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MAKING SENSE OF FREQUENCY

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Nick Ellis's article is impressive for its breadth of scholarship and the cogent case made for frequency as an important factor in second language acquisition (SLA). This response begins with a brief historical sketch, which aims to contextualize the frequency factor in terms of the evolution of SLA research. Although researchers have known about a frequency effect for some time, until recently, we have lacked neurologically plausible models and technologically convenient means of measuring and testing frequency effects in input. Still, as relevant and important as a frequency factor is, it requires greater definition and qualification. For instance, L2 learners are agents of their own learning process. They do not merely record frequency; they categorize frequently occurring patterns, abstract, and generalize from them. Higher level generalizations emerge from interactions, impose top-down expectancies on future data, and, in turn, are altered by the data in a perpetually dynamic interplay. In a similar fashion, it is incumbent on SLA researchers not to be satisfied with a frequency explanation, but to interpret it—in short, to make sense of frequency.

I am impressed by Nick Ellis's "Frequency Effects in Language Processing and Acquisition." I have been aware for some time of the powerful distributional regularities in language. They make language the inherently fine-tooled and acquirable system of communication that it is. However, I am newly appreciative of the breadth of scholarship that Ellis has brought to bear on the important issue of human beings' capacity to perceive and make use of frequency information. Second language acquisition (SLA) research clearly needs to be informed by such work in psycholinguistics. Writing with authority and drawing on studies in this relevant discipline, Ellis has made a convincing case for the fact that (input) frequency plays an important role in SLA.

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Of course, I needed little convincing. As Ellis points out, way back in 1976, I concluded that frequency was an important factor in SLA. To provide a context for what follows, I first revisit that point in history to understand the significance of this conclusion and what its impact was. I then explain why I set it aside for the time being, and why, in my opinion, it has now resurfaced. This requires a short, somewhat autobiographical—and thus inevitably selective—diversion, which I will indulge in before returning to a discussion of Ellis's paper. When I do, I organize my remarks around eight qualifications, what I call the *Yes, And*s. *Yes*, I absolutely believe in the importance of frequency effects. *And*, at the same time, as I am sure Ellis would agree, it is essential to note that the story does not end here. Any frequency claim needs further definition and qualification.

FREQUENCY IN SLA HISTORY

Most scholars date the beginning of the modern-day rise of the autonomous subdiscipline of SLA to 1967 or 1972, with the publication of influential and innovative thinking represented in Pit Corder's "The significance of learners' errors" or Larry Selinker's "Interlanguage," respectively. It is important to appreciate that these articles were published when behaviorist views of language acquisition predominated. What was exciting about Corder's and Selinker's articles, and the Chomsky-inspired early SLA studies (which were a direct outgrowth of similarly inspired L1 acquisition research), was that learners' L2 performance was considered worthy of investigation in its own right. Reports concluded that learners' language was systematic and convergent, irrespective of the learners' L1 or language learning experience. Claims of common developmental sequences with regard to certain syntactic structures and morpheme acquisition-accuracy orders were the headlines of the day. To be sure, much of the early research was limited to English L2 learners, and there were obvious individual differences and native language effects, with subsequent research attesting to the pervasive, yet sometimes subtle, effects of the latter. Nevertheless, the convergence of learners' linguistic performance was indeed newsworthy, given the prevailing climate in which successful SLA was seen to be primarily a matter of overcoming the habits of the L1. Clearly, learner performance was not simply a reflex of the L1.

Around this time, my own research was conducted. I was totally captivated with the hypothesis that there was some built-in syllabus or innate language acquisition device that would account for the common features of learners' interlanguage. Having recently been a full-time language teacher, I was sanguine that if we could more fully articulate the learners' built-in syllabus, then we would be able to teach more harmoniously with the natural learning process, rather than contrarily, as we may have been doing. However, before this could be realized, we had to make sure that the morpheme order was not an artifact of the instrument, in particular, the Bilingual Syntax Measure (Burt, Dulay, & Hernandez-Chavez, 1975), which had been used for much of the re-

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search. What I learned from my own study of 24 learners of ESL at two different points in time was that there were indeed task effects and individual performances that did not always conform to the order (Larsen-Freeman, 1975). However, I also found that when modality, skill (productive or receptive), and planning time were controlled for, the order seemed to be robust enough to remain significant despite task and individual differences. To me, this was an utterly fascinating finding but one that necessitated an explanation.

