Grammatical agreement is more often a lightning rod for language purists than a target of psycholinguistic investigation. Not long ago, the New Yorker posed to its readers the query:

Efforts to make English the official language is gaining strength throughout the U.S. What is your reaction? (quoted in the New Yorker, November 17, 1986, p. 94)

The New Yorker magazine offered this tongue-in-cheek response:

It's hopeless.

Plainly, this judgment was prompted by the absence of agreement between the question's subject and verb. Efforts is plural and requires the plural are, not the singular is.

Belying its reputation as an effete detail, agreement is a paradigm case of what syntax does. Fundamentally, syntax ties together words that represent elements of nonlinguistic thought. The following example illustrates how agreement helps to fulfill this basic syntactic function.

(a) The mother of the girls who was... 
(b) The mother of the girls who were... 

A speaker who says (a) probably intends to say something about the mother, whereas a speaker who says (b) probably intends to say something about the girls. Hearers can understand this because the speaker has used elements of English that linguistically mark number, calling on number to specify which elements of the thought are related. In (a), was is singular and is thereby linked to the singular noun mother. In (b), were is plural and so is girls. Many languages around the world use agreement in similar ways, whether the agreeing elements reflect number, grammatical gender, animacy, or other features.

Added to the linguistic significance of agreement is the psycholinguistic significance of the regularity with which it is required in speech. Every English sentence requires number agreement between subjects and verbs, overtly or covertly. Speakers therefore take tacit account of number in virtually every utterance they produce, and their observance of number features is surprisingly scrupulous. Even four-year-olds have been shown to use correctly agreeing verbs more than 94% of the time in spontaneous speech.¹

The integral role of agreement in the production of normal utterances gives it unusual utility for observing how speakers create and implement basic conceptual and linguistic dependencies. In order to link words in a way that captures a thought, the mechanisms for marking number agreement in language must be sensitive to the features of thought that represent number. In order to make the thought communicable, the mechanisms that implement agreement in speech must embody the systematic features of the language. These systematic features constitute the grammar, encompassing the knowledge of sound structure, word structure, and sentence structure that is shared among people who know the language. Because theories of language production are concerned with how the twin demands of symbolizing thought and implementing grammar are dynamically negotiated in spontaneous speech,² the theories inherit a rich set of tests from the phenomena of agreement.

A central issue in the cognitive psychology of language involves the relationship between language and nonlinguistic cognition, continuing a centuries-long debate about whether language is a unique ability. Experimental psycholinguistics likewise focuses heavily on the interplay between general cognitive and specific linguistic mechanisms in language processing. These same issues drive research on the production of agreement.

Agreement may call on the properties of either the specifically linguistic or the general conceptual elements that are linked to one another in an utterance. This is illustrated in the difference between notional and grammatical number agreement. A reporter for the West Austin Texas News wrote:

A recent survey conducted by the Sunbelt Institute of Atlanta, called Workforce Literacy in the South, indicates that one in three Texans are functionally illiterate. (quoted in the New Yorker, January 23, 1989, p. 97)

The reporter used a plural verb, are, perhaps because she had in mind all the functional illiterates. If so, this is an example of notional agreement. The New Yorker, ever on guard, reprinted the sentence along with a riposte:

And the other two is a little careless sometimes.

Why careless? Apparently, because

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Table 1. Agreement attraction in spontaneous speech

<table>
<thead>
<tr>
<th>Attracted feature</th>
<th>Attracting element</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verb number</td>
<td>Plural local noun</td>
<td>The readiness of our conventional forces are at an all-time low.</td>
</tr>
<tr>
<td>Verb number</td>
<td>Singular local noun</td>
<td>Disputes over health coverage was the cause.</td>
</tr>
<tr>
<td>Pronoun number</td>
<td>Plural local noun</td>
<td>The breaking of relations in themselves . . . [speaker corrects himself in itself] . . .</td>
</tr>
</tbody>
</table>

Note. The attracted word is italicized in each example.

The reporter's use of notional agreement deviates from prescribed grammatical conventions. Prescriptive grammatical agreement requires the verb to be singular because the word one is singular, regardless of how many illiterates "one in three Texans" actually denotes.

