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On the Comprehension and Production of Pronouns

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Four experiments investigated whether subjects understand the supposedly generic *he* generically. In Experiment I, subjects responded YES if an auditorily presented sentence could refer to a female and otherwise NO. Responses were 98% correct for sentences containing sex-specific nouns and pronouns, but 87% incorrect (i.e., NO) for sentences containing generic *he*. In Experiment II, subjects heard identical sentences but responded YES if the sentence could refer to a male. Responses were 99% correct, indicating high availability of the concept "male" for sentences containing generic *he*. In Experiment III, responses were 97% incorrect with *she* substituted for *he* in otherwise identical generic sentences. Experiment IV determined the effect of removing the pronouns from the sentences. The results inspired a general model of processes underlying the comprehension and production of pronouns.

The present experiments examine the comprehension of pronouns in the light of two general hypotheses: the *pronominal dominance hypothesis*, whereby the lexical meaning of a pronoun determines the interpretation of its antecedent, and the *pronominal surrogate hypothesis*, whereby the nature of an antecedent completely determines the interpretation of a pronoun. Under the pronominal surrogate hypothesis, pronouns do not contribute meaning but merely stand for their referents. For example, the pronoun *it* seems to act as a surrogate for its antecedent so that its meaning changes with each use. In a sentence such as "Your ambition to become president sounds unrealistic but it makes sense to me," *it* stands for the referent "your ambition to become president," but in "That idea is ahead of its time," *it* stands for an idea, and in neither case does *it* seem to contribute new meaning of its own. However, the fact that *it* agrees in number, gender, and humanness with its antecedent in these examples makes it impossible to tell whether the pronoun influences the interpretation of the antecedent or vice versa. Agreement rules generally obscure the possibility of observing pronominal dominance.

To test the pronominal dominance hypothesis the present study examined an exception to gender agreement rules: the generic use of *he* as in "A professor usually sees his students during office hours." Linguistic descriptions (e.g., Clark & Clark, 1977) characterize generic *he* as an example of neutralization, a feature of grammar seen in many areas of English and other languages. Use of generic *he* is considered analogous to the use of *long* in referring to the length of objects in neutral contexts such as "How long is the bench?" It is assumed that to ask how *long* something is simply requests information and does not presuppose or bias the nature of the response and more generally that "unmarked" members of polar pairs do not polarize the interpretation of neutral references. The use of *he* as the unmarked category in English is likewise assumed to be neutral when the specific sex of a referent is indeterminate, unknown, or irrelevant.

The pronominal surrogate hypothesis is a natural ally of the assumption that *he* has a context-dependent neutral interpretation. If the antecedent is paramount and pronouns contribute no meaning of their own, then any old stand-in will do as a pronominal substi-

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tute for a neutral antecedent such as *person*, and it would make no difference if English prescribed *she* as the sex-indefinite third-person pronoun rather than *he*. Moreover, if an antecedent such as *doctor* in a sentence such as *A doctor earns his wages* is interpreted as *male* rather than *male or female*, then it is not the fault of the generic pronoun, but of some other factor such as society (where doctors are usually male) or the perceiver who interprets *doctor* as male.

To test these assumptions, the present study undertook to examine the comprehension of generic *he* in sentences containing predominantly male antecedents (e.g., *lawyer*), neutral antecedents (e.g., *person*), and predominantly female antecedents (e.g., *nurse*). Under the pronominal surrogate hypothesis, the nature of the antecedent should determine the interpretation of a sentence as including or excluding women. In contrast, the pronominal dominance hypothesis predicts that sentences containing generic *he* should usually be interpreted as excluding women, regardless of the nature of the antecedent. Moreover, omitting the generic pronoun or changing the generic pronoun from *he* to *she* should dramatically change the interpretation of the sentences according to the pronominal dominance hypothesis but should have little effect under the pronominal surrogate hypothesis.

The present study also examined the issue of conceptual availability: whether the male interpretation is more available than the female interpretation of generic *he*, and whether the male interpretation is more available for specific versus generic uses of *he*, as measured by reaction time techniques.

Experiment I: Generic *he* and the Availability of the Concept "Female"

Experiment I determined whether subjects interpret generic uses of *he* to include or exclude females. Subjects listened to sentences, some of which contained generic *he* and responded as rapidly as possible either YES (the sentence could refer to one or more females) or NO (the sentence could not refer to one or more females). Reaction times were taken as a highly sensitive measure of the relative availability of the generic concept.

