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A Usage-Based Investigation of L2 Lexical Acquisition: The Role of Input and Output

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This study investigates relations between second language (L2) lexical input and output in terms of word information properties (i.e., lexical salience; Ellis, 2006a). The data for this study come from a longitudinal corpus of naturalistic spoken data between L2 learners and first language (L1) interlocutors collected over a year's time. The corpus was analyzed using word information properties related to concreteness, familiarity, and meaningfulness to examine word repetitions between input and output, correlations between the input and the output, linear trends over time, and whether lexical properties in the output were predictive of growth in TOEFL scores. The results indicate that L2 learners are more likely to repeat word types found in L1 input and that L1 interlocutors and L2 learners follow similar linear trends over time such that words with lower concreteness, lower familiarity, and lower meaningfulness were produced over the course of the study in both the input and output. A linear mixed model analysis showed that decreases in concreteness scores explained significant gains in TOEFL scores over time. The findings from the study indicate strong associations between L2 input and output and provide evidence linking development in word information properties to development in academic English proficiency.

Keywords: acquisition; naturalistic; corpus linguistics; input–output; proficiency; vocabulary

USAGE-BASED APPROACHES TO LANGUAGE acquisition are increasingly used in second language (L2) studies to investigate the development of a number of linguistic skills. A usage-based approach presumes that language learning does not differ from other types of learning (e.g., Bybee, 2006; Langacker, 1987; Tomasello, 2003) in that the cumulative experience of interacting with a language results in language learning. However, under a usage-based approach, the grammatical, syntactic, phonological, and lexical features and their regularities within a language attune the cognitive abilities of the person learning that language (Tomasello, 2003). Thus, the structure of the language itself helps promote language learning.

In L2 studies, usage-based approaches are most commonly used to examine L2 syntactic

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and grammatical development (e.g., Ellis & Ferreira–Junior, 2009a; Gries & Wulff, 2005; Römer, O'Donnell, & Ellis, 2014). More rarely, usage-based approaches provide information about the lexical development in L2 learners (Crossley et al., 2014). Reasons for this difference vary but, historically, there has been less interest in lexical as compared to grammatical and syntactic research (Meara, 2002), and the features commonly measured in usage-based studies (e.g., type frequency, salience, and prototypicality) are more difficult to operationalize from a lexical perspective.

One common approach to examining lexical development that has strong links with usage-based approaches is word frequency (Ellis, 2002; Gries, 2008; MacWhinney, 1997). Frequency approaches to lexical acquisition suggest that frequent words are acquired and automatized more quickly than infrequent words. Thus, the more frequently words are heard, the more likely they are to be processed, stored, and retrieved (Verspoor & Schmitt, 2013). A number of studies have demonstrated links between lexical processing and production in terms of word frequency (Bell, 2003; Crossley et al., 2011a, 2011b; Laufer & Nation, 1995; Ovtcharov, Cobb, & Halter, 2006), and a more recent study indicated that mean word frequency as measured by word types demonstrated links between L2 input and output (Crossley et al., 2014).[1]

However, while frequency is an important component of usage-based approaches, measuring linguistic items strictly in terms of absolute frequency is not usage-based. For example, word frequency by its nature focuses on a single word (or lemma), and a single word alone may be difficult to abstract into larger analogies or patterns of language use that demonstrate form–meaning mappings (Goldberg, 2003; Robinson & Ellis, 2008). Such analogies and patterns are common in frequency focused usage-based approaches. For instance, usage-based research may consider construction frequency (e.g., how often the pattern of a particular verb–argument construction occurs) or type of frequency (e.g., how many lexical types can fit into a specific verb–argument construction), both of which examine regularities in language that go beyond the individual word. Thus, while there is overlap between usage-based approaches and a pure word frequency approach, commonalities are not strong because word frequency studies cannot take into consideration form–meaning mappings based on matching patterns of acquisition. As an example, function words like determiners are not accurately acquired early by learners (Goodman, Dale, & Li, 2008) even though they are quite frequent in the learner input mainly because many function words do not have strong form–meaning mappings.

One usage-based perspective that has not, to our knowledge, been used to investigate L2 lexical development is salience. Salience is often related to how difficult it is to notice an item. Items of lower salience attract less attention (Schmid, 2007) and are argued to be more difficult to acquire (Ellis, 2006a; MacWhinney, 2008). Our goal in this study is to investigate associations between L2 input and output in terms of salience and link this attribute to gains in learner proficiency. Specifically, we investigate word attributes related to salience such as word concreteness, familiarity, and meaningfulness. To examine associations in input and output, we collected data in a year-long longitudinal study. The data comprise naturalistic speech between 6 L2 learners and 13 native speaker (NS) interlocutors and include standardized proficiency tests for the learners over the course of the year. The longitudinal data in this study allow us to examine associations in word property between the input and the output as well as lexical growth over the course of the year-long period. In addition, the proficiency tests afford us the chance to link development in word properties to language proficiency gains.