The New Yorker's disdain for notional agreement reflects a widely held belief that errors in grammar are a product of intellectual sloth, likely to arise when an otherwise careful speaker's attention drifts from the serious business of language to the egocentric whims of thinking. The presumption is that the cognitive processes that serve language calculate agreement sometimes on the basis of the thoughts a speaker is thinking and sometimes on the basis of the grammar a speaker is following, and may willfully consult either source of information unless the speaker is vigilant. Traditional grammarians were explicit about the peril. H.W. Fowler regarded agreement errors as "a matter of carelessness or inexperience only." On this view, language and thinking are tightly interwoven, loomed into the same cognitive cloth.

There is an entirely different perspective on language processing which says that it is to some degree insulated from thought, encapsulated and specialized. This view asserts that the varieties of human cognition reflect quasi-independent faculties that are rooted in different sorts of biological predispositions. Language is a candidate to be one of those faculties, partly because of its universality and unusual developmental course. Seen in this light, grammatical agreement may be fundamentally different from notional agreement, a consequence of processes that have their own logic and legitimacy.

One way to evaluate the nature of agreement objectively is to examine the features of agreement errors. Though the rate of such errors is low, mistakes are readily observable because of the frequency with which number agreement is required in English. Agreement errors promise to reveal something about the potential interactions between conceptual and grammatical constraints because speech errors in general often arise when conflicting linguistic forces are at work. At the same time, because speech errors are tightly restricted by properties of normal language production, the characteristics of errors should be interpretable in terms of the mechanisms that are available for error-free language use.

THE ATTRACTION OF AGREEMENT

The most familiar kind of agreement error involves a phenomenon called attraction in the traditional linguistic literature. Table 1 gives some instances from spontaneous speech. In the first two examples, the verb agrees with the noun phrase that immediately precedes (the local noun) instead of the noun that ordinarily carries the number of the entire subject phrase (the head noun). A similar problem sometimes crops up in agreement between pronouns and their intended antecedents, as shown in the third example.

Table 2. Experimental procedures for eliciting verb and pronoun number attraction

<table>
<thead>
<tr>
<th>Event</th>
<th>Verb elicitation</th>
<th>Pronoun elicitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Experimenter presents auditory preamble:</td>
<td>&quot;The key to the cabinets&quot;</td>
<td>&quot;The key to the cabinets disappeared&quot;</td>
</tr>
<tr>
<td>2. Speaker repeats preamble and completes:</td>
<td>As a full sentence: &quot;The key to the cabinets was missing.&quot;</td>
<td></td>
</tr>
<tr>
<td>3. Scoring: Does the verb or pronoun agree (correct) or disagree (attraction) with the head noun in number?</td>
<td>Correct: &quot;The key to the cabinets missing.&quot;</td>
<td>Attraction: &quot;The key to the cabinets dropped.&quot;</td>
</tr>
</tbody>
</table>

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To assess the properties of errors in verb and pronoun agreement in a controlled way, my colleagues and I use the experimental protocols that are sketched in Table 2. In studies on verb agreement, on each trial a speaker hears a recording of a noun phrase—a sentence preamble—like ‘The key to the cabinets.’ The speaker repeats the preamble and completes it as a full sentence. So the speaker might say, ‘The key to the cabinets was missing.’ The repetition serves to ensure that the speaker heard and understood the preamble correctly. In turning the preamble into a complete sentence, the speaker naturally adds a verb. We examine whether the verb’s number agrees with that of the head or local noun. The key to the cabinets was missing has a verb that agrees with the head, but The key to the cabinets were missing has a verb that agrees with the local noun, exhibiting attraction. When number is ambiguous, as in The key to the cabinets dropped, we discount the response. The usual dependent measure is the proportion of agreement errors (attraction) among the unambiguous agreement inflections.