I considered a number of explanations (syntactic complexity, semantic complexity, phonological complexity, learner experience, processing strategies, perceptual salience, and frequency of occurrence) and concluded that a single explanation was insufficient to account for the common morpheme order, which I referred to as an accuracy or difficulty order, being careful not to confuse correlations with causality (Larsen-Freeman, 1975). However, despite there being several contending explanations (i.e., several factors that may have contributed to subjects' performance), the most significant factor of those I considered was frequency of occurrence (Larsen-Freeman, 1976), as determined by significant positive correlations between the accuracy order and the frequency order in Brown (1973) and later corroborated by significant positive correlations with the frequency of the morphemes in ESL teachers' talk during classroom instruction (Larsen-Freeman, 1978).[1]

The methodological flaws in these early morpheme studies are by now well known (see, e.g., Andersen, 1977; Brown, 1983). Nevertheless, the robustness of the acquisition-accuracy order over many studies, coupled with the high correlation with the frequency order, was compelling (Larsen-Freeman & Long, 1991). Then, too, others were finding correlations between the frequency of occurrence in input directed to learners and developmental sequences in SLA (Hatch & Wagner-Gough, 1976). Findings such as these led to the realization that more attention had to be paid to the input with which learners had to contend. This seems perfectly obvious in retrospect, but given the theoretical commitment at the time to a built-in or a hard-wired acquisition device, such a development seemed revolutionary. It goes without saying that the shift to looking at input to heighten an understanding of the SLA process has since been wholly embraced by at least mainstream SLA[2] and has fostered empiricist or environmentalist perspectives that have contributed to important interactionist theories. However, there remained the matter of interpreting or making sense of the frequency effect. What was it about frequency that produced such high correlations with the accuracy-acquisition order? As Ellis rightly asks, "How exactly does the frequency of patterns in the input affect acquisition?" (p. 165).

Disappointingly, at that time, I came to realize that a frequency factor was too ambiguous to resolve any theoretical debates. An interpretation of the effect of frequency depends on one's conception of the language acquisition process. For instance, a behaviorist might feel that the fact that the morpheme order mirrors the frequency of occurrence supports a stimulus-response view of language acquisition. The more frequently a morpheme is encountered, the

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more likely it is reinforced and a habit is established. On the other hand, from the same findings, one could argue just as convincingly that a cognitive perspective on language acquisition is justified. Structures with high frequency might be more noticeable and supply learners with more data on which to base and refine hypotheses about rules. Both of these explanations rest on an analysis of the input data. In Larsen-Freeman (1978), I advanced a third hypothesis. Taking a cue from Peters's (1977) claim that at least some learners tune in to the gestalt of the language, I also pointed out that learners might be treating input language more holistically. It is possible that learners supply morphemes correctly in obligatory contexts, not because the learners control speech habits or have induced rules, but because these morphemes are present in unanalyzed memorized patterns that learners have incorporated into their repertoires. Indeed, it seemed that the morphemes clustered at the top of the accuracy-acquisition order were more likely to enter into such memorized patterns. At this juncture, still convinced of the importance of frequency, but not sure how to proceed with an empirical resolution to its ambiguous role, I set the matter aside.

FREQUENCY REVISITED

Returning now to Ellis's paper, I find it not at all surprising that the issue of frequency has resurfaced at this time when we have access to connectionist models that are both neurologically plausible and methodologically convenient in measuring frequency effects. In these models of neural networks, items that are frequent in the input increase the connection weights between nodes, which are taken to represent neurons in the CNS. As the input is processed, certain connection weights are strengthened, while others atrophy, simulating the plasticity of synaptic connections. Thus, "it is the higher-level systematicities that emerge from the interactions of constructions large and small" (Ellis, p. 167). "The knowledge of a speaker-hearer cannot be understood as a fixed grammar but rather as a statistical ensemble of language experiences that changes slightly every time a new utterance is processed" (Ellis, p. 162; see also Cooper, 1999).

