



Teaching verbs through child-directed speech: Are mothers doing it right?

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Abstract

Compared to learning nouns, infants struggle with verb learning and there is limited evidence to indicate whether caregivers are making this process easier through child-directed speech. An infant's ability to learn a new verb is largely affected by the time it is verbalised and when the related action is performed; much evidence supports hearing verbs in non-ostensive contexts (when the action is impending or has recently been completed) to be more beneficial for learning than hearing verbs ostensively (while the action is ongoing). American mother-child play of 18 dyads was coded for maternal verb utterances and related action performance, with dyads categorised by three infant age groups: 6, 12 and 19 months-old. The results did not reflect the findings of previous literature (Tomasello & Kruger, 1992); approximately 61% of maternal verb utterances labelled ongoing actions, 25% labelled impending actions and 14% labelled actions that had just been completed. Mothers uttered significantly more movement-focused verbs in the completed and ongoing conditions than result-focused verbs, with movement-focused verbs more frequently labelling ongoing actions than impending or completed actions. Similar differences between conditions for result-focused verbs did not reach significance. These findings suggest that children are not hearing verbs at the supposed optimum time for learning and maternal action labelling differs depending on verb-type.

Key words: verbs, child-directed speech, language development, action labelling, perceptual demands

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Introduction

Noun-learning versus Verb-learning

Learning how to associate actions and words presents one of the most important linguistic challenges of a child's life. After their first year, infants' capacity for word learning is monumental, but early vocabulary is predominantly comprised of object names, with nominals accounting for about 64% of an English-speaking child's first fifty words (Nelson, 1973). While infants have a robust ability to learn nouns (Ogura, Dale, Yamashita, Murase, & Mahieu, 2006), they trail behind significantly in their verb-learning skills (Waxman, Fu, Arunachalam, Leddon, Geraghty, & Song, 2013).

It has been suggested that children must learn nouns before they start learning verbs, because firstly conceptualising the relationship between nouns and their roles as performers of actions is required for understanding verb meanings (Waxman et al., 2013). More evidence proposes that the relationship between noun-learning and verb-learning may be bi-directional, with nouns helping children learn verbs through the process of syntactic bootstrapping (Yuan, Fisher, & Snedeker, 2012), but known verbs also being used by infants to determine the meanings of novel nouns (Ferguson, Graf, & Waxman, 2014), as well as to acquire additional complex grammatical elements (Bloom, Lifter, & Hafitz, 1980). Furthermore, other elements of grammar have been found to facilitate verb-learning, including adverbs (Syrett, Arunachalam, & Waxman, 2014) and syntax (Arunachalam & Waxman, 2015), for determining the meaning of a novel verb. Ultimately, however, verbs are at the forefront of language comprehension and production abilities (Roseberry, Hirsh-Pasek, & Golinkoff, 2014).

There are numerous possible reasons why verbs are much harder to learn than nouns (Gentner, 1982; Snedeker & Gleitman, 2004; Waxman et al., 2013). Firstly, the concept of a noun – the label of an object – is far more concrete than that of a verb (Gentner, 1982). For example, in the case of a woman opening a door, both the woman and the door remain visually stable and unchanged. The “opening” action, on the other hand, is not stable, but transitory and determinable by a particular moment in time (Waxman et al., 2013). Furthermore, while nouns tend to label more conceptually tangible and therefore easier to understand entities, verbs often describe a variety of concepts outside movement actions, describing more abstract ideas (Bergelson & Swingley, 2013), such as feelings or expressions. The idea that abstractness plays a part in language-learning (Brown, 1958; Naigles & Hoff-Ginsberg, 1998) gains support from a study by Bergelson and Swingley (2013), who found that 6 – 9 month-olds could recognise concrete object words but not abstract non-object labels. Additionally, they found mothers were using these abstract words less frequently than the concrete words while interacting with their children (Bergelson & Swingley, 2013). Imagination may also play a role; nouns may be easier to learn than verbs because they are often used to mark referents that are more immediately conceivable than verbs (Snedeker & Gleitman, 2004), for example, concrete objects such as “teddy” and “cup”, compared to the processes of “hugging” and “drinking”.

The verbs that do appear in early child language-learning and speech production tend to be action words like “go” and “throw” (Snedeker & Gleitman, 2004). This is inconsistent with the frequency of verbs in maternal speech, when verbs that are not movement-focused, such as “think” and “look”, are common (Snedeker & Gleitman, 2004). Infant's conceptual ability is considered to be the determining factor for

children's early verb-learning and production, instead of the frequency of particular verbs uttered by caregivers; "go" and "throw" are far easier concepts to grasp than the more abstract "think" (Snedeker & Gleitman, 2004). Hearing verbs used more frequently in speech has not been found to make learning them easier for infants (Willits, Seidenberg, & Saffran, 2014), thus "think" will remain harder to learn than "go", regardless of how often the infant hears the former.

Verbs may be harder for children to learn, because of the differences in how children are taught nouns and verbs ostensibly, through natural child-directed speech. When opening a door for their child, a parent is more likely to touch the door and explicitly label the object by saying "that is the door", rather than "this is opening" while performing the action. Equally, while taking a walk in the park, a parent may point to a running animal and tell their child "hey it's a dog!", but they are less likely to say "that is running/fetching/panting" etc. This object-labelling is known as "the Original Word Game" (Brown, 1956); a worthy equivalent does not exist for action-labelling in English.

Cultural Differences and Similarities

This advantage for noun-learning over verb-learning may be culturally determined. Some languages are noun-friendly (e.g. English and French), whereby nouns play a significant role in understanding speech by acting as referents. Other languages are considered verb-friendly (e.g. Japanese and Mandarin); in these languages nouns are not always required by the listener to understand a sentence, when the noun has previously been used and the verb provides enough context (Waxman et al., 2013). These language-specific structural aspects give rise to assumptions about children's order and ability of word-type learning; it is not unreasonable to assume that children acquiring verb-friendly languages will learn verbs easier than nouns, as verbs appear more commonly in speech. However, this instead is another example of frequency in speech not correlating with facility (Willits et al., 2014). As nouns are considered to be integral in learning the concepts behind verbs, instead of verbs being easier to learn in verb-friendly languages, the lower frequency of used nouns may actually pose greater difficulty to these children for verb-learning (Waxman et al., 2013). Indeed, studies involving introducing children of either noun-friendly or verb-friendly languages to novel nonsense words have found that this noun-advantage applies cross-culturally (e.g. Imai, Haryu, & Okada, 2005).

