

Distinguishing language from thought: Experimental evidence that syntax is lexically rather than conceptually represented.

Running head: lexical syntax
word count: 3977

Jeffrey S. Bowers
University of Bristol
Department of Experimental Psychology
8 Woodland Road
Bristol BS8 1TN
England
J.Bowers@bristol.ac.uk
Tel: 011 44 117 928 8573

Gabriella Vigliocco
Dept. of Psychology
University of Wisconsin - Madison

Hans Stadthagen-Gonzalez
Department of Psychology
Rice University

David Vinson
Dept. of Psychology
University of Wisconsin - Madison

Abstract

It is generally assumed that syntax is represented linguistically rather than conceptually, consistent with the more general view that language and thought are coded separately. This claim is widely defended on logical grounds, but it has received little experimental support. In the present study, we address this problem by asking Spanish and English speakers to make semantic and syntactic categorizations to a set of pictures and their corresponding names. Consistent with past results, latencies to semantically categorize pictures and words were similar. The new finding is that participants were faster to make syntactic decisions to words compared to pictures, suggesting that syntactic features such as grammatical gender and the count mass distinction are more closely linked to lexical compared to conceptual representations.

Distinguishing language from thought: Experimental evidence that syntax is lexically rather than conceptually represented.

There is a widespread consensus regarding the main architectural joints of the language production and comprehension systems, as outlined in Figure 1. According to this general framework, language production begins with the construction of a pre-verbal message that specifies the basic concepts that the speaker wishes to communicate. The message triggers a set of language specific processes that comprise the formulation stage. This stage is itself divided into two main components: grammatical and phonological encoding. During grammatical encoding, lexical-semantic representations are retrieved that encode (or are associated with) syntactic information required for computing the hierarchically organized syntactic structures for complete sentences (cf. Garrett, 1992; Levelt, 1989). Syntactic features include the grammatical category of words (i.e., noun, verb, adjective, etc.), their grammatical function (i.e., subject, object etc.), the kinds of syntactic structures they can be part of (i.e., noun phrase, verb phrase, etc.), and more specific lexical features, such as count/mass (Vigliocco, Vinson, Martin & Garrett, in press) and grammatical gender (for Romance languages such as Spanish) for nouns. These lexical-semantic codes and their associated syntactic features are called lemmas (Kempen & Huijbers 1983). In the following phonological encoding stage, the phonological codes associated with lemmas are retrieved, and they are combined in the order specified by the syntactic structure of the sentence computed in the previous stage. On one view, phonological codes are themselves coded lexically--so-called lexemes--which in turn map onto phonemes (e.g., Levelt, 1989), whereas on another view, lemmas directly connect to phonemes (see Caramazza & Miozzo, 1997). In either case, the output of the phonological stage then serves as input to the articulators, that convert phonological plans into overt speech.

The main processing stages involved in production are also found in comprehension. According to Figure 1, the same set of representations are involved in production and comprehension, but it is possible that the different sets of representations mediate these two processes (for review of this and related debates, see Bock, 1995).

The assumption that word retrieval during formulation is divided into two main stages--a stage in which lemmas are selected followed by the retrieval of phonological knowledge--is supported by a variety of evidence, including observations from slips of the tongue (c.f., Dell, 1986; Fay & Cutler, 1977; Garrett, 1976), experimental evidence that indicates that the semantic activation of words precedes phonological activation (e.g., Schriefers, Meyer, & Levelt, 1990), as well as the finding that speakers in a tip-of-the tongue state can have access to semantic and syntactic (i.e., grammatical gender and the count-mass distinction) features of words in the complete absence of any knowledge regarding their phonological form (e.g., Vigliocco, Antonini, & Garrett, 1997; Vigliocco, Vinson, Martin and Garrett, in press).

