
Cristina Burani,* Francesca M. Dovetto,* † Alberto Spuntarelli,* and Anna M. Thornton*,‡

*Istituto di Psicologia del CNR, Roma, Italy; †Università di Napoli ‘Federico II,’ Naples, Italy; and ‡Università de L’Aquila, L’Aquila, Italy

In two experiments, pseudowords made up of Italian roots and derivational suffixes were investigated. In visual lexical decision, the licensing of a new root–suffix combination was affected by its semantic interpretability, but not by its grammatical appropriateness. By contrast, the degree of interpretability of new root–suffix combinations did not affect naming. However, and irrespective of differences in interpretability, pseudowords made up of two morphemes were named more efficiently than pseudowords with no morphological constituency. These results, while showing the involvement of the semantic component in the licensing process, also show its dissociability in lexical naming, thus suggesting morpholexical nonsemantic naming.

Key Words: morpholexical access; morpholexical naming; morphological pseudowords; semantic interpretability; licensing; root–suffix combinations.

In preceding experiments of visual lexical decision and naming we showed that pseudowords made up of two morphological constituents, a root and an affix, although not in the appropriate combination, can gain access to the lexicon. Lexical decisions to these pseudowords showed interference effects (i.e., longer reaction times and higher error rates) with respect to pseudowords with no morphological constituency. By contrast, naming of morphological pseudowords was facilitated with respect to nonmorphological pseudowords (see, e.g., Burani, Dovetto, Thornton, & Laudanna, 1997; Laudanna, Burani, & Cermele, 1994; Laudanna, Cermele, & Caramazza, 1997). These results were interpreted within a model of lexical processing in which access to the lexicon involves activation of representations corresponding to morphemes. It is the activation of lexical representations corre-
sponding to the constituent roots and affixes that determines interference on nonword response in lexical decision and facilitation in naming.

According to the model, when activated in the lexicon, entries corresponding to a root and an affix undergo composition and their resulting combination must be tested in order to be licensed (or not licensed, as in the case of pseudowords).

In the present experiments (one visual lexical decision and one naming experiment), we exploited new (i.e. not existing) combinations of a root and a derivational suffix in order to assess (1) which sort of information (grammatical or semantic or both) is activated in the mental lexicon for licensing a new root–suffix combination and (2) whether this information is crucial for lexical decision only, or if it affects naming too.

LEXICAL DECISION EXPERIMENT

In lexical decision-making we investigated to what extent the grammatical/categorial appropriateness of the root–suffix combination and its semantic interpretability affect licensing.

Materials

Pseudowords made up of three different types of root–suffix combinations were compared. Pseudowords in set A were formed by combining frequent and productive Italian nominal and adjectival suffixes with verbal roots which were inappropriate categorially; that is, they violated the selectional restrictions on the grammatical category of the base to which the suffix should attach. For instance, the agentive suffix -aio, which takes only nominal bases, was combined with a verbal root, e.g., seppell- (‘‘to bury’’), giving rise to a pseudoword like seppellaio.

Set B included the same nominal and adjectival suffixes in combination with roots which did not violate the categorial restrictions (the noun category of the root was indeed appropriate) but violated the restrictions imposed by the suffix on the inherent syntactic–semantic features of the base. For instance, the suffix -aio takes as bases only concrete nouns, the deriving agentive nouns having the meaning of ‘‘a person who sells or manufactures something.’’ To violate this restriction, -aio was combined with abstract noun bases, e.g., terror- (‘‘terror’’), resulting in terroraio (‘‘terror seller, terror maker’’).

In set C, the same suffixes were combined with roots which did not violate any restrictions: they were appropriate both categorially and semantically. For instance, -aio was combined with the root for divano (‘‘sofa, divan’’) thus forming divanaio (‘‘sofa seller or maker’’). The items in this set actually were possible words that are nonexistent in Italian but could in principle be coined as neologisms.

In order to get empirical measures of the extent to which people assign meaning to these combinations, independent of how they are linguistically analyzed, the pseudowords were submitted to ratings for interpretability using a 7-point scale. Stimuli in set C, which did not violate any restriction, were rated by participants as the most interpretable (mean: 5.39). Both sets A and B were rated significantly less interpretable than C ($p < .001$). However, different types of linguistic violations did not result in significantly different interpretability ratings: Violations of grammatical restrictions and violations of semantic restrictions resulted in comparable interpretability (means: 3.35 for A and 3.51 for B, respectively).
Predictions

Pseudowords in the three sets were matched for frequency of the constituent morphemes and for orthographic/phonological properties of both the morphemes and the resulting combination. Therefore, when submitted to lexical decision, pseudowords in the three sets should have equal probabilities of activating morphological constituents in the mental lexicon.