Action Labelling Positioning

Importantly, learning novel words goes beyond labelling objects and direct teaching (Callanan, Akhtar, & Sussman, 2014) and, crucially, learning novel verbs goes beyond observing events (Hirsh-Pasek & Golinkoff, 2006). Both linguistic cues (e.g. Naigles, Fowler, & Helm, 1992; Arunachalam & Waxman, 2015) and social cues (e.g. Imai et al., 2005; Roseberry et al., 2014) have consistently been shown to play substantial roles in verb-learning. Of the latter, behavioural cues represent a key aspect of verb-learning, as they help children establish the focus of an adult's attention when referring to a specific action (Tomasello & Kruger, 1992). These cues differ depending on the demonstrational context, which may be either ostensive or non-ostensive. Ostensive contexts refer to labelling utterances (Callanan et al., 2014), whereby verbs are used to label currently ongoing actions attended to by both speaker and listener. In non-ostensive contexts, verbs are used to request or anticipate actions that are impending, or to remark on actions that have just been completed (Tomasello, 1992; Tomasello

& Kruger, 1992). Since the relevant action is not perceptually available at the time of reference, children must use other cues to assess what the verb refers to. In the impending context, this might include a preceding question, e.g. “can you do it?” or an anticipatory expressive term (Gentner, 1982), e.g. “look!”, whereas commenting on the changed state of an object may be a cue in the completed context (Tomasello & Kruger, 1992). Callanan et al. (2014) reserve the term “labelling” for ostensive contexts. However, in this study, ongoing, impending and completed contexts will be referred to as action labelling positioning (ALP), maintaining that actions can also be labelled before and after they have occurred, not only ostensively while they are occurring.

When verbs are used to label actions, it is important that this happens correctly and at the optimal time for children to attend to both the word and the action. It is commonly believed that children learn novel verbs best in non-ostensive contexts, when the labelled action is impending or had just been completed, rather than in ostensive contexts, when the action is ongoing; a concept supported by the work of Tomasello and Kruger (1992, Study 2). When introducing 24 months-olds to novel verbs, they found the children were more successful at learning verbs that were used to declare, anticipate or request an upcoming action, rather than those that labelled actions perceptually available to the children and occurring at the same time as the verb utterance (Tomasello & Kruger, 1992). Tomasello (1995) found similar learning biases, but additionally discovered that children also succeeded at learning verbs better when they had been uttered after the related action had been completed, compared to while the action was ongoing.

Tomasello (1995) suggests that non-ostensive contexts may be more advantageous for verb-learning than ostensive contexts because of the attentional demands of hearing and understanding a new verb while also focusing on a perceptually available action; a child will struggle more with learning the name of an action when they also have to focus on the action’s performance. These demands may be stronger with novel and engaging actions, holding the child’s focus and causing them to ignore the verb being uttered (Tomasello & Barton, 1994; Tomasello, 1995). Hearing a verb labelled before or after the action occurs frees the child to devote their attention to the word, thus reducing their perceptual demands (Tomasello, 1995). Other research, however, suggests that non-ostensive contexts may not always overshadow ostensive contexts; for example, Tomasello and Barton (1994) found that 24 month-olds learnt novel verbs equally well in both impending and ongoing contexts. It seems likely that certain conditions may dictate whether children will learn novel verbs better in ostensive and non-ostensive contexts, such as directing attention, verb-type and action focus (Tomasello, 1992; Tomasello & Barton, 1994). This is certainly the case for novel noun-learning (Callanan et al., 2014; Shimpi & Huttenlocher, 2007), although noun and verb-learning remain distinct language processes (Hirsh-Pasek & Golinkoff, 2006), so assumptions about similarities will remain no more than speculation until further experimentation is undertaken.

Few studies have addressed what caregivers are actually doing when they speak to their children, regarding their verb usage. Most notably, Tomasello and Kruger (1992, Study 1) conducted a study with 15 month-old children, recording them playing with their mothers in a naturalistic setting. Maternal verb utterances were coded, to determine how frequently they labelled impending, ongoing or completed actions. Analysis revealed that 60% of maternal verb utterances labelled actions that were

impending, while only 30% labelled actions that were ongoing (Tomasello & Kruger, 1992). These findings suggest that mothers' actual child-directed speech corresponds to the most effective manner in which children learn verbs. Importantly, to the best of my knowledge there has not been another study since that has attempted to replicate these findings.

Verb-type

Not only do verbs differ greatly from nouns in their meaning, structure and difficulty of learning, but verbs themselves are distinct from one another, in relation to how they are learnt. Abstractness represents one of these differences; Hirsh-Pasek and Golinkoff (2006) suggest that verbs (and words in general) exist on a continuum of concrete to abstract, with learning words closer to "abstract" on the continuum requiring more linguistic and social cues. Different cues might also be required for verb-learning, depending on the event's focus; another major difference between verb-types. Verbs may be defined by the manner of a movement (e.g. to sway, to roll) or by a change in state (e.g. to break, to fill), amongst many other classes (Levin 1993). Research has found evidence that the optimum ALP contexts differ between these manner (or movement-focused) verbs and change in state (or result-focused) verbs (Ambalu, Chiat and Pring, 1997).