This bottom-up, emergent view of language and language acquisition represents a major departure from the long-held view that language structure is independent of language use (Bybee & Hopper, 2001). As I have written elsewhere, viewing language metaphorically as a naturally occurring, emergent, complex, nonlinear, dynamic system (Larsen-Freeman, 1997), where cognitive representations are highly affected by experience, begins to explain many phenomena, such as idiolects, fuzzy boundaries in language, individual creativity and social adaption, the "systematic instability" of interlanguage, language change originating in performance variability, and the interdependence

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of language acquisition and language use (Larsen-Freeman 1997, 2000, in press-a, in press-b).

Incidentally, as a side issue, I think that it is interesting to ask an even more fundamental question than Ellis asks: What purpose does frequency serve in language? After all, language is characterized by a number of distributional regularities involving frequency. For example, language can also be characterized as a hapex legomenon phenomenon: Approximately half of the words in any given text occur only once in the text. To cite another example, the 10 most frequent words in a text of a given size will be rank ordered in the same sequence in a text much larger than it.

Operating from the "law of least effort," Zipf (1972) explained why frequency is an important dimension exploited by language. The law of least effort encourages speakers and auditors to economize on verbal labor. For example, Zipf's Force of Unification exerts pressure on speakers to reduce the size of their vocabulary thereby conserving mental labor. This entails speakers using words for more than one meaning, thereby inflating their frequency of use. Conversely, the auditor's economy benefits from an increased vocabulary, with the ultimate aim of having one distinct meaning for each single word, what Zipf attributes to the Force of Diversification. Keeping the forces of unification and diversification in check involves using some words, but not all, for more than one meaning. Initially, then, polysemous words run contrary to the law of least effort for auditors because they require more processing attention for auditors to discern which of their potential meanings the speaker intended. However, because polysemous words are more frequent, over time their processing becomes much more efficient and thus requires less effort.

QUALIFICATIONS CONCERNING FREQUENCY

Implicit in what I have written thus far is that simple frequency does not, in and of itself, explain much about language acquisition. As I wrote earlier, the role of frequency needs interpreting. Additionally, a frequency effect cannot be determined by sheer plurality of numbers. Recognizing this, Ellis qualifies the impact of frequency in three ways. First, frequency can be expressed as a power law. Frequency does not yield a uniform effect at all times. Then, too, there is the moderating influence of cue competition and constraint satisfaction. Finally, Ellis brings to our attention the fact that there is a difference between type frequency and token frequency.

In the following sections, I continue with my own contributions to the qualifications. I start off each by acknowledging, "yes," the effects of frequency are important. Then, preceded by "and," I underscore another qualification raised by Ellis or I introduce one of my own, which was stimulated by my reading of his paper.

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Yes, and We Still Need to Account for Some Generative Capacity

Although we may have capacious memories, we certainly do not memorize our language. How can we account for the generativity of language with a frequency explanation alone? How can we account for the improvisational metaphors of ordinary language use? I was quite drawn to Becker's words when I first read them in 1983: "Suppose that, instead of shaping discourse according to rules, one really pulls old language from memory . . . and then reshapes it to the current context" (p. 218). However, we need to know what "reshaping" entails: Is the reshaping accomplished by the application of rules of syntax, or is reshaping the result of scaffolded co-construction of interlocutors in the moment? Or, might it be a process of morphogenesis, pattern formation, or emergentism whereby input data trigger the creation of novel complexity, complexity beyond that of the input data, much like the creative pattern formation and problem solving that happens in other natural systems (Larsen-Freeman, 1997; MacWhinney, 1999; Mohanan, 1992)? This is clearly an issue of central concern among SLA researchers and theoreticians these days.