However, the distinction between conceptual level information and lemma level information is less well supported by experimental evidence. The acceptance of this distinction is largely based on logical arguments for the separation of language and thought (e.g. Fodor, Bever, & Garrett, 1974) and the related common-sense assumption that speakers of different languages think the same way, despite the different ways in which these thoughts are expressed, contra the view of Whorf (1956). But there is little

experimental evidence in support of this view, and the separation of language and thought is disputed in some camps (e.g., Slobin, 1996).

The distinction between conceptual and lemma level information concerns both whether conceptual knowledge can be distinguished from lexico-semantic information, as well as whether conceptual knowledge can be distinguished from syntactic information. With respect to the separation between conceptual and lexico-semantic information, the reader is referred to Schriefers et al. (1990) for some evidence compatible with such a distinction. The focus of the present study concerns the distinction between conceptual and syntactic information. In particular, we assess whether syntactic features that do not bear much semantic force become nonetheless part of conceptual structures for adult native speakers and therefore show processing effects similar to other conceptual features.

To this end, we contrast speakers' latencies to make semantic vs. syntactic decisions for a set of words and corresponding pictures. In Figure 1, we schematically outline how written words and objects are generally assumed to interface with these representations. In the case of written words, lexical-orthographic codes have direct access to lemma representations that encode syntactic information, whereas access to conceptual representations that encode various semantic relations are only contacted via the lemma codes. In the case of objects, however, the perceptual outputs feed directly into the conceptual system, which in turn, access lemma (and then phonological) representations.

This characterization of the production and comprehension systems makes some straightforward predictions regarding the latencies to make semantic and syntactic decisions to pictures and words. Given that written words have direct access to lemma codes, and given that syntax is directly associated with these lexical representations, it should be predicted that latencies to access the syntax of a noun should be shorter for words compared to pictures that must make an extra step through the conceptual system. By contrast, if syntax is represented within a conceptual store, it might be expected that latencies to access this information should be similar for pictures and words (or perhaps slightly faster for pictures). Indeed, previous studies have found similar semantic decision latencies to pictures and words, with pictures sometimes showing a slight advantage (e.g., Potter and Fauconer, 1975; Theios & Amrhein, 1989; for review, see Glaser, 1992).

In testing these predictions, we focused on two syntactic features in the present investigation: Grammatical gender in Spanish and count/mass marking in English. These two syntactic features differ in the degree to which there is a transparent relation between conceptual structure and syntax, and thus provide a range of conditions in which to test the concept/lemma distinction. These syntactic features are described in more detail in the appropriate experimental sections.

Experiment 1

In Spanish, all nouns are assigned either a masculine or feminine gender. For nouns that refer to entities with an intrinsic sex, such as chico, [boy] or chica [girl] there is a systematic correspondence between the gender of the noun and the sex of the referent. In these cases, the gender of a noun can be determined by the underlying conceptual representations, so-called natural gender. However, for nouns referring to objects and abstract entities, gender is arbitrarily assigned to the noun, in which case the term

grammatical gender is used. For nouns in this class, being feminine or masculine is strictly a linguistic property, and has nothing to do with the conceptual properties of the referent and different languages can assign different grammatical gender to words referring to the same object. For example, milk is feminine in Spanish (la leche) while it is masculine in Italian (il latte).

It is important to note that the arbitrariness of the relation does not rule out the possibility that syntactic information is coded within the conceptual system. In fact, there are accounts in the literature that make such an assumption. For example, Konishi (1993) asked speakers of Spanish and speakers of German to rate words on the semantic differential semantic scale (Osgood, Suci & Tannenbaum, 1957), and found that grammatically masculine words were rated higher on semantic dimensions that have masculine connotations, such as power and strength, and grammatically feminine words were rated higher on semantic dimensions that have feminine connotations, such as nurture. Crucially, speakers of Spanish and German differed in their ratings for words that had a different gender in the two languages (for example, the word "sun" is masculine in Spanish and feminine in German). Based on this correspondence between speakers' semantic ratings and the grammatical gender of nouns, Konishi argues that grammatical gender is intimately related to the conceptual representation for the words. A similar argument is presented by Tawmoski-de Ryck and Verluyten (1982) who note that information about the grammatical gender can be used together with information about the semantic content of nouns in the selection of appropriate referring expressions. For example, the gender of a noun determines the form of a pronominal reference when there is no pronominal antecedent. So for instance, in talking about something that could be named "table" (la-F table-F, in French), it is appropriate to say (1).