The assessment of attraction requires conditions that guard against counterfeit agreement errors. Some speakers’ dialects never mark number, some additions or deletions of number inflections may actually be insertions or omissions of single sounds, and other errors may be purely random occurrences. To measure the incidence of these events, all of the experiments include control conditions in which the preambles’ heads and local nouns match in number (e.g., The key to the cabinet). Because these preambles lack the attractors that give rise to the anomalous verb forms, the frequency of those forms in the control responses provides a baseline against which to assess the likelihood of attraction. With these precautions, the paradigm yields attraction patterns that appear very similar to those in spontaneous speech.5

Using the methods just described, we have addressed three broad questions about the production of agreement. One has to do with the nature of agreement controllers. In subject-verb agreement, the controller seems to be the subject because the subject carries the number value that the verb agrees with. However, a large literature testifies to the difficulty of defining what subjects actually are. They may be basic grammatical relations, but they also tend to convey the pragmatic topics of utterances. Accordingly, the production mechanism that is responsible for implementing agreement could look at the grammatical relation itself or at a conceptual representation that incorporates the notional features of the topic.

A second question concerns the nature of the agreeing information. It, too, may be grammatical or notional, as illustrated in the contrast between grammatical and notional number. English has several classes of nouns whose grammatical and notional number can conflict. In American English, collective nouns (e.g., army, team, choir) are typically treated as singular for purposes of verb agreement, and so they seem to be grammatically singular. But because they refer to collections of people or animals, they are judged to be notionally plural, and are often treated as plural in British English. The opposite pattern is found in invariant plural nouns like scissors, pliers, and binoculars. They are grammatically plural but judged to be notionally singular, because they refer to single objects. The same objects are denoted with singular words in such languages as Dutch and German. These contrasts between grammatical and notional number offer a litmus test for the penetration of notional information into ongoing language processing.

The third question has to do with the span of the mental representations in which agreement is marked and implemented. The intuitive view of agreement is that it requires cognitive vigilance. The speaker must remember the grammatical number of the subject and then pay attention to creating a verb form with a consistent value. Any superficial property that serves to disrupt memory or attention (greater distance between head and verb, more complex construction, physical resemblance of head or local noun to plural words) should serve to disrupt the implementation of agreement.

If one assumes that the factors that affect attraction are factors that are likely to be important in normal agreement, it is possible to address these questions using the experimental paradigms in Table 1. Table 3 gives concrete illustrations of some of the comparisons that have been made. The first example illustrates the conditions that elicit attraction most reliably. When the head is singular and the local noun is grammatically plural, the verb that follows the local noun has a reliable tendency to be plural. In contrast, when the head is plural and the local noun is singular (as in Example 2), the verb that follows the local noun shows only a wavering tendency to be singular. This singular-plural asymmetry in attraction appears to be a consequence of a disparity in underlying number marking. Eberhard reported evidence that plurality is a marked feature of words, whereas singularity is not. That is, the mental representation of a plural word carries a plural value, whereas the mental representation of a singular word carries no number at all: The singular is specified by default. The underlying marking of the plural makes grammatical plurality a strong force in attraction.
Turning to the question of notional versus grammatical control of agreement, the third example in Table 3 shows that local nouns with the notional features of prototypical topics (animacy, concreteness) are no more likely to attract agreement than local nouns without such features, suggesting that less probable topics have as much control over agreement as highly probable topics. The fourth example illustrates the finding that notional plurality in local nouns that merely sound plural (like *rose*) fails to perturb agreement implementation; the local noun must be plural (like *rows*), but either a regular or irregular plural will do (as shown in Example 6). 7 Examples 7 and 8 bear on the scope of the mental representations that contain agreeing elements. The disruptions to agreement that we have observed are not straightforwardly related to the sheer length or complexity of the material that separates head nouns from verbs. Although gross attentional disruptions can increase errors across the board, 8 the underlying error distribution is more intricate. Errors are less frequent after clauses than after phrases, 9 despite the fact that clauses are more complex (as in Example 7). The distance between heads and verbs matters only when the verb follows an interrupting phrase, that is, when the local noun and the verb are in the same clause (as in Example 8). 10

On the assumption that attraction reflects features that are crucial to the usual implementation of agreement, these findings imply that there are mechanisms of verb agreement that are more attentive to grammatical than to notional information. "Good" topics—nouns that are a priori likely to be subjects but in fact are not the subjects—are no more likely to attract agreement than "bad" topics—nouns that are a priori less likely to be subjects. The number that affects attraction is grammatical, not notional. Finally, attraction varies in ways which suggest that agreement is marked or un-marked.

