Word and World Order: Semantic, Phonological, and Metrical Determinants of Serial Position

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Animacy, word length, and prosody have all been accorded prominent roles in explanations for word order variations in language use. We examined the sequencing effects of these factors in two types of tasks. In recall tasks designed to simulate language production, we found selective effects of animacy. Animate nouns tended to appear as subjects in transitive sentences, but showed no special affinity for initial position in conjunctions within sentences, suggesting a stronger involvement of animacy in grammatical role assignment than in word ordering. Word length had no significant impact: Shorter words did not appear earlier than longer words within sentences or within isolated conjunctions of nouns. Prosody had a weak effect on word order in isolated conjunctions, favoring sequences with alternating rhythm, but only in the absence of an animacy contrast. These results tend to confirm a hypothesized role for conceptual (meaning-based) accessibility in grammatical role assignment and to disconfirm a hypothesized role for lexical (form-based) accessibility in word ordering. In a judgment task, forms with animate nouns early were preferred across all constructions, and forms with short words early were often preferred both in sentences and in conjunctions. The findings suggest a possible asymmetry between comprehension and production in functional accounts of word order variations. © 1993 Academic Press, Inc.

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One of the central problems in speaking is the transformation of thoughts into language. A key component of this problem is the disparity between thought and language in their potential for simultaneity. Whereas thoughts seem to have the capacity to capture many features and relations at once, spoken languages convey these features and relations in segments that must be uttered one at a time. This makes word order an important device for conveying information in language (Bates & Mac-Whinney, 1982; Gernsbacher, 1990) and one gauge of the elements that have priority in language use (Bock, 1982).

In this paper we will examine three factors with reputed control over the word-order options allowed by the grammar of English. The first, animacy, is one member of a set of semantic factors that seem to have conceptual priority by virtue of their centrality to human communication (Cooper & Ross, 1975). The second, word brevity, is a factor that may create priority in speech by virtue of its facilitation of language processing (Zipf, 1949). The third, prosody, offers an alternative account of some of the effects of word length that have been observed in the literature (e.g., Campbell & Anderson, 1976; Cooper & Ross, 1975; Pinker & Birdsong, 1979). It emphasizes the importance of regular rhythmic structure in speech and so values ease of production over ease of retrieval.

Comparisons of these factors require the consideration of differences in the mechanisms by which they might affect word order. The simplest hypotheses about ordering are those that relate order directly to retrieval from memory. Perhaps words that are easily retrieved appear early in the output, so animate expressions (because of their centrality to human thought) and short words (because of their phonological simplicity) are recovered or assembled quickly (Bock, 1982). Accordingly, words that are readily recallable in many settings, even settings that do not involve sentence production, may be the same words that appear early in sentences.

This simple picture is complicated by the architecture of the sentence production process (Bock, 1987b; Dell, 1986; Garrett, 1988). In languages such as English, word order is mediated by assignments to grammatical relations. As a result, what comes first in a sentence is often (though not always) the subject. For a readily recalled word to have priority in production, it must achieve that status by way of an assignment to the subject relation. However, such assignments are not made on the basis of the sounds of words so much as on the basis of their grammatical categories and meanings (see Pinker, 1989, for a survey and analysis of some of the semantic correlates of function assignment). In Garrett's (1988) model, for example, lexical retrieval proceeds in steps linked first to meanings and then to forms (cf. Levelt, Schriefers, Vorberg, Meyer, Pechmann, & Havinga, 1991; Schriefers, Meyer, & Levelt, 1990), with these steps

linked to grammatical role assignments and word order, respectively. In Dell's (1986) model as well, words assume syntactic relations at a level prior to that at which their phonological components are specified. Although there are means in Dell's model for sound to affect grammatical role assignments, and some evidence that it may do so (Bock, 1987a), these means are indirect.

To account for different ordering mechanisms, Bock (1987b) called on the distinction between *conceptual* and *lexical* accessibility (see Clark & Clark, 1977). Words that are conceptually more accessible (those whose base forms or *lemmas* are more accessible because of their meanings) will be assigned to roles that are higher in hierarchies of grammatical relations (in which subjects dominate direct objects, which in turn dominate indirect and oblique objects; e.g., Keenan & Comrie, 1977). Words that are lexically more accessible (with surface forms or *lexemes* that are more accessible because of their phonology) will be allotted to earlier serial positions than lexically less accessible items. Although conceptual and lexical accessibility are sometimes naturally confounded, as they may be for prototypical concepts (Kelly, Bock, & Keil, 1986), there are means for dissociating their effects.

These ideas motivated the basic hypotheses that we tested in our research. Since animacy is a semantic rather than a surface form property, animate nouns may be conceptually more accessible than inanimate nouns. If so, animates should tend to be assigned to higher-level grammatical roles than inanimates, other things being equal. Conversely, since word length is a surface form property rather than a semantic property, short words may be lexically more accessible than long ones. If so, short nouns should be assigned to earlier serial positions than long nouns, other things being equal.

What Controls Word Order Options?

In this section, we review the case for the foregoing hypotheses about word order, and then offer an alternative, prosodic account of the evidence for lexical accessibility.

Conceptual accessibility. Conceptual accessibility is linked to retrievability from memory or, more broadly, from a knowledge base. One candidate source of this retrievability is transient priming within a semantic network. Bock (1986) investigated this possibility with a primed picture-description task in which speakers were presented with priming words that were semantically or phonologically related to other words that could serve as either the subjects or objects of sentences. After the presentation of the primes, the speakers produced these sentences as descriptions for pictured actions. With semantic priming, the primed words tended to be produced as subjects more often than as objects, whereas with phonolog-

ical priming, there was no significant difference between primed and unprimed words in their tendency to appear as subjects.

A different source of conceptual accessibility is the structure of the conceptual network itself (Bock & Warren, 1985). A richer network simultaneously offers more conceptual relations in which a lemma may participate and more retrieval routes to a lemma. One index of this sort of accessibility is predicability (Keil, 1979), or the range of predicates that sensibly qualify a concept. Predicability can differ substantially for different concepts. For example, *lions* can be said to be fierce or cowardly, found in Africa, found in zoos, tawny, carnivorous, feline, large or small, long or short, and scarce or plentiful, among many other things. *Time* can also be readily said to be long or short and scarce or plentiful, but not much more, and certainly not cowardly, resident in Africa or zoos, tawny, carnivorous, feline, or large. Because of variations in predicability, people have more things to say about some things than others.

Bock and Warren (1985) examined whether predicability—measured in terms of the correlated property of concreteness—affected grammatical role assignments. They created sentences whose grammatical roles were filled by nouns that varied systematically in concreteness, and presented the sentences to students for later recall. In recall, the grammatical role assignments were often changed by shifting more concrete nouns from lower to higher grammatical roles. For example, active sentences in which the original direct object was more concrete than the subject tended to be recalled with the direct object as the subject of a corresponding passive. A similar tendency appeared in a different sentence type, datives, involving grammatical roles other than the subject.

These results are consistent with the hypothesis that conceptually accessible lemmas tend to be assigned to higher-level grammatical roles. But because higher-level roles and earlier word position go together in English (e.g., subjects typically precede direct objects), accessible lemmas also preceded less accessible ones in the recalled sentences. To determine whether role assignments or simple ordering tendencies were responsible for the results, Bock and Warren (1985) included sentences in which the two critical nouns differed in concreteness and serial position but shared the same grammatical roles. The sentences contained conjoined nouns (e.g., *time* and *winter* in *The lost hiker fought time and winter*). If conceptual accessibility affects word order, the more concrete word should tend to be produced before the less concrete one. However, concreteness had no effect on the order in which the critical nouns were recalled, implying that the effects of concreteness were in fact due to changes in role assignment and not to preferences for word orders in which more concrete words precede less concrete words.

Like concreteness, animacy may create conceptual accessibility by vir-

tue of the centrality of animate concepts within knowledge networks. And like concreteness, animacy seems to have an affinity for higher-level grammatical roles (Clark, 1965; Clark & Begun, 1971; Itagaki & Prideaux, 1985; Jarvella & Sinnott, 1972; Johnson, 1967). In tasks that require generating sentences (including recall and picture description), there is a strong tendency to use animates as subjects (Dewart, 1979; Harris, 1978; Lempert, 1984, 1989). Bock, Loebell, and Morey (1992) summarized the results from several experiments which showed that in 4845 descriptions of events with inanimate agents and animate patients, 74% were passive and only 26% active. Since the passive allowed the animate patient to serve as the subject, this option helped to outweigh the enormous bias against the use of the passive. For example, Goldman-Eisler and Cohen (1970) found that passive production ranged between .8 and 11% in natural speech from sources as disparate as parliamentary debates and schizophrenic dialogue, with actives making up the remainder.

The relationship between animacy and subjecthood is standardly explained in terms of the link between particular thematic roles (often agency) and the subject function. In linguistics, the link is sometimes formulated as a mapping from more primitive semantic relations such as agency of causation or motion (e.g., Jackendoff, 1987; Pinker, 1989). These accounts help to explain why certain types of noun phrases (technically, *arguments*) must play certain grammatical roles with respect to certain verbs. However, the accounts generally focus more on what is possible than on what is probable, with the consequence that they may fail to offer an explanation of broad but noncategorical tendencies. One of these broad tendencies is the affinity of animates for subjecthood. This affinity appears in passive as well as in active sentences, and for passives it is hard to give a uniform explanation in terms of thematic roles. For example, Pinker (1989, following Zubizaretta, 1987) offered an analysis which removes the thematic role of agent from candidacy for subjecthood in passives, but it is unclear why the demotion of the agent is most likely to accompany the presence of an animate patient or theme.

The animate–subject bias might instead reflect a simple ordering preference—a preference for what we will call animate *leaders*. As Cooper and Ross (1975) observed, there is a noticeable preference for animates to precede inanimates in utterances. They ascribed this to a general ordering principle that they dubbed "Me First," according to which speakers place first those things that are most closely linked to their self-images (e.g., Illinois students attend what they call the Illinois–Michigan game, whereas Michigan students attend what they call the Michigan–Illinois game). Cooper and Ross thereby linked word order to "World Order" (the oft-miscited title of their paper).

Strong evidence that animates lead, regardless of whether they are

subjects, comes from Byrne and Davidson (1985). The children in their experiment learned nonsense names for a set of toy horses and toy carts (e.g., Kal for a horse and Tep for a cart, Zot for another horse and Wug for another cart). Given pairs of names to recall, half presented in the horse–cart order and the other half in the cart–horse order, the children were more likely to recall the horse–cart order. This was true not only for English-speaking children, whose language regularly places subjects first in sentences, but also for Fijian-speaking children, whose language regularly places subjects last. It is therefore unlikely to be a linkage between animacy and subject status that produced the order preference. Instead, it appears that animates simply tend to precede inanimates.