Ambalu and colleagues (1997) investigated impending and completed ALP conditions and the event-focus of verbs. Thirty English-speaking children were presented with two nonsense verbs ("*pog*" and "*bock*"), each with two different events – either a movement continuing for a short while and then ceasing (movement-focused), or a movement that occurred and resulted in a change in state (result-focused). Results from this experiment showed that the movement-focused verb ("*pog*" – the action of spinning an object on a wheel) was learnt significantly better in the impending condition ("look I am going to *pog* the ring") than in the completed condition ("look I *pogged* the flower). Children were found to largely ignore the movement-focused verb if it had been uttered after the movement had been completed, whereas hearing the verb before the movement incited the children to focus on the coming action (Ambalu et al., 1997). Additionally, the result-focused verb ("*bock*" – the action of stamping a print on paper) was learnt significantly better in the completed condition ("look I *bocked* the paper") than in the impending condition ("look I am going to *bock* the card", Ambalu et al., 1997). To explain this, children are thought to effectively map a change in state to a result-focused verb when the action is labelled after it has been completed, if said change remains observable and salient (Behrend, 1990; Ambalu et al., 1997).

Research in this specific area is relatively limited, especially compared to the wealth of literature on noun-learning and labelling contexts (e.g. Tomasello & Farrar, 1986; Callanan et al., 2014; Masur, Flynn, & Lloyd, 2013). However, Ambalu and colleagues' findings provide an inviting starting point for observational investigations of child-directed speech that specifically address verb-type; an area that would add to the current research on maternal verb use initiated by Tomasello and Kruger in 1992.

Study Aims

Early experimental studies give an insight into how children best learn verbs, and how this learning may differ based on verb-type. Tomasello and Kruger's (1992) research has provided an observational understanding of what is occurring during play-based child-directed speech and has been referenced by numerous publications of child

verb-learning (e.g. Tomasello & Barton, 1994; Ambalu et al., 1997; Ibbotson, Lieven, & Tomasello, 2014; Gampe, Brauer, & Daum, 2016). It is currently largely understood that mothers use verbs more commonly to label actions that are impending, rather than ongoing, based on the results of this single study. Consequently, it is hugely necessary to attempt to replicate Tomasello and Kruger's findings, to assess the consistency of those claims.

The current exploratory study will address the relationship between verb utterances and ALP, by analysing the verbs used in mothers' child-directed speech during play and measuring the times at which they occur, relative to the associated actions being performed. Two research questions will be asked; firstly, *do mothers label actions with verbs more frequently when the action is impending, ongoing or has just been completed?* This questions aims to replicate Tomasello and Kruger's (1992) research, with a different sample and more updated coding and annotation methodology. The second research question – *do mothers label verbs differently, depending on whether they are movement-focused or result-focused?* – aims to fill a gap in the literature, as the use of different verb-types in child-directed speech has not yet been studied in a naturalistic play-based context. The implications from the results of these observational findings will provide a context for further experimental areas of research looking at the different ways children learn verbs. This work is part of a larger project in collaboration with Michael Frank (Stanford University), Matthew Valteau and Sudha Arunachalam (Boston University).

Method

The present study received ethics approval from the University of Bath Psychology Ethics Committee. The videos and audio used in this study were originally recorded by Fernald and Morikawa (1993). Their corpus analysed cross-cultural linguistic differences and included both American and Japanese mother-child dyads; however the current study only utilises the recorded data of the American mother-child dyads. Thanks to Michael Frank (Stanford University) for providing access to this data source.

Design

The design of the present study was observational, assessing mother-child dyads in a naturalistic setting. The corpus involved transcribed recordings of toy-based play between mother and child pairs in their own homes, joined by two female observers. Age group of the child, ALP and verb-type were the independent variables in this study, while frequency of verb utterances was the dependent variable.

Participants

Mothers were recruited at a university hospital and were all white, middle-class occupants of a wealthy suburban area with two to four years of university education. The original corpus included 30 American mother-child dyads, however this study analyses only 18 of those pairs, as some videotapes had to be excluded due to poor recording quality and file corruption. Dyads were categorised according to the age of the infants, for which there were three age groups; 6 month-olds (N = 8, 4 females; all 6 months-old), 12 months-olds (N = 6, 2 females; range = 11 – 13.5; average age = 12.05) and 19 months-old (N = 4, 2 females; range = 18 – 20; average age = 19).

Procedure

Mother-child dyads played together using the child's own toys for a variable period of time until the child became comfortable with the recording environment and observers. These toys were then removed and three standardised sets of toys were introduced; two cuddly toys (a pig and a dog), two wooden vehicles (a truck and a car) and a brush and box. Mothers were asked to use the toys to play with their children as they would in a normal play session. The participants were given the sets of toys consecutively, for 3 – 5 minutes each, varying on the interest of the infant. The order in which the cuddly toys and vehicles were presented was counterbalanced, but the brush and box were produced last each time and only the 12 and 19 month-old age groups received these particular toys. A total of 5 hours, 15 minutes and 52 seconds of audio and visual data were analysed (6 month-olds = 1 hour, 11 mins, 52 secs; 12 month-olds = 2 hours, 23 mins, 42 secs; 19 month-olds = 1 hour, 40 mins, 18 secs), along with the annotation of 390 verb utterances.

Videos were recorded using a Panasonic WV-3250 camera and a Panasonic PV-9000 portable video recorder, while audio was recorded using a Sony TG-D5M professional quality recorder (Fernald & Morikawa, 1993). Utterances from the audio recordings were coded using the speech analysis programme, Praat, while visual information from the video recordings was coded using VideoTextGridProgram; software created specifically for this analysis (Valleau, 2014).

Audio files were annotated by two coders. On a random file, percentage agreement within 500 ms was calculated to assess inter-rater reliability, giving 85.1% for the utterance start and end times and 87.5% for the total difference between start and end times. These levels of agreement were considered above acceptable.

Annotation Procedure for Analysis

The initial transcription of mother-child interactive speech was amended in Excel to extract utterances involving no verbs. Annotation involved two distinct stages; firstly, using Praat to segment the mothers' speech into utterances in which verbs appeared and exporting the start and end timings of each utterance. These utterances were either whole sentences involving a verb or simply the mention or repetition of a verb, and were annotated from the moment the sound started to as soon as the utterance ended.

