SES Differences in the Communicative Functions of Variation Sets

Shira Tal and Inbal Arnon

1. Introduction

Child-directed speech (CDS) is known to have unique features that are suggested to be beneficial for learning (Golinkoff et al., 2015; Soderstrom, 2007; Weisleder & Fernald, 2013). Among other features, CDS is characterized by certain structural properties that facilitate language learning (Soderstrom, 2007). Compared to adult conversation, CDS is highly repetitive, containing frequently recurring phrases (e.g., *Are you ---,* Cameron-Faulkner et al. 2003). This repetitiveness can facilitate learning: the frequency of maternal self-repetitions and expansions is positively correlated with language growth (Fernald & Hurtado, 2006; Hoff-Ginsberg, 1986; Küntay & Slobin, 1996; Lew-Williams, Pelucchi & Saffran, 2011; Newport, Gleitman & Gleitman, 1977; Waterfall, 2006). Interestingly, CDS also includes additional repetitions of a specific sort: Caregivers tend to use successive utterances with partial self-repetitions, also known as VARIATION SETS (Küntay & Slobin, 1996; Waterfall, 2006). The following sequence of utterances in which a mother addresses her two-year-old child (taken from the Howe corpus, Howe, 1981), provides an example of a variation set:

-Yes yes, he's got **toes**.
-Four **toes**.
-Have you got **toes**, Richard?
-Where are your **toes**?
-Show me your **toes**.
-Come and show me your **toes**.
-Where are your **toes**?

Variation sets are not only frequent in CDS (Küntay & Slobin, 1996; Onnis, Waterfall, & Edelman, 2008), but are also related to better learning outcomes in both naturalistic and experimental settings. Longitudinal studies revealed that the appearance of verbs and multiword constituents inside variation sets is

* Department of psychology, Hebrew University of Jerusalem. Corresponding author: shira.tal1@mail.huji.ac.il

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correlated with their later appearance in children's production (Küntay & Slobin, 1996; Waterfall, 2006). Accordingly, in an artificial language learning study, Onnis et al. (2008) showed that adults who were exposed to variation sets (20% of their input) showed better word segmentation compared to another group who received the same utterances, but not in variation sets. Importantly, in an experiment conducted on two-year-olds, children were better at learning new words when they were repeated across adjacent sentences rather than repeated the same number of times throughout the input (Schwab & Lew-Williams, 2016).

In a previous study (Tal & Arnon, in revision), we showed that like other characteristics of the linguistic input (Fernald, Marchman, & Weisleder, 2013; Hart and Risley, 1995; Hoff, 2006; Hoff, Laursen & Tardif, 2002), the proportion of variation sets is subjected to SES differences. In that study we used an automatic procedure to identify variation sets in two English and Hebrew corpora and compared their proportion in low and high SES. Our automatic procedure followed the one suggested by Brodsky, Waterfall & Edelman (2007). Before going over the results of that study, we briefly describe how we identified variation sets in the corpora. Variation sets were defined as two consecutive utterances that share at least one word, excluding a list of high-frequency words like fillers, pronouns, auxiliaries and a set of function words (see the full table of excluded words in Appendix A). The repeated word could change throughout the variation set, as long as there was a continuity of self repetition between each two successive utterances in the set (e.g., -Oh, there's your hand. - Is that hand a horse?- I think I can see a horse. - Hello horse). Importantly, a variation set must contain some sort of a variation (at least one change of word or a change of word order) to be included: identical utterances were not defined as variation sets.

After extracting the variation sets, we calculated the proportion of utterances (PU) and proportion of words (PW) spoken to the child that appear inside variation sets. These measures were compared in the speech of parents from higher and lower SES for two sets of corpora in two languages: Hebrew (Abramson, Mankuta, Yagel, Gagne & Knafo-Noam, 2014) and English (Howe, 1981). Both PW and PU were found to be higher in the higher SES group, for both languages [English: PW: 33% vs. 27% (p=0.04), PU: 27% vs. 22% (p=0.07). Hebrew: PW: 40% vs. 32% (p=0.04), PU: 32% vs. 25% (p=0.047)]. Figure 1 shows the differences in PU and PW for both languages. This study shows that structural features of CDS are subjected to the influence of SES. That is, the speech directed to children from different SES varies not only in the amount of speech (Hart and Risley, 1995; Hoff, 2003a; Ninio, 1980; Rowe, 2007), or its' complexity (Heath, 1982; Hoff-Ginsberg, 1991; Huttenlocher, Vasilyeva, Waterfall, Vevea, & Hedges, 2007), but also in the way information is structured and transmitted.

