in the graphic representation in figure 8 below, plotting the trimmed mean value data at 95% confidence level across each MLU band:

Variable	Mean values		
	MLU band 1	MLU band 2	MLU band 3
ME	.684	.636	.574
CE	.316	.364	.426
DPO	.174	.232	.288

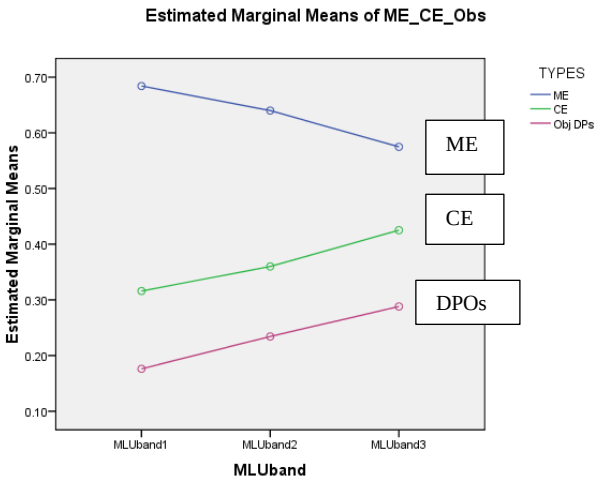

Fig 8 Plot of means for ME, CE and DPO by MLU band

A Pearson correlation test was used to explore the relation between DPO and Utterance type. The result was as follows (The ME and DPO correlation is the negative – mirror image, as expected):

Pearson correlation analysis for utterance types and DPO

Utterance types	Correlation	Significance
ME	r = 0.632 p<.001	Negative significant
CE	r = -0.632 p<.001	Positive significant

Linear Regression $F(1,58)=38.521$ $p<.001$ ($R^2=0.399$). The linear relationship (CE:DPO) accounts for 40% of the total variance.

A regression test was also applied to reveal that CE is a robust predictor, accounting for 40% of the variance, showing a stronger association between DPO and CE than was evident for DP and CE.

In line with Study 1, the analysis was repeated to indicate the relation between DPO, ME and each of the sub-components of CE utterance types: INT and RES.

The relation between ME; INT; RES; and DPO is represented visually by the means plot shown in figure 9, plotting the trimmed mean value data at 95% confidence level across each MLU band:

Variable	Mean values		
	MLU band 1	MLU band 2	MLU band 3
ME	.684	.636	.574
INT	.263	.310	.365
RES	.053	.053	.060
DPO	.174	.232	.288

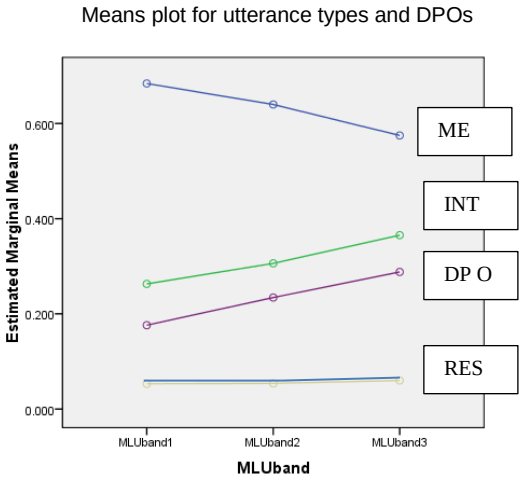

Fig 9 Plot of means of ME, INT, RES and DPO by MLU band

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

Pearson correlation analysis for utterance type and DPO

Utterance types	Correlation	Significance
ME	r = -0.632 p<.001	Negative, significant
INT	r = 0,658 p<.001	Positive, significant
RES	r = 0.066 p=.615	Non-significant

Linear Regression F(1,58)=44.384 p<.001 (R^2 = 0.434). The linear relationship (INT:DPO) accounts for 43% of the total variance.

These results show a positive, significant correlation between DPO use and INT utterances. The strength of this relation was further tested by Regression analysis which showed INT to be a robust predictor of DPOs. The linear relationship accounted for 43% of the total variance.

This demonstrates that the generalised conclusion that DPOs bear a significant relation to INT utterances is reliable and robust. The conclusion can be drawn that INT utterances have a relatively larger number of DPs in Theme role.

5.2.2 The relation of subsets of DPO to utterance type, and frequency of occurrence

Given the frequency of 'it' and 'the' as DPOs in the raw data, there is the possibility that the result so far achieved might be prompted by the disproportionate influence of these DPOs. To explore this eventuality the raw data was recalculated to give proportions of 'it/the'-DPs separate from DPOs excluding 'it/the'. Comparative correlation tests were run, which yielded the following results (only the positive significant results are given here).

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

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

These results persist in underlining a strong correlation between DPOs and CE utterances, particularly INT utterances. It does raise a further question of what if any effects are contributed by RES utterances. As there are comparatively few RES examples in the corpus (5% of all utterances) correlation tests are not fine-tuned enough to show what contribution RES might play. χ^2 analysis provides a

test for an association between variables by comparing the observed probability of occurrence against an expected probability.

5.2.2.1 The association between DPO and ME; CE

For this test, a new data set needed to be derived from that used so far. As DPOs had been independently identified, a tally was made of DPO as they occur in ME, INT and RES utterances.

Thus the probability of occurrence of DPOs for each utterance type could be calculated. Calculations were made for each MLU band independently. The null hypothesis is that utterance type will have no effect on DPO use within any MLU band. As with previous studies the first test compared the broad division by ME and CE utterances, to the occurrence or non-occurrence of DPOs at each MLU band level, with the following results.

The table shows a strong association between CE and DPO, i.e. the actual count of DPO use in Complex Events is greater than the expected count (highlighted in **bold**).

Association between occurrence of DPO and event types

MLU1	χ^2 = 867.8 df=1 p<.001	
	ME	CE
Actual	275	**715**
Expected	669.2	**320.8**
MLU 2	χ^2 = 1702.6 df=1 p<.001	
	ME	CE
Actual	399	**1339**
Expected	1122.5	**615.5**
MLU 3	χ^2 = 1439.0 df=1 p<.001	
	ME	CE
Actual	626	**1818**
Expected	1411.7	**1032.3**

These results show that there is an association between use of DPO and utterances of Complex Events. The frequency of occurrence of DPOs in CE utterances is higher than the expected probability, which demonstrates a significant effect of CE utterances on DPO use in all MLU bands.

5.2.2.2 The association between DPO and ME; INT; RES

The analysis was refined using disaggregated data for CE and applying the same test only this time to all three utterance types: ME, INT and RES. In this test, the resultant observed versus expected probabilities were used to differentiate between the significant utterance types.

The following results were obtained. The frequency table shows that the significant association is between the presence of DPO in both INT and RES utterances (significant cells are highlighted and in **bold**):

Association between occurrence of DPO and Utterance types

MLU1	χ^2 = 874.3 df=2 p<.001		
	ME	INT	RES
Actual	275	**607**	**108**
Expected	669.2	**265.3**	**55.5**
MLU 2	χ^2 = 1703.9 df=2 p<.001		
	ME	INT	RES
Actual	399	**1134**	**205**
Expected	1122.5	**517.1**	**98.4**
MLU 3	χ^2 = 1470.3 df=2 p<.001		
	ME	INT	RES
Actual	626	**1501**	**317**
Expected	1411.7	**882.8**	**149.6**

For all MLU bands observed DPO occurrence in ME was consistently below the expected occurrence and the association was not significant. DPO occurrence in both INT and RES utterance types was higher than the expected count and significant.

The difference between the actual and expected counts for any utterance type variable, gives an indication of the relative strength of the association. So, reading from the frequency tables for MLU bands 1-3, the difference between the presence of DPO count for INT and the expected count, is in each table higher than that for RES:

	INT (YES count- expected)	RES (YES count- expected)
MLU 1	342	52
MLU 2	617	107
MLU 3	618	167

An interesting feature is that over time the difference between actual and expected count for DPO in RES utterances is increasing at a greater rate than for INT. This might suggest a developmental trend in the productive use of DPO in RES utterances.

5.2.2.3 The association between DPit and ME; INT; RES

Given the high incidence of 'it' in the data, a further series of χ^2 frequency measures was run this time to explore the association between the word 'it' (which is here coded DPit) and utterance types within each MLU Band. The results were as below, all showing a significant association between DPit and the Complex Event utterance types INT and RES (except in MLU band 2 where INT alone shows the significant association).

Association between DPit and utterance types

MLU1	χ^2 = 115.2 df=2 p<.001		
	ME	INT	RES
Actual	40	**277**	**33**
Expected	104.5	**230.7**	**14.8**
MLU 2	χ^2 = 90.28 df=2 p<.001		
	ME	INT	RES
Actual	35	**383**	**53**
Expected	106.2	**308.9**	**55.8**
MLU 3	χ^2 = 31.37 df=2 p<.001		
	ME	INT	RES
Actual	112	**416**	**92**
Expected	164.7	**378.0**	**77.3**

The results raise the interesting question why 'it' in INT utterance types has such an apparently privileged status. This question will be addressed in more detail in Chapter 7.

5.2.3 Study 2 discussion

The study set out to explore the relation between DPOs (endocentric DPs), and utterance types. A series of correlation tests established that there is a robust positive relation between DPO and Complex Event utterance types, and a negative relation between DPO and Manifest Event utterances. Although correlation studies do not signify a causal relation, testing for observed versus expected frequency of occurrence showed there is a significantly higher than

expected occurrence of DPO in CE types compared to ME. When the Complex Event utterance types INT and RES were subject to the same testing, both INT and RES showed a significant effect. The null hypothesis, which would assume no differences is therefore disproved.

Utterances of Complex Events appear to provide the context for the advent of distinct DPs in a non-agentive thematic role. Indeed, this context appears to be so robust that tests which attempted to distinguish between subsets of the DPO tally ('it/the' set versus the remainder) showed that such subsets each correlated significantly with Complex Event INT utterances. Focusing on the occurrence of 'it' in each utterance type, the χ^2 test confirmed that there is a significant association between 'it' and utterances of Complex Events occurrence particularly INT utterances, and to a lesser extent in RES utterances. ME utterances consistently showed no significant association with DPO use. It must be concluded that there is a very strong association between CE utterances and DPO use, and as INT utterances constitute the majority of CE utterances, it would appear that INT is the locus of initial DPO use in English, and 'it' shows a privileged relation with INT particularly in MLU band 2. It appears that direct objects occur more often in INT utterances than in utterances of Manifest Events.

Study 3 addresses the relation between utterance types and DPS

5.3 Study 3 - Utterance types and DPS

5.3.1 Testing the relation between all DPS and utterance types

This study involves a number of correlation and frequency analyses, following a similar pattern to study 2. The test data is the already identified DPS. This category was formed of those DPs remaining after the DPO category had been extracted. The whole data set for this study appears in table 5. It may be noted that the relative totals for 'I' and Rigid Designators are larger than those for the other DPS, and highlighted in **bold.**

Infant DP use	DPS
it	765
that/those	760
this/these	366
the/a	345
I (DPI)	**2561**
me	
Rigid Designators (RDS)	**1106**
He/she/they	398
him/her them	
You	497
We	98
us	
Totals	6551

Table 5 Data set for DPS and DPA

What makes these subsets additionally interesting is firstly that, the DPS set 'I' played no part in the DPO analyses in 5.2 above (Table 3), and secondly, the total use of RD in the DPS set (1106) is almost double that of the RD use in the DPO set (654). Each of these DPS subsets, which will be coded as DPI (for first person pronoun) and RDS, will be analysed to establish their relation to utterance type, if any.

The relation between ME; INT; RES; and DPS is represented visually by the means plot shown in fig 10, plotting the trimmed mean value data at 95% confidence level across each MLU band:

Variable	Mean values		
	MLU band 1	MLU band 2	MLU band 3
ME	.684	.636	.574
INT	.263	.310	.365
RES	.053	.053	.060
DPS	.225	.294	.387

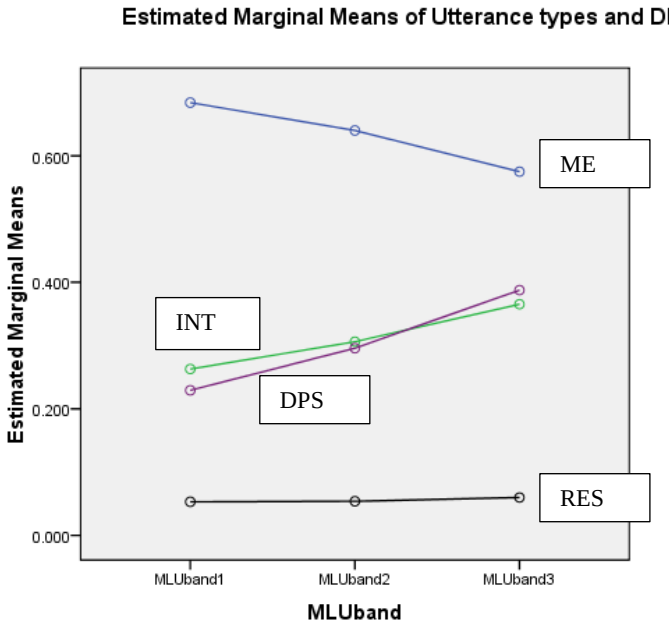

Fig 10 Plot of means of ME, INT, RES and DPS by MLU band

As in the previous study, a series of Pearson tests were performed to confirm or otherwise the positive correlation between each utterance type and DPS. These gave the following results:

Pearson correlation analysis for utterance type and DPS

Utterance types	Correlation	Significance
ME	r = -0.381 p=.003	Negative, significant
INT	r = 0.362 p=.005	Positive, significant
RES	r = 0.149 p=.257	Non-significant

Linear Regression F(1,58)=8.729 p=.005 (R^2 = 0.133). The linear relationship (INT:DPS) accounts for 13% of the total variance.

These results show a positive, significant correlation between DPS and INT utterances. The strength of this relation was further tested by Regression analysis which establishes whether INT is a valid predictor of DPS, (regression was significant at the .005 level, significantly greater than chance: The linear relationship accounted for 13% of the total variance. This result is not as robust

as the linear relationship between INT utterances and DPO (43% predictor), and gives grounds to query whether the correlation analysis is being affected by factors derived from the way that the DPS category was defined (essentially non-DPO). A series of frequency analyses were conducted for each MLU band, to measure the association between DPS occurrence and utterance types ME; INT; RES. The results are as follows:

Association between DPS and utterance type

MLU1	χ^2 = 13.67 df=2 p=.001		
	ME	INT	RES
Actual	658	242	**78**
Expected	661.1	262.0	**54.8**
MLU 2	χ^2 = 71.86 df=2 p<.001		
	ME	INT	RES
Actual	847	338	**137**
Expected	853.8	393.4	**74.8**
MLU 3	χ^2 = 182.32 df=2 p<.001		
	ME	INT	RES
Actual	**1196**	514	**220**
Expected	**1114.8**	697.1	**118.1**

For MLU bands 1 and 2, it is with RES that the association is significant.

For MLU band 3, it is with RES and ME that the association is significant.

These results present an interesting contrast to the correlation analysis. The differential function of DPs which have been designated as DPS, may be the source of the problem. It is possible that 'I' (first person), he/she/they and RD could indicate Agentive roles in some utterances, which other DPS do not. Some may be non-agentive subjects, or expletives. Although the frequency analysis shows a significant association with RES, the correlation analysis shows a significant relation with INT. The frequency result at MLU band 3 shows further interesting results where ME utterances and DPS show a significant association.

To clarify this outcome, further tests were conducted by separating subsets of the DPS category. The subsets were those DPs which were the most frequent: DPI (first person pronoun) and RDS. The analysis of each these two DPSs is described in the next two sections.

5.3.2 The relation of DPI to utterance type, and frequency of occurrence.

Given the extent of DPI use in the raw data (2561 occurrences), there is the possibility that the result so far achieved might be influenced by it. To explore this eventuality, the raw data was recalculated as the proportion of DPI use to the total number of utterances for each script. All these calculations resulted in data values less than 1, recorded to 3 decimal places.

Pearson correlation and regression tests were run to analyse the correlation between DPI and utterance types ME; INT; RES, which yielded the following:

Pearson correlation analysis for utterance type and DPI

Utterance types	Correlation	Significance
ME	r = -0.441 p<.001	Negative, significant
INT	r = 0.373 p=.003	Positive, significant
RES	r = 0.304 p=.018	Positive significant

Linear Regression F(1,58)=9.376 p=.003 (R^2 = 0.139). The linear relationship (INT:DPI) accounts for 14% of the total variance.

Linear Regression F(1,58)=5.926 p=.018 (R^2 = 0.093). The linear relationship (RES:DPI) accounts for 9% of the total variance.

The linear regression analysis shows INT and RES to be predictors of DPI.

As with the previous study, the correlation analysis was followed up with a χ^2 frequency analysis.

Appropriate data sets were prepared involving a tally of all DPS data as they appear in individual utterance types. χ^2 tests were applied to the DPI data, to establish if there is an association between DPI and Utterance type ME; INT; RES and then to note the observed and expected frequency of occurrence.

The results of the first analyses appear below, and show that the association between DPI and utterances of Complex Events is significant across all MLU bands, and that the difference between the observed and expected frequency of occurrence is high for both INT and RES utterance types (highlighted in the frequency tables):

Association between DPI and utterance types

MLU1	χ^2 = 222.5 df=1 p<.001		
	ME	INT	RES
Actual	72	**146**	**55**
Expected	184.5	**73.1**	**15.3**
MLU 2	χ^2 = 571.6 df=1 p<.001		
	ME	INT	RES
Actual	255	**489**	**129**
Expected	563.6	**260.0**	**49.4**
MLU 3	χ^2 = 672.4 df=1 p<.001		
	ME	INT	RES
Actual	366	**848**	**178**
Expected	804.0	**502.8**	**85.2**

The findings from these tests are in line with the previous correlation tests for the relation between DPI and utterance types. Both show a significant effect between DPI and both INT and RES.

5.3.3 The relation of RDS to utterance type, by frequency of occurrence.

For the following tests the RDS data was expressed as a proportion, derived from total RDS use divided by the total number of utterances for each script. All these calculations resulted in data values less than 1, recorded to 3 decimal places. The RDS data was in a narrow range (average mean scores for each MLU band: MLU 1 = .066; MLU 2 =.051; MLU 3= .044) and correlation testing gave no significant results:

Pearson correlation analysis for utterance type and RDS

Utterance types	Correlation	Significance
ME	r = -0.022 p.865	Non-significant
INT	r = 0.041 p=.753	Non-significant
RES	r = -0.193 p=.139	Non-significant

χ^2 tests were applied to the frequency count RDS data, to explore the association between RDS and Utterance type ME; INT; RES and then to note the observed and expected frequency of occurrence.

The results of these analyses appear below, and show that the association between RDS and utterances of Complex Events is significant for RES utterances across all MLU bands. INT utterances show a positive association with RDS for

MLU bands 1 and 2, but not MLU band 3 where ME utterances show higher than expected occurrence of RDS:

Association between RDS and utterance types

MLU1	χ^2 = 478.20 df=2 p<.001		
	ME	INT	RES
Actual	174	**124**	**30**
Expected	219.8	**82.2**	**26.1**
MLU 2	χ^2 = 52.96 df=2 p<.001		
	ME	INT	RES
Actual	188	**136**	**64**
Expected	246.0	**98.5**	**43.6**
MLU 3	χ^2 = 10.54 df=2 p=.005		
	ME	INT	RES
Actual	254	**78**	**46**
Expected	232.1	**103.2**	**42.7**

5.3.4 Study 3 discussion

Analyses were conducted on three different DPS types.

Firstly all DPS: In the correlation studies, DPS and INT utterances showed a significant relation, although not as robust as the DPO/INT relation. Frequency analyses showed RES to have a significant association with DPS for all MLU bands, ME to have a higher than expected DPS count at MLU band 3. In all bands INT utterances consistently scored a lower than expected count. These results seem to be contradictory. The tests each use different data sets (proportioned data for correlation analysis, and tally data for frequency analysis) and therefore the differing test results is revealing the heterogeneous nature of the DPS data set (all non-DPO). As the largest components of the DPS set are DPI and RDS, separate analyses of each of these provided some clarity.

Testing DPI: For both correlation and frequency tests INT and RES utterances were found to have a significant association with DPI, and INT has the stronger association by consistent higher than expected occurrences.

Testing RDS: Correlation tests showed a non-significant result. Frequency tests showed a significant association between RES and RDS for all MLU bands, and an association between ME and RDS at MLU band 3.

One conclusion is that the category DPS as defined, is as suspected, somewhat hybrid, and test results for DPS analysis seem to show a mix of two types of result: INT significant for correlation tests, but RES and ME for frequency tests. This contrast was clarified by separating DPS into DPI which exhibits the stronger association with INT, and RDS which exhibits the stronger overall association with RES, and also with ME at MLU band 3.

6. General discussion

The series of studies was set up to explore the relation between DP use and utterance types (ME, INT, RES). The first study found that bare nominal use correlated positively and significantly with ME utterances and that total DP use correlated positively and significantly with CE utterances. This result confirms the original prediction that infants will tend to use bare nominal forms when characterising Manifest Events, while the use of DPs will emerge when Complex Events are being described.

Study 2 confirmed the strong correlation between INT utterances and DP elements functioning in a non-agentive 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 correlations with INT utterances. The strong effect was confirmed by regression, and frequency analyses. The latter showed that RES utterances also had a significant effect on DPO use, but not as strong as INT utterances. All DPOs and particularly the single word ‘it’, very common in the data, was shown, by the frequency measure, to have a strong association with INT utterances.

As transitive verbs are words that need to be linked to their non-agentive themes, the underlying assumption is that a category [V] is present in utterances that have DPOs. In conventional terms this constitutes a verb phrase [VP]. As it is INT utterances which appear to provide a robust context for the advent of distinct DPs in a non-agentive theme role, there is a strong suggestion that INT utterances are providing the context for the acquisition of the verb phrase in English. There is also the suggestion that ‘it’ is playing an important role in this process.

Study 3 considered the relation between utterance types and potentially Subject role DPs, with comparable successive testing of sub-divisions of DPS.

These tests seemed more inconclusive. Frequency tests which focus on specific DPS use revealed for the most commonly used DPSs, that INT utterances have the strongest association with 'I' (first person) and RES utterances have a strong association with RDS. There is also the suggestion that RDS use is subject to a developmental effect, as progression in linguistic ability (MLU) and age experience show increased frequency over expected levels in ME utterances in MLU band 3. These results suggest that INT provides a context for DPI and RDS use, as does RES. One evident conclusion is that DPI and RDS are each fulfilling an Agent role, and for English acquisition, these are also grammatical subject.

In considering how these studies contribute to the bigger picture, it is strongly inviting to conclude that CE utterances are providing the essential context for the Conceptual-Intentional bootstrapping hypothesis to operate:

INT utterances exhibit DPO use, effectively suggesting [$_{VP}$ V DPO] constructions, where initially 'it' appears as DPO: [$_{VP}$ V -it]

INT utterances also exhibit DPO and DPS use, suggesting [DPS[$_{VP}$ V DPO]] constructions, where initially 'I' (first person) appears as [DPS: I [$_{VP}$ V -it]]

RES utterances exhibit DPO and DPS use: suggesting [DPS[$_{VP}$ V DPO]] constructions, where RDS seems to fulfil an Agent role: [RDS[$_{VP}$ V DPO]]

ME appears much later to exhibit RDS but not DPO use: suggesting possible [RDS[V]] constructions.

How these proposed structural descriptions are realised in practice is explored in detail in the next Chapter. In general, however, this evidence supports the proposal made in the conclusion to the previous chapter, that it is the unique properties of utterances about Complex Events which initiate syntactic growth. As INT utterances appear to be strongly implicated in all positive test results, a clear question is raised: why are INT utterances such a productive powerhouse for development, and why is first person use so evident?

INT utterances are highly informative. They express mental representations that are attributed to the infant herself; are 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. Utterances of this kind are highly important to an intentional being. Thus the acquisition of a conventionally acceptable means of expression is a high priority making the effort-engagement balance of infant intentionality very cost effective.

In the next chapter, based on this empirical evidence and qualitative data drawn from the Travis and Manchester corpora, I will characterise how the bootstrapping process may proceed, to result in the acquisition of core English syntax for infants in the 18 – 30 month age range.

Chapter 7
Conceptual-Intentional bootstrapping in the acquisition of the English [V]erb

Introduction

A decisive meta-cognitive development, described in Chapter 5, enables infants to construct new intentional environments of their own, as opposed to those given and manifest in the 'here and now'. These have been termed Complex Events, which still focus on dynamic substantives, but concern intentional change of state. These events are all complete or culminated, and following Vendler (1957) can be classed as Achievements or Accomplishments rather than Activities. A simple mapping of linguistic expression to context will not meet the communicative needs to talk about Complex Events, which involve two sub-events, one manifest and one constructed. This complex context demands new linguistic means to be acquired. Traditional acquisition accounts appeal to the idea that verbs denote actions and nouns denote entities, and that word mapping proceeds on this basis, deriving a route into syntax through lexically sourced grammatical categories. On these accounts, one reason why verbs have been considered to be 'hard words' is that it is conceptually impossible to separate an action from the actor, or recipient. Actions cannot occur without an actor of some sort. Thus learning verbs as conceptual labels of discrete actions is found to be difficult without including information about potential participants, and learning nouns as discrete object labels is equally difficult without including information about dynamic potentialities.

In English syntax, it is noun phrases (DPs) and not nouns that refer to entities, and verbs are typically interpreted as functions from DP referents to types of events, denoted by verb phrases. It is the referent of the DP that 'measures out' (Tenny 1987, Dowty 1991) the event denoted by the verb phrase.