INPUT AND OUTPUT

When studying language from a usage-based perspective, examining the relationship between linguistic input and output is crucial. Input refers to the language to which the language learner is exposed and often serves as linguistic evidence from which linguistic hypotheses are formed. Often, NS talk is modified to take the form of foreigner talk or teacher talk. Both of these forms are simplified at the lexical, phonological, and syntactic levels in an attempt to ease comprehension and facilitate the processing of linguistic features (Gaies, 1983; Hatch, 1983). Strong arguments for the role of input in L2 acquisition state that L2 acquisition relies on the quality of available input (Ellis & Collins, 2009) and that it is input driven (Wulff et al., 2009). By themselves, however, the linguistic features contained in the input cannot sufficiently explain L2 acquisition (Swain, 1995). Acquisition also depends on learner-based variables such as noticing, processing, storing, and production (i.e., output).

Output, or language use, is thought to allow L2 learners the opportunity to move from

lexical to syntactic processing. Language production also affords L2 learners the opportunity to experiment with new syntactic forms by testing hypotheses about language structure (Swain, 1985). Output may also direct learners' attention to notice input, thus introducing the learner to new language data from which to develop linguistic knowledge, which may facilitate learning. In this sense, output sensitizes learners to patterns and associations in future input (Swain, 1995). Output has been demonstrated to be an important component of noticing (Izumi et al., 1999). Furthermore, it has been shown to increase frequency (Toth, 2006) and accuracy of use of grammatical structures (Izumi & Bigelow, 2000).

USAGE-BASED APPROACHES TO ACQUISITION

As noted earlier, frequency effects are a key foundation of usage-based approaches to language learning. The basic notion behind frequency effects is that the more one hears a linguistic item, the more likely that item will be activated, the more likely it will be used, and the more likely it will be acquired (Rumelhart & McClelland, 1987). An important component to this notion is that linguistic items follow Zipfian (1935) distributions in which the most frequently occurring types account for the majority of tokens. Zipfian distributions illustrate the tendency for language learners to be exposed to a small set of highly frequent items that decrease input variability and aid in language learning because they lead to the increased probability of form–function mappings for the frequent items (Ellis, 2006a, 2006b; MacWhinney, 1997). In essence, Zipfian distributions support learners in acquiring and producing those linguistic items that are more frequent in the input such that Zipfian distributions in the input are replicated in learner output (Ellis & Ferreira–Junior, 2009a). These replications have led Ellis (2006a, 2006b) to refer to learners as intuitive statisticians.

However, Zipfian distributions are more complicated in L2 lexical acquisition studies. For instance, Crossley et al. (2014) showed that, while the lexical input received by L2 learners was Zipfian, the corresponding L2 output was not Zipfian, indicating a mismatch between the input received and the output produced. The mismatch between the input and output for the word tokens could be explained by the repetition of highly infrequent words (and the lack of repetition of some frequent words) by L2 learners at the early stages of acquisition. Indeed, once the words were controlled for repetition (by examining the word types and not the word tokens), similar frequency distributions in both the input and output were reported. The most likely sources for L2 learners producing and repeating infrequent words early in the acquisition stages included difficult form–function mappings for frequent words, L1 transfer effects, and phonological salience. This study helped to demonstrate that it may not be the absolute frequency with which an item occurs that drives learning, but the reliability and salience of the frequent items to which learners are exposed (MacWhinney, 2008).

Reliability is based on the regularity of use of an item and the ease with which the item leads to discernible patterns. Thus, it is not just the raw frequency of an item to which learners are exposed, but rather how the input patterns the item in conversation (Ellis, 2012). The meaningful patterns of input that occur frequently are often referred to as linguistic constructions, which are basically conventionalized form–meaning mappings. These mappings can encase units of language at the phonological, morphological, syntactic, and lexical level (Goldberg, 2003; Robinson & Ellis, 2008). Lexically, form–meaning mappings link words, idioms, and lexical phrases to their discourse or semantic functions (Ellis, 2012). The form–meaning and form–function mappings that occur most frequently are argued to be learned first. However, it is not only the frequency of a construction that leads to learning, but also a construction's type frequency.[2] Type frequency refers to the potential for a greater number of items to substitute into a specific slot, which affords quicker acquisition of a form (e.g., the number of nouns that can be slotted before the regular plural suffix -s in English).

Beyond reliability, usage-based learning also relies on the salience of the item, the prototypicality of the item, and the redundancy of items (Boyd & Goldberg, 2009; Ellis, 2006a, 2012). In this study, we are interested in salience, which involves the degree to which an item is noticed or its perceived linguistic strength.[3] Some concepts, by their nature, attract our attention to a greater degree than others based on their salience. For example, a dog has "better attention-attracting potential" than the field on which it is standing (Schmid, 2007, p. 120). Those items that have higher salience cues are more likely to be cognitively entrenched, more noticeable to language learners, and, thus, easier to acquire (Ellis, 2006a; MacWhinney, 2008; Schmid, 2007). This salience is not only conceptual, but can also be grammatical. For instance, the low phonological salience of the past tense

might explain why it is acquired later than the progressive aspect, which has greater salience (Boyd & Goldberg, 2009). Usage-based elements related to frequency, reliability, and salience can work individually to assist in language acquisition or, more likely, can work together (Wulff et al., 2009). Therefore, learning is not solely based on frequency but also the salience of linguistic items (MacWhinney, 2008).