Method

Materials. Table 1 provides examples of the materials and an outline of the experimental design. The materials consisted of 32 sentences of equivalent length in syllables, recorded by a male experimenter in four different random orders on magnetic tape with a 10-second silent interval between sentences. Sentences containing generic *he* ($N=12$, e.g., *A lawyer must frequently argue his case out of court*) contained a habitual action marker (e.g., *frequently*), occurred in present tense, and had one of three types of indefinite antecedent preceded by the article *a*. One type of antecedent referenced a predominantly female class (*secretary, receptionist, typist, model*), another type referenced a predominantly male class (*banker, plumber, lawyer, judge*), and the third type referenced a neutral class composed about equally of males and females (*student, artist, dancer, musician*). The referent class categories were determined operationally by an independent group of 80 UCLA undergraduates who estimated the proportion of males and females currently included in these and 24 other classes. We then categorized a referent class as predominantly male if the mean rating for the 80 subjects exceeded 70% male; as predominantly female if the mean rating exceeded 70% female; and as neutral if the mean rating did not exceed 65% either way.

The remaining 20 "filler" sentences contained either a sex-specific pronoun ($N=10$) or a sex-specific noun ($N=10$). Sentences containing sex-specific pronouns resembled the generic *he* sentences in number of syllables, sentence structure, and nature of the antecedent but contained other features generally

TABLE 1
EXPERIMENTAL DESIGN AND SAMPLE SENTENCES: EXPERIMENTS I–III

Type of sentence	Correct response (% averaged across subjects and sentences)		Number of sentences per subject	Total number of sentences
1. Generic pronoun	YES	100	6	12
	NO	0	0	
Examples:	*When a botanist is in the field, he is usually working.* (predominantly male antecedent)			
	A bicyclist can bet that he is not safe from dogs. (neutral antecedent)			
	A nurse must frequently help his patients get out of bed. (predominantly female antecedent)			
2. Sex-specific pronoun	YES	50	5	10
	NO	50	5	
Example:	*The old housekeeper cleaned her carpet before sunrise.*			
3. Sex-specific noun	YES	50	5	10
	NO	50	5	
Example:	*The front door was quickly answered by his aunt.*			
	Total		26	32

incompatible with genericness: past tense, the definite article *the* for the antecedent, and an absence of habitual action markers. An example is *The famous scientist was cleaning her glasses with paper*, where the antecedent is predominantly male (*scientist*) and the pronoun is sex specific and cannot receive a generic interpretation. Sentences containing sex-specific pronouns (*she*, *her*, *he*, *his*, or *him*) enabled comparison of the time to comprehend the specific versus generic use of *he* and served as a control to ensure that the subjects could respond accurately to sex-specific pronouns.

The 10 sentences containing sex-specific nouns resembled those containing sex-specific pronouns, except that a noun such as *aunt* or *mother* determined the correct response. Half of these sentences also contained a "catch" pronoun which had to be ignored. For example, *His aunt became faint at the idea of the voyage* requires the YES (applies to a female) response because of the sex-specific noun *aunt*; the male pronoun *his* is irrelevant.

Subjects and procedure. Ten male and 10 female undergraduates received course credit for participating in the 20-minute experiment. The subjects wore earphones attached to a four-channel TEAC 4070G stereo tape recorder. One channel carried the stimuli and instructions, while the second carried an inaudible click for activating a timer (Lafayette Clock-Counter) via one channel of a Lafayette voice key. The timing click was synchronized with the occurrence of the "critical word" in each sentence, the pronoun in the sentences containing generic *he*, and the sex-specific noun or pronoun in the remaining sentences. The subjects' responses stopped the timer via a microphone attached to the second channel of the voice key. A Sony TC 355 recorded the responses and timing clicks.

Instructions were as follows: This is an experiment on sentence comprehension. You will hear sentences and you are to simply respond YES if the sentence could refer to one or more females, and NO if it could not. Make sure that your response is correct but respond as quickly as you can, before the end of the sentence if possible. Are there any questions?

Each subject heard two practice sentences to ensure that they properly understood the task requirements, followed by 26 experimental sentences: 6 containing generic *he*, 10 containing a sex-specific noun, and 10 containing a sex-specific pronoun. Generic *he* sentences were counterbalanced across sub-

jects such that each subject received two containing a neutral antecedent (e.g., *dancer*), two containing a predominantly male antecedent (e.g., *doctor*), and two containing a predominantly female antecedent (e.g., *typist*). No feedback was provided during the experimental session, and when a subject spontaneously corrected an initial response, only the first response was included in the data analysis.