### Table 3. Local-noun features that do and do not attract spurious agreement

<table>
<thead>
<tr>
<th>Example</th>
<th>Attracting feature (1-6) or disruption (7-8)</th>
<th>Attraction effect</th>
<th>Sample response contrastsa</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grammatical plurality</td>
<td>Strong</td>
<td>The key to the cabinets &gt; The key to the cabinet were</td>
</tr>
<tr>
<td>2</td>
<td>Grammatical singularity</td>
<td>Very weak</td>
<td>The keys to the cabinet was = The keys to the cabinets were</td>
</tr>
<tr>
<td>3</td>
<td>Animacy, concreteness (topic features)</td>
<td>None</td>
<td>The island of the kings were = The king of the islands wereb</td>
</tr>
<tr>
<td>4</td>
<td>Notional plurality (collectivity)</td>
<td>None</td>
<td>The strength of the army were = The strength of the soldiers were</td>
</tr>
<tr>
<td>5</td>
<td>Sham pluralityc</td>
<td>None</td>
<td>The appearance of the rose were = The appearance of the rows were</td>
</tr>
<tr>
<td>6</td>
<td>Irregularly marked grammatical plurality</td>
<td>Same as regular marking (see #1)</td>
<td>The trap for the mice were = The trap for the rats were &gt; The trap for the mouse were = The trap for the rat were</td>
</tr>
<tr>
<td>7</td>
<td>Phrase vs. clause interruption</td>
<td>Stronger after phrases</td>
<td>The report of the destructive fires were &gt; The report that they controlled the fires wereb</td>
</tr>
<tr>
<td>8</td>
<td>Short vs. long interruption</td>
<td>None after clauses</td>
<td>The report that they controlled the forest fires were = The report that they controlled the fires wereb</td>
</tr>
</tbody>
</table>

a The inequalities shown with the sample responses indicate the relative frequency of different response types. The italicized portion of each sample response corresponds to the preamble, and the nonitalicized portion represents which verb-number marking the speakers produced spontaneously, whether singular (was) or plural (were).

b The comparison illustrated is made in relation to appropriate control conditions, rather than directly, for the reasons described earlier. So, this test of attraction is based on two contrasts, each one between the sentences shown (with singular heads and plural local nouns) and matched control sentences, each with a singular head and a singular local noun.
c Preambles presented visually rather than auditorily.

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implemented in representations that encode such structural properties of language as clause boundaries, not merely length or conceptual complexity. Evidently, momentary confusions in thought are not immediately culpable for attraction errors. The culprit behind attraction in verb agreement appears to be a momentary confusion of linguistic computation.

FROM VERBS TO PRONOUNS

Because pronouns also agree in number with controllers of some kind, it is possible to examine a similar set of questions about pronoun number agreement. However, these questions start from a different vantage point because of natural differences between verbs and pronouns. In English, verbs rarely lack an explicit linguistic controller, but this is not true of pronouns. Speakers commonly use pronouns to denote individuals and things that are present only to the eye or the mind, and are not linguistically instantiated (e.g., him in "just look at him!"). For these pronouns, number agreement seems to depend on a notional representation. At issue is whether this is true for all pronouns, even those that have an explicit linguistic antecedent (e.g., myself in "I looked at myself").

To test this possibility, we carried out a pair of experiments in which the grammatical and notional properties of preambles were manipulated while eliciting either verb or pronoun attraction. The only difference between the experiments was that in pronoun elicitation, each preamble ended in a number-neutral verb (see Table 2), and the speaker's completion was a tag question. Tag questions contain pronouns that normally agree in number with the sentence subject, just as verbs do. So, the pattern of attraction errors should be similar, if the sort of number that controls pronouns is the same sort of number that controls verbs.

In both experiments, notional number was varied in terms of something that semanticists call distributivity. Half of the preambles referred to a single abstract entity that was concretely distributed over multiple objects (e.g., The slogan on the posters). Independent judges rated these preambles as notionally plural, even though the head nouns were grammatically singular. The remaining preambles were both notionally and grammatically singular and lacked distributivity (e.g., The key to the cabinets). Judges rated these as notionally singular, interpreting them as referring to single objects.