- (1) Tu n'arriveras jamais a la faire entrer dans la voiture
 You'll never manage to get it-F into the car
 (Tasmowski-De Rick & Verluyten, 1982, p. 328)

However, for "a desk" (le-M bureau-M), the masculine pronoun would be used. These observations were taken to indicate that grammatical gender and semantic knowledge are intimately connected in determining the selection of pronouns (hence, agreement between nouns and pronouns) in language production. Indeed, based on these observations, the authors argued that grammatical gender is part of the conceptual representation for the object. (see Garnham, Oakhill, Ehrlich & Carreiras, 1995, for a similar view in comprehension). Finally, Sera (1994) presents developmental data concerning a task in which speakers of English and Spanish were asked to assign a gender to pictured objects. She found that grammatical gender was used for the classification task starting from second graders. However, English speakers would use other conceptual criteria for the task, such as classifying artificial objects as masculine and natural objects as feminine. In line with the other studies reported above, she concludes that grammatical features during development are meshed with conceptual features.

However, there are also other findings in the literature that seem to indicate that arbitrary syntactic features such as gender are lexically represented (see for e.g., Cacciari, Carreiras and Barbolini-Cionini, 1997; Meyer and Bock, submitted). For example, Cacciari et al. (1997) showed that when the grammatical gender of an Italian word referring to a human (a word such as "vittima" [victim-feminine] that can refer to both

men and women) was mismatching with conceptual information (for example, when "vittima" was used to refer to a man) Italian speakers were slower in understanding a sentence than when there was a match between the syntactic and conceptual information. These results indicate that the conceptual and syntactic connotations of gender can be separated, and therefore argue for a non-conceptual basis for grammatical gender.

In order to provide some additional evidence regarding the relation between grammatical gender and concepts, Spanish speakers in Experiment 1 completed a gender decision and a semantic decision task in which nouns were presented in written and pictorial formats. In the gender decision task, participants indicated the appropriate determiner for each noun by pressing one of two keys on a keyboard, and in the semantic decision task, indicated whether a noun was an artifact or natural kind by pressing one of the same keys. If gender is conceptually represented, then we would expect to find no difference between for pictures and words in the syntactic task. However, if they are represented separately, as assumed in Figure 1, then participants should be faster to make the gender decision for words than for pictures.

Method

Participants. 24 native speakers of Spanish from the Houston area participated in the present experiment.

Materials and Design A set of 15 masculine and 15 feminine nouns with grammatical gender referring to concrete entities were selected, and a corresponding set of 30 pictures that clearly depicted the words were constructed. Nouns were selected so that their phonological and orthographic form did not mark gender, that is, words ending with the vowel "e" or with a consonant. This was necessary because the majority of words ending in "a" are feminine (e.g., la casa [the house]) and the majority of words ending in "o" are masculine (eg., el carro [the car]), and thus for these items, participants could correctly identify the gender based on the word's phonology (or orthography). Words were displayed in 24-point standard IBM-font, and are listed in the Appendix. The pictures were taken from a variety of sources and were hand drawn. Sixteen of the pictures depicted artifacts, and 14 depicted natural kinds, which formed the basis for participants' semantic categorizations. The experiment was run on a Texas Instrument 486/50 4000M portable computer with an active matrix screen, and stimuli were presented with the DMASTER software program developed by K.I. Forster and J.C. Forster, at the University of Arizona.