Still, the bias toward animate subjects in English may be something more than a byproduct of leader assignments. In the experiments we report below, we attempted to separate grammatical role assignment from leader assignment with a strategy similar to that employed by Bock and Warren (1985). In the first two experiments, we used both transitive sentences (e.g., *A farmer purchased a refrigerator*) and sentences with phrasal conjunctions (e.g., *The key and the manager were nowhere to be found*). In transitive sentences, animacy differences have the possibility of affecting both subject assignments and leader assignments, whereas in conjunctions, animacy differences can affect only leader assignments. If animacy affects subject assignments over and above leader assignments, there should be a stronger tendency to employ animates as leaders (and therefore as subjects) in transitive sentences than as leaders in conjunctions.

Lexical accessibility. Tip-of-the-tongue states suggest that it is possible for lemmas to be accessed without their corresponding lexemes (Brown & McNeill, 1966), and phonological word substitutions suggest that incorrect lexemes can be retrieved even when lemmas themselves are correct (Fay & Cutler, 1977). Moreover, words vary in the ease with which their lexemes may be recovered (e.g., Huttenlocher & Kubicek, 1983) and lemmas may be prepared somewhat in advance of the lexemes for an utterance (Dell & O'Seaghdha, 1992). These things being so, the lexical accessibility hypothesis suggests that variation in the difficulty of retrieving or assembling the lexeme for a word may affect how that word is ordered in speech. But because lexeme retrieval is assumed to follow lemma retrieval and the assignment of grammatical roles, the effects of lexical accessibility may be hard to discern unless the grammatical roles of words are the same.

Just as for conceptual accessibility, lexical accessibility may be a product of transient changes in the strength of the representation of a lexeme or of preexisting differences among lexemes. Bock (1987a) examined the effects of phonological priming on word order in transitive and conjunc-

tive sentences, and found that in both cases, there was a tendency for lexically more accessible words (*unprimed* words[1]) to appear earlier. However, the tendency was just as strong in the transitive as in the conjunctive sentences, offering no evidence that grammatical role assignments moderated the ordering effect. This is incompatible with the supposition that there are different word-order consequences of conceptual and lexical accessibility.

Levelt and Maassen (1981) explored the effects of preexisting differences in lexical accessibility on word order in several timed production tasks. They first determined the times required to recognize and to name various shapes that were presented in isolation, and from these they selected shapes that were equally recognizable (equally conceptually accessible, in our terms) but differentially nameable. They then explored how variations in naming times were related to word order and to the times required to produce utterances containing the words. These utterances were elicited as descriptions of moving displays containing the shapes. There was a tendency to order the more readily named shapes before the less readily named ones (the magnitude of this tendency was roughly the same as that reported in Bock, 1987a, although the effect was not significant in Levelt and Maassen's study), and sentences that began with more accessible shape-names took significantly less time to initiate than those beginning with less accessible ones.

There are at least two factors that appear to create stable differences in lexeme accessibility. One is word frequency, which affects word pronunciation or naming times even in circumstances in which conceptual contributions can be partialled out (Balota & Chumbley, 1985; Huttenlocher & Kubicek, 1983). The second is word length. In various situations that demand the retrieval of words from memory, words with fewer syllables may have an advantage. Brown and McNeill (1966) noted that monosyllabic words were less often responsible for tip-of-the-tongue states in their sample, and in word-list memory studies, shorter words have been found to be more recallable than longer ones both in long-term (Calhoon, 1935) and immediate recall tasks (Baddeley, Thomson, & Buchanan, 1975).

Frequency and word length may also affect word order. This conclusion stems largely from analyses of "frozen" phrases, phrases in which word order is invariant or nearly so (e.g., *salt and pepper, every Tom,*

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[1] There is mounting evidence that a common if not inevitable effect of phonological priming is suppression or inhibition of the primed (phonologically related) word relative to unprimed (phonologically unrelated) words. This evidence comes from a variety of tasks including word pronunciation (e.g., Grainger, 1990; Lukatela & Turvey, 1990; Peterson, Dell, & O'Seaghdha, 1989), lexical decision (Colombo, 1986), and picture naming (Eberhard, 1991).

Dick, and Harry). In a sample of 400 frozen phrases from English, German, and Russian, Fenk-Oczlon (1989) found that the more frequent word came earlier than the less frequent in 84% of the cases, and frequency accounted for the order of the phrases much better than any other single factor. Short words likewise tend to lead long ones in frozen expressions. Cooper and Ross (1975) observed that the first elements of frozen conjoined expressions tend to have fewer syllables than the second elements. Their analyses yielded strong support for the short-first principle, and they found it to dominate several other proposed phonological principles of frozen word order. As further support, analyses of novel, nonfrozen conjunctions from a massive sample of famous quotations revealed a significant tendency for shorter words to precede longer ones (Kelly, 1986).

However, there are difficulties with the simple length-in-syllables hypothesis. Word length is confounded with many other factors, including word frequency and derivational or morphological complexity. For example, Malkiel (1959) noted that the first part of a frozen expression generally contains fewer morphemes than the second part. A tendency for short words to lead could simply reflect the accessibility of more frequent or simpler words, rather than the accessibility of shorter words.

Another problem for the length hypothesis is that short words might precede longer ones not because of any differences in accessibility, but because such an ordering more often creates a euphonious sequence. Speakers seem to prefer regular alternations between strong and weak stresses (Kelly & Bock, 1988; Selkirk, 1984; but see Cooper & Eady, 1986), and those preferences are strong enough that lexical stress may change over time to maximize an alternating pattern (Kelly, 1988a,b, 1989, 1992). Similarly, Malkiel (1959) and Lambrecht (1984) pointed out several cases in German in which the first member of a conjunctive freeze loses its ending in order to make it shorter or equal in length to the second member (e.g., *Freud' und Leid,* instead of *Freude und Leid* [*joy and sorrow*]), which also enhances alternation. These rhythmic preferences will often favor placing monosyllabic stress-bearing words early in conjunctions, since the monosyllable is followed by an unstressed conjunction (as in *men and women*). However, conformity to rhythmic preferences can also produce violations of the short-first principle (*hippety-hop* is an example cited by Campbell and Anderson, 1976).

An obvious implication is that word order may reflect principles of metrical structure that are often confounded with variations in the lengths of words in the sequence (Jespersen, 1923). Since sequences in which short nonsense syllables precede long ones are preferred over sequences in which this order is reversed (Pinker & Birdsong, 1979), it is clear that

there may be an explanation for the short–long preference that does not depend on differences in the retrievability of real words.

Summary. Word order in speech is a complex product of factors that reflect language structures (including factors linked to syntactic and metrical structures) and factors that reflect the retrievability of information from memory and general knowledge (including factors linked to the accessibility of lemmas and lexemes). There is considerable evidence for a conceptual accessibility hypothesis: Conceptually accessible words (more accurately, words representing accessible lemmas) tend to precede less accessible words both in structured and unstructured sequences. There is also some evidence that this tendency may be enhanced when syntactic–structural assignments are involved.

The case is less clear for the lexical accessibility hypothesis—that words containing accessible word forms or lexemes precede those containing less accessible ones. The experimental record offers weak support, but that record is slim. Likewise, although there are a number of observations consistent with the hypothesis, some of those observations are equally consistent with a prosodic or metrical-structure hypothesis. There is little evidence relevant to the claim that lexical accessibility affects word order more directly than it affects syntactic–structural assignments, and that evidence is negative.

The following experiments were designed to more directly test these ideas. In the first two experiments, we examined the effects of animacy and word length on grammatical role assignments and on word order in the recall of full sentences. In the next three experiments, we examined the effects of the same two factors on word order in the recall of simple conjunctive phrases (e.g., *room and children*) in which grammatical role assignments play no overt role. In the sixth experiment, we narrowed our focus to the metrical structure of conjunctive phrases and the interaction between this structure, word order, and word length. The final experiment was designed to see whether acceptability judgments for sentences and phrases with different word orders varied along the same lines as recall for those sentences and phrases.

The recall tasks in the first six experiments were used because they are convenient and effective simulators of normal language production. In many experiments, the recall of sentences has been found to be sensitive to factors that characterize natural formulation processes (see Bock, 1982, for a review), probably because the reconstruction that underlies the recall of linguistic materials rests heavily upon normal production mechanisms. Even short-term sentence recall tasks seem to be surprisingly vulnerable to the effects of these mechanisms (Potter & Lombardi, 1990). The advantage to the recall methodology is that it permits better

control of the target sentences across a wider range of lexical contents and sentence types than is possible with less constrained production tasks.

In the recall experiments, participants heard and later attempted to remember sentences or phrases that contained two target nouns. The target nouns differed in animacy, number of syllables, and, in Experiments 4, 5, and 6, stress patterns. The orders in which the target nouns occurred were systematically varied in the presented materials, and we looked for systematic patterns of preservation and change in those orders at recall.

EXPERIMENT 1

In the first experiment, the to-be-recalled sentences contained pairs of target nouns that varied in animacy, length, and the order in which they appeared. In half the sentences, these variations occurred between the subjects and objects of transitive sentences (e.g., *policeman* and *crown* in *A policeman guarded the crown around the clock*) and in the other half, between the first and second words in a conjunctive phrase within a sentence (e.g., *crew* and *camera* in *The crew and the camera suffered minor injuries*). The same target nouns appeared in different orders within related sentences for different participants (as in *The crown was guarded by a policeman around the clock* and *The camera and the crew suffered minor injuries*).

The sentences were presented as the answers to brief, question-posing vignettes, and later prompted for recall by re-presentations of the vignettes alone. We examined the orders in which the target nouns were recalled, and how those orders were related to the relative animacy and length of the targets. According to the conceptual accessibility hypothesis, animate nouns should tend to precede inanimates. If this is normally a consequence of grammatical role assignment rather than simple ordering, the effect should be stronger in transitive than in conjunctive sentences. According to the lexical accessibility hypothesis, shorter nouns should tend to precede longer ones. If this is a simple ordering effect, it should be stronger for conjunctive sentences (in which the grammatical roles of the target nouns were the same) than for transitives (in which the roles were different).

Method

Participants. The participants were 60 Michigan State University undergraduates who took part as an extra credit option in introductory psychology classes.

