The acquisition of the active transitive construction in English:
A detailed case study*

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Abstract

In this study, we test a number of predictions concerning children's knowledge of the transitive Subject-Verb-Object (SVO) construction between two and three years on one child (Thomas) for whom we have densely collected data. The data show that the earliest SVO utterances reflect earlier use of those same verbs, and that verbs acquired before 2;7 show an earlier move towards adult-like levels of use in the SVO construction and in object argument complexity than later acquired verbs. There is not a close relation with the input in the types of subject and object referents used, nor a close adherence to Preferred Argument Structure (PAS) before 2;7, but both early and late acquired verbs show a simultaneous move towards PAS patterns in selection of referent type at 2;9. The event semantics underpinning early transitive utterances do not straightforwardly fit prototype (high or inalienable) notions of transitivity, but rather may reflect sensitivity to animacy and intentionality in a way that mirrors the input. We conclude that children's knowledge of the transitive construction continues to undergo significant development between 2;0 and 3;0, reflecting the gradual abstraction and integration of the SVO and VO constructions, verb semantics, discourse pragmatics, and the interactions between these factors. These factors are considered in the context of a prototype for the transitive construction.

1. Introduction

Transitive relations are at the heart of most, if not all, of the world's languages, thus child language researchers face the challenging task of explaining how children acquire the various linguistic devices, such as word order, case marking and subject-verb agreement, and prosody that can express transitive relations. Acquiring the transitive construction[1] means learning not only its syntactic form, but also the range of event types it can be used to encode, with the English transitive subject encompassing a range of semantic roles including agents, instruments, experiencers, and goals, and the object role including patients and themes among others. A number of theorists have argued that transitivity is a matter of degree, and that transitivity relations serve the requirement in discourse to foreground certain information. For example, Hopper and Thompson (1980) attempted to establish parameters for prototypical transitivity and presented a continuum along which 'High' transitivity was demonstrated to correlate, across a wide range of languages, with high potency of an agent, a high level of affectedness of an object, and the extent to which an event can be characterised as an 'action', among other factors. The ability to use the transitive construction in an adult-like way therefore also depends on having knowledge of the broadly applicable pragmatic factors that govern the order of mention of participants in discourse (old information is realised before new, thus new information is more likely to be realised as the object, and given information as the subject, of a transitive SVO clause) and of the appropriate linguistic forms to refer to the various participants (such that new information is typically realised with a lexical noun, whereas given information can be realised pronominally or omitted altogether). DuBois (1987) referred to this pattern, observed in a diverse range of languages, as Preferred Argument Structure (PAS). In addition, it is widely observed cross-linguistically that the subjects of transitive clauses tend to be animate, and often human, whereas objects are much more likely to be inanimate themes and patients (Givón 1983; DuBois 1987; Dowty 1991; Langacker 1991). Thus, an understanding of how different kinds of semantic and pragmatic information map onto the subject and object roles of the transitive construction is necessary to support adult-like use.

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1. Throughout this paper the term *transitive construction* is used to refer to the active transitive construction containing a single verb with its subject and object arguments, although of course 'transitive' can also refer to multi-verb utterances or those with passive argument structure.

1.1.   *What are children's early transitive representations like?*

Slobin (1982, 1985, see also Pinker 1984) suggested that children approach the acquisition task with biases that privilege the acquisition of some syntactic forms over others—an accessibility hierarchy—favouring prototypical events, in particular agent-patient relations in which an animate agent causes some change of state to an inanimate patient (Slobin's 'manipulative activity scene'). Under this approach, knowledge of the semantic-syntactic correspondences for canonically transitive scenes results in their early acquisition. However, children's early transitive utterances do not always encode prototypical agent-patient relations (Bowerman 1990; Lieven et al. 1997; Ninio 1999) casting doubt on this suggestion, and Slobin has since revised his earlier position as "crosslinguistic diversity precludes a pre-established table of correspondences between grammatical forms and semantic meanings" (Slobin 1997: 282).

   Usage-based accounts highlight the low-scope nature of children's early utterances, focusing on initial periods of lexically specific combination (e.g. Tomasello 2003). In this approach, abstract knowledge of structure emerges gradually from concrete representations which are initially specific to particular predicates, in terms of both their semantic and combinatorial characteristics. However, the process of abstraction is not straightforward given that the English transitive construction encompasses such semantically contrasting bedfellows as *Billy pushes the car* [AGENT VERB PATIENT] and *Billy got a book* [GOAL VERB THEME]. From a usage-based perspective, children are assumed to acquire knowledge of the constructions of their language directly from the input to which they are exposed. Thus, they would be expected to acquire a range of semantically varied forms of the transitive construction if these verbs are frequent in the input. However, the process by which they realise that these varied forms are related is not entirely clear, although analogy and structure mapping are thought to be involved. Certainly, children take some time to demonstrate productivity in their transitive usage. English-speaking children are around 3;0 before they are consistently able to use a novel verb learned in an intransitive construction transitively (Tomasello and Brooks 1998; Brooks and Tomasello 1999), and only towards 4;0 can children consistently correct utterances with transitive novel and known low frequency verbs in non-canonical word orders (Akhtar 1999; Matthews et al. 2005). This suggests that children take some time to fully understand how agent and patient roles relate to their respective positions in transitive utterances in production. Although Naigles et al.'s (2009) diary study of eight children shows that the children demonstrate some degree of flexibility in their first transitive verb uses around or before 24 months of age, it is unclear to what extent they were generalising over different verbs as opposed to reproducing patterns of variability in use in their input.

However, in comprehension a rather different story emerges that has led some researchers to conclude that children show very early abstraction. Early studies showed that sentences containing known reversible action verbs with animate agents and patients are comprehended just as accurately by two- and four-year-olds as those with a prototypical animate agent and inanimate patient (de Villiers 1980; Corrigan 1988). Moreover, although two-year-olds comprehend sentences exhibiting the reverse pattern of inanimate agent-animate patient less well, this effect holds only for 'prototypical' verbs: inanimate-animate sentences with verbs low in prototypicality are comprehended just as accurately as those with animate agents (Corrigan 1988). However, as these studies examine known verbs, they do not determine how abstract the children's knowledge is. More recently, novel verb studies using the intermodal preferential looking paradigm have shown that at around two years of age children link transitive sentences with causative rather than non-causative actions (Naigles 1990; Hirsh-Pasek and Golinkoff 1996; Yuan and Fisher 2009). Researchers argue that by attending to the number of noun phrases in a sentence, children can infer the nature of the event (e.g. Landau and Gleitman 1985; Naigles 1990; Fisher 1996, 2002; Lidz et al. 2003). Furthermore, Gertner et al. (2006) demonstrated that 21 month olds could correctly identify the agent and patient of novel reversible causative transitive actions. Although there is some debate over the role of the training phase included in this study in determining the results (see Dittmar et al. 2008a), some level of comprehension appears to precede production by a significant time period.

On the other hand, studies using pointing and act-out methodologies have systematically varied the cues such as animacy, case marking, and word order that co-occur or conflict to indicate the agent and patient of novel reversible transitive actions in English (Ibbotson et al. 2011), English and German (Dittmar et al. 2008b) and English, German and Cantonese (Chan et al. 2009). In these studies, children successfully comprehend reversible transitive sentences at around age 2;6 when all cues work together, but only comprehend in adult-like ways at much later ages when cues are in conflict. These studies suggest that although relatively young children have a grasp of the most common or prototypical forms of the transitive construction in comprehension, they are still piecing together the fully abstract adult-like construction, and this may occur at different rates for different languages (see Ibbotson and Tomasello 2009 for a discussion, and Abbot-Smith et al. 2008 for cross-linguistic differences in production).

To date, studies of children's acquisition of the transitive construction have been limited in a number of ways. Although a large number of experimental comprehension and production studies exist, these largely focus on causative verbs, yet the transitive construction encompasses a wide range of varied semantic event types. On the other hand, analyses of naturalistic corpus data

showing that children produce a range of transitive event types from early on (Bowerman 1990; Tomasello 1992; Lieven et al. 1997; Ninio 1999) are limited by the relatively sparse samples available for analysis or, in the case of diary data (e.g. Tomasello 1992; Naigles et al. 2009), by a lack of detailed input data for the children involved. Moreover, none of these studies has systematically examined a single data set for the relation between transitive utterances, the child's previous uses and input for the same verbs as well as their transitive event semantics and patterns of PAS.

In the current study, we test a number of hypotheses regarding acquisition of the transitive construction by systematically examining its development in a densely collected corpus from a single child learning English (Lieven et al. 2009). Unlike previous corpus-based studies, a densely collected corpus has the advantage of significantly increasing the likelihood of sampling low frequency items and uncovering otherwise overlooked patterns of acquisition (Tomasello and Stahl 2004).

1.2. *Aims of the study*

There were three main aims:

1.2.1. *Prior use of related lexical items and constructions.* Our first aim was to test the hypothesis that full SVO transitive utterances will be based on previously produced SV or VO combinations by examining the specific lexical items used in subject and object position in the earliest full SVO utterances. We also consider how transitive verbs acquired during the second half of the third year (2;7 to 3;0) are assimilated by assessing whether early acquired knowledge of the combinatorial properties of transitive verbs (from 2;1 to 2;6) is transferred to newly acquired verbs.

Tomasello (1992) claimed that for one child between the ages of 16 and 24 months, the best predictor of her use of a given verb was her previous use of that same verb rather than her current use of other verbs. The suggestion was that children's complex utterances are built up from earlier uses of the same lexical items. Later studies have sought to investigate this suggestion further and to identify a point in development at which the child's verb use becomes increasingly independent of previous use. McClure et al. (2006) found that at MLU Stage 2, early acquired verbs were used in longer utterances with a greater number of arguments than newly acquired verbs. However, they also report that the first uses of later acquired verbs were longer and more complex than the first uses of early acquired verbs, showing evidence for some generalisation which they attribute to the use of low-scope constructions organised around other word types. Lieven and colleagues' traceback methodology compares a child's utterances to utterances produced previously

to determine their degree of similarity. They have demonstrated that although children's early utterances at around 2;0 are relatively creative, much of this creativity can be accounted for in terms of fairly minor changes to previously produced utterances. Over development, children's constructions increase in abstractness (e.g. Lieven et al. 2003, 2009; Dąbrowska and Lieven 2005).