In the second stage, these Praat timings were used to annotate the actions of the mothers and children on the video files. The utterance timings were imported into VideoTextGridProgram, where they were used to find where referenced actions were taking place in the video. A new set of timing were annotated, indicating when the action began and when it had visibly ended. Verb utterances that did not label an associated action performed by either mother or infant were excluded from the data set. Similarly, actions either the mother or child were executing at the time, but had no relation to the verb utterance, were ignored.

These utterance and action timings (in milliseconds) were then exported to Excel, where both sets were compared against each other to calculate if utterances were verbalised when the action was impending, ongoing or had just been completed.

Impending: The action was considered to have occurred after the utterance if the action start time was greater than the utterance end time.

Completed: The action was considered to have occurred before the utterance if the action end time was lower than the utterance start time.

Ongoing: The action and utterance were deemed to be occurring simultaneously when the utterance and action start timings were the same, or if the action start time was lower than the utterance end time (the action started before the utterance had ended).

Coding and Analysis

Verbs were coded for if they were in their canonical (dictionary) form and if they appeared as a compound phrase (e.g. “wanna play ball” coded for as “want, play”). Verb utterances in question formats were also coded. For words that could be considered either a noun or verb (e.g. “brush”), the context of the sentence was used to determine the word-type and only verb forms were coded.

Exclusion criteria. Due to the focus on verbs and expressive actions, auxiliary verbs (e.g. “do”, “will”) were not coded, nor were any forms of “be” or modal verb forms (e.g. “must”, “can”). Simple future verb forms (“will”, “going to”/“gonna”) or the cohortative “let’s” were also excluded. As an auxiliary verb, “have” was not coded, but it was also excluded as a possessive verb, unlike “hold” which demonstrates a clear action.

Owing to the nature of play, the commands “look!” and “see!” were common, but were not coded as these were considered to be closer to expressive terms (Gentner, 1982) than action words. However, “look at...” or “see the...” was included if the child visibly changed their attentional focus to what the mother was referring to. Utterances containing mental verbs (e.g. “wish”) or those that referred to events beyond the current play context (e.g. from the distant past or future) were also excluded. “Go” was coded if it referred to a movement (e.g. “go round and around”), but not if it referred to making a noise, in which case it was considered to be onomatopoeic, not movement-focused (e.g. “go vroom”).

In the primary annotation stage (simply marking which utterances mentioned verbs), all repetitive utterances involving verbs were included. However, when annotating where an action was taking place, repeated utterances and actions were excluded if they occurred immediately after the original (which was coded) and if the same action was executed by the same actor. Utterances that were very similar in structure but not identical in meaning were not counted as repetitions (Fernald & Morikawa, 1993). Conversely, when repetitions that were not syntactically identical, but were semantically identical, occurred immediately in sequence (e.g. “you taking a drink?”... “are you having a drink?”), the second utterance was excluded.

Verb-type classification. The second research question asked if mothers are labelling actions at different times, depending on verb-type. To address this, Levin’s English Verb Classes and Alternations – a semantic classification system (Levin, 1993) – was used to help classify verbs as either “result-focused”, “movement-focused” or “other”. Only verbs demonstrating a distinct action (e.g. “brush”, “push”) were coded as movement-focused verbs, while those encoding a change in state of

an object (e.g. “open”, “close”) were coded as result-focused verbs (Levin, 1993). “Other” verbs were ignored for the purpose of this research question.

Annotation challenges. Annotating verb utterances was not always as straightforward as “open the door” or “brush the doggy’s hair”. Some utterances involved more than one verb, for example “try to go forward”. In these cases, the most relevant verb and action for this analysis was annotated; in this example, this would have been “go”. Another example would be “let’s watch them both drive”, in which case “drive” would have been coded. These decisions were made based on which verb had a more obvious action associated with it. Additionally, “try” and “watch” are neither movement, nor result-focused verbs, so were less useful for the second research question. Some utterances included multiple verbs, but only one verb corresponded with a visible action, in which case this was the only verb coded.

Certain verbs were also considered to be ambiguous and therefore the decision to annotate was based on the coder’s justification for a definite action occurring with it. For example, “come to life” was coded in one instance because the child moved the toy as if to animate it. Appoint verb utterances (Levin, 1993), such as “do you *want* the pig”, were only coded in the cases either child or mother could be seen actively reaching or gesturing for something, with “want” referring to the action of obtaining (e.g. “want the doggy”) but not when expressing the desire to do a separate action (e.g. “do you want to sit up with it?”).

Results

Research Question 1: Action Labelling Positioning

The first question to address from the data was whether mothers label actions more frequently when the action is impending, ongoing or had just been completed. The descriptive statistics (Table 1) indicate that the majority of maternal verb utterances labelled ongoing actions, while impending actions were far less frequently labelled. These results do not reflect those presented in previous literature (Tomasello & Kruger, 1992). Actions that had just been completed were the least frequently labelled.

Table 1.

Means of verb utterances across individuals in each ALP condition for the three age groups, with percentages in brackets (N = 18)

Age group	Impending	Completed	Ongoing
6	3.38	2.38	10.25
12	5.83	1.50	17.17
19	8.50	5.50	14.75
Mean	5.90	3.13	14.06
	(25.55)	(13.56)	(60.89)
SD	0.91	0.60	2.29

Tests of one-way repeated measures ANOVA were run to analyse the significance of the differences between ALP conditions. Mauchly's Test indicated that the assumption of sphericity had been violated; $\chi^2(2) = 14.004$, $p = .001$, therefore Greenhouse-Geisser corrected tests are reported ($\epsilon = .613$).

No significant effect of age group on action positioning was found, $F(2.451, 18.380) = 1.007$, $p = .399$, $\eta^2_p = .118$. This suggests the age of the infant did not influence whether the action was labelled most frequently when impending, ongoing or completed. An extremely significant effect was found for ALP, $F(1.225, 18.380) = 18.655$, $p < .001$, $\eta^2_p = .554$, suggesting mothers were uttering verbs significantly differently depending on whether the action was impending, ongoing or had just been completed.