Materials. Table 1 gives examples of the two types of sentence pairs from each of the four conditions of the experiment, along with the vignettes used to prompt recall of the sentences. The two sentence types were transitives and conjunctives. In each sentence type, the sentences were equally divided among those with a short animate target noun preceding

TABLE 1

Example Vignette Prompts and To-Be-Recalled Sentences from Experiment 1

Prompts	To-be-recalled sentences
Transitives	
Appliances were rare in rural America until after World War II. What occasioned a lot of talk in Deadwood, South Dakota, one week in March, 1940?	Animate short condition (active) A farmer purchased a refrigerator. Inanimate long condition (passive) A refrigerator was purchased by a farmer.
Queen Elizabeth allowed the royal jewels to go on tour, and a gang of thieves planned to steal one especially valuable piece. How were they foiled?	Animate long condition (active) A policeman guarded the crown around the clock. Inanimate short condition (passive) The crown was guarded by a policeman around the clock.
After investigating the loud rumbling in the hallway, the elementary school teacher returned to find her entire class under their desks. Why?	Inanimate short condition (active) The sound frightened the students. Animate long condition (passive) The students were frightened by the sound.
The crying in the nursery stopped. Why?	Inanimate long condition (active) The music soothed the child. Animate short condition (passive) The child was soothed by the music
After an earthquake in China, NBC sent a team to cover the disaster. What happened when an unexpected aftershock occurred?	Animate short condition (original order) The crew and the camera suffered minor injuries. Inanimate long condition (reversed order) The camera and the crew suffered minor injuries.
Paul was moving into a new apartment. Why was he unable to get in?	Animate long condition (original order) The manager and the key were nowhere to be found. Inanimate short condition (reversed order) The key and the manager were nowhere to be found.
The old bachelor decided to spend a quiet evening at home. What happened?	Animate short condition (original order) He sat in front of a roaring fire with his cat and some whiskey. Inanimate long condition (reversed order) He sat in front of a roaring fire with some whiskey and his cat.
There had been many alcohol-related accidents in the Chicago area. What did law-enforcement officers do to try to decrease drunk driving?	Inanimate short condition (original order) The police cracked down on the bars and the customers. Animate long condition (reversed order) The police cracked down on the customers and the bars.

a long inanimate target noun, a short inanimate preceding a long animate, a long animate preceding a short inanimate, and a long inanimate preceding a short animate. For the transitives, actives and passives occurred equally often in each of these conditions, and for the conjunctives, sentences with the conjunction in subject position and sentences with the conjunction in objection position occurred equally often.

Each experimental item occurred in two different versions containing the alternative orders of the two target nouns. For the transitives, the two versions were the active and the passive, and for the conjunctives, the two versions were the originally composed conjunction (designated the *original order*) and its reversal, the *reversed order* (e.g., *the key and the manager* versus *the manager and the key*).

The sentences were constructed from 48 pairs of animate and inanimate target nouns. The targets ranged between one and five syllables in length. The median length difference between the words in a pair was one syllable, with a range from one to four. Within a pair, nouns were matched for frequency to within .165 $\log_{10}$ units, with a median difference of .012 (Kucera & Francis, 1967).

Two stimulus lists were formed from the sentences containing these word pairs. One list was created by choosing 48 sentences containing each of the 48 target–noun pairs, such that there were an equal number of sentences on the list representing the factors of sentence type (transitive vs conjunctive), length of animate noun (short vs long), and order of target nouns (animate first vs inanimate first). As an additional counterbalancing measure, half of the transitive sentences were in the active form and half in the passive form, and half of the conjunctives had the target nouns as subjects and half as objects. The second stimulus list contained the target-reversed versions of each of the 48 sentences. Corresponding sentences appeared in the same positions in the two lists.

The 48 sentences on each list were divided into six blocks of eight items each. Each block contained one sentence representing each of the eight conditions formed by crossing the factors of sentence type, length of animate noun, and order of target nouns. An equal number of active and passive sentences and subject and object conjuncts also occurred in each block. The sentences were ordered so that no more than two sentences with the same frame appeared consecutively, and passives never appeared together; otherwise the order of items was random.

Both lists began with a practice block of six filler items. The six experimental blocks started with one filler and ended with two others, and had an additional filler item among the experimental items, for a total of 12 items per block. The filler sentences were of several different syntactic types in order to add variety. The same fillers were used in the same places in both stimulus lists.

Vignette prompts, each consisting of one or two sentences and a short question, were written for each experimental item. The vignettes were written so as to minimize any focusing or information structure variations that could affect the forms of the recalled sentences, or to equalize those variations across sentences. To this end, the questions used none of the target words from the experimental sentences, and were relatively neutral in their presuppositions and implications, presupposing or implying either both or neither of the entities denoted by the target words. Comparable vignettes were written for each of the filler items.

Procedure. For each block, the experimenter read each vignette followed by its sentence "answer." After this initial presentation, each vignette was read as a recall prompt, followed by an interval long enough for the participants to write down the sentence that answered the prompt question. The prompts were read in the same order in which they were originally presented. The participants were instructed to write the answers to each question as accurately as possible, giving the gist of the answer even if they were not sure of its exact wording.

The six blocks in each stimulus list were presented in three different rotations, one

TABLE 2
Percentages of Sentences Recalled in Correct and Shift Categories, Experiment 1

Presented sentence	First noun in presented sentence							
	Correct				Shift			
	Animate		Inanimate		Animate		Inanimate	
	Short	Long	Short	Long	Short	Long	Short	Long
Transitive								
Active	49	48	26	30	0	1	4	4
Passive	17	13	25	18	5	2	32	34
Conjunctive								
Original order	44	48	40	57	6	6	9	6
Reversed order	55	34	42	42	9	7	12	6

beginning at block 1, the second at block 3, and the third at block 5. Equal numbers of participants received the two stimulus lists and the different rotations within each one. The lists were presented to small groups ranging in size from 10 to 24 participants. To equalize cell sizes across lists and presentation orders, the recall protocols from some of the participants were randomly discarded.

Scoring and data analyses. Included in the analyses were all sentences that maintained the essential meaning of the presented sentences and employed both of the target nouns, either in the same (correct) or the opposite (shift) order from the form given. For transitives, a change in the order of the targets required a change in the voice of the recalled sentence for the sentence to be included in the analysis. Acceptable deviations from verbatim recall included changes in number (singular or plural) on the target nouns, as long as number of syllables was not affected, changes in verb tense, synonym or near-synonym substitutions of nontarget open-class words, article deletions, substitutions, or additions, and adjective deletions or additions. A switch from *and* to *or* in the conjoined noun phrase of conjunctives was also considered acceptable. All other recalled sentences, including those that contained both target nouns but changed the original meaning (typically with a change in the syntax), and those that contained only one or neither of the target nouns, were omitted from the analyses.[2] The percentages of sentences recalled in the correct and shift scoring categories, for every presentation condition, are shown in Table 2.

We used a dependent measure that captured how often a sentence was recalled with the animate noun first, regardless of its location at presentation. Since each item was presented equally often in animate-first and animate-second versions, any consistent effect of animacy on word order should be reflected in deviations of this measure from chance (or indifference). Thus, for each of the four combinations of the sentence type (transitive or conjunctive) and length (animate short or animate long) factors, every participant received a score representing the proportion of his or her acceptably recalled sentences with the animate target first. Because our interest was in the forms of the sentences that were produced and not in their memorability, proportions were used instead of simple counts of animate-first recalls so as to correct for the sheer recallability of the various sentence pairs.

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[2] Analyses that included all sentences containing the two target nouns (regardless of whether the sentence meaning was preserved) did not yield substantially different effects from those reported here.

To correct for chance, we subtracted .50 from each participant's score before analysis. The impact of animacy was then tested within the analysis of variance by examining whether the intercept was significantly different from zero. The analyses of variance directly reflected any effects of length as differences between the short and long condition, and any effects of sentence type as differences between the transitive and conjunctive conditions. In order to resolve small differences near the zero point, we applied an arcsine transformation to the data prior to analysis. Analogous subtractions and transformations were applied to the scores for individual items (pooling the scores for the two versions of each item).

The analysis of the participants' scores included two crossed within-subjects factors, sentence type (transitive versus conjunctive), and length of animate noun (short or long). The analysis of the item scores included the same two factors, crossed between items. In all of the analyses to be reported in this article, the alpha level was set at .05, and only probabilities that exceed this are explicitly noted. When the results for participants and items (designated by the test statistics F_1 and F_2, respectively) fall on different sides of this level of significance, we take the results for participants as the more definitive. The implications of the variability among the items are considered in the General Discussion.

Results

Figure 1 shows the effects of animacy in terms of deviations from the chance line, with excursions above the line reflecting a tendency for the animate to be produced before the inanimate noun. Animates were more likely to be produced first ($F_1(1,59) = 29.0$; $F_2(1,44) = 3.4, p < .07$), but unequally across the two sentence types ($F_1(1,59) = 30.9$; $F_2(1,44) = 2.6$, $p > .10$). Separate one-way analyses of variance on the two types of sentences showed that the tendency for animates to precede inanimates
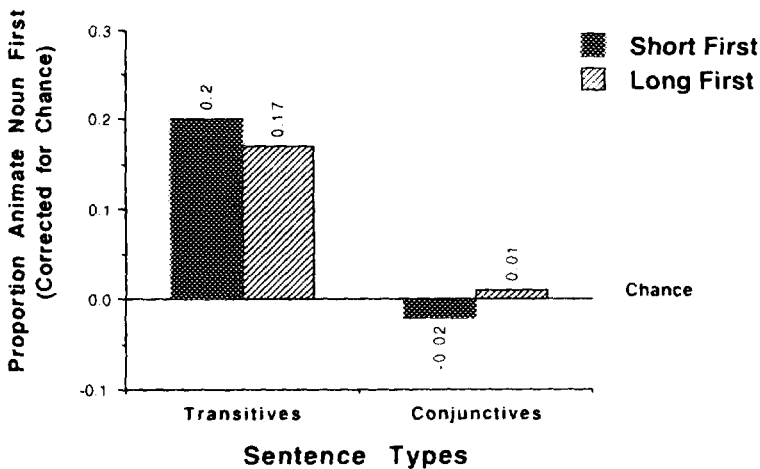

FIG. 1. Proportions of transitive and conjunction sentences produced with the long or short animate noun first, corrected for chance, in Experiment 1. Sentences were produced in recall after question prompts. Deviations from chance are shown as excursions above and below zero. The chance-corrected mean proportions in each condition are given above or below the condition bars.

was significant for the transitive sentences ($F_1(1,59) = 45.6$; $F_2(1,22) = 3.4$, $p = .08$) but not for the conjunctive sentences (both $Fs < 1$). There were no significant effects of word length on order of recall, either in the main effect (both $Fs < 1$) or in the interaction with sentence type (both $Fs < 1.2$).

Discussion

The results of Experiment 1 aligned well with the predictions from the conceptual accessibility hypothesis. Animate nouns tended to be produced before inanimates, but only in transitive sentences. In conjunctives, where the order of the two targets could be changed without other changes in sentence structure, there was no ordering bias. Since variations in target order within the transitive sentences required changes in grammatical role assignments, the implication is that animacy affected these assignments rather than word order directly.

There was no tendency for short nouns to precede longer ones in the sentences of either type. There are several possible explanations for this beyond the obvious one, that the number of syllables in words simply has no effect on their order. We explored several of these alternatives in the subsequent experiments.

EXPERIMENT 2

The sentences in the previous experiment were produced as answers to extended questions that had the potential to bias word order through changes in the information structure of the recalled sentences. Such changes come about when there are discourse differences that create variations in the givenness and newness of different constituents of sentences, with consequent changes in word order (Bock, 1977, 1982). By themselves, information structure variations could create word-order differences that would obscure any effects of word length.

Because information-structure variations are powerfully induced by question-answering situations, it is important to examine whether the same differences in word order across sentence types occur in the absence of the vignettes that were used in the previous experiment. Although those vignettes were constructed with an eye toward neutrality, they could not be completely unbiased. In this experiment, we therefore eliminated the vignettes and their use as recall prompts. In their place, we substituted verbs or nontarget nouns from the sentences as prompts for recall.