Each participant completed both the gender and semantic decision tasks. Half of the participants completed the gender task first and half the semantic task first, and there was a minimum of a two hour delay between completing the tasks. In each task, the 30 pictures and 30 words were presented one at a time in a random order. Thus, the experiment included Test Type (gender vs. semantic categorization) and Stimulus Type (picture vs. word) as within-subject factors.

Procedure Participants were tested individually on two different occasions. At the beginning of each session, they were presented with the list of critical pictures and their names in order to insure there was no ambiguity regarding the names of the pictures. Next, subjects completed one of the two tasks. In the gender task, participants were instructed to press the right shift key as quickly as possible if the word or picture was preceded by the masculine determiner "el" when spoken in a phrase (e.g., el lapiz) and

press the left shift key if preceded by the feminine determiner "la" (e.g., la nariz). Each item was immediately preceded by a "+" sign displayed for 500 ms that acted as a fixation point. The same display conditions were used for the semantic decision task, and participants were instructed to press the right shift key if the item referred to an artifact, and the left shift key if it referred to a natural kind. Prior to completing the critical picture and word trials, a set of practice items were included in each test session in order to familiarize the participants with the task.

Results and Discussion

A trial was dropped from the analysis when an error was made, or if the reaction time was two or more standard deviations from the subject's overall mean. Based on this procedure, 8.1% of the trials were dropped. Participants were faster to semantically categorize pictures (802 ms) compared to words (835 ms), which was significant by subjects [$F_1(1,23) = 5.14$, $MSe = 2549$, $p < .05$] and approached significance for items [$F_2(1,58) = 2.84$, $MSe = 5541$, $p = .09$]. Similar error rates were obtained for pictures (7.4%) and words (7.6%), indicating that the reaction time results do not reflect a speed-accuracy tradeoff. This finding suggests that participants are faster to gain access to conceptual knowledge from pictures compared to words, consistent with some past findings (e.g., Potter & Faulconer, 1975). The critical new finding is that participants were much faster at gender decisions to words (816 ms) compared to pictures (883 ms), which was significant by subjects and items [$F_1(1,23) = 42.25$, $MSe = 2541$, $p < .001$; $F_2(1,56) = 22.44$, $MSe = 3201$, $p < .001$]. No interaction was obtained between the gender and the word/picture factor [$F_1 \& F_2 < 1$], indicating that similar word advantage was obtained for both masculine and feminine items. Similar error rates were also obtained for the words (7.5%) and pictures (10.0%) [$F_1(1,23) = 2.06$, $MSe = 72.6$, $p > .15$; $F_2(1,56) = 2.07$, $MSe = 45.6$, $p > .15$], again ruling out a speed-accuracy trade off interpretation of the RT data. These results suggest that words have more direct access to the grammatical gender than pictures, consistent with the general framework out-lined in Figure 1.

Experiment 2

The second experiment was carried out in English, and exploited the syntactic distinction between count and mass nouns. Count/mass marking affects the choice of phrasal frames for the noun phrase. For example, being count or mass determines the selection of the correct quantifier (fewer vs. less) and the use of indefinite determiner (a vs. some). In contrast with grammatical gender, the count/mass distinction for English nouns is largely conceptually motivated. Things that occur in single tokens are count nouns; substances and things that occur in bunches are mass nouns. However, there is some arbitrariness. For example, why is "knowledge" mass and "opinion" count? Nevertheless, count/mass contrasts with grammatical gender in that it has some semantic grounding, and thus provides us with a stronger test of the concept/lemma distinction.

Method

Participants Forty English speakers from the University of Wisconsin-Madison participated in return for course credit.

Design and Materials A set of 12 words that referred to natural objects and 12 words that referred to artifacts were selected, and a corresponding set of 24 pictures that clearly depicted the words were constructed. Half of the words in each set were count

nouns and half were mass nouns. Words were displayed in 24-point standard IBM-font, and are listed in the Appendix B. The pictures were taken from a variety of sources and were hand drawn. The experiment was run on PC computers using the DMASTER software program.