Results and Discussion

Error analyses. Under the hypothesis that generic *he* functions to include females, YES responses were considered correct for sentences containing generic *he*. Inspection of Table 1 shows that slightly more correct (16 YES vs 10 NO) responses are YES, which might ordinarily lead to a response bias favoring the hypothesis that generic *he* includes females, but the data indicated an overwhelming effect in the opposite direction. The error rate for generic sentences was 87% (see Table 2): 95% of the subjects made at least one error, while 80% made no correct responses whatsoever to generic sentences. As can be seen in Table 2, errors interacted with neither subject sex, $X^2(1)=.04$, nor referent class gender, minimum Wilcoxon $T=9, N'=6, p>.05$, for example, *judge* versus *typist* versus *student*.

For filler sentences containing sex-specific pronouns, YES responses for the male pronoun and NO responses for the female pronoun constituted errors. Error rates for these sentences were low (2%), which suggests that the high error rate for sentences containing generic *he* was not due to subject inattention or inability to judge gender reference. The difference in error rates for generic *he* versus sex-specific pronoun sentences was reliable to the .001 level, Wilcoxon $T=1$, $N'=19$. Subjects also spontaneously corrected errors with a probability much higher for sentences containing a sex-specific pronoun ($p=0.43$) than a generic pronoun ($p=0.0$), which suggests that they were confident of their nongeneric interpretations of generic *he*.

For sentences containing a sex-specific noun and a "catch" pronoun, for example, *His aunt became faint at the idea of the voyage*, YES responses for male referents (e.g., *his father*) and NO responses for female referents (e.g., *his mother*) constituted errors. The probability of error for these sentences was

TABLE 2

PERCENTAGE ERRORS AS A FUNCTION OF SUBJECT SEX AND PREDOMINANT GENDER OF THE ANTECEDENT: EXPERIMENTS I–III

		Experiment					
		I		II		III	
Subject sex	Antecedent	Generic *he* sentences	Sex-specific sentences	Generic *he* sentences	Sex-specific sentences	Generic *she* sentences	Sex-specific sentences
Males	Predominantly male	95	3	0	0	90	3
	Neutral	85	—	0	—	95	—
	Predominantly female	85	3	0	3	100	0
Females	Predominantly male	80	3	7	3	100	3
	Neutral	85	—	0	—	90	—
	Predominantly female	90	0	0	0	100	6
	Total	87	2	1	2	96	3

low ($p=0.23$ per subject per trial) and decreased systematically across trials. No subjects consistently responded incorrectly to these sentences, and all of the errors occurred during the first half of the experiment. This indicated that the subjects were not responding solely on the basis of a superficial analysis of the pronouns, since such a strategy would lead to 100% errors for these sentences.

Referent class judgments. As a further check on the referent class categories, we had the subjects themselves rate the 36 referent classes following the experiment proper. There was no significant difference in the ratings of male subjects (55.4% male) versus female subjects (54.9% male), using the 36 categories as unit of analysis, $t(35)=0.51$. No referent class was rated 100% male or 100% female, which indicates that the subjects were aware of the androgynous nature of these classes. Mean ratings (78% male for the predominantly male nouns, 52% male for the neutral nouns, and 26% for the predominantly female nouns) were in close agreement with the original 80 subjects (only 0.91% difference on the average), thereby verifying the original categories for this sample of subjects. Moreover, the combined ratings of the 100 subjects were in close agreement with the *actual* percentages of women in these categories, as determined by the California Census of the Labor Force by Sex (U.S. Department of Commerce Census Bureau, 1976). In fact, the subjects *overestimated* the actual percentages of women by an average of 1.9%. Since the subjects must have experienced these referent classes in conjunction with generic *he* many times over the course of their lifetimes, these findings indicate that neither natural nor experimental experience with generic *he* had discriminable effects on how they perceived or described the referent classes in this task. These data clearly contradict the pronominal prototype hypothesis which assumes that generic *he* is needed to signal the fact that doctors are mostly men and generic *she* to signal that nurses are mostly women. Since neither generic *he* nor generic *she* had any effect on such judgments, people must rely on more accurate real-world (language independent) knowledge to determine the composition of classes such as *doctor* or *nurse*.