Pairwise comparisons using the Bonferroni adjustment revealed that mothers were labelling impending actions more frequently than actions that had just been completed (means and SDs; 5.903 ± 0.909 vs 3.125 ± 0.595 , respectively), with a significant difference found between the impending and completed conditions (mean difference = 2.778 , $p = .017$, 95% CI [$0.455, 5.101$]). Maternal utterances labelled ongoing actions significantly more frequently than those that were impending (14.056 ± 2.287 vs 5.903 ± 0.909 , respectively; mean difference = 8.153 , $p = .008$, CI [$2.013, 14.293$]) and significantly more frequently than those that had just been completed (14.056 ± 2.287 vs 3.125 ± 0.595 , respectively; mean difference = 10.931 , $p < .001$, CI [$5.254, 16.608$]). These results indicate that mothers were labelling verbs more frequently in ostensive contexts than in non-ostensive contexts and that between the non-ostensive conditions, significantly more actions were labelled when they were impending than when they had just been completed.

Research Question 2: Verb-type and Action Labelling Positioning

Previous literature has yet to address if mothers are labelling movement-type and result-type verbs differently, with respect to ALP conditions. Evidence suggests that children learn movement-type verbs better if the utterances are verbalised when the related actions are impending, while result-focused verbs are learnt best when the actions had been completed just before they were labelled (Ambalu et al., 1997).

Table 2 shows the twenty most frequently uttered verbs with associated actions, excluding verbs that are neither movement nor result-focused. This illustrates that, while the most commonly uttered verb is a result-focused verb (open, $N = 33$), overall the most commonly uttered verbs during mother-child play were movement-focused verbs.

Table 2.

Twenty most commonly uttered verbs

Verb	Frequency of Utterance	Verb-type
open	33	result
come	27	movement
brush	20	movement
close	13	result
go	10	movement
shut	9	result
move	6	movement
push	6	movement
fall	5	movement
make go	4	movement
sit	4	movement
throw	4	movement
grab	3	movement
tickle	3	movement
drive	2	movement
hit	2	movement
kick	2	movement
reach	2	movement
ride	2	movement
roll	2	movement

Table 3.

Means and standard deviations of movement-focused and result-focused verb utterances across individuals in each ALP condition, with percentages in brackets (N = 18)

	Movement-focused		Result-focused	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Impending	1.39 (18.81)	1.38	0.94 (28.23)	2.07
Completed	0.94 (12.72)	1.31	0.39 (11.71)	0.78
Ongoing	5.06 (68.47)	4.11	2.00 (60.06)	3.25

The descriptive statistics in Table 3 reveal that maternal movement-focused verb utterances labelled more impending actions than completed actions. However, mothers most frequently labelled movement-focused verbs when the actions were ongoing; a finding that does not reflect the suggested optimum ALP timing for children hearing movement-focused verbs (Ambalu et al., 1997). Maternal result-focused verb

utterances labelled more impending actions than recently completed actions, but the majority labelled ongoing actions. These results also fail to complement the suggested optimum ALP timing for children hearing result-focused verbs (Ambalu et al., 1997).

A two-way repeated measures ANOVA was carried out on the main effects of verb-type and ALP, and the verb-type by ALP interaction. Only result-focused and movement-focused verbs were analysed; “other verbs” were excluded. Mauchly's test indicated that the assumption of sphericity had been violated for the main effect of ALP; $\chi^2(2) = 11.680$, $p = .003$, therefore Greenhouse-Geisser estimates of sphericity were used to correct the degrees of freedom for this effect ($\epsilon = .659$). The interaction between verb-type and ALP did not violate the assumption of sphericity; $\chi^2(2) = 3.899$, $p = .142$. Sphericity was met for verb-type.

Results indicated that there was a significant main effect of verb-type, $F(1, 17) = 6.253$, $p = .023$, $\eta^2_p = .269$, with movement-focused verbs being labelled more frequently than result-focused verbs (2.463 ± 0.413 vs 1.111 ± 0.389 , respectively; mean difference = 1.352 , 95% CI [$0.211, 2.492$]).

An extremely significant main effect was found for ALP, $F(1.317, 22.397) = 14.568$, $p < .001$, $\eta^2_p = .461$, with maternal verb utterances labelling significantly more ongoing actions than impending actions (3.528 ± 0.671 vs 1.167 ± 0.291 , respectively; mean difference = 2.361 , $p = .007$, 95% CI [$0.602, 4.121$]) and significantly more ongoing actions than completed actions (3.528 ± 0.671 vs 0.667 ± 0.221 , respectively; mean difference = 2.861 , $p = .001$, CI [$1.115, 4.608$]). Maternal verb utterances labelled more impending actions than completed actions, but the difference was not significant (1.167 ± 0.291 vs 0.667 ± 0.221 , respectively; mean difference = 0.500 , $p = .341$, CI [$0.296, 1.296$]). This pattern is therefore not the exact same as that found in Research Question 1, with the lack of significance between impending and completed conditions likely due to the exclusion of “other verbs”.

A significant interaction between verb-type and ALP was also found, $F(2, 34) = 5.570$, $p = .008$, $\eta^2_p = .247$. Pairwise comparisons using the Bonferroni adjustment were carried out to further identify the source of this interaction.

