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Comprehending Conceptual Anaphors in Spanish

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Abstract

This paper examines the mechanisms involved in the assignment of an antecedent to an anaphoric element. In general, pronouns must match their antecedents at least with respect to number and gender. Sensitivity to such constraints has been shown in several experiments. But Gernsbacher (1991) has also shown that people have no difficulty comprehending a plural pronoun with an antecedent that is grammatically singular but conceptually plural. In the first three experiments, we tested whether such a "conceptual effect" was preserved with zero anaphors in Spanish. (The typical omission of pronouns in subject position in Spanish.) Verbs in a second clause were marked with plural or singular endings. Plural verbs were rated more natural than singular verbs when they followed three types of singular but conceptually plural antecedents (Experiment 1). Clauses containing plural verbs were read faster when they followed one type of singular but conceptually plural antecedents, i.e. collective sets (Experiments 2 and 3). In fact, clauses containing plural verbs were read equally fast when they followed literally singular collective sets or explicitly group nouns. Using pronominal anaphors, these reading time effects were replicated and extended to sentences that contained generic types as antecedents (Experiment 4). The results are discussed in terms of the use of information during the comprehension of anaphors.

INTRODUCTION

Anaphors, such as pronouns, are important to discourse coherence. The interpretation of pronouns depends on a number of factors ranging from those that are purely linguistic to factors based on general knowledge of the world. In general, pronouns are used to reintroduce a previously mentioned antecedent into a sentence or discourse without repeating the antecedent itself. But often there is more than one prior antecedent to which a pronoun may refer. In those cases, the assignment of the pronoun to the appropriate antecedent may require inferences based on general knowledge (e.g. Carreiras, Garnham, & Oakhill, in press; Ehrlich, 1980; Garnham & Oakhill, 1985: Gernsbacher, 1989; Hirst & Brill, 1980). Hence, in sentence (1a) the pronoun *she* is ambiguous:

1a. Sandra gave her old jigsaw to Mary

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because she had bought a new one.

In this sentence, linguistic rules cannot rule out either Sandra or Mary as a potential antecedent for the pronoun. To interpret the sentence appropriately, the reader must infer from general knowledge that *she* refers to Sandra. Thus, in cases of ambiguity, a reader may use pragmatic inferences to derive a plausible and unambiguous interpretation of a pronoun. If Mary were repluced by David. as in sentence (1b), then the pronoun could be interpreted by relying on gender marking. without the need for pragmatic inferences.

1b. Sandra gave her old jigsaw to David

because she had bought a new one.

The importance of cues such as lexical markings for gender and number has been shown in several experiments using English stimuli (Ehrlich, 1980; Garnham & Oakhill. 1985). When English pronouns are unambiguously marked for gender and number, subjects identify their antecedents more rapidly and read sentences containing the unambiguously marked pronouns more quickly. Thus, the second clause of sentence (1b) would be read faster than the second clause of (1a).

However. in some languages, syntactic gender for some nouns is arbitrary. For example, in Spanish, all nouns are either masculine or feminine, even those that denote inanimate objects: “E! libro” (the book) is masculine and “la mesa” (the table) is feminine. Spanish pronouns are also marked for gender, so a pronominal reference to a book would use a masculine form “lo”, and a pronominal reference to a table would use a feminine form “ia”. Carreiras et al. (in press) discovered that gender-marked pronouns (e.g. lo) referring to inanimate objects (e.g. el libro) are interpreted more quickly when they can be resolved on the basis of their gender marking, even though their referents have arbitrary gender (e.g. book).

Thus, lexical marking. such as gender marking, appears to affect pronoun interpretation. However, Gernsbacher (1991) demonstrated a phenomenon in English in which lexical marking for number was often overridden. She manipulated cases in which there was a mismatch between a pronoun and its antecedent’s lexical marking for number. She used three discourse situations in which the antecedent was a collective set. a generic type or a multiple item/event. A collective set expression. such as a *basketball team*, is used to refer to a group of individuals; a generic type is a broad and general concept, like *a book* in general, as opposed to a particular book someone is reading: and a multiple item/event noun refers to an item a person is likely to have multiples of (e.g. *a plate*), or to an event that is usually experienced repeatedly (e.g. *a birthday*). Gernsbacher found that in situations in which a pronoun was used to refer to a collective set, a generic type or a multiple item/event, subjects rated more natural and read more rapidly sentences containing a mismatched plural pronoun than sentences containing a matched singular pronoun. For instance, the sentence containing *they* was rated more natural and read more rapidly that the same sentence containing *it*:

2. After college, my sister went to work for *IBM*.

They/it made her a very good offer.