Response times. A three-way analysis of variance (referent class gender × subject sex × subjects within sex categories) of correct response times for the sex-specific filler sentences showed no main effects, maximum $F(1, 18)=1.19$, and no interactions, maximum $F(2, 36)=.30$. Response times (see Table 3) were uniformly longer for sentences containing generic *he* (2.21 seconds for correct responses versus 1.85 seconds for incorrect responses) than for sentences containing sex-specific pronouns (1.72 seconds for correct responses versus 1.60 seconds for incorrect responses). For sentences containing generic *he*, YES responses (2.21 seconds) took longer than NO responses (1.85 seconds), but the opposite was true for sentences containing sex-specific pronouns (1.86 seconds for YES

TABLE 3

MEAN REACTION TIMES IN SECONDS FOR YES VERSUS NO RESPONSES TO GENERIC AND SEX-SPECIFIC SENTENCES: EXPERIMENTS I–IV

	Experiment							
	I		II		III		IV	
Response	Generic	Sex-specific	Generic	Sex-specific	Generic	Sex-specific	Generic	Sex-specific
YES	2.21	1.86	1.62	1.46	1.55	1.40	2.46	1.67
NO	1.63	1.58	2.64	1.98	1.80	1.96	2.41	2.11
Total	1.70	1.67	1.64	1.72	1.80	1.67	2.44	1.88

responses versus 1.58 seconds for NO responses). These data are consistent with the hypothesis that the female interpretation of generic *he* is less available than the male interpretation, but the overwhelming number of errors for generic sentences rendered statistical comparisons questionable. Another factor further contradicted our original expectation that response time would provide the more sensitive measure of the communicative adequacy of generic *he*: an effect of relative position of the critical word in a sentence, which reflected a tendency to postpone responses until the end of a sentence. Specifically, response times were significantly longer for sentences with the critical word in the first rather than the second half of a sentence, $t(24)=5.35, p<.001$. Corroborating this finding, postexperimental interrogation indicated that subjects often postponed their response so as not to "interrupt." It is for these reasons that we simply describe rather than carry out statistical tests on the response times in the experiments to follow.

Experiment II: Generic *he* and the Availability of the Concept "Male"

Experiment II was designed to determine the probability of correctly responding that generic *he* refers to males, and was identical to Experiment I except that subjects were instructed to respond YES if a sentence could refer to one or more males, and NO if not. We expected fewer errors than in Experiment I under the hypothesis that the concept "male" is more available than the concept "female," given use of generic *he*.

Method

Seven male and seven female undergraduates from the UCLA subject pool received course credit for participating in Experiment II. Materials, procedures, and instructions were identical to those in Experiment I, except that the subjects, none of whom had participated in the previous study, were to respond YES if a sentence could refer to one or more males and NO if it could not.

Results and Discussion

Error analysis. Errors (NO responses in the case of sentences containing generic *he*) are shown in Table 2. As in Experiment I, error rates were unaffected by subject sex, $X^2(1)=.209$, or referent class gender, minimum Wilcoxon $T=6$, $N'=5$, $p>.05$, but in Experiment II, the error rate for generic sentences was no higher than that for sex-specific pronoun sentences (1.1 versus 3.5%, respectively), and significantly lower than that for generic sentences in Experiment I (1.1 versus 87%), $t(32)=12.53, p<.0001$, subjects as the unit of analysis. These differences between the two experiments indicate that generic *he* readily conveys the male interpretation but not the female interpretation, a psychological bias which supports none of the assumptions of the pronominal surrogate hypothesis.

Referent class judgments. Referent class judgments of subjects in Experiment II resembled those of Experiment I (1.3% difference on the average), indicating that the task of responding YES (male) for sentences containing generic *he* had no effect on judgments of this sort.

Response times. Response times (see Table 3) for sentences containing sex-specific pronouns (1.72 seconds) closely resembled those in Experiment I (1.67 seconds). Moreover, response times for excluding females in generic sentences of Experiment I (1.63 seconds) were virtually identical to the response times for including males in the same sentences in Experiment II (1.62 seconds), which suggests that generic *he* sentences underwent similar interpretational processes in the two experiments.

