

Dissociation in Italian Conjugations: A Single-Route Account

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Say and Clahsen (S&C) report an experiment involving assignment of past participle suffixes to nonce words in Italian. Their evidence suggests a dual-route model that assigns the theme vowel of the 1st conjugation, while storing it lexically in other conjugations. However, these nonce words were assigned suffixes by a computer algorithm that determined the past participle of the nonce items on the basis of phonological similarity to existing inflected forms. The outcome of the simulation mirrors that of the subjects closely, suggesting that the dissociations found by S&C are not adequate evidence for a dual-route model of Italian stem formation.

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INTRODUCTION

In recent years, a great deal of interest has been shown in theories of inflectional morphological processing. In particular, the debate between dual- and single-route models has been quite heated. On the one hand, Pinker and his colleagues argue that inflection involves two distinct processes. Some inflection is carried out via rules of morphological concatenation, while inflection for other words is a matter of accessing the preinflected word from memory (Pinker, 1991; Pinker & Prince, 1988, 1994; Prasada & Pinker, 1993). On the other hand, single-route models assume that all inflection may be accounted for with the same mechanism, either massive storage (Bybee, 1985, 1988; Stemberger, 1994) or equal processing of all forms as in connectionism (Daugherty & Seidenberg, 1992, 1994; Elman, Bates, Johnson, Karmiloff-Smith, Parisi, & Plunkett, 1996; Rumelhart & McClelland, 1986; Seidenberg, 1992; see McClelland, 1988, for an introduction to connectionism).

A sizable number of studies may be found in the psycholinguistic literature that bear on this debate. A number of authors present evidence in favor of the dual-route model (Clahsen, Rothweiler, Woest, & Marcus, 1992; Jaeger, Lockwood, Kemmerer, Van Valin, Jr., Murphy, & Khalak, 1996; Marcus, Brinkmann, Clahsen, Wiese, Woest, & Pinker, 1995; Marslen-Wilson & Tyler, 1997; Penke, Weyerts, Gross, Zander, Clahsen, & Münte, 1997; Pinker, 1991, 1997; Pinker & Prince, 1994; Prasada, Pinker, & Snyder, 1990; Ullman, 1999). Others cite evidence in favor of the view that inflection is the work of a unitary process (Bybee, 1995; Eddington, 2000; Marchman, 1997; Nakisa, Plunkett, & Hahn, 1998; Seidenberg, 1992; Seidenberg &

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Hoeffner, 1998; Seidenberg & Bruck, 1990; Sereno & Jongman, 1997; Stemberger & MacWhinney, 1986, 1988). A review of the literature in which this debate is embodied would be a formidable undertaking and is far beyond the constraints of the present article. However, one notion that is central to the debate is that of dissociations.

Dissociations are said to exist when one group of inflected items appears to be processed differently than another group. Their existence is considered *prima facie* evidence of the dual-route model, which is why so many studies are dedicated to bringing dissociations to light. Single-route proponents, on the other hand, have spent a great deal of effort demonstrating that single-route models can also account for dissociations. For example, arguing in favor of the dual-route approach, Prasada and Pinker (1993) asked English speakers to produce past tense forms of nonce words. They observed that the subjects' willingness to form an irregular past tense was related to the nonce word's similarity to existing irregular past tenses. Conversely, their willingness to apply the regular past tense suffix to a nonce item was unrelated to the words' similarity to existing regular past tense forms. This was presented as evidence of a dual-route mechanism for English past tense inflection. However, this dissociation has also been modeled in a number of single-route models using the same nonce words (Eddington, 2000; Hare, Elman, & Daugherty, 1995; Westermann, 1997).

In a similar vein, Jaeger et al. (1996) demonstrated that different parts of the brain were activated when processing regular versus irregular English past tenses. However, critics contend that this dissociation may be accounted for in a single-route framework as well (Seidenberg & Hoeffner, 1998). Dissociations in aphasics have also been interpreted as evidence for separate mechanisms (Ullman et al., 1997), but such dissociations have also been modeled in a single-route connectionist network when the network is selectively damaged in different ways (Joanisse & Seidenberg, 1999).