The aim of the present research was to discover whether this phenumenon also occurs in Spanish. The Spanish and English pronoun systems differ in several respects. Spanish is a PRO-dmp language. so that pronouns in subject position are frequently omitted, as illusirated in sentences (3a-f) (the pronouns in the brackets are optional.) The use of subject pronouns is often optional in Spanish because verbs are marked for person and number, as illustrated by sentences (3b) and (3d). When the verb markings disambiguate, the subject pronouns in subject position are usually included only for emphasis. For example, the verb "ir" ("to go") in the progressive past has different forms for the first- and third-person plural ("ibamos" for first-person plural and "iban" for third-person plural); therefore, the pronouns in brackets in sentences (3b) and (3d) are unnecessary. However, pronouns are used when the verb endings do not distinguish between the first and the third singular persons, as iliustrated by sentence (3f). For example, the same verb form "iba" is used for the first-person singular as the third-person singular; therefore, the pronoun in sentence (3f) is necessary for disambiguation:

3a. I saw the children when they were going to the beach.

b. Vi a los niños cuando (ellos) iban a la playa.

c. I saw the children when we were going to the beach.

d. Vi a los niños cuando (nosotros) ibamos a la playa.

e. I saw John when I/he was going to the beach.

f. Vi a Juan cuando yo/él iba a la playa.

In the present experiments, sentences describing discourse situations in which the antecedent was a collective set, a generic type or a multiple item/event were presented to subjects. The sentences were written so that the subject pronouns could be omitted, as illustrated by sentence (4b). The verb forms distinguished the singular *vs* plural antecedent:

4a. I have to call the telephone company again

because they/it did not fix the problem.

b. Tengo que llamar otra vez a Telefónica

porque no me han/ha arreglado la averfa.

Four experiments were conducted to answer the question of whether pronouns and null anaphors are used and can be understood even when they violate the number co-reference constraints. Based on Gernsbacher's (1991) results, we predicted that null anaphors followed by plural verbs would be more acceptable (rated as more natural, and read more rapidly) than null anaphors followed by singular verbs when their antecedents were collective sets, generic types or multiple items/events. In contrast, we predicted that null anaphors followed by singular verbs would be more acceptable when their antecedents were individual members, specific tokens or unique items/events.

Our first experiment was a questicnnaire study, in which the subjects had to rate each sentence for naturalness. In the other three experiments. the subjects read each sentence at their own pace. In the first three experiments, we tested whether "conceptual preference"

was preserved with zero anaphors. In the last experiment, pronouns (marked for number) were included.

EXPERIMENT 1

Our first question was whether conceptual anaphors are acceptable in Spanish, i.e. whether conceptual anaphors are rated as being natural by native speakers. Conceptual anaphors could be specific to English speakers, although if they are really conceptual, the possibility of their use in other languages is very high. To answer this question, the subjects rated the naturalness of sentences that contained conceptual anaphors, along with sentences that contained anaphors that matched in number. If conceptual anaphors are acceptable in Spanish, even when they violate the normative co-reference constraints of number agreement between verbs and their antecedents, readers should have rated them as natural.

Method

Subjects—The subjects were 92 volunteers from the undergraduate population of the University of La Laguna.

Materials and Procedure—Altogether, 48 sets of four sentences were constructed, each of which had two independent clauses. The first clause contained an antecedent that was referred to in the second clause. The second clause included a verb that was marked either plural or singular. Each set of four sentences was constructed by combining two factors: (I) whether the antecedent in the first independent clause was a collective set, a generic type or a multiple item/event as opposed to an individual member, a specific token or a unique itemlevent, and (2) whether the verb in the second independent clause was marked as singular or plural, as illustrated in Table I. Sixteen sets of four sentences were constructed to manipulate collective sets *vs* individual members; 16 sets manipulated generic types *vs* specific tokens; and 16 sets manipulated multiple items *vs* unique items. Approximately 75% of the sentences were direct translations of those constructed by Gernsbacher (1991). Another 20% were modified translations, modified to replace expressions specific to American culture (e.g. Sears department stores) with expressions typical of Spanish culture (e.g. Iberia Airlines). A final 5% were replaced completely with newly constructed sentences because the conceptual antecedents were not singular in Spanish. Four lists of materials were constructed to ensure that each sentence occurred in each condition.