1.2.2.   *Verb semantics.*   Our second aim was to test whether early transitive utterances pattern according to either the 'high transitivity' event semantics posited for adult language by Hopper and Thompson, or the inalienable transitivity semantics posited by Ninio.

Goldberg (1995, 1999) found that many of children's earliest verb utterances tend to express basic scenes such as someone acting on something forming "the building blocks for much of human cognition" (Goldberg 1999: 203). This view bears some resemblance to Hopper and Thompson's (1980) characterisation of high transitivity and suggests that the earliest transitive utterances may be those that encode a highly volitional agent acting on a highly affected patient (see also Slobin 1985). Ninio (1999) presented a contrasting proposal based on her finding that early VO and SVO utterances with transitive verbs typically involved verbs of obtaining, creation, perception, and ingestion, which score relatively poorly for transitivity. She claimed that these verbs express inalienable transitivity, i.e. a very tight relation between a verb and its object, and assigned them a 'pathbreaking' role in the acquisition of transitivity. In another proposal, Budwig (1995) suggested that children's early concept of agentivity revolves around the notion of control (over others and the environment) as well as incorporating actions on physical objects. Thus, children's early transitive utterances might be organised around a broad notion of agentivity rather than any particular semantically delimited set of verbs. The apparent discrepancies between these accounts mean it is unclear exactly how verb semantics might operate in the child's abstraction of the transitive construction (e.g. see Theakston et al. 2004, Naigles et al. 2009). Interestingly, Brown (2008) offers another way of conceptualising the acquisition of the transitive construction. She argues that in languages such as Tzeltal, children's initial transitive verb vocabularies are dominated by 'heavy' verb forms that, due to their specificity in meaning, do not in any obvious sense correspond to the semantics of the transitive construction in general. However, in languages that allow a high degree of argument ellipsis, highly specific verbs with concrete meanings allow children to recover omitted arguments by restricting the range of possible referents. Thus, it is possible that (in some languages at least) children begin by learning verbs that are tightly tied to very specific object forms, and only gradually extract the more abstract relation between transitive verbs and their objects in general.

Few studies exist that examine the role of verb semantics in the abstraction of the transitive construction. Abbot-Smith et al. (2004) exposed children to transitive sentences containing verbs of caused motion and tested their ability to generalise to novel verbs of (sound and light) emission. Although children generalised at levels similar to those observed when both training and test verbs expressed caused motion (Childers and Tomasello 2001), Abbot-Smith and Tomasello (in press) point out that the emission verbs could have been interpreted as causative, thus verb semantics may play a role in abstraction. Taking a slightly different approach, Ninio (2005) examined the role of semantic similarity in generalisation by noting the different types of direct objects produced in Hebrew-speaking children's earliest transitive VO utterances. She reported that there was very little overlap in the semantic roles of the direct objects produced with each child's first six VO verb types, claiming that semantic similarity is not necessary for generalisation. However, the extent to which children differentiated objects according to the criteria used in the study, and the extent to which the semantics of the utterances overlapped in broader terms such as those posited by Hopper and Thompson (e.g. 'affectedness of the object') is unclear. Taken together, these studies illustrate the considerable difficulties in establishing exactly how children interpret transitive verb meanings and the basis for early generalisation.

1.2.3.   *Pragmatic development.*   Our third aim was to test whether the child's early transitive utterances reflect PAS in the choice of referent type for, and animacy of, the subject and object roles. We also ask whether, in production, prototypical animate-subject inanimate-object transitive utterances are produced earlier than less prototypical inanimate-subject animate-object transitive utterances.

In addition to acquiring an abstract syntactic transitive construction allowing children to manipulate the roles of subject and object, children must also learn how these arguments should be realised in different pragmatic contexts. A large body of research suggests that in naturalistic contexts children show relatively good sensitivity to PAS from around age 2;0 (e.g. Allen 2000, Guerriero et al. 2001, Clancy 2003), using lexical nouns to encode new information about typically inanimate entities in the object role, and encoding given information with reference to animate agents in the subject role using pronouns (or omitting reference altogether). Tightly controlled experiments, however, suggest that knowledge undergoes development with 2-year-olds showing relatively less sensitivity to the knowledge states of others than 3- and 4-year olds, in particular in their use of pronouns (e.g. Matthews et al. 2006). It is an empirical question how knowledge of syntactic constructions (that may initially be based around pronouns in subject and/or object position) becomes integrated with knowledge of the pragmatic principles governing reference

realisation (where use of pronouns is only pragmatically appropriate in contexts where the referent is already known to the interlocutors) and knowledge of PAS (subjects are encoded pronominally and objects as full lexical nouns).

2.   Method

2.1.   *Participants*

The data for the study were taken from a dense corpus containing the speech of one child (Thomas) and his mother (Lieven et al. 2009), available from the CHILDES database (MacWhinney 2000). Both participants are monolingual English speakers. The dyad was recorded for an hour five times a week (four audio and one video recording) from age 2;0 until 3;2 and from then on for five hours within one week every month until age 5;0. The recordings were conducted by trained staff from the Max Planck Child Study Centre at the University of Manchester. Thomas's family live in the Manchester area and he is an only child. Thomas's mother is the primary caregiver. At 1;11.14 Thomas's score on the McArthur CDI (Fenson et al. 1994) was at approximately the 25th percentile.

2.2.   *Transcription*

Research assistants transcribed all of the recordings using standard CHAT procedures (MacWhinney 2000). Transcription was subsequently checked twice by trained assistants. Each utterance was linked to the sound file by a second transcriber and any discrepancies resolved. Then each transcript was run through the MOR program and any further errors were corrected.

2.3.   *Child data*

The data used in this study covers the period from 2;1 to 3;0. We first created a master list of all the verbs produced by Thomas from 2;1 to 3;0 that could potentially have been used transitively. We then searched the data from 2;1 to 3;0 using the CLAN programs (MacWhinney 2000) to establish which of these verbs Thomas used in a transitive VO or SVO construction and extracted every multiword utterance in the corpus containing these verbs. We excluded from the analysis all imitations, self-repetitions and utterances containing routines (e.g. nursery rhymes, songs), along with any partially intelligible utterances or those made ambiguous by missing information (e.g. neither a subject nor object was produced), and questions (which, during the early period, are not very productive—see Dąbrowska and Lieven 2005 for an analysis of Thomas's early questions). Complex utterances, produced in increasing numbers from 2;7, were also excluded to allow a more controlled comparison between the

earlier and later data. Complex utterances were defined as utterances including full (rather than contracted) modals, relative, temporal and adverbial clauses and uses of the verbs as verbal complements or as matrix verbs[2]. Coding was carried out by the second author. Approximately 65% of the data from 2;7 to 3;0 was coded independently by the first author to calculate reliabilities on the exclusion criteria for complex utterances. Agreement was high (99.4%, Cohen's kappa = 0.982), and for the data included in the reliability check, 23% of utterances were excluded according to the criteria. Each remaining utterance was then categorised according to the construction in which the transitive verb occurred (namely V, SV, VO and SVO). SV utterances included erroneous transitives (e.g. *I want*), as well as correct uses of alternating verbs (e.g. *I'm eating* [*it*], *I'm rolling the ball*/*the ball's rolling*). VO utterances included potentially imperative forms. Each utterance was also coded according to the word type (pronoun [pN], proper noun [PN], or noun phrase [NP]) in subject and/or object position.

For the purposes of analysis, the data were split into two six-month periods from 2;1 to 2;6 and 2;7 to 3;0. The data were aggregated into months, each accounting for around 20 hours of recordings (max 22, min 18), and referred to by age beginning at 2;1 for the data taken from 2;00.12 to 2;01.11, and from then on in monthly samples until 3;0. From 2;7 to 3;0, all verbs were categorised as Old (those verbs appearing in the 2;1 to 2;6 data) or New (those not recorded at all before 2;7).

2.4. *Input data*

For the analyses concerning Thomas's data from 2;1 to 2;6, a sample of the mother's transitive usage was taken from the recordings at 2;4. The input sample was restricted to only those transitive verbs produced by Thomas in the 2;4 data when he began to produce a much wider range of verb types. Matching the input sample to Thomas's sample at 2;4 controls the input down to the child in terms of verb vocabulary and is likely to capture the most frequently produced verbs while ensuring sufficient variation in verb types to provide an overall impression of verb use. Complex utterances were excluded from the input sample as above to allow a direct comparison between the child and input data. Coding was carried out by the second author and approximately 10% of the input sample at 2;4 was coded independently by the first author showing high levels of agreement on the application of the inclusion criteria (94.8%, Cohen's

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2. Within the usage-based approach, these sentences are instantiations of more complex constructions that are expected to show their own developmental trajectory, although there is likely to be some benefit accrued from the earlier use of the simple transitive SVO construction (see Abbot-Smith and Behrens 2006 for discussion of these ideas).

kappa = 0.892). A similar sample of input was taken from the recordings at 2;10, matched to Thomas's 2;10 verb vocabulary. This allowed comparison with his data from 2;7 to 3;0 controlling for any possible changes in input over development and taking into account the increase in his transitive verb vocabulary during the latter half of his third year.

Each utterance with a transitive verb in the input data was coded according to construction (SV, VO, SVO), the nature of the arguments in subject and object position (pronoun, proper noun, or noun phrase) and, in SVO utterances, the subject and object were coded for animacy (see below for further details).

2.5.   *Semantic event structure coding (child data 2;1 to 2;6)*

We carried out three analyses on the data. First, we coded the verb types (separately for the SVO and VO constructions), based on their first use, according to whether they (a) were associated with highly transitive actions according to the criteria outlined by Hopper and Thompson (H&T), (b) fit Ninio's classes of creation, ingestion, perception, and obtaining denoting inalienable transitivity, or (c) fit neither category (see Appendix A for coding criteria). Coding of the full data set was carried out by the first author and for purposes of checking reliability, by a second trained coder. For further details of the H&T coding scheme and reliabilities, see below. For the Ninio coding, when both coders assigned a verb to one of Ninio's categories, they always chose the same category. Reliabilities calculated on whether or not coders placed individual verbs in one of Ninio's four categories showed a high rate of agreement (SVO 94.1%, kappa = 0.87, VO 92.6%, kappa = 0.80). Note that it was possible for the coders to assign a verb both high transitivity according to H&Ts criteria, and membership of one of Ninio's classes. This happened for four verbs in SVO (*do, pick up, eat* and *drink*) and five verbs in VO (*eat, drink, collect, bring* and *build*).