In terms of lexical acquisition, frequency alone may be a poor predictor of acquisition because it is compounded by differences in word type and word token frequency (Crossley et al., 2014). In addition, word frequency is not always a strong predictor of word learning. For instance, studies have shown that children acquire function words such as determiners more slowly than content words such as nouns even though function words are frequent in the input (Goodman et al., 2008). A key reason for this may be that function words have low salience and may be redundant with other linguistic cues in the input impeding their acquisition. Thus, it is likely that for lexical items, salience may be a more robust indicator of acquisition than frequency.

METHOD

Our goal in this study is to investigate the effects of lexical salience in NS input to L2 learners in relation to L2 lexical production and language proficiency. Thus, we are interested in investigating the following research questions:

RQ1. Do more salient words in the L2 input have a relationship with lexical production in L2 output (i.e., does saliency affect the input–acquisition relationship; Ellis & Collins, 2009)?

RQ2. Do changes in lexical production lead to increases in overall language proficiency?

In this manner we can test the hypothesis that L2 lexical acquisition is at least partially driven by information properties in the words to which L2 learners are exposed, which leads to the final research question:

RQ3. Does salience of a word explain lexical acquisition and, by implication, is this lexical acquisition beneficial overall?

To examine this hypothesis, we collected a longitudinal corpus of naturalistic spoken data between L2 learners and NS interlocutors over a year's time. During this year, we also collected Test of English as a Foreign Language (TOEFL) scores from the L2 learners. We computed information properties related to concreteness, familiarity, and meaningfulness values for the words in the input and the output data. We used these values to examine correlations between the input and the output and development over time in both the input and the output. We used the TOEFL scores to assess language growth in the L2 learners and to examine links between the L2 learner lexical output and standardized tests of language proficiency.

CORPUS

Our corpus comprises transcripts from interviews between 6 L2 learners and 13 native English-speaking interlocutors. Interviews were conducted over a one-year period at approximately 2-week intervals. In each interview, one or more of the learners would have a taped 30–45 minute discussion with an L1 interlocutor. The corpus is subdivided into two sections. The first section includes all of the utterances made by the native speakers (NS corpus) and the second includes all of the utterances made by the nonnative speakers (NNS corpus). At the beginning of the study, all of the NNS participants tested into the lowest level of a six-level English program. Because of their limited prior English language instruction, their low TOEFL scores ($M = 388.333$, $SD = 49.794$), and because the L2 learners tested into the beginning level of the English program, we considered them false beginners.

Over the course of the one-year study, all of the participants progressed through each level of the English program. The participants were dispersed throughout different classes in the English program (i.e., they were not all in an intact class). The participants ranged from 18–29 years old, and none had lived in the United States for longer than 3 weeks prior to enrolling in the English program. Each learner in the study was given a study on data from Eun Hui (Korean NS), Faisal (Arabic NS), Jalil (Arabic NS), Kamal (Arabic NS), Marta (Spanish NS), and Takako (Japanese NS).

The NS interlocutors consisted of graduate students recruited from a second language acquisition course. Over the course of the year, each learner interacted with at least three different NS interlocutors ($M = 3.667$; $SD = 1.211$). NS interlocutors were rotated to control for familiarity effects between the L2 learner and the NS. The average number of meetings per interlocutor was 7.615 ($SD = 7.621$). One interlocutor

TABLE 1
Descriptive Statistics for Longitudinal Output Data

Learner	Number of Meetings/ Transcripts	Average Number of Words per Utterance	Average Number of Utterances	Average Number of Words per Transcript	Number of Words in Input
Eun Hui	18	22.706	52.167	1164.778	20966
Faisal	13	37.952	71.077	1963.692	25528
Takako	18	33.722	51.000	1179.167	21225
Kamal	14	26.467	49.286	1307.000	18298
Jalil	17	40.887	61.765	2456.471	41760
Marta	18	32.586	63.611	1896.333	34134

TABLE 2
Descriptive Statistics for Longitudinal Input Data

Learner	Number of Meetings/ Transcripts	Average Number of Words per Utterance	Average Number of Utterances	Average Number of Words per Transcript	Number of Words in Input
Eun Hui	18	18.838	70.222	1295.111	23312
Faisal	13	13.871	85.231	1187.615	15439
Takako	18	13.960	58.944	877.833	15801
Kamal	14	11.015	61.571	697.857	9770
Jalil	17	10.238	71.529	713.412	12128
Marta	18	15.717	64.389	985.611	17741

conducted 31 meetings, while three conducted only one meeting each.

The NNS corpus consisted of the spoken data collected from the six L2 learners. A total of 99 transcripts were collected. Transcriptions of each interview session were cleaned to eliminate non-English words, interjections, and spelling errors to aid in computational analysis. Each elicitation session was saved as a text file that contained the words of only the L2 learner in focus. Descriptive data for the NNS corpus is presented in Table 1.

The NS corpus consists of the spoken data collected from the native speakers when interacting with the L2 learners. We selected the 99 native speaker transcripts that corresponded to the transcripts found in the NNS corpus. Like the NNS corpus, we cleaned the input corpus to eliminate interjections and spelling errors. Each session was saved as a single text file containing only the words spoken by the interlocutor in focus. Descriptive data for the input corpus is presented in Table 2.