Experiment III: The Comprehension of Generic *she*

Experiment III determined whether the pronoun *he* was specifically responsible for

the bias toward the male interpretation of generic sentences in Experiments I and II, and examined the communicative adequacy of generic *she*. Current uses of generic *she* mainly refer to predominantly female classes as in *A nurse (teacher, secretary) earns her wages*, which clearly facilitates a female interpretation. However, there is some question about the male interpretation since men in predominantly female occupations complain of pronoun-based exclusion, much like women in predominantly male occupations (see Miller & Swift, 1976). Several investigators have nonetheless argued in favor of replacing generic *he* with generic *she* (Corea, 1975; Densmore, 1970; Adamsky, Note 1), and some recent publications have adopted this proposal (e.g., Boden, 1977). Experiment III therefore examined whether hearers can perceive a male referent when *she* replaces *he* in the generic sentences of Experiments I and II, and served to further test the pronominal surrogate hypothesis, that pronouns merely stand for their referents and do not alter meaning.

Method

Ten male and 10 female undergraduates who had not participated in Experiments I or II received course credit for participating in Experiment III. Materials, instructions, and procedures were identical with those in Experiment II except that *she* replaced *he* in all generic contexts, that is, generic sentences took the form *A lawyer must frequently argue her case out of court*. Subjects were to respond YES if a sentence could refer to one or more males and NO if not.

Results and Discussion

Error analyses. Errors (NO responses for sentences containing generic *she*) appear in Table 2. As in Experiments I and II, error rates for generic sentences were unaffected by referent class gender, minimum Wilcoxon $T=94.5$, $N'=5$, $p>.05$, or subject sex, $X^2(1)=.12$. Error rates for generic *she* (97%) and sex-specific pronoun sentences (2%) were significantly different, Wilcoxon $T=1$, $N'=20$, $p<.001$, and even more extreme than in Experiment I, indicating that generic *she* is at least as inadequate for conveying a male interpretation as generic *he* is for conveying a female one. The fact that changing the pronoun reversed the response pattern (87% exclusion of females in Experiment I versus 97% exclusion of males in Experiment III) confirms that the pronouns were specifically responsible for the outcomes of these experiments, and illustrates the disproportionate influence of pronouns on sentence comprehension in this task.

Referent class judgments. Referent class judgments following Experiment III resembled those following Experiment I (0.46% difference on the average), indicating that changing generic *he* to generic *she* in the experimental materials had no effect on judgments of this sort.

Response times. Response times (see Table 3) for sentences containing sex-specific pronouns (1.67 seconds) closely resembled those in Experiment I (1.67 seconds). Curiously, however, response times for excluding males in generic sentences in Experiment III (1.80 seconds) were much longer than those for excluding females in the same sentences in Experiment I (1.63 seconds), indicating that interpretive processes are slower in the case of generic *she*.

Experiment IV: The Comprehension of Generic Nouns

Nouns such as *student*, *teacher*, or *lawyer* supposedly designate either a male or a female when used generically as in *A student's (teacher's, lawyer's) money is usually well earned.* Experiment IV determined how subjects interpret such nouns in the absence of generic *he*. Under the pronominal surrogate hypothesis, the results of Experiments I and IV should be similar.

Method

Twelve male and 12 female undergraduates who had not participated in the previous studies received course credit for their participation in Experiment IV. Instructions and procedures were identical to those in Experiment I. Each subject heard 9 experimental sentences and 22 filler sentences in one of three random orders and responded either YES (the sentence could refer to one or more females) or NO (the sentence could not refer to one or more females).

Materials. The materials consisted of 22 filler sentences containing sex-specific nouns, 11 male (e.g., *boy*, *son*) and 11 female (e.g., *girl*, *daughter*), and 27 experimental sentences containing generic nouns: 9 predominantly male (e.g., *engineer*, *doctor*, *dentist*), 9 predominantly female (e.g., *model*, *secretary*, *nurse*), and 9 neutral (e.g., *student*, *musician*, *novelist*), classes determined as in Experiment I. To control for context, exemplars of the three classes of generic nouns appeared in the same slot in one of nine sentence frames, e.g., *To a secretary/doctor/novelist, life can be one big headache*, with counterbalancing across subjects to prevent unwanted interactions. The generic nouns occurred equally often in nominative, accusative, and possessive cases, and in sentence frames which were similar but not identical to those used in Experiments I–III, since none of the sentences contained a pronoun. Sentences containing sex-specific nouns, for example, *For safety the lady changed the lock on the front door*, were matched with the generic sentences for number of syllables, number of words, surface syntax, and position of the "critical word" (generic or sex-specific noun).

Results and Discussion

Error analyses. The error rate for sentences containing sex-specific nouns was low (1.5% overall, 2.5% for male nouns such as *father*, and .5% for female nouns such as *mother*), again indicating that the subjects were attentive and competent judges of unambiguous gender reference.