The subjects were tested in two groups in two separat e classrooms. They received 48 sentences and rated them for naturalness, t aking “nat ural” to mean “how likely it is that you might hear such a sentence or produce such a sentence”. They used a 5-point rating scale where 1 = “not very natural” and 5 = “very natural”.

Results

The mean rating for sentences with collective sets *vs* individual members, generic types *vs* specilic tokens and multiple items/events *vs* unique items/events as antecedents when followed by plural *vs* singular verbs is shown in Table 2. From this point, we shall use “verb number” to refer to the number of the verb in the second independent clause. Analyses of variance (ANOVAs) were performed separately for each discourse situation in two ways- by

collapsing over subjects but including sentences, and by collapsing over sentences but including subjects.

Collective Sets vs Individual Members—A 2 (antecedent) × 2 (verb number in the second clause) ANOVA was performed. The main effect of the antecedent factor was reliable, indicating that sentences with a collective set antecedent were rated more natural than sentences with an individual member antecedent [$F1(1,91) = 9.34$, $P < 0.005$; $F2(1,15) = 11.08$, $P < 0.005$; min $F'(1.58) = 5.07$, $P < 0.05$]. Moreover, as predicted, the interaction between antecedent and verb number was also reliable [$F1(1,91) = 73.00$, $P < 0.0001$; $F2(1,15) = 25.88$, $P < 0.0001$; min $F'(1,27) = 19.11$, $P < 0.01$]. Sentences with collective antecedents were rated more natural when followed by plural than singular verbs [$F1(1,91) = 51.16$, $P < 0.0001$; $F2(1,15) = 12.35$, $P < 0.005$; min $F'(1,30) = 9.95$, $P < 0.01$]. In contrast, sentences with individual members as antecedents were rated more natural when followed by singular than plural verbs [$F1(1,91) = 36.93$, $P < 0.0001$; $F2(1,15) = 44.74$, $P < 0.0001$; min $F'(1,59) = 20.23$, $P < 0.01$].

Generic Types vs Specific Tokens—The main effect of verb number was reliable. Sentences with singular verbs were rated more natural than sentences with plural verbs [$F1(1,91) = 15.34$, $P < 0.0005$; $F2(1,15) = 10.44$, $P < 0.01$; min $F'(1,39) = 6.21$, $P < 0.05$]. More importantly, however, verb number reliably interacted with antecedent type [$F1(1,91) = 50.06$, $P < 0.0001$; $F2(1,15) = 19.88$, $P < 0.0005$; min $F'(1,28) = 14.23$, $P < 0.01$].

Sentences with generic type antecedents were rated more natural when they were followed by plural than singular verbs; however, this effect was reliable only when subjects was treated as a random factor [$F1(1,91) = 4.23$, $P < 0.05$]. In contrast, sentences with specific tokens as antecedents were rated more natural when they were followed by singular than plural verbs [$F1(1,91) = 48.91$, $P < 0.0001$; $F2(1,15) = 32.44$, $P < 0.0001$; min $F'(1,38) = 19.50$, $P < 0.01$].

Multiple Items/Events vs Unique Items/Events—Both main effects were reliable. Sentences were rated more natural when they contained a multiple as opposed to unique antecedents [$F1(1,91) = 20.06$, $P < 0.0001$; $F2(1,15) = 8.40$, $P < 0.01$; min $F'(1,29) = 5.92$, $P < 0.05$]. Sentences were rated more natural when they included singular as opposed to plural verbs [$F1(1,91) = 33.95$, $P < 0.0001$; $F2(1,15) = 10.62$, $P < 0.01$; min $F'(1,25) = 8.09$, $P < 0.01$]. Finally, the interaction between the two factors was reliable [$F1(1,91) = 87.53$, $P < 0.0001$; $F2(1,15) = 30.60$, $P < 0.0001$; min $F'(1,27) = 22.67$, $P < 0.01$]. Sentences with multiple items/events antecedents were rated more natural when they were followed by plural rather than singular verbs, but this effect was reliable only in the subjects analysis [$F1(1,91) = 6.71$, $P < 0.01$]. In contrast, sentences with unique items/events as antecedents were rated more natural when they were followed by singular than plural verbs [$F1(1,91) = 84.16$, $P < 0.0001$; $F2(1,15) = 38.28$, $P < 0.0001$; min $F'(1,31) = 26.31$, $P < 0.01$].

Discussion

The main result was that in some discourse situations native Spanish speakers found the use of plural verbs following a singular antecedent natural. When the verbs were preceded by

collective sets, plural verbs were preferred over singular ones. This preference was not as strong when the verbs were preceded by generic types and multiple items/events; in this case, the differences were reliable only when subjects was considered as a random factor. Thus, these data are consistent with the results reported by Gernsbacher (1991), and suggest that the use of conceptual anaphors in Spanish is acceptable in discourse situations in which zero anaphora operates.