In our second analysis, we considered early event semantics in more detail by examining the first three utterances produced with each verb type (or fewer if Thomas produced less than three SVO or VO utterances with that verb in total from 2;1 to 2;6). Many verbs can exhibit either high or low transitivity, depending on the nature of their arguments and the context. For example, the verb *hit*, often seen as highly transitive, nevertheless has a rather different meaning in the context *The falling tree hit the ground* in which the subject lacks agency or volition, and the ground may remain relatively unaffected by the action. We coded each utterance according to kinesis, punctuality, volitionality, and affectedness of the object[3]. Again, coding was carried out by the first

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3.   We initially attempted to also code each utterance according to agency and individuation of the object. However, it proved difficult to establish with any accuracy the agency of the sentence subject (due to ambiguities in the assignment of agent potency to inanimate objects

author and a second trained coder. A high rate of agreement was achieved for all categories for SVO (kinesis, 90.6%, kappa = 0.76; punctuality, 90.6%, kappa = 0.81; volitionality, 96.7%, kappa = 0.89; affectedness of object 89.1%, kappa = 0.76) and VO utterances (kinesis, 88.1%, kappa = 0.73; punctuality, 88.2%, kappa = 0.74; volitionality, 85.0%, kappa = 0.56; affectedness of object 87.6%, kappa = 0.75). We also calculated an overall transitivity rating (out of four) for each utterance, such that an utterance scoring highly on all four measures would score four, whereas one scoring low on all measures would score zero. Utterances scoring three or four were deemed to have high transitivity, those scoring two or below to have low transitivity (this measure was used to code high transitivity for the first analysis). Again, there was a high rate of agreement between coders when comparing the binary rating of high/low for each utterance based on these composite scores (SVO 86.9%, kappa = 0.74; VO 89.7%, kappa = 0.79).

For our third analysis, we coded the subject and object arguments of all of Thomas's SVO and VO utterances for animacy and calculated the proportion of animate subjects and objects at each age. To avoid ambiguity, a strict coding scheme was adopted in which animate entities were deemed to be humans or human-like creatures (for example, characters from children's television programmes) and animals, whereas inanimate entities were deemed to be 'things' (including objects such as trains or cars which appear as characters in children's television programmes and move of their own accord), and also included body parts, for example hands, heads, and feet, which, although in a sense are animate, do not move of their own accord. The data was coded by the second author and approximately 20% of the data was coded for reliability by the first author resulting in a 100% rate of agreement.

3. Results: 2;1 to 2;6

3.1. *The distribution of utterances containing potentially transitive verbs across constructions*

From 2;1 to 2;6, Thomas produced 112 verbs in a transitive construction resulting in 1230 utterances with these verbs in the SV, VO and SVO[4] constructions

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acting as agents, for example cars, trains, soft toys), and the individuation of the object (due to uncertainties about other objects present in the perceptual scene and the late mastery of linguistic means of encoding the definite/indefinite distinction) so these coding categories were removed. Other aspects of H&T's transitivity criteria (aspect, affirmation, mode) were also not easily applied as many of Thomas's early verbs were only produced in stem form, few included negation, and his early utterances typically corresponded to the here-and-now.

4. Thomas produced 2307 tokens of these verbs overall including single word utterances. Thomas's use of SV and VO constructions does not necessarily imply omitted arguments,

Table 1.   *Verb tokens and types produced with transitive verbs in the SV, VO and SVO construc-tions from 2;1 to 2;6.*

	No. hrs	Verb tokens				Verb types		
		SV (ungrammatical)	VO	SVO	% SVO	SV (ungrammatical)	VO	SVO
2;1	22	3	4	3	30.0	3	4	3
2;2	21	6	20	0	0.0	5	11	0
2;3	22	5 (3)	100	9	7.9	4 (2)	21	7
2;4	22	44 (8)	199	50	17.1	25 (7)	37	12
2;5	22	82 (32)	239	62	16.2	30 (5)	51	19
2;6	18	49 (10)	271	84	20.8	25 (6)	58	18
Total	127	189	833	208	16.9			
Input 2;4	22	211	240	1081	70.6	33	39	52

(see Table 1), accounting for 0.8% of utterances at 2;1, increasing to 7.7% at 2;6. A small number of questions were recorded from 2;3 onwards, but the rest of Thomas's transitive verb use consisted of bare stems (e.g. *bash*), negations without arguments (e.g. *no bash*) and locatives without subject or object argu-ments (e.g. *put in trailer*). There is a relatively low proportion of full SVO compared to VO utterances, both in terms of verb types and tokens. We can therefore be confident that these data captured the beginnings of the develop-ment of Thomas's SVO construction in production (see Figure 1).

3.2.   *Were Thomas's early SVO utterances built on previous SV or VO combinations?*

To test whether Thomas's SVO utterances were closely related to earlier pro-duced SV or VO constructions, we examined whether the first SVO utterance produced with each verb was preceded by simpler construction(s) with the same verb. We then examined the lexical items and types of arguments (pro-noun [pN], proper noun [PN] or full noun phrase [NP]) used in subject and object roles with each verb to determine whether there was overlap between the SV and VO constructions and the more complex SVO construction.

Of the 33 verbs Thomas produced in the SVO construction from 2;1 to 2;6, 26 had previously occurred in either the SV (1), VO (18) or both constructions (7). For the eight verb types previously produced in the SV construction, six (75%) had the same subject type (pN, PN or NP), and three of these contained the same lexical subject as the earlier SV construction (38%). For the 25 verbs

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since these figures include permissible uses of verbs which enter into transitivity alternations (in SV, found at 2;4, 2;5 and 2;6, $\underline{M} = 25.46\%$), as well as imperatives (VO).
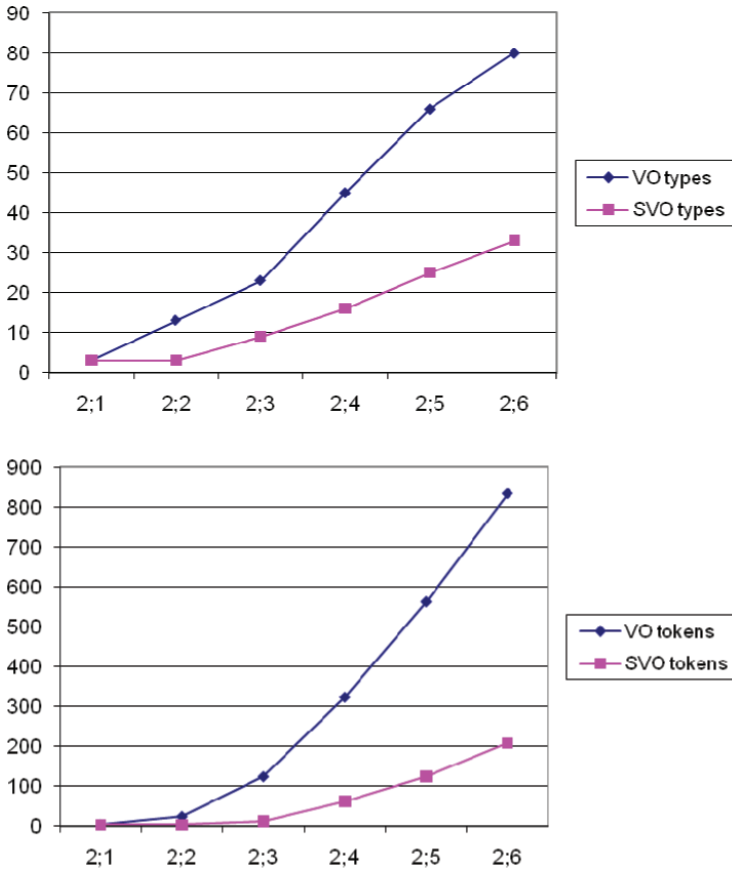
Figure 1.   *Cumulative verb types and tokens produced in the VO and SVO constructions from 2;1 to 2;6.*

previously produced in the VO construction, 20 had the same object type (80%), and of these 14 shared the same lexical object as the earlier VO construction (56%). This suggests that, at least before 2;6, Thomas often relied on a particular word type that he had previously used as a subject or object with a specific verb, and on a specific lexical item previously produced as an object with that verb when he first employed it in the full SVO construction.

3.3.   *Did Thomas's choice of subject and object referents conform to the input and/or PAS?*

We then examined whether Thomas showed a particular reliance on specific lexical items or broad classes of items in his early SVO utterances, and how
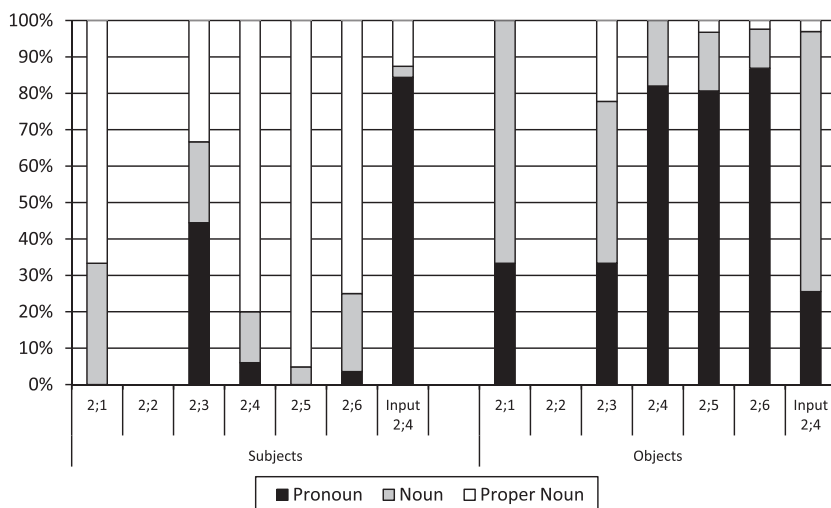
Figure 2.   *Percentage of subjects and objects in the SVO construction that were pronouns, nouns and proper nouns between 2;1 to 2;6.*

this compared to use in the input. Of the very first occurrences of these 33 verbs in the SVO construction, 79% had either a proper noun (PN) subject (15), the pronominal object *it* (4), or both conforming to the construction *PN V it* (7). Of the seven verbs produced in the SVO construction that had no SV or VO precursors in our corpus, six conformed to the __ *V it* or *PN V* __ constructions, suggesting that there may be some early transfer between verbs in the SVO construction. The proportion of SVO subjects and objects across all of Thomas's SVO utterances (not just first uses) that were pronouns, noun phrases, or proper nouns at each age is shown in Figure 2. Again, especially from 2;4 to 2;6 when SVO use increased, there was a clear dominance of proper noun subjects and pronominal objects, with over 75% of objects realised as '*it*' (76%, 77% and 85% at 2;4, 2;5 and 2;6 respectively). This is in stark contrast to the patterns observed in Thomas's input where a much larger proportion of subjects in the SVO construction were pronouns and objects were nouns, in line with PAS. Thus, Thomas's early SVO utterances bore relatively little resemblance to the patterns observed in the input or those predicted on the basis of PAS with respect to the specific classes of lexical items instantiating the subject and object roles.