My hypothesis makes certain predictions, as stated in Chapter 6, that infants will tend not to use DPs when characterising Manifest Events and determiner-less nominals will predominate. The use of DPs will become apparent when Complex Events are being described. The empirical study in Chapter 6 revealed that

Complex Events do have properties significantly different from those of Manifest Events. Bare nominals correlated positively and significantly with utterances about Manifest Events, but negatively with Complex Event utterance-types. The results confirmed that DPs are robustly present in Complex Event type utterances as opposed to those of Manifest Events. Complex Event utterances require a predicate that describes the change of state and a means to refer to a theme object that 'measures out' the change of state. There is, therefore, the strong suggestion that Complex Event utterances are the locus for the acquisition of grammatical categories [DP] and [V].

Dividing the occurrence of DPs in the corpus into two general groups, roughly those defined as appearing to perform a Theme role and those that do not, revealed that Theme role DPs (DPOs) are robustly predicted to occur in INT and RES utterances. 'It' in this group (DPit) had a highly significant association with INT utterances. Of the other group, non-theme role DPs (DPSs), the results tended to reflect the hybrid nature of the group as defined. It was found that the most frequently used DPSs, 'I' and RDS, did have strong associations: 'I' with INT and RES, and RDS with RES (and later with ME).

The Conceptual-Intentional Bootstrapping proposal has tracked important contributory developments towards this point. As indicated in Chapters 1 & 2, no other acquisition proposal explicitly addresses the inevitability of language acquisition, nor why it does not occur productively, earlier than it does. The innate linguistic specifications and recognition of complex conceptual ability assumed by the generative theory implies inevitability deriving from inbuilt systems, but cannot explain why it is not until part way through the second year of life that productive linguistic expression is apparent. Similarly, emergent theories, which define early (neonate) learning of social communication abilities with recognised early understandings of the world, and plentiful linguistic input, cannot clarify why infants do not acquire productive language earlier than they do. The Conceptual-Intentional Bootstrapping proposal shows how the developing infant is driven inevitably towards acquiring certain key features of grammar, a year or more after birth, as a natural consequence of various constraints. Chapters 3-5 set out the influential contextual components of the

Conceptual-Intentional Bootstrapping proposal, which characterise the nature of a system of 'constrained flexibility'.

This is afforded by the interaction between:

- Infant intentionality: engagement with events is delimited by relevance.
- Infant generic knowledge: formed by the funnelling effect of engagement with wide to ever narrowing contexts. The prime contexts are the social/cultural, location, bounded events, intentional action, and finally the substantive dynamic properties of the immediate perceived environment (Chapter 3).
- Meta-cognitive developments: enabling a shift from monitoring perceived events to mapping between events including perceived linguistic events. In this way word learning and word meanings are distilled out from global contexts (Chapter 4). Thence a further meta-cognitive ability enables expression of Complex Events.

When productive infant utterances can be recorded, they exhibit evidence of the influence of a syntactic system. The aim of the discussion in this chapter is twofold.

i) To provide a schematic description of the nature of infant early syntactic development as evidenced through utterances of Manifest and Complex Events. This will be inevitably speculative but is informed at each point by corpus and empirical evidence. The description will profile the developing syntactic knowledge of the infant from 18 to 30 months, and indicate the implications for generativist and emergentist or constructionist theories.

ii) The outcome from (i) will define what syntactic knowledge infants can be expected to have by age 30 months according to the Conceptual-Intentional Bootstrapping proposal. This will prepare the way for the discussion in Chapter 8 which will focus on empirical studies which have conflicting assumptions about syntactic knowledge by this age. I will demonstrate that the expected syntactic knowledge can account for the outcomes of key comprehension experiments, in contrast to the outcomes proposed by the researchers.

Examples for the following discussion will be sourced from the two corpora already used: Travis' data and the CHILDES/UK-Eng/Manchester corpus (abbreviated to Manchester data)

1. The structure of Manifest Event utterances

Two word utterances in Manifest Events are descriptive of objects/entities in the shared event with adults, and the infant utterance, in effect, explicates her understanding and knowledge of the dynamic attributes of that object. So the following utterances all describe an actual event involving objects/entities doing what the infant expects such entities to do.

(68)

a) Baby crying
b) Swimming hippo
c) Doll sit

I have argued in Chapter 5, that the syntactic relation between the words used, appears to be a sister relation between [substantive] and [modifier] categories: $[_{sub}$[mod][sub]] or $[_{mod}$[sub][mod]] and conceptually centred on the object/entity and those attributed dynamic properties known (by the infant) to be inherent to that entity. I have shown that in the context of these early Manifest Event types, the two word utterances that adults might analyse as Noun+V-ing combinations are in effect representing this substantive/modifier relation. As the structure represents an on-going inherent relation between the perceived object/entity and its dynamic properties, the overall utterance expresses an incomplete or imperfect event.

Although this differs substantially from adult usage, examples, from such, can be found which appear to mirror infant utterances. As already suggested, 'a spinning top' describes a traditional toy both in its static and dynamic state. Other adult examples are not so clear cut. Compare, for instance, the nature of the adjectives in (69) below:

(69)

a) watering can
b) drawing pad
c) writing table
d) jumping cow
e) amazing book

'Jumping cow' (69d) appears to express a different relation from those expressed by the other examples. 'Cow' indicates the experiencer of the activity described by the adjective, not reflected in the other phrases. (Such an interpretation can be made, but the sense would be absurd; tables do not write, pads do not draw. There is a possibility that cans do water, or books do amaze given an instrumental interpretation).

Borer (1990) in discussing the controversy over whether different V-ing type words are verb particles (69d) or adjectives (69e), concludes that there is an advantage in considering V-ing to be adjectival rather than verbal based on the syntactic distribution and morphological affixation. Borer proposes that the differences between V-ing adjectives, are due to the properties of the verbs from which they are derived.

For the 18 to 30 month old, I suggest that these verb derivations are not accessible, as infants do not have verbs in ME syntax. I propose that all V-ing type words learned and expressed by infants are descriptive of the dynamic attributes of the object/entity described. These attributes commonly include what animate entities do, as well as their affordances and instrumental function. For infants, most V-ing type words function as modifiers in the elementary syntax of Manifest Event utterances.

Note that V-ing does not appear to be a productive stem+suffix construction, as shown in examples (68a-c), and the supposition made here is that words at this stage are used as they are heard. As '–ing' is a frequently used suffix in English, appearing appropriately in utterances about on-going events, it is reasonable to assume that this form will be well represented in CDS.

For an infant, [substantive][modifier] type sentences ($[_{mod}$[sub][mod]] or $[_{sub}$[mod][sub]]) are limited to utterances about Manifest Events. Reference to an

object is made implicitly through the ostensive presence of the object/entity and the explication of its dynamic attribute is also motivated through its presence, and /or infant generic knowledge of such object-types. These expressions are inherently imperfect and on-going. Aspect, therefore is an important differentiator between utterances about Manifest and Complex Events, and so the rudimentary syntax of Manifest Event (ME) utterances will include an Aspect feature [imperfect], which will be accommodated for the time being as: $[_{Aspect}$(imperf)[sub phrase]] or $[_{Aspect}$(imperf)[mod phrase]].

2. The structure of Complex Event, INT utterances

Throughout the Travis and Manchester data a progressive elaboration of INT utterances is plainly observable, and described in the previous chapter. In this section, I will attempt to track developments to provide a schematic description of the structure of INT utterances, based on informed speculation. I will also indicate implications for generativist and constructionist analyses as they arise.

Complex Events of the INT type, as described above, contrast with Manifest Events in that the desired object/entity goal of the event is not apparent in actuality. To describe this type of event verbally, requires a linguistic means of referring to the object/entity, the equivalent for the infant of 'linguistic pointing'. The referred object/entity then 'measures out' the event to its conclusion, - the goal outcome (Tenny 1987, cited in Dowty 1991 p570). So an event, where obtaining juice is the goal, has an associated utterance like 'get the juice'. In this case the [V]erb 'get' is a predicate over the obtaining event and 'the juice' measures out the event to completion, the tracking of which specifies the end point. In this way, INT utterances exhibit the dual properties of event completion and reference. The generalised event that INT utterances describe is one of change of state.

The empirical study (Chapter 6) demonstrated a strong association between INT utterances and DPs, and negatively with the use of bare nominals. Linguistically, DPs refer whereas bare nouns do not. Bare nouns indicate category sets attributive of objects/entities. Therefore, 'dog' denotes a set of kinds which all exhibit the properties which contribute to the attribute 'dogginess', however this is arrived at. Bare nominal use in adult English can be exemplified by the

generic plural. So, for example 'dogs are dangerous', does not refer to any particular dogs, but expresses an unquantifiable collection of similarly categorised kinds, which are judged to have a salient attribute worthy of being given focus. DPs, however, can pick out individual members or subgroups of the set. So for example, 'the dog' picks out, by definite reference, one and only one member from the category set of entities conceptualised as 'dog'.

There are clues evident in the corpus, to how the structural change from ME utterances to INT utterances may come about to meet these requirements.

2.1 Deriving [V] and [DP] in INT utterances

Due to the privilege afforded by Tomasello's data, which describes Travis' progressive development, it is possible to note the heuristics this infant employs to differentiate the communicative intentions of ME and INT utterances. (The other infants, in the Manchester data, appear to exhibit similar developments, but due to the sampling process, a profile of progressive development is unavailable).

A useful strategy to use, when confronted with something new, is to try out what is already known and see if it works - a strategy Braine (1992) had suggested (and discussed in Chapter 2 section 1.4.1). As change of state provides a fundamental differentiator between ME and INT utterances, Travis shows evidence of initially adopting the syntactic construction she already knows for ME utterances but with a perfective feature, relying on adult pragmatic abilities to interpret her intention.

For instance, revisiting the example first cited in Chapter 5:

(70)

a) see Stu – *seeing Stu* (atelic)
b) see Stu – *wants to be lifted up in order to locate Stu* (perfective)
c) crying mummy – mummy is crying (atelic)
d) crying mummy – wants to see the picture of mummy crying (perfective)

This type of utterance, through using a named and identifiable person as a participant, provides the reference necessary to make the utterance work for both ME and INT. In 70a and 70c, Stu or mummy is present. The contrasting intention in 70b and 70d is conveyed contextually by the knowledge shared by infant and

adult in this case that Stu, or (crying) mummy are not present (within the eye-line of Travis).

Relying on the hearer to interpret quite different content pragmatically has its limitations. There is a strong chance that insufficient information can be derived from the context, or that the hearer is unwilling to expend the effort required for the interpretation. Other devices are available and appear to be utilised not only by Travis, but systematically by all the infants in the Manchester corpus too.

There is no doubt that all infants will have experienced in CDS, utterances like: 'shall I get it?' 'do you want to get it?' and the like, and there is a strong possibility that 'get-it' may initially be learned as a single unit. Tomasello suggests this to be the case and his notes on Travis' first use of 'get-it' records it as a single word utterance. Tomasello also regularly hyphenates 'get-it' in the transcripts.

The empirical evidence (Chapter 6) showed that 'it' has a strong association with INT utterances. If '-it' is some sort of suffix, then 'get-it' could be thought to be overtly marking the verb as telic to express a perfective event. The 'get' event terminates with 'it'. This is, however, not a usual suffix in adult English, even though the combination is an acceptable utterance in its own right.

Travis' two word utterances, as transcribed by Tomasello, for the period from 16 to 17 months show the following uses of 'get-it'.

(71)

a) Block get-it (16m25)
b) Bottle get-it (16m26)
c) Spoon get-it (17m07)
d) Books get-it (17m25)

On the face of it, Travis appears to be using the familiar ME merged construction type for these utterances: [substantive][modifier]. But this sentence form presents a problem. 'Get-it' is an unusual modifier, unlike any other. It does not modify or elaborate on the dynamic property of the substantive object. Spoons, books, bottles and so on, can of course be 'got', but this dynamic action is not a property that can be attributed to the object itself, which adopts a Theme

role within the event as a whole. These utterances appear to be closely reflecting the conceptual content of INT utterances by expressing what appear to be the two sub-events involved: objects (block, bottle, spoon or books), which are not present, and an end state where they are. Whether Travis is using familiar syntax or simply labelling conceptual elements of the event (or attempting both) is an open question, but from 18 months, Travis changes this construction consistently to [get-it] [Substantive], as in:

(72)

a) Get-it puppet (18m11)
b) Get-it guide (19m01)
c) Get-it spoon (19m29)

This is an extraordinarily important development, for two reasons:

Firstly, this construction is not an acceptable adult sentence and as such will not have been heard uttered by an adult to the infant. Adults simply do not speak like this.

Secondly, this usage is not restricted to Travis. The empirical evidence (Chapter 6) showed that 'it' is significantly associated with INT utterances alone, at MLU band 2. All the infants in the corpus studied, employ such an 'it' construction, although using different words from 'get'.

The main words used in INT utterances throughout both corpora are all used to express a change of state, and are listed in Table 6 below, the commonest are marked in **bold.** In adult English, some of these verbs are atelic (marked with an asterisk) although they have telic connotations in infant use,

bite-it	bring-it	mend-it
do-it *	buy-it	open-it
eat-it	chop-it	pick-it
find-it	clean-it	play-it
get-it	cook-it	push-it
have-it *	drink-it	show-it
hold-it *	finish-it	shut-it
put-it	fit-it	throw-it
see-it *	fix-it	tie-it
take-it	leave-it	tip-it

Table 6 Common change of state words in INT utterances

Each of the words used can be interpreted as providing information about the required goal state of whatever object the infant is engaged with at the time. In addition, they play a key syntactic role in this construction. The words most commonly used (apart from 'bite' and 'eat' which incidentally provide insight into infant intentional priorities) denote an intention for the appearance or presence of an absent object. All these verbs are telic given what the infant intends to convey. The less common words display how the infant is refining and making more precise what goal states she intends to occur as she engages with varying contexts. This process of refinement will eventually affect the telicity (for the infant) of the asterisked verbs in Table 6. 'Do', 'have', 'hold' and 'see' are initially used in INT utterances and serve to express the perfective, punctual nature of the event described. As more appropriate (in adult terms) verbs are learned then these early verbs will express the more usual atelicity associated with them.

The only large-scale condition that all the infants have in common, apart from their age, is that they are all learning English (British or American). This type of construction appears to be so pervasive in early infant INT utterances that it suggests it must be a common leverage point into English syntax, yet other acquisition research programmes rarely, if ever, remark on it. This may be because it appears to exhibit a very odd [V] it [N] construction type. If this is in fact a 'bootstrapping' moment, then how can it be accounted for?

A partial solution can be found by recognising the inherent nature of INT utterances, in any acquisition model. INT expresses events that are perfective, describing an intentional change of state towards an object which appears manifestly in its unchanged state (including being absent). The intention is focussed on the changed state of the object and not on the means of making the change. There would appear to be nothing to prevent an infant uttering 'get spoon', but the evidence is that they do not do so consistently. 'It' is a remarkably simple device with considerable power. As a word it can refer but its referential meaning must be contextually provided. As a feature it provides an end point for the telic verb expressing the complete event.

Intuitively 'it' is integral to the meaning of the verb, as the list in Table 6 shows: if viewed without the attached '–it', the list reads simply as a vocabulary

list, but with '–it', the Table reads as a list of interpretable utterances (admittedly requiring context). This intuitive adult judgement may have prompted Tomasello to record 'get-it' as one word.

One explanation for the [V]it[N] construction might be that 'it' is making a major contribution by bridging object reference and verb telicity, the two important components of INT utterances. In Complex Events, the contextual information is not apparent from the physical context, and must be supplied. [N] fulfils this role by providing additional linguistic material attributive of the object/entity the infant has in mind (spoon, puppet, juice and so on).

This does not address the problem of the grammatical status of 'it' nor why it disappears, when more appropriately adult-like utterances are made. The corpora show that when determiners are used, in most cases 'it' drops out, as in the following examples (although determiner use is sometimes approximate, a point discussed further below):

(73)

a) find a spoons (plural)
b) mend the train (when a specific train needs mending)
c) have this doll (no doll present)

Explaining this from a constructionist viewpoint, Tomasello (1992) suggests that words like 'get-it' are learned from hearing adults say them ('I'll get-it' or 'you get-it'). The infant can then make a productive construction like [get-it][N].

On Tomasello's verb island account, the other verbs in table 5 would be learned individually; 'mend-it', 'pull-it' and so on. The problem for this account is when infants acquire determiner use; that is, when 'get it spoon' is replaced in favour of 'get the spoon'. This would demand that either the prior construction has to be unlearned, or 'it' is acting as some sort of infant determiner, which is simply replaced by more appropriate words. In opposition to this last suggestion, Pine & Lieven (1997) through corpus study have also noted that determiner-like words appear in infant speech at this age. Their conclusion however, from a Tomasellan item-based usage approach, states that infants do not have a determiner category, as those that appear to be determiners are not used correctly

(relative to adult usage). The point they raise about correct usage will be addressed presently, but in their paper, Pine & Lieven do not identify 'it' as a determiner, even one used incorrectly. Constructionist accounts would appear not to provide a generalised view of 'it', its function or structural role. The problem can be approached differently by adopting a generative approach. The problem is essentially is 'it' incorporated with the verb, as the transcript hyphenation suggests? Or is it more an early infant determiner?

As stated in Chapter 5, in a Minimalist generative framework, Merge, is normally driven or constrained by the grammar-specific requirements imposed by lexical features of the items or markers involved (Adger 2003). On this account, for 'get-it' in early infant grammars, 'it' may be viewed as an overt feature of 'get' which marks telicity. According to the theory, features remain in the derivation and contribute to semantic interpretation, or perform a syntactic function after which they are deleted (motivated by syntactic principles).

This would suggest, for an INT utterance expressing change of state, the following, schematically expressed, illustrative structure in fig 11:

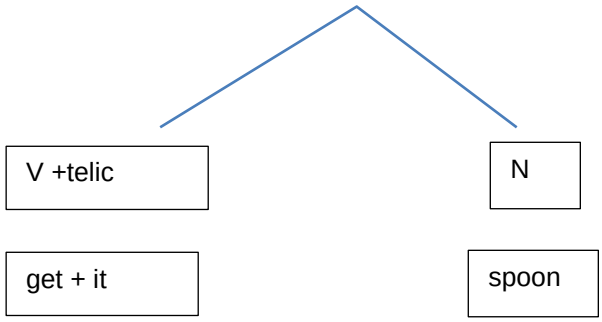

Fig 11 Schematic diagram of INT structure where +telic indicates a feature marking telicity

The verb in this structure has a feature (+telic) for telicity, realised by 'it'. In utterances like 'get it spoon' there is no motivation for its deletion, and therefore it remains.

But when determiners are present, which function as marking out the course and completion of the event predicated by the telic verb, ‘it’ is deleted, as illustrated in fig 12:

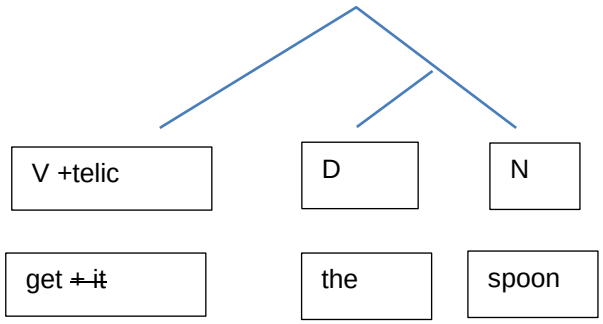

Fig 12 Schematic diagram showing deletion of ‘it’

This account, where ‘-it’ is considered an integral part of the verb, is unsatisfactory in at least two respects:

i) If ‘it’ is an overt verb feature of telicity, there is little reason for its deletion in the presence of a determiner. ‘Get-it the spoon’ should be commonplace, but such expressions do not obviously occur in the corpora.

ii) ‘It’ may be an overt argument marker of the verb. Its overt nature in intuitively acceptable utterances (‘get it’) makes it accessible. It maps to infant understanding of whole events, and provides a marker for a direct object. Although there is controversial debate about the relation between verb telicity and direct objects (outlined in section 2.2 below), ‘it’ could provide an overt link, but its deletion is unexplained as with ‘get-it spoon’, spoon could adequately fulfil a direct object role.

The alternative, that ‘it’ is an early infant determiner, has more plausibility. In order to make INT utterances, the sentence used will need to exhibit minimally three grammatical categories:

i) a category with may predicate over the state change event

ii) a category that provides reference to the participating object/entity undergoing the change of state, and

iii) a category that describes the kind of object entity involved.

Traditionally these categories are [V]; [D]; and [N] respectively. If this is the correct, then each word in 'get it spoon' faithfully maps to this category designation. This would point to 'it' as an early infant determiner.

Pine & Lieven (1997) claim that infants do not have a determiner category, as those that appear to be determiners are not used correctly (relative to adult usage) as in: 'find a spoons'. This view appears to be based on the synthetic approach often favoured by item-based research. This generally suggests that lexical items are learned independently and coalesce into categories when sufficient are learned. The alternative analytic process would propose that the global category [D] is established because of the syntactic function it needs to perform and category membership is extended and refined over time. What is odd about Pine & Lieven's conclusion is that it seems to ignore that determiner-like words, whether used with adult precision or not, appear in determiner-like relations within sentences. From the analytic approach adopted here, it is noted that the determiner-like words and only these in effect project to the [D] node. This would appear to confirm that the words, although as yet lacking in the refinements of use, are all recognised as potential members of the same global category. Refinements in Determiner use can be eventually derived from positive evidence in nearly all adult utterances.

'It' seems to be a mysterious element. There appear to be no examples of adults specifically correcting this unconventional use. Indeed, as the usage also seems to be generally transparent to researchers, it may be that adult carers do not even notice it. It is tempting to suggest that adult utterances like 'get it' constitute an unambiguous trigger for localised syntactic growth (treelets) of the kind Janet Fodor (1998) has suggested (discussed in Chapter 2 section 2.4.2).

When adult-like determiners are used, the INT structure expressing change of state resembles a traditional VP type configuration for English. The result is generalised to a functional, syntactically well-formed 'treelet' or part sentence, which can be schematised below (fig 13) using conventional labels for nodes:

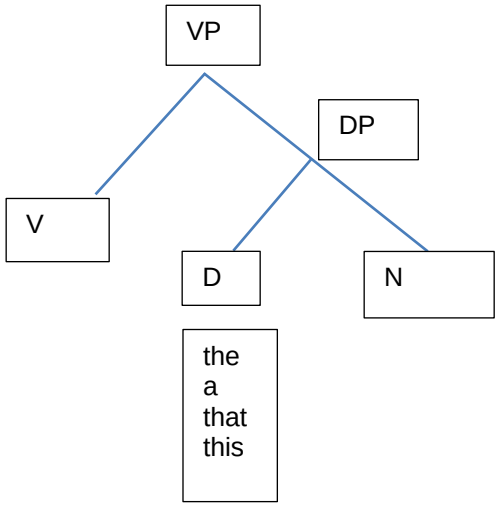

Fig 13 Schematic diagram of the INT 'treelet'

Across all corpora, it is clear that this is a productive syntactic construction for INT utterances. Different words can appear in [V] position indicating different state change events (exemplified in Table 6), different objects can be indicated in [N], and a small restricted set of determiners [D] are used, to effect linguistic reference.

The generalised structure of INT utterances and the verbs used, provide a strong challenge to Tomasello's VIH proposal. His account states that lexical items, through frequent use and individual morphological development, form verb islands which when reaching a critical mass fall together by some means (analogy was suggested) to form a common category – [V]erb. The case made here is that the identified change of state words ('have-it', 'get-it' and others in Table 6) are not lexical items independently developing through usage, but those that can be members of an existing syntactic category [V] which functions within the context of INT utterances, and motivated by a change of state event. It is the category membership which develops over time, not the category. What is the source of such categories?

I have indicated that to express the content of an INT utterance, three discrete contrastive categories are required. These have been labelled conventionally as [V], [D], and [N], but could equally be infant prototypical categories [event change], [reference] and [substantive]. These are clearly closely

related to the conceptual content of an INT utterance and, like [substantive] and [modifier] may be tracked to an innate endowment. However sourced, these necessary categories appear to be established early, and in the context of INT utterances.

Reviewing the commonly developing 'verb islands' in Tomasello's (Travis) data, reveals that they are in actual fact performing a role within INT utterances. Although Tomasello does not identify INT as an utterance type, he does define 'change of state verbs' and more importantly he does explicitly recognise Travis' intentions. His contextual comments on each recorded utterance frequently indicate that Travis' utterances involve wants, requests, demands or reference to as yet unrealised outcomes.

Calculating the proportion of unambiguously identified INT utterance types in the Travis data based on Tomasello's own explicit comments about Travis' intentions, gives the following results (Table 7):

Verb	Proportion % INT
get	99
hold	88
fix	85
open	85
give	75
pick	71
get + out/in/off	70
have	67
wipe	50
come	50
see	46
move	43
take	41
put	20

Table 7 Proportions of INT utterance use of verbs in Travis data

If INT utterances were recognised, it would be apparent that the lexical items for which Tomasello claims an island effect, possibly appear so courtesy of the role they play within the syntactic construction associated with INT, alongside other roles. They already contribute to a category necessary for INT utterance types, which I have labelled conventionally as [V].

Given the division between Manifest and Complex Event types, two troubling problems of VIH can begin to be resolved. Firstly, the observation that different verbs exhibit differential degrees of morphological and structural development can be traced to the roles they are playing in ME and CE utterances rather than their isolation as islands. Secondly, the problem of analogy is solved because of the presence of the superordinate category [V] in the syntax which defines the common relation between the collections of different words learned. There is no need to propose an undefined critical mass of islands that coalesce into [V].

From a different perspective, Ninio's path-breaking verb hypothesis can be challenged. In Chapter 2 Section 3.5.2, Ninio's view of path-breaking verbs was outlined. On this account, initial word combinations are semantically motivated rather than reflecting syntactic knowledge. Given a growing store of word combinations, Ninio suggested (Ninio 1999 p116) that children gain a 'growing realisation' or 'insight' into which words require arguments and therefore function as predicates. However, what constitutes, motivates, or guarantees a 'growing realisation' or 'insight' is unclear. Ninio's path-breaking hypothesis proposes that the first verbs children acquire are prototypically transitive, and based on infant data, she claims that initial transitivity is reflected in terms of two cognitive processes, either objects being drawn to/into the self (possession or consumption) or object creation. This is explained by her observation that the first (S)VO constructions involve 'want' 'take' 'eat' 'hold' 'get', or 'make' which she terms 'path-breaking verbs' upon which verb phrase construction is based. Just how a 'growing realisation' can become an inevitable outcome is not clear. Early INT utterances would appear to provide the clarification missing from Ninio's observation. As INT utterances express infant intentions towards a change of state of identified objects, it is most likely that the verbs Ninio lists will be included as verbs learned by infants to express INT utterances. Thus it is not specific verbs as discrete lexical items which demand a (S)VO construction, but the obligatory role they play in INT utterances.