Yes, and We Are Not Imprinted by Frequency

Although we are noticers of probabilistic tendencies, we are also sense makers. We are not simply imprinted by frequency. Frequently occurring items that are not comprehended remain noise and likely do little to further the SLA process. Instead, we attempt to make sense of them using processes such as deduction, induction, and abduction. We seek patterns. We categorize frequently occurring items by abstracting from them underlying schema, prototypes, generalizations, and so forth. If abstraction does not occur, the data are at least organized by features, such as in Instance-based theories (Truscott, 1998) or through settling into or forming "basins of attraction" (Cooper, 1999; Larsen-Freeman, 1997; Mohanan, 1992). Thus, any bottom-up systematicities that emerge impose top-down expectancies on future data, creating some pattern stabilization (Cooper; Grossberg, 1988; Loritz, 1991), which in turn is altered by new data in a perpetually dynamic interplay between bottom-up and top-down processing (Larsen-Freeman, in press-b). Furthermore, as I just wrote, we do not only organize the data, we look for meaning in the patterns. If we cannot find it, we make it. Although we rely greatly on positive evidence, we make use of negative evidence as well in our meaning making. In other words, learners of a language attempt to make sense of the input forms, fitting the new forms into the network of interrelated constructions that constitutes their knowledge of language (Goldberg, 1995).

Yes, and It Is Not Only about Formal Frequency Either

I wish to warn against equating frequency with frequency of form alone. Ellis asserts that frequency cannot be the only factor at play because if it were so, "we would never get beyond the definite article in our speech" (p. 178). I take

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Ellis's point, but it is important to remember that, though invariant in form, *the* is not monolithic in use. Even though it is used to show definiteness, the occasions of when one uses *the* for definiteness (and when one uses other forms for this notion) are very complicated indeed. It is little wonder, then, that although *the* is a frequently occurring form, it is not easily acquired. We cannot limit our discussion of frequency to frequency of form. We need to consider frequency of form-meaning-use composites. Structures are indeed multidimensional (Larsen-Freeman, 1991).

Yes, and We Need to Think Emically, Too

With access to computer-based linguistic corpora, researchers can measure frequency much more easily these days than when we used to have to tediously pore over transcripts. However, it is well known that attention is influenced by experience. Therefore, we need to think emically, too, in order to see things from the point of view of the learner. Frequency can enhance salience, but it cannot guarantee attention. As is also well known, for instance, attention can be determined by developmental readiness. When a learner has a framework into which a new form fits, the new form becomes salient; otherwise it remains noise. A form can also be made salient through interaction. It is important to note that, as with frequency, the criterion of salience can apply to all three dimensions—form, meaning, and use. Whereas frequency may heighten the salience of the form of a structure, the meaning of a particular form may become salient when it is encountered in a contrastive way. Furthermore, the pragmatics or use of a form may become apparent when learners observe that they have committed some infraction of a norm. In short, as attractive as connectionist models are, they clearly do not explain all of human SLA experience. There is no computer that can be programmed to reflect human agency or intention. Even though they provide good models of implicit learning, they take into account neither attention nor the will of the agent directing it.

Yes, and Speakers Still Have Choice

Finally, at the level of the individual, choice does exist. Frequently occurring patterns provide a degree of predictability to what one will say, but only a degree. Our speech does not totally mirror the frequency in the input. For instance, there is even work demonstrating that there is a relationship between the use of certain grammatical structures and one's personality (Larsen-Freeman, 2002). There are probabilistic tendencies in language, not absolutes.

Yes, and Input Frequency Does Not Immediately Translate into Output Production

One thing that will no doubt bother some of Ellis's readers is his collapsing of distinctions: comprehension and production, structure and use of language,

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processing and acquiring language. For instance, because frequency facilitates processing in the studies cited by Ellis, does that mean it also facilitates acquisition? I, myself, am less concerned with the collapsing of distinctions that Ellis makes between processing and acquisition or use and acquisition or structure and use because I believe that they are all reflective of the same underlying dynamic process (Larsen-Freeman, in press-b). As I have discussed, in connectionism, there is no principled distinction between structure or its representation on the one hand and processing or acquisition on the other.

Perhaps inconsistently, however, I do have some concern with the blurring of the boundary between comprehension and production. Ellis writes, "The enormity of the lexical pool . . . makes it clear that the necessary representative experience for fluency must be vast indeed" (p. 167). I do not believe that it is simply a matter of mapping input by comprehending the lexical pool and then reproducing it as fluent output, nor do I believe that one simply processes input, which becomes automatized with practice as fluent output. There is clearly overlap between a comprehension grammar and a production grammar, but they are not isomorphic (Larsen-Freeman, in press-b).