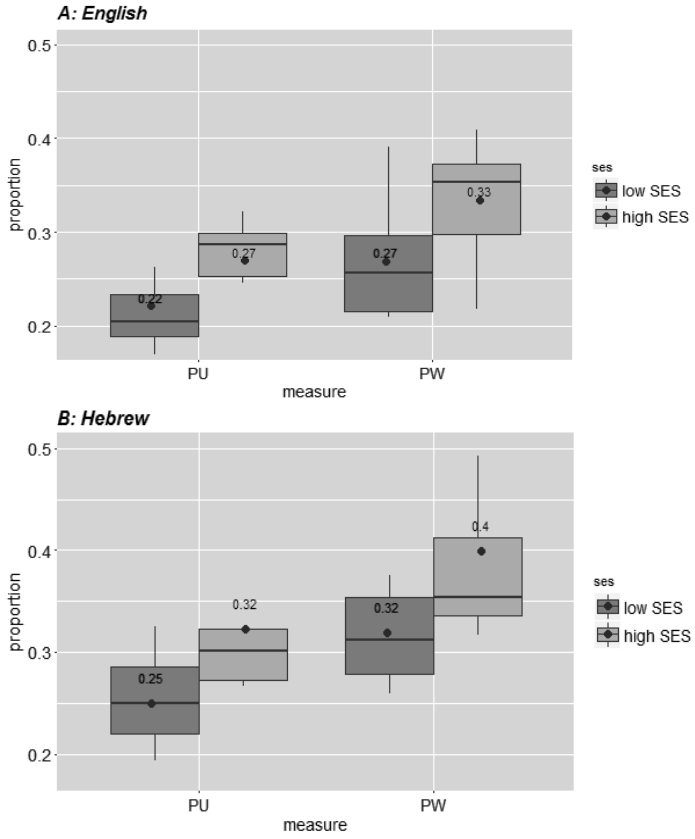

Figure 1. Proportion of utterances (PU) and Proportion of words (PW) that appear in variation sets in low- and high-SES CDS in (A) English corpora (B) Hebrew corpora.

In the current study, we go beyond a purely quantitative estimate of the proportion of variation sets to take a closer look at the *kinds* of variation sets used by high and low-SES parents. The definition we used in the previous study is insensitive to the pragmatic context in which variation sets occur: in addition to differences in the proportion of variation sets, children's input could also differ in the kinds of variation sets they hear. Here, we examine the communicative functions of variation sets in the same English corpus used before to see if, and how, SES impacts the distribution of variation sets. The prediction that SES may impact the distribution of the kind of variation sets is motivated by two separate lines of research: the literature on the communicative function of variation sets (Küntay and Slobin, 2002) and the literature on the different conversational styles of high and low SES parents (for a review, see Hoff, Laursen, & Tardif, 2002).

Variation sets can serve different communicative functions. In an important study, Küntay and Slobin (2002) classified variation sets into three types: (1) control-oriented variation sets: these call for an action on the part of the child and serve to control or direct the child's behavior. Since these variation sets are focused on eliciting behavior, we call them *behavioral-directive* here, (2) ideational variation sets: these serve the function of providing information, performing merely on the plane of ideation, and (3) information-querying variation sets: these prompt the child to answer a question with additional information. The following is an example for each type of variation set, taken from our English corpus:

1. Behavioral-directive:
- Come on, make a wall.
- Make a wall.
- A big long wall.
- Make a wall going all along the outside, can you?

2. Ideational:
- It's a fish.
- Funny fish, isn't it?
- Fish.

3. Information-querying:
- Where's this cat?
- Where's this little cat?

In their study, Küntay & Slobin (2002) examined the distribution of these three types in the input of one child. They found that the distribution changed as a function of age, such that behavioral-directive variation sets increased between the age of 1;3 and 2;0. This study highlights the different communicative functions that variation sets can have and the ways their distribution can change in child-directed speech.