EXPERIMENT 2

The judgements in Experiment 1 represent the evaluations of subjects who were under no time pressure to answer. Therefore, there is no guarantee that these decisions were made while the subjects were processing the sentences for the first time. The subjects could have made their decisions after they read the whole sentence and thought quite a bit about its possible meaning. Experiment 2 was conducted to determine whether subjects experience any immediate comprehension difficulties when they read plural verbs following singular, though conceptual, antecedents. A clause-by-clause, subject-paced reading time task was used, and the subjects' reading times for the second independent ciause were recorded.

Method

Subjects—Altogether, 56 undergraduate psychology students from the University of La Laguna participated in the experiment for course credit.

Design and Materials—The design and materials were identical to those of Experiment 1.

Procedure—The subjects were tested individually in a small, quiet room. Each subject read 48 experimental sentences intermixed randomly with 82 other sentences that served as filkrs to divert attention from the structure of the materials. Some of the filler sentences were followed by questions.

The experiment was controlled by an IBM compatible computer. The subjects' task was to read the two clauses at their own pace, and to answer questions that followed some of the filler sentences as quickly and accurately as possible. The two clauses were presented successively in the centre of the screen. The subjects had to press the space bar to read each clause.

Before each sentence, the prompt "COMIENZA OTRA FRASE" (another sentence is ready) appeared on the screen. When it was presented, the subjects had to press a button with their dominant hand to display the first clause. Another button press displayed the second clause. The instructions stressed that the sentences were to be read at normal reading speed.

Before the presentation of the experimental materials there were six practice trials, whose primary purpose was to familiarise the subjects with the self-paced reading procedure. The subjects could read the instructions and read the practice sentences as many times as they wished.

Results

The data of interest were the second clause reading times for the three discourse situations. Table 3 shows the mean reading times for these second clauses when they contained plural *vs* singular verbs and when they were preceded by collective sets *vs* individual members, generic types *vs* specific tokens and multiple items/events *vs* unique items/events as antecedents.

Collective Sets vs Individual Members—ANOV As revealed that the type of antecedent (collective set *vs* individual member) interacted with verb number (plural *vs* singular) [$F1(1,55) = 5.23$, $P < 0.05$; $F2(1,15) = 4.75$, $P < 0.05$]. Second clauses preceded by collective set antecedents were read faster when they contained plural as opposed to singular verbs [$F1(1,55)= 4.92$, $P < 0.05$; $F2(1,15) = 5.59$, $P < 0.05$]. In contrast, second clauses preceded by individual members antecedents were read faster when they contained singular as opposed to plural verbs, although the difference was not reliable. Neither main effect was reliable.

Generic Types vs Specific Tokens—The type of antecedent (generic type *vs* specific token) interacted with verb number (plural *vs* singular) [$F1(1,55) = 12.59$, $P < 0.0001$; $F2(1,15) = 14.55$, $P < 0.005$; min $F'(1,51) = 6.75$, $P < 0.05$]. Second clauses preceded by generic type antecedents were read faster when they contained plural as opposed to singular verbs, although the difference was not reliable. In contrast, second clauses preceded by specific token antecedents were read faster when they contained singular as opposed to plural verbs [$F1(1,55) = 22.67$, $P < 0.0001$; $F2(1, 15) = 24.69$, $P < 0.0005$; min $F'(1,49) = 11.82$, $P < 0.01$].

The main effect of verb number was also reliable [$F1(1,55) = 7.53$, $P < 0.01$; $F2(1,15) = 7.83$, $P < 0.05$]. Second clauses were read slower when they contained plural rather than singular verbs.

Multiple Items/Events vs Unique Items/Events—Only the main effect of verb number was reliable [$F1(1,55) = 5.65$, $P < 0.05$; $F2(1,15) = 7.64$, $P < 0.05$]. Second clauses were read faster when they contained singular rather than plural verbs.

Discussion

The results of this experiment support the hypothesis that conceptual anaphors do not cause processing difficulties in at least two of the three discourse situations tested: collective sets *vs* individual members and generic types *vs* specific tokens. Second clauses were read faster when they contained plural rather than singular verbs, but only when they were preceded by a collective set antecedent. When they were preceded by a generic type antecedent, the data showed a similar tendency, but the difference was not reliable. For multiple item/event sentences, second clauses were read slower when they contained plural rather than singular verbs, both when multiple items/events and unique items/events acted as antecedents.