WORD INFORMATION PROPERTIES

We selected three word information indices reported by the Tool for the Automatic Analysis of Lexical Sophistication (TAALES; Kyle & Crossley, 2015). TAALES is a freely available, cross-platform, user-friendly tool for analyzing over 130 indices of lexical sophistication. The program is accessed through a graphical user interface (GUI), processes .txt formatted files, and produces output in a comma-separated values (.csv) file. TAALES includes a number of indices that focus on five areas of lexical sophistication: lexical frequency, range, n-gram frequency, academic vocabulary, and word information properties.

The word information indices in TAALES are derived from the MRC psycholinguistic database (Coltheart, 1981); Brysbaert, Warriner, & Kuperman (2013); and Kuperman, Stadthagen–Gonzales, & Brysbaert (2012). Word information scores are calculated by adding the score for each token in a text that is given a word information score and dividing the total by the number of such tokens in the text (i.e., words that are not in the selected word information lists but are in the texts are not included in the counts). Word information indices are calculated for all words (AW), content words (CW), and function words (FW). Word information indices are calculated from the following lists: familiarity (i.e., how

familiar a word is; Coltheart, 1981), concreteness (i.e., how concrete a word is; Brysbaert et al., 2013; Coltheart, 1981), imageability (i.e., how imageable a word is; Coltheart, 1981), meaningfulness (i.e., how many associations a word has; Toglia & Battig, 1978), and age of acquisition (i.e., at what age a word is learned; Kuperman et al., 2012).

For this study we focused on indices calculated for all words in the text. From the MRC psycholinguistic database, we selected word familiarity and word meaningfulness indices. We selected the concreteness index from Brysbaert et al. (2013) over the MRC psycholinguistic index because it contains a larger sample of words that were evaluated by a larger sample of participants. We did not select an imageability index because imageability and concreteness are generally strongly correlated with one another (Toglia & Battig, 1978). We did not select an age of acquisition index because of weak overlap with our construct of interest (salience).

We presume that more familiar words such as *breakfast, girl,* and *paper* have greater salience than less familiar words such as *sultan, buffoon,* and *puck* because familiarity effects result from learners attending to more familiar words that they have heard in several different contexts before actually using that word in production. In terms of word meaningfulness, highly meaningful words such as *beautiful, mother,* and *book* should be more salient when compared to less meaningful words such as *steppe, brisket,* and *shale* because the semantic links embedded in more meaningful words help organize the words into tighter semantic association networks that allow them to be stored, processed, and retrieved more efficiently (Ellis & Beaton, 1993). Last, more concrete words such as *milk, tomato,* and *ape* should be more salient than less concrete words such as *impossible, aspect,* and *unknown* because more concrete words are more easily recalled, recognized, named, and comprehended (Gee, Nelson, & Krawczyk, 1999; see Paivio, 1991, for a review).

STATISTICAL ANALYSES

Our first analysis examined growth in TOEFL scores for the NNS participants in this study. We used a within-subjects analysis of variance (ANOVA) to examine whether developmental patterns occurred over the year-long study. Our hypothesis was that the NNS participants would show significant linear growth over the course of the study. We next checked for correlations between the input and the output for the word information measures under the presumption that the input L2 learners received would correlate with their output, indicating support for the input–acquisition relationship (Ellis & Collins, 2009). To assess whether words produced by NNS participants were the result of NS input, we calculated the word types that were first produced by NS participants and repeated by NNS participants. We also calculated the word types that were first produced by NNS participants and repeated by NS participants. For these two word type lists (repeated NS and NNS word types), we then examined differences in the number of types and the word information for the types. We followed these analyses with within-subjects ANOVAs to assess whether there were significant growth patterns in the L2 output in reference to the word information measures (i.e., lexical development). We predicted significant growth over time for all indices except familiarity because previous studies have not reported links between L2 development and word familiarity (cf. Crossley et al., 2014; Salsbury, Crossley, & McNamara, 2011). We conducted a similar ANOVA on the NS output to examine whether the NS output changes over time as the L2 learners advance in their lexical skills. We predicted significant growth patterns for all the word information measures, presuming that NS interlocutors would adjust their input based on the proficiency levels of L2 learners. We lastly conducted linear mixed model analyses to examine whether the word information indices in the output were predictive of growth in TOEFL scores over the course of the study.

RESULTS

Language Proficiency

We conducted repeated-measures ANOVAs to investigate the development of L2 proficiency over one year of English instruction. We predicted that TOEFL scores would increase as time spent learning English increased. Increased TOEFL scores would provide some evidence of overall growth in English proficiency. Of the six participants, only four completed all six of the tests given over the course of the year. One participant missed the second TOEFL and another participant missed the fifth. Thus, the ANOVA for the TOEFL scores included only the first, third, fourth, and sixth testing sessions.