   Of course, it is possible to argue that Thomas's VO utterances represented SVO utterances with omitted pronominal subjects as, in terms of information structure, pronouns tend to convey given information, and in many languages given information can often be omitted altogether (e.g. Clancy 2003). Thus,
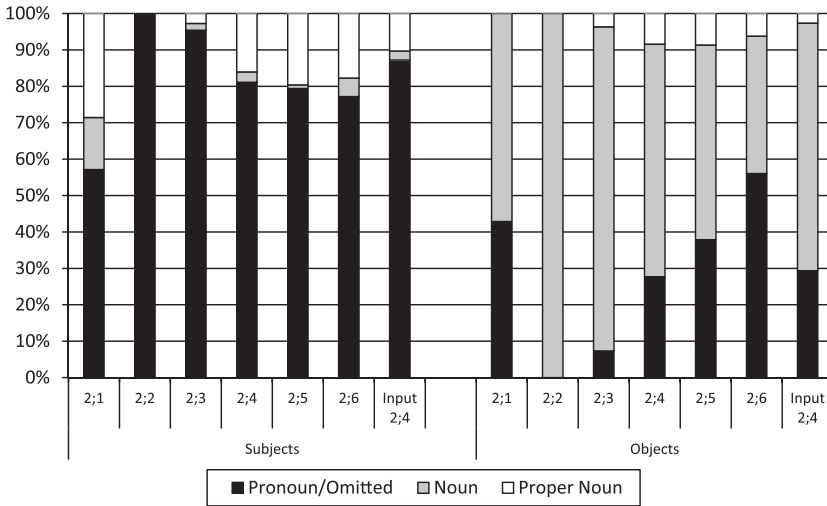
Figure 3. *Percentage of subjects and objects in the SVO and VO constructions that were pro-nouns (or omitted subjects), nouns and proper nouns between 2;1 to 2;6.*

collapsing across VO and SVO utterances by combining pronoun and omitted subjects may provide a fairer comparison of Thomas's data with the input (see Figure 3). When we compared the distribution of pronoun/omitted, noun, and proper noun subjects in Thomas's data in SVO and VO utterances combined at 2;6 with patterns in the input, a chi-squared test showed that the distribution was significantly different. Thomas produced more noun and proper noun subjects than his mother (χ^2 (2) = 22.47, $\underline{p}$ < 0.001, standardised residuals +2.19, +3.21 respectively) while his mother produced marginally more pronoun/omitted subjects (standardised residual = 1.84). Similarly, when we collapsed SVO and VO utterances and examined the distribution of objects, a chi-squared test revealed that at 2;6 Thomas produced a higher proportion of pronoun and proper noun objects and a lower proportion of noun objects than his mother (χ^2 (2) = 108.78, $\underline{p}$ < 0.001, standardised residuals +6.7, +2.86 and −5.72 respectively), reflecting in part the dominance of *it* in his SVO utterances. Despite the very high frequency of full SVO utterances containing the PAS pattern of pronominal subjects and noun objects in the input, Thomas started out producing SVO utterances with proper noun subjects and pronominal objects.

3.4. *What were the event semantics of Thomas's early transitive verb types?*

The verb types produced in the SVO and VO constructions were categorised as high transitivity (HT: on a fairly broad interpretation of H&T's criteria), in-alienable transitivity (IT: belonging to one of Ninio's four classes, obtaining,
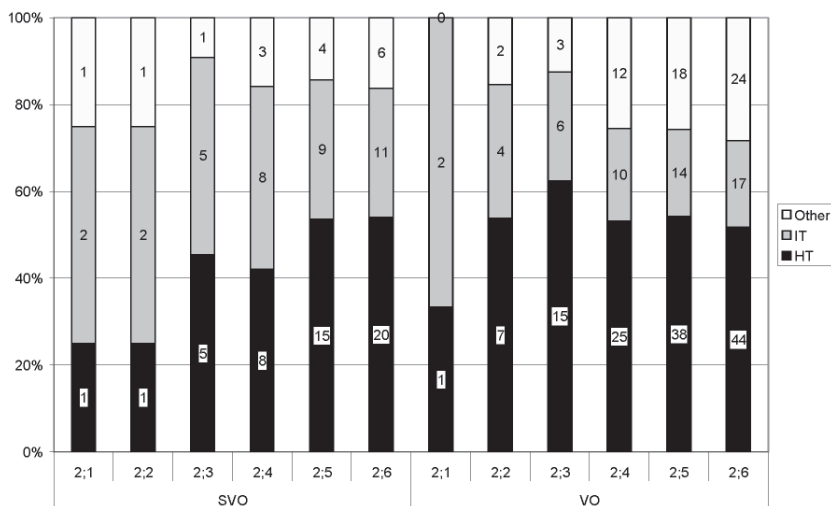
Figure 4.   *Cumulative percentage of high transitivity (HT), inalienable transitivity (IT) and other verb types based on first verb use for the SVO and VO constructions.*
Nb: For SVO, at 2;1, 2;3, 2;4 and 2;6 one verb type appears in both the HT and IT groups (*do*, *pick[up]*, *eat*, and *drink* respectively); for VO at 2;3, 2;4, and 2;6 one verb type appears in both HT and IT groups (*eat, drink,* and *build* respectively), and at 2;5 two verbs (*collect* and *bring*) appear in both HT and IT groups.

creation, perception, ingestion), or 'other' for those predicates which were not easily captured by either classification (e.g. *drop*, which scores low on the H&T criteria and is not among Ninio's subset of IT verbs), based on their first use. Figure 4 shows the cumulative frequencies of verb types across months, falling into the HT, IT, and 'other' categories for the SVO and VO constructions.

At 2;1 there appeared to be a small advantage for IT (2) over HT (1) verbs in the SVO and VO constructions, however any claim for early IT dominance is weakened by the fact that only three verb types were produced, one of the two IT verbs in SVO (*do*) was also coded as high in transitivity, and the third verb produced in the SVO construction fell into the 'other' category. For the SVO construction, there was again roughly equal use of HT and IT verbs at 2;3 and 2;4, and thereafter larger numbers of HT verbs were acquired, with IT and 'other' verbs acquired in lower but equal numbers from 2;5. In the VO construction, there was an earlier dominance of HT verbs (from 2;2), with verbs in the 'other' category also acquired at a similar or faster rate than IT verbs from 2;2.

The cumulative type frequencies of the verbs in each semantic group for the SVO and VO constructions show that both HT and IT verbs played an important role in early acquisition, and although 'other' verbs were less frequent, they appeared alongside the early HT and IT verbs. Although we are unlikely

to have captured the very first verb uses, only three verb types were found in the SVO and VO constructions in the 22 hour sample at 2;1. Due to the increased density of our data over other naturalistic corpora we can be reasonably confident that we captured the early stages of acquisition. Thomas's data thus do not provide clear support for an early advantage for either notion (HT or IT) of transitive semantics.

3.5. *Do Thomas's early verbs have stable and adult-like event semantics?*

For this analysis, we looked in more detail at the extent to which Thomas's SVO and VO utterances scored highly on H&T's continuum of transitivity for those aspects that could sensibly be judged (kinesis, punctuality, volitionality, affectedness of the object). We asked how consistently Thomas's early utterances exhibited high transitivity, and which aspects of H&T's criteria were characteristic of his early utterances.

When we examined the verbs used at least twice in the SVO or VO constructions, we found that of the 20 used two or more times in the SVO construction, 18 (90%) received the same coding (10 HT, 8 show low transitivity LT), regardless of whether they were coded on the basis of the first utterance, or the first two/three utterances with that verb. For the VO construction, of the 61 verb types produced at least twice, 48 (78.7%; 26 HT, 22 LT) were categorised in the same way on the basis of both the first verb use and two/three utterances, whereas 13 verbs showed mixed coding, that is they were coded as high in some contexts and low in others. Thus, although overall around 81% of Thomas's verbs were used with stable event semantics, there is some evidence that even in early acquisition, some individual verbs are used more variably.

However, this kind of global analysis reveals little about the precise nature of early event semantics, as it is unclear exactly what properties of an utterance resulted in it exhibiting high or low transitivity. We therefore examined in detail which aspects of event semantics were central to Thomas's early SVO and VO constructions. Although overall 56% of Thomas's SVO and VO utterances exhibited high transitivity (a score of 3 or 4 on H&Ts criteria, see Table 2 for a breakdown of overall utterance categorisation according to the 4 criteria), utterances were not rated equally highly on the four aspects of transitivity coded for. A higher proportion of utterances received high transitivity ratings for kinesis (69.6%) and volition (78.1%) than for punctuality (41.6%) or affectedness of the object (46.6%). Recall that volition concerns the extent to which a subject/agent acts intentionally, and studies have shown that 18-month-old children discount accidental actions, imitating only intentional acts (e.g. Carpenter et al. 1998). There is reason to believe, therefore, that degree of intentionality is something children are likely to pay attention to when beginning to learn how events are expressed in their language. In contrast, Thomas seemed little

Table 2. *Aspects of utterance semantics relating to ratings of high transitivity*

	SVO	VO	Overall	
4	12.50	21.69	17.10	
3	43.75	34.39	39.07	
2	18.75	11.11	14.93	
1	20.31	19.58	19.94	
0	4.69	13.23	8.96	
	Kinesis	Punctuality	Volition	Affectedness of object
SVO				
% utterances HT	70.31	50.00	79.69	39.06
Total utterances	64	64	64	64
VO				
% utterances HT	68.95	33.16	76.44	54.21
Total utterances	190	190	191	190

Distribution of utterances according to ratings of high transitivity across the four semantic catego-
ries (0 = lowest in transitivity to 4 = highest in transitivity)

concerned with the extent to which the object of an action is affected. Without
a detailed semantic coding of transitive utterances in the input, we cannot
comment on whether Thomas's early transitive utterances display a different
semantic pattern to those he hears. However, we can conclude that his early
transitive utterances, although often exhibiting high transitivity, do so along
only a limited range of semantic criteria in comparison with those suggested in
the literature for adult speech.