As the informative content of INT utterances is characterised by change of state and verb telicity, my account of early verb acquisition may shed some light

on the relation between verb arguments, aspect and event structure, an issue which has been hotly debated.

2.2 Verb argument structure in INT utterances

Verbs are traditionally categorised in terms of their argument structure, which helps differentiate those labelled intransitive - one argument, transitive – two arguments, and di-transitive – three arguments, exemplified respectively:

(74)

a) The girl is running (SV)
b) The girl is holding a baton (SVO)
c) The girl is passing the baton to a boy (SVOO)

In many ways this is the converse of the conceptual problem stated in the introduction, where verbs are considered to be 'hard words' because conceptually, actions cannot be divorced from the participants performing them. This linguistic converse addresses the problem from the point of view of the verb where the meaning of a verb cannot be divorced from the nature of the allowed participatory entities.

Although, the in/di/transitive classification differentiates 67 (a) - (c), it does not capture why the following should be possible without needing 'write' to be three different verbs:

(75)

a) The girl is writing (SV)
b) The girl is writing a message (SVO)
c) The girl is writing a message to a boy (SVOO)

Additional problems occur for causative alternates, where some alternate and others do not as example (69) below:

(76)

a) The girl broke the vase (SVO)
b) The vase broke (SV seemingly expressing *OV)
c) The girl cleared the table
d) *The table cleared

A traditional solution has been to assign appropriate theme role information to word entries in the lexicon, which describe the kinds of participatory roles a verb allows. Amongst these are Agent, Patient, Experiencer, Theme and many others. So in 69(a), the girl is Subject of the sentence and Agent of the act of breaking where the vase is grammatical Object and Patient of the act of breaking. In 69(b) the vase is Subject of the sentence but still Patient of the act of breaking warranted by the inference that a vase has an inherent structural potential for breaking. This contrasts with 69(d) where the table is the Patient/experiencer of the act of clearing, but has no inherent potential for clearing. Generative approaches generally adopt a procedure utilising thematic information through lexically supplied θ-marking and case assignment during the derivation.

The problem with thematic role assignment is that the potential roles seem to proliferate to capture more information to account for the ways different verbs operate. There is little agreement about what such an inventory should be as Parsons (1994) has noted. One solution to this, following Vendler (1957), is to consider Aspect, as the time schemata relative to the events being described. Vendler identified 4 such event types (Aktionarte) labelled respectively States, Activities, Achievements, and Accomplishments, which Vendler defines in the following way:

> “For activities: "A was running at time t" means that time instant t is on a time stretch throughout which A was running.
> For accomplishments: "A was drawing a circle at t" means that t is on the time stretch in which A drew that circle.
> For achievements: "A won a race between t1 and t2" means that the time instant at which A won that race is between t1 and t2.
> For states: "A loved somebody from t1 to t2" means that at any instant between t1 and t2 A loved that person.
> This shows that the concept of activities calls for periods of time that are not unique or definite. Accomplishments, on the other hand, imply the notion of unique and definite time periods. In an analogous way, while achievements involve unique and definite time instants, states involve time instants in an indefinite and non-unique sense.” (Vendler 1957 p149)

By this definition an Accomplishment is an activity with a unique and definite time period, and an Achievement is a state involving unique and definite time instants.

Different researchers (Comrie 1976/98, Smith 1991) have found these categories too wide to be useful and have decomposed them into feature sets.

These features may combine in different ways to provide greater nuance for analysis. The features are variously labelled by different researchers but here the terms ±durative, ±dynamic and ±telic will be used.

Olsen (1997) proposes that the aspectual features are not equipollent (+ or -) but privative, appearing only as a + marking for a verb as part of its semantics under all conditions. In other cases where a verb is unmarked, the aspectual feature (+ or -) is derived pragmatically from the context of use. For instance, 'drink' is inherently an activity (+durative +dynamic -telic), but there is a need to draw a distinction between atelic 'she is drinking' and telic 'she is drinking the coffee. If 'drink' is privatively marked (+durative +dynamic) and pragmatically (ø-telic) then the telic feature receives its value from the context. 'She is drinking the coffee' (+durative +dynamic +telic), where telicity is pragmatically marked positive because the activity has a stated end point, and can be formally classed as an Accomplishment.

On this account Olsen predicts 8 possible situation types (2 of which she finds unattested by the wide range of languages to which she applies her account).

The two possible situation types in additional to Vendler's are Semelfactive (a single dynamic action: sneeze or cough, which may be repeated into a longer sequence) and Stage level state (a state of limited duration: 'I am sick' as in currently sick but knowing this state will not last). The 8 situation types appear in Table 8 below: (ø denotes that the value is pragmatically derived):

Situation types	Durative	Dynamic	Telic
Stative	+	ø	ø
Semelfactive	ø	+	ø
Activity	+	+	ø
Stage level state	+	ø	+
Achievement	ø	+	+
Accomplishment	+	+	+
unattested	ø	ø	+
unattested	ø	ø	ø

Table 8 Olsen's organisation of privative and pragmatic Aspect features

By this analysis, INT utterances which have been noted to be non-durative, and telic, pattern fully with the notion of Achievement. Rappaport Havav & Levin (2005), however, note that uniformity in argument expression does not correlate

uniformly with aspect for change of state verbs, particularly those denoting incremental change (as in ‘he dimmed the lights’). Kratzer (2002) noted that telic verbs take direct objects, and in the languages studied Finnish, Gaelic, German, proposes that there is a direct link between telicity and objects being assigned the accusative case.

The debate centres on how the aspectual features interact between the semantics and syntax and whether they are the exclusive property of one or the other component. Such a debate is well beyond the scope of the current concerns of a bootstrapping process. However, a bootstrapping focus gives a privileged view of language acquisition at its beginnings and may provide some insight into what may be at the heart of the debate, in the following way.

The Conceptual-Intentional Bootstrapping proposal is based on the well-motivated assumptions that young infants have an under-developed lexicon not innately specifying categories like [V]erb and [N]oun. In the beginning conceptual-intentional abilities exert a strong effect on the initial acquisition of syntax. As has been described, in Manifest Events there is a direct relation between the perceived context and an infant’s informative intent. Consequently, the relation between words in two-word ME utterances is conceptually motivated based on generic knowledge of events and/or perception. Complex events do not allow for this.

Complex event INT is based on a conceptual-intentional content summarised as ‘state change with a specified goal’, and it is the goal which is the focus of the infant’s attention. The actual object/entity involved and the change state is contextually motivated. An aspectual analysis places these events, in this context semantically as Achievements [+dynamic, +telic]. What is pivotal to syntactic development is the word ‘it’. As ‘it’ is referential of the infant’s representation of the goal state, there are grounds to suggest that ‘it’ provides expression to the telicity inherent in INT.

In the initial acquisition of words that will function as [V], it might be proposed that the telicity inherent in the end state event bestows telicity on the word meaning of the verb. In other words, more simply, words used as verbs in INT utterances acquire their lexical telicity from the INT context.

Considering again the example (70) (quoted above as examples 62a and 62b and repeated here for convenience)

(77)
a) see Stu – *seeing Stu* (atelic)
b) see Stu – *wants to be lifted up in order to see Stu* (telic)

It was suggested that an infant's word use (telic vs atelic) can be pragmatically motivated to draw the distinction between atelic Manifest Events and telic Complex Events. On the currently developing account only 'see' in 77(b) is a verb, and in the context of INT must be telic. The strong claim is that an infant's way into verbs demands that all early verbs are telic. INT utterances appear to require an object (conceptually the focus of the informative intent), and the empirical study showed a significant relation between INT utterances and object DPs. Intuitively, some of the INT verbs in table 5, are not telic in many contexts for adult speech: 'have', 'hold', 'leave', push', but in infant INT utterances they are. They express intentions and have the form 'have-it', 'hold-it', 'leave-it', 'push-it'. They are required to express complete state change events and all require an Object DP. It would appear that a relation between event end state, verb telicity and object arguments is established early.

However, there is no escaping that the verbs as lexical items, need to have been learned/acquired from somewhere. All the INT verbs listed in table 5 above, have been reported with an '–it' suffix, and each combination, given an appropriate context, can be accepted as felicitous adult utterances, and telic. There is every reason to suppose that such verbs regularly appear in CDS (Child Directed Speech) possibly as imperatives, as sub-sentential or as stressed subcomponents of larger utterances. Thus these verbs are presented to the infant with, in effect, an overt yet inherently un-interpretable marker of the verb's potential internal argument structure. They would also appear to provide evidence for word order in English: essentially direct object following the verb (VO). This provides little evidence for the universality of the telic-direct object debate. It does suggest that verbs that take a direct (theme role) object may not be telic in adult English, but the prototype is, however, telic. The key feature of the prototype is that it is the locus of acquisition, which however reinforces the bootstrapping case for English.

2.3 The morphology of INT verbs

Key differences from adult syntax are that early INT utterances exhibit a null subject and that [V] is non-finite. This may qualify INT utterances for inclusion in Wexler's optional infinitive stage (discussed in Chapter 2 section 2). The alternative being proposed here is that in INT utterances the non-finite form is not optional, but a feature of this early construction. As Wexler has not recognised Complex Event utterances, his analysis cannot show that there is a relation between verb finiteness and utterance type. Discussion in Section 3 below will show that RES utterances do appear to require a finite verb, but sometimes use a verb stem depending on factors outside of the syntax.

Verb forms in English tend to utilise auxiliary verbs to make them finite. Morphological changes to verb stems are sparse and are limited to the past tense or the simple present, forms which infants will have already experienced through hearing past reference (daddy drove the tractor) or generic statements (daddy drives a tractor). Neither absolute past nor generic present meanings are relevant to INT utterances. If there is a time reference then it must be a relative time from the present into the future when the intended goal is achieved. English does not mark futurity through finite verb stem morphology.

Imperatives in English, however, generally are formed from the verb stem (with zero morphological inflexion). Clearly, INT utterances can be interpreted as imperatives by adults (much to the advantage of the infant of course), yet it does not seem to be at the heart of the infant construction. INT utterances focus on achieving the object as a goal, not the means of accomplishing it, and as such an agent is not relevant to fulfil the goal. If anything, the implied imperative is directed towards the world generally not to a specific agent. In early uses, when specific individuals are referenced, the utterance appears to have an additional vocative element, seemingly drawing that person's attention to the intention, rather than demanding they perform a specific action. Vocatives also include the infant's own name.

(78)

a) Gail, get the doll (Gail is the infant)
b) Mummy, eat it egg. (Carl is going to eat the egg)

Alternatively, the syntax might be interpreted as having a missing modal or future tense auxiliary, an issue addressed directly in (Section 4) below:

(79)

? Daddy (will) fix it

The discussion so far has raised further possibilities about the developing structure of INT utterances which can be captured now with the following schematic diagram fig 14 (t* represents the time of culmination, t='now', so t*>t characterises futurity, and here is used to signify the intentional state-change element of the INT utterance).

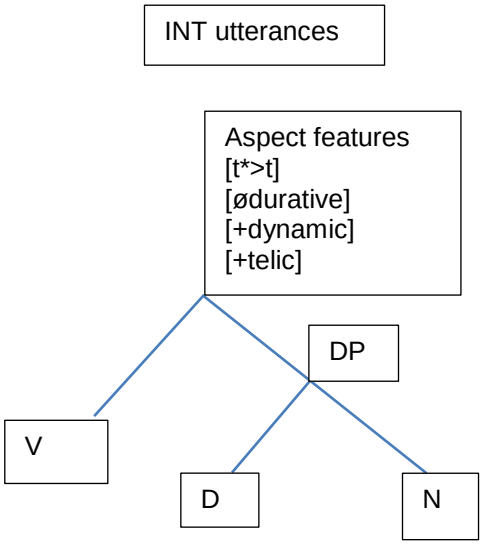

Fig 14 A schematic diagram of the structure of early INT utterances

The 'treelet' (schematised in fig 14), which first develops for INT utterances is a partial sentence configuration. As will be shown in section 4, it seems to become subject to significant and speedy development. Before exploring these developments, it will be useful to review the structure of RES, the companion utterance type for Complex events, which reveals additional structure, in a comparatively straightforward way.

3. The structure of Complex Events: RES utterances

RES utterances express how a present state has come about; usually the presence or absence of an object. This utterance type appeared, in the empirical

study, to be sparingly used representing only 5% of the infant utterances. One reason for this is that the goal state needs to be particularly relevant to the infant to prompt a spontaneous intention to communicate about it. So those means which result in exciting, interesting or surprising goal states are more likely to be brought to mind. An early RES utterance from the Travis corpus is of the following type:

(80)

Buy this plum (referring to shopping being unpacked at home)

This utterance appears to have the same [V[DP]] structure as INT utterances. It is perfective in that the focus for the utterance is the 'plum', and 'buying' describes the change of state now apparent and shares Travis' knowledge of how the plum has come to be present. In this example, the RES utterance relies on pragmatic interpretation by the hearer to differentiate it from an INT utterance. More usual examples from both corpora show how the communicative intention behind RES utterances is made more explicit:

(81)

a) Mailbox made this (a doll arrived by post)
b) Weezer ate the roach (the noticeable action of a pet resulting in the absence of the insect)
c) Nana bought this Porsche (toy gift)
d) Daddy hurt my leg (emotional outcome)

These utterances identify an end point in the present and the additional information provided indicates some means by which the goal has been accomplished. Additionally a responsible Agent is named, and the verb form is finite.

Thus a general schematic structure for RES (changed state, completed) utterances comparable to the following (fig 15) is suggested.

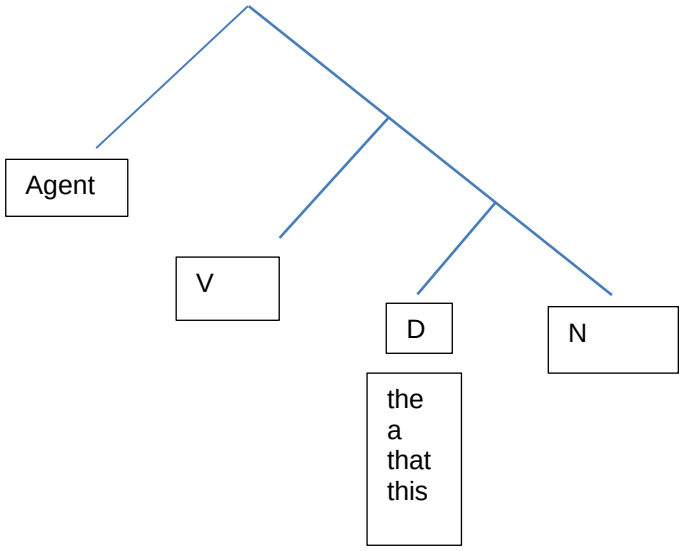

Fig 15 Partial schematic structure for RES utterances

In traditional generative approaches, an IP or TP node (inflexion, tense) is defined which has the effect on [V] to license morphological inflexion and has the additional function of enabling subject raising after theta role assignment to the verb argument structure derived from the lexicon. This theoretical approach preserves the simplicity of syntactic development utilising successive merge operations.

On the current account the structural requirements of verbs are still to be learned by the infant, and considerations of tense and inflexion are assumed as yet not to be established. However, Aspectual information is available to influence how RES utterances are structured. Although RES appears to refer to a past event, it is not a discrete past time event. The event is reported according to infant knowledge as explanatory only of the end state which is clearly present in the here and now.

It is generally accepted that infants younger than 3 years have very limited episodic memory (Tulving 2002), and as such cannot recall specific details of prior events or answer a ‘what did we do yesterday/last week’ type questions. Infants can give answers if provided with heavy prompting from an adult.

The Travis corpus does not include adult infant dialogues, but an example can be drawn from the Manchester data, where Gail who is 25 months old (CHI) is talking with her mother (MOT):

(82)

*MOT: and what did you find in the garden that we had to take to hospital
*MOT: do you remember ?
*CHI: Mummy .
*MOT: Mummy ?
*CHI: yeah .
*MOT: no .
*MOT: what did you find on the ground ?
*CHI: &um +...
*MOT: a butterfly ?
*CHI: no .
*MOT: no ?
*MOT: you did .
*MOT: do you remember ?
*CHI: yeah .
*MOT: what had happened to it ?
*CHI: flopped .
*MOT: it had flopped .
*MOT: yeah .
*CHI: xxx .
*MOT: it had flopped .
*CHI: flopped .
*MOT: it had flopped .
*MOT: and you asked Daddy to take it to hospital , didn't you ?
*CHI: yeah .
*CHI: and Gail's coming now .
*CHI: Daddy's coming .
*MOT: Daddy's coming ?
*CHI: yes .
*MOT: Daddy's coming home for dinner today .
*CHI: Gail's coming Gail's home .
*MOT: Gail's coming to Gail's home ?
*CHI: mhm .

CHILDES/Manchester/Eng-UK/Gail06a//
Gail (25.15)

In this case the adult prompt is helping the infant form a Secondary representation of the event in the present, making it possible for her to respond as she would in a Manifest Event in the ‘here and now’ with generic information from her Generic Knowledge, in this case about flopping butterflies.

This example of effectively 'failed' communication underlines that infants have considerable difficulty in placing episodes in absolute time divorced from the present. Relative time, however, is significant for RES utterances. RES utterances do not simply report a past event.

The Complex Event, RES utterance covers the time from before the present, culminating only with the present goal. So 'Nana bought this toy' refers to how the toy has become present, and does not focus on the activity of buying. An appropriate adult gloss on the meaning which respects these aspect features might be 'This toy is a result of Nana's buying'. The Aspectual features for RES are [+dynamic, +telic, t*< t] which in general terms characterises Achievements. The following studies shed light on the infant choices of words which operate at [V] in RES utterances.

3.1 RES Morphology

Bloom, Lifter & Hafitz (1997) conducted a corpus study of infants' acquisition of verb stem inflections: -ing; -s; irregular past; -ed. Their study focussed on individual verbs used by 2 year olds, listing the acquisition order of inflexions in relation to the semantic value of each lexical item. They found that the earliest acquisition centred on verbs which were contextually sensitive – light verbs – and reflected the aspect of the context of use. Three contexts were defined in the research: actions; agent/mover/patient locatives; or states. Those used to reflect durative events developed –s and –ing inflections, and those that were completive developed irreg/-ed inflexions. The conclusion was that infants were not using inflexions as tense markers, but were strongly influenced by event-aspect, which was claimed to support the 'aspect before tense hypothesis'. Antinucci & Miller (1976) observed that infants' learning Italian and English both used past tense inflexions with verbs which indicate 'end states'. Bronkart & Sinclair (1973) investigated French verbal forms and found that up to the age of 6 years, aspectual information took precedent over temporal relations. Hyams (2007) research into infant root infinitive use in English, Russian, Greek and Dutch all showed that event structure, aspect and modality play a role in interpretation.

The Bloom, Lifter & Hafitz study also found that ‘irreg’ inflection was the first ‘in emergence’, although other studies place ‘irreg’ as ranked second to be acquired after ‘–ing’. In the present research, I have shown that ME expressions may utilise ‘–ing’ inflected words as attributional (adjectival) modifiers of substantive items.

An overview of verb-form use for RES utterances from the Manchester data is summarised in Table 9 below.

It shows how the verb morphology is realised in the 1283 RES utterances in the corpus data, and the number of verbs involved. So, of the 493 examples of ‘irreg’ use, only 29 different verbs are involved. Of the 107 uses of ‘-ed’ only 30 different verbs are involved. There are 11 instances of ‘-ing’ or ‘-s’ suffixes being used for RES utterances.

	Irreg	-ed	Ø (verb stem)	-ing/-s	Total
# utterance tokens	493	107	672	11	1283
# different verb types used	29 verbs	30 verbs	>90 verbs	4 verbs	

Table 9 Breakdown of infant RES utterances by inflectional verb forms

The 29 ‘irreg’ and 30 ‘-ed’ verbs used are listed in Table 10 below, but these do not represent any regularity between infants; that is, any one may use ‘irreg’ when another uses a verb stem form. The disparate use of forms between infants suggests that RES verbs are simply learned as such. This underlines that RES utterances do not utilise a regular past tense form, derived by morphological rule, but express Aspectual, relative time by the acquisition of forms which are individually learned.

Finite verbs 'Irreg'		Finite verbs '-ed'	
ate	forgot	bumped	hooked
been	found	carried	jumped
bit	gave	chewed	moved
bought	gone	cleaned	pood
broke	got	clicked	pushed
broken	had	coloured	ripped
brought	left	drilled	rolled
built	lost	dropped	saved
did	made	finished	showed
done	saw	fixed	slipped
drunk	seen	flopped	stopped
eaten	shot	flushed	stopped
fallen	was	frightened	tidied
fell	went	goed	weed
flew		happened	wiped

Table 10 Infant finite verbs used in RES utterances with inflectional forms

Further scrutiny of Table 9 shows that for a large proportion of RES utterances, the required finite [V]erb is realised by the bare verb stem. These examples and early INT [V]erbs are probably providing source data for the observations motivating the optional infinitive stage proposals. My claim is that in RES utterances, the [V]erb is finite even though the word used resembles the non-finite verb form.

RES utterances appear to utilise 'irreg' inflexions for finite verbs, when available (i.e. known). '–ed' inflexions are sparingly used compared to irreg or ø, and also appear to have been individually learned for specific verbs. If a specific alternative finite verb form is not known then infants use the word which is known to them, which is usually the same as the non-finite verb stem.

That 'irreg' appears before '–ed' suggests that infants of this age do not as yet have a past tense morphological formation rule, and that the finite verb variation is learned on an item by item basis. The prevalent use of 'irreg' would suggest that the lexical differentiation is overt enough to be relevant for acquisition and use. In addition, verbs which have 'irreg' morphology in English are amongst the most common, and will have been heard frequently.

At this stage, RES utterances can be schematically presented as in fig 16 below. It shows that Aspect features play a grammatical role in the structure of RES, by prompting the acquisition of a distinctive finite verb form which is (for English) based on a recognisably contrastive morphophonemic form.

As demonstrated at the beginning of section 3, Agency is a commonly present thematic role in RES utterances, and my claim is that this is accommodated once again by a simple Merge operation which will be continuously confirmed from positive evidence in input.

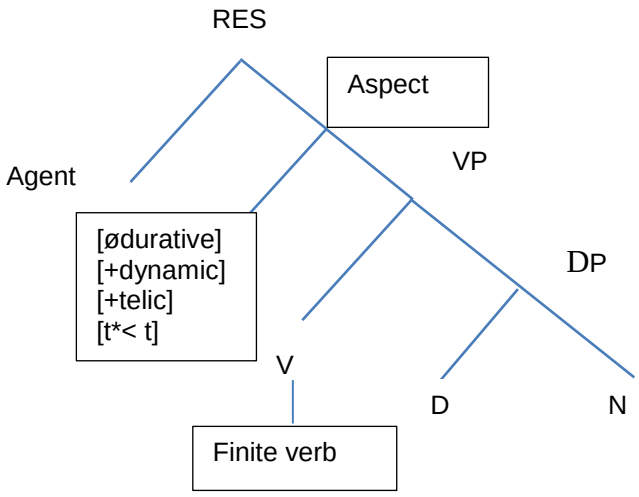

Fig 16 Schematic representation of RES utterance structure

This structure appears to be what underlies the canonical transitive structure in English, and may be making the contribution to those studies that recognise SVO constructions as developing after VO constructions, as in Ninio's study (discussed in Chapter 2 section 3).

The construction and semantics underlying RES utterances are open to significant development when infants are able to understand and express causative relations, rather than resultative action. This requires that the activity leading up to the resultant goal can be evaluated by the infant as a planned intention by the agent.

So "Nana bought this toy" as a RES utterance focuses on the toy and its appearance, and expresses 'this toy is here as a result of something Nana did'. "Nana bought this toy" as a causative focuses on Nana's intentional action in making the toy be present, 'Nana undertook an act of buying to make the toy present', and is a recount of a past event largely unavailable to infants 30 months old, as exemplified in example (75) above. This further development, requiring a Theory of Mind reading of the intentional planning towards a causative outcome is not typically expressed by infants younger than 30 months, and there are no such examples in the corpus data.

Further discussion will be reserved for the next Chapter, when the nature of experimental evidence which claims to identify the acquisition of causative constructions from essentially manifest events will be reviewed and challenged.

It was noted above that SVO structures are commonly observed in infant speech, yet RES utterances which are claimed here to be the source of such, are quite thinly distributed through the corpora used here. This suggests that further developments in the structure of INT utterances are accounting for this increase. The next section will show how this might be possible.

4. Structural developments in INT utterances

The word 'want' seems to capture the semantics of INT utterances. It is not until the later entries in Travis' corpus that 'want' is used, and its use becomes increasingly evident in the Manchester corpus as the infants are generally older than Travis. 'Want' appears to be a very flexible word and seems to be responsible for further syntactic development in INT utterance types. It can appear as [V] in the initially developed treelet:

$[_{VP}[_{V}$ want$][_{DP}$ the spoons$]]$ (want the spoons)

It can appear 'higher' in the construction:

$[_{VP}$ [Wanna $[_{V}$ have$]][_{DP}$ the spoons$]]$ (wanna have the spoons)

Further development shows:

I want $[_{CP}$ to$[_{VP}[_{V}$ have$][_{DP}$ the spoons$]]]$ (I want to have the spoons).

These developments can be explained best if Aspectual features play a role in INT utterances in a manner comparable to those identified for RES.