Interestingly, the distinction they made – between variation sets whose function is to direct behavior and ones that serve to elaborate on the linguistic content – is consistent with documented differences in conversational style between different SES groups. Various studies suggest that the speech of higher-SES mothers is used more often to elicit conversation than the speech of lower-SES mothers (Hoff-Ginsberg & Tardif, 1995), that higher-SES mothers use more language-teaching speech with their children than do lower-SES mothers (Brophy, 1970; Hammer & Weiss, 1999; Lawrence & Shipley, 1996; Ninio, 1980; Reger, 1990), that higher-SES parents pose more questions to their children than lower-SES parents (e.g., Heath, 1982; Hoff-Ginsberg, 1991) and that the speech of lower SES mothers is more focused on directing their children's behavior than the speech of higher SES mothers (Hoff-Ginsberg, 1998; Hoff, 2003b; Lawrence & Shipley, 1996). Extrapolating from this

literature, we may expect these differences in the types of interactions used by high- and low-SES parents to be reflected in the kinds of variation sets they use.

Taken together, these literatures suggest that SES may impact the kinds of variation sets used. If indeed SES groups typically differ in the type of communication they use, they may also differ in the kinds of variation sets they use. Specifically, following previous literature, we expect to see an increased use of the behavioral-directive type and reduced use of both the information-querying and the ideational type in the lower SES group. To test these predictions, we hand-coded each variation set found by our algorithm and classified each into the different communication functions following the definition of Küntay & Slobin (2002). If the speech of higher SES mothers differs from the speech of lower SES mothers also in its' communicative style, then we should see differences in the proportion of different types of variation sets between the two SES groups. This study aims to further understand the difference in the amount of variation sets between different SES groups while expanding our knowledge of the different communicative functions of variation sets. Despite the growing research on variation sets, Küntay & Slobin (2002) is the only study to have examined their communicative function. Given that it was based on a corpus of only one child, further work is needed to substantiate and validate the existence of these different functions in larger samples of children.

2. Method

We used the Howe corpus in this study (Howe, 1981). The Howe corpus contains transcripts of 16 children, half middle-class and half working class who were recorded twice (one at age 1;6 to 1;8 and five months later at ages 1;11 to 2;1). Following the criteria of Küntay and Slobin (2002), each variation set found in the corpora was coded for at least one of the three types mentioned above. Since clusters of self repetitons could involve different communicative acts, each variation set could be classified into more than one type. As the examples above demonstrate, behavioral-directive variation sets are ones in which the mother leads the child through different components of the activity, often elaborating, adding justifications, explanations and other associated information to the central control act. In ideational and information-querying variation sets, the mother makes the information or the question more specific in successive utterances, often providing reordering of original constituents, summarized information, or answers to her own questions.

Unlike Küntay and Slobin (2002), we had an optional fourth category, "other", that was reserved for repetitions of routines (e.g., -"Good night Jason", "Good night"), that to our judgement missmatch all of the other three options. It is important to emphasize that like in Küntay and Slobin's study (2002), each variation set in our study could be classified to more that one communication function. For example, the next variation set was classified as both ideational and behavioral-directive:

- He's got a hat on.
- Take this hat off and give him another one.

In contrast, the following variation set was classified as both ideational and information-querying:

- There's a piggie and he's throwing some beanbags.
- And what's that piggie doing?

The variation sets were coded by a research assistant blind to the purpose of the study. After all variation sets were coded, the average proportion of each type was calculated for each child.

3. Results

Table 1 provides a breakdown of all the variation set types that were used by high- and low-SES mothers, averaged across children. Figure 2 portrays the different types of communication functions in each SES group.

Table 1. Proportions of different kinds of variation sets for each SES group

	ideational	info-queyring	behavioral-directive	mixed	Other
Low SES (N=463)	24.53% SD=9.6% (N=113.6)	15.88% SD=10.7% (N=73.5)	39.71% SD=17.8% (N=183.9)	19.14% SD=8.4% (N=88.6)	0.74% SD=1% (N=3.43)
High SES (N=541)	32.27% SD=10.7% (N=174.6)	14.75% SD=9.5% (N=79.8)	25.28% SD=15.3% (N=136.8)	25.83% SD=6.6% (N=139.7)	1.87% SD=2.9% (N=10.1)