To summarise, there is evidence that Thomas started out by producing both
utterances that exhibited high transitivity and those that exhibited low transi-
tivity, sometimes showing variation even within his uses of the same verb.
However, a large proportion of his utterances scored highly with respect to
kinesis and volition, suggesting that his early transitive constructions may have
been organised around the extent to which an action was transferred from the
agent to the patient, and the extent to which the agent acted intentionally.

3.6.   *The role of animacy*

We first examined whether Thomas differentiated the subjects and objects of
SVO utterances, and the objects of SVO and VO utterances, in terms of their
animacy. The data showed that Thomas did indeed differentiate the subjects
and objects of his SVO utterances, with an average of 97% of subjects being
animate in comparison with just 11% of objects (see Table 3 for the proportion
of animate subjects and objects at each age). In this respect then, Thomas's
SVO utterances conform to PAS. Interestingly though, we also observed dif-
ferences in the extent to which Thomas's objects in his SVO and VO utterances

Table 3.   *Proportion of animate subjects and objects.*

Subjects	2;1	2;2	2;3	2;4	2;5	2;6	Input
SVO	1.00	–	1.00	0.92	1.00	0.95	0.95
Objects							
VO	0.00	0.15	0.09	0.16	0.13	0.13	
SVO	0.00	–	0.44	0.04	0.03	0.04	0.06

were animate. We compared the distribution of animate vs. inanimate objects in the VO and SVO constructions at 2;4, 2;5 and 2;6. Objects in VO utterances were significantly more likely to be animate than objects in SVO utterances (2;4 χ^2 [1] = 4.95, p = 0.026; 2;5 χ^2 [1] = 4.51, p = 0.034; 2;6 χ^2 [1] = 6.19, p = 0.013[5]), driven by the highly frequent use of the inanimate object referent *it* in SVO utterances. Thus, the differences observed in the kinds of lexical items used to express SVO and VO objects (with VO objects more likely to be NPs and SVO objects pNs) were mirrored in differences in the animacy of these two groups of objects.

Second, we looked at Thomas's SVO utterances as a whole to determine the semantic relations between the subject and object roles. The data revealed that 88.0% of Thomas's SVO utterances between 2;1 and 2;6 showed a pattern of contrasting animacy in subject and object positions, with subjects animate (and often human) and objects inanimate. A similar pattern was observed in the input with 88.9% of his mother's SVO utterances following this semantic pattern. Thus, although Thomas's SVO utterances differed from those he heard with respect to the particular lexical items he produced in subject and object position, with Thomas showing a greater reliance on proper noun subjects and pronominal objects while his mother used a higher proportion of pronominal subjects and noun objects, the semantics of his early SVO utterances matched those of his mother, at least when measured in terms of the animacy of the subject and object roles.

Thus, there is some evidence that Thomas's earliest representation of the SVO construction may reflect the prototypical semantic relationship between the subjects and objects of transitive clauses, but in terms of simple animacy and a high degree of intentionality on the part of the agent, rather than encompassing

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5.   Benjamini-Hochberg corrections were applied for multiple comparisons, these differences remained significant. In these analyses and others in this paper, we were interested in whether there was developmental change in a single child, and in comparing the child's language use to use in his input. Thus, the data points all come from the same speaker(s) and are, in this sense, not independent. We acknowledge that there is some debate over the appropriateness of the use of statistical tests that assume independence between data points, but apply these tests here (as has been done previously in the literature) to give a sense of the precise pattern of change over development.

the full range of H&Ts more sophisticated criteria. However, it is important to note that at 2;3 (following just three prototypical SVO utterances in our 2;1 sample) Thomas produced SVO utterances involving two animate entities (e.g. *I see you, Lala brush Molly*—6.1% of SVO input) and at 2;4 began to produce SVO utterances with inanimate subjects (e.g. *balloon bang head*—5.1% of SVO input). There were, however, no SVO utterances exhibiting the reverse inanimate-subject, animate-object pattern by 2;6. These data suggest that although the highly frequent animate-inanimate pattern is acquired early and could result in children having a better understanding of argument roles in utterances of this type, Thomas was also learning how to understand and produce reversible transitives and transitives with an inanimate subject from the beginnings of transitive verb use. Further evidence for this comes from his VO objects which contrasted with SVO objects in being more frequently animate entities, contributing to the acquisition of reversible transitives. Although the lack of inanimate-animate SVO utterances could suggest, in line with the results of comprehension studies (e.g. Corrigan 1988; Chan et al. 2009), that sentences where the prototypical role asymmetry is reversed pose particular problems in acquisition, inanimate-animate transitive sentences are also very infrequent in the input (0.19% of the input) and thus their absence from Thomas's data may reflect the relatively smaller size of his corpus in comparison with that of his mother.

3.7.   *Summary of development from 2;1 to 2;6*

Between 2;1 and 2;6, Thomas produced an increasing number of transitive verb types, and produced these verbs in the SV, VO and the full SVO constructions. Initially, he produced only a handful of verb types in the SVO construction, and over three quarters of these verbs had previously appeared in the less complex SV or, more commonly, VO construction. Moreover, around three quarters of these verbs had previously appeared with the same type of subject or object, and around half with the same lexical item in the subject or object slot. An examination of the semantics associated with Thomas's early SVO and VO utterances suggested that he does not rely on a particular, semantically delimited set of verbs for his early transitive production, but rather is better characterised as producing, across semantic categories, utterances which conform to a dominant semantic pattern that favours animate (often human) subject referents perceived as having a high degree of intentionality in relation to inanimate objects.

   By 2;6, Thomas's grasp of the SVO construction was still relatively non-adult-like in his nonconformity to preferred argument structure principles which favour pronominal subjects and lexical noun objects in accordance with the tendency for subjects to encode given and objects new information. Thomas

relied instead on the pronominal form *it* in object position, and had a marked tendency to produce proper nouns in subject position. Even when Thomas's VO utterances were considered as examples of subject omission licensed by pragmatic factors similar to those that operate on pronominal reference, his transitive utterances still differed from those found in his mother's speech with respect to the way in which subjects and objects were realised.

We next examine how Thomas's knowledge of the transitive construction developed between 2;7 and 3;0, the age at which experimental production studies suggest that children begin to acquire productive use of the SVO construction (Tomasello 2003). We differentiate between Old verbs (those transitive verbs acquired prior to 2;7) and New verbs (those transitive verbs acquired between 2;7 and 3;0) to investigate whether these verb groups show different developmental trajectories towards adult-like usage. If acquisition proceeds gradually and on the basis of prior use, we might expect to see the earlier acquisition of the full SVO construction for Old verbs. To examine this issue, we conducted three analyses. First, we examined the proportional use of Old and New verbs in the SVO construction to determine whether Old verbs appeared in this construction earlier than New verbs. Second, as transitive objects are commonly realised in adult speech with lexical nouns, but can take a variety of forms from a simple pronoun (*it*) to much more complex noun phrases (NPs) (*The big yellow digger, the brown cow and the black horse*), we examined the complexity of the object arguments produced with Old and New verbs, in terms of their mean length of utterance (MLU) and the presence of determiners. If previous knowledge of the combinatorial properties of verbs contributes to the development of more abstract object slots, we might expect to see that the objects of Old verbs were longer and more likely to appear with determiners than those of New verbs. Finally, we examined the extent to which Thomas's SVO utterances conformed to preferred argument structure with respect to the types of subject and object referents he produced. Here we made no specific predictions regarding patterns of acquisition for Old and New verbs as it is not clear whether previous use of Old verbs with proper noun subjects and pronominal objects would be expected to promote the transition to PAS or, in contrast, hinder such a transition as the previous pattern of use may have been well entrenched.

4. Results: 2;7 to 3;0

4.1. *The distribution of utterances containing potentially transitive verbs across constructions*

Thomas produced 66 new transitive verb types from 2;7 to 3;0, 16 in the SVO construction, 24 in the VO construction, and 26 in both constructions. In the 2;1 to 2;6 data, Thomas used a much smaller proportion of his verb types and
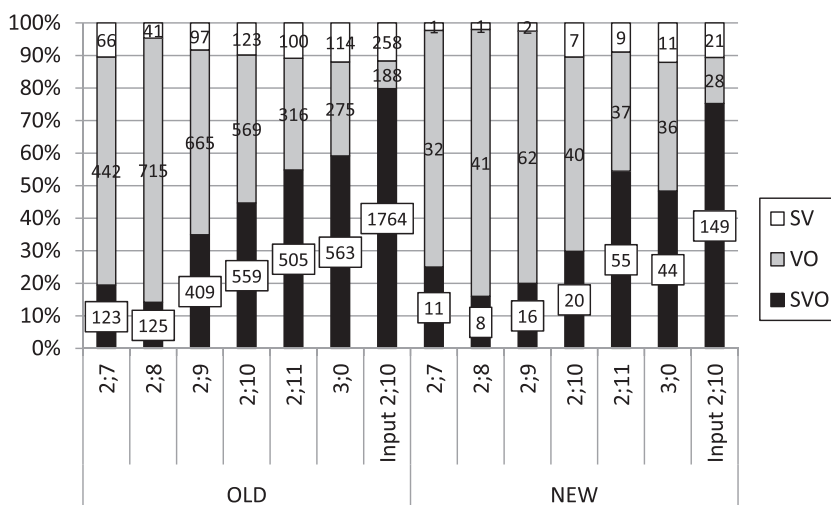
Figure 5.   *Percentage of Old and New verb tokens produced in the SV, VO and SVO constructions from 2;7 to 3;0.*

tokens in the SVO construction, in comparison with his mother's verb use. We therefore examined the distribution of Old verb tokens (verbs first produced between 2;1 and 2;6) in the SVO construction relative to other constructions (VO & SV combined) in Thomas's 2;7 to 3;0 data and compared this with input data from the 2;10 sample to see whether he began to converge on adult patterns of verb use (see Figure 5). Firstly, there was a clear development toward the adult pattern with a steady increase in the proportional use of the SVO construction (chi-squared analyses revealed that there were significant differences between each consecutive month sample from 2;7 to 2.11 (χ^2 [1] values ranged from 7.54 to 112.32, p values < 0.01[6]), and a marginally significant increase from 2;11 to 3;0 (χ^2 [1] = 3.54, p = 0.06). However, even at 3;0, Thomas produced a significantly lower proportion of SVO utterances than his mother (χ^2 [1] = 146.43, p < 0.001). Secondly, at 2;9 Thomas showed a marked increase in the use of the SVO construction (standardised residual = +5.94). The interesting question, if we are looking for evidence of gradual abstraction of verb-general knowledge of the transitive construction, is whether this pattern was repeated for New verbs (see Figure 5).