The features for INT and RES have been defined in the following way:

INT= [ødurative] [+dynamic] [+telic] [*t > t]

RES= [ødurative] [+dynamic] [+telic] [t* < t]

In English, RES utterances appear to specify that the verb is finite, expressed morphologically (‘irreg’, ‘-ed’ or ø), with a subject fulfilling an Agent role. In English, finiteness, apart from past tense forms, is generally expressed through auxiliary verbal elements which work in conjunction with non-finite verb stem forms. It seems that INT utterances employ this means to derive a finite verb capable of accommodating a subject.

Assuming that Tense features of absolute time are inaccessible at this stage, it follows that verb auxiliaries expressing tense relations are not found. Verbs can be made finite in English through use of auxiliaries which have a modal sense, which is in keeping with the intentional purpose and implied futurity of the INT utterance.

The words used to fill the subject ‘slot’ are generally null or ‘I’ (first person) and unlike RES do not generally denote Agency. (The unique function of ‘I’ will be addressed in detail in section 5). A fuller INT structure, accommodating a grammatical subject, can be represented diagrammatically as in fig 17 below.

It introduces the new element ‘modal’ which, it is suggested, provides the means to make the verb finite. The list of items which commonly occur as infant modals is shown below. Some of these are clearly different from adult usage, although all can be understood, and generally acceptable to adults.

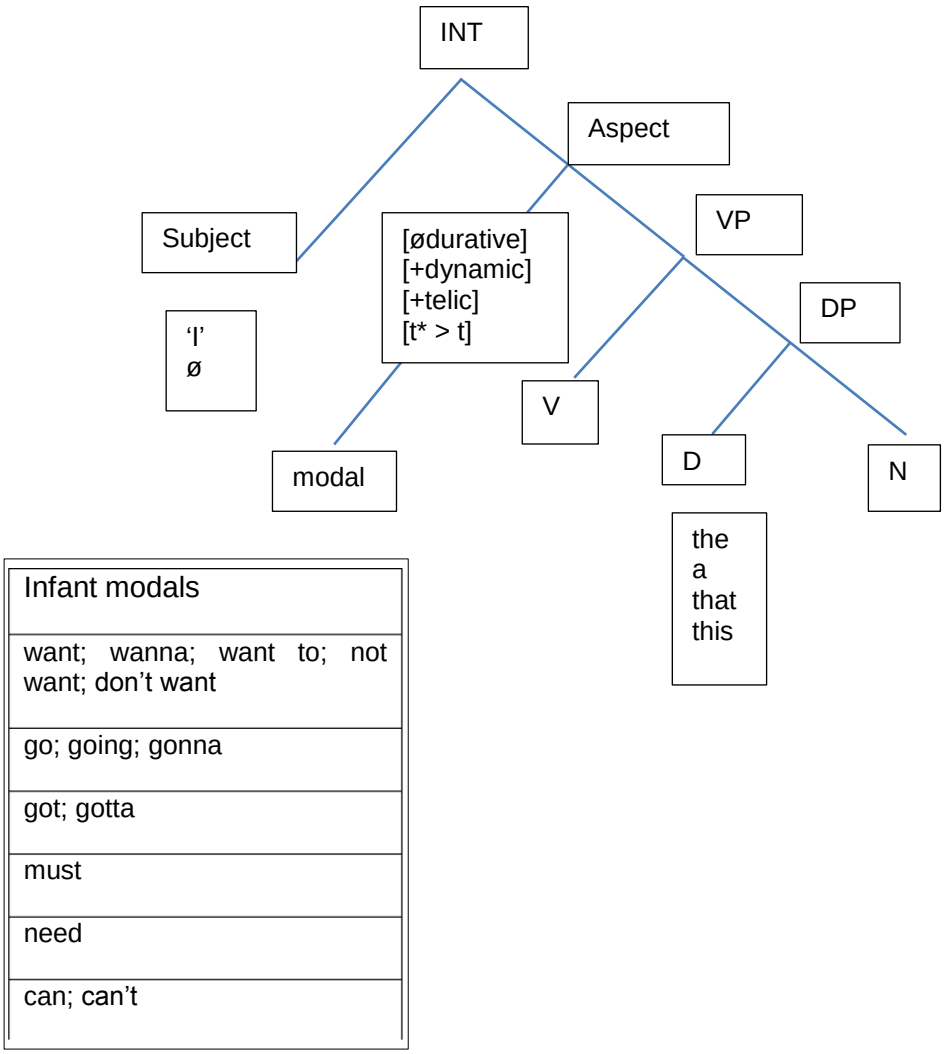

Fig 17 Schematic representation of INT utterance structure

All the infant modals identified have a common semantics expressing futurity/possibility/intention.

Further developments are beyond a bootstrapping remit, but at some point it is clear that 'wanna', 'gotta', and 'gonna', will eventually no longer group as simple modals. Positive evidence is plentiful for 'wanna' to be split into 'want+to'.

Attributing 'wanting' intentions to others, comparable to the attributing of causative intentions for RES, will require the infant to have further cognitive abilities providing an additional focus on the actual activity involved within the intentions described by an INT utterance. This would enable the infant to specify potential actions which can be attributed to the planned intentions of others as

opposed to intention in action (Searle 1983). This advanced mind reading ability is generally agreed not to be available to infants of 30 months. There are some examples of intentions attributed to toys in pretence on a 'like me' basis (Meltzoff 2007):

(83)

(Gordon and Annabel are steam train characters in a children's story book)
a) Gordon want get Annabel
b) This doll want dinner

The developments associated with INT appear to be challenging to infants, as the corpus examples show some developmental errors, while the system is becoming refined. The examples below, however, indicate that the errors still honour the underlying syntactic structure, and can be attributed to the problem of accommodating additional complexity, in two cases negation.

(84)

a) Want eat it the sausage (27 months)
b) I can't want to throw (28 months)
c) I can't go to fall (28 months)

The next section turns to an explanation for the extensive use of the first person pronoun as grammatical subject in early infant speech.

5. The role of 'I' (first person pronoun)

The first person pronoun 'I' was shown to be extensively used in the corpus analysed in Chapter 6, and had a significant association with both INT and RES utterances. For RES, the strong association for both 'I' and RDS is accommodated through the Agent role appearing as grammatical subject as shown in section 3 above and exemplified in (78) below

(85)

a) I broke the chair
b) I hurt my leg
c) Danny made this
d) Nana bought this car

But Agency for INT utterances is only sparingly expressed, and generally indicates the person expected to be responsible for the change of state intention

expressed, and where it is relevant for the infant to indicate herself in such a role, her own name (RDS) is used:

(86)

a) mummy eat it egg
b) Gail come outside

'I' does not appear to fulfil an Agent role, in this way.

Acquisition of personal pronouns in English has been a focus of infant acquisition research for some time, largely because of the apparent difficulties it may present to infants. If pronouns are referential then the reference for 'I' and 'you' changes continuously as different speakers participate in a conversational exchange. An adult refers to herself as 'I' and to the infant as 'you', yet the infant must reverse the reference of the pronouns when using them herself. Generally it is held that 'I' and 'you' differentially refer to addresser and addressee. How infants understand this difference has been the focus of much research.

Chiat (1986/97) summarises the extensive literature discussing this area and makes the following six summary points, which have a measure of agreement:

i). Personal pronouns do not emerge in a clear cut order. Infants generally develop a predictable sub-set of pronouns which do not constitute a natural class, but generally are 1st person singular; inanimate 3rd person; then 2nd person. ('I', 'it', 'you')

ii). Those pronouns acquired tend to occur in specific contexts rather than the adult distribution; with 'it' confined to post verbal position.

iii). The order of acquisition of the remainder is not well established and is neither rigid nor predictable.

iv). Sporadic use precedes systematic or frequent use.

v). Pronouns are initially used in stereotyped, unanalysed phrases which encode the relationships involved in events and states as a whole.

vi). Although pronouns are sporadic or limited, confusions between different personal pronouns rarely occur.

Many of Chiat's summary points are borne out by the current research. The order of acquisition she cites in (i) is clearly replicated in the corpus data. The data count is reproduced here from Chapter 6 as Table 11 for convenience.

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**

Table 11 DP count of the corpus data used for the empirical study (Chapter 6)

Chiat's second point that 'it' occurs only post verbally is supported through the analysis of INT utterances, but occurrences of utterances like 'it's a…', are also common in ME.

As for the last four points, the developmental process cannot be as random as it would appear, as infants are able to differentiate the pronouns successfully. The most difficult to explain is the differential use of 'I' and 'you'. Loveland (1984) claims that successful learning depends on infants gaining a distinction between spatial perspectives of speakers and hearers, claiming that only infants with complete understanding of points of view are able to use I/you pronouns without error. The fact that infants do use such pronouns before achieving the required understanding of viewpoint is explained as infant production without understanding. Loveland suggests such utterances may be due to the use of unanalysed phrases. Charney (1980) prefers attributing I/you use to an understanding of speech roles – addresser/addressee – distinctions, but concludes that infants are aware of speech roles only when they themselves occupy those roles, which accounts for the disproportionate use of 'I'. Budwig (1990) related pronoun use to function, and describes extensive use of 'I' as being attributed to

ego-anchored versus non-ego-anchored infants. Clarke (1977) noted that infants judged to be on the autistic spectrum were more likely to make errors in I/you reference reversals than typically developing infants. Her conclusion supports a theory of mind analysis assuming that the I/you distinction is based on mental perspectives on events.

The difficulty with these and other accounts rests on the assumption that first or second person pronouns are solely referential. Wechsler (2010) provides an interesting challenge to this assumption. His case is that 1st and 2nd person pronouns are not referential TO speakers and addressees, but attributed BY speakers and addressees.

So, 1st person when produced, and 2nd person when heard are attributed to SELF, a process he terms self-ascription. He cites the example of a teacher addressing a whole classroom with the utterance "write your names at the top of the paper". This will be interpreted by members of the class as attributed to themselves as individuals and signify their own name, not a list of the names of all classroom participants. Wechsler proposes that the person feature of 1st and 2nd person pronouns designates participants in a speech act as self-ascribers: 'I' in speaker role and 'you' in addressee role. But for a hearer to comprehend a speaker's use of 1st person requires the hearer to infer the speaker's utterance as a self-ascribed belief.

Wechsler's complex analysis is focussed on adult participants, but the core proposal can be summarised in the following way:

Situation 1 requires only simple self-ascription for understanding

As a speaker producing 1st person or as an addressee hearing 2nd person

Situation 2 is more complex and requires an inference of self-ascription to be attributed to the other participant.

As a speaker producing 2nd person or as an addressee hearing 1st person

If this is correct, the account would predict that for infants Situation 1 would be more accessible than Situation 2, because infants' theory of mind ability is as yet severely limited.

There is evidence that would appear to support this position. The 1st person pronoun is extensively used by infants (see Table 11 above), and the research generally shows that infants understand 2nd person pronouns when addressed to them.

The data also shows that the 2nd person pronoun is sparingly used by infants, and appears later in use than the 1st person. There is a shortage of evidence of how infants understand the 1st person pronoun when used by adults to them, but some insight can be gained from the ways adults use the 1st person in talking with infants in CDS.

A survey of utterances, as recorded for two of the adults from the study corpus, distinguishes those which use an unstressed first person pronoun as a carrier for contracted auxiliaries (I'm, I've, I'll) from those which have stressed 1st person pronoun use. The data shows that the 1st person predominantly used by adults, accompanied verbs expressing the adults' mental states.

The commonest, by far, is 'I think…'

Others include:

I don't know	I bet
I like	I want
I wonder	I remember
I missed you	I can't
I saw you	I thought

This would suggest that adult use of 'I' is underlining the self-ascription of mental states. It is possible that adults intuitively recognise the difficulty for infants in hearing 'I' used. They appear to be focussing infant attention on the relation between hearing 'I' and the speaker's mental state. So there would seem to be some support for concluding that infants will find Situation 1 (producing 'I' and hearing 'you') more accessible than Situation 2 (producing 'you' and hearing 'I')

An explanation why infant use of the 1st person pronoun is so extensive in the corpus data, may be that on Wechsler's account, it can be assumed that self-ascription presents little difficulty to infants in understanding their own use of 'I'.

This does not explain why it should be used so frequently when INT utterances are by default about self-ascribed intentional states. Null would be just as appropriate, more economical and therefore expected. Initially this seems to be the case. Early INT utterances exhibit a null subject as shown in Section 2.1 above.

However, given the acquisition of the basic syntactic structure with an available 'slot' for grammatical subject, and the positive evidence in the input that English obligatorily specifies subjects, a viable proposal is that 'I' becomes used as a default non-agentive subject marker, and perhaps plays a similar structural inroad to syntax, as 'it' would seem to do.

This presents no communication problem as 'I' fits felicitously as a subject responsible for the intention (want) in INT utterances, and also fulfils a grammatical requirement. There are instances in the corpus, where infant use of 'I' appears quite specifically not to imply the agency of the child as in (80) below where the Agent involved appears to be the mother and not the infant at all .

(87)

*MOT: what do you want me to do ?
*CHI: this here .
*CHI: I fit this .
*CHI: I fit it .
*MOT: did I fit it?
*CHI: this here.
*MOT: did it wrong ... did I?

(CHILDES/UK-Eng/Manchester/Anne02b (Anne 22 months)

In general, the first person pronoun functions as a grammatical device as a subject marker, and not to designate a specific Agent role. It is not used initially to make any semantic contribution, and as such could be simply an expletive Subject place-holder. Further evidence for this is found when infants are making specific reference to agents. In this case, they use a name (RD) which frequently includes their own when they wish to specify themselves as an agent of the Achievement, most commonly '[RD] do it' as in:

(88)

a) Carl do it (Infant is Carl)
b) mummy do it (Infant is Carl)
c) Becky do it (Becky is the infant speaking)
d) Gail fit it (Gail is the infant speaking)
e) Caroline get it (Caroline is the visiting researcher)

6. Discussion

This chapter has shown the possible bootstrapping of syntax which results from the principles forming the Conceptual-Intentional Bootstrapping hypothesis developed throughout this dissertation. These principles are summarised in the following list, each item contributing to the schematic development presented through this chapter:

i. Infant intentionality and generic knowledge

ii. An optimum set of possibly innate grammatical categories (state change [V]; reference [D] and substantive [N]

iii. Analytic, as opposed to synthetic processes.

iv. The acquire-as-required principle

v. Meta-cognitive growth

Appreciation of Complex Events is evident from around 18 months old when infant cognitive growth enables them to hold Primary and Secondary Representations in awareness at the same time. Complex Events are, therefore, comprised of two sub-events. This collation of representations/sub-events underpins two utterance types: INT (expressing an intended change of state from current actuality) and RES (expressing a resultant changed state in current actuality). The informative content of each of these utterance types is not a fully shared event, and requires that the infant acquires the means of expression to make public what are essentially privately constructed sub-events. Only a syntactic system can provide such means.

The bootstrapping process begins to give the infant access to language specific syntax, honouring the ‘acquire-as-required’ and ‘analysis rather than synthesis’ principles. In English, the pivotal lexical item for bootstrapping verbs is the word ‘it’. Its conceptual content is totally contextually derived; it acts as a

bridge between the goal entity of the two sub-events in a Complex Event; and it has non-semantic structural properties. The word therefore provides a link between the Conceptual-Intentional and the Syntactic interface. A further pivotal lexical item for English is 'I'. Its conceptual content is self-ascription and structurally marks Subject, obligatory in English. These two structural elements mark self-ascription and object reference, both of which underpin the abstract semantic content of INT utterances: "I (want) it".

Syntactic construction is effected through the principle of a simple successive Merge, motivated by Aspectual properties inherent in the utterance types of Complex Events. These are characterised as: ødurative, +dynamic, +telic, and relative time t*>t/t*<t.

Through these means a generalised core syntactic structure for both Complex Events utterance types may be thought to be derived, schematised as fig 18 below:

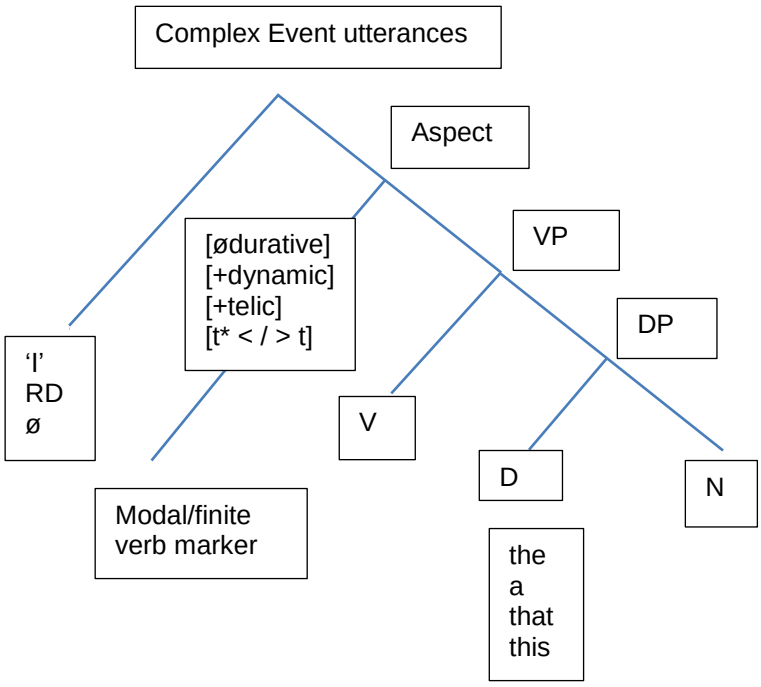

Fig 18 Schematic representation of the structure of Complex Event utterances

The resultant structure is not dependent on lexical semantics, as words projecting to [V] and [N] nodes may vary substantially between infants acquiring English. Although item-based acquisition, as espoused by Tomasello, will inform what words are selected for [V] and [N] nodes, they do not of themselves play a

pivotal role in the bootstrapping process, and choice of word is a product of refinement within already set category boundaries. Although Travis has a preference for 'get' for INT utterances and 'made' for RES utterances, other infants make quite different choices.

If this hypothesis is correct, then it would appear that a core syntactic structure is acquired before infants are 30 months old, and this structure is available to them for use in other contexts.

ME and CE utterances are both characterised as focussing on objects/entities. ME utterances normally communicate information about objects/entities in the here and now. CE utterances, on the other hand, express intentions towards an as yet unrealised change of state of objects/entities, or events leading to an apparent, realised change of state. Complex Events expressed as INT and RES utterances are characterised as Achievements, and it is claimed that this is the main context for the acquisition of verbs.

Most bootstrapping proposals are based on the assumption that Activities provide the source for the acquisition of [V] category expressions. Activities, which unfold in the here and now, present major complexity for the infant, particularly for linguistic expression. For instance

"Gail is building the house" is an utterance of a Manifest Event. It focuses on an on-going activity rather than the goal but nevertheless expresses the intended goal outcome. In traditional analyses this is described as two independent yet concurrent aspect roles: the telic, lexical, aspect of 'build' and the grammatical durative aspect of the on-going event expressed through the imperfect (present) tense: 'is…ing'.

Conceptually, this should present no problem for an infant observing the scene in understanding what is happening. Chapter 3 discussed how infants from a very young age can monitor events, and infer intentional goals for actions, and maybe also causation in relation to actions and goals. The problem presented to the infant, however, is to develop syntactic resources which go beyond those already established for INT and RES which will enable a focus on activities rather than outcomes.

It might be supposed that the already established aspectual structure, schematised above, could provide a basis for doing so, by simply setting [durative] to positive, but the syntactic form requires quite wide ranging development. This would suggest that the means to productively express such content should not be readily available. Evidence drawn from the corpus, shows that such utterances are not usually present by 30 months.

The bootstrapping proposal therefore would assume that infants up to 30 months presented with a scene and utterance equivalent to "Gail is building the house", would be able to make sense of the scene by event monitoring but would understand the utterance, in terms of the ME syntax she has acquired. This would imply that her parse would result in the two elements of the scene being represented: 'Gail building' or 'building house', but not combined.

Published empirical evidence for verb learning and language production is based almost exclusively on Manifest Events. This may be because it is a convenient context for the design of elicitation studies, but also it is due to the belief on the part of many researchers that verbs are learned as referring to or labelling activities. I have attempted to show that it is Achievements not Activities which bootstrap infants' first [V]erbs. Studying utterances of Complex Events, because they are based on an infant's own intentions, tends to require a corpus study of spontaneous production, although it would be possible to develop experimental scenarios to elicit such intentional utterances.

The next chapter will address the relation between comprehension testing in Manifest Events and demonstrate that conclusions, drawn by research which does not recognise the ME/CE contrast, are open to challenge from the point of view of the Conceptual-Intentional Bootstrapping proposal.

Chapter 8
Syntactic knowledge and comprehension testing

Introduction

The previous chapter presented a schematic profile of infant syntactic growth or development operating within Complex Event utterance types. This profile showed the establishment of a category [V] with a telic feature selecting for a Theme role argument, and a category [DP] noun phrase with a functional head. Complex utterance-types are labelled INT or RES. This proposal was based on available corpus data from infants less than 30 months of age - (Travis data and CHILDES/UK-Eng/Manchester).

A strong position has been taken on defining syntax acquisition, namely that acquisition is confirmed when an infant has executive control over syntax for effective spontaneous production of language for intentional communication. This position enables a distinction to be made for the role syntactic knowledge plays in production and comprehension. For the latter, in natural settings, the infant has access to a range of heuristics to support understanding: relevance, generic knowledge, observation of the physical context, and pragmatic inference, all of which may complement and enrich a developing knowledge of syntax. In addition adult linguistic utterances are intuitively designed to make comprehension more accessible for the infant. Thus infants need not have acquired fully productive syntax to be able to make an interpretation of the communicative intention behind utterances addressed to them. That infants seem to understand more than they can say is generally assumed.

My claim is that by 30 months, infants have acquired the syntax necessary for them effectively (by their own judgement) to communicate within the contexts they experience. The utterance types they have acquired are identified as ME, INT and RES, and each exhibits a specific productive syntactic form, summarised here:

i) ME utterances generally have a structure incorporating the following elements ME[$_{\text{Aspect}}$ imperfect[mod[substantive][modifier]]], or ME[$_{\text{Aspect}}$ imperfect[sub[modifier][substantive]]] (e.g. ‘hippo swimming’ or ‘swimming hippo’). Utterances of this type are attributive of events, and modifiers make

explicit (dynamic) properties or types of activities of participating objects. Modifiers explicating dynamic properties frequently appear with '-ing' morphology and function adjectivally. ME utterances are not linguistically referential of specific objects, and do not need to be, as any entity/object is implicitly referred to, being present and manifest.

ii) Early INT utterances begin as 'have it spoon' type utterances which become consolidated as $[_{VP}[V_{telic}]+[_{DP}[D]+[N]]]$ 'have the spoon'. These are goal-focused, and express intentional outcomes. The [V]erb is non-finite, telic and selects for a Theme role. My claim is that 'it' is an early infant determiner. Semantically, the verb predicates on the intentional change of state event.

iii) RES structure is generalised as $RES[[DP][_{Asp}[[_{VP}[V]+[_{DP}[D]+[N]]]]]]$ and are also goal focused ('Nana bought this car'), but are descriptive of a resultant change of state or outcome. Responsible Agents are frequently expressed, and an Aspect node is suggested to be present marking features of telicity, and relative time t*< t (where t* is the time of culmination). The finite form of the verb in English is recognised by adults as morphological {irreg/-ed/ø}, although this does not seem to be productive for the infant. Finite verbs for [V] in RES utterances in English seem to be individually learned. If an 'irreg' or '-ed' form is not known, then a verb root is used.

iv) Later INT structure appears to develop in a way comparable to RES: $INT[[DP]\ [_{Asp}[[_{VP}[V]+[_{DP}[D]+[N]]]]]]$ ('Daddy gonna get the spoon', 'I wanna mend the train'). These utterances are goal focussed, may state an Agent, but frequently appear with a grammatical subject ('I'). An Aspect node is again suggested as marking the features of telicity and relative time t*> t (where t* is the time of culmination). Again English requires a finite verb, which seems to be achieved through productive use of auxiliary elements which appear to be modal in nature. An exception (as discussed in Chapter 7) may be the late acquired 'want' which has an integral semantic relation with INT utterances, and appears at various points in development as a non-finite verb ('want a banana'), a modal ('I wanna get a banana'), and a main verb selecting for a CP ('I want mummy to get a banana'), where it seems to pattern with utterances of self-attributed mental and epistemic states ('I (don't) want …', 'I (don't) think …', 'I (don't) know').

The significant innovation of INT and RES utterances is the establishment of [DP] and [V] grammatical categories. Once established, there is the developmental possibility for [V] to be a grammatical object in its own right, and become a focus for the more complex developments typical of verbs in English. It, therefore, becomes possible to express absolute time relations, imperfective events, and means as opposed to ends. The claim here is that such developments occur typically after the establishment of INT and RES utterances. This is important because a sentence like 'Gail is building the house' is a present continuous construction describing a current event and differs fundamentally from '**house** building' (ME); 'Gail gonna build the **house**' (INT), or 'Gail built the **house**' (RES) – ('**house**' is emboldened to signify the conceptual focus of the utterances), in the following ways:

i) Unlike ME utterances, 'Gail is building the house' contains a referential DP, and although it states an outcome (a house), the focus is on the means, i.e. the agent's activity of building. This differs from INT or RES, where the nature of the activity of an Agent per se is implicit.

ii) With the focus on the activity or means, certain additional aspectual information can be accommodated. Conventionally, this is analysed as lexical and grammatical aspect. 'Build' is lexically telic requiring a direct object in Theme role. 'Is building' is imperfective and also carries absolute time information T*=T (T* is the absolute time of the described event and T is the present). In English this requires a finite verb formed with the auxiliary BE and a non-finite verb formed from the verb stem + ing.

Although it might be argued that adjustments to the syntactic structure of INT and RES should allow for this development, and this may well be correct, the syntactic means to express this new complexity still has to be additionally acquired. This would suggest that productive utterances incorporating the present continuous are acquired after 30 months, and corpus data show this.