Each participant completed both the gender and semantic decision tasks. Half of the participants completed the gender task first and half the semantic task first, and there was a minimum of a two hour delay between completing the tasks. In each task, the 24 pictures and 24 words were presented one at a time in a random order. Thus, the experiment included Test Type (gender vs. semantic categorization) and Stimulus Type (picture vs. word) as within-subject factors.

Procedure Participants were tested individually. Before the testing began, participants were presented with the list of the target pictures and their names in order to insure there was no ambiguity regarding the names of the pictures. Next, they completed one of the two tasks. In the count/mass task, participants were instructed to press the right shift key as quickly as possible if the word or picture referred to a count noun, and the left shift key for a mass noun. Specifically, they were asked “to press the right shift key if the word was an ‘a word’ and the left shift key for a ‘some word’”. Each item was immediately preceded by a "+" sign displayed for 500 ms that acted as a fixation point. The same display conditions were used for the semantic decision task, and participants were instructed to press the right shift key if the item referred to an artifact, and the left shift key if it referred to a natural kind. Prior to completing the critical picture and word trials, a set of practice items were included in each test session in order familiarize the participants with the task.

Results and Discussion

A trial was dropped from the analysis when an error was made, or if the reaction time was two or more standard deviations from the subject's overall mean. Based on this procedure, 10.8% of the trials were dropped. In the semantic decision task, participants were slightly faster to respond to words (711 ms) compared to pictures (733) [$F_1(1,39) = 4.21, p < .05, MSe = 5450, F_2(1,23) = 5.11, p < .05, MSe = 4533$], whereas there were slightly more errors to words (7.3%) compared to pictures (4.5%) [$F_1(1,39) = 5.22, p < .05, MSe = 54.2, F_2(1,23) = 5.43, p < .05, MSe = 34.2$]. This pattern of results reflects a small speed-accuracy trade off, with no evidence of an advantage for pictures or words when both dependent measures are considered. Although this finding contrasts with the results of Experiment 1 where latencies to make semantic decisions were slightly less for pictures, we would note that the literature on the semantic categorization task is quite mixed, with some studies showing a small advantage for pictures over words (e.g., Potter & Faulconer, 1975), and others not (Theios & Amrhein, 1989). Most critically however, and, consistent with gender decision results, participants were much faster to make count/mass decisions to words (766 ms) compared to pictures (882 ms) [$F_1(1,39) = 91.89, p < .001, MSe = 5848, F_2(1,23) = 145.434, p < .001, MSe = 1567$]. There also was, an interaction between the syntactic and picture/word variables [$F_1(1,39) = 3.708, p = .08, MSe = 5725, F_2(1,23) = 4.769, p < .05, MSe = 3439$], reflecting the fact that the difference between pictures and words was greater for mass nouns (150 ms) than for count nouns (76 ms). The basis for this difference is unclear. Errors for words (6.4%) and pictures (7.5%) were non-significantly different, with F_1 and F_2 values < 1 ,

indicating that the advantage for words over pictures cannot be attributed to a speed-accuracy trade off. Accordingly, the present results suggest that the count/mass syntactic feature is more closely associated with lexical vs. conceptual information, as was the case with grammatical gender.

General Discussion

As noted in the introduction, the distinction between conceptual representations on the one hand, and lemma level knowledge on the other, is largely based on logical rather than experimental considerations. However, the present findings of (1) faster gender decisions to words compared to pictures and (2) faster count/mass decisions to words than pictures, and (3) faster or equivalent semantic categorizations to pictures compared to words provides some experimental evidence in support of this distinction, and the framework depicted in Figure 1 in particular.