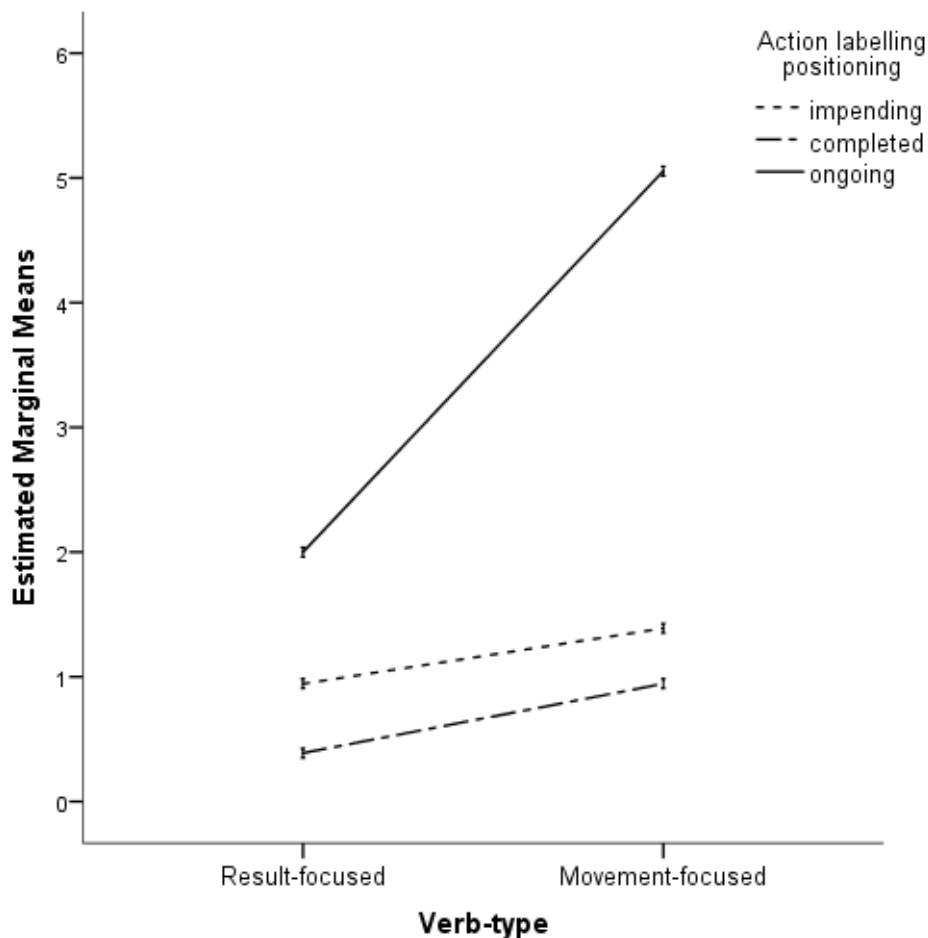


Figure 1. The interaction between verb-type and action labelling positioning

Comparing ALP between verb-type. Figure 1 indicates that movement-focused verbs were being labelled more frequently than result-focused verbs in all three APL conditions. However pairwise comparisons revealed the difference between movement and result-focused verbs in the impending condition was not significant ($p = .461$). Conversely, mothers labelled more movement-focused verbs than result-focused verbs in the completed condition and this difference was reasonably significant (mean difference = 0.556, $p = .037$, 95% CI [0.038, 1.074]). A significant difference was also found for mothers labelling more movement-focused verbs than result-focused verbs in the ongoing condition (mean difference = 3.056, $p = .014$, CI [0.695, 5.416]).

Comparing ALP within verb-type. Pairwise comparisons revealed that, for result-focused verbs, the differences between any of the three APL conditions did not reach significance: between impending and completed, $p = .845$; impending and ongoing, $p = .391$; completed and ongoing, $p = .123$.

For movement-focused verbs, the difference between the impending and completed conditions was not significant ($p = .809$). However, the differences between the other paired conditions did reach significance, with mothers labelling movement-focused actions more frequently in the ongoing condition than in the impending condition (mean difference = 3.667, $p = .003$, 95% CI [1.210, 6.123]) and in the ongoing

condition compared to the completed condition (mean difference = 4.111, $p = .001$, CI [1.637, 6.585]).

Discussion

Action Labelling Positioning

Approximately 61% of maternal verb utterances in this study labelled ongoing actions, while 25% labelled actions that were impending and 14% labelled actions that had just been completed. Results from a one-way ANOVA revealed a significant effect of ALP on verb utterance frequencies, with a large effect size indicated by partial eta-squared suggesting this effect is also likely to be occurring in the wider-population of American mothers. Additionally, the differences between all ALP conditions reached statistical significance. These findings suggest that, during a play-based setting, mothers are not labelling actions at the supposed optimum time for children to learn verbs (Tomasello & Kruger, 1992); significantly more verbs were labelled ostensively than non-ostensively. Importantly, these findings contradict Tomasello and Kruger's (1992) previous research, which found over 60% of maternal verb utterances referred to actions that were impending and 30% referred to ongoing actions.

There are a number of possible reasons for why these results do not replicate those of Tomasello and Kruger. Firstly, the videos in the latter study were coded over three decades earlier, for a different study (Tomasello & Farrar, 1986). Thus, it is fair to suggest that the methodology in the current study was more advanced, implementing strict boundaries for utterance and action annotation and utilising a specially-made programme that allowed for extremely accurate annotations of actions' start and end points (Valleau, 2014). Conversely, the annotation methodology used by Tomasello and Kruger is unclear.

Additionally, it is unspecified in Tomasello and Kruger's methodology exactly how they classified the "impending", "ongoing" and "completed" conditions. In the current study, this was measured to the millisecond; for example, if the end time of an action was 268967 ms and the utterance start time was 269001 ms, the action was considered to have been "completed" before the verb utterance. This would have been especially important for the ongoing condition; in the current study, actions and utterances were classed as occurring simultaneously if the utterance and action start timings were the same, or if the action start time was lower than the utterance end time. These were the boundaries deemed most accurate for the term "ongoing", but alternate boundaries for this condition, such as disregarding lower action start times than utterance end times, would have given lower frequencies in the ongoing ALP condition.

A further explanation for the disparities between the results of these two studies may be a matter of the verbs chosen for exclusion. One important difference is the inclusion of "see" and "look" in Tomasello and Kruger's study (see Table 3, Tomasello & Kruger, 1992); utterances that were excluded as single words in the current study because they were regarded as expressive terms (Gentner, 1982), rather than action words. In Tomasello and Kruger's study, these two words were among the top five most frequent maternal verbs, though it is unspecified if the single-word forms were included. It is reasonable to suggest that before exclusion in the current study, "see" and "look" utterances would have featured commonly in the impending context, as they would

have been used to direct the child's attention towards something, thus being uttered before the child "looked" (i.e. turned their head). Perhaps if these two words had not been excluded in the current study, the figures in the impending condition would be higher. Additionally, the high frequency of "see" and "look" utterances in Tomasello and Kruger's study may possibly go towards explaining the high frequency of maternal verbs uttered in the impending context.