This suggestion runs contrary to most conventional thinking about verb acquisition. Generally the present continuous is considered to be a basic form for acquiring and communicating transitive and causative events. This may be largely due to the assumption that events expressed in the 'here and now' are supported

by perceptual information to aid comprehension. Although it may be demonstrated that infants appear to understand such utterances in context, it is debatable whether infants have acquired productive use of this construction. Many empirical studies start from the position that the present continuous construction is basic. By extension the assumption holds that linguistic transitivity is also basic and that the causative relations generally expressed by transitive sentences will be grasped by infants from the utterance. I am making two claims about how infants under 30 months old interpret utterances which employ present continuous syntax:

Firstly, that 'Gail is building the house' uttered in the context of a Manifest Event will be interpreted in accordance with the acquired syntax typical of ME utterances: i.e. 'Gail building' or 'building house' with a focus on the on-going dynamic potentiality of 'Gail' or 'house' (involving a child's toy construction game).

Secondly, that infant interpretation of the utterance may not necessarily be a causative understanding.

The following sections will review a number of studies devised to support the Syntactic Bootstrapping proposal (SyB) theoretical position concerning language comprehension. In these studies test utterances are based on the present continuous. In reviewing the experiments, the given explanation of the outcome of the testing process will be complemented by an alternative explanation based on the syntactic knowledge that the Conceptual-Intentional Bootstrapping proposal (CIB) claims infants have productively acquired.

1. Comprehension studies: general overview

In this section, all studies focus on comprehension, and are generally motivated by the syntactic bootstrapping proposal (SyB), which in brief, claims that infants use experience of linguistic constructions to access the meaning of new verbs. The more constructions an infant hears containing the verb, the closer the infant comes to assigning a meaning to it. The hypothesis is supported by constructionist proposals that constructions themselves have a generalised semantics, which influences the interpretation of verbs (Goldberg 1995). Relevant to this is the view that transitive constructions, SVO in English, express causative

actions. Syntactic bootstrapping does not detail how the syntax is acquired or known, but the implication at its weakest is that syntactic variations can be differentiated and appreciated by infants.

Infant comprehension in these studies is tested by differential looking at appropriate scenes. The length of looking time is assumed to accord with an infant's understanding of the novel verb. In general the infants view a composite scene depicting, for example, a causative and synchronous act by two participants. This is accompanied by a linguistic input which varies for different groups of infants depending on the test focus. For instance one group hear a transitive sentence, the other an intransitive both using a nonsense word as a surrogate novel verb ('X is gorping Y' or 'X and Y are gorping'). The infants then see the scene decomposed on two screens into its component parts (causative act on one screen; synchronous act on the other) and asked 'Where's gorping now?' The assumption is that infants will look longer at the scene whose meaning they associated with the input sentence. The task for the infant is one of recognition and mapping a linguistic input onto an observed scene.

This type of comprehension testing contrasts with (re)enactment tasks which other studies have used. For these infants are asked to act out (using toy figures) scenes as described verbally by the experimenter, exemplified by Olguin & Tomasello (1993) (O&T). For clarity, this experiment will be described.

The experiment was devised to test the Verb Island Hypothesis, which proposes that words are used in the frame that they are learned and there is no generalisation across 'verbs' in morphological paradigms. Verbs develop as individual words not as a verb class.

Eight infants, 22-25 months old participated. 8 novel verb meanings were created for novel words. The meanings denote a causal relation between two characters (represented by plastic toy figures). Infants were assigned to one of two groups (A or B) and the room was set up with two different stations each providing the physical context for four of the eight activities. Each assigned group experienced only one set up, therefore taking part in 4 activities and experiencing 4 of the 8 nonsense words used in context. One such set is exemplified in (82) and

gives the novel word used and its novel meaning (X and Y represent participating toy characters).

(89)

a) **Keef** - X steps on a button that quickly pulls Y towards X by means of a string
b) **Gorp** - X drops a coloured dough-like substance on top of Y
c) **Dack** - X pushes Y down a hole
d) **Pud** - X jumps on top of an apparatus that shoots out a plastic horseshoe, knocking Y over

Infants individually took part in a free play session with the apparatus and the participating experimenter modelled each verb in only one type of the following sentence frame:

(90)

a) no arguments (e.g. oh look, keefing);
b) agent argument only (e.g. see that, Ernie's gorping);
c) patient argument only (e.g. look, dacking cookie monster) or
d) both agent and patient (e.g. see Ernie's pudding cookie monster).

During the game session, the experimenter said the appropriate frame 10 times. Comprehension testing took the following form.

The infants were asked to enact with the figures according to an instruction e.g. 'Can you make Mickey Mouse gorp Ernie?' or 'Make Mickey Mouse gorp Ernie'. The test focussed on whether the infant could understand the appropriate word order for arguments if the verb had not been heard before with Agents and Patients specified. So the focus was on participants experiencing the no argument presentations (83a) above, with both arguments (83d) above as a control.

The results of the comprehension tests were inconclusive. 4 out of 7 infants did not comply with the test requirements. O&T explain this as possibly simply infant reluctance to perform on this task. They claim that it is known that it is generally difficult to get 2 year olds to comply with requests. However, it is also generally known that 2 year olds do comply with requests they understand and find relevant.

Based on the extent of infant linguistic knowledge assumed by CIB, it is possible the infants were simply unable to understand the instruction. Replacing

the lexical causative with a periphrastic lexicalisation which had not been modelled previously for the infants, presents them with a major processing problem. 'Make A do Y to B' requires the introduction of an additional agent and double causative. 'You act on A, with the result that A acts on B'. (Note also that there is a change in sentence structure and verb form: 'X is **gorping** Y' becomes 'Make X **gorp** Y')

The infants had been quite capable of performing the actions required because the toys are not animate and therefore will have to have been moved by infant or experimenter for the game to proceed. So the request would present no conceptual difficulty for the infants to perform. What is not considered is that the event 'X is gorping Y' when enacted during the game phase is occurring within pretence (pretence is discussed in Chapter 5 section 2.1). In this pretence event the toy/Agents are operating as if animate intentional beings. The manipulation by the infant or experimenter is transparent and unimportant to the pretence. The utterance 'make A gorp B' breaks the pretence and provides a focus on the actual, introducing explicitly an additional level of Agent, the infant herself. This presents three levels of representation for the infant to process, which may simply be too much, giving the test results found:

i) [infant intentional action (complying with request)

ii) [infant acting on X (non-pretence)

iii) [X gorping Y (pretence)]]].

Researchers do refer to the behaviour of infants when confronted with this task as continually looking to the experimenter for reassurance. This tends to indicate infant confusion with the nature of the task rather than with their response, as this type of uncertain behaviour is not reported in other contexts.

Re-enactment tests seem to yield better results when older children are involved (Naigles, Fowler & Helm 1992). This may be due to the complex nature of the task. Not only do infants need to understand the input (the linguistic request) but also mentally construct and physically express the outcome. Because of this the experiments reviewed in this section will be those involving preferential looking time and which have been devised largely in support of SyB.

The task the infants are asked to perform does not include the additional physical construction of the outcome, as this is given.

CIB implies that infants by 30 months old have acquired, and therefore have productive control over syntax to express three utterance types, the nature of this has been described previously. In keeping with the Syntactic Bootstrapping hypothesis the generalised semantics of such utterances can be stylised as

ME: steady, (dynamic) state, atelic

INT: intentional state change, telic.

RES: resultant state change, transitive and telic.

The infant participants in the various studies discussed below are likely to have acquired ME, INT and RES, but not as likely to have any more elaborate syntax than this. The input sentences in the experiments are generally (with exceptions which will be indicated in the descriptions of the studies) present continuous. The discussion of each will show that the results of the experiments can equally be accounted for in terms of the CIB proposals.

The first series of experiments discussed below (Section 2) closely follow the general profile. The rest of the studies (from section 3) make certain innovations using what appear to be INT and RES utterances in the input with interesting results.

2. Naigles' syntactic bootstrapping experiments

An early research study by Naigles 1990 (discussed in Chapter 2 section 4.1) was designed to show that infants used syntactic information to acquire the meaning of verbs. The apparatus consisted of 2 video screens separated side by side which the infants face seated on their mothers' knees. The infants, average age 25 months, view a single video scene replicated on both screens depicting a simultaneous causative and synchronous act, to which is associated a novel word. I will illustrate one of the scenes here. The whole experiment is comprised of 4 comparable examples.

The composite scene consists of two characters – duck and rabbit – and the causative element consists of duck pushing rabbit to a bending position. Simultaneously, the synchronous element is depicted by both duck and rabbit

making a fully matching arm motion. The novel word associated with this scene is ‘gorping’.

This is illustrated as in Fig 19 below (reproduced from Naigles and Kako 1993 p1672)

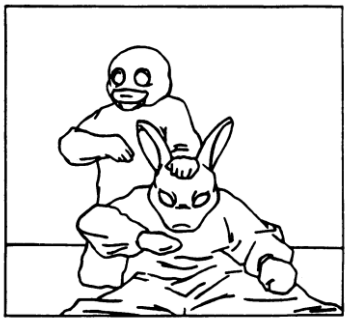

Fig 19 Composite scene for experiment 1 (Naigles & Kako 1993)

The experiment runs in the following way. One group of infants, while viewing the scene, hear an audio voice saying “duck is gorping rabbit”, a transitive construction. A different group hear the audio “duck and rabbit are gorping”, an intransitive construction. After several repeats, the scene changes to duck and rabbit engaged in the causative action on one screen, and on the other, the synchronous act is shown. All the infants hear the instruction “Where’s gorping now? Find gorping”. Infants’ total looking time towards each screen is measured. The assumption is that infants will look longer at the scene they understand from the prior presentation input. It is reliably found across all the four different scene/novel word examples that infants who had heard the transitive input looked more (to significance) towards the causative scene, and those who had heard the intransitive sentence looked more to the scene depicting synchronous activity.

Naigles had concluded from this that infants had derived a meaning for the novel word from the syntactic structure in the presentation, and therefore their attention was directed overall to the appropriate screen. In her conclusion, Naigles says;

> “Transitive frames appear to implicate actions which are at least ‘acting-on’ and perhaps specifically causal, while intransitive frames implicate actions which are non-causal or perhaps symmetric.” (Naigles 1990 p372)

Naigles also notes that the experiment does not address how such form-meaning correlations are acquired, nor is it known precisely what meanings infants infer from the syntax.

The experiment and its conclusion are very compelling and as such it has become somewhat iconic. Superficially, it would appear to present a strong challenge to the CIB account, which claims that infants of this age (25 months) do not have a productive syntax for expressing the present continuous, which this experiment is based on. CIB does propose that infants have transitive constructions which appear in later developing INT or RES utterance types, but these are not relevant to the experimental condition. The argument that infants may infer that the transitivity of their INT and RES utterances is analogous to the audio input is too speculative.

What CIB does assume is that infants are equipped with ME type utterances to support their understanding of Manifest Events which the depicted scenes undeniably are. ME utterances have an $[_{mod}$[substantive][modifier]] or $[_{sub}$[modifier][substantive]structure with flexible word order, and these can signify the dynamic properties of substantive object/entities. Modifiers can be words with an '–ing' ending, which are adjectival in nature. There are no [V]erbs, and as such no grammatical Agents or Patients can be specified or relevant.

The question is whether infants can perform the experiment as described drawing only on knowledge of ME syntax.

The causative event consists of two dissimilar sub-events:

i) duck pushing

ii) rabbit bending

Infants in the transitive condition (hearing 'duck is gorping rabbit'), may process this as 'duck gorping' or 'gorping rabbit' both of which assign a different attribute to either duck or rabbit.

The simultaneous, synchronous event consists of both duck and rabbit performing the same action, - arm moving.

Infants in the intransitive condition (hearing 'duck and rabbit are gorping') may process this as 'duck and rabbit gorping', which is a well formed ME

utterance with conjoined substantives modified by 'gorping'. Alternatively the utterance may be processed simply as 'gorping'. (There is evidence from the next experiment that suggests the latter is the case). This ME utterance expresses a modifier and the infant will need to infer the substantive element.

On viewing the two test scenes, the infants who understand the input as 'duck gorping', or 'gorping rabbit' have an expectation that 'gorping-ness' is a specific attribute of 'duck' or 'rabbit', but not of both. It is only in the 'causative' scene that duck or rabbit have unique dynamic properties, and this scene should receive more attention than the other. The test results support this.

The infants who process the input as 'duck and rabbit gorping' or simply 'gorping', are forced, on viewing the scenes, to infer that as the input is about characters exhibiting 'gorping-ness', the best option is to attend to the scene where both appear to have a common attribute. The synchronous scene meets this requirement. The test results support this.

Clearly, there is no evidence in the experiment to make the CIB proposal any more viable than the Naigles' explanation. Three follow up experiments by Naigles and Kako (1993) (N&K), however, add new dimensions and it is evidence from these which appears to tip the balance in support of the CIB proposal.

The first study in the series replicates the one discussed above but adds a third audio input condition. There are 3 groups of infants (these are older with an average age of 27 months). During the viewing of one of the composite scenes, one group hears a 'frameless' input ('Look! Gorping!'). Another group hears the intransitive input: ('duck and rabbit are gorping'), and the third hears the transitive ('duck is gorping rabbit'). In all other respects the experiment, testing and measuring is conducted in the same way.

The results are reported as follows: those infants who heard the transitive input looked significantly more at the causative action. For those infants in the frameless or intransitive condition there was no significant difference in responses - both looked more at the synchronous scene. N&K interpret these results as confirmation that hearing the transitive sentences has prompted the infants to derive causative meanings. This does not explain why the frameless and

intransitive input should give the same results. By design, ‘gorping’ is frameless, i.e. considered to be without a syntactic frame, and according to syntactic bootstrapping theory, the result for this group should be ambiguous.

The alternative CIB view noted that frameless and intransitive are interpreted as equivalent (‘gorping’) using ME syntax. The result that the frameless and intransitive conditions give the same outcome would confirm this. Only the ‘transitive’ input, parsed as either ‘duck gorping’ or ‘gorping rabbit’ can be interpreted as intended for the hearer to focus on the unique dynamic attribute of the labelled substantive (duck or rabbit).

In the second study in this series, N&K note that transitive constructions are also used to express contact events which may have no causative element. This study repeats the previous one, only this time instead of frog pushing and bending duck (a new character is used for this experiment), frog approaches duck’s head with its hand and touches it with a grasping motion. Duck does not react to this. Both frog and duck simultaneously make the synchronous arm movement.

This scene is illustrated as in Fig 20 (again reproduced from Naigles and Kako 1993 p1672), the other composite screens in the experiment had the same contact/synchrony structure. In all other respects the experiment is the same as before.

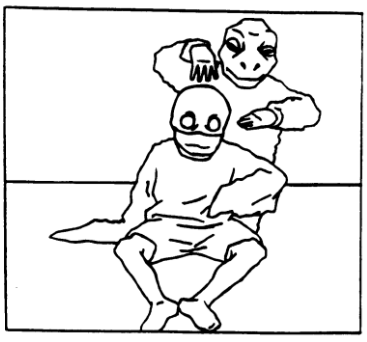

Fig 20 Composite scene for experiment 2

This time the contact scene has only one dynamic event: frog touches duck, but duck does nothing.

The results show more looking time towards the synchronous scene for frameless and intransitive inputs, and virtually equal looking time at the scenes (contact or synchrony) for the transitive input. N&K conclude that the different type of response for the transitive input demonstrates that the transitive input prompted infants to look more to the contact event than did the other groups. So the transitive input is claimed to have had some effect, albeit non-significant. Alternatively, the results might be interpreted as showing a positive relation between the intransitive or frameless priming and the synchronous scene choice. The transitive priming, however, only displays an ambiguous result.

CIB suggests that responses to the frameless and the intransitive input both interpreted as 'gorping' with no substantive mentioned would be as in the previous experiment: i.e. the recognition that 'gorping' is a dynamic attribute which can be applied to all participants in the scene, and therefore the synchronous actions are favoured.

The transitive frame is ambiguous from the CIB viewpoint given that it is interpreted as 'frog gorping' or 'gorping duck', but there is no unique dynamic attribute associated with duck other than being static. If the infants parse the input as 'gorping duck' and expect a unique attribute, then this will fail and so this parse should be less favoured when viewing the 'contact' screen. Although 'gorping duck' may be applied to the synchronous scene, it will also fail because 'gorping' will not be seen to be a unique attribute of duck. The recorded equal looking towards contact or synchronous scenes in the transitive condition can be argued to be reflecting this dilemma. The infants are attempting to attribute the property of 'gorping-ness' uniquely to frog or duck. Frog has a unique dynamic attribute (touching) but duck does not.

The third study in this series, attempts to pit causative against contact actions, and is problematic for both Naigles' and the CIB accounts. The composite scene shows the following: frog touches duck's head with one hand and pushes duck down by the shoulder with the other. This scene is illustrated as in figure 21 (again reproduced from Naigles and Kako 1993 p1672), the other composite screens had the same contact/causative structure.

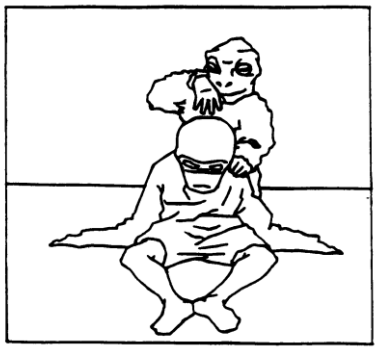

Fig 21 Composite scene for experiment 3

A particular problem is that the discrete nature of the two test actions (contact or causation) is masked. In the composite scene the contact element may be considered to be integral and contributing to the causative event. It is only when the scenes are separated that the contact action becomes clearly separate from the causative action.

In this experiment the infants hear only frameless input ('Look gorping') or transitive input ('frog is gorping duck'). The test question is 'Find gorping now. Find where gorping is now.' The recorded result is that the infants, regardless of input looked more towards the causative screen. The infants in the frameless condition looked comparatively more towards the causative screen than those in the transitive condition. There were however no significant effects between the screen, or input condition. N&K conclude that the most striking finding is that the significant effect of the transitive frame found in the previous experiments, was not present in this one:

> Instead, the significant preference for the causative action in the Frameless condition did not differ from the non-significant preference for the same action found in the Transitive condition. (ibid p1679)

What this means for the infant's understanding is not clear. With the transitive condition, Naigles' position is that the overlapping meaning of transitive constructions for causative and contact is the source of the ambiguity. If the transitive sentence is interpreted as ME utterances, 'frog gorping' or 'gorping duck' then the causative scene would satisfy this, which accounts for the recorded longer looking time at the causative scene. The frameless condition is trickier (for both SyB and CIB) and the results may be due to the causative element of the

composite scene being striking enough to prompt longer looking time to the (separated) causative scene regardless of linguistic priming.

The CIB explanation can be applied successfully to the first two experiments[2]. The explanation supports the conclusion that the infants may be using syntactic knowledge already acquired. This is ME type syntax, which does not have [V]erbs.

The SyB proposal states that hearing novel verbs in a range of syntactic frames enables infants to learn the meaning of those words. CIB suggests from these experiments that infants use their productively acquired syntax not as a source for learning the meaning of the verb, but as a guide to interpreting the newly presented scenes as overall events. It is the observation of the scene which provides infants with some idea of what the novel word might mean. If this is correct, then there is no obligation on the infant to assign any meaning to the novel word at all. Their existing syntactic knowledge (ME) provides them with sufficient structure to direct their attention to one or the other scene to derive a pragmatically relevant interpretation.

3. Fisher and colleagues: Syntactic bootstrapping experiments

These experiments introduce input sentences which are designed to present the novel verb in different syntactic frames. The research supports SyB, which claims that when infants hear a novel verb in a number of syntactic frames they are better able to acquire its meaning. The test questions, however, are still presented in the present continuous.

3.1 Gertner, Fisher & Eisengart (2005)

This series of experiments is designed with the explicit intention of demonstrating that infants do have abstract syntactic knowledge that they bring to the learning task, and focuses on infant knowledge of word order to evoke the correct agent / patient relationship. The test scenes involve a bunny doing something to a duck, or a duck doing something to a bunny. The test measure is the identification, by looking time, of the appropriate scene given either 'the

[2] This leaves aside the third experiment, which is problematic, largely due to a possible design fault in how discrete contact and causative actions are depicted in the composite scene.

bunny is gorping the duck' or 'the duck is gorping the bunny' as the linguistic input.

The first experiment involves infants with an average age of 25 months. The practice phase involves the infants hearing familiar verbs being used: 'hug' and 'feed'. Initially the scene is blanked from the screen and the infants hear: 'the bunny is gonna hug the duck'. The scene appears on the screen and the sentence 'the bunny is hugging the duck' is heard. The screen is then blanked and the infants hear: 'the bunny hugged the duck'. The scene is played again and the infants hear 'the bunny's hugging the duck! Find hugging' The procedure is repeated again for a new scene this time 'the bunny is feeding the duck' preceded as before with 'the bunny is gonna feed the duck' or 'the bunny fed the duck' in the appropriate place.

After this familiarisation, the test phase then involved the infants hearing to a blank screen 'Hey look! The duck's gonna gorp the bunny!' Two scenes are then presented simultaneously on two screens: one with the bunny as agent pushing the duck as patient along in a truck, and the other with the duck pulling the bunny's arm. This time the infants hear: 'The duck is gorping the bunny'. The screens are blanked and the audio states: 'the duck gorped the bunny'. The scenes return to the screens and the infants hear 'The duck is gorping the bunny! Find gorping. Find gorping.'

The result is that infants looked significantly longer at the appropriate scene (in this case the duck as agent pulling the bunny's arm). It should be noted at this stage that the range of input sentences include INT utterances ('the duck's gonna gorp the bunny') prior to viewing the scenes, and RES utterances ('the duck gorped the bunny') after viewing the scenes. The syntax of these utterance types accommodates an Agent and an object/entity undergoing some change of state described by the verb.

The second experiment is designed to test whether infants know that the second named participant is the patient. It involved the same procedure, only this time the subject of the audio sentences was 'he' (as in 'he is gorping the bunny'). Although the experimental report does not detail the input, it is assumed that when the researchers declare the experiment to have the same structure as the first

experiment, then the audio can be assumed to include at the appropriate time, ‘he is gonna gorp the bunny’ and ‘he gorped the bunny’.

The result of this experiment showed the infants looked significantly longer at the correct scene (bunny as patient).

The third experiment focussed on younger infants, 21 month olds. The researchers reason that as the infants are younger and only at the beginning of word combination, they would fail the comprehension task. In this case the report suggests the design was similar to experiment one, with the change that the participants were a boy and girl in ordinary clothing (rather than dressed in duck or bunny costumes), and the test involved a choice between the girl bending the boy back and forth by pressing on his shoulder, or the boy rotating the girl on a chair by pulling on a band tied round her waist. The aim of the test was the correct identification of agent and patient roles using word order.

The result was that the 21 month olds reliably looked at the appropriate scene, contrary to the experimenters’ prediction. Disappointingly, the researchers concluded that the infants allocated the correct agent/patient roles based on the test sentence: ‘the boy is gorping the girl’, and make no reference to the possibility that 21 month old infants may have acquired appropriate syntax to be able to make use of the practice sentences as INT or RES utterances.

The fourth experiment with 21 month olds replaced the test sentence with ‘who’s gorping the girl?’ This had the aim of demonstrating that infants would identify the agent from this frame. Again no mention is made of the structure of the practice utterances given, but as it is reported that the structure is similar to the other experiments and that changes to the test phase are reported, it must be assumed that infants heard the INT and RES type utterances in practice.

The results showed that infants reliably identified the appropriate scenes.

The researchers conclude that infants have an abstract knowledge of word order to be able to identify the appropriate participant roles from the test sentence, but miss the possible contributory factor that the infants may have prior knowledge of INT utterance syntax. ‘The X’s gonna gorp the Y’ is possibly an INT utterance, expressing an intentional action; and ‘the X gorped the Y’ is a possible RES utterance, expressing the result of an action. Both utterance types

have DPs in appropriate roles for the utterance type and should have a known and fully understood syntax. CIB suggests that infants of this age having already productively acquired the syntax for INT and RES utterances used, will have formed a representation of the scene which can be verified when the test scene is revealed.

A further series of experiments following a similar design reinforce the conclusion that the acquired syntax for INT and RES utterances may be playing a role as CIB would assume. In each experiment the significance of this prior acquisition is not noted by the researchers.

3.2 Yuan & Fisher 2009

Two experiments with infants (average age 28 months) follow a similar design to those already discussed, except the test scenes are presented 'cold' at the time of the test. The preliminary phase involves the infants viewing a scene of two people in dialogue, discussing either a transitive or intransitive scene. The infants on test then identify by looking time the appropriate scene. For example, dialogues are as follows (reproduced from the paper):

Transitive	Intransitive
A: Hey … Jim is gonna blick the cat. B: Really? He's gonna blick the cat? A: And Mary was blicking the man. B: Wow, she was blicking the man. And A: Guess what? Jane blicked the baby. B: Hmm, she blicked the baby? A: And Bill was blicking the duck. B: Yeah, he was blicking the duck	A: Hey … Jim is gonna blick! B: Really? He's gonna blick? A: And Mary was blicking. B: Wow, she was blicking. And A: Guess what? Jane blicked B: Hmm, she blicked? A: And Bill was blicking. B: Yeah, he was blicking.

The infants then see two scenes presented simultaneously on two screens, one of a man pulling on a woman's leg, and the other of a man alone standing holding his arm in the air. The accompanying audio asks: 'Find blicking! Where's blicking? See? Where's blicking?'

The results showed that infants reliably identified the appropriate scene from the input of the transitive dialogues, but looking time to the intransitive

condition was less statistically robust. The conclusion, drawn by the researchers, is that infants learned combinatorial facts about a novel verb simply by listening.

This can only be part of the story, as it leaves two factors out of the account. Firstly, the priming sentences in the transitive condition mention two actors while the intransitive condition mentions only one. It could be that infants only look at the scene with the relevant number of actors. Secondly, the syntax for INT utterances, in particular, utilises DPs and raises the expectation that the scene will exhibit a change of state for one of the two participants, and the change can be described as 'blicking'. The researchers note that it is only the transitive input which has a strong effect on looking time.