However, pseudowords in the three sets should have different probabilities of being licensed. Longer latencies and higher error rates were expected for deciding that the pseudowords of set C type are nonexistent words: They are combinations in which neither categorial nor semantic restrictions on the base are violated, and they are also highly interpretable.

The expected pattern of results for sets A and B should depend on which information is crucially activated in the lexicon for licensing the root–suffix combination. Two main possible outcomes could be predicted.

(1) If the grammatical compatibility of root and suffix is checked first, as a prerequisite for compositionality, set A pseudowords should be more likely to be rejected than the other pseudowords because their roots are not grammatically compatible with the suffixes they are combined with. Pseudowords in set B should be intermediate between sets A and C. They should take longer to be rejected than pseudowords in set A because roots in set B belong to a grammatical category which is compatible with the suffix. However, they should also be rejected more quickly than pseudowords in set C because combinations in set B violate the semantic restrictions on the base and are also less interpretable than in set C.

(2) By contrast, if only interpretation of the root–suffix combination is crucial for licensing, pseudowords in sets A and B, which did not differ for interpretability, would also not differ in decision times and, being less interpretable, would both be rejected more quickly, and with fewer error rates, than pseudowords in set C.

Results

Figure 1 shows that only interpretability played a role. Stimuli in set C, which were the most interpretable, were less likely to be rejected as nonexistent words with respect to both sets A and B: set C pseudowords produced
significantly longer decision times \( p < .02 \) and more false alarms \( p < .001 \) than set A and set B pseudowords. However, the violation of restrictions on the grammatical appropriateness of the base, which had not resulted in different interpretability of stimuli in sets A and B, played no differential role with respect to violation of semantic restrictions. No difference was found in rejecting stimuli of sets A and B, either on reaction times or on error rates.

**Discussion**

In synthesis, what affects the probability of licensing a root–suffix combination is the extent to which some meaning or interpretation can be obtained. By contrast, information on whether the two morphemic constituents are compatible in terms of grammatical category does not have a special role in a task like lexical decision.

**NAMING EXPERIMENT**

This experiment investigated whether the semantic interpretability of new root–suffix combinations affects naming speed and accuracy.

Effects of interpretability in naming morphologically complex pseudowords could be expected under the assumption that, for these pseudowords, lexical naming is exploit able.

In a dual-route model of reading, stimuli which do not correspond to an existing word cannot be named by lexical look-up (there is no lexical representation corresponding to a nonword). They must be named aloud through the extralexical route in which submorphemic units corresponding to letters and possibly syllables are activated and converted in their phonological counterparts.

However, in a model in which the lexical route can be accessed by activation of morphemic constituents, it could be assumed that a pseudoword composed of a root and an affix, in addition to the possibility of being named extralexically like any other nonword, is also likely to be named lexically by activating and matching the representations corresponding to its constituent morphemes in both the input and the output lexicon.

Therefore it could also be assumed that morphological pseudowords can be named more quickly and more accurately than nonmorphological pseudowords because morphological pseudowords take advantage of preassembled lexical units which correspond to two morphemes (the root and the affix), while the only units which can be activated in nonwords with no morphological constituency are individual letters, phonemes, and/or syllables. It is the availability of preassembled morphemic units in the different components of the process of lexical naming, that may result in more efficient naming if contrasted with the extralexical process of segmenting and reassem-
bling smaller and more numerous units corresponding to single letters, phonemes, and syllables.

The extralexical process is consequently assumed to be both slower and more subject to error. Specifically, a higher error rate should be expected to be a function of the higher probability of making errors when assembling a higher number of processing units.

For Italian, a language with shallow orthography, faster orthography-to-phonology processing and weak effects of lexical factors might be predicted. However, in other articles (Burani et al., 1997; Laudanna et al., 1997), we showed that, even in Italian, naming pseudowords through activation of morphological constituents (namely, morpholexical naming) is advantageous.