The results indicated that the L2 learners' TOEFL scores increased as a function of time, $F(3,15) = 22.782$, $p < .001$ and in a linear fashion, $F(1,25) = 40.076$, $p < .001$ (see Table 3). These

TABLE 3
Means and Standard Deviations for TOEFL Scores

Testing Session	Week	Mean	Standard Deviation
1	6	358.330	49.790
3	22	418.830	33.040
4	42	450.660	30.120
6	52	458.830	29.250

TABLE 4
Correlations Between NS Input and NNS Output

Index	*r*	*p*
Brysbaert Concreteness	0.496	< .001
MRC Familiarity	0.376	< .050
MRC Meaningfulness	0.471	< .001

findings suggest that significant L2 development likely occurred during the year of study.

Correlations Between NS Input and NNS Output

Pearson product–moment correlations were conducted between the averages for the word information measures in the L2 learner output and the NS input. The analysis yielded significant correlations in the predicted directions for each (see Table 4). The effect sizes for the correlations ranged from medium to large, indicating that NS interlocutors and L2 learners followed similar linear patterns over time that showed a movement in both the input and output toward the production of words with lower concreteness, lower familiarity, and lower meaningfulness.

Differences in Repeated Word Types

We conducted *t*-tests between the repeated types for the NS and NNS participants for number of types and word information indices to examine whether there were differences in the lexical features of the word types repeated by NNS participants from NS input and the word types repeated by NS participants from NNS input. There was a significant difference in the number of types repeated, $t(196) = 2.863$, $p < .010$, $d = .407$; the concreteness of the types; $t(196) = 4.168$, $p < .001$, $d = .591$; and the meaningfulness of the types, $t(196) = 7.035$, $p < .001$, $d = 1\ 000$. Significant differences were not reported for the familiarity of the types, $t(196) = 1.123$, $p > .050$, $d = .160$. Descriptive statistics for these analyses are presented in Table 5. The results indicate that NNS participants repeated more types from NS participants than vice versa. The results also indicate that the words repeated by NNS participants were more concrete and meaningful than those repeated by NS participants.

TABLE 5
Linguistic Features of NS Words Repeated by NNS and NNS Words Repeated by NS

Index	NNS Words Repeated	NS Words Repeated
Number of types	42.455 (16.749)	51.505 (26.629)
Brysbaert Concreteness	2.932 (0.285)	3.099 (0.28)
MRC Familiarity	588.501 (7.137)	587.294 (7.966)
MRC Meaningfulness	430.416 (19.926)	449.934 (19.105)

Within Subjects ANOVAs

Output Data. To investigate the development of L2 lexical proficiency, we conducted repeated-measures ANOVAs using the learners' word information scores (i.e., concreteness, familiarity, and meaningfulness score) to analyze whether temporal intervals affected scores. Our prediction was that, as time spent learning English increased, concreteness and meaningfulness scores would decrease. We predicted no growth patterns for familiarity scores. Because not all learners were sampled at all 18 temporal intervals, we selected only those intervals in which all learners participated (11 intervals).

The results for the concreteness scores showed decreased linear growth as a function of time, $F(10,5) = 13.198$, $p < .050$, $\eta_p^2 = .725$ (see Table 6) indicating that, as the learners developed, they produced words with lower concreteness scores. The results for the familiarity scores did not demonstrate significant decreased linear growth as a function of time, $F(10,5) = 3.417$, $p > .050$, $\eta_p^2 = .406$ (see Table 7). However, the results reported a large effect size indicating a strong relationship between familiarity scores and time. The results for the meaningfulness scores did not indicate significant decreased linear growth as a function of time, $F(10,5) = 4.784$, $p > .050$, $\eta_p^2 = .489$ (see Table 8) although the results approached significance ($p = .080$) and the effect size for the analysis was large. Confidence intervals (95%) for the output analyses are presented in Table 9.

TABLE 6
Means and Standard Deviations for Concreteness Scores: Output

Week	Mean	Standard Deviation
1	2.824	0.110
2	2.753	0.137
4	2.712	0.109
5	2.662	0.066
6	2.654	0.097
7	2.708	0.122
10	2.613	0.065
11	2.618	0.056
12	2.636	0.119
16	2.588	0.131
18	2.570	0.148

TABLE 7
Means and Standard Deviations for Familiarity Scores: Output

Week	Mean	Standard Deviation
1	594.489	3.922
2	595.760	2.216
4	592.535	2.061
5	593.889	3.198
6	592.001	4.735
7	590.202	4.426
10	592.623	2.379
11	593.638	2.733
12	590.759	4.405
16	592.208	3.214
18	591.202	4.077

Input Data. To investigate differences in L2 learning input over time, we conducted repeated-measures ANOVAs using the NS interlocutor word information scores (i.e., concreteness, familiarity, and meaningfulness) to analyze whether temporal intervals affected scores. Our prediction was that as L2 learners became more lexically proficient over time, NS interlocutors would modify their input such that it became more lexically sophisticated. As in the output data, not all learners were sampled at all 18 temporal intervals and we selected only those intervals in which all learners participated (11 intervals).