Method

Participants. The participants were 90 Michigan State University undergraduates who received extra credit in introductory psychology classes. None of them took part in any of the other experiments.

Materials. The materials consisted of the sentence pairs from Experiment 1, but without the vignettes. The sentences underwent minor revisions that were designed to make them readily interpretable in the absence of the contexts provided by the vignettes. Most of the revisions involved replacing pronouns with full nouns or noun phrases and changing verb tenses to the simple past.

A nontarget word from each sentence pair was chosen as a prompt. For the transitives, the prompt was a simple past-tense verb, and for the conjunctive sentences, the prompt was a predicate adjective or a nontarget subject or object noun. Similar prompt words were chosen for the filler sentences.

List construction and order of item presentation were as in Experiment 1.

Procedure. The procedure followed that of the first experiment, except that the sentences from each block were first presented alone, followed by the presentation of the prompt words during the recall period. The blocks of sentences composing each list were rotated as in Experiment 1, with 15 subjects receiving each list in each rotation.

The scoring, design, and data analyses duplicated those of the first experiment. The raw percentages of sentences recalled in the correct and shift scoring categories are shown in Table 3.

Results

As shown in Fig. 2, there was again a strong tendency to recall the animate noun first ($F_1(1,89) = 27.3$; $F_2(1,44) = 8.4$) and it again differed across sentence types ($F_1(1,89) = 13.5$; $F_2(1,44) = 1.4, p > .10$). Separate one-way analyses of variance on each type of sentence revealed a significant animate-first preference for the transitives ($F_1(1,89) = 39.4$; $F_2(1,22) = 5.7$) but not for the conjunctive sentences ($F_1(1,89) = 2.1, p > .10$; $F_2(1,22) = 2.7, p > .10$).

Sentence type and word length interacted in the main participants' analysis ($F_1(1,89) = 5.0$, $F_2(1,44) < 1$) because of a difference between the sentence types in the positioning of the short target noun. In the transitive sentences, the short target tended to be produced before the long one, but in the conjunctives, the tendency was in the other direction.

TABLE 3
Percentages of Sentences Recalled in Correct and Shift Categories, Experiment 2

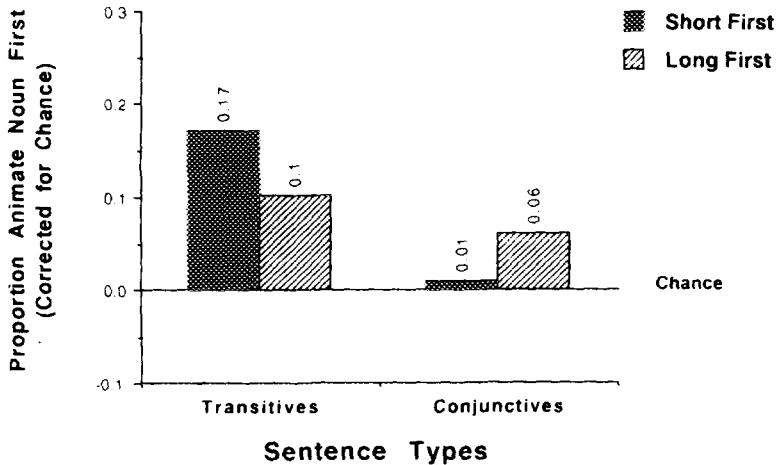| Presented sentence	First noun in presented sentence							
	Correct				Shift			
	Animate		Inanimate		Animate		Inanimate	
	Short	Long	Short	Long	Short	Long	Short	Long
Transitive								
Active	43	38	24	20	0	2	8	6
Passive	19	20	17	18	7	4	19	24
Conjunctive								
Original order	35	33	27	41	6	6	3	9
Reversed order	40	29	21	27	14	7	14	13

Fɪɢ. 2. Proportions of transitive and conjunctive sentences produced with the long or short animate noun first, corrected for chance, in Experiment 2. Sentences were produced in recall after single-word prompts. The chance-corrected mean proportions in each condition are given above the condition bars.

However, separate analyses of the two sentence types showed that neither of these length effects was significant on its own ($F_1(1,89) = 2.1$, $p > .10$; $F_2(1,22) < 1$ for transitives; $F_1(1,89) = 1.4$, $p > .10$; $F_2(1,22) < 1$ for conjunctives).

Discussion

The results of Experiment 2 in most respects replicated those of Experiment 1, indicating that the previous findings cannot be explained in terms of the information–structure variations created by the question prompts. The animacy of the target nouns significantly affected their positioning in the recalled sentences, but only in the transitives—where positioning was mediated by differences in grammatical role assignment—and not in the conjunctives. The effects of length also differed for the two sentence types, although the directions of the effects were the opposite of what was predicted by the lexical accessibility hypothesis. Short nouns tended to precede long ones in the transitives, but long nouns tended to precede short ones in the conjunctives. The strength of the ordering trends themselves, however, fell far short of significance.

One difference between the conjunctives and the transitives that could have affected the propensity for animates to precede inanimates is the possibility of appearing in sentence-initial position. In transitives, the first target position was also sentence initial, whereas in conjunctives, the first target position was sentence initial only if the conjunction was a subject

conjunction. We examined the subject and object conjunctions separately in both experiments in order to assess this possibility. Although there was a slightly greater overall tendency toward animate leaders in subject conjunctions than in object conjunctions (54% versus 51%), the difference was not significant in any of the analyses.

EXPERIMENT 3

In the previous experiments, we found consistent effects of animacy on grammatical role assignment but not on simple word order. We detected minimal influences of word length, suggesting that its impact on sentence construction is negligible. Still, much of the existing evidence for word length effects has been gathered in nonsyntactic settings or from minimally structured uses of language, raising the conjecture that the tacit requirement to produce full sentences obliterated any ordering effects of variations in accessibility attributable to length. We explored that possibility in this experiment by putting all of the target noun pairs from both sentence types into simple conjunctions (e.g., *crown and policeman, child and music, camera and crew, manager and key*).

Method

Participants. Sixty Michigan State University undergraduates took part in return for extra credit in introductory psychology classes.

Materials. The stimuli were the 48 target–noun pairs used to generate the sentences from Experiments 1 and 2. The pairs were presented as simple conjunctions, without definite or indefinite articles. There were two conjunctions containing each pair, differing only in the order in which the targets occurred.

The two conjunctions representing each pair were assigned to two different lists. Each list consisted of four blocks of 14 conjunctions (12 experimental and 2 filler conjunctions). In each block, there were three conjunctions representing the four cells formed by crossing the factors of animate noun length (animate short and animate long) and order of presentation (animate first or inanimate first). The position of items within a block was random, with the constraint that no more than 2 conjunctions from the same experimental condition occurred consecutively. Every block began and ended with a filler conjunction to reduce primacy and recency effects in recall, and a practice block of 7 filler conjunctions preceded the experimental blocks. In other respects, the materials were as described in Experiment 1.

Procedure. The participants were told that they would first hear and then be asked to recall three-word phrases like *bacon and eggs*. To aid recall, they were given interactive imagery instructions (Bower, Lesgold, & Tieman, 1969) that emphasized forming mental images of the named objects, in some relationship to each other. The instructions permitted recall of the phrases in any order, and within the phrases, recall of the two nouns in any order.

The experimenter read each conjunction aloud, allowing 8 s between phrases for the participants to carry out the imagery instructions. A free-recall period followed each block of items, during which the participants wrote down the phrases they could remember.

The blocks within each of the two lists were administered in two different rotations. Half the participants received a list beginning with block 1 and the other half a list beginning with block 3, with equal numbers of participants assigned to each list.

Scoring. The recalled conjunctions were included in the analysis if both nouns were recalled, regardless of their order. If singular nouns were replaced by plurals, or vice versa, the phrases were counted as long as the change did not alter the number of syllables in the noun. The dependent variable and the analyses were identical to those of Experiments 1 and 2.

Although the target nouns did not occur in sentential contexts, we included as a factor in the analyses the sentence types in which the noun pairs had appeared in the two earlier experiments. This allowed us to better assess whether the differences in the previous results for the two sentence types were in some way attributable to differences in the specific noun pairs that appeared in the sentences. Table 4 shows the original sentence types for the phrases recalled and gives the percentages of the corresponding phrases that were recalled in the correct and shift scoring categories.

Results

Animate nouns were more likely to be recalled first than inanimate nouns $(F_1(1,59) = 142.8; F_2(1,44) = 71.9)$. Figure 3 shows that this effect was nearly as strong for target nouns from the conjunctive sentences of the previous experiments as that for target nouns from the transitive sentences, although there was a marginal effect of sentence type in the participants analysis $(F_1(1,59) = 3.8, p < .06; F_2(1,44) < 1)$. Separate analyses showed that the animate-first trend was highly significant for the target–noun pairs assigned to either sentence type (for transitives, $F_1(1,59) = 106.5; F_2(1,22) = 72.9$; and for conjunctives, $F_1(1,59) = 48.1; F_2(1,22) = 22.3$).

There was no effect of word length, either overall (both Fs < 1) or in the interaction with the target–noun pairs from the individual sentence types $(F_1(1,59) = 1.7, p > .10; F_2(1,44) = 1.3, p > .10)$.

Discussion

The results of this experiment indicate that a predilection toward animate leaders occurs outside of sentential contexts, replicating the results of Byrne and Davidson (1985) and supporting the Cooper and Ross (1975) analysis of ordering in frozen conjunctions. This also suggests that the grammatical role assignment effects observed in the first two experiments

TABLE 4
Percentages of Phrases Recalled in Correct and Shift Categories, Experiment 3

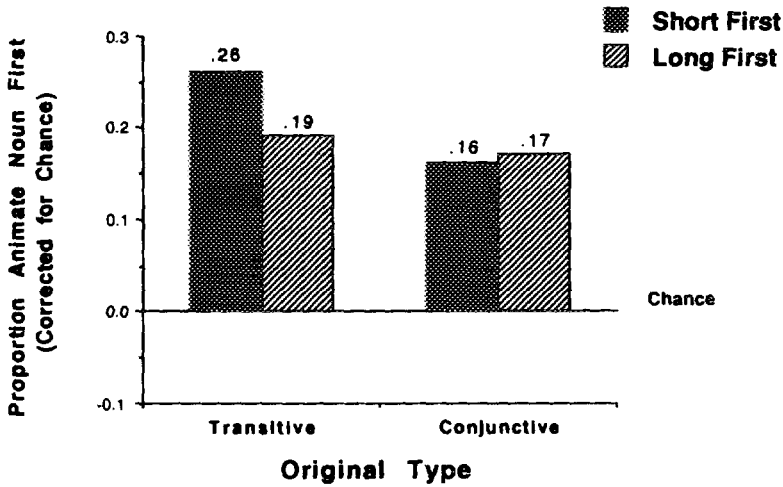|	First noun in presented phrase							
	Correct				Shift			
Original sentence type	Animate		Inanimate		Animate		Inanimate	
	Short	Long	Short	Long	Short	Long	Short	Long
Transitive	47	38	20	21	4	4	18	27
Conjunctive	38	38	20	26	6	6	18	20

FIG. 3. Proportions of conjunctions recalled with the long or short animate noun first in Experiment 3. Chance-correlated mean proportions in each condition are given above the condition bars. The Original Type is the type of sentence in which the target–noun pair had occurred in Experiments 1 and 2.

may indeed be linked to more general characteristics of the relationship between animates and inanimates, since the conjunctions produced in this experiment contained no strictly syntactic roles.