Verb-type

The results from this study suggest mothers are labelling both movement-focused and result-focused verbs most frequently when the action is ongoing, only moderately frequently when the action is impending and least frequently when the action had just been completed. Overall, these movement-focused verbs were being labelled more frequently than result-focused verbs. A two-way repeated measures ANOVA revealed the main effects of verb-type and ALP, and the interaction between verb-type and ALP all reached statistical significance. Additionally, all three effect sizes were large, indicating that these results are likely to reflect what is occurring in real-world settings.

Post-hoc tests revealed two important findings that suggest mothers are labelling actions differently, depending on verb-type. Firstly, maternal verb utterances labelled significantly more movement-focused verbs in the completed and ongoing conditions than result-focused verbs. No significant differences were found between movement and result-focused verbs for impending actions, however, so this labelling difference between verb-type appears to be dependent on the ALP context. Secondly, maternal movement-focused verb utterances significantly labelled more ongoing actions than impending actions, and more ongoing actions than actions that had just been completed. Movement-focused verbs cannot be said to be labelled differently across non-ostensive contexts, since the difference between the impending and completed conditions was not significant. Furthermore, it is not possible to say that mothers were labelling result-focused verbs differently, according to ALP, since none of the differences between the three ALP conditions reached significance.

It is possible that the very high frequency in the ongoing condition for movement-focused verbs, compared to the impending and completed conditions, may be partly due to two common types of action execution and labelling: the mother carrying out an action and demonstratively labelling it as she goes ("Oh let's turn it around"), and the child executing the action with the mother narrating the play ("Ah, brush your hair"). By nature, this sort of ongoing narration is likely to happen more with verbs focused on the occurring motions than with result-focused verbs whose end states are the focus. This may also help to explain why a similarly high frequency of the ongoing condition was not found for result-focused verbs.

The significantly higher frequencies of movement-focused utterances in the completed and ongoing conditions, compared to result-focused verbs, are likely due to movement-focused verbs generally occurring more frequently during parent-child play. From the list of the twenty most frequently uttered verbs (Table 2), it is evident that movement-focused verbs were more commonly uttered than result-focused verbs during the play sessions; only three verbs out of the top twenty were result-focused. It appears there is a verb-type bias during parent-child play, in which mothers tend to label movement-focused actions more than actions resulting in a change in state.

It is important reiterate that hearing verbs more frequently in speech does not necessarily make learning them any easier; even when common verbs occur frequently in speech, 9.5 month-olds fail to recognise them (Willits et al., 2014). However, when the same verbs appear in *-ing* frames, infants as young as 7.5 months old can recognise them in speech (Willits et al., 2014). Thus, perhaps future experimentation should address the verb frames in relation to ALP. This would be especially relevant in a study investigating infants as young as 6 and 12 months-old, since other aspects that facilitate verb-learning, such as imitation, are largely only effective in older and more developed children (Gampe et al., 2016).

Overall, based on previous research that has looked at verb-learning and ALP, the mothers in this study were not labelling either movement-focused or result-focused verbs at the theoretical optimum time for children to learn them (Ambalu et al., 1997). When children hear a verb that describes a movement after it has taken place, they are likely to ignore the verb. On the other hand, if they hear the same verb before the movement occurs, the child is more likely to notice and focus on the following movement (Ambalu et al., 1997). Children are believed to learn verbs describing a change in state better when the action is completed before the verb is labelled, but the result of this change is still salient and observable (Ambalu et al., 1997; Behrend, 1990). However, Ambalu et al.'s (1997) study, on which most of this optimum timing theory originates, only looked at the impending and completed ALP conditions and did not investigate whether movement or result-focused verbs are learnt more or less effectively when the action is ongoing. In fact, Tomasello (1992) found that verbs labelling changes of state were often learnt by children non-ostensively, while verbs for distinct actions were largely learnt in ostensive contexts.

Therefore, the research must be extended into child experiment studies, to determine what the best ALP conditions for learning result and movement-focused verbs are; until then it is not possible to say for certain that mothers are labelling movement and result-focused verbs incorrectly for verb-learning. In fact, there is some support for mothers labelling movement-focused verbs correctly. In accordance with the research of Ambalu et al. (1997), the children in the current study were hearing more movement-focused verbs before the actions they described occurred, rather than after the actions had taken place, although importantly the difference between these ALP conditions did not reach significance. Furthermore, the majority of movement-focused verbs were labelled ostensively, complementing Tomasello's (1992) findings.

Children have been found to demonstrate a result bias, showing a preference for associating a verb label to the result of an action, rather than its manner (Brandone, Pence, Golinkoff, & Hirsh-Pasek, 2007). Manner verbs fall into the category of movement-focused verbs (Levin, 1993). Brandone et al. (2007) suggest that this bias may be caused by greater attention to the results of an action that are perceptually available at the time. It would be necessary to examine this result bias in different ostensive and non-ostensive contexts, to find if children continue to map verb labels to an action's result while the action is ongoing, or if the perceptual salience of the action's manner and simultaneous verb labelling causes children to overcome the result bias and map verb labels to the manner instead.