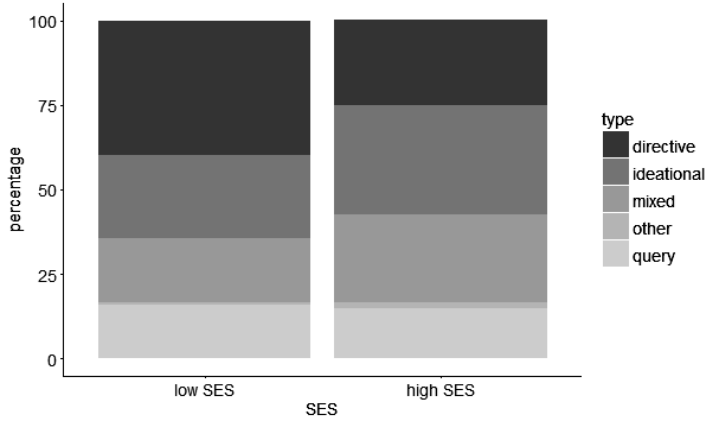

Figure 2. Difference in communication functions of variation sets according to SES group

A chi-square goodness of fit test was calculated to compare the occurrence of each type of variation set in the low SES population with the occurence found for the high SES population (as depicted in table 1). Significant deviation from the values was found ($\chi 2(df=4)=58.37$, $p<0.001$), suggesting that the division to types in the low-SES population is different from the division in the high-SES population.

In order to test our specific predictions regarding the different functions, we looked at the proportion of the three types across SES. Because we are comparing across SES (rather than across types), each variation set was classified according to its' broader classification, regardless of the other categories it was also coded for (e.g., ideational variation sets were ones that were either exclusively ideational, or ideational combined with another function). Table 2 provides a breakdown of each communicative function into the proportion of variation sets that were classified as only one function (e.g., exclusive ideational variation sets) or more (e.g., variation sets that have other functions in addition to the ideational one).

In line with our hypothesis, higher-SES children heard more ideational variation sets (M=51.74, SD=11.7) compared to lower-SES children (M= 38.68, SD=8.2), t(12.78)=-2.57, p=0.02). When we used a more stringent classification and looked at the proportion of variation sets that were ideational but not behavioral-directive, the effect remained the same (low-SES: M=31.69, SD=11.22, high-SES: M=45.49, SD=13.55. t(13.53)=-2.22, p=0.04). This indicates that the difference between the two groups was driven by a difference in ideation-sets and not behavioral-directive ones. In addition, we compared the proportion of variation sets that are both ideational and information-querying. The reason we looked at this is that these variation sets are most similar in nature to the ones simulated in the study of Schwab & Lew-Williams (2016), in which variation sets improved two-years-old ability to learn new words. Again, this type was higher for higher-SES input compared to lower-SES input (low-SES: M=6.9, SD=4.5, high-SES: M=13.2, SD=5.2, t(13.7)=-2.57, p=0.02). As for our second prediction, while it seems that there are more behavioral-directive variation sets in low-SES input (M= 51.96, SD=18) compared to high-SES input (M= 37.88, SD=17.8), this difference doesn't reach significance (t(14)=1.57, p=0.13). Lastly, in contrast to our hypothesis, we found no difference in the proportion of information-querying variation sets between the two groups (low-SES: M=29, SD=14.5, high-SES: M=35.18, SD=14.3. t(14)=-0.85, p=0.4). Figure 3 shows the SES-difference in the different kinds of variation sets.

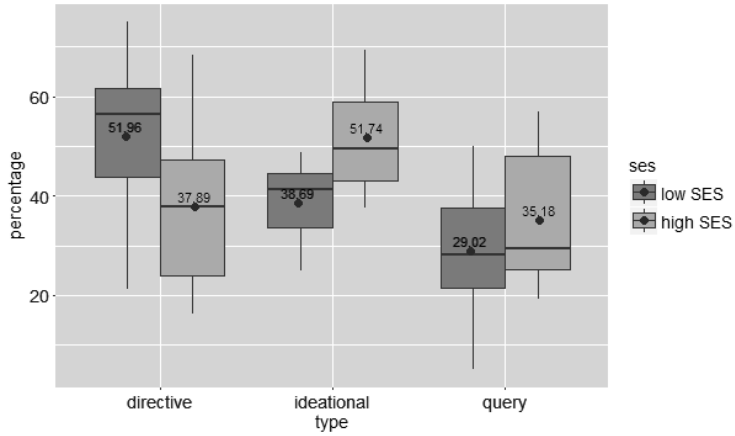

Figure 3. Proportion of different kinds of variation sets in low- and high-SES

Table 2. Proportion of variation sets that serve exclusively one function compared to more functions

	ideational	info-queyring	behavioral-directive
Low SES (N=463)	65% (127/195)	53% (78/147)	74% (160/216)
High SES (N=541)	60% (172/289)	42% (87/208)	61% (119/195)

Importantly, the differences found between the SES-groups are in the distributions of the different communicative kinds. The variation sets themselves, however, seem to be of similar nature and to reflect similar contexts of use in both groups. That is, there seems to be no difference between an ideational-set uttered by a high-SES parent and a low-SES parent. Examples of variation sets from both SES groups are given in Table 3.