The number mismatch effects on reading time observed in this experiment partially replicate Gernsbacher's (1991) findings and extend them to a less explicit referential form (zero or

null anaphora) and to another language. In two of the three situations tested - sentences describing collective sets and generic types - our results are similar, although some differences are weaker, a discrepancy which could be explained by the use of zero anaphors. Some other experiments have also shown slight differences between results obtained with zero anaphors and explicit pronouns (Corbett & Chang, 1983; Gernsbacher, 1989). In addition, fewer observations in this experiment compared with Gernsbacher's (1991) experiment could explain the weaker effects. In this experiment, there were 56 subjects and each subject read 48 sentences, but in Gernsbacher's (1991) experiment there were 72 subjects and each subject read 96 sentences. Both in the present data and in Gernsbacher's (1991) data, the collective sets always showed the greatest effects, the generic type effects were next, and the multiple item/event effects were the weakest. With zero anaphora, a smaller number of subjects and a smaller number of observations, these effects maintained their "relative ordering", although sometimes the effects were not statistically reliable.

EXPERIMENT 3

The reading times in Experiment 2 showed that conceptual, but illegal, anaphors do not cause processing difficulties. However, an alternative explanation is that subjects might have developed a strategy for dealing with plural verbs in Experiment 2 because the plural verbs never agreed in number with their antecedents.

Experiment 3 tested this alternative explanation by including literally plural nouns as a third type of antecedent. For example, the antecedent could be a collective set, an individual member or several members (e.g. IBM, the vice-president of IBM or the managers of IBM). Or the antecedent could be a generic type, a specific token or several tokens (e.g. a novel, El Quijote or several novels). Or the antecedent could be a multiple item/event, a unique item/event or several items/events (e.g. the key, the wallet or the keys). Concerning the comparison between a collective set *vs* several members, a generic type *vs* several generic types or a multiple item/event *vs* several items/events, if conceptual anaphors do not disrupt comprehension, we should not expect differences between reading times for second clauses containing plural verbs preceded by conceptual antecedents (a collective set, a generic type or a multiple item/event) as opposed to explicitly plural antecedents (several members, several types or several items/events).

Method

Subjects—A total of 48 undergraduate psychology students from the University of La Laguna participated in this experiment in fulfilment of a course requirement.

Design and Materials—Two factors were manipulated: (1) whether the antecedent in the first clause of each sentence was conceptually plural (a collective set, a generic type or a multiple item/event), conceptually singular (an individual member, a specific token or a unique item/event), or explicitily plural (several members, several tokens or several items/events); and (2) whether the verb in the second independent clause was marked as singular or plural.

Altogether, 72 sets of six sentences were used in this experiment: 24 sets of six sentences tested each discourse situation. Table 4 illustrates the design with examples of sentences. Another 74 sentences acted as fillers.

Procedure—Except for the number of sentences, the procedure was similar to that for Experiment 2.

Results

Table 5 shows the mean reading times for second clauses with plural *vs* singular verbs when preceded by collective sets *vs* individual members *vs* several members as antecedents; generic types *vs* specific tokens *vs* several tokens; multiple items/events *vs* unique items/events *vs* several items/events as antecedents. For all three discourse situations, we will report only the statistics concerning the critical comparisons that motivated this experiment. The other effects replicated those obtained in the previous experiment. In particular, clauses preceded by collective sets antecedents were again read faster when they contained plural as opposed to singular verbs [$F1(1,47) = 6.47$, $P < 0.05$; $F2(1,23) = 4.47$, $P < 0.05$].

Collective Sets—Second clauses preceded by several members antecedents were read faster when they contained plural as opposed to singular verbs [$F1(1,47) = 7.09$, $P < 0.01$; $F2(1,23) = 6.89$, $P < 0.05$]. However, there were no reliable differences in reading times between second clauses with plural verbs when preceded by collective sets *vs* several members [$F1(1,47) = 0.06$, $F2(1,23) = 0.06$].

Generic Types—Second clauses preceded by several tokens antecedents were read faster when they contained plural as opposed to singular verbs [$F1(1,47) = 9.50$, $P < 0.005$; $F2(1,23) = 7.51$, $P < 0.05$; min $F'(1,56) = 4.19$, $P < 0.05$]. Again, there were no reliable differences in reading times between second clauses with plural verbs when preceded by generic types *vs* several tokens [$F1(1,47) = 0.51$; $F2(1,23) = 0.47$].