The error rate for sentences containing generic nouns (43%) was higher than that for those containing sex-specific nouns (1.5%), a difference reliable at the .001 level, Wilcoxon $T=1$, $N'=22$, $p<.001$. Subject sex had no effect on error rates for sex-specific sentences, but unlike Experiment I, males made more errors on generic sentences (51%) than did females (34%), a difference significant at the .05 level, $X^2(1)=3.96$. There were fewer errors overall for generic sentences in Experiment IV than for the similar sentences in Experiment I (43 versus 87%) which also included generic *he*, $X^2(1)=13.03$, $p<.001$.

Also unlike Experiment I, characteristic gender of the generic noun altered the error rates significantly, maximum Wilcoxon $T=10.5$, $N'=12$, $p<.05$, and systematically: 19% for predominantly female nouns, 42% for neutral nouns, and 68% for predominantly male nouns. All three findings further emphasize the powerful and subtle influence of a pronoun on the interpretation of its antecedent. Introducing the supposedly generic *he* washed out effects of subject sex and referent class gender, and increased the probability of excluding females by 100%. These findings cannot be explained under the assumption that pronouns simply stand for a noun in the comprehension of sentences. Pronouns to a large extent determine how their antecedents are interpreted.

Referent class judgments. Referent class judgments in Experiment IV were virtually identical to those in Experiment I (.025% difference on the average), which indicates that the presence or absence of generic *he* in the main task had no effect on judgments of this sort.

Subjects in Experiment IV judged predominantly male nouns as 78% male, neutral nouns as 53% male, and predominantly female nouns as 23% male, which closely resembles the pattern of errors for males in the main experiment (75, 53, and 25%,

respectively). As in Experiment I there were no systematic differences in referent class judgments of male versus female subjects. Males judged the classes 54.7% male (standard deviation 12.9%) and females 53.7% male (standard deviation 13.3%).

Response times. As in Experiments I–III, response times (see Table 3) were faster for for sex-specific sentences (1.88 seconds) than for generic sentences (2.44 seconds) but this difference was much greater in Experiment IV than in Experiments I–III (.56 versus .02 second). Moreover, response times for generic sentences were .73 second longer in Experiment IV (2.44 seconds) than in Experiments I–III (1.71 seconds), whereas response times for sentences containing sex-specific nouns were only .19 second longer (1.88 versus 1.69 seconds). Pronouns may reduce the decision time for both generic and sex-specific sentences, but reduce the decision time much more for generic than for sex-specific sentences.

Response times for generic sentences in Experiment IV varied systematically with subject sex but interacted with response errors. Correct responses were faster for females than for males (2.36 versus 2.58 seconds), whereas response times for males and females were comparable for incorrect generic responses (2.38 versus 2.45 seconds) and for sentences containing sex-specific nouns (1.94 versus 1.84 seconds).

Response times for generic sentences varied with characteristic gender of the antecedent, and interacted with response correctness. Correct responses were longer for predominantly male antecedents (2.75 seconds), shorter for neutral antecedents (2.65 seconds), and shortest for predominantly female antecedents (2.30 seconds). The opposite was true of incorrect response times which were longest for predominantly female antecedents (2.76 seconds), shorter for neutral antecedents (2.41 seconds), and shortest for predominantly male antecedents (2.27 seconds).

General Discussion

Experiment I indicated that generic *he* is not neutral but perceptually polarizes an otherwise neutral antecedent, while Experiment II indicated that the male interpretation of generic *he* is more readily available than the female interpretation. Both findings contradict the neutralization assumption and illustrate a major gap between linguistic description and how people actually use language to encode concepts related to real-world events. This gap seems symptomatic of a larger problem associated with the use of intuition in determining linguistic descriptions. Although linguists reached consensus in their intuitions regarding generic *he*, the interpretation of the generic masculine has troubled the intuitions of scholars, translators, lawyers, and others for centuries (see Beard, 1946). Intuitions are susceptible to both spurious consensus and irreconcilable disagreement, and cannot be relied upon to resolve even relatively simple issues such as this.

Experiment III indicated that not just any pronoun will do for conveying the *he or she* concept and that prescription of generic *she* would be as inadequate as the 250-year-old prescription of generic *he*, while Experiment IV indicated that adding the supposedly generic *he* greatly altered the interpretation of generic antecedents such as *student*. Clearly pronouns do not just stand for their antecedents but contribute a meaning of their own which must in some sense dominate the meaning of an antecedent in the interpretation of sentences. All four experiments supported the pronomial dominance rather than the pronominal surrogate hypothesis.