The general trend for New verbs resembled the Old verb pattern, with a tendency for Thomas's distribution to be more like his mother's as he ap-

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6.   These findings are still significant when Benjamini-Hochberg corrections are applied, as are those for New verbs, and for the comparisons of Old and New verbs reported below.

proached 3;0. However, the most marked change in the proportion of New verb tokens produced in the SVO construction relative to other constructions (SV & VO combined) occurred somewhat later at 2;11 than for Old verbs (2;9), with the only significant increase in SVO use month by month occurring at 2;11, $\chi^2[1] = 9.87$, $\underline{p} = 0.002$). The Old verbs reached 35% SVO use at 2;9, and 45% at 2;10, while New verb SVO utterances accounted for less than 30% of his verb uses until an increase to 54% at 2;11[7]. Thus, both Old and New verbs lagged significantly below the level of SVO use in the input even at 3;0. This difference reflects the higher proportion of VO utterances in Thomas's speech in comparison with the higher proportion of SVO utterances in the input (SV utterances account for 10–12% of the data for both Old and New verbs in Thomas's speech and the input).

To determine whether the apparent differences between Old and New verbs were statistically significant, chi-squared comparisons were carried out. First, it was necessary to establish whether Thomas's mother's proportional use of the SVO construction with Thomas's Old and New verbs was similar, as differences in the patterns of use in the input might account for differences in Thomas's use of these verbs. A chi-squared test showed that there was no difference in the proportional use of Old and New verbs in the SVO construction in the input (79.8% and 75.2% respectively, $\chi^2[1] = 2.32$, $\underline{p} = 0.13$).

We then compared Thomas's use of the SVO construction with Old and New verbs at each age with a series of chi-squared tests. At 2;7 and 2;8, there were no differences in his use of the SVO construction (2;7, Old = 20%, New = 25%, $\chi^2[1] = 0.78$, $p = 0.38$; 2;8 Old = 14%, New = 16%, $\chi^2[1] = 0.13$, $p = 0.72$). At 2;9, however, Thomas produced his Old verbs in the full SVO construction significantly more often than his New verbs (Old = 35%, New = 20%, $\chi^2[1] = 7.44$, $p = 0.006$), and this was mirrored at 2;10 (Old = 45%, New = 30%, $\chi^2[1] = 5.68$, $p = 0.017$). Only at 2;11 did New verbs show the same proportional use in the SVO construction as Old verbs (Old = 55%, New = 54%, $\chi^2[1] = 0.01$, $p = 0.92$). Thus, Old verbs showed an earlier move towards adult-like use of the SVO construction than New verbs (which instead were produced in the VO construction).

4.2. *Are Old verbs used with more complex object arguments than New verbs?*

We calculated the MLU of object types (in morphemes) occurring with the SVO and VO constructions for Old and New verbs at 3;0, the latest data point

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7. When we examined the number of verb types produced in the SVO construction each month, the same pattern emerged with Old verbs showing a marked increase in the number of verb

in this study, and then compared these values with Thomas's mother's object use with each group of verbs to determine whether the object arguments Thomas produced with Old verbs were closer to adult use than those he produced with New verbs. For the purposes of this analysis, we counted each utterance type only once to avoid, for example, multiple exact repetitions of utterances such as *Mummy do it* reducing the MLU of objects occurring in the SVO construction (thus *it* was counted only once if it occurred in multiple occurrences of *Mummy do it*, but was counted separately if it occurred in other utterances such as *Daddy do it* or *Mummy find it*). We combined VO and SVO utterances to allow a fair comparison (as Thomas omitted subjects more than his mother). Mann-Whitney tests showed that for Old verbs, Thomas's objects at 3;0 did not differ in length from those found in the input (Thomas $\underline{M}$ = 1.99, input $\underline{M}$ = 2.13, $\underline{U}$ = 521450.5, $\underline{N}$ = 2509, $\underline{p}$ = 0.10), whereas for New verbs, Thomas's objects at 3;0 were significantly shorter than those in the input (Thomas $\underline{M}$ = 1.38, input $\underline{M}$ = 1.85, $\underline{U}$ = 3667.5, $\underline{N}$ = 213, $\underline{p}$ = 0.001). This suggests that Thomas's use of Old verbs was more adult-like than his use of the more recently acquired New verbs, even at 3;0.

An examination of the object arguments Thomas produced with Old and New verbs revealed that he produced fewer determiners with his objects of New verbs than with his objects of Old verbs. To control for the fact that Thomas had a more limited vocabulary than his mother, we examined the use of 10 highly frequent determiners that were in Thomas's vocabulary (*a, another, any, his, my, some, that, the, this, your*). 47% of Thomas's Old verb objects occurred with one of these 10 determiners (this mirrored the pattern observed in the input where 43% of Old verb objects appeared with one of these high frequency determiners (a chi-squared test revealed that these distributions were not significantly different χ^2 [1] = 2.00, $\underline{p}$ = 0.16). However, only 20% of Thomas's New verb objects occurred with one of these highly frequent determiners in comparison with 37% of New verb objects in the input, a chi-squared test revealed this difference to be significant χ^2 [1] = 4.79, $\underline{p}$ = 0.029. This shows that although Thomas is able to employ a range of determiners with his Old verb objects, and these same determiners appear with equal frequency with both Old and New verbs in the input, Thomas fails to produce determiners with his New verb objects, resulting in the use of less complex NPs with these verbs. It is worth noting, however, that the MLU of objects with Old verbs remains slightly longer than with New verbs, even when the determiners are excluded from the calculation (Old verbs MLU = 1.46, New verbs MLU = 1.17). This suggests that the complexity associated with Old verb objects is not just

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types produced in the SVO construction at 2;9, whereas New verbs showed an increase at 2;11.

restricted to the use of determiners, but is also likely to involve the greater use of adjectives, numerals, noun morphology and so on.

4.3.   *Did Thomas's choice of subject and object referents conform to PAS?*

At 2;6, Thomas's use of both subjects and objects in the SVO construction differed from his mother's and contrasted with PAS. The distribution of subject and object types in SVO utterances for Old and New verbs from 2;7 to 3;0 is shown in Figure 6, and the same information is shown in Figure 7 when VO utterances were also included (in the category of pronoun/omitted subjects).

Before 2;9 Thomas relied heavily on proper noun subjects in SVO utterances with both Old and New verbs. From 2;9, however, there was a sharp increase in his use of pronominal subjects, although use was more varied for New than for Old verbs. From Figure 7, we can see that there was little difference in the proportional use of the combined category of pronominal and omitted subjects in SVO/VO between 2;8 and 2;9. This suggests that the increase in pronoun subjects in SVO at 2;9 reflected a concurrent decrease in the production of VO utterances in which the subject was omitted, and this occurred for both Old and New verbs. In particular, there was a sudden increase in the use of *I* which was produced in 308 SVO utterances (72%) at 2;9 across Old and New verbs (44 of 54 Old verb types and 5 of 8 New verb types in the SVO construction occurred with *I* as subject). However, there were 44 instances of *I* produced in SVO
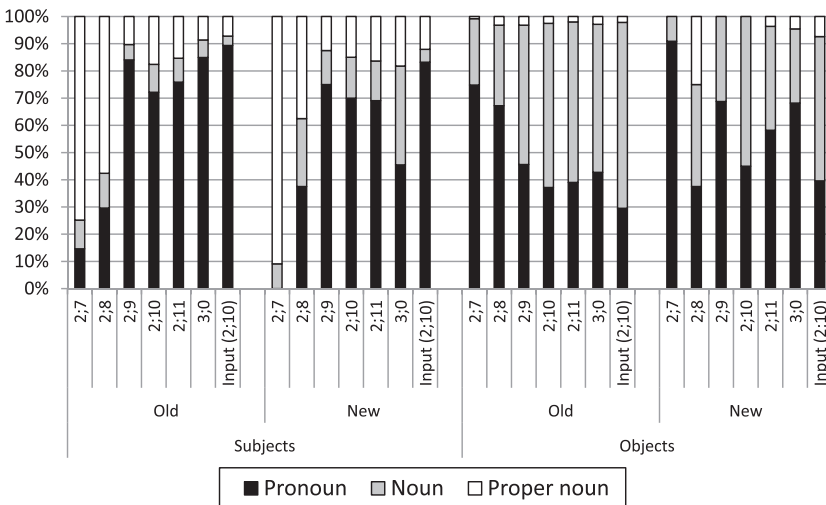