A CIB standpoint can provide a possible explanation why the intransitive input did not prompt significant looking time towards the intransitive scene. The input sentences feature sentences that might be described as INT utterances with omitted objects ('He's gonna blick'). A possible consequence may be that because INT focuses on change of state of a participant in Theme role, this prompted infants to enrich their interpretation of the utterance by pragmatically inferring the existence of an object/entity to exhibit the necessary change of state. This eventuality could affect the amount of looking time to the intransitive scene, as the expected object/entity is absent. The infant can, however, find a representation of the expected object/entity in the transitive scene, attention to which would reduce looking time to the intransitive scene.

A follow up experiment is described with certain changes to the amount of input, by increasing the syntactic frames for the new verb, although it is not reported what these are other than preserving the transitive / intransitive distinction. The test phase was changed so half the participants were asked 'where's blicking', and the other half 'what's happening' as a control. An additional difference was that a group were tested after a delay of about a day, and this group had further additional sentence input, although the nature of this input was not reported.

The results of this experiment showed that there was a robust response for the transitive events, and a lesser response for the intransitive which was border-line for statistical significance for both the same day and next day testing

condition. This was principally for the experimental rather than control conditions, supporting the effect of the linguistic input rather than simply a perceptual response.

Again, although the researchers make no reference to the effect of the dialogue input, CIB would suggest that the transitive events implied by INT utterances experienced prior to viewing the test scenes, were powerful enough to prompt the response. The infants might understand that 'blick' signified some change of state of a participant in Theme role, and when asked to identify 'blicking' could home in on explicating the meaning already derived from the INT utterance. The control, 'what's happening' may well prompt the infants to consider the scenes as unrelated to the prior dialogue, i.e. a new event experience, and therefore not relate the prior dialogue to the scenes. This appears to be what occurred.

The conclusion given by the researchers is to support the hypothesis that infants, on hearing multiple syntactic frames for verbs, are enabled to deduce the meaning of the verb. Bombarding the infant with linguistic experience may well have had an effect, but it does not explain why the intransitive results should be markedly less robust than the transitive. Prior knowledge of INT utterance types would seem to provide some explanation for the results achieved.

Two follow-up experiments emphasise this point even more:

3.3 Arunachalam & Waxman (2010) (A&W)

This experiment was designed to support the SyB hypothesis that meaning is derived from syntax, and follows closely the methodology adopted by Yuan & Fisher (above).

The participants had an average age of 27 months. Again infants experienced a dialogue phase, and the test phase depicted scenes either of humans acting on other humans or humans acting on inanimate objects. Dialogues were accompanied by video of two human participants in discussion, talking about transitive or intransitive events, with the following format:

Transitive	Intransitive
A: You know what? B: What? A: The lady mooped my brother. B: Really? The lady mooped your brother? A: And the boy is going to moop the girl. B: Oh yes, he's going to moop her	A: You know what? B: What? A: The lady and my brother mooped. B: Really? The lady and your brother mooped? A: And the boy and the girl are going to moop. B: Oh yes. They are going to moop.

The infants then see two simultaneous scenes on two screens: a transitive (causative) and a synchronous intransitive activity, both involving two participants, and the infants are asked 'where's mooping?' which they indicate by pointing to the appropriate screen.

The results showed that infants in the transitive condition were more likely to point to the causative screen. The infants in the intransitive condition pointed only at chance. The researchers explain this in the same way as Naigles, that infants accept both causative and non-causative scenes as representative of intransitive input. That is the verb may refer to one of the sub-events of the causative action rather than the whole complex event. The main conclusion drawn by the research is to highlight that infants formed a representative meaning for the verb from syntactic input. A&W suggest that infants are fast mapping verb meanings in the dialogue phase using syntactic information alone. This is interpreted as the verb's syntactic properties which prompts a semantic interpretation.

There is no doubt that syntactic bootstrapping might play a significant role in infant access to verb meaning, however, the case made here is that it could be that all infants have is ME, INT and RES type syntax, which does appear to explain the data. If my claim is correct, then infants are not focussing on a causal implication for the transitive sentence but the implication of a result.

CIB proposes that as these utterances express a focus on object or entity state change, it is this which the infants are searching for in their identification procedure on test. It is not that the syntax provides a causal entailment for the verb which is then matched to the scene; it is rather that the infants are primed to

find out what state change might be attributed to the verb from the scene when viewed. INT and RES utterances have an obligatory theme role (whether overtly expressed or not) and as such it is expected that the transitive events will accord with the infants understanding of the dialogue. As there is no theme role expressed in the intransitive dialogues they are faced with a dilemma which is reflected in the results occurring at chance level.

3.4 Arunachalam, Escovar, Hansen, & Waxman (2011)

This experiment repeats the one above but the participating infants were 21 months old. The same results were achieved. The researchers conclude that the infants use argument structure rules to define the meaning of verbs, in the absence of the visual scene. On the CIB account, it would be expected that a significant number of the 21 month old infants would have acquired INT and RES utterance types, and are using this information to understand the dialogue as a state change event. It is therefore not the deduced meaning of the verb which is actively prompting which scene to attend to, but rather the implied meaning of the whole utterance which prompts the infants to anticipate some kind of state change. It is this that the infants are looking for in the scene, and it is the interpretation of the visual scene which supports how infants assign meaning to the novel verb.

Researchers, in not recognising infant knowledge of INT and RES utterance structure, miss the effect that the already acquired syntax may have on understanding.

4 Discussion

These comprehension studies test whether infants can learn the meaning of novel verbs from hearing them used in different syntactic frames, and aim to support the Syntactic Bootstrapping hypothesis. The hypothesis relates to a much wider time frame of input than can be defined by the content of the experimental condition. The alternative offered, that infants have knowledge of syntax for expressing ME and CE type utterances, appears to provide some explanation for the experimental results generally. It could be that by attending to the possibility that infants have established syntactic knowledge of the type suggested, further experiments could be devised to capitalise on this knowledge. Without this

acknowledgement the experimental design may include distractors affecting the results.

All the experiments discussed in this chapter show a striking common feature. Despite different methodologies, the test results can be explained as the infants drawing on syntactic knowledge acquired according to the CIB proposal. This is encouraging, but leaves open a new question why the research design frequently adopts the use of INT and RES type utterances in practice sessions for the tests, yet there is no discussion why such have been selected. Tomasello & Kruger (1992) had suggested that in carer/infant CDS (discussed in Chapter 2 section 1.2), new verbs are introduced predominantly prior to or directly after an event, which flags up that there is an element of intuition involved. CIB can offer the clarification that adults are approaching the introduction of new verbs intuitively by utilising INT and RES utterances which infants have developed independently. The experimenters may also have been influenced by this intuition, which serves to underline the natural bootstrapping effect of such utterances.

Chapter 9
Summary review and prospect

Language is a uniquely human facility, and infants experience virtually continuous linguistic activity around them, either directed towards them or not. Thus, the acquisition of language and more specifically, the ambient language of the speech community is a must. For infants to acquire language, the learning system has to be such that it delivers an inevitable, positive outcome, without which the learner would be at a severe disadvantage.

Any type of learning system would be inefficiently constructed if it were to make available too much information for the infant to process. Overloading the infant with processes which are not of immediate relevance cannot be viable, and as such there is a means for constraining learning in order to guarantee an inevitable result. These constraints limit the learning space sufficiently for a simple bootstrapping process to provide access to the acquisition of syntax.

1. Constraints on learning

Throughout my thesis the outcomes at each stage have defined a series of constraints on the learning space, and my proposal is that Conceptual-Intentional Bootstrapping works in conjunction with these to guide the infant to an inevitable result, i.e. access to syntax becomes plainly available. The constraining mechanisms, which in themselves may serve diverse purposes, can be summarised as follows from the discussion in the foregoing chapters.

1.1 Conceptual-intentional development (Chapter 3) is structured, focussed and relevant to the infant.

i). The initial interaction and development of inter-subjectivity with an adult provides a unique human relationship, from which a conversational, communicative exchange is established.

ii). CDS focuses on meaning and understanding which helps build infant generic knowledge of the world. This is organised in such a way to provide a 'contextual funnel' which ensures that all learning is inherently meaningful, which in turn, provides the context for interpreting and acquiring new knowledge.

iii). The key component of infant subjective (generic) knowledge is the event. Events are bounded, complete in themselves yet can be sequenced and integrated. Through their intentionality, infants engage with that which is relevant and contextually meaningful to them. Manifest, dynamic events are, therefore, understood in terms of participatory entities operating in largely predictable ways.

1.2 Early word learning (Chapter 4) is flexible but contextually bound within the confines of the infant's conceptual-intentional development.

i). Because words are language specific and languages operate in different ways, it is advantageous for word learning to be maximally flexible. This is initially achieved if infant words are not considered to have inherent grammatical specifications. Syntactic role and category membership is defined by syntax and categories like [V] and [N] form as necessary elements of syntactic structure, not as specifications of lexical items.

ii). Flexibility can be maintained if words are considered to be semantically under-determined. Conceptual understanding of objects/entities and their dynamic potentialities are derived from further 'contextual funnelling' from global categories to the particular. Meta-cognitive developments enable a shift from monitoring perceived events to mapping between events including linguistic events. In this way word learning and word meanings are distilled out from global contexts. On this basis, words do not label individual concepts, but map to events which can simulate or summon up a range of relevant experience stored as generic knowledge.

1.3 Utterances of Manifest and Complex events (Chapter 5) provide the basis for productive verbal communication.

i). Combining words requires a conventional means of organisation – syntax. In its acquisition, two contexts are identified, constrained by an infant's growing meta-cognitive and representational abilities: Manifest and Complex Events.

ii). Manifest events are defined as those occurring in the context of shared joint attention with an adult in the here and now. Infants form Primary Representations - the on-going updating of actuality. Two word utterances about

Manifest Events are descriptive of these events and have been characterised as syntactic constructions which exhibit the basic principle of Merge, which at this stage is not licensed by syntactic features but by perceptual, or conceptual binding.

Utterances about Manifest Events are inherently atelic, and have been characterised as: ME [$_{\text{Aspect}}$ atelic[substantive][modifier]].

iii). Complex Events are defined as those which exhibit two sub-events which are the result of a collation of a Primary representation of current actuality and a constructed Secondary representation, which contrasts with current actuality. These have been shown to make two differing utterance types available: INT characterising intention towards a change of state, and RES characterised as the result of a changed state. These differ significantly from Manifest Events in that the infant's communicative intention is not a directly shared feature of the context with the carer.

1.4 Empirical evidence (Chapter 6) supports the contrast between Manifest and Complex Event utterance types.

The empirical study in Chapter 6, demonstrated the influence of communication about Complex events, particularly INT utterances. This took the form of the positive significant association between DPs in Theme role and utterances of Complex Events. This was matched by the correlation between bare nominal forms and utterances of Manifest events. The strength of these relations suggested that INT utterances are the locus for syntactic development. Endocentric DPs occur as components of verb phrases, thus one conclusion is that INT utterances play a significant role in the development of [V]erbs. RES utterances. although fewer in number than INT utterances, showed strong associations with DPs, and those in Agentive roles in particular.

It was noted that utterances of Manifest and Complex events differ by Aspect; the former are atelic, and the latter telic.

1.5 Utterances about Complex Events provide the locus for syntactic growth (Chapter 7).

Based on infant utterances and the empirical data, the syntactic structure of INT and RES utterances could be characterised by a process of successive binary Merge. An important contributory element was found to be Aspect features.

1.6 ME and CE syntactic knowledge confirmed by comprehension and production testing (Chapter 8).

The assumption, that infants 18-30 months old have productive knowledge of ME and CE utterance types, was supported by demonstrating that the outcomes from comprehension testing experiments can be achieved by infants utilising such knowledge.

2. How the Conceptual-Intentional Bootstrapping proposal differs from other bootstrapping proposals

Bootstrapping describes the problem of how an infant can relate an ungraded auditory linguistic input, to the syntactic specifications of the ambient language. The innatist version assumes a full competence system innately available to the infant from UG. The task is, therefore, one of starting up the language learning facility which will operate in the background to set parameters of UG which match those of the target language being acquired. For theoretical positions which do not attribute a role for UG, a bootstrapping process, however, can still be seen to play a role. For instance, emergentists need to define how item-specific lexical construction frames, learned from input, can become generalised syntactic constructions for productive use.

Linguistic systems vary considerably across languages and are specific for individual languages. Unlocking the mysteries of a language specific syntactic system, which is always achieved successfully and accurately by all (typically developing) infants, is the bootstrapping problem.

As has been shown, (Chapter 2), different bootstrapping approaches weight different aspects of this process. SeB suggests a direct semantic link to existing innately specified grammatical categories, on a perceived world to structure basis. VEPS assumes a kind of parametric template through which the language is

perceived and co-ordinated with innately specified UG. For both these approaches the learning space is constrained by innately specified elements. If, as has been discussed (Chapter3), the possibility of innate grammatical categories is denied, then SeB, which relies heavily on their existence cannot operate. Janet Fodor (1998) has argued that Gibson & Wexler's (1994) approach to defining whole sentence triggers for VEPS presents the infant with a vast array of ambiguous triggers which necessitate a trial and error approach. In turn this can result in wholesale parameter resetting to derive the correct syntax. Her solution is to constrain the infant to unambiguous triggers which tend to mark structures within sentences or 'treelets' rather than whole sentence structure.

VIH on the other hand, adopts a cumulative word-concept learning process where frequency of use groups words and phrases into larger units. The constraint on learning seems to be the context of use, although the tipping point from individual collections of words (verb islands) to categorical verb constructions appears to be ill-defined. The tipping point, which Tomasello (1992, 2000) attributes to analogy, may constitute a bootstrapping process.

SyB, from an alternative perspective, assumes a syntactic knowledge and uses this as a constraint on deriving verb meaning.

All approaches assume a degree of bootstrapping as useful, but to date the differing versions do not fully address the range of constraints on the learning process. As such these hypotheses leave too much of the acquisition process to chance, which patently cannot be the case.

I have identified the following five key characteristics of the Conceptual-Intentional Bootstrapping proposal which together mark it out as different from other bootstrapping hypotheses:

i). Intentionality

ii). Innate principle Merge, and possibly innate prototypical categories [substantive] [modifier], and grammatical [V], [D], and [N].

iii). Analytic, as opposed to synthetic processes.

iv). The acquire as required principle

v). Language production

2.1 Intentionality

The overriding difference between CIB and all others is the role given to the infant herself as a participating, sentient being, not simply a location for acquisitional mechanisms. Recognising this aspect has a pervading effect on all other principles, as the infant takes some 'responsibility' for guiding her learning on the basis of what she finds relevant for her engagement in the learning process.

This still allows for mechanistic processing to be happening in the background, and addresses the problem of dealing with ambiguous input. Background processing may provide possibilities, processing for relevance provides solutions.

CIB therefore maintains that the infant, involved with human interaction, learning from and being included in the social/cultural context of the dyadic carer/infant relationship and the wider family/social context, has a growing individuality and identity. CIB capitalises on the advent of an infant's personal identity and her desire to communicate her own intentions which are not simply following an adult lead. The process is therefore communication driven.

2.2 Innate elements

CIB recognises certain innate properties.

Learning from prior experience, and the establishing of cognitive relevance are both assumed to be innate abilities for all infants; so too (meta-)cognitive development. The advent of conceptually complex events is the result of general universal cognitive growth: the correlation of Primary and Secondary representations.

Yang's proposal (2004) that UG may be a guide for language learning, i.e. some sort of instruction manual, cannot be so. UG is generally held to specify universal linguistic options yet there seems to be no published evidence that UG is graded. This view is reinforced by Fodor's (1998) observation of the extent of ambiguous triggers affecting parameter setting. A further problem is why, if UG is a guiding principle, does it appear to take so long to yield results? Does UG lie dormant until an infant has matured enough for it to start up? If so, the bootstrapping problem remains. However, Chomsky's vision (1980, 1995) that language acquisition can be thought akin to biological growth is instructive. CIB

has specified a developmental process inevitably resulting in language acquisition, which provides the certain environment for UG to operate. The bootstrapping process as described appears to define innate prototypical categories such as [substantive] and [modifier], when describing Manifest Event representations and are closely matched to conceptual categories evident in infant generic knowledge. Expressions about Complex Event representations require the grammatical categories [V], [D], and [N], and appear to be in a direct relation to conceptual properties of stae-change, reference and object/entity kind. I claim CIB to provide the missing link, which, due to its innate universality and inevitability of output, stands in a very close relation to UG itself, such that Principles operate and Parameters are set in a cognitive environment of rich contextual meaning and communicative intent.

Emergentists rely on the linguistic input for infants to learn linguistic constructions, yet analysis of the input shows that there is not a systematic presentation of linguistic structures that can ensure the level of inevitability required. In fact it appears that adults are unaware of how to provide systematic instruction for grammar learning. There is evidence that initial utterances exhibit a mapping from linguistic to perceived events, but productive use of language by infants appears to begin using constructions never heard uttered by adults – (‘have it spoons’). CIB provides tight guiding principles which utilise what adults do actively provide in their talk with infants, leading to a position where the infant takes over the acquisition process for herself. This link is missing from the emergentist account.

2.3 Analysis rather than synthesis

The constraints in CIB are built on the notion of learning occurring within meaningful global contexts which is then subject to further refinements. This top down approach places CIB in opposition to many item-based acquisition theories (Tomasello 2005, Ninio 1999, McClure, Pine & Lieven 2006) where individual words and their meanings are learned and then combined into constructions which initially operate autonomously until there is some form of motivation for them to coalesce into a generalised structure. Throughout, it has been demonstrated that wide contexts always provide the starting point. Global categories define their membership rather than collections of items forming categories. Therefore, global

contextual, generic knowledge provides a meaningful context for learning about how entities interact in the world; global conceptual categories provide the context for distilling component categories; and words gain syntactic category membership from the roles demanded by syntax. This approach allows for what might be termed 'constrained flexibility', a process which allows for a functionally defined category boundary but the contents are loosely defined until accuracy becomes relevant. This 'best fit' approach favours fluency over accuracy and provides optimal access to an interacting conceptual/intentional/linguistic system which is communication driven. CIB makes quite strong claims about the communicative constraints on infants during the bootstrapping process. There are just two event types which characterise all early infant communication requirements: Manifest and Complex Events, and the latter present just two utterance types: INT and RES. These represent the communicative constraints within which there is a wide range of possibilities of what can be communicated, given the additional contextual constraints from infant subjective experience.

2.4 Acquire-as-required.

The problem with a full competence model is how to explain why very young infants do not talk immediately like adults. Indeed it would be profoundly disturbing if they did! Conventionally the explanation centres on performance limitations in the young infant. CIB redefines performance limitations in terms of systematic constraints which limit infant access to aspects of syntax and communicative content relative to cognitive development and relevance in intentionality. The result is to view the infant not as a deficient adult, but as a developing human acquiring what is needed for effective communication at any one time in the infant's life. CIB claims that infants acquire those aspects of adult grammar, within the bounds of 'constrained flexibility', which effectively meet their needs at any one time. It supports Rizzi's (2002) and Fodor's (1998) notion of partial syntactic acquisition. It implies a system, suggested by Braine (1992) of 'use what is already known, and if this doesn't work then make appropriate changes'. Judgements of whether the system 'works' or not are defined on the basis of effective communication i.e. expressing a communicative intention and being understood by another.

This approach has implications for what constitutes 'acquisition'. Language acquisition is not simply an inventory of linguistic knowledge but includes effective communicative use. As stated above communication is limited to two event types: Manifest and Complex Events. Manifest events provide overt support for comprehension; the context is fully shared between the infant and adult. Complex events provide a motivation for developing effective means for the expression of non-overt informative content. INT utterances in particular must be understood by a hearer because they represent important needs and requirements for the infant. A definition of language acquisition that fails to show that language knowledge is acquired for the purpose of linguistic production fails to take account of this evidence.

2.5 Production

By defining language acquisition as the acquisition of language knowledge for production raises a contentious proposition. There has been extensive debate about the relation between comprehension and production and language knowledge. Some of the issues are summarised here. Generative theory defines language knowledge in the form of syntax as the central element which through performance processes provides for comprehension and production as two comparable outcomes. The implication is that neither is possible without existing language knowledge (the syntax of the language). SyB (Syntactic bootstrapping) approaches claim that 'structure is easy but meaning is difficult' (Naigles 2002) implying a divide between syntax and comprehension and that syntax has ascendancy over comprehension. Production is not considered. Other approaches, like item-based, usage models, claim that meaning and comprehension have ascendancy over structure. Tomasello (2002) maintains that infants learn and reproduce structures that have been heard used in appropriate contexts.

Either way, however the input is gained it is not until the infant attempts to put together what has been learned/constructed/confirmed in the personal context of her intentionality to make and produce an utterance, that she can gauge the effectiveness of her learning. As adults we may watch, study and understand what a master chef is doing in creating a remarkable dish, and appreciate it when eaten, but this will provide only a guide when asked to produce such a dish oneself. Infants experience communication from master crafts-people daily, delivered in

such a way to be readily understood and appreciated. Producing comparable utterances is difficult and an integral part of the acquisition process. CIB separates comprehension from production, and given the constraints already outlined proposes that comprehension is based on syntactic knowledge plus extensive pragmatic, inferential abilities drawn from generic knowledge. Production requires well-formed syntactic knowledge. Only the latter demands that the infant controls and manipulates syntactic elements. It is gaining control and ownership of linguistic knowledge for production that constitutes the largest part of the acquisition process. This major undertaking is mediated by the acquire-as-required principle.

3. Implications and ways forward

The Conceptual-Intentional Bootstrapping proposal described in this thesis has been exemplified through the acquisition of the English verb, but all the steps which eventually arrive at Complex Event utterances can be assumed to be universal for all infants. An inevitable prediction is that when infants are able to make complex event utterances they will achieve a defining moment for accessing the syntax of the ambient language they are acquiring. Clearly the special privilege accorded to 'it' in English is a language specific device, which operates as a syntactic feature on words expressing telic events. The implication is that other languages make similar important devices apparent when infants express utterances about Complex Events. The uncovering of the significance of INT and RES utterance-types for syntactic growth should provide valuable insights into the explanation for various acquisition phenomena. One such is the use of Root Infinitives (RI) in infant speech to express eventualities.

Use of RI by infants is evident in many languages and notably is absent from adult speech. Infants will not have learned this usage from adult input. Research into RI, briefly reviewed in Chapter 2 section 2.6, has described usage to be restricted to event-denoting verbs and related to a modal interpretation in several languages: French, German, Dutch, Greek and Russian (Hoekstra & Hyams 1998). Event denotation and modal interpretation provide a strong suggestion that INT utterances are implicated. It is noted by Hoekstra & Hyams and other research that for English, having no infinitival form, non-finite verbs

behave differently. CIB suggests that in English, INT utilises a discrete non-finite form, but RES verbs only appear to be non-finite in form because English does not have a distinct verb morphology to express Aspect as opposed to tense. Infants learn verb forms for RES (irreg, -ed, ø) dependent on what they have heard used.

Gavruseva (2003) and Hyams (2007, 2011) have proposed conflicting aspectual explanations to incorporate infant use of bare perfectives and bare verbs for the languages listed above including English, although there is technical disagreement over how this should be formulated.

INT and RES utterances are shown in CIB to have a significant influence on how Aspect, particularly telicity, is expressed by infants in English. It is predicted that categorising infant utterances into ME, INT and RES utterance-types from corpus data, drawn from languages other than English, will provide a clearer insight into how infants are approaching syntactic organisation in these languages, particularly RI usage.

Even more interesting would be the insights revealed by INT and RES utterance-types into infant syntactic development, drawn from non-European languages.

It would appear that utterances about Manifest and Complex Events described by CIB constitute the early intentional communication of all infants less than 30 months old, and therefore will provide a rich source of insight into the acquisition of the syntax of any language. By uncovering the specific linguistic devices infants uniquely use to express INT and RES utterances, additional otherwise hidden information about the syntax of particular languages will become apparent to researchers as much as it evidently does to 18 month old infants.