Table 3. Examples of variation sets from both SES groups

	Ideational	info-queyring	behavioral-directive
Low SES	-Oh look, he's under the shower. - Washing himself under the shower.	- What are you going to do? - Are you going to give her a drink?	- Put his tail on then. - Put a tail on.
High SES	- That's a watering can. - Teeny-weeny watering can.	- Where's that you can see? - What can you see on there?	- Sit him down in the back. - Make him lie down in the back.

4. Discussion

The present study set out to examine the effect of SES on the different kinds of variation sets that are used in child-directed speech. Following previous work showing SES-differences in the proportion of variation sets between low and high SES (Tal & Arnon, in revision), we wanted to ask where these differences come from and whether they reflect different communicative styles. Examining the different communicative functions that variation sets serve can illuminate their facilitative role in language learning (Onnis et al., 2008; Schwab & Lew-Williams, 2016; Waterfall, 2006) and the reason for the disparities found in different SES groups (Tal & Arnon, in revision). In line with the differences in conversational styles documented in the literature, we found that high-SES children are exposed to a different distribution of variation sets compared to lower-SES children. Specifically, high-SES children hear more ideational variation sets than low-SES children, and more variation sets that are both ideational and information-querying. This finding is in line with previous literature on the effect of SES on types of communication: Different studies demonstrate that more educated mothers engage in more explicit teaching of object labels than do less educated mothers (Brophy, 1970; Hammer & Weiss, 1999; Lawrence & Shipley, 1996; Ninio, 1980; Reger, 1990), and elicit more talk from their children compared to lower SES mothers (Hoff-Ginsberg & Tardif, 1995). In addition, although it is not statistically significant, our findings suggest that high-SES children are possibly exposed to less behavior-directive variation sets than low-SES children. If this is indeed the case, this is also in line with previous literature: naturalistic and experimental studies reveal that lower-SES mothers devote proportionately more talk to directing child behavior than higher-SES mothers (Budwig & Chaudary, 1996; Hart & Risley, 1995; Hoff-Ginsberg, 1991; 1998; Pomerleau, LaCroix, Malcuit & Seguin, 1999; Reger, 1990; Tardif, 1993). Finally, although there are some studies that suggest that high-SES children hear more questions comared to low-SES children (Heath, 1982; Hoff-Ginsberg, 1991), we did not find a significant difference in the proportion of information-querying variarion sets between the two SES groups.

It is important to keep in mind that results of this study are drawn from only one set of corpora in one language. In addition, the transcripts are of relatively short interactions that take place in experimental settings. This study should therefore be replicated for bigger corpora, for different languages, and ideally for more naturalistic settings of interactions.

Taken together, the results of this study suggest that the use of ideational variation sets is a possible candidate underlying the SES effect found in our previous study (Tal & Arnon, in revision). The SES differences in the proportion of variation sets are not merely driven by low-SES parents being less repetetive, but also by them engaging or generating fewer situations that elicit ideational variation sets. This is again compatible with varoius studies in the SES liteature. First, high-SES mothers produce more topic-continuing replies to their children compared to lower-SES mothers (Hoff, 2003a). Second, a recent study found

that high-SES parents use more "contingent talk" with their children (McGillion, Pine, Herbert & Matthews, 2017); a style of communication whereby the caregiver talks about what is in the infant's current focus of attention. The use of ideational variation sets may similarly reflect the tendency to use language for conversation and further engagement in what the child is already attentive to.

These findings also contribute to the SES literature: The effect of SES on communicative styles is replicated for variation sets, thus corroborating the fact that high-SES children experience a different language-learning environment from low-SES children on a pragmatic dimension as well as a data-providing dimension (Hoff, 2003b).