These findings must be reconciled with the absence, in the previous experiments, of consistent ordering effects attributable to animacy in conjunctions within sentences. One striking feature of the present results was that the animate and inanimate target nouns which had occurred in conjunctive sentences and which, in those sentences, showed little inclination to array themselves with the animate in the lead, were almost as susceptible to animate-first ordering as the target nouns which had occurred within transitives. Clearly, for conjunctions within sentences, the sentence context dampened the effect that animacy can have on the ordering of conjoined words outside of sentence contexts.

The most likely explanation for this is that the relationship between conjoined nouns within sentences is prescribed in a way that the relationship between nouns in a simple conjunction is not. When two nouns share a grammatical role, they often share an event role. For example, two nouns sharing the direct-object role typically share the event role of theme (the object affected by an event). However, outside of sentences, conjoined nouns are free to assume whatever relationship is imputed to them, and that relationship can be asymmetrical. For example, a disconnected phrase such as "manager and key" conjures up ideas about the

ways managers use keys more readily than ideas about managers and keys as simultaneously missing or sought-for entities (their role in the sentences in which they had appeared). The interactive imagery instructions employed in Experiment 3 were very likely to have magnified such asymmetries.

The sentence contexts of the previous experiments evidently did not neutralize effects of the length differences between the target words, since such effects failed to materialize in the simple conjunctions. There was again no significant tendency to place short words before long ones (or long ones before short ones). However, it is possible that the interactive imagery instructions promoted a meaning-based encoding strategy that washed out any effect of word length. We will address this possibility in Experiment 4.

EXPERIMENT 4

If the animate leaders in the conjunctions produced in Experiment 3 were a consequence of the imputation of different event roles to the conjoined nouns, by eliminating incentives to impute these roles we should eliminate or at least greatly reduce the animacy effect. In this experiment we attempted to do this by encouraging the use of a mnemonic technique that emphasized the sounds of the target words rather than their meanings. When the conjunctions were presented, the participants were asked to actively mouth them.

We also developed a different set of target words for use in this experiment, so as to better control the length and the metrical properties of the recalled phrases. In the previous experiments, the words in the target noun pairs consistently differed in their relative lengths (in terms of the numbers of syllables that they contained), but their absolute lengths (in numbers of syllables) and stress patterns varied. In this experiment, all of the short nouns in the target noun pairs were monosyllabic and all of the long nouns were trisyllabic. To control the metrical structure, half of the trisyllables were dactyls (STRONG–weak–weak; e.g., *telephone*) and half were amphibrachs (weak–STRONG–weak; e.g., *potato*). As before, the paired target nouns also differed in animacy.

Method

Participants. The participants were 168 Louisiana State University undergraduates who received extra credit for their participation. This experiment was the second of two phrase–recall tasks that they performed in the same session. The first is not reported here.

Materials. The conjunctions were created from 24 target–noun pairs that were matched in frequency to within .03 $\log_{10}$ units, with a median frequency difference of 0 (Kucera & Francis, 1967). Each pair contained one animate and one inanimate noun. Half of the animates were monosyllabic words and half were trisyllabic words, and the inanimates were similarly divided. The trisyllables of each type were equally split between dactyls and

amphibrachs. Two conjunctions contained each target pair, one for each of the word orders. All conjunctions employed the work *and* and contained no articles. Example pairs are given in Table 5.

Two stimulus lists were formed. Each contained one conjunction representing each of the 24 target pairs. Three items represented each of the eight orthogonal combinations of the length of the animate noun (long or short), the stress pattern of the trisyllabic noun (dactylic or amphibrachic), and the position of the animate noun (first or second). The only difference between the two lists was the order of the target nouns within the individual conjunctions.

The conjunctions in each list were presented in six blocks. Every block contained one representative of each of the four conditions shown in Table 5, half with the animate noun first and half with the inanimate first. Four filler conjunctions were added to every block for a total of eight items per block. The filler phrases all contained pairs of disyllabic inanimate nouns, and occurred in the first, fourth, fifth, and eighth position in each block. The experimental conjunctions were randomly assigned to the remaining positions. A practice block of eight fillers preceded the experimental blocks.

Procedure. The procedure was similar to that of Experiment 3, except that the instructions specifically discouraged the use of imagery. Instead, the participants were asked to physically mouth the phrases during the 8-s intervals that separated the items, in order to help remember them.

Rather than varying the block order between groups of participants receiving the same version of each list, as in the previous experiments, every experimental conjunction was rotated through positions 2, 3, 6, and 7 within its block, creating four different orderings of the lists. An equal number of participants received each ordering.

The scoring, design, and data analysis were identical to that of Experiment 3, with the added contrast in stress pattern (dactylic versus amphibrachic) on the long noun. The raw percentages of phrases recalled in the correct and shift scoring categories in each condition are shown in Table 6.

Results

Figure 4 reveals that there was a significant tendency to put the animate noun first in recall ($F_1(1,167) = 46.3$; $F_2(1,20) = 29.5$). There were no significant effects of length in the primary analysis of variance, either as a main effect ($F_1(1,167) = 1.6, p > .10$; $F_2(1,20) < 1$) or interaction with sentence type ($F_1(1,167) = 2.4, p > .10$; $F_2(1,20) < 1$). Although the interaction between length and stress was not significant in the main

TABLE 5
Examples of Conjunctions from Experiment 4

Conjunction type	Example
Dactylic trisyllables	
Animate short	dog and telephone
Animate long	bachelor and spoon
Amphibrachic trisyllables	
Animate short	priest and potato
Animate long	attorney and desk

Note. Conjunctions were presented with the nouns in both of the two possible orders.

TABLE 6
Percentages of Phrases Recalled in Correct and Shift Categories, Experiment 4

	First noun in presented phrase							
	Correct				Shift			
	Animate		Inanimate		Animate		Inanimate	
Trisyllable	Short	Long	Short	Long	Short	Long	Short	Long
Dactylic	35	32	24	28	2	2	8	9
Amphibrachic	47	36	30	28	4	2	7	10

analysis, individual analyses of the two stress-pattern types confirmed the short-first trend for the amphibrachs that is evident in Fig. 4, but only in the participants' analysis $(F_1(1,167) = 4.6; F_2(1,20) = 1.1, p > .10)$.

Discussion

The results indicate that animate words tend toward first position regardless of encoding instructions that emphasize conceptual features (as in Experiment 3) or phonological features (as in the present experiment). However, a comparison of Figs. 3 and 4 suggests that the impact of animacy was very much weakened—indeed, cut in half—by the phonological emphasis. Although this difference may be attributable to other disparities between the two experiments (of which there were several) the
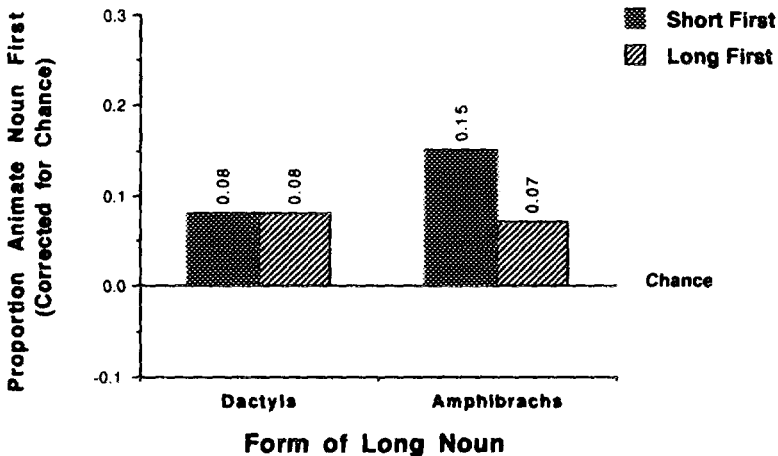

FIG. 4. Proportions of conjunctions recalled with the long or short animate noun first in Experiment 4. Chance-corrected mean proportions in each condition are given above the condition bars. The long nouns in each conjunction were trisyllabic, either dactyls (with the stress pattern STRONG–weak–weak; e.g. *bachelor*) or amphibrachs (with the stress pattern weak–STRONG–weak; e.g., *attorney*).

difference is consistent with the hypothesis that animate leadership is promoted by the roles that animates assume in conceptual and grammatical combinations, as well as by the inherent accessibility of the lemmas of animate words.

The change in the instructions did not markedly change the influence of the length of the words on the order in which they occurred. Although there was a tendency to put the short word before the long one in one type of item (those with amphibrachic long words such as *potato* and *attorney*), there was no hint of a corresponding tendency for the other type. Such stress-related variations in word order are a possible product of an effect of metrical structure. The next two experiments were designed to more directly address the possibility that metrical structure is more important than sheer length in syllables.

EXPERIMENT 5

The expressions that offer the clearest evidence for a short-first tendency are the frozen conjunctions analyzed by Cooper and Ross (1975) and Malkiel (1959). In those expressions, a common composition is a monosyllabic word followed by a disyllabic word with stress on the first syllable (a trochee). Together with the conjunction between the words, this yields the perfectly regular alternating metrical structure seen in such phrases as *salt and pepper, bread and butter, men and women,* and *hale and hearty.*

For this experiment, we constructed novel conjunctions of animate and inanimate words that conformed to this metrical pattern (e.g., *judge and secret*) or, with the words reversed, violated it (e.g., *secret and judge*). If rhythmic alternation between strong and weak syllables is an important force in the creation of word order variations during production, we should see a stronger tendency to place the monosyllabic word before the disyllabic word than the other way around.

Method

Participants. The participants were 104 Michigan State University students who received extra credit in introductory psychology courses. None took part in any of the previous experiments.

Materials. The conjunctions were created from 24 pairs of animate and inanimate nouns, matched in frequency to within .082 log units, with a median frequency difference of .015 (Kucera & Francis, 1967). Half of the nouns of each type were monosyllables and half were trochaic disyllables. Two conjunctions were composed for each pair, one for each of the two possible orders of the nouns, all conjoined with the word *and,* and none containing articles. Example items are shown in Table 7.

Two stimulus lists were formed from these materials. Each list contained one conjunction representing each of the word pairs, and equal numbers of conjunctions of the four types

TABLE 7
Examples of Conjunctions from Experiment 5

Conjunction type	Example
Animate short	horse and tower
Animate long	children and room

Note. Conjunctions were presented with the nouns in both of the two possible orders.