The present study focuses on a dissociation reported in Italian verbal morphology (Say & Clahsen, 2001; hereafter S&C). While S&C present their findings as favoring the dual-route model, the remainder of this article demonstrates that these results are compatible with a single-route model as well. The study is organized as follows. First, S&C's experiment is summarized and critiqued. Next, the single-route framework into which S&C's data are recast, namely Analogical Modeling of Language (AML), is described. The remainder of the article presents a simulation of the Italian data.

SAY AND CLAHSEN'S STUDY OF ITALIAN VERB STEMS

Italian verbs fall into one of three conjugations. The first conjugation is characterized by the theme vowel /a/ in most of its inflections and forms the past participle with the suffix *-ato*. Verbs of the second conjugation have /e/ as the theme vowel and form the past participles with *-uto*. The theme vowel of third conjugation verbs is /i/, and the past participle is formed with *-ito*.

There are several reasons why the first conjugation is considered the default (Say & Clahsen, 2001). Roughly two-thirds of Italian verbs are from the first conjugation. Neologisms, foreign borrowings, onomatopoeia, deadjectival verbs, and denominal verbs all take first conjugation inflections. In addition, there are only three irregular verbs in this class. In comparison to the other conjugations, in particular the second conjugation, many of whose members are phonologically similar, the phonological make-up of first conjugation verbs varies widely.

Say and Clahsen draw a parallel between Italian verb stems and English past tense

formation as envisioned by Pinker (1991, 1999) and Pinker and Prasada (1993). According to Prasada and Pinker, during acquisition the regular English past tense forms are identified as the default pattern and are derived by rule. Irregular past tense forms on the other hand are stored in associative memory. Past tense inflection involves matching the input with irregularly inflected items stored in memory. If a match is found the corresponding irregular form is produced. If no match is found, the default regular suffix *-ed* is applied.

Say and Clahsen's analysis of Italian focuses on verb stems, not on inflections which they assume are derived at a later stage. They present a model in which first conjugation stems are the default and, as such, are produced by rule application. They propose a rule which affixes the theme vowel to the root by which *parl-*, for example, becomes *parla-*, 'to speak'. The stems of second and third conjugation verbs are stored in the lexicon in the same way irregular English past tense forms are thought to be. In other words, the theme vowels /e/ and /i/ in these stems are stored pre-attached (*sparge-*, 'to scatter', and *dormi-*, 'to sleep').

In order to demonstrate the validity of their model, S&C devised a number of nonce words. Test subjects were then presented these verbs in the context of a sentence. Their task was to determine the past participle of each nonce verb. In this way, the conjugation associated with the nonce word could be determined. Only present tense forms of the first person singular (*io*) and plural (*noi*) were used since these forms do not include theme vowels indicative of conjugation. The past participles were elicited with questions of this type:

1. Oggi *praino*¹ con mio fratello. (Today I *praino* with my brother.)
 Ieri ho _____ con i miei amici. (Yesterday I have _____ with
 my friends.)

Nonce verbs were included which are phonologically similar to second and third conjugation verbs as well as nonce items that are dissimilar to any Italian verb.

The purpose of the study was to determine if a dissociation between first versus second and third conjugation stems exists. They hypothesize that if second and third conjugation stems are stored with preattached theme vowels, and if first conjugation stems comprise the default conjugation (and receive their theme vowel by rule), certain differences should be found between them. In the first place, only nonce verbs that are phonologically similar to other second or third conjugation verbs should be assigned a second or third conjugation past participle. If the first conjugation is indeed the default, nonce verbs that are dissimilar to any Italian verb should take the first conjugation past participle *-ato*. They also hypothesize that frequency effects will be found for the second and third conjugations. That is, nonce verbs that are phonologically similar to high frequency second and third conjugation verbs should be more apt to be assigned a second or third conjugation past participle when compared to nonce items that bear resemblance to low frequency verbs in these classes. Low frequency items should fall into the default first conjugation more easily.

Say and Clahsen chose nonce words that had the same root-final rhyme as existing verbs. These nonce items fall into eight different categories. It should be noted that all third conjugation verbs with irregular past participles are high frequency in Italian, hence the lack of nonce items that are similar to low frequency irregular third conjugation words: (1) nonce words that are similar to high frequency second conjugation verbs that have irregular past participles ($n = 11$); (2) nonce words that are similar to low frequency second conjugation verbs that have irregular past participles ($n = 9$); (3) nonce words that are similar to high frequency third conjugation verbs that

¹ The nonce word *praino* is given as an example and is not one of the nonce words used in the study.