Finally, this study brings us a step closer in trying to understand why variation sets are useful for learning. Why are certain types of variation sets useful for learning, and why are they more frequent in high SES? It could be the case that ideational (or ideational and information-querying) variation sets are used in order to introduce new words to the child (an illustrative example from our corpus: -It's a key, isn't it? -We use a key to open the door). Alternatively, what we define as ideational variation sets could also be simply a proxy of joint attention. A third possibility, offered by a recent study (Onnis, Truzzi, Venuti, Bentenuto, Esposito, & Edelman, 2017), is that variation sets facilitate children's motivation to communicate and interact. Further work is needed in order to examine in more detail the contexts of use of variation sets, their connection to age of acquisition and joint attention, and possibly other factors that can affect their frequency. Importantly, variation sets that are both ideational and information-querying, a type that was found to be subjected to the influence of SES, are most similar in nature to the ones simulated in the study of Schwab & Lew-Williams (2016), in which variation sets improved two-years-old ability to learn new words. It is possible that the learning advantage associated with variation sets is in fact caused by the use of one particular kind of variation set: the ideational kind which expands on the linguistic content of the conversation (whether by labeling, adding information about known labels or expanding on meaning). This hypothesis opens two novel avenues for future work. First, we should re-examine previous longitudinal work showing links between the use of variation sets and language outcomes (Waterfall, 2006) to see if the facilitation is more strongly linked to one particular kind of variation set. This would allow us to see whether certain types of variation sets predict later linguistic outcomes more than others. Second, we can experimentally test the advantages of learning from different kinds of variation sets. It is possible that not all variation sets are beneficial for learning, or that different kinds contribute to different facets of learning.

To conclude, the findings of this study highlight the need to tease apart different types of variation sets, in order to better understand the settings in which they occur and their advantage for language learning. Further integration of the CDS and the SES literature is promising in helping us to better understand the individual and social-driven differences in language learning.

Appendix A

	English	**Hebrew**
pronouns	*I, I'm, I'll, me, my, you, your, you're, you'd, you've, you'll, we, we'll, she, her, hers, she's, he, he's, his, him, they, they're, them, 'em, it, it's*	*ani* 'I', *at* 'you-FEM' , *ata* 'you-MASC', *hi* 'she', *hu* 'he', *anaxnu* , 'we', *atem* 'you-PLURAL-MASC', *aten* 'you-PLURAL-FEM, *hem* 'they-MASC', *hen* 'they-FEM'
Indefinite pronouns	*all, another, any, anybody, anyone, anything, each, everybody, everyone, everything, few, many, nobody, one, some, ,none, several somebody, someone*	*Kol* 'every/all/any/each', *mishehu* 'anyone'/somebody', *mashehu* 'something/anything', *qcat* 'few/some', *harbe* 'many', *kama* 'several/some'
demonstratives	*this, that, that's, there, there's, here, those, these*	*ze* 'this-MASC', *zot* 'this-FEM', *hine* 'there it is', *po* 'here', *kan* 'here'
articles	*the, a, an*	*Ha* 'the'
auxiliaries	*is, isn't, are, aren't, was, wasn't, were, weren't, do, don't, does, doesn't, will, won't, be, am, can, can't, could, would, should, gonna, did, didn't, must, mustn't, shall, let's*	*bo* 'come-MASC' (used in Hebrew as the auxiliary 'lets'), *boii* 'come-FEM' (used in Hebrew as the auxiliary 'lets')
prepositions	*to, in, on, of, with, as, at, for*	*le* 'to', *lexa* 'to you-MASC', *lax* 'to you-FEM', *lo* 'to him', *la* 'to her', *lanu* 'to us', *li* 'to me', *be* 'in', *'al* 'on', *shel* 'of', *'im* 'with', *kmo* 'as', *et* 'ACC', *mi* 'from'
Negations, prohibitions and affirmations	*no, not, yes, yeah, okay*	*loh* 'no', *eyn* 'there isn't, *asur* 'must not', *al* 'do not', *ken* 'yes', naxon 'right', *yofi* 'great', *nununu* 'admonition word', *kol hakavod* 'well done'

connectives	*Or, and*	*O 'or'*, *ve* 'and', *she* 'subordinator'
WH-questions	*what, what's, where, where's, when, when's, which, who, who's, why, why's, how, how's*	*ma* 'what', *eifo* 'where', *matay* 'when', *eyze* 'which', *mi* 'who', *lean* 'where to', *lama* 'why', *ex* 'how'
Disfluencies	*Um, oh, huh, ah, ow*	uy, ah, um
Interjections and fillers	*wow*	*wow* 'wow', *way* 'excitement word', *nu* 'urging word', *kaxa* 'like this', , *zehu* 'that's it', *oyoyoy* 'oh no', *oy* 'oh', *hopa* 'hop!', *rega* 'hold on' (used often as a filler in Hebrew)

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