Multiple Items/Events—There were no reliable differences between second clauses preceded by several items antecedents when they contained plural as opposed to singular verbs [$F1(1,47) = 1.67$; $F2(1,23) = 2.48$]. Also, there were no reliable differences in reading times between second clauses with plural verbs when preceded by multiple items/events *vs* several items/events [$F1(1,47) = 0.03$; $F2(1,23) = 0.03$].

Discussion

The results of this experiment showed that plural verbs were not read faster when preceded by explicitly plural antecedents (several members, several tokens or several items/members) than when preceded by literally singular, but conceptually plural, antecedents (collective sets, generic types and multiple items/events). Moreover, the expected effect for plural *vs* singular verbs arose in two of the three types of sentences in which there were plural antecedents. Plural verbs were read faster than singular verbs when preceded by several members and by several tokens, but the difference was not reliable when preceded by several items/events antecedents.

In sum, the results of this experiment replicated those obtained in Experiment 2 and also showed that collective sets. which are superficially singular, but conceptually plural antecedents, produced similar results to several members, which are superficially and conceptually plural antecedents. This pattern of results is reflected to a lesser extent when comparing generic types and several tokens antecedents, but not in the case of multiple items/members *vs* several items/members. These results suggest that conceptual anaphors. although technically illegal, are resolved as quickly as legal anaphors, the case of collective sets being the most clear.

EXPERIMENT 4

In the previous experiments, the experimental sentences contained zero anaphors. It could be argued that the weak conceptual effect obtained in the previous experiments as compared with Gernsbacher's (1991) results could be due to the use of zero anaphors. Co-reference constraints could act differently with pronominal anaphora than with zero anaphora, leading to a decrease of some effects with zero anaphora. To test this possibility, and to establish a direct comparison with Gernsbacher's (1991) experiment, anaphoric pronouns were used in Experiment 4 instead of zero anaphors. In all other ways, this experiment was identical to Experiment 2.

Method

Subjects—The subjects were 36 undergraduate students from the University of La Laguna. They received course credit for participating.

Design and Materials—In this experiment, plural and singular pronouns were included in the second clauses. Example sentences are shown in Table 6. Otherwise, the design and materials were similar to those for Experiment 2.

Procedure—The procedure was similar to that for Experiment 2.

Results

Table 7 shows the mean reading times for second clauses when they contained plural *vs* singular pronouns and were preceded by collective sets *vs* individual members, generic types *vs* specific tokens or multiple items/events *vs* unique items/events as antecedents.

Collective Sets vs Individual Members—The interaction between type of antecedent and pronoun number was reliable [$F1(1,35) = 14.28$, $P < 0.0005$; $F2(1,15) = 7.54$, $P < 0.05$; min $F'(1,31) = 4.94$, $P < 0.05$]. Second clauses preceded by collective sets antecedents were read faster when they contained plural as opposed to singular verbs [$F1(1,35) = 15.10$, $P < 0.0005$; $F2(1,15) = 16.80$, $P < 0.001$; min $F'(1,44) = 7.95$, $P < 0.01$]. In contrast, second clauses preceded by individual members antecedents were read faster when they contained singular as opposed to plural verbs, although the difference was not reliable. Furthermore, the main effect of type of antecedent was reliable, although only in the items analysis [$F2(1,15) = 4.71$, $P < 0.05$]. Second clauses were read faster with plural than with singular pronouns.

Generic Types vs Specific Tokens—The interaction between type of antecedent and pronoun number almost reached significance [$F1(1,35) = 3.49$, $P < 0.08$; $F2(1,15) = 4.16$, $P < 0.07$]. Second clauses preceded by generic types antecedents were read faster when they contained plural as opposed to singular pronouns [$F1(1,35) = 4.29$, $P < 0.05$; $F2(1,15)$ 22.47, $P < 0.0005$]. No other differences were reliable.

Multiple Items/Events vs Unique Items/Events—The only reliable effect was that second clauses preceded by unique items/events antecedents were read faster when they contained singular pronouns as opposed to plural pronouns [$F1(1,35) = 4.24$, $P < 0.05$; $F2(1,15) = 4.69$, $P < 0.05$].

Discussion

The results of this experiment are consistent with those of Experiment 2, and partially replicate the results obtained by Gernsbacher (1991). In this experiment, when collective sets and generic types were antecedents, second clauses were read faster with plural pronouns than with singular pronouns. These effects were greater than those obtained in Experiment 2. Therefore, pronominal anaphors amplified the conceptual effects. But when multiple items/events were antecedents, there were no differences between plural and singular pronouns.