Verbs and pronouns reacted differently to notional number, as Figure 1 discloses. As in previous experiments, verb agreement was perturbed only by grammatical plurality: Plural verbs were attracted to grammatically plural local nouns, but no more often after notionally plural than after notionally singular preambles. Pronouns, however, were sensitive to notional number. Their tendency to take plural values after plural local nouns escalated when the preambles were notionally plural. Another recent experiment has shown that attraction to notional plurality is not restricted to tag pronouns. It also occurs at high rates for reflexive pronouns (e.g., themselves in "The gang with the dangerous rivals armed themselves" reflects the notional plurality of the grammatically singular collective gang). Reflexive pronouns are in the same clauses as their controllers and, according to formal grammatical theory, should be governed by the controllers' linguistic features.

The upshot is that number agreement comes in two varieties. One sort, exemplified in verb agreement, is partly carried out by a process that is blind to notional number, or in a representation that is strictly grammatical. Another sort of agreement, pronoun agreement, is more likely to reflect notional features, perhaps because pronouns get their number from a representation of the speaker's meaning. In short, the number inflection of a verb is a dependent grammatical element that is relatively indifferent to a speaker's com-

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**Fig. 1.** Plural attraction of verb and pronoun number after grammatically singular sentence subjects. Notionally, the sentence subjects referred to one thing (as in The key to the cabinets) or to multiple things (as in The slogan on the posters), shown as singular and plural notional number. Local-noun attractors were grammatically singular (cabinet, poster) or plural (cabinets, posters).
municative intentions, whereas pronouns are words much like other words, selected on the basis of what the speaker means to say.

For two similar relations to be created in such different ways, the language production system must have substantial internal structure coupled with specialized processing mechanisms. These mechanisms have different sensitivities and blind spots, creating different kinds of solutions and problems for conveying thought in language. In verb agreement, there is a degree of protection from flights of cognitive fancy. Pronoun use may be much more vulnerable to egocentricity in attention, as attested in the frequency of befuddled listeners’ requests for pronoun disambiguation (“Which she do you mean?”).

Because most of this research has been restricted to English, inferences about the natural origins of language processing systems are severely limited. Mechanisms for language performance could be universal, constrained by innate biological capacities, or they could organize themselves as a language is learned. If languages make different ongoing demands from conceptual and grammatical information, their performance systems could develop differently. Agreement again offers a rich testing ground because languages are diverse in their agreement phenomena. English has just two verb agreement categories, whereas the Bantu languages, in imposing contrast, have upwards of 20. Cross-linguistic assessment of the normal development and implementation of agreement thus offers a valuable tool for mapping the path between thinking and talking.

Acknowledgments—The preparation of this article and the research summarized in it were made possible in part by grants from the National Institutes of Health (ROI HD21011) and the National Science Foundation (BNS 90-09611), and by fellowship support from the Max Planck Society and the Fulbright Program. Sincere thanks go to Cynthia Fisher, Vicki Fromkin, C.R. Gallistel, and an anonymous reviewer for helpful comments on a previous version of the manuscript.

Notes

4. For example, in “The key to the cabinets seem too big,” the production of seem in place of seems could occur because of an agreement error, or because the speaker omitted the ‘s sound. Such omissions can occur independently of agreement errors. A speaker who intends to say “the River Thames” (tEcmz) and instead says “the River Thame” (tEEmz) has committed a single deletion error.
10. Several of the cited experiments incorporated preliminary assessments of individual differences that might be expected to affect agreement, including measurements of working memory capacity and sensitivity to the grammaticality of alternative agreement patterns. Neither of these factors systematically predicted a tendency to produce attraction errors. Under the conditions of these experiments, attraction occurred at low but uniform rates across speakers and items.

Posttraumatic Stress Disorder Following Assault: Theoretical Considerations and Empirical Findings

Edna B. Foa and David S. Riggs

Pathological reactions to traumatic events have been reported in the literature for more than 100 years. In 1980, with the inclusion of posttraumatic stress disorder (PTSD) in the third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-III), these reactions gained the status of a psychiatric disorder. In this review, we discuss the diagnostic criteria for PTSD, describe the prevalence and patterns of PTSD symptoms in female assault victims, and discuss possible mechanisms that underlie both the natural decline of symptoms over time and successful therapy for persistent posttraumatic symptoms.

DIAGNOSTIC CRITERIA OF PTSD

The first criterion for the diagnosis of PTSD is the experiencing of a traumatic event. The revised DSM-III (DSM-III-R) defines a trauma as “an
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