TABLE 8
Means and Standard Deviations for Meaningfulness Scores: Output

Week	Mean	Standard Deviation
1	409.236	15.794
2	407.348	18.212
4	400.868	14.415
5	396.726	13.130
6	398.809	14.254
7	400.239	9.784
10	397.853	8.061
11	394.887	11.295
12	394.023	12.209
16	388.400	11.579
18	387.156	13.596

The results for the concreteness scores showed a negative linear trend as a function of time, $F(10,5) = 17.404$, $p < .001$, $\eta_p^2 = .777$ (see Table 10), indicating that, as the learners developed, NS interlocutors produced words with lower concreteness scores. The results for the familiarity scores also demonstrated a negative linear trend as a function of time, $F(10,5) = 14.425$, $p < .050$, $\eta_p^2 = .743$ (see Table 11), indicating that, as the learners developed, NS interlocutors produced less familiar words. The results for the meaningfulness scores indicated decreased linear growth as a function of time, $F(10,5) = 10.018$, $p < .050$, $\eta_p^2 = .667$ (see Table 12), indicating that, as the learners developed, NS interlocutors produced less meaningful words. Confidence intervals (95%) for the input analyses are presented in Table 9.

TABLE 9
Confidence Intervals for Lexical Features: NNS Output and NS Input

Index	Lower Bound (Output)	Upper Bound (Output)	Lower Bound (Input)	Upper Bound (Input)
Concreteness	2.586	2.748	2.543	2.607
Familiarity	590.487	594.841	590.305	591.704
Meaningfulness	386.982	408.572	374.096	377.369

TABLE 10
Means and Standard Deviations for Concreteness Scores: Input

Week	Mean	Standard Deviation
1	2.694	0.069
2	2.651	0.056
4	2.622	0.088
5	2.599	0.099
6	2.512	0.028
7	2.609	0.049
10	2.530	0.098
11	2.531	0.135
12	2.533	0.078
16	2.536	0.051
18	2.509	0.040

TABLE 11
Means and Standard Deviations for Familiarity Scores: Input

Week	Mean	Standard Deviation
1	593.948	1.537
2	592.437	3.837
4	590.763	2.426
5	593.294	0.732
6	589.580	1.268
7	592.129	2.788
10	590.099	2.610
11	590.600	1.988
12	589.863	1.905
16	589.821	2.257
18	588.517	1.711

TABLE 12
Means and Standard Deviations for Meaningfulness Scores: Input

Week	Mean	Standard Deviation
1	381.736	5.231
2	381.136	6.618
4	377.422	8.620
5	379.617	3.830
6	371.877	4.751
7	376.505	3.427
10	372.344	9.379
11	374.017	3.860
12	370.914	6.415
16	376.109	5.357
18	371.384	3.938

Linear Mixed Model Analyses

We conducted a linear mixed model (LMM) analysis to examine whether word information indices for the L2 learners' output were predictive of their TOEFL scores. Unlike repeated-measures ANOVAs, a mixed model analysis allowed us to keep all available data from the TOEFL test results. In the LMM, the TOEFL scores were our dependent variable. Our fixed factors were the three word information indices and the collection intervals. We examined main effects for each fixed factor and interactions between the word information indices and the collection intervals. For random effects, we selected the collection interval for each individual L2 learner.

For the initial mixed effects model, only concreteness, $F(1,20.849) = 14.114$, $p < .001$, and the interaction between concreteness and collection intervals, $F(1,21.929) = 10.521$, $p < .010$, showed significant effects on TOEFL scores. Thus, we removed the nonsignificant explanatory variables (i.e., familiarity and meaningfulness) and reran the LMM with only concreteness. The simpler model showed significant effects on TOEFL scores for concreteness, $F(1,26.378) = 11.550$, $p < .010$, and the interaction of concreteness and collection intervals, $F(1,28.928) = 7.058$, $p < .050$. The interaction between concreteness and collection interval demonstrated gain scores of 5.014, $t(28.928) = 2.657$, $p < .050$, indicating that decreases in concreteness scores explained gains of 5 points for the TOEFL scores at each temporal interval.

DISCUSSION

Usage-based perspectives are predicated on the idea that the patterns and features of a language attune learners to most efficaciously acquire that language. The majority of studies investigating usage-based perspectives in language learning have focused on syntactic and grammatical acquisition. In addition, most of these studies have focused on frequency-based approaches (i.e., the frequency of constructions and type frequency; though see Ellis & Ferreira–Junior, 2009b). Similar frequency studies regarding lexical acquisition have been rare. This study goes beyond a frequency-based approach to understanding lexical acquisition by focusing on individual word properties related to salience, two tenets of usage-based approaches to language acquisition. The analyses reported in this study provide support for the notion that salience is an important element of lexical acquisition.