These findings challenge the views of Konishi (1993) and Tawmoski-de Ryck and Verluypen (1982) according to whom arbitrary syntactic features such as grammatical gender become part of the conceptual representation for words during the course of language learning. Indeed, our results indicate that a grammatical distinction that have some semantic grounding, namely the count-mass marking in English, is not incorporated into conceptual representations. Although our conclusions are different, the various empirical results can be reconciled. As noted earlier, these authors based their conclusion on the observation that the grammatical gender of nouns can influence performance on semantically related tasks. We would just note that these findings can also be explained as long as it is assumed that lexically specified syntactic features such as grammatical gender that have an affinity with important conceptual distinctions (male/female) can be used by speakers of gender marked languages in making semantic judgments. So for example, when asked to rate the word table on a semantic scale that includes power as one of the dimensions, a speaker might consider the grammatical gender of the word in order to constrain his or her response, even though syntax is coded separately from semantics.

Thus, our findings provide support for a distinction between features that need to be retrieved in the semantic task and features that need to be retrieved during our syntactic task. More strongly, our study indicates that syntactic features such as grammatical gender and whether a noun is count or mass are strictly linked to the lexical representation for the word rather than to the corresponding concept. In the general framework we have described in the introduction, these findings support a distinction between a lemma (a lexical representation that specifies some semantic properties of the word as well as its syntax) and other conceptual correlates, as well as challenge views according to which syntactic properties are indistinguishable from concepts (for an overview of various syntactic approaches of this latter type, see Langacker, (1998).

The findings we reported here, however are compatible with a number of different architectures for comprehension and production processes: they are compatible with models that assume decompositional (e.g., Dell, Schwartz, Martin, Saffran, & Gagnon, 1997; Zorzi and Vigliocco, in press) and models that assume non-decompositional conceptual representations (Levelt, Roelofs & Meyer, in press). They are also compatible with models that assume that lexical retrieval involves two stages: lemma and lexeme retrieval (Garrett, 1992; Levelt, 1989, in press) as well as with models that include only

one step: lemma retrieval followed by sub-lexical phoneme retrieval (Caramazza and Miozzo, 1997; Dell et al., 1997). Whatever the resolution to these latter debates, the present findings provide some empirical support for the widespread assumption that concepts and lexical representations (thought and language) are represented separately.

References

- Bock, J.K. (1995). Sentence production: From mind to mouth. In J.L. Miller & P.D. Eimas (Eds.), Handbook of perception and cognition: Speech, language, and communication (Vol. 11, p. 181-216). San Diego: Academic Press.
- Cacciari, C. Carreiras, M., & Barbolini-Cionini, C. (1997). Anaphora resolution in Italian. Journal of Memory and Language, *37*, 517-532.
- Caramazza, A. & Miozzo, M. (1997). The relation between syntactic and phonological knowledge in lexical access: evidence from the 'tip-of-the-tongue' phenomenon, Cognition, *64*, 309-343.
- Dell, G. S. (1986). A spreading activation theory of retrieval in sentence production. Psychological Review, *93*, 283-321.
- Dell G.S., Schwartz M.F., Martin N., Saffran, E.M., & Gagnon, D.A. (1997). Lexical access in aphasic and nonaphasic speakers, Psychological Review, *104*, 801-838.
- Fay, D., & Cutler, A. (1977). Malapropisms and the structure of the mental lexicon. Linguistic Inquiry, *8*, 505-520.
- Fodor, J.A., Bever, T.G., & Garrett, M (1974). The psychology of language. New York: McGraw-Hill.
- Garnham, A, Oakhill, J., & Ehrlich, M.F. (1995). Representations and processes in the interpretation of pronouns: New evidence from Spanish and French. Journal of Memory and Language, *34*, 41-62.
- Garrett, M. F. (1976). Syntactic processes in sentence production. In R. Wales & E. Walker (Eds.), New approaches to language mechanisms. Amsterdam: North-Holland.
- Garrett, M. F. (1992). Disorders of lexical selection. Cognition, *42*, 143-180.
- Glaser, W.R. (1992). Picture Naming. Cognition, *42*, 61-105.
- Kempen, G., & Huijbers, P. (1983). The lexicalization process in sentence production and naming: Indirect election of words. Cognition, *14*, 185-209.
- Konishi, T (1993). The semantics of grammatical gender: A cross-cultural study. Journal of Psycholinguistic Research, *22*, 519-534.
- Langacker, R.W. (1998). Conceptualization, Symbolization and Grammar. In M. Tomasello (ed.) The new psychology of language. London: Lawrence Erlbaum.
- Levelt, W. J. L. (1989). Speaking: From intention to articulation. Cambridge, MA: MIT Press.
- Levelt, W.J.M., Roelofs, A., & Meyer, A.S. (in press). A theory of lexical access in speech production. Behavioral and Brain Sciences.
- Meyer, A., & Bock, J.K. (1998). Representations and processes in the production of pronouns: Some perspectives from Dutch. Manuscript submitted for publication.
- Potter, M.C., & Faulconer, B.A. (1975). Time to understand pictures and words. Nature, *253*, 437-438.
- Osgood, C.E., Suci, G.J., & Tannenbaum, P.H. (1957). The measurement of meaning, Urbana: University of Illinois Press.
- Schriefers, H., Meyer, A.S., & Levelt, W.J.M. (1990). Exploring the time course of lexical access in production: Picture-word interference studies. Journal of Memory and Language, *29*, 86-102.