The present results are not as clear as those described in Gernsbacher (1991). Gernsbacher found similar effects for the three discourse situations, and the effects were stronger than in this experiment. Again we should mention that compared with Gernsbacher's (1991) experiment, this experiment tested fewer subjects who read half as many sentences. Also, while we used only a reading comprehension task, the subjects in Gernsbacher's experiment read each sentence and then were required to paraphrase it. This requirement could induce subjects to pay more attention to the sentences and make a deeper - more conceptual - interpretation in order to reproduce its meaning afterwards.

GENERAL DISCUSSION

Taken together, the four experiments suggest that conceptual, although grammatically illegal, anaphors do not cause comprehension difficulties. This finding was obtained using both zero and pronominal anaphora with collective sets as antecedents, and to a lesser extent with generic types. However, there was no such effect with multiple items. The fact that the "relative ordering" of these three discourse situations was similar to the ordering found in Gernsbacher's (1991) data, suggests that the three discourse situations might differ in the degree to which they are contextually plural. Collective sets seem to be contextually free in their plurality; whenever we use collective sets we are almost always referring to the people who are part of, or involved in, the collective set, like for example the members of a band. In contrast, multiple items/events depend more on the contextual situation. An iron could be a unique antecedent in one situation (a house), but a multiple item in another situation (a department store).

The fact that readers do not show processing difficulties with some conceptual anaphors suggests that pragmatic information plays a guiding role in on-line comprehension. The

similar pattern of reading times found in Experiment 3 for conceptually plural but technically singular antecedents and legally plural antecedents also suggests that.

It is commonly assumed that anaphors have to be connected to some entity in order to be understood. Sag and Hankamer (1984) suggested that one type of anaphora, ellipsis, is interpreted with reference to a superficial representation of a text. while another, model-interpretative anaphora (e.g. pronouns), is interpreted using a content-based representation. Some empirical research has indicated that the comprehension of deep anaphors involves accessing elements in a discourse model (e.g. Lucas, Tanenhaus, & Carlson, 1990; Tanenhaus, Carlson, & Seidenberg, 1985). However, other experiments have shown that mental models have a role in the interpretation of ellipses (Garnham & Oakhill, 1987; 1989), and that a surface representation is involved in the interpretation of pronouns or deep anaphors (Carreiras et al., in press). Therefore, it seems that a theory of anaphor interpretation must allow for both content-based and superficial representations to play a role in the interpretation of anaphors. Then, the question is when the superficial representation is consulted rather than the conceptual representation.

Our data are consistent with a system that is highly flexible and opportunistic in its use of superficial and conceptual information to achieve the goal of building an abstract representation from a text. Perhaps, in such a system, heuristics to resolve anaphors are used in parallel (cf. Marslen-Wilson & Tyler, 1987; Sanford & Garrod, 1989; Tyler & Marslen-Wilson, 1982). There are many potential sources of cues for correct mapping, one of which is the explicit number of the pronouns; others include the expectations derived from the structure of the discourse. Both types of constraints - number cues and pragmatic coherence - could be equally capable, under the right conditions, of controlling the anaphor resolution process. This flexibility in using different sources of information suggests that discourse comprehension does not always depend on computing syntactic information, although superficial cues can contribute to the process of anaphoric reference resolution.

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TABLE 1

Example of Sentences Used in Experiments 1 and 2

Collective sets *vs* individual members
Ayer noche fuimos a escuchar una nueva banda de jazz *[Last night we went to hear a new jazz band]*
Ayer noche fuimos a escuchar un nuevo guitarrista de jazz *[Last night we went to hear a new jazz guitarist]*
(Tocaron/tocó) durante casi cinco horas *[(They/it) played for nearly five hours]*
Generic types *vs* specific tokens
Mi vecino tiene una moto *[My neighbour owns a motorbike]*
Mi vecino tiene una moto sin luces *[My neighbour owns a motorbike which doesn't have a light]*
Creo que (son/es) realmente (peligrosas/peligrosa) *[I think (they are/it is) really dangerous]*
Multiple items/events *vs* unique items/events
Le pedí a José que buscase una bombilla *[I asked Joseph to look for a light bulb]*
Le pedí a José que buscase una escalera *[I asked Joseph to look for a stepladder]*
pero no se acordaba donde (estaban guardadas/estaba guardada) *[but he didn't remember where (they were kept/it was kept)]*