TABLE 1
Percentages of S&C's Subject's Responses in Each Category^a

Response Type → condition ↓	1st conj. <i>-ato</i>	2nd conj. <i>-uto</i>	3rd conj. <i>-ito</i>	Irregular
Similar to irreg. 2nd conj.	59	7	3	31
Similar to irreg. 3rd conj.	71	4	4	21
Similar to reg. 2nd conj.	54	38	1	8
Similar to reg. 3rd conj.	62	1	35	1
No similarity	90	4	4	2

^a Adapted from S&C 2001, Table 8: Participle forms of novel verbs by condition.

Note. The two most frequent responses in each condition are highlighted in boldface.

have irregular past participles ($n = 10$); (4) nonce words that are similar to high frequency second conjugation verbs that have regular past participles ($n = 9$); (5) nonce words that are similar to low frequency second conjugation verbs that have regular past participles ($n = 10$); (6) nonce words that are similar to high frequency third conjugation verbs that have regular past participles ($n = 10$); (7) nonce words that are similar to low frequency third conjugation verbs that have regular past participles ($n = 10$); and (8) nonce words that are dissimilar to any Italian verb in that they share no root-final vowel and consonant(s), but which are still phonotactically licit ($n = 12$). Table 1 summarizes the outcome of S&C's study in terms of percentages of responses in each category.

Several conclusions may be drawn from these data. First, it is clear that the phonological similarity of the nonce words to existing words in each category influenced the subjects' choice of past participle. However, nonce words that are dissimilar to any verb are assigned past participles of the first conjugation in 90% of the cases. Second, the first conjugation past participle was the most common response in all categories. Both of these findings strengthen the claim that the first conjugation is the default. The critical dissociation that the data display is that first conjugation responses are found in every category regardless of the phonological shape of the nonce word. Second and third conjugation responses, on the other hand, are almost exclusively assigned to nonce words resembling verbs of their respective classes.

Say and Clahsen also present evidence from frequency effects. Table 2 presents the data from their study in terms of the frequency of the Italian verbs that the nonce words were designed to rhyme with. For nonce words resembling verbs with regular past participles, the high frequency items elicited more expected responses than the low frequency ones. If verbal stems are stored in associative memory, high frequency items would be expected to exert a stronger gang effect on the nonce verbs than low

TABLE 2
Responses According to Frequency

Condition	Frequency	1st conj.	2nd conj.	3rd conj.	Irregular
2nd conj. irregular	High	60	11	1	28
	Low	57	3	6	34
2nd conj. regular	High	43	45	2	10
	Low	65	31	1	4
3rd conj. regular	High	55	2	41	2
	Low	69	1	30	1

Note. The two most frequent responses in each condition are highlighted in boldface.

frequency items would. The fact that the irregular second conjugation items did not demonstrate a frequency difference was unexpected. Say and Clahsen feel that this may be due to the fact that the low frequency items are more phonologically consistent than their high frequency counterparts. This may have confounded the expected frequency effect.

CRITICISMS OF SAY AND CLAHSEN'S STUDY

There are several aspects of this experiment that raise questions. For example, the major goal of this study is to demonstrate that the first conjugation dissociates from the second and third conjugations. Given this goal, it is odd that only nonce items were included that were phonologically similar to second and third conjugation verbs; no items were devised to resemble first conjugation items. Therefore, the dissociations found are limited to those found between items that are similar to no Italian verb, and those that are similar to second and third conjugation verbs. Say and Clahsen assume that second and third conjugation stems are stored in associative memory in such a way that they are able to exert gang effects on nonce words that they are phonologically similar to. Nevertheless, their exclusion of test items that are similar to first conjugation verbs does not allow one to test whether first conjugation verbs may exert gang effects as well. It is entirely plausible for gangs of phonologically similar second conjugation verbs (ending in *-endere*, for example) to influence such nonce words. Why would it not be possible for gang effects to be had with groups of first conjugation verbs ending in the frequent strings *-tare*, *-lare*, or *-nare*? The existence of frequency effects among lexical items that are thought to be rule-derived also puts serious doubt on their derived status (cf. Alegre & Gordon, 1999; Burani, Salmaso, & Caramazza, 1984; Sereno & Jongman, 1997; Taft, 1979), yet the design of the study did not allow this possibility to be discounted.