Sera, M, Berge, C.A.H., & del Castillo Pintado, J. (1994). Grammatical and conceptual forces in the attribution of gender by English and Spanish speakers. Cognitive Development, 9, 261-292.

Slobin, (1996). From "thought and language" to "thinking for speaking". In J.J. Gumperz & S.C. Levinson (Eds.). Rethinking linguistic relativity. Cambridge University Press.

Tasmowski-De Rick, L., & Verluyten, P. (1982). Linguistic control of pronouns. Journal of Semantics, 1, 323-346.

Theios, J. & Amrhein, P.C (1989). Theoretical analysis of the cognitive processing of lexical and pictorial stimuli: Reading, naming, and visual and conceptual comparisons. Psychological Review, 96, 5-24.

Vigliocco, G., Antonini, T. & Garrett, M.F. (1997). Grammatical gender is on the tip of Italian tongues. Psychological Science, 8, 314-317.

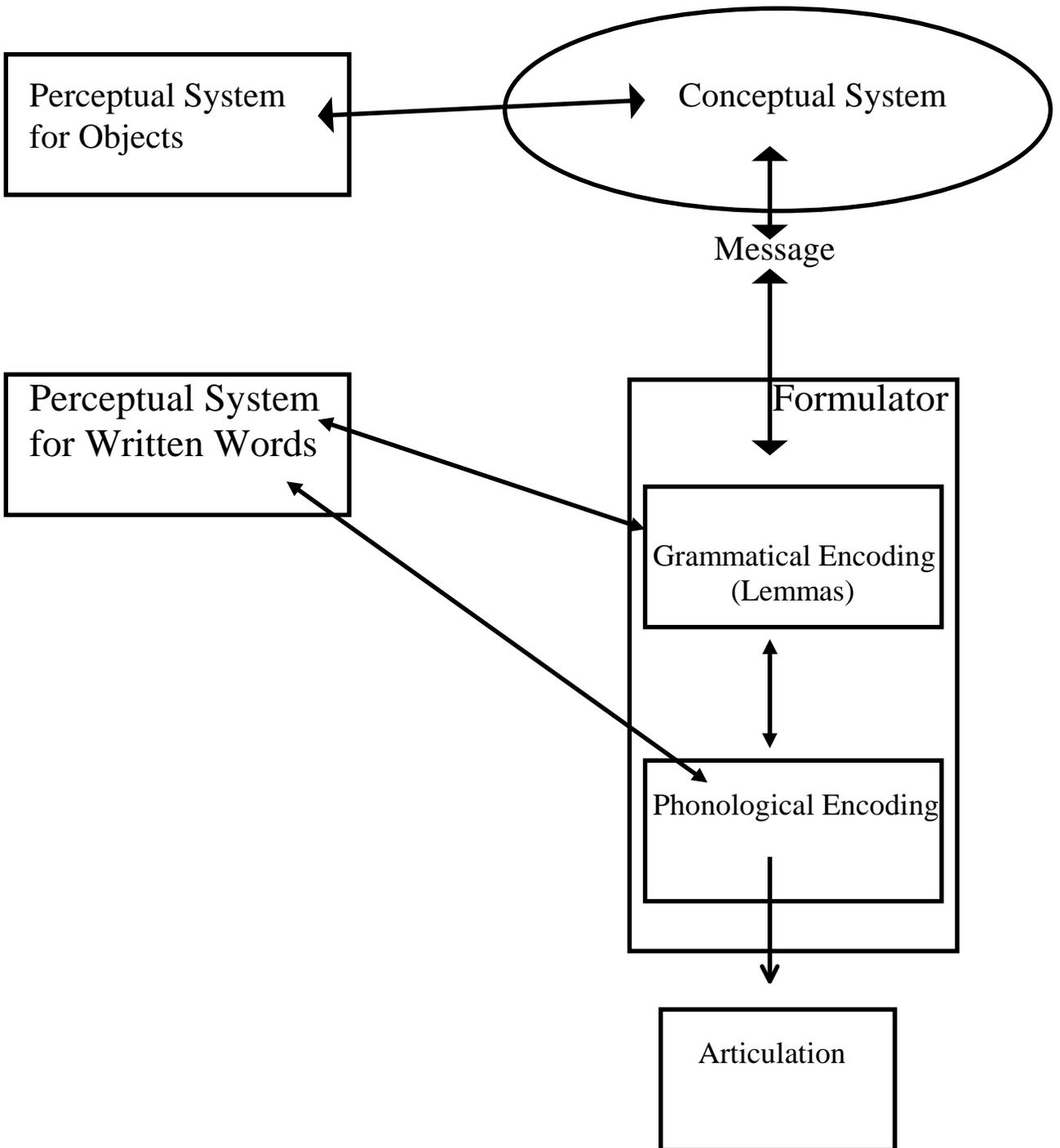
Vigliocco, G., Vinson, D., Martin, R., & Garrett, M.F. (in press). Is "count" and "mass" information available when the noun is not? An investigation of tip of the tongue states and anomia. Journal of Memory and Language.

Whorf, B.L. (1956). Language, thought, and reality. Cambridge, MA: MIT Press.

Zorzi, M., & Vigliocco, G. (in press). Compositional semantics and the lemma dilemma. Commentary to "A Theory of Lexical Access in Speech Production" by Levelt, Roelofs and Meyer. Behavioral and Brain Sciences.

Figure Caption

Figure 1. Schematic diagram of the language comprehension and production system(s) and associated perceptual systems.



Appendix

List of 30 nouns organized according to their grammatical gender and semantic category.

Masculine, natural kind: elefante, rinoceronte, pie, tomate, cactus, maiz.

Masculine, artefact: violin, peine, sobre, guante, pincel, lapiz, tren, patin.

Feminine, natural-kind: piel, nariz, nube, raiz, nuez, cicatriz, nieve.

Femine, artefact: esfringe, piramide, carcel, fuente, cruz, llave, torre, helice.

List of 24 nouns organized according to their count/mass and semantic category

Count, natural kind: nose, tree, bone, feather, peanut, carrot.

Count, artefact: table, cup, bus, clock, lamp, hammer.

Mass, natural-kind: rain, snow, corn, lightning, garlic, lettuce

Mass, artefact: music, mail, paint, soap, gum, toothpaste.