Figure 6.   *Percentage of subjects and objects in the SVO construction that were pronouns, nouns, and proper nouns with Old and New verbs from 2;7 to 3;0.*
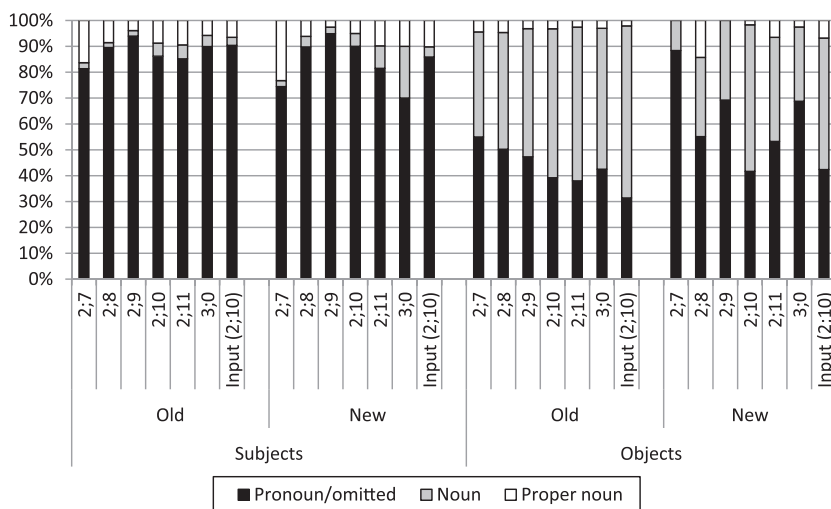
Figure 7.   *Percentage of subjects and objects in the SVO and VO constructions that were pronouns (and omitted subjects), nouns, and proper nouns with Old and New verbs from 2;7 to 3;0.*

utterances prior to 2;9 illustrating that this was not a newly acquired lexical item. Indeed, extrapolating on the basis that our sample represents around 8% of the child's total output (Maratsos 2000), we can surmise that by 2;9, Thomas had produced something like 500 previous SVO utterances with *I* as subject. He also produced 14 other pronominal reference types at 2;9, ten of which were recorded prior to 2;9 although in small numbers. Thus, the underuse of pronouns in SVO utterances prior to 2;9 cannot be attributed to Thomas's lack of knowledge of the relevant lexical items, nor of how to combine them in SVO utterances. Rather, his ability to produce adult-like SVO utterances appeared to be undergoing gradual development.

With respect to object use in the SVO construction, at 2;7 and 2;8 Thomas used a high proportion of pronominal objects (although the pattern was less clear for New verbs due to the small number of utterances at 2;8). From 2;9 he began to move towards adult-like use with a greater tendency to produce noun objects, especially with Old verbs, mirroring the pattern in the input where only 30% of objects with Old verbs were pronominal compared to 40% of objects with New verbs. When VO utterances were also included the pattern was similar, although at 2;7 and 2;8 the proportion of noun objects with Old verbs increased, reflecting the earlier tendency for Thomas to produce noun objects in the VO construction and pronominal objects in the SVO construction.

To summarise, the data show that from 2;9 Thomas's use of the SVO construction came to much more closely resemble his mother's use, in particular in his production of transitive utterances containing pronominal subjects. However, Old verbs more reliably converged on the adult pattern for noun objects from 2;9, whereas New verbs continued to appear with higher levels of pronominal objects, even when compared against the higher level of pronominal object use in the input with New verbs.

4.4.   *Summary of development from 2;7 to 3;0*

This series of analyses on Thomas's use of Old and New verbs between 2;7 to 3;0 revealed that even taking into account distributional differences in the input in the use of Old and New verbs, Thomas's use of Old verbs more rapidly converged on the adult pattern of use, whereas his use of New verbs lagged behind. More specifically, Old verbs in comparison with New verbs (1) showed an earlier move towards higher levels of use in the full SVO construction, (2) were produced with more complex object NPs, even at 3;0, and (3) appeared with lexical (rather than pronominal) objects earlier in development. All this evidence suggests that Thomas's greater experience of using his Old verbs confers an advantage on them in terms of development toward adult patterns of use. We therefore conclude that his knowledge of the transitive construction at 3;0 is still, in some important respects, fragmented and reliant on previous patterns of use. At same time, it is clear that knowledge of some aspects of the transitive construction, more specifically the use of pronominal subjects at 2;9, seems to generalise across verbs.

5.   **Discussion**

In this study we set out to address a number of questions regarding the acquisition of the transitive SVO construction between two and three years of age. Specifically we asked whether early transitive utterances (1) were built on the previous use of simpler constructions, (2) reflected patterns in the input and/or PAS with respect to the kinds of lexical items used in subject and object positions, (3) showed evidence of either the event semantics associated with high transitivity or of inalienable transitivity, and (4) reflected patterns in the input and/or PAS with respect to the animacy of the subjects and objects. To address these questions, we carried out an exhaustive analysis of the simple transitive utterances produced in dense data from one child (Thomas) between two and three years of age.

First, we found evidence that Thomas's transitive verb use was closely related to his prior use of those same verbs. From 2;1 to 2;6 he showed little use of the full SVO construction, but those SVO utterances that he did produce

tended to share the same subject and object type, and for objects the same lexical item as he had previously produced in either an SV or VO construction with that same verb. Broadly speaking, his early SVO utterances could be characterised by low level constructions organised around proper noun subjects and pronominal objects. During the latter half of Thomas's third year (2;7–3;0), we found that verbs acquired before 2;7 had accrued some advantage that was carried over into later use. These verbs were produced in the SVO construction earlier than verbs learned after 2;6, and the objects of Thomas's New verbs were less complex and appeared with fewer determiners than his objects of Old verbs. These data are consistent with earlier studies that suggested that knowledge of the transitive construction builds up gradually on the basis of prior use (Tomasello 1992; Lieven et al. 2003), and that frequent subjects and/or objects may play a particularly important role in the abstraction of a variable verb slot (Lieven et al. 1997; Pine et al. 1998; Jones et al. 2000; Childers and Tomasello 2001; Savage et al. 2003, 2006; Laakso and Smith 2007). On the other hand, both verb groups shifted towards greater pronominal subject use in the SVO construction at 2;9, suggesting some degree of generalisation across verbs. This asymmetry between subject and object use with Old and New verbs suggests that Thomas was sensitive to a critical distinction between the subjects and objects of transitive events. In the input subjects are often realised pronominally (and refer to a limited set of animates) and thus take a limited range of forms, whereas objects are often realised as full nouns and encompass a much wider variety of items. If we add to this the fact that many early acquired verbs exhibit particularly strong relations with their objects (Brown 2008), this might lead children to accept generalisations across the subject slot of the transitive construction, but to show less readiness to generalise across the object slot.

One question that arises from these data is whether Thomas's increase in pronominal subject use at 2;9 is restricted to the transitive construction. According to some theories, the subject of the transitive construction is represented separately from the subject of, say, the intransitive construction (e.g. Croft 2001), and on this kind of account, generalisation across constructions will take developmental time. On the other hand, previous research suggests that each construction does not develop in isolation, but rather can have a positive (or negative) impact on the acquisition of other constructions (e.g. Abbot-Smith and Behrens 2006). Although a detailed examination of construction networks is beyond the scope of the current paper, we briefly examined the kinds of subjects Thomas produced with his intransitive verbs between 2;7 and 3;0. The data show that at 2;9, the critical age when we observed an increase in pronominal subjects in transitive utterances, the proportion of pronoun subjects produced in the intransitive also increased (57% at 2;9 vs. 18% at 2;8). However, at 2;9 pronoun subject use in the intransitive (57%) was somewhat

lower than in the transitive (84% for Old verbs, 75% for New verbs), the form 'I' accounted for only 22% of Thomas's intransitive subjects in comparison with 72% in the transitive. This is likely to reflect the fact that in adult (and child) language, the intransitive subject argument is associated with both a larger proportion of lexical nouns used to denote new entities in the discourse, and a larger number of inanimate referents than the subject of transitives (e.g. DuBois 1987; Clancy 2003), and lends further support to the suggestion that constructions develop, at least to some degree, independently. Of course, it is possible that stronger relations would be found between the simple transitive and other more complex transitive constructions that share similar discourse pragmatics, but this would require further detailed investigation.

Second, we found that Thomas's SVO utterances contrasted with patterns of use in the input and those of PAS in his choice of subject and object referents. However, Thomas's objects in his VO utterances were more likely to be full nouns, more closely resembling the input and PAS. Why did Thomas's SVO and VO utterances differ in this respect? One possibility is that this reflected sensitivity to discourse pragmatics, with the SVO construction used when the subject represented new information and the object was given, and the VO construction used when the object represented new information and the subject was given. On balance, however, this seems unlikely. The majority of Thomas's proper noun subjects referred to either himself, his mother, the family cat, or the research assistant, all of whom almost certainly represented given information in the context, and related analyses of Thomas's and other children's data show that between 2;1 and 2;7 they sometimes produced lexical subjects when the referent was fully accessible yet omitted subjects when the referent represented new information (Hughes and Allen 2009). This incomplete understanding of pragmatic principles suggests that discourse pragmatics are not the primary explanation for the contrast between the objects in Thomas's SVO and VO constructions. Another possibility is that this reflected a processing trade-off between the subject and object roles in production such that when Thomas produced a full noun object, he tended to omit the subject, whereas when he produced the subject he was only able to produce a less complex pronominal object (e.g. Bloom 1990). However, Freudenthal et al. (2007) demonstrated, using a computational model with an utterance-final bias, that the observed association between the length of the verb phrase and the presence/omission of a subject argument can be explained in terms of performance-limited learning. If children are limited in how much information they are able to learn at any one time, utterances including longer verb phrases are less likely to be fully learned than those with shorter verb phrases, thus sentences with pronominal objects are more likely to be learned with their subject arguments than are those with longer noun phrase objects. As learning within their model is dependent on frequency of exposure, this could also account for our finding that

Thomas's Old verbs appear with longer object NPs and show an earlier move to the full SVO construction than his New verbs. We conclude that in production at least, Thomas was unable to manipulate the subject and object roles in an adult-like way due to a reliance on input-based learning (albeit with variation in the lexical items used in subject and object positions) and relatively low levels of generalisation across verbs.