TABLE 2

Mean Naturalness Ratings for Sentences which Contained Plural and Singular Verbs Preceded by Collective Sets *vs* Individual Members, Generic Types *vs* Specific Tokens and Multiple Items/Events *vs* Unique Items/Events

	Plural Verbs	Singular Verbs
Collective sets	3.60	2.99
Individual members	2.78	3.40
Generic types	3.36	3.18
Specific tokens	2.86	3.59
Multiple items/events	3.36	3.17
Unique items/events	2.48	3.44

TABLE 3

Mean Reading Times (msec) for Second Independent Clauses with Plural and Singular Verbs Preceded by Collective Sets *vs* Individual Members. Generic Types *vs* Specific Tokens and Multiple Items/Events *vs* Unique Items/Events

	Plural Verbs	Singular Verbs
Collective sets	2219	2421
Individual members	2230	2210
Generic types	2302	2343
Specific tokens	2459	2179
Multiple items/events	1845	1805
Unique items/events	1951	1763

TABLE 4

Example of Sentences Used in Experiment 3

Collective sets *vs* individual members *vs* several members
Ayer noche fuimos a escuchar una nueva banda de jazz
[Last night we went to hear a new jazz band]

Ayer noche fuimos a escuchar un nuevo guitarrista de jazz
[Last night we went to hear a new jazz guitarist]

Ayer noche fuimos a escuchar unos nuevos guitarristas de jazz
[Last night we went to hear some new jazz guitarists]

(Tocaron/tocó) durante casi cinco horas
[(They/it) played for nearly five hours]

Generic types *vs* specific tokens *vs* several tokens
Mi vecino tiene una moto
[My neighbour owns a motorbike]

Mi vecino tiene una moto sin luces
[My neighbour owns a motorbike which doesn't have a light]

Mi vecino tiene dos motos
[My neighbour owns two motorbikes]

Creo que (son/es) realmente (peligrosas/peligrosa)
[I think (they are/it is) really dangerous]

Multiple items/events *vs* unique items/events *vs* several items/events
Le pedi a José que buscase una bombilla
[I asked Joseph to look for aa light bulb]

Le pedí a José que buscase una escalera
[I asked Joseph to look for a stepladder]

Le pedí a José que buscase dos bombillas
[I asked Joseph to look for two light bulbs]

pero no se acordaba donde (estaban guardadas/estaba guardada)
[but he didn't remember where (they were kept/it was kept)]

TABLE 5

Mean Reading Times (msec) for Second Independent Clauses with Plural and Singular Verbs Preceded by Collective Sets *vs* Individual Members *vs* Several Members, Generic Types *vs* Specific Tokens *vs* Several Types and Multiple *vs* Unique *vs* Several Items/Events

	Plural Verbs	Singular Verbs
Collective sets	2870	3165
Individual members	3043	2917
Several members	2899	3284
Generic types	2398	2423
Specific tokens	2487	2253
Several types	2325	2684
Multiple items/events	2206	2162
Unique items/events	2467	2264
Several items/events	2190	2347

TABLE 6

Example of Sentences Used in Experiment 4

Collective sets *vs* individual members
Ayer noche fuimos a escuchar una nueva banda de jazz *[Last night we went to hear a new Jazz band]*
Ayer noche fuimos a escuchar un nuevo guitarrista de jazz *[Last night we went to hear a new jazz guitarist]*
(Ellos tocaron/El tocó) durante casi cinco horas *[(They/it) played for nearly five hours]*
Generic types *vs* specific tokens
Mi vecino tiene una moto *[My neighbour owns a motorbike]*
Mi vecino tiene una moto sin luces *[My neighbour owns a motorbike which doesn't have a light]*
Creo que (éstas son/ésta es) realmente (peligrosas/peligrosa) *[I think (they are/it is) really dangerous]*
Multiple items/events *vs* unique items/events
Le pedí a José que buscase una bombilla *[I asked Joseph to look for a light bulb]*
Le pedí a José que buscase: una escalera *[I asked Joseph to look for a stepladder]*
pero no se acordaba donde (las/la) habia guardado *[but he didn't remember where he had kept (them/it)]*

TABLE 7

Mean Reading Times (msec) for Second Independent Clauses with Plural and Singular Pronouns Preceded by Collective Sets *vs* Individual Members, Generic Types *vs* Specific Tokens and Multiple Items/Events *vs* Unique Items/Events

	Plural Pronouns	Singular Pronouns
Collective sets	2880	3278
Individual members	2942	2757
Generic types	2656	2945
Specific tokens	2753	2684
Multiple items/events	2344	2362
Unique items/events	2509	2242