TABLE 13
Word Information for Repeated Words From a Single Conversation

Speaker	Number of Types	MRC Meaningfulness	MRC Familiarity	Brysbaert Concreteness
Eun Hui repeated	47	471.621	589.121	3.363
Interlocutor repeated	30	426.077	567.357	2.992

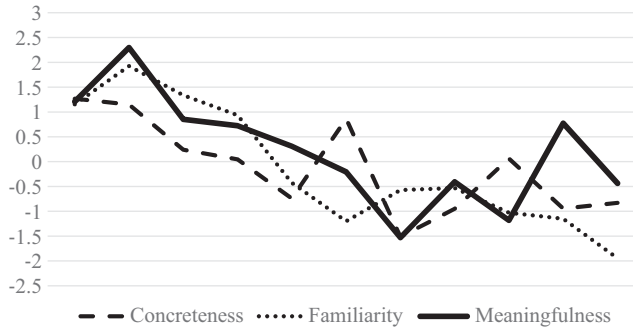
More specifically, these analyses indicate that the salience of words shows strong associations between learner input and output. In addition, the findings report that L2 learners are more likely to repeat word types found in L1 input as compared to their L1 interlocutors and that the words they repeat were more concrete and meaningful (i.e., more salient). Additionally, as L2 learners developed language skills over the course of the year, the input they received became less salient, as did the output they produced. Last, and perhaps most important, the decreased salience in the L2 learners' output explained a significant amount of growth in the learners' TOEFL scores. We discuss each of these below in terms of their importance for both understanding lexical development in L2 learners and forwarding usage-based theories of language acquisition.

Our first analysis examined associations between the salience of words in the input and the output. The purpose of this analysis was to test the presumption that L2 learners' lexicon would match the input they received. Thus, if L2 learners received more salient input, they would produce more salient output and if they received less salient input, they would produce less salient output. The correlational analyses yielded significant and positive correlations for each of our word information indices, indicating that L2 learners' output matched the input they received and that the input and output became less salient over time. The strongest correlations were reported for word concreteness, followed by word meaningfulness and familiarity. This analysis provided evidence for an input–acquisition relationship (Ellis & Collins, 2009) such that the input the learners received appeared to influence the learners' output and convergence between the input and output occurred.

One limitation of the first analysis was that it provided no evidence that the native speaker input was influencing the L2 output. Our second analysis aimed to address this limitation by examining the words repeated in the conversations between the L1 and L2 participants. That is to say, we wanted to analyze whether the L1 speakers were repeating the L2 learners' words or whether the L2 learners were repeating the L1 speakers' words. We also wanted to analyze the salience of the words that were being repeated. Our hypotheses, based on an input–acquisition relationship, were that L2 learners would repeat more L1 speakers' words and that the words repeated would be more salient (supporting a usage-based perspective). These hypotheses were supported in the analysis in that more L1 words were repeated by L2 learners and the words that were repeated were more concrete and meaningful. As an example, we report the mean scores for the repeated words for Eun Hui and her interlocutor (see Table 13). The table indicates that Eun Hui repeated words that were more meaningful, more familiar, and more concrete than those of her interlocutor. For instance, Eun Hui repeated words such as *family, people, speak, teacher, pet, friend, guitar,* and *watch*, all words that are very salient in terms of concreteness, familiarity, and meaningfulness. Her interlocutor, on the other hand, repeated numbers (e.g., *24, 29*, and *100*) and words such as *accountant, retire, together,* and *gem*, that is, words that are not particularly salient.

Our next goal was to look at trends in the input and the output across the entire year-long study to examine whether the words in the input and the output became less salient as a function of time. Our purpose here was to examine changes in lexical sophistication for both learners and interlocutors over time. We hypothesized that interlocutors would begin to change their input, making it more sophisticated as learners had more exposure to the language and that learners would begin to produce more sophisticated language as a result of that exposure. Both of these hypotheses were borne out in the data analyses. The input that learners received did become more sophisticated over time (i.e., less concrete, meaningful, and familiar). Thus, interlocutors initially appeared to modify their language so that it was lexically more salient to the learners. As the learners developed, their interlocutors continued

FIGURE 1
Eun Hui's Lexical Output Over Time (*z*-scores)



to modify their language so that it became less salient over time. These differences seemed to occur in lockstep with the L2 learners' development as seen in the initial correlational analysis and the L2 linear growth analysis, which demonstrated increasing sophistication of language in L2 learner output (i.e., the output became less salient) as a function of time. This was especially true for the concreteness of learners' words, which showed both significant linear trends and strong effects with time. Neither familiarity nor meaningfulness scores showed significant linear trends; however, both did report large effect sizes (i.e., strong relationships between the word property scores and time). The most likely reason that familiarity and meaningfulness scores did not reach significance was the low power of the analyses. The power for the familiarity analysis was .324 and the power for the meaningfulness analysis was .425, indicating that there was well over a 50% chance that the statistical tests would fail to detect an effect that was present. To illustrate the trends reported, we present the linear trends for a single learner (Eun Hui) in Figure 1. The figure shows the linear trends for each of the lexical indices (calculated as *z*-scores to allow comparisons) over the course of the year. Overall, the longitudinal analyses demonstrated that L1 interlocutors modified their input to accommodate L2 learners and that L2 learners showed increasing lexical sophistication that corresponded to the input modifications. These analyses provide evidence that input modification plays an important role in lexical acquisition (Ellis & Collins, 2009; Wulff et al., 2009).

Our final analysis was designed to link changes in L2 output to gains in TOEFL scores. Our initial analysis demonstrated significant linear trends in TOEFL scores such that the L2 learners scored increasingly better on the TOEFL as a function of time. These gains indicated that the learners in this study were steadily increasing their academic language proficiency. The linear mixed model analysis using the word property indices, the collection intervals, and the TOEFL scores showed an interaction between concreteness scores and collection intervals on TOEFL scores, such that decreases in concreteness scores at each TOEFL collection explained a 5-point gain in TOEFL scores. This interaction was significant and shows that increasing lexical sophistication on the part of the L2 learners is strongly linked to increased academic proficiency as measured by the TOEFL. Thus, as learners begin to produce less salient words, their TOEFL scores increase.