In the present experiment, we assessed whether morpholexical naming is sensitive to the activation of semantic information as well. For pseudowords that are highly interpretable, the activation of morphemic representations in the output lexicon should not only be a function of the direct match of morphemes in the input and in the output lexicon, but might benefit also from the activation of some newly created concept in a semantic component (e.g., for a highly interpretable pseudoword like divanaio, the concept of a person who sells or makes only sofas).

**Predictions**

If semantic information is activated in the process of naming morpholexically a new root–affix combination and if it contributes to the activation of units in the morphologically decomposed output lexicon, the prediction could be made that highly interpretable pseudowords are named faster and more accurately than less interpretable pseudowords.

**Materials**

In the experiment, a large proportion of words was included: words accounted for 75% of the list, while pseudowords were only 25%. In a context like this, lexical naming should be the more likely strategy. Consequently, activation of morphological units should be quite probable, and activation of the semantic component, if any, should be highly favored.

To assess the contribution of the semantic component, morphological pseudowords that differed in semantic interpretability were compared.

Three sets of pseudowords were included: (1) highly interpretable root–suffix pseudowords (e.g., divanaio, meaning ‘sofa seller or maker’), (2) root–suffix pseudowords with low interpretability (e.g., terrorario, ‘terror seller or maker’), and (3) A control set of no-root/no-suffix stimuli (e.g., dalonasa), which were obviously not interpretable.

In addition to being matched for the orthographical, phonological, and frequency properties of their constituents, the three sets were also matched for factors which could affect naming speed, such as the initial phoneme, the syllabic structure, and mean bigram frequency.

**Results**

Figure 2 shows an effect of morphological constituency on both naming times and errors: pseudowords of sets 1 and 2, which were constituted by two morphemes, were named significantly more quickly ($p < .003$) and more
FIG. 2. Naming experiment: mean reaction times and percentage of errors for three types of pseudowords: (1) root–suffix combinations with high interpretability; (2) root–suffix combinations with low interpretability; and (3) no root–no suffix combinations.

accurately ($p < .001$) than pseudowords in set 3, which did not include any morphemes. However, differences in semantic interpretability did not result in different performances: pseudowords in sets 1 and 2 did not differ at all, either when reaction times or when error rates were considered.

Discussion

These results confirmed the availability of morpholexical naming (i.e., naming which benefits from lexical representations corresponding to roots and affixes) even in a language with shallow orthography like Italian. Pseudowords made up of a root and a derivational suffix were named more quickly and accurately than nonwords that did not include any morpheme. By contrast, they also showed that, at least for new root–suffix combinations, morpholexical naming can be performed with no mediation of semantic factors; interpretability did not affect naming speed or accuracy.

CONCLUSIONS

The two experiments produced two results,

1. The process of licensing a new root–suffix combination is affected by interpretability: in lexical decision, combinations that are more interpretable are more subject to be accepted as a word than less interpretable combinations. By contrast, the grammatical appropriateness of the combination does not play any additional role.

2. Differences in the interpretability of new root–suffix combinations do not affect naming efficiency differentially (see also, for results on Dutch novel compounds, Coolen, Van Jaarsveld, & Schreuder, 1991). However, lexical naming via activation of constituent morphemes (morpholexical nam-
ing) is definitely more efficient than extralexical naming, irrespective of the semantics resulting from the root–affix combination.

These results, while confirming the involvement of the semantic component in lexical decision, point to its dissociability in naming. The absence of the interpretability effect in naming is open to different interpretations. No differences in interpretability in the naming task might be taken as support for a postlexical interpretation of interpretability differences (Coolen et al., 1991). However, the strong lexicality effect that was found in our naming experiment in the absence of differential effects of different degrees of interpretability needs a somewhat more complex account.

Our results point to the possibility that the lexical (or addressed) route for reading is subdivided into two pathways: a semantic pathway in which the semantic component is involved and a lexical nonsemantic pathway. Although evidence for this second lexical pathway comes almost exclusively from neuropsychological studies of patients with acquired reading disturbances, a few results from intact readers support this distinction. Buchanan and Besner (1993) showed that normal readers of a shallow orthography can use a lexical nonsemantic route to read aloud at least some of the time.

Our naming data add evidence to this possibility by indicating morpho-lexical nonsemantic naming, obtained by direct match of morphological input units with homologous output units, with no involvement of the semantic component.

REFERENCES