Thirdly, we found that the semantics of Thomas's early transitive utterances were varied, encompassing verbs exhibiting high transitivity (Hopper and Thompson 1980) and inalienable transitivity (Ninio 1999), as well as some verbs that corresponded to neither categorisation. These data share similarities with Brown's (2008) data on Tzeltal, and Naigles et al.'s (2009) data on American-English where children acquire both semantically general and very specific verbs from the earliest stages of verb acquisition. Detailed analysis revealed that Thomas's transitive utterances were best characterised as encoding intentional agents and the transfer of an action from agent to patient. It is important to note that the event semantics for some verbs differed from one instance to another, cautioning against categorising verb types in the absence of contextual information (see Naigles et al. 2009 for similar arguments with respect to the semantic flexibility with which children use their early verbs), and that some verbs appeared to match both the HT and IT coding criteria, questioning the extent to which these categories differ. Thus, although there is a fierce debate over the central nature of transitivity, as exemplified by the proposals for prototypical transitivity outlined by H&T and Ninio, among others (see Næss 2007 for a discussion of prototypicality and markedness in transitive constructions), it is not clear that these specific differences are relevant for the language-learning child.

Finally, we observed a close relation between Thomas's SVO utterances and those of his mother and of PAS in terms of the animacy of his subjects and objects, with a majority of utterances encoding an animate agent and an inanimate patient. Thus, although Thomas's utterances did not map onto those in his input or PAS in terms of the specific referent types in subject and object position, there was overlap in terms of his broad utterance semantics. One possibility is that his early transitive construction was organised at a very general level in terms of animate agents engaging in interaction with the world in ways which actively involve patients that may be, but are not necessarily, affected by the interaction. This is certainly consistent with Budwig's (1995) work on early notions of agentivity, although in Thomas's data we have not attempted to determine whether different pragmatic functions are associated with different forms of self reference. In recent work, we have evaluated another characterisation of the transitive prototype, namely an utterance in which there is maximal differentiation between the subject (agent) and object (patient), both physically and with respect to the semantic roles that they play in the event

(Næss 2007). Our data suggest that adults show a prototype effect (and mistakenly 'recall' prototypical transitive sentences that they have not heard before), showing that Næss's characterisation of the transitive has some psychological reality for adults. However, 5 year olds did not show this effect, more accurately retaining item-based memory for the exact exemplars they were exposed to in training (Ibbotson et al. in press). This suggests that although a large majority of children's early transitive utterances conform to the prototypical pattern of intentional animate-agent acting on inanimate-patient, this may not amount to the same thing as possessing the kind of tightly integrated network of transitive utterances organised around a semantic prototype proposed for the adult transitive construction.

There are a number of possible reasons for this, two of which we outline here. First, there is a wealth of evidence for individual verb effects in language processing both in children (e.g. Corrigan 1986, 1988; Naigles et al. 2009, Pyykkönen et al. in press) and adults (e.g. Trueswell and Tanenhaus 1994). These verb-specific effects show that even beyond determining whether a given verb can be used transitively (cf. see Naigles [2003] for arguments against indiscriminate verb generalisation), children must establish, at the lexical level, the precise types of objects that are appropriate for use with a given verb or semantic class of verbs to use language conventionally. Second, it is not clear that our intuitions regarding which subjects and objects are animate necessarily match those of the child. In the child's world, inanimate entities are frequently animated and act independently in television programmes and books, and children are prone to talk about what their toys are 'doing' even when the toys are manipulated by the child (especially in blame assignment for misdemeanours—*The car knocked my drink over!*). Thus, we are unable to tell with great accuracy to what extent early transitive utterances exhibit the PAS pattern of animate agents affecting inanimate patients, and thus to what extent they conform to an adult-like prototype.

In recent work building on the competition model (Bates and MacWhinney 1987), some researchers have argued for prototype effects of a slightly different kind in children's acquisition of the transitive construction. The argument goes that the prototype is an utterance in which multiple cues redundantly indicate participant roles, with deviations from the prototype resulting in lower levels of accuracy in children's ability to identify the agent of a transitive causative action (Dittmar et al. 2008b, Chan et al. 2009, Ibbotson et al. 2011). From this perspective, the prototype is not necessarily defined in terms of the semantic relation between the agent and patient (e.g. Næss 2007, Hopper and Thompson 1990), but rather in terms of a set of criteria associated with the agent and/or patient. Thus, the agent might typically be the first mentioned participant in an event, often animate, and represented by a nominative form. Although studies have only been carried out with causative action verbs, these criteria

could equally well apply to non-causative scenes, provided that the 'agent' was animate, and thus constitute a broad schema for the interpretation of the transitive construction. These broad heuristics for sentence interpretation could operate much earlier in development than the more fine-grained semantic representations needed for a full understanding of the prototypicality of agent-patient relations. The current study shows that Thomas's input contained a large proportion of transitive sentences that exhibited the animate-agent inanimate-patient pattern, and only a very small proportion of utterances that showed the reverse animacy pattern. If this is representative of the input children are exposed to, it is perhaps not surprising that children have been shown to be sensitive to animacy in their identification of the agent of an action (Chan et al. 2009), but it is important to note that these kinds of animacy effects do not automatically entail that the animate agent acts entirely intentionally, or that the object of the action is highly affected. Further studies are needed to pinpoint exactly what aspects of animacy are relevant in children's early sentence interpretation strategies.

It is clear that Thomas's transitive construction was undergoing gradual development in production, yet comprehension studies show earlier generalisation in some children with highly causative verbs at least. What then, if anything, can these data say about the comprehension-production asymmetry? Thomas's SVO utterances showed a marked tendency to encode animate agents and inanimate patients, a pattern also mirrored in his input. At the same time, however, his VO utterances frequently contained animate patients thus, for Thomas at least, VO utterances were not simple parallels of SVO utterances, and agents and patients were not clearly differentiated in terms of their animacy. The animacy issue is further confounded by the fact that some inanimate entities may be perceived as animate by young children. If, like Thomas, children typically encounter a range of both agents and patients that exhibit animacy characteristics, this could explain why one of the first things English-speaking children show sensitivity to in their comprehension of the transitive construction is the order of mention of the agent and patient, allowing them to perform accurately in comprehension tests (e.g. Gertner et al. 2006, Ibbotson et al. 2011). Even before children begin to produce transitive utterances themselves they are exposed to very large numbers of utterances in which two participants who may be poorly differentiated in terms of their animacy are causally related, and we might assume therefore that they have developed an effective strategy for interpreting what they hear.

However, the task in production is rather different. Performance-limited, frequency-driven learning provides one explanation for why Thomas produced SVO utterances with pronominal objects and VO utterances with full noun objects, and for why Old verbs showed an advantage over New verbs. But Thomas's SVO and VO constructions also differed in their relation to PAS,

suggesting that he had not yet integrated his knowledge of these partially overlapping constructions. Integration would require a proper understanding of how pragmatic principles influence choice of referring expression. Although even two-year-olds show some sensitivity to discourse pragmatic principles, in the absence of a full understanding, it is perhaps clearer why children are conservative in their use of novel verbs (Tomasello 2003). Knowledge of both the typical realisation of arguments in the input and of pragmatic principles works against the production of two full noun phrases as agent and patient of a novel verb. In addition, children learn a wide range of different semantic verb types from the beginning of acquisition, yet verbs are choosy in their selection of object referents. Children's sensitivity to this property of the input is likely to limit extensive generalisation of the SVO construction across verbs in production.

The data presented in this study suggest that although previous studies have shown children to have some degree of competence in their comprehension of reversible transitive sentences at around age 2;0, Thomas's understanding of how to produce the SVO construction continues to develop throughout his third year. Coming back to our three aims, our data suggest that previous verb use does indeed provide a foundation for later use (aim 1), and this may reflect frequency-driven learning from the input, with the statistical properties of the input driving generalisation when and where it occurs. In terms of aim 2, identifying the semantics of the early transitive construction, this is best captured by a broad range of verb semantics, held together by an intentional agent, and it remains an empirical question when Thomas might arrive at an adult-like prototype of the transitive, however that may be defined. Finally, early but partial knowledge of discourse pragmatic principles appears to interact with Thomas's developing knowledge of the SVO construction, adding a further layer of complexity to the acquisition of the SVO construction in production (aim 3).

Of course, the trade-off for analysing a particularly dense corpus allowing more accurate inferences to be drawn regarding the timing and pattern of acquisition is that this study included data from only one child. It is highly likely that different patterns of acquisition would be observed in other children learning English (e.g. Naigles et al. 2009), and in other languages. On the other hand, nor is the child in this study likely to be unique in his pattern of acquisition. As such, the data presented in this paper require explanation within an integrated theory of how children acquire grammatical constructions, allowing for individual differences in the patterns of acquisition observed. We would predict that with adequate language samples, it should be possible to trace the gradual pattern of acquisition and pinpoint in more detail exactly how knowledge of the transitive construction develops over time, and the relation between comprehension and production. Our hypothesis that children start out with

constructions that are partially related, and at the same time underspecified with regard to their appropriate use, requires further investigation.

Appendix A: Semantic coding criteria

<u>**Ninio's coding categories:**</u>
Obtaining verbs: e.g. *get, give, bring, find, want, take*
Perception verbs: e.g. *see, hear*
Ingestion/consumption verbs: e.g. *eat, drink*
Creation verbs: e.g. *make, do, prepare, build, draw*

These verbs are examples—there are likely to be others that seem to fit these criteria and should be coded as such. The above categories contrast with what Ninio calls 'typical highly transitive verbs such as *kill, break, burn, cut, freeze, roll, clean* and so on, which involve a highly active subject who changes the state of an object by the act' (Ninio, 1999: 642).

<u>**Hopper & Thompson's (1980) High transitivity**</u>:
A hypothetical utterance exhibiting very high transitivity would express affirmatively, and in realis mode, a highly kinetic and punctual telic action, with two or more participants. The agent would be highly potent and act entirely deliberately, and the highly individuated object would be totally affected by the action. The following definitions were used (taken from Hopper & Thompson 1980: 252–253):

KINESIS: Actions can be transferred from one participant to another; states cannot. Thus something happens to Sally in *I hugged Sally*, but not in *I like Sally*.

PUNCTUALITY: Actions carried out with no obvious transitional phase between inception and completion have a more marked effect on their patients than actions which are inherently on-going; contrast *kick* (punctual) with *carry* (non-punctual).

VOLITIONALITY: The effect on the patient is typically more apparent when the agent/subject is presented as acting purposefully; contrast *I wrote your name* (volitional) with *I forgot your name* (non-volitional).

AFFECTEDNESS OF OBJECT/PATIENT: The degree to which an action is transferred to a patient is a function of how completely that patient is

AFFECTED; it is done more effectively in *I drank up the milk* than in *I drank some of the milk*

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