(short animate first, long animate first, short inanimate first, long inanimate first). The only difference between the two lists was the order in which the words appeared in the conjunctions.

In each list, the 24 conjunctions were divided into six blocks of four each, with one representative of each type of conjunction in every block. Every block also contained four filler conjunctions. The fillers consisted of all possible combinations of monosyllables and disyllables, with various stress patterns on the disyllabic nouns and were arranged as in Experiment 4. A practice set of eight filler conjunctions preceded the experimental blocks.

Procedure. The procedure was identical to that of Experiment 3 (so imagery instructions were used), except that two rotations of the six blocks were employed, one beginning at block one and the second at block four. Half the participants received each rotation.

The scoring and data analyses duplicated those of the preceding experiments. The raw percentages of phrases recalled in the correct and shift scoring categories are shown in Table 8.

Results and Discussion

Figure 5 shows a strong tendency to produce the animate noun first ($F_1(1,103) = 175.6$; $F_2(1,22) = 35.3$) and no tendency to produce the short noun first (both $Fs < 1$). Once again, then, we have confirmed the effect of animacy on word order and failed to detect any effect of length. Because we deliberately confounded the short–long order with an alternating rhythm, this finding suggests that, in the presence of an animacy contrast, differences in the euphony of alternative word orders may have no more impact on word order in production than differences in the lengths of words.

TABLE 8
Percentages of Phrases Recalled in Correct and Shift Categories, Experiment 5

First noun in presented phrase							
Correct				Shift			
Animate		Inanimate		Animate		Inanimate	
Short	Long	Short	Long	Short	Long	Short	Long
64	63	41	42	8	4	24	26

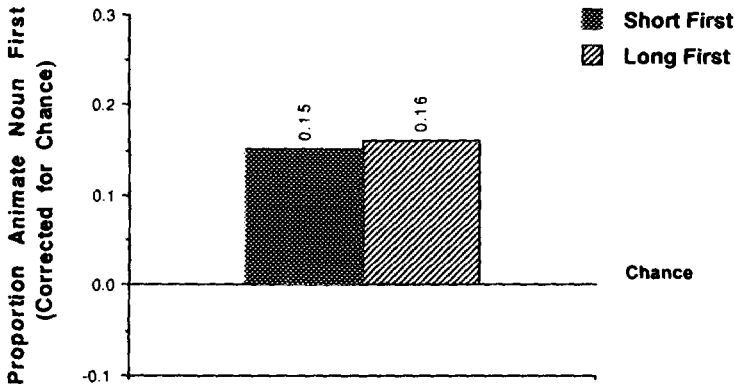*Note.* All of the disyllabic words were trochees.

FIG. 5. Proportions of conjunctions recalled with the long or short animate noun first in Experiment 5, corrected for chance. All conjunctions produced with the short noun first had a rhythmically alternating metrical pattern (STRONG–weak–STRONG–weak); those produced with the long noun first had the pattern STRONG–weak–weak–STRONG.

EXPERIMENT 6

Language production normally seems to proceed from ideas to articulations. Views of production that regard this top–down information flow as strictly staged (e.g., Garrett, 1988; Levelt et al., 1991) make few allowances for feedback from phonological implementation to semantic formulation. Even in frameworks that account for various phenomena of production in terms of interactions between higher- and lower-level sources of information (Dell, 1986; Stemberger, 1985), feedback effects are comparatively weak and secondary to the impact of higher-level information sources. Consequently, when semantic or conceptual forces are in control of word order, it may be difficult to elicit effects of phonological factors that might still come into play when higher-level contributions are in some way neutralized. Supporting this conjecture, Cooper and Ross (1975) noted in their analysis of frozen conjunctions that semantic principles overshadowed phonological ones.

In all of the previous experiments, we examined the ordering of animate and inanimate nouns that also varied in length. In this experiment, to assess the contribution of lexeme features in the absence of animacy differences, we used only inanimate target nouns. These nouns varied in length, occurring in pairs of monosyllabic and disyllabic words. The disyllables also varied in their stress patterns. Half were trochees, as in the previous experiment, and half were iambs, with the stress pattern weak–STRONG. This yielded conjunctions such as *doll and attic* and *doll and antique,* along with their inverses.

The stress difference in the disyllables allowed us to directly contrast

the length hypothesis with the metrical hypothesis. If there is any validity to the length hypothesis, the monosyllables should tend to precede the disyllables, regardless of their stress patterns. However, if metrical structure is a more important factor in the control of word order than word length, and if alternating rhythm is a favored feature of metrical structure, there should be no tendency for short to precede long. Instead, monosyllables should tend to precede trochaic disyllables (creating conjunctions with a STRONG–weak–STRONG–weak pattern, as in *doll and attic*) but should tend to follow iambic disyllables (creating conjunctions with a weak–STRONG–weak–STRONG pattern, as in *antique and doll*).

Method

Participants. The participants were 192 Michigan State University undergraduate students who received extra credit in introductory classes in return for their assistance.

Materials. The conjunctions were formed from 48 pairs of inanimate target nouns. Half the pairs contained 24 monosyllabic nouns and 24 disyllabic trochaic nouns. The other half of the pairs contained the same 24 monosyllabic nouns and 24 disyllabic iambic nouns. The words in each pair were matched to within .23 log_{10} frequency units (Kucera & Francis, 1967), with a median of .02. All of the conjunctions used *and* and contained no articles. Examples are shown in Table 9.

Four stimulus lists were constructed. Each contained 24 of the conjunctions described above, every conjunction with a different monosyllabic target. Half of the conjunctions contained trochees and half iambs, with six conjunctions in each of the two possible orders for each type. Every monosyllable appeared once on each of the four lists and, across the lists, twice with its trochee (once first and once second) and twice with its iamb (once first and once second).

Within each list, the conjunctions were equally distributed across four blocks. Every block contained at least one and no more than two exemplars of the four combinations of stress pattern of the disyllable and position of the monosyllable. One filler conjunction began and ended each block, and the experimental items were randomly assigned to the remaining positions. Across the four stimulus lists, pairs with the same monosyllable occurred in the same position. A practice set of eight filler conjunctions preceded the experimental blocks. All fillers were constructed of uniformly monosyllabic or disyllabic words.

Procedure. The procedure was identical to that of Experiment 5.

Scoring. The scoring procedures were the same as those in the previous experiments. Table 10 gives the raw percentages of phrases recalled in the correct and shift scoring categories in each condition.

The responses were analyzed in terms of the proportion of the time that the short target occurred first in the conjunction in recall, regardless of its original position. The dependent

TABLE 9
Examples of Conjunctions from Experiment 6

Conjunction type	Example
Trochaic disyllable	doll and attic
Iambic disyllable	doll and antique

Note. Conjunctions were presented with the nouns in both of the two possible orders.

TABLE 10
Percentages of Phrases Recalled in Correct and Shift Categories, Experiment 6

Disyllable	First noun in presented phrase			
	Correct		Shift	
	Short	Long	Short	Long
Trochaic	48	48	9	13
Iambic	48	53	14	11

measure was analogous to the one used in all of the other experiments, except that the proportions reflected the occurrence of the short noun (rather than an animate noun) in first position. The transformations of the measure were also the same. So, .50 was subtracted from each proportion to correct for the effects of chance, and the proportions were arcsine transformed.

The data were analyzed in a one-way within-subjects analysis of variance with the stress pattern of the disyllable as the only factor. The item data were analyzed in the same design, with every version of a conjunction that contained the same monosyllable treated as a representative of the same item. In both analyses, the effect of word length was assessed with a test of the intercept.

Results

The stress pattern of the disyllable significantly influenced the word order of the recalled conjunctions in the participants' analysis ($F_1(1,191)$ = 7.3) and marginally in the items' analysis ($F_2(1,23)$ = 3.7, $p < .07$). Separate analyses of variance on the iambic and trochaic conditions showed a tendency to put the long word first in the iambic condition (this was again significant by participants, $F_1(1,191)$ = 8.6, and marginal by items, $F_2(1,23)$ = 3.0, p < .10) but not in the trochaic condition (both Fs < 1). There was no effect of word length ($F_1(1,191)$ = 1.4, $p > .10$; $F_2(1,23)$ < 1). The corrected proportions are shown in Fig. 6.

Discussion

The results of Experiment 6 offer no support for the length hypothesis: If anything, there was a tendency for disyllabic words to precede mono-syllabic words. However, this tendency was evident only when the di-syllable had an iambic stress pattern. This aligns with the predictions of the metrical hypothesis: Words are more likely to be ordered in a way that enhances rhythmic alternation between stressed and unstressed syllables. In conjunctions containing iambic disyllables, a regular alternation re-quired putting the long word first (as in the conjunction *surprise and sin*) whereas in conjunctions with trochaic disyllables, a regular alternation required putting the short word first (as in the conjunction *sin and si-lence*). Although the short-first tendency for the latter conjunctions did not significantly exceed chance expectations, the direction of the ten-
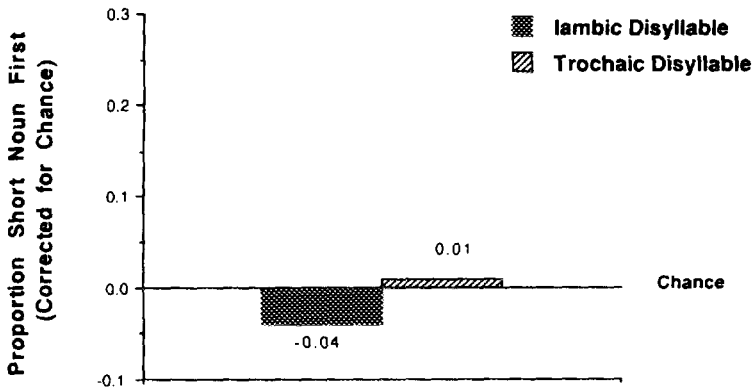
FIG. 6. Proportions of conjunctions recalled with the short (monosyllabic) noun first in Experiment 6, corrected for chance. Trochaic–disyllable conjunctions produced with the short noun first contained a regular alternation between stressed and unstressed syllables (e.g., *sin and silence*); iambic–disyllable conjunctions contained a regular alternation when produced with the long noun first (e.g., *surprise and sin*).

dency and the difference between the two conjunction types is consistent with the view that prosody is a more important force than word length in creating word order differences.

Notably, these effects emerged only when there was no difference in animacy between the conjoined nouns. In Experiment 5, in which there was such a difference, the results actually ran against the rhythmic alternation prediction, albeit not significantly. This suggests that the properties of lexemes—word forms themselves—are most likely to affect word order when their affiliated lemmas are similar in their grammatical or pragmatic privileges.

EXPERIMENT 7

All of the previous experiments used a recall task to assess the effects on word order of the retrieval and construction processes involved in language production. Experiment 7 was designed to examine the extent to which similar patterns of results emerge from a task in which retrieval and construction are minimized, but linguistic acceptability and comprehensibility come into play.