In total, these analyses provide a clearer picture of interactions among learner input, learner output, lexical growth, and academic language development. The results support input and output hypotheses of second language acquisition and usage-based perspectives of learning. What we see is the importance of modifying lexical input in terms of salience and how L2 input converges around these modifications. This convergence leads to steady growth in lexical word properties over the course of a year such that L2 learners begin to produce more sophisticated language (i.e., less salient language). Most important, changes in the word properties of L2 learners can be linked to gains in overall language proficiency. The findings from this study call into question the strong argument that learners are intuitive statisticians (Ellis, 2006a, 2006b) in that salience does not rely on learners implicitly understanding the distributions of words in a language. However, there is little doubt that frequency is important and it is most likely that frequency interleaves with salience to explain

lexical acquisition and that the two features are intercorrelated (Gries, 2008, 2010).

Theoretically, these analyses demonstrate that aspects of usage-based theories of language learning are key components of lexical development. Specifically, language that is more salient is the more likely to be acquired. Over time, as learners develop and their language skills increase, we see a decrease in their use of salient language. This decrease co-occurs with changes in the input they receive from L1 interlocutors. Thus, both input and output are important components of understanding lexical development.

The findings reported here also have interesting applications for second language teaching. As reported in Crossley et al. (2014), frequency-based accounts of lexical acquisition are confounded by differences in types and tokens as well as considerations of form–meaning mappings and L1 lexical transfer. However, frequency has long been the principal selection criterion for vocabulary in L2 teaching, with researchers explicitly claiming that high frequency vocabulary is extremely useful for beginning level learners (Nation, 2011; Schmitt & Schmitt, 2012). While we find very few faults with this assumption, it should be noted that frequency is not an easy construct to fully grasp and implement. There are differences in how to operationalize frequency (i.e., frequency in terms of bands or frequency in terms of normalized occurrence; Crossley, Cobb, & McNamara, 2013). Frequency bands are the most common pedagogical approach, but even this operationalization can be ambiguous because the extent and boundaries of high and low frequency vocabulary may not be optimized (Schmitt & Schmitt, 2012). With these difficulties in mind, it might be advantageous to develop L2 vocabulary criteria based on salience either alone or in conjunction with word frequency. Such criteria may include cut-offs for low, mid, and high frequency vocabulary that is weighted by the concreteness, meaningfulness, and familiarity of the words. In this way, learners would be exposed to words that are both frequent and salient, maximizing the potential for acquisition. However, we are not strictly advocating the development of word lists and their use in isolation. As evidenced by this study, words need to be contextualized in meaningful conversations for acquisition to occur.

CONCLUSION

This study provides support for a usage-based account of language learning and the importance of input and output. Specifically, this study finds that words that are more salient show convergence in L1 input and L2 output and that L2 learners are more likely to repeat more salient words in the L1 input. In terms of input, L1 interlocutors modify their lexicon to match that of the L2 learner they are speaking with and the L2 learners show developments over the course year such that their vocabulary becomes less salient (i.e., more sophisticated). Last, the development of less salient output on the part of L2 learners can account for gains of 5 points per collection interval in standardized tests such as the TOEFL.

The results of this analysis open doors for future research. Most specifically, it remains to be seen how frequency and salience interact with lexical acquisition. Investigating such interaction is best suited to behavioral studies and not corpus studies such as this one. In addition, the results reported here need replication, specifically with larger populations to overcome the low statistical power reported. It may also be advantageous to examine how salience interacts with different parts of speech. Previous studies on frequency and range indices have shown differences in how nouns and verbs interact (Crossley, Subtileru, & Salsbury, 2013). A similar approach may prove important for understanding form–meaning mappings between content and function words and between types of content words. In addition, the salience approach discussed here could be extended to verb–argument construction and type frequency analyses to help develop theories of usage-based approaches to syntactic and grammatical knowledge. Lastly, knowing that acquisition involves learner features such as cognitive abilities, learners' L1s, age, and gender (Verspoor & Schmitt, 2013), future studies should consider these individual differences.

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NOTES

[1] Researchers have also begun to examine word entropy/contextual diversity (i.e., the number of different contexts in which a word appears) as an indicator of

lexical development and knowledge (Adelman, Brown, & Quesada, 2006; Crossley et al., 2013; Johns & Jones, 2008; McDonald & Shillcock, 2001). This research indicates that the range of texts a word appears in is often a better indicator of lexical decision latencies, word naming, and word production.

[2] Construction type frequency is different than word type frequency. Word type frequency is the frequency of a unique word.

[3] In cognitive linguistics, the term *salience* can refer to both cognitive salience (i.e., whether a linguistic item has been activated by another linguistic item) and ontological salience (i.e., whether a particular referent/entity is likely to attract attention). Schmid (2007) argues that cognitive salience and ontological salience are related—cognitively salient concepts are more likely to be evoked by ontologically salient concepts.

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