The present findings also indicate that the semantic memory for a word in context is sometimes quite different from judgments of what the word in isolation refers to in the real world. We found no evidence to suggest that generic *he* distorts our cognitive map of the world. The same subjects who systematically miscomprehended nouns such as *pedestrian*

and *scientist* as male when associated with generic *he* were able to accurately and reliably judge the true nature of the classes these nouns refer to. Such judgments are undoubtedly based on extensive real-world experiences with categories such as *pedestrian*, experiences which are stored independently of the language used to refer to the categories. Language and thought based on real-world experience are apparently independent (see also Rosch, 1974). Of course this is not to say that language does not influence descriptive thought in formative stages, as when children encounter generic *he* in conjunction with categories for which they have little or no experience or real-world knowledge.

The results discussed above are consistent with a two-stage model of the comprehension of pronouns. The first stage involves lexical lookup whereby the semantic formative of nouns and pronouns is read from the internal lexicon and stored in short-term memory. The semantic formative in this model consists of a set of features with "weights" that vary depending upon the probability or relative frequency of the association of word and feature. For example, the semantic formative for a specific use of *he* consists of the features [human], [male], [third person], and [singular] and since *he* is used specifically about 80–95% of the time (see Faggen-Steckler, McCarthy, & Tittle, 1974; Graham, 1973), the weight of the feature [male] can be set to +0.87. Similarly, the weights of [singular] and [third person] can be set at 1.0 and 0.99 since *he* almost invariably refers to a singular entity and designates someone other than the speaker or listener at least 99% of the time. Gender features for generic nouns such as *student*, *professor*, or *doctor* assume a weight which reflects the perceived relative frequency of males and females in the classes these nouns refer to. Lexical readout clearly suffices to explain the pattern of results for the males in Experiment IV where the probability of perceptually excluding females from a generic class directly reflected the relative frequency of females in the class.

The second, "interpretive" stage is needed to explain the effects of pronouns in Experiments I–III while a third, "decision" stage (above and beyond the comprehension stages) is needed to describe the tasks of responding "YES" (applies to females) or "YES" (applies to males) in Experiments I–III and to account for the differences between male and female subjects in Experiment IV. During the interpretive stage, the semantic formative of a pronoun is used to guide the search for a "best-fit" antecedent. Other factors influence the antecedent assignment process (see Clark & Sengul (1979) for a review of previous studies) but lexical features of the pronoun are the most fundamental factors according to the present model. Once the best-fit antecedent is found, a "feature-sharing" process follows whereby features of the formatives of noun and pronoun are simply combined such that the dominant weight for a feature determines the final interpretation.

By way of illustration, consider the sentence *A student usually sees his counsellor during his office hours.* Both *his*'s receive a weight of [0.87 male] during the lexical readout stage, while *student* receives a weight of [0.51 male] and *counsellor* [0.47 male] (as estimated from judgment data from Experiment I). During the interpretive stage, the first *his* is assigned to *student* and the second *his* to *counsellor*, their feature values are shared, and the final interpretation is determined by the dominant weight, in the present examples [0.87 male].

According to the model, pronominal dominance reflects the way we use pronouns in the comprehension of sentences. In particular, when we encounter the pronoun *he* we search semantic memory for a singular, third-person antecedent assumed with high probability to be male, rather than, say, deducing that *he* means "he or she" because its antecedent is a generic noun such as *person*. Likewise, when we encounter the pronoun *she* we search semantic memory for a singular, third-person antecedent assumed with even higher prob-

ability to be female.

This strategy is especially useful for comprehending the many nouns in English such as *Robin* or *Sandy* which are ambiguous (rather than indefinite) as to gender. For example, the pronoun *his* efficiently disambiguates its antecedent *Sandy* in *Sandy likes cookies but his favorite food is cake*. The fact that this disambiguation process readily crosses paragraph boundaries, sentence boundaries, and clause boundaries (as above), without "garden path" or backtracking effects, casts doubt on recent theories of sentence processing which claim that ambiguous words are recoded with only one meaning retained following a clause boundary (see Bever, Garrett, & Hurtig, 1973).