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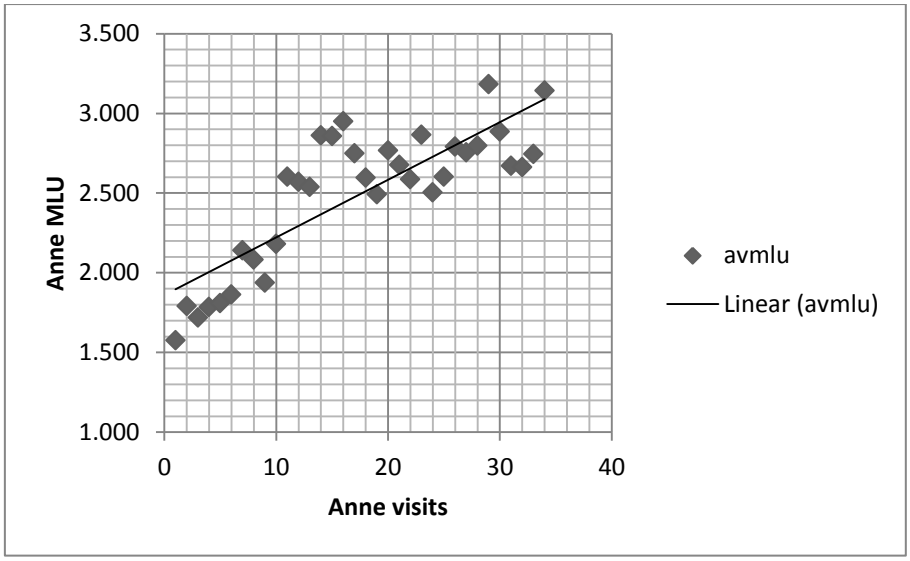
Appendix 1: MLU calculations

The graphs presented here represent the MLU calculations for all the infants in the CHILDES/UK-Eng/Manchester corpus.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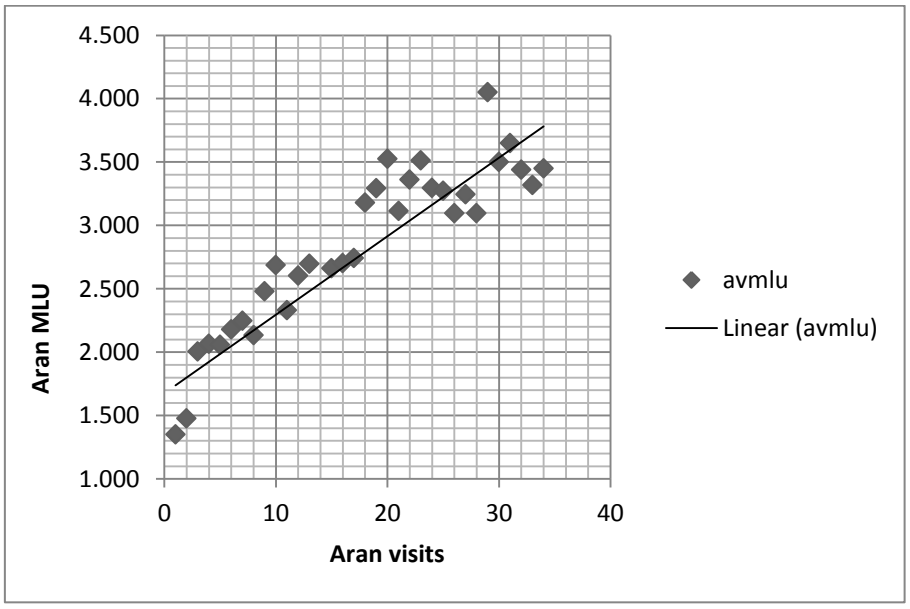
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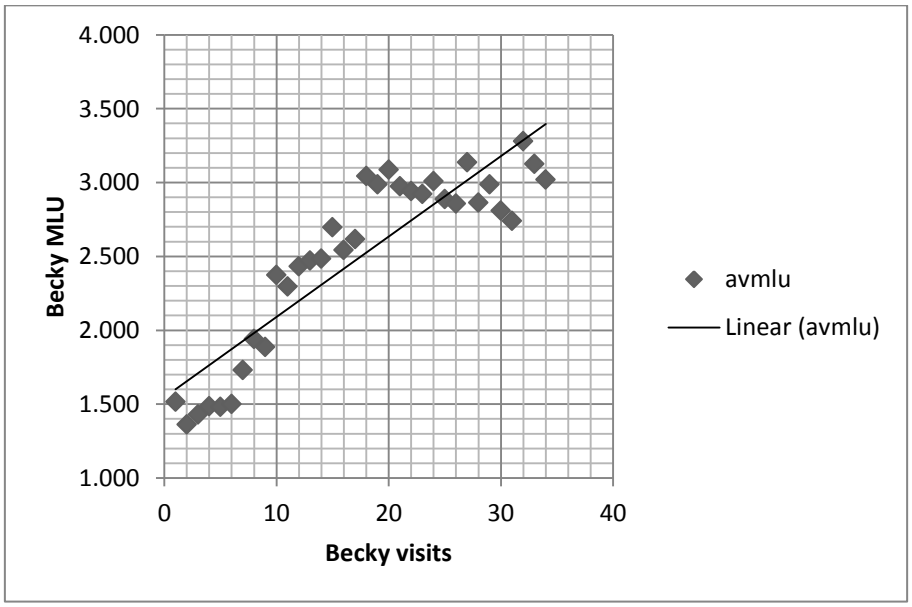
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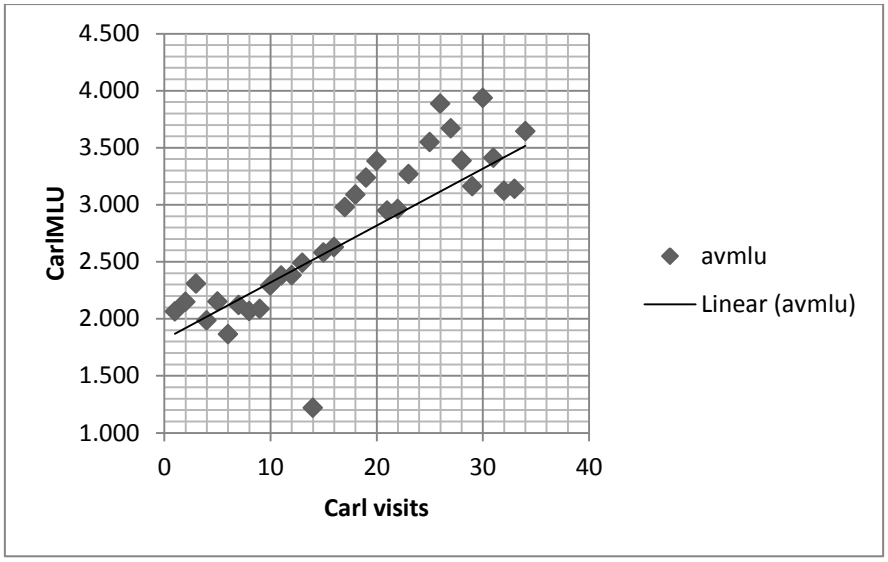
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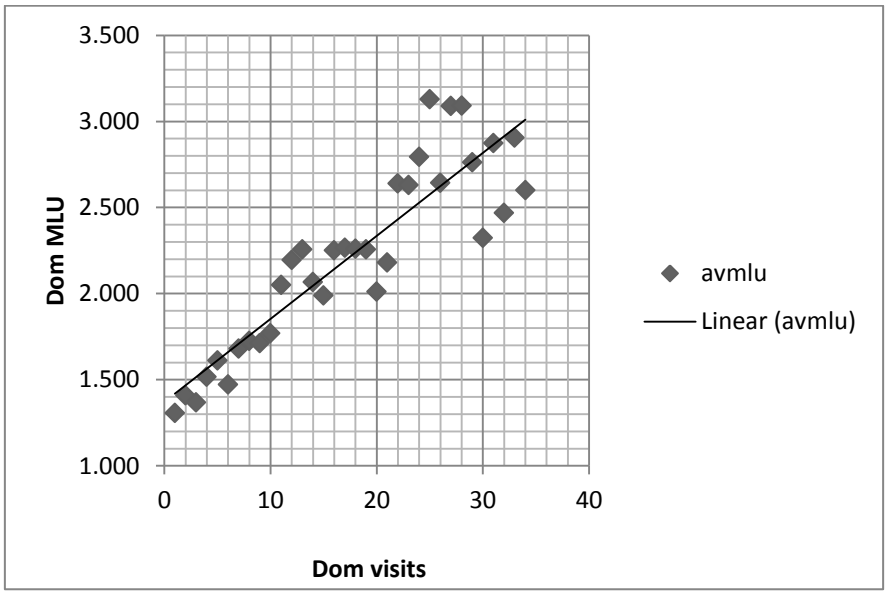
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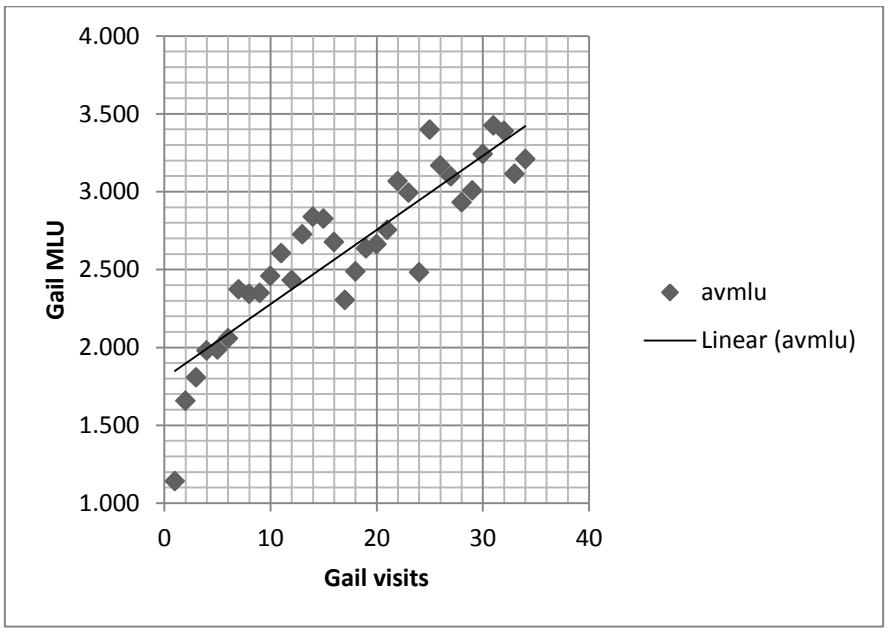
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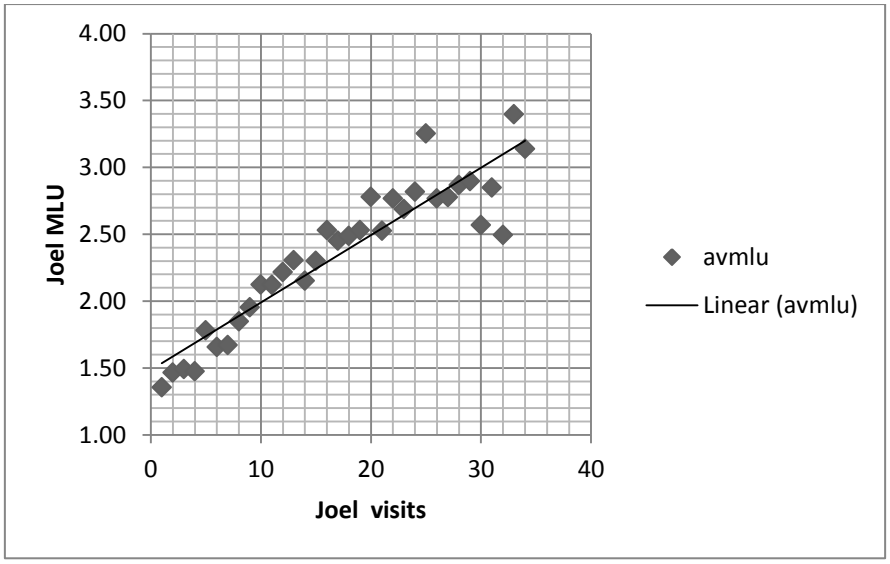
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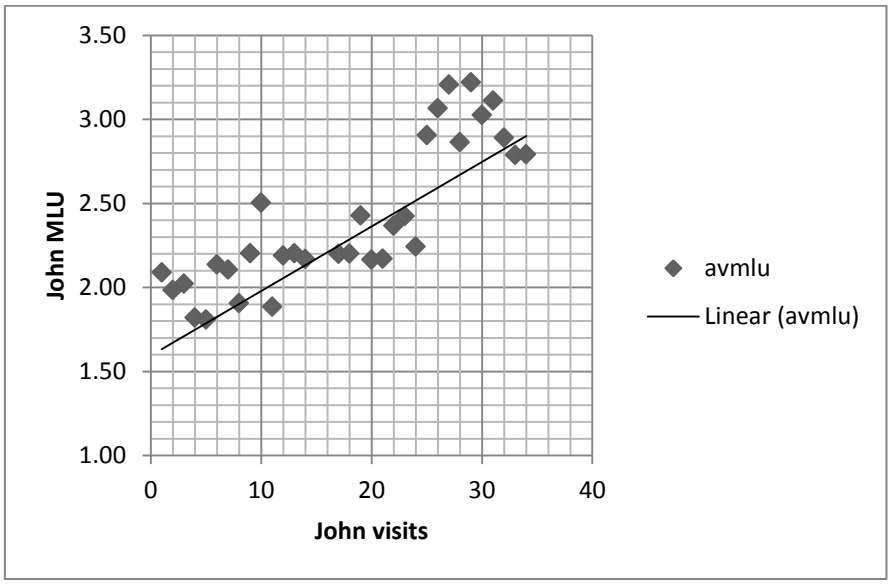
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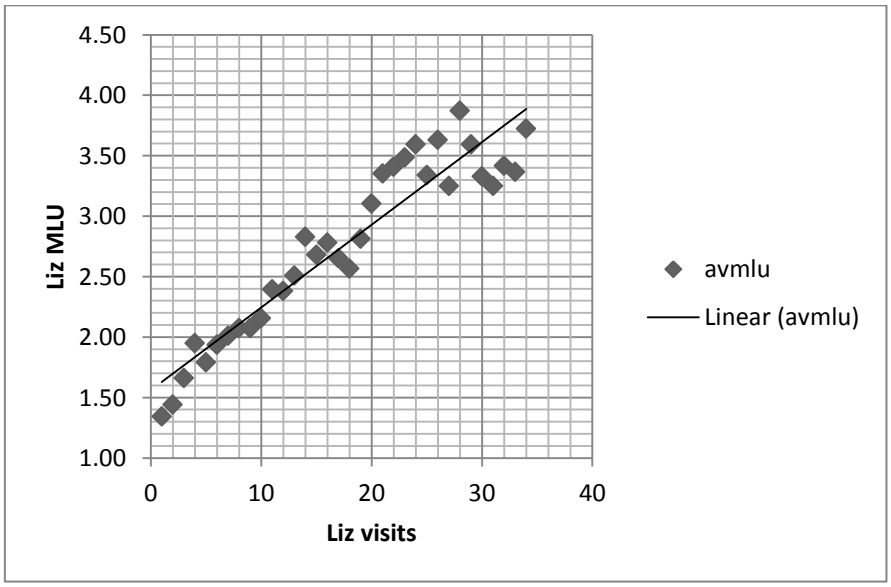
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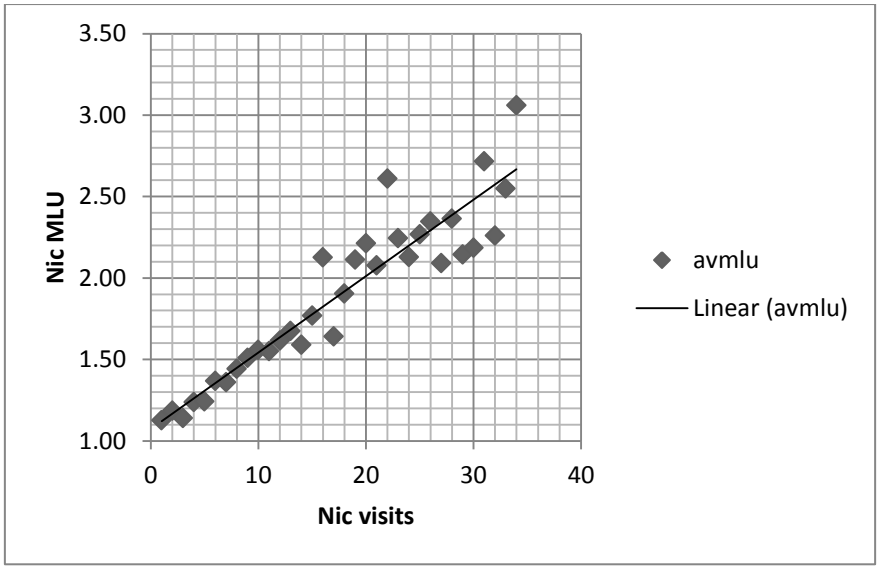
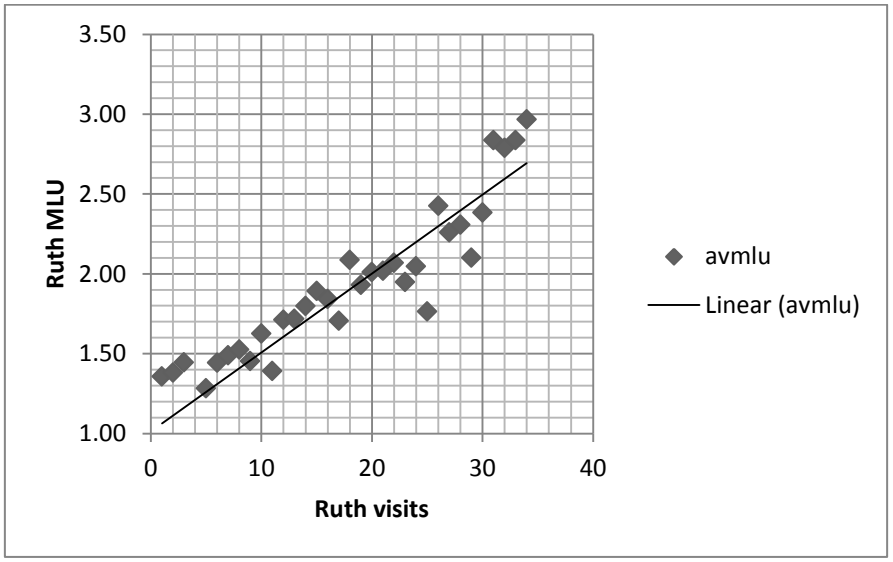
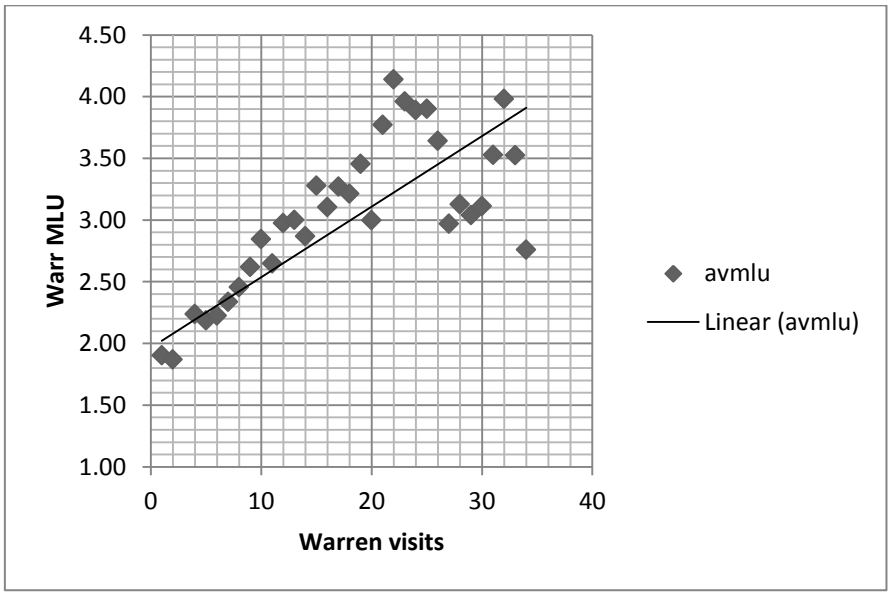
avmlu
Linear (avmlu)


3.50
3.00
2.50
2.00
1.50
1.00
Nic MLU
0
10
20
30
40
Nic visits
avmlu
Linear (avmlu)


3.50
3.00
2.50
2.00
1.50
1.00
Ruth MLU
0
10
20
30
40
Ruth visits
avmlu
Linear (avmlu)


4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
Warr MLU
0
10
20
30
40
Warren visits
avmlu
Linear (avmlu)

Appendix 2: Guidance for analysts

Written guidance produced to provide support and 'training' for the independent analyst performing the verification task, for the empirical study reported in Chapter 6.

Guidance for independent analysts

The task is to analyse each of the given 6 scripts into utterance types. There are three different types that are to be identified which are termed 'here and now'; 'intentional' or 'resultative' in the main research. This task is an important contribution to the research, and your participation is much appreciated. This document gives information about how to identify the types and provides a practice session in preparation for the main task.

Some general points:

i) Identification will depend quite a lot on your own judgement of what the infant is intending to communicate. It is recognised that this presents certain difficulties especially when there is only a transcribed text to work with.

ii) Clearly, 2 year olds are not adults. Their topics of conversation and the ways they express themselves are sometimes obscure. As such, it is advisable to read through at least part of a transcript before analysing it to 'tune into' what is going on.

iii) Infants' general knowledge and ability with language is comparatively limited at this age and *how* infants say *what* they want to express can be quite approximate so the task is to try to focus on meaning rather than form.

iv) Because context plays an essential role in the infant/adult interactions, your judgements will involve not only considering what an infant says but how the adult prompts or responds to the infant.

v) The scope of this analysis is limited to two or more word utterances, so single word utterances (however interesting they may be) should be ignored.

vi) Getting into this analysis may be slow at the beginning, but it really does get easier with practice!

What you will be looking for:

Following this general overview, the utterance types will be considered in more detail with a practice extract. There are three utterance types that interest us.

i) The first we will term the '**here and now**', for the sake of this exercise. Through this type of utterance the child is describing what she can see or perceive actually happening in front of her, including her own actions. E.g. 'doll sitting'; 'broken toy'; 'that, Thomas'.

You will not be asked to physically mark these utterances as they are the majority and we will consider them the default. (Naturally you will need to identify them in order to contrast them with the other utterances which we do want to be marked up!).

ii) The second utterance type is termed (for various reasons) **intentional** (abbreviated to **INT**). In general terms a child will be expressing a desire to have something, or a desire for a change of state of an object or event. The key sign post is not the desiring per se (as she will have the desire in the here and now) but that the goal referenced in the utterance is different from the actual state of affairs in the **here and now**. e.g. 'get it train' (train not present); 'want juice' (juice not present); 'no play this' (desire for a changed event); 'mend it' (desire for a change of object state from broken to fixed). There is a (near) future sense about these utterances.

iii) The third utterance type is termed **resultative** (abbreviated to **RES**). In general terms, the focus of the utterance is on the means by which an object or event in the here and now has come about. There is a recent past sense about these utterances. E.g. 'found the spoons' (spoons present now and how this came about is suggested). 'Nana bought this car'; 'I hurt my hand'.

What you are asked to do

i) Consider each two or more word infant utterance (infant utterances appear with the designation CHI:) for each of the six script sets you have been given, and decide which of the three utterances she is probably using.

ii) If the utterance is considered to be an INT utterance then use the green marker tool to highlight the utterance (just mark the CHI: designation in the transcript).

iii) If the utterance is considered to be a RES utterance then use the red marker tool to highlight the utterance (again just the CHI: part).

iv) If you find it impossible to make a decision one way or the other despite careful investigation (it happens), then as a last resort just mark the utterance with blue.

v) That's all there is to it!!

vi) When you have finished, please send your marked scripts to <n.parr@ucl.ac.uk> and arrangements will be made for you to receive payment for this task. Many thanks for your time and effort.

More detailed guidance and sample

The following are some strong pointers towards INT utterances:

CHI use of 'where' or 'where's' generally signals INT.

CHI use of 'want'; 'wanna'; 'want to'. In general infants appear to use these words to signal intention (as do adults). Comparably the words 'need'; 'need to'; 'go'; 'gonna'; 'going to'; 'can'; 'will' and negative forms of these with 'no' or 'not' frequently appear in INT utterances. Note that this is not always the case. Compare the following:

1) CHI: wanna have train (**INT**)

MOT: OK. I think it's in the box over there.

2) CHI: wanna have train (playing with it in the **here and now**)

MOT: Yes that is always your favourite.

In these examples the context shows that the infant is expressing different meanings. In (1) she is expressing that she wants the train, in (2) she is merely expressing something (in a non-adult way) about playing with her favourite train at present. Note that it is the context and the mother's utterance which disambiguates this for the sake of the analysis.

Other decision points concern whether the required action has happened or not:

3) CHI: oh, broken…

CHI: Mend it train (**INT**)

MOT: Daddy'll mend it when he gets home

4) CHI: oh, broken…

CHI: Mend it train (**RES**)

MOT: So you have. You are clever!

Once again the adult response disambiguates the utterance. In (3) the train is to be mended. In (4) the mending has taken place and the fixed train is the result.

Although 'get it' frequently signals INT, 'got' is more difficult (as too in adult speech). Consider the following:

5) CHI: got this train (in possession in the **here and now**)

MOT: well, you have several there to play with.

6) CHI: got this train (retrieved it from the box- **RES**)

MOT: oh yes, did you find it in the box?

The following suggest RES utterances:

The infants sometimes use a (strong) past tense form of a verb in RES utterances:

7) CHI: Nana bought the car

8) CHI: I hurt my hand

But as these infants do not have a full knowledge of tense forms, they are just as likely not to use a past tense form. Consider the single utterance (Weezer is the family pet):

9) CHI: Weezer eat the food

This could equally be expressed in adult terms as:

10) Weezer ate the food [**RES**]

11) Weezer (is) eat(ing) the food [**here and now**]

12) (I want) Weezer (to) eat the food [**INT**]

13) Weezer (is going to) eat the food [**INT**]

It is only the context which will disambiguate these examples.

A further issue to consider is when adults prompt the infant to remember a past event from the day or week before. There are only a few examples of this. A straight memory of the past with no resultant event or object in the present should not be marked as RES (simply left unmarked). For instance:

14) MOT: tell Anna what we did yesterday, when we went out…do you remember..we went to the clinic and you played didn't you? Do you remember what you did?

CHI: Play ball.

MOT: You played in the ball pond didn't you.

Below is a sample script for you review. [Note that there is a certain amount of transcriber coding in the scripts which cannot easily be deleted. Ignore @c; < >

and [/]. [*0..] means the transcriber has inserted what she thinks the child might mean (this can be helpful).