A specific motive for contrasting recall and judgment is that comparative word order preferences have provided convincing evidence for the importance of word length. Pinker and Birdsong (1979) asked native speakers of several different languages to give their relative preferences for different conjunctions of nonsense words, some of the conjunctions presented within sentences and some presented in isolation. Word length in syllables was one of the factors that Pinker and Birdsong varied, as in

the pairs of nonsense conjunctions *boof and kaboof* versus *kaboof and boof* or *dabig and dadabig* versus *dadabig and dabig*. In two experiments, they obtained strong, consistent evidence for a length-in-syllables effect, with a preference for the short "word" first among speakers of all languages and at all levels of proficiency in English. Among the five phonological factors that they varied, relative length had the strongest effect. They attributed the short-before-long tendency in frozen expressions to speakers' intuitions about which order sounds better, and suggested that this order may aid comprehension by postponing more complex words.

In the present study, the participants were asked to judge which of the two alternative forms of the sentences and phrases used in the previous experiments sounded better. In the six parts of the experiment, separate groups of participants evaluated the sentence and phrase pairs from Experiments 1 through 6.

Method

Participants. A total of 176 students served as judges. All of them were undergraduates at Michigan State University or Louisiana State University who received extra credit in return for their participation. One group received the items from Experiment 1, another received the items from Experiment 2, another the items from Experiments 3, 4, and 6, and another the items from Experiments 4, 5, and 6. The distribution of judges over the six-item-sets is shown in Table 11. The total of the tabled *n*'s does not match the total number of judges because of variations in the numbers of judges whose data were randomly discarded in order to equate cell sizes for each item set.

Materials. The sentence and phrase pairs from Experiments 1 through 6 were converted into six sets of forced-choice items. Each item corresponded to one of the pairs from the previous experiments, and all of the pairs from those experiments were tested. Within each pair, the order of the alternatives was counterbalanced so that, across all items in each set, the first sentence or phrase in a pair represented every cell of the design from the original experiment equally often.

The items were arranged in random order in lists. Except for the set from Experiment 6, there were two lists for each set of items, differing only in the order in which the alternatives composing each item were presented. For the Experiment 6 item set, four lists were required to counterbalance the order of appearance of the alternatives, every list including one of the four conjunctions formed with each of the monosyllables. Within each item set, equal numbers of judges received each list.

The sentence pairs from Experiment 1 were preceded by their vignettes. All other sentence and phrase pairs were presented in isolation.

Procedure. The lists were presented in written form, in booklets. The judges were instructed to pick the sentence or phrase in each pair that they thought sounded better and to circle a letter (*a* or *b*) corresponding to their choice.

Scoring, data transformations, and analyses. The dependent measure was derived from the percentages of choices of the alternative with the animate (for the items from Experiments 1 through 5) or short (for the items from Experiment 6) target-noun first. To remain consistent with the analyses in the recall experiments, 50% (indifference or chance) was subtracted from the percentage for each judge in each condition. An arcsine transformation was then applied to these scores.

TABLE 11

Analysis-of-Variance Results for the Preference Judgments of the Alternative Sentence and Phrase Forms Used in Experiments 1 through 6

Factor	Participant analysis	Item analysis
Judgments of Experiment 1 sentences ($n = 64$)		
Animacy (intercept)	$F_1(1,63) = 110.4^*$	$F_2(1,44) = 38.9^*$
Length	$F_1(1,63) = 1.5$	$F_2(1,44) = .2$
Sentence type	$F_1(1,63) = 3.2\dagger$	$F_2(1,44) = .6$
Length by type	$F_1(1,63) = 3.4\dagger$	$F_2(1,44) = .5$
Judgments of Experiment 2 sentences ($n = 30$)		
Animacy (intercept)	$F_1(1,29) = 74.9^*$	$F_2(1,44) = 27.7^*$
Length	$F_1(1,29) = 5.7^*$	$F_2(1,44) = 1.3$
Sentence type	$F_1(1,29) = .8$	$F_2(1,44) = .2$
Length by type	$F_1(1,29) = 2.8$	$F_2(1,44) = .4$
Judgments of Experiment 3 phrases ($n = 38$)		
Animacy (intercept)	$F_1(1,37) = 22.9^*$	$F_2(1,44) = 5.7^*$
Length	$F_1(1,37) = .4$	$F_2(1,44) = .7$
Original type	$F_1(1,37) = 6.1^*$	$F_2(1,44) = 1.1$
Length by type	$F_1(1,37) = 2.6$	$F_2(1,44) = .6$
Judgments of Experiment 4 phrases ($n = 82$)		
Animacy (intercept)	$F_1(1,81) = 38.0^*$	$F_2(1,20) = 62.3^*$
Length	$F_1(1,81) = .2$	$F_2(1,20) = .3$
Trisyllable type	$F_1(1,81) = .5$	$F_2(1,20) = .2$
Length by trisyllable type	$F_1(1,81) = .2$	$F_2(1,20) = .1$
Judgments of Experiment 5 phrases ($n = 36$)		
Animacy (intercept)	$F_1(1,35) = 45.9^*$	$F_2(1,22) = 68.9^*$
Length	$F_1(1,35) = 15.3^*$	$F_2(1,22) = 6.3^*$
Judgments of Experiment 6 phrases ($n = 72$)		
Length (intercept)	$F_1(1,71) = 3.3\dagger$	$F_2(1,22) = 1.8$
Type of disyllable	$F_1(1,71) = .2$	$F_2(1,22) = .1$

Note. The ns are the number of judges for each set of materials.
* $p < .05$.
† $p < .10$.

Separate analyses of variance were conducted on the transformed scores for the item sets from each experiment.

Results

For each set of items, the corrected percentages of choices in each condition are shown in the six panels of Fig. 7. The results from the analyses of variance are reported in Table 11.

To assess the marginally significant interaction between length and sentence type in the Experiment 1 materials, separate analyses of variance were performed on the transitives and conjunctives. These revealed a significant effect of length for the transitives, but only in the analysis for

participants ($F_1(1,63) = 4.4$; $F_2 < 1$). The length effect for the conjunctives was not significant (both Fs < 1).

Separate analyses of the items representing the original item classifications in Experiment 3 showed that animacy had a marginal effect for pairs
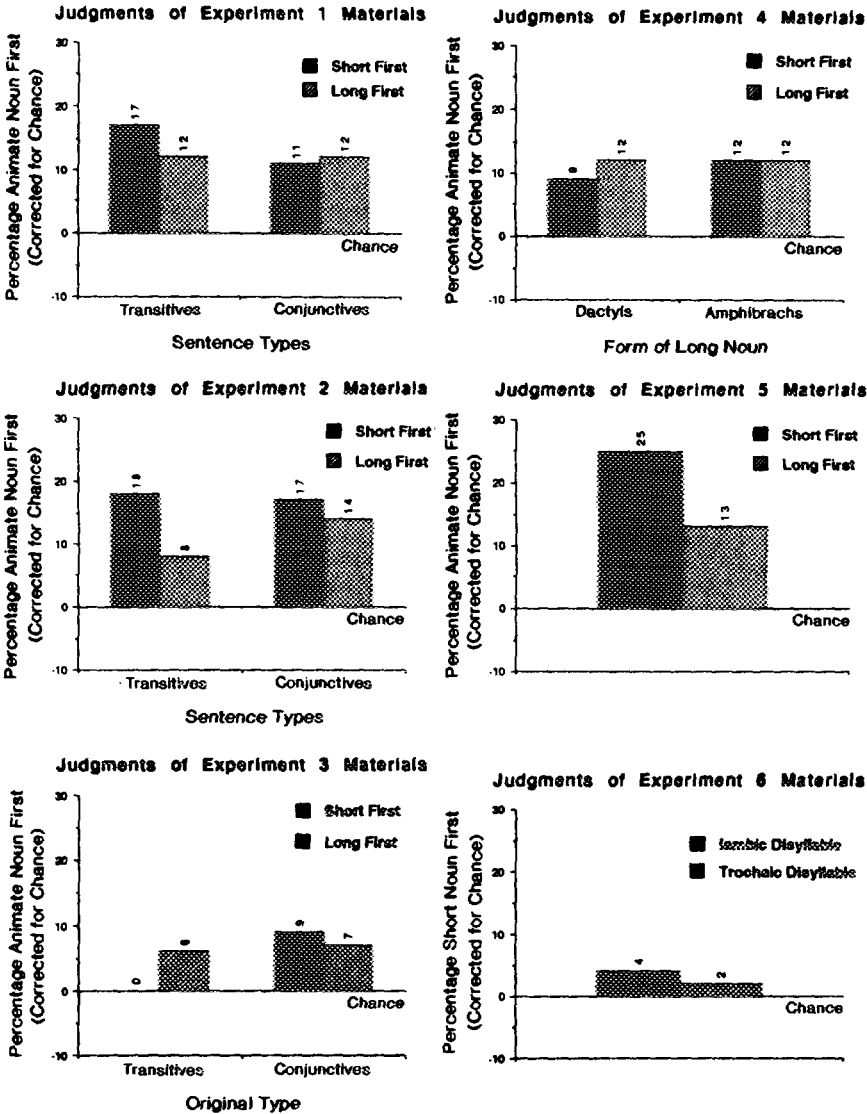

FIG. 7. The six graphs give the chance-corrected percentages of judged preferences for alternative sentence or phrase forms in the materials from Experiments 1 through 6.

originally presented as transitives ($F_1(1,37) = 3.7$, $p < .07$; $F_2(1,22) = 1.3$, $p > .10$) and a significant effect for pairs originally presented as conjunctives ($F_1(1,37) = 32.7$; $F_2(1,22) = 4.5$).

Discussion

For nearly all of the sentences and phrases that contained an animacy contrast, there was a strong and significant preference for forms with the animate noun first. Less consistently, but more frequently than in recall, there was a preference for forms with the short noun first. This effect was significant in both participants' and items' analyses for the stimuli from Experiment 5, and significant or marginal in the participants' analyses for the stimuli from Experiments 2 and 6 and for the transitives from Experiment 1. Metrical variations had no significant impact on the judgments of the materials from either of the experiments in which those variations were assessed independently of length (Experiments 4 and 6), even when length affected the judgments, as in Experiment 6. We will consider the relationship between these results and those from the recall experiments in more detail in the General Discussion.

GENERAL DISCUSSION

The first five experiments clearly reflected the impact of animacy on word order in language production as well as the intricacy of the effect. In Experiments 1 and 2, animate nouns tended to be used as the subjects of sentences, although they did not reliably take the lead position in conjunctions within sentences. This is the same pattern found by Bock and Warren (1985) for concrete nouns, and it suggests that the bias toward animate subjects in production is not merely a product of a serial ordering tendency but a consequence of the assignment of grammatical roles. Reinforcing this suggestion, Kelly's (1986) large-scale analysis of novel conjunctions in sentences disclosed no general bias toward animate leaders. Apparently, animates take the role of subject because of the large number of verbs in English that require or permit animate subjects (Jarvella & Sinott, 1972), and it happens that English sentence structure typically positions subjects in first position. The location of animate nouns in sentences, then, appears to be largely a byproduct of their grammatical role assignments.