Yes, and There Is Still Room for a Dual-Processing View

Ellis writes, "Frequency of occurrence may lead to independent representation of even so-called regular constructional patterns. In this usage-based perspective, the acquisition of grammar is the piecemeal learning of many thousands of constructions and the frequency-biased abstraction of regularities within them" (p. 168). As I have already indicated, I subscribe to this view, and I find its parsimony appealing. However, I am a bit more cautious than Ellis about representing the outcomes of the process. To my mind, there has not yet been definitive research to favor single- over dual-processing modes (exemplars vs. rules and symbols). Positron emission tomography scans have shown, for instance, different patterns of brain activation for human subjects asked to produce the past tense of English regular and irregular verbs (Jaeger et al., 1996). As I indicated earlier, conferring importance on frequency in the input need not automatically force the conclusion that there is only bottom-up processing and storage. Adaptive Resonance Theory models, for instance, incorporate competitive learning from both top-down and bottom-up inputs (Cooper, 1999).

Yes, and What Consequences for Instruction Does a Frequency Effect Suggest?

I also agree with Ellis about the value of explicit instruction. However, although powerful, instructors cannot just be purveyors of frequent patterns. As Ellis notes, they can promote noticing to moderate frequency effects. They can also provide helpful negative evidence in the form of consciousness rais-

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ing. Indeed, in the case of pragmatics or markedness in the L2, acquiring some linguistic structures may require negative evidence. For me, output production also plays an important part in instruction and not just in promoting noticing of the input or in developing automaticity. Output production contributes to restructuring (Larsen-Freeman, in press-a).

I say all this because I fear that findings of frequency effects might be interpreted as lending support to the claim that all learners need is to be given abundant comprehensible input. This is not a justifiable interpretation of a frequency effect in my opinion. We still have a responsibility to seek the most efficacious manner of building from humans' perceptions of probabilistic tendencies. Although doing so may to some extent vary from learner to learner, I think we know enough not to simply play the same tapes over and over again for students without, at least, redirecting their focus. Rather, we need to engage students in meaningful interaction because engaging them so provides the optimal way for learners to benefit from frequency and saliency—etic and emic.

Finally, I must confess that I do not know exactly what to make of the pedagogical implications of corpus-based research that reveals frequently occurring patterns. Besides making sure that the patterns and their variants are represented in materials, I am still at a loss for how to work with learners on the patterns systematically, not in a piecemeal fashion.

CONCLUSION

I end as I started this piece: It seems to me that Ellis has made a powerful case that human beings are very good at determining underlying frequency distributions and central tendencies. This capability can be exploited in language, making it a fine-tooled, acquirable system of communication. Ellis makes his case at a time when neurologically plausible models and theories exist, which may help us make sense of frequency in a way that we were prevented from doing 25 years ago.

It also seems to me that Ellis has been appropriately circumspect about frequency by pointing to the power law of practice, the modulation of frequency effects, the differential effects of type versus token frequency, and the moderating influence of instructional factors. To these I have added (to which I do not think Ellis would take exception) that we also have to (a) explain the generative capacity of humans, (b) not ignore the fact that we must measure the frequency of form-meaning-use composites, not form alone, (c) take into account human agency and attention, (d) recognize that choice still exists at the level of the individual, (e) not assume an isomorphism between production and comprehension grammars, (f) remain open to a dual-processing view, and (g) not rely on learners' sensitivity to frequency to do our instructional work but take advantage of this sensitivity by creating meaningful, engaging, and interactive activities. In conclusion, when Ellis writes that frequency is "a causal variable in language learning" (p. 175), we understand that this is a

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significant statement whose brevity should not belie the fact that making sense of it requires a much longer story.

NOTES

1. I must say that it was gratifying to read Goldschneider and DeKeyser's (2001) meta-analysis of L2 studies, which essentially concurs that there are multiple determinants for the morpheme order, frequency of occurrence being a statistically significant one of them.
2. UG researchers continue, of course, important research from an innatist perspective.

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