Sample script:

139	*CHI:	it's like it .
140	*MOT:	he likes it but what is it ?
141	*MOT:	what's that ?
142	*CHI:	oh no .
143	*MOT:	it's a sausage .
144	*CHI:	a sausage .
145	*CHI:	want eat it the sausage .
146	*CHI:	&mm .
147	*MOT:	yum yum yum .
148	*CHI:	bite it the lid off .
149	*CHI:	bye .
150	*CHI:	bye .
151	*CHI:	bye the sausage .
152	*CHI:	I find ice+cream .
153	*MOT:	&mm .
154	*MOT:	&mm .
155	*CHI:	&mm .
156	*CHI:	it's ice+cream .
157	*CHI:	xxx .
158	*CHI:	a egg .
159	*CHI:	there [* 0is] a egg in there .
160	*CHI:	there's a egg .
161	*MOT:	that's how you do boiled eggs , isn't it ?
162	*MOT:	&mm .
163	*CHI:	blup@c .
164	*CHI:	blup@c .
165	*MOT:	oh: .
166	*MOT:	you have to knock the top off and get your soldiers .
167	*MOT:	dunk it in the egg .
168	*CHI:	blup@c .
169	*CHI:	blup@c .
170	*MOT:	this is a silly game .
171	*CHI:	blup@c .
172	*CHI:	blup@c .
173	*CHI:	egg say blup@c .
174	*MOT:	you're talking nonsense .
175	*CHI:	oh I wanna blup@c .
176	*MOT:	you want to blup@c ?
177	*MOT:	okay then .
178	*MOT:	you blup@c .
179	*CHI:	blup@c .
180	*CHI:	oh <it's it's> [/] it's go blup@c .
181	*CHI:	go blup@c .
182	*CHI:	I want try again .
183	*CHI:	try again .
184	*CHI:	blup@c .
185	*CHI:	blup@c .
186	*MOT:	this cat's getting hungry .
187	*MOT:	he wants something to eat .
188	*CHI:	blup@c .
189	*CHI:	not [//] it's not cat want .
190	*CHI:	blup@c .
191	*CHI:	<I try I try> [/] I try again .
192	*CHI:	blup@c .
193	*CHI:	xxx .
194	*CHI:	blup@c .
195	*MOT:	what're you doing ?
196	*CHI:	I playing this little egg .
197	*CHI:	blup@c .
198	*CHI:	it bluped@c .
199	*CHI:	I got it .
200	*MOT:	yum yum yum .
201	*CHI:	blup@c .
202	*CHI:	oh he all cry .
203	*MOT:	oh is he crying ?
204	*MOT:	did you hit him ?
205	*MOT:	poor cat .
206	*CHI:	I want thank+you .
207	*CHI:	I want some .
208	*CHI:	it's in there .
209	*MOT:	has he eaten that all up ?
210	*MOT:	he's a good cat , isn't he eating his dinner ?
211	*CHI:	he's finished .
212	*CHI:	he's finished now .
213	*CHI:	he wants some .
214	*CHI:	he wants some nanas .
215	*CHI:	you better peel .
216	*CHI:	&mm .
217	*CHI:	and this want a bit of chew .
218	*CHI:	bit of chew .
219	*CHI:	want bit of chew .
220	*CHI:	he want [* 0es] bit of chew .
221	*MOT:	peeling them ?
222	*CHI:	yes .
223	*CHI:	you peel it .
224	*CHI:	sausage and chips .
225	*CHI:	sausage and chips .
226	*MOT:	&mm .
227	*CHI:	oh it's too hot .
228	*MOT:	oh dear .
229	*MOT:	blow on it .
230	*CHI:	it's too hot .
231	*CHI:	chips are hot .
232	*MOT:	oh: .
233	*MOT:	Carl likes chips .
234	*CHI:	too hot .
235	*MOT:	too hot .
236	*MOT:	oh dear .
237	*CHI:	it's too hot and no xxx here .
238	*CHI:	I [* 0am] not hungry .
239	*CHI:	I [* 0have] not got salamis .
240	*CHI:	got salamis in there .
241	*CHI:	got two .
242	*CHI:	got xxx .
243	*MOT:	you've got two what ?
244	*MOT:	what [/] what's in there ?
245	*CHI:	no .

Summary of the marking showing INT, RES and the 'unmarked' utterances.

Lines with INT	Lines with RES	Here and now
145	152	139
148	198	142
175	199	144
182	211	151
183	212	156
189		158
191		159
206		160
207		173
213		180
214		181
215		196
217		202
218		208
219		224
220		225
223		227
		230
		231
		234
		237-242

Lastly if there are any questions or problems that unduly worry you, don't hesitate to get in touch: n.parr@ucl.ac.uk

Thanks for your time and energy.

Best wishes

Neil Parr.

Appendix 3 Infant data

Appendix 3 contains the raw data used for each of the 10 infants, for the empirical study in Chapter 6.

The data is coded using combinations of the following elements:

[ME] = ME utterance type

[INT] = INT utterance type

[RES] = RES utterance type

[UttTOTAL] = total utterances

[prop-] = indicates data proportioned to total utterances

[-tot] = indicates totals of types

[O-] = indicates theme role DP

[S-] = indicates non-theme role DP

[I-] = indicates first person singular

[Bn] = indicates bare nominal

[CE] = indicates Complex Event (INT+RES)

Name		Band1	Band1	Band2	Band2	Band3	Band3
Anne	Script	2	6	8	10	14	17
	MLU	1.791	1.863	2.082	2.180	2.861	2.750
	MEtot	178	227	208	177	209	328
	INTtot	98	135	141	108	164	144
	REStot	16	15	27	10	21	20
	UttTOTAL	292	377	376	295	394	492
	propPR	0.610	0.602	0.553	0.600	0.530	0.667
	propINT	0.336	0.358	0.375	0.366	0.416	0.293
	propRES	0.055	0.040	0.072	0.034	0.053	0.041
	Otot	90	40	82	43	79	73
	Stot	33	102	57	73	126	100
	Itot	20	1	4	13	29	16
	Bntot	79	46	53	43	26	28
	INTOtot	66	30	62	32	65	61
	RESOtot	12	9	19	4	12	12
	MEOtot	12	1	1	7	2	0
	INTStot	9	17	18	14	34	20
	RESStot	0	5	12	4	5	9
	MEStot	4	79	23	42	58	55
	INTItot	10	1	3	11	23	12
	RESItot	7	0	1	1	2	1
	MEItot	3	0	0	1	4	3
	INTOprop	0.673	0.222	0.440	0.296	0.396	0.424
	RESOprop	0.750	0.600	0.704	0.400	0.571	0.600
	MEOprop	0.067	0.004	0.005	0.040	0.010	0.000
	INTSprop	0.092	0.126	0.128	0.130	0.207	0.139
	RESSprop	0.000	0.333	0.444	0.400	0.238	0.450
	MESprop	0.022	0.348	0.111	0.237	0.278	0.168
	INTIprop	0.102	0.007	0.021	0.102	0.140	0.083
	RESIprop	0.438	0.000	0.037	0.100	0.095	0.050
	MEIprop	0.017	0.000	0.000	0.006	0.019	0.009
	propO	0.308	0.106	0.218	0.146	0.201	0.148
	propS	0.113	0.271	0.152	0.247	0.320	0.203
	propI	0.068	0.003	0.011	0.044	0.074	0.033
	Bnprop	0.271	0.122	0.141	0.146	0.066	0.057
	CEprop	0.390	0.398	0.447	0.400	0.470	0.333

Name		Band1	Band1	Band2	Band2	Band3	Band3
Aran	Script	2	4	8	11	13	17
	MLU	1.476	2.066	2.133	2.331	2.697	2.742
	MEtot	124	256	255	211	207	204
	INTtot	33	168	104	141	166	204
	REStot	5	40	49	32	37	26
	UttTOTAL	162	464	408	384	410	434
	propPR	0.765	0.552	0.625	0.549	0.505	0.470
	propINT	0.204	0.362	0.255	0.367	0.405	0.470
	propRES	0.031	0.086	0.120	0.083	0.090	0.060
	Otot	12	88	77	118	143	77
	Stot	30	90	117	131	122	150
	Itot	12	28	89	51	88	82
	Bntot	87	90	43	34	19	13
	INTOtot	10	50	33	81	92	63
	RESOtot	0	19	12	15	15	14
	MEOtot	2	19	32	22	36	0
	INTStot	0	25	6	11	0	14
	RESStot	0	7	9	11	4	12
	MEStot	18	30	13	58	30	42
	INTItot	9	10	37	37	48	63
	RESItot	2	11	27	8	18	8
	MEItot	1	7	25	6	22	11
	INTOprop	0.303	0.298	0.317	0.574	0.554	0.309
	RESOprop	0.000	0.475	0.245	0.469	0.405	0.538
	MEOprop	0.016	0.074	0.125	0.104	0.174	0.000
	INTSprop	0.000	0.149	0.058	0.078	0.000	0.069
	RESSprop	0.000	0.175	0.184	0.344	0.108	0.462
	MESprop	0.145	0.117	0.051	0.275	0.145	0.206
	INTIprop	0.273	0.060	0.356	0.262	0.289	0.309
	RESIprop	0.400	0.275	0.551	0.250	0.486	0.308
	MEIprop	0.008	0.027	0.098	0.028	0.106	0.054
	propO	0.074	0.190	0.189	0.307	0.349	0.177
	propS	0.185	0.194	0.287	0.341	0.298	0.346
	propI	0.074	0.060	0.218	0.133	0.215	0.189
	Bnprop	0.537	0.194	0.105	0.089	0.046	0.030
	CEprop	0.235	0.448	0.375	0.451	0.495	0.530

Name		Band1	Band1	Band2	Band2	Band3	Band3
Becky	Script	6	9	12	14	18	21
	MLU	1.502	1.888	2.433	2.485	3.046	2.976
	MEtot	164	193	277	348	351	321
	INTtot	61	84	171	126	201	133
	REStot	25	36	34	43	35	27
	UttTOTAL	250	313	482	517	587	481
	propPR	0.656	0.617	0.575	0.673	0.598	0.667
	propINT	0.244	0.268	0.355	0.244	0.342	0.277
	propRES	0.100	0.115	0.071	0.083	0.060	0.056
	Otot	24	71	108	85	103	43
	Stot	31	91	196	225	306	204
	Itot	10	50	90	78	137	64
	Bntot	85	35	36	49	16	5
	INTOtot	20	45	88	57	61	24
	RESOtot	1	21	10	19	19	15
	MEOtot	3	5	10	9	23	4
	INTStot	7	11	25	34	44	28
	RESStot	2	3	15	12	21	25
	MEStot	12	27	66	101	104	87
	INTItot	4	12	60	27	78	33
	RESItot	0	19	4	22	7	5
	MEItot	6	19	26	29	52	26
	INTOprop	0.328	0.536	0.515	0.452	0.303	0.180
	RESOprop	0.040	0.583	0.294	0.442	0.543	0.556
	MEOprop	0.018	0.026	0.036	0.026	0.066	0.012
	INTSprop	0.115	0.131	0.146	0.270	0.219	0.211
	RESSprop	0.080	0.083	0.441	0.279	0.600	0.926
	MESprop	0.073	0.140	0.238	0.290	0.296	0.271
	INTIprop	0.066	0.143	0.351	0.214	0.388	0.248
	RESIprop	0.000	0.528	0.118	0.512	0.200	0.185
	MEIprop	0.037	0.098	0.094	0.083	0.148	0.081
	propO	0.096	0.227	0.224	0.164	0.175	0.089
	propS	0.124	0.291	0.407	0.435	0.521	0.424
	propI	0.040	0.160	0.187	0.151	0.233	0.133
	Bnprop	0.340	0.112	0.075	0.095	0.027	0.010
	CEprop	0.344	0.383	0.425	0.327	0.402	0.333

Name		Band1	Band1	Band2	Band2	Band3	Band3
Carl	Script	1	6	11	13	16	18
	MLU	1.865	1.988	2.380	2.491	2.627	3.089
	MEtot	328	259	465	410	390	366
	INTtot	70	54	87	166	184	271
	REStot	20	7	26	19	30	55
	UttTOTAL	418	320	578	595	604	692
	propPR	0.785	0.809	0.804	0.689	0.646	0.529
	propINT	0.167	0.169	0.151	0.279	0.305	0.392
	propRES	0.048	0.022	0.045	0.032	0.050	0.079
	Otot	37	23	79	121	127	185
	Stot	90	30	78	84	146	235
	Itot	15	0	7	56	76	164
	Bntot	55	59	39	56	28	30
	INTOtot	25	14	49	100	91	140
	RESOtot	1	0	10	20	18	37
	MEOtot	11	9	20	1	18	8
	INTStot	7	10	8	6	25	41
	RESStot	3	2	9	2	5	15
	MEStot	65	18	54	20	40	15
	INTItot	12	0	1	38	53	116
	RESItot	1	0	2	5	16	24
	MEItot	2	0	4	13	7	24
	INTOprop	0.357	0.259	0.563	0.602	0.495	0.517
	RESOprop	0.050	0.000	0.385	1.053	0.600	0.673
	MEOprop	0.034	0.035	0.043	0.002	0.046	0.022
	INTSprop	0.100	0.185	0.092	0.036	0.136	0.151
	RESSprop	0.150	0.286	0.346	0.105	0.167	0.273
	MESprop	0.198	0.069	0.116	0.049	0.103	0.041
	INTIprop	0.171	0.000	0.011	0.229	0.288	0.428
	RESIprop	0.050	0.000	0.077	0.263	0.533	0.436
	MEIprop	0.006	0.000	0.009	0.032	0.018	0.066
	propO	0.089	0.072	0.137	0.203	0.210	0.267
	propS	0.215	0.094	0.135	0.141	0.242	0.340
	propI	0.036	0.000	0.012	0.094	0.126	0.237
	Bnprop	0.132	0.184	0.067	0.094	0.046	0.043
	CEprop	0.215	0.191	0.196	0.311	0.354	0.471

Name		Band1	Band1	Band2	Band2	Band3	Band3
Dom	Script	7	10	13	16	23	26
	MLU	1.680	1.769	2.257	2.252	2.630	2.643
	MEtot	203	201	280	295	311	348
	INTtot	70	74	125	106	93	132
	REStot	9	21	21	40	36	38
	UttTOTAL	282	296	426	441	440	518
	propPR	0.720	0.679	0.657	0.669	0.707	0.672
	propINT	0.248	0.250	0.293	0.240	0.211	0.255
	propRES	0.032	0.071	0.049	0.091	0.082	0.073
	Otot	73	30	77	59	80	94
	Stot	23	35	96	128	164	227
	Itot	7	18	66	74	38	108
	Bntot	63	87	75	74	53	40
	INTOtot	50	23	57	38	26	58
	RESOtot	2	2	6	17	22	20
	MEOtot	21	5	14	4	32	16
	INTStot	15	5	9	21	19	29
	RESStot	1	5	8	7	13	15
	MEStot	0	7	13	26	94	75
	INTItot	7	16	52	38	3	46
	RESItot	0	2	7	17	16	10
	MEItot	0	0	7	19	19	52
	INTOprop	0.714	0.311	0.456	0.358	0.280	0.439
	RESOprop	0.222	0.095	0.286	0.425	0.611	0.526
	MEOprop	0.103	0.025	0.050	0.014	0.103	0.046
	INTSprop	0.214	0.068	0.072	0.198	0.204	0.220
	RESSprop	0.111	0.238	0.381	0.175	0.361	0.395
	MESprop	0.000	0.035	0.046	0.088	0.302	0.216
	INTIprop	0.100	0.216	0.416	0.358	0.032	0.348
	RESIprop	0.000	0.095	0.333	0.425	0.444	0.263
	MEIprop	0.000	0.000	0.025	0.064	0.061	0.149
	propO	0.259	0.101	0.181	0.134	0.182	0.181
	propS	0.082	0.118	0.225	0.290	0.373	0.438
	propI	0.025	0.061	0.155	0.168	0.086	0.208
	Bnprop	0.223	0.294	0.176	0.168	0.120	0.077
	CEprop	0.280	0.321	0.343	0.331	0.293	0.328

Name		Band1	Band1	Band2	Band2	Band3	Band3
Gail	Script	1	4	9	12	16	20
	MLU	1.142	1.981	2.350	2.433	2.676	2.662
	MEtot	187	229	216	266	195	232
	INTtot	74	85	103	175	117	157
	REStot	6	17	16	18	23	25
	UttTOTAL	267	331	335	459	335	414
	propPR	0.700	0.692	0.645	0.580	0.582	0.560
	propINT	0.277	0.257	0.307	0.381	0.349	0.379
	propRES	0.022	0.051	0.048	0.039	0.069	0.060
	Otot	37	66	92	74	68	115
	Stot	84	66	94	69	73	106
	Itot	3	3	30	22	49	57
	Bntot	48	46	38	24	18	7
	INTOtot	35	48	74	65	51	89
	RESOtot	1	10	11	6	16	22
	MEOtot	1	8	7	3	1	4
	INTStot	22	34	20	28	12	15
	RESStot	2	6	7	6	10	8
	MEStot	57	23	37	13	2	26
	INTItot	0	2	17	13	39	36
	RESItot	0	1	4	5	5	10
	MEItot	3	0	9	4	5	11
	INTOprop	0.473	0.565	0.718	0.371	0.436	0.567
	RESOprop	0.167	0.588	0.688	0.333	0.696	0.880
	MEOprop	0.005	0.035	0.032	0.011	0.005	0.017
	INTSprop	0.297	0.400	0.194	0.160	0.103	0.096
	RESSprop	0.333	0.353	0.438	0.333	0.435	0.320
	MESprop	0.305	0.100	0.171	0.049	0.010	0.112
	INTIprop	0.000	0.024	0.165	0.074	0.333	0.229
	RESIprop	0.000	0.059	0.250	0.278	0.217	0.400
	MEIprop	0.016	0.000	0.042	0.015	0.026	0.047
	propO	0.139	0.199	0.275	0.161	0.203	0.278
	propS	0.315	0.199	0.281	0.150	0.218	0.256
	propI	0.011	0.009	0.090	0.048	0.146	0.138
	Bnprop	0.180	0.139	0.113	0.052	0.054	0.017
	CEprop	0.300	0.308	0.355	0.420	0.418	0.440

Name		Band1	Band1	Band2	Band2	Band3	Band3
Joel	Script	5	8	11	14	16	20
	MLU	1.780	1.848	2.121	2.151	2.530	2.802
	MEtot	119	105	202	134	171	193
	INTtot	60	27	46	57	77	166
	REStot	16	5	6	2	17	22
	UttTOTAL	195	137	254	193	265	381
	propPR	0.610	0.766	0.795	0.694	0.645	0.507
	propINT	0.308	0.197	0.181	0.295	0.291	0.436
	propRES	0.082	0.036	0.024	0.010	0.064	0.058
	Otot	61	41	48	51	85	179
	Stot	89	52	72	86	134	165
	Itot	18	6	31	34	50	49
	Bntot	19	17	25	30	26	34
	INTOtot	36	22	17	26	41	108
	RESOtot	6	1	2	0	9	12
	MEOtot	19	18	29	25	35	59
	INTStot	15	15	3	6	9	43
	RESStot	4	2	2	0	2	4
	MEStot	52	29	36	46	73	69
	INTItot	12	1	8	9	23	28
	RESItot	3	3	1	0	11	6
	MEItot	3	2	22	25	16	15
	INTOprop	0.600	0.815	0.370	0.456	0.532	0.651
	RESOprop	0.375	0.200	0.333	0.000	0.529	0.545
	MEOprop	0.160	0.171	0.144	0.187	0.205	0.306
	INTSprop	0.250	0.556	0.065	0.105	0.117	0.259
	RESSprop	0.250	0.400	0.333	0.000	0.118	0.182
	MESprop	0.437	0.276	0.178	0.343	0.427	0.358
	INTIprop	0.200	0.037	0.174	0.158	0.299	0.169
	RESIprop	0.188	0.600	0.167	0.000	0.647	0.273
	MEIprop	0.025	0.019	0.109	0.187	0.094	0.078
	propO	0.313	0.299	0.189	0.264	0.321	0.470
	propS	0.456	0.380	0.283	0.446	0.506	0.433
	propI	0.092	0.044	0.122	0.176	0.189	0.129
	BNprop	0.097	0.124	0.098	0.155	0.098	0.089
	CEprop	0.390	0.234	0.205	0.306	0.355	0.493

Name		Band1	Band1	Band2	Band2	Band3	Band3
Liz	Script	2	5	8	10	13	16
	MLU	1.662	1.793	2.075	2.156	2.510	2.783
	MEtot	110	203	178	258	171	175
	INTtot	35	80	116	100	92	175
	REStot	1	12	2	14	8	20
	UttTOTAL	146	295	296	372	271	370
	propPR	0.753	0.688	0.601	0.694	0.631	0.473
	propINT	0.240	0.271	0.392	0.269	0.339	0.473
	propRES	0.007	0.041	0.007	0.038	0.030	0.054
	Otot	20	57	108	76	92	216
	Stot	41	47	118	116	159	169
	Itot	1	4	41	54	64	111
	Bntot	63	101	67	84	32	11
	INTOtot	7	20	82	33	42	115
	RESOtot	0	2	1	2	4	17
	MEOtot	13	35	25	41	46	84
	INTStot	5	8	19	6	4	29
	RESStot	0	2	0	1	2	1
	MEStot	35	33	58	55	89	28
	INTItot	1	1	31	23	42	78
	RESItot	0	1	0	8	6	14
	MEItot	0	2	10	23	16	19
	INTOprop	0.200	0.250	0.707	0.330	0.457	0.657
	RESOprop	0.000	0.167	0.500	0.143	0.500	0.850
	MEOprop	0.118	0.172	0.140	0.159	0.269	0.480
	INTSprop	0.143	0.100	0.164	0.060	0.043	0.166
	RESSprop	0.000	0.167	0.000	0.071	0.250	0.050
	MESprop	0.318	0.163	0.326	0.213	0.520	0.160
	INTIprop	0.029	0.013	0.267	0.230	0.457	0.446
	RESIprop	0.000	0.083	0.000	0.571	0.750	0.700
	MEIprop	0.000	0.010	0.056	0.089	0.094	0.109
	propO	0.137	0.193	0.365	0.204	0.339	0.584
	propS	0.281	0.159	0.399	0.312	0.587	0.457
	propI	0.007	0.014	0.139	0.145	0.236	0.300
	BNprop	0.432	0.342	0.226	0.226	0.118	0.030
	CEprop	0.247	0.312	0.399	0.306	0.369	0.527

Name		Band1	Band1	Band2	Band2	Band3	Band3
Ruth	Script	16	19	22	26	31	33
	MLU	1.843	1.931	2.069	2.425	2.836	2.837
	MEtot	182	178	170	218	221	275
	INTtot	56	77	79	151	159	176
	REStot	3	17	18	22	16	51
	UttTOTAL	241	272	267	391	396	502
	propPR	0.755	0.654	0.637	0.558	0.558	0.548
	propINT	0.232	0.283	0.296	0.386	0.402	0.351
	propRES	0.012	0.063	0.067	0.056	0.040	0.102
	Otot	27	45	80	144	172	215
	Stot	33	51	66	148	200	269
	Itot	13	31	34	54	86	81
	Bntot	67	88	56	45	27	46
	INTOtot	6	21	38	77	64	89
	RESOtot	0	11	9	13	12	32
	MEOtot	21	13	33	54	96	94
	INTStot	7	7	6	27	28	57
	RESStot	1	3	6	10	11	37
	MEStot	12	10	20	57	75	94
	INTItot	9	13	22	32	55	40
	RESItot	0	2	4	7	2	15
	MEItot	4	16	8	15	29	26
	INTOprop	0.107	0.273	0.481	0.510	0.403	0.506
	RESOprop	0.000	0.647	0.500	0.591	0.750	0.627
	MEOprop	0.115	0.073	0.194	0.248	0.434	0.342
	INTSprop	0.125	0.091	0.076	0.179	0.176	0.324
	RESSprop	0.333	0.176	0.333	0.455	0.688	0.725
	MESprop	0.066	0.056	0.118	0.261	0.339	0.342
	INTIprop	0.161	0.169	0.278	0.212	0.346	0.227
	RESIprop	0.000	0.118	0.222	0.318	0.125	0.294
	MEIprop	0.022	0.090	0.047	0.069	0.131	0.095
	propO	0.112	0.165	0.300	0.368	0.434	0.428
	propS	0.137	0.188	0.247	0.379	0.505	0.536
	propI	0.054	0.114	0.127	0.138	0.217	0.161
	BNprop	0.278	0.324	0.210	0.115	0.068	0.092
	CEprop	0.245	0.346	0.363	0.442	0.442	0.452

Name		Band1	Band1	Band2	Band2	Band3	Band3
Warren	Script	1	2	6	8	11	18
	MLU	1.903	1.870	2.225	2.456	2.648	2.868
	MEtot	237	162	165	228	171	182
	INTtot	93	89	101	122	122	213
	REStot	16	30	18	17	17	9
	UttTOTAL	346	281	284	367	310	404
	propPR	0.685	0.577	0.581	0.621	0.552	0.450
	propINT	0.269	0.317	0.356	0.332	0.394	0.527
	propRES	0.046	0.107	0.063	0.046	0.055	0.022
	Otot	65	83	86	130	116	182
	Stot	122	122	138	101	135	139
	Itot	20	13	27	15	15	37
	Bntot	92	53	57	61	36	19
	INTOtot	36	43	49	76	76	145
	RESOtot	3	7	18	11	5	4
	MEOtot	26	33	19	43	35	33
	INTStot	21	12	41	31	28	33
	RESStot	8	22	11	5	15	6
	MEStot	73	75	59	50	77	63
	INTItot	19	7	15	12	12	30
	RESItot	1	2	3	3	1	0
	MEItot	0	4	9	0	2	7
	INTOprop	0.387	0.483	0.485	0.623	0.623	0.681
	RESOprop	0.188	0.233	1.000	0.647	0.294	0.444
	MEOprop	0.110	0.204	0.115	0.189	0.205	0.181
	INTSprop	0.226	0.135	0.406	0.254	0.230	0.155
	RESSprop	0.500	0.733	0.611	0.294	0.882	0.667
	MESprop	0.308	0.463	0.358	0.219	0.450	0.346
	INTIprop	0.204	0.079	0.149	0.098	0.098	0.141
	RESIprop	0.063	0.067	0.167	0.176	0.059	0.000
	MEIprop	0.000	0.025	0.055	0.000	0.012	0.038
	propO	0.188	0.295	0.303	0.354	0.374	0.450
	propS	0.353	0.434	0.486	0.275	0.435	0.344
	propI	0.058	0.046	0.095	0.041	0.048	0.092
	BNprop	0.266	0.189	0.201	0.166	0.116	0.047
	CEprop	0.315	0.423	0.419	0.379	0.448	0.550