Yet, when the conjunctions were removed from sentences and produced as isolated phrases in Experiments 3, 4, and 5, animate nouns regularly assumed the leading position. This is consistent with the typical order of words in frozen conjunctions (Cooper & Ross, 1975) and with ordering patterns for nonsense names whose referents differ in animacy (Byrne & Davidson, 1985). The results of Experiment 4 suggested that one component of this effect may have been tacit assignments of the

animate and inanimate members of the conjunctions to different event roles (such as agent and patient). However, this is unlikely to be the whole story. The animate-first tendency was significant in Experiment 4 despite instructions designed to minimize assignments of event roles, and Byrne and Davidson (1985) found a similar tendency operating among child speakers of a language that does not place agents before patients in its basic sentences. Thus, there also seems to be a fundamental predisposition toward animate leaders, although this predisposition is neutralized when two nouns share the same grammatical role in production.

This pattern of results follows well from the predictions of the conceptual accessibility hypothesis for production. The interrelated components of lemma accessibility, predicability, and retrievability affect word order predominantly through grammatical role assignments that are prerequisites to the production of grammatically structured discourse. These assignments can both enhance and dampen variations in accessibility. When grammatical structure is absent, however, we see forces at work which may have molded the cross-linguistic tendency for subjects themselves to lead (Clark & Clark, 1978): Words that denote animates have priority in production over words that denote inanimates.

With respect to conceptual accessibility, the judgment results both converged with and diverged from the recall results, and did so in ways that are consistent with disparities in the normal requirements of language comprehension and production. There was a consistent preference for sentences and phrases with animate leaders, suggesting that this order may be more natural for comprehension. The first referring expression in a sentence seems to have a privileged role in language comprehension (Gernsbacher & Hargreaves, 1988; Gernsbacher, Hargreaves, & Beeman, 1989; MacWhinney, 1977), with more prominence in memory than later expressions. Since animate nouns should generally be easier to integrate with subsequent material than inanimates because of their predicability, comprehension may flow more smoothly when animates lead.

At the same time, there is an important respect in which the role of animate nouns in language comprehension may differ from their role in production. Comprehenders have to piece interpretations together from the utterances that they hear, but speakers, because they know the messages behind the utterances they create, do not. The speaker's problem, instead, is to create a syntactic structure that conveys the message. This disparity between comprehension and production may explain the major difference between the recall and judgment results. In recalling sentences (in Experiments 1 and 2), there was a strong tendency to use the animate noun as the subject in transitives, but relatively little tendency to use it as a leader within conjunctive sentences. We have proposed that this is attributable to the effect of animacy on grammatical role assignments in

sentences, and the neutrality of those assignments in the conjunctive phrases within sentences. In judging transitive and conjunctive sentences, however, the preference for animate subjects in the former was as strong as the preference for animate leaders in the latter. This comports with the results of Gernsbacher and Hargreaves (1988), who demonstrated that the prominence of first nouns in language comprehension does not depend on their being subjects, or agents, or the first word in a sentence, or being conjoined with another noun. In interpreting sentences, the conceptual centrality of animates may make them a useful starting point (MacWhinney, 1977) regardless of their syntactic role.

With respect to the role of word form or general phonological factors in word order, the recall and judgment tasks produced somewhat divergent results. We found no consistent effect of word length on word order in production. However, in accord with the findings of Pinker and Birdsong (1979), our judges in Experiment 7 often (but not always) preferred short words before long ones, and sometimes very strongly. The metrical properties of the materials had no detectable effect on judgments, but they weakly influenced word order in the recall of conjoined phrases in Experiment 6.

There is no especially compelling account of these differences, and the inconsistency and weakness of the phonological effects, wherever they were assessed, calls for caution in their interpretation. Only a negative conclusion seems warranted: Whatever the mechanisms by which lexeme features (either length in syllables or suprasegmental prosody) may mediate word order, those mechanisms do not operate robustly across utterance forms and situations. Because of their fragility, their effects may be most evident in language that is used repeatedly, such as frozen conjunctions (Cooper & Ross, 1975) and in language that is composed or memorialized for its euphony, such as famous quotations (Kelly, 1986). This tends to disconfirm the view that length in syllables affects lexical accessibility and, more generally, casts doubt on the lexical accessibility hypothesis.

Of course, there may be problems in our experiments that are responsible for these null results. One persistent problem was the unreliability of the results for items, indicating that there was a great deal of variability among them. It may be that with larger or more judiciously selected samples of sentences and phrases, the effects would change. However, most of the results that were significant for participants but not for items were replicated with different sets of items in other experiments, without changing the null length results, suggesting that the patterns are generalizable. An important exception is the finding from Experiment 6 that suggested a metrical contribution to word order. The evidence for that contribution is quite weak, and needs further evaluation.

Other problems may arise from the use of recall tasks to simulate language formulation. Recall involves an effort to retrieve an episodic representation—an effort that plays little role in normal formulation—and creates the possibility of interference from special recall strategies. As we noted in the introduction, there is convincing evidence that recall incorporates the processes of production. However, recall inevitably adds other things to those processes. Notably, when a memory component is added to a production task, relatively inaccessible words may be temporarily accorded a special place in working memory or short-term storage, giving them production priority over words that are ordinarily more retrievable (Levelt & Maassen, 1981). Similarly, priming from the encoding of words (which necessarily preceded their subsequent recall) may have neutralized small differences between them in lexical accessibility. More generally, the factors responsible for production priority in spontaneous speech may sometimes diverge from those responsible for priority in recall (Brainerd, Reyna, Howe, & Kevershan, 1990). Although such sources of variability evidently did not neutralize animacy in our experiments, they may have obscured the effects of word–form variables.

Likewise, writing is not talking, and there are serious hazards in generalizing from one to the other. Compared to speech, the written response mode may involve different mechanisms and different representations operating under different time pressures in a different output system. All of these things could change the impact of phonological factors more than the impact of semantic factors, and thereby work against the appearance of phonological effects that may be prominent in normal speech. This is an issue that demands much more attention. Nonetheless, there is evidence that phonological codes are active during writing (e.g., Frith, 1979), and Kelly (1986) found few differences between naturally written and spoken conjunctions in the phonological factors that affected word order, indicating that the written modality does not by itself preclude the workings of phonological factors.

Conclusion

Although English word order is relatively rigid, it can and does vary in response to a variety of pragmatic and linguistic forces. Our goal in this paper was to better specify some of the linguistic factors, both semantic and phonological, that contribute to this variability. We found, as many have before, that animate constituents are commonly produced before inanimates. Going beyond this, we found that animate leadership is enhanced by grammatical role assignments: In sentences, animates are more likely to precede inanimates when their grammatical roles differ than when they are the same.

We failed to find any compelling word order variations attributable to

the phonological features of words. In the same materials that yielded strong animacy effects on word order, there was no tendency for words with fewer syllables to precede words with more syllables. When the animacy contrast was eliminated, a weak tendency emerged to order words in a way that created a rhythmic alternation between syllables, but this was not attributable to the relative lengths of the words involved. Evidently, and perhaps unsurprisingly, conceptual factors play a preeminent part in the control of word order.

APPENDIX

Materials for Experiments 1, 2, and 3 (the sentences shown are those that were used in Experiment 1; corresponding sentences were used in Experiment 2 with some minor modifications; Experiment 3 used only the italicized target words in conjunctions)

His *wife* had taken out a large life insurance *policy*
The *girl* sued the *university*
The *boys* forged the *letter*
The *bride* opened the *presents*
A *farmer* purchased a *refrigerator*
The *painter* opened the *envelope*
The *child* was soothed by the *music*
His *horse* was startled by the *radio*
The *chief* was commended by the *report*
The *fans* were shocked by the *photograph*
The *Nazi* was incriminated by a *biography*
The *driver* was embarrassed by the *uniform*
The *general* deliberately misrepresented the *number*
A former *president* was painting the *church*
Their *children* had painted the *room* black
The *leader* threw a *rock*
The *veterans* raised the *flag*
A *policeman* guarded the *crown* around the clock
The *family* had been separated by the *war*
The *students* were frightened by the *sound*
The *secretary* was delighted by the *plan*
The *scientist* was blinded by the *sunlight*
The *writer* was disgusted by the *wine*
The *attorney* was upset by the *message*
Their *king* and their *battle* were both lost
His *son* and the *river* were the only things that mattered to the old steamboat captain
The *dancer* and the *studio* were featured in all the magazines that week
The *dog* and the *telephone* were both making noise

The *crew* and the *camera* suffered minor injuries
The *lawyer* and the *oxygen* arrived too late
They earn their living from *tourists* and *cigarettes*
They disapproved of the *senator* and the *legislation*
He sat in front of a roaring fire with his *cat* and some *whiskey*
The newspaper story concerned the *judge* and the *election*
Her scrapbook brought back happy memories of *friends* and *summer*
The surgeon yelled for a *nurse* and a *needle*
The *principal* and the *funds* had both disappeared
The *detective* and the *gold* were found buried together in a remote
wooded area
The *manager* and the *key* were nowhere to be found
Her *husband* and the *bed* both went up in flames
The studio *audience* and the *game* had become boring
The *enemy* and the *ship* were about to join battle
The ombudsman had questions about the *student* and the *test*
The actor was unhappy with the *doctor* and the *price*
They were squabbling over what to do about their *mother* and the *land*
The FBI tried to identify the *couple* and the *gun*
The entertainment included a *poet* and a *film*
The police cracked down on the *customers* and the *bars*

Phrases from Experiment 4 (with the short word first)

dog and telephone
duck and handkerchief
nurse and photograph
spy and vinegar
goat and ambulance
witch and bicycle
coach and detergent
priest and potato
guest and piano
wolf and martini
bird and museum
pig and umbrella
spoon and bachelor
crate and butterfly
prune and crocodile
ink and elephant
shirt and veteran
comb and bartender
bead and mosquito
desk and attorney

stool and instructor
harp and coyote
crown and policeman
wand and hyena

Phrases from Experiment 5 (with the animate word first)

child and music
nurse and needle
horse and tower
boys and letter
cat and whiskey
king and battle
dog and coffee
bear and wagon
cow and butter
bride and presents
friends and summer
judge and secret
student and test
husband and bed
couple and gun
poet and film
lion and drums
rabbit and egg
chickens and cups
writer and wine
mother and land
leader and rock
doctor and price
children and room

Phrases from Experiment 6 (with the short word first)

doll and attic/antique
blade and arrow/baton
bed and tower/hotel
lake and entrance/estate
flame and lighter/cigar
costs and data/report
sin and silence/surprise
cups and cooler/champagne
gift and lesson/debate
shoes and dancing/ballet
steam and pavement/cement
storm and picnic/parade

moose and zebra/giraffe
bell and ladder/guitar
luck and doctrine/award
post and battle/campaign
creek and canyon/lagoon
glass and products/machine
sleep and message/belief
flag and lantern/balloon
risk and worry/disease
guilt and error/mistake
ship and crisis/event
bones and chapel/garage

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