The pronominal dominance phenomenon also has important implications for the problem of language change. For example, it suggests that generic *he* will dominate the interpretation of a new word such as *chairperson* in sentences such as *A chairperson has his prerogatives*. Without changing the pronoun, the present results indicate that changes in nouns such as *chairman* may have little conceptual impact on the interpretation of sentences containing generic *he*. Of course, the interpretation of *chairperson* or any other new word in sentences not containing generic *he* will be quite another matter according to the results of Experiment IV.

The production of pronouns can be readily incorporated into the model by viewing production and perception as mirror-image processes. Under this assumption, the model predicts that number and gender characteristics of the antecedent will determine the choice of a "best-fit" pronoun in production. For singular, third-person antecedents, the acceptable choices are limited to *he*, *she*, *he or she*, and singular *they*. The model predicts that *he* will most likely be used with predominantly male antecedents, *he or she* and singular *they* with neutral antecedents, and *she* with predominantly female antecedents.

Recent evident is consistent with this prediction. Martyna (1978, Note 2) had subjects complete sentence fragments such as *Before a judge can give a final ruling*, (fragment) *he must weigh the evidence* (sample completion), and, as in this example, subjects usually chose to complete the fragments using *she*, *he*, *they* or *he or she*. As expected under the model, most (96%) of the subjects used generic *he* to complete fragments containing predominantly male antecedents, and most (87%) used generic *she* for predominantly female antecedents. However, 65% used generic *he* rather than singular *they* or *he or she* to complete fragments containing a neutral antecedent. Prescriptive grammar has apparently made generic *he* more available than *he or she* and singular *they* for referencing neutral antecedents.

As in Experiment IV, Martyna (1978) also reported an effect of subject sex. Female subjects used generic *he* less than males, but used generic *she*, *he or she*, and singular *they* more than males, especially with neutral antecedents. As our data on referent class judgments indicate, these findings are undoubtedly not due to a sex difference in the underlying concept or semantic memory for nouns such as *person* or *judge*. A more likely explanation is that *he or she* and singular *they* are more available as lexical alternatives to generic *he* for females than males. Another possible explanation is that subjects interpreting sentences not containing generic *he* tend to image themselves in the generic roles, interpreting the gender of the sex-indefinite nouns to match their own sex (see Martyna, 1978). This "self-imagery" hypothesis may explain why female subjects were better able than males to interpret generic nouns as applying to females in Experiment IV, but generic *he* must have precluded the possibility of female self-imagery to explain the results of Experiment I.

Limitations of the present study should be stressed. It only probed the conceptual or denotative meaning of generic *he* and not its associative or connotative meaning, but this

shortcoming seems minor, since there are good reasons for assigning priority to conceptual meaning and secondary or derivative status to connotative meaning (see Leech, 1974). Another limitation is that all subjects were UCLA students. Since UCLA students express overwhelming sympathy for the women's movement in questionnaires, their failure to comprehend a female extension of generic *he* might conceivably be traced to the women's movement which has for years maintained that the generic masculine excludes women.

Another limitation of the present study is that it only examined one of the exceptions to pronoun agreement rules. Three other exceptions for further study are the human *it* (e.g., *A baby sometimes wets its pants*), the singular *they* (e.g., *Someone left their sweater*), and personification or allegory (e.g., *Fortune spread her wings for us*). All three of these phenomena are relevant to models incorporating a search for the "best-fit" antecedent. The present model predicts that, all other factors being equal, use of the human pronouns *he* and *she* will suffice to personify animals and things, that use of *it* will depersonalize a referent such as *child*, and that most sentences containing singular *they* will be interpreted as plural rather than singular.

Interactions between definite and indefinite pronouns such as *everyone* and *someone* provide another area for further research. Although indefinite pronouns account for less than 1% of the uses of generic *he* in formal literature (see MacKay, Note 3), they nonetheless have theoretical significance for models of pronoun comprehension. Martyna (Note 2) found much lower error rates with indefinite pronouns as antecedents of generic *he*: 19 to 34% errors (depending upon experimental procedure) as opposed to 87% in the present study. If this difference holds up using the present experimental paradigm, it may be because indefinite pronouns such as *everyone* or *anyone* are conceptually plural and therefore more susceptible to generic interpretation. Another possibility is that noun antecedents are more susceptible to pronominal dominance than pronoun antecedents such as *everyone* because of the inordinate frequency with which we normally encounter pronouns in everyday speech. This being the case, it may be necessary to introduce the concept of "strength" into the model, where strength reflects the *absolute* frequency of an interpretation as opposed to weight, which reflects the *relative* frequency of alternate interpretations.

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