General Discussion

The optimum timing for verb-learning is likely to be more complex than a simple ostensive versus non-ostensive context matter. Labelling objects while they are perceptually salient has been suggested to be more beneficial for children learning verbs, as this follows the child's focus of attention (Callanan et al., 2014). This is in contrast to the re-directing of a child's attention when verb utterances are directive (i.e. in non-ostensive contexts, such as verbalising an anticipated action). Indeed, better word-learning has been found to occur during mother-child interaction when the words referred to objects already attended to by the child, as opposed to word referents intended to redirect the focus of the child's attention (Tomasello & Farrar, 1986). Conversely, directive utterances have also been found to aid word-learning in instances where they were supportive and complemented the child's focus of attention (Masur et al., 2013) or actually succeeded in redirecting the child's focus (Shimpi & Huttenlocher, 2007). Importantly, such previous literature did not focus on verb-learning and determining whether maternal verb utterances in the current study were attention-directing, labelling already attended-to actions, supportively directive or successfully directive is beyond the scope of this paper. However, these findings do support the speculation that ostensive contexts may not be as ineffective for verb-learning as they are currently believed to be. Indeed, this idea has already been somewhat suggested by Tomasello and Barton (1994), who found children learnt novel verbs equally as well when the action was impending or ongoing. This area of research would benefit from further experimental studies addressing attention and verb-learning specifically.

Ultimately, this study is concerned with the learning of novel verbs, not simply hearing verbs in speech. To the best of my knowledge, no other naturalistic studies exist that have addressed verb use in child-directed speech with children as young as 6 or even 12 months-old. It is likely that maternal child-directed speech will include verbs 6 and 12 month-olds do not know, or are at least new to them in more of a direct context rather than in overheard speech (although it is important to note that research consistently shows vocabulary learnt during infancy can occur through overhearing, e.g. Floor & Akhtar, 2006). We are, however, beginning to better understand the word-learning capabilities of young infants in experimental settings. The idea that children learn nouns much more easily than verbs is well-documented in the literature (Gentner, 1982; Snedeker & Gleitman, 2004; Waxman et al., 2013), with infants showing the ability to recognise nouns in fluent speech as early as 6 months-old (Bortfeld, Morgan, Golinkoff, & Rathbun, 2005), but failing to recognise clear verbs at 10.5 months of age (Nazzi, Dille, Jusczyk, Shattuck-Hufnagel, & Jusczyk, 2005). However, there is evidence that children between 10 and 12 months of age are able to categorise dynamic human-performed actions, which is needed for learning movement-focused verbs (Song, Pruden, Golinkoff, & Hirsh-Pasek, In Press) and may be essential for more generalised verb-learning. The lack of verb discrimination or closely related foundational abilities in infants at 6 months-old strongly suggests that such language processing is simply beyond their developmental reach. However, there is evidence that novel word acquisition through statistical learning does occur in children as young as 3 months-old (Friedrich & Friederici, 2015). Thus, examining how caregivers use verbs when playing with their 6 and 12 month-olds is important, as verb-learning processes do not wait to begin when children are developed enough to explicitly comprehend or produce verbs themselves.

Results from a recent study indicated the importance of imitation in verb-learning of 2 – 3 year-old children; children's imitation success was found to positively correlate with novel action label learning abilities (Gampe et al., 2016). Thus, the current research could be extended to examine imitation and modelling during mother-child play, by coding the instances mothers performed an action, followed by imitation of the child. However, Gampe et al.'s research suggests that learning verbs via imitation is unlikely to be effective in children as young as 6 and 12 months old, as their ability to perform more complex actions is limited. Therefore, further analysis might involve determining if differences exist between age groups for modelling and imitation-based child-directed speech.

This corpus was appropriate for the current study for a number of reasons. Firstly, the inclusion of audio and visual information allowed relative timings to be measured quantitatively between utterances and the actual execution of actions by both mother and child. Additionally, when one form of recorded information was unclear (which was inevitable with the quality of relatively old recordings), the other could be referred to for contextual evidence. For example, determining which objects the mother was referring to in her utterances if the visuals were not clear, or where the mother or infant's focus of attention was if the audio was indistinguishable, based on their eye-gaze. Lastly, toy-based play ensured that verb-usage would be abundant in the child-directed speech, compared to book-reading, for instance, during which nouns dominate over verbs (Tardif, Gelman, & Xu, 1999).

Methodologically, this study is limited by a number of participant-related factors. Firstly, focusing solely on middle-class white mothers with at least two years of university education ignores the differences that exist for child-directed speech between parental genders, socioeconomic status (SES) and cultural backgrounds. For example, differences in child-directed speech have been found between parents of low and high SES (Hoff, 2003; Rowe, 2008). High SES parents' child-directed speech appears richer in vocabulary and lengthier in utterances than that of low SES parents; elements that are reflected in the greater vocabulary development of high SES children, compared to that of low SES children (Hoff, 2003). Maternal and paternal child-directed speech has been found to differ in lexical diversity and utterance length (Rondal, 1980), and with fathers now more commonly playing the role of stay-at-home dads and regularly interacting with their infants, it is important to attribute more research towards their patterns of verb-labelling during father-child play.

Additionally, this area of research would hugely benefit from a cross-cultural analysis, for example comparing the current results with child-directed speech of verb-friendly languages, which do not rely on nouns for providing context as much as noun-friendly languages like English do (Waxman et al., 2013). Consequently, it is possible that the two language-types differ in how verbs are used to label actions. Such research is currently underway at Boston University, replicating the methodology of this study and using the Japanese recordings recorded by Fernald and Morikawa (1993).

Conclusion

The current study provides evidence that, during toy-based play, mothers are most frequently labelling verbs ostensively while the related action is ongoing and least frequently in non-ostensive contexts (when the action is impending or had just been completed). These results do not support the commonly held view that mothers label

actions most frequently in non-ostensive contexts (Tomasello & Kruger, 1992). Maternal action labelling differed depending on verb-type; a significantly higher frequency of actions labelled ostensively than non-ostensively was found for movement-focused verbs, while no such significance was found for result-focused verbs. These results provide an observational insight into how and when children are hearing verbs, but there is still a lot more to learn about this timing. Continuing to research experimentally how children best learn verbs in different contexts is necessary for enriching our understanding and evaluating if real-world practice complements language-learning. We now have a better indication of what mothers are doing during play; next we need to better understand how children learn verbs. Therefore “verb-learning: are mothers doing it right?” is a question that must wait to be answered, until we know more about what doing it right entails.

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