A second difficulty with the study concerns the relationship between the dissociation they describe and the rule that is assumed to affix *-a* to first conjugation stems. While the dissociation does support the default status of the first conjugation, it does not necessarily provide evidence that the theme vowel is applied by rule to first conjugation stems. Say and Clahsen's commitment to the rule-plus-storage paradigm forces them to find something in first conjugation stems that is regular enough to admit rule derivation. Since the theme vowel is the only predictable difference between the conjugations, affixation of the theme vowel is the only possible rule one could devise. Nevertheless, the dissociation does not necessarily support the existence of the hypothesized rule.

According to S&C, processing of the nonce words is carried out in the following manner. Each nonce item is first compared to second and third conjugation stems which are stored in the mental lexicon. If a word is found to have a similar phonological shape, it is assigned the conjugation of the most similar item(s). If it is found to be dissimilar to any stored stem, the default intervenes and assigns it to the first conjugation. What this means is that phonological resemblance is only relevant for the assignment of second and third conjugation stems. Assignment of an item to the first conjugation supposedly does not entail matching the nonce item to existing first conjugation stems in the lexicon. Albright (1999), in contrast, demonstrates that phonological gang effects are found in all Italian verb conjugations, including the default first conjugation. The purpose of the following simulation, therefore, is to determine whether S&C's results may be mirrored by a single-route model that makes conjugation assignment solely on the basis of phonological similarity. It will be seen that despite this equal processing, the first conjugation emerges as the default.

ANALOGICAL MODELING OF LANGUAGE

Since the simulation of the Italian data was carried out within the framework of AML, a brief outline of this model is in order. The reader is referred to Skousen (1989, 1992, 1995) for specific details about AML's algorithm, which go beyond the scope of the present study. Analogical Modeling of Language is essentially a model of how stored linguistic experiences may be used to predict linguistic behavior. For this reason, it bears some resemblance to other exemplar-based models (Bod, 1998; Daelemans, Zavrel, van der Sloot, & van den Bosch, 1999; Medin & Schaffer, 1978; Nosofsky, 1988, 1990; Riesbeck & Schank, 1989; see Shanks, 1995, for an overview of exemplar-based models). In AML, all forms are processed with the same mechanism which makes it reminiscent of connectionism, since neither model extracts overall characterizations of the data in the form of rules.

There are, however, significant differences between AML and connectionist models (Chandler, 1995; Jones, 1996; Skousen, 1989, 1995). Connectionist networks predict only one outcome for a given context, while AML predicts the probability that one or more outcomes will be chosen. Connectionist networks require extensive training, while AML does not. In connectionism, information is stored as patterns of activation in a network of interconnected nodes; there is no representation of individual words. In AML, the information is contained in a database of exemplars representing the contents of the mental lexicon. This database may be added to at any time. In contrast, connectionist networks cannot readily accept new data without having to be completely retrained to include the new data.

Analogical Modeling of Language's algorithm contains an explicit procedure for assembling an analogical set from which analogs may be chosen and subsequently applied to the given context. It calculates the probability that one or more behaviors will apply to the given context. In general, database entries most similar to the given context will appear in the analogical set. However, unlike other analogical models, less similar items have a smaller chance of being included as well. In addition, AML makes no advance determination of which variables are most relevant for the task.

In AML, when the need arises to determine some linguistic behavior (such as determining the conjugation a word belongs to), a search of a database is conducted beginning with the entries most similar to the given context whose behavior is being predicted and then extending to less similar entries. The members of the database are grouped into sets called subcontexts whose members share similarities with the given context. For example, in determining the behavior of the nonce verb *gopro*, one subcontext would be composed of all items whose stem ends in /r/, another whose stem ends in /pr/, another whose stem-initial syllable onset is /g/, another whose stem-initial syllable onset is /g/ and which also ends in /pr/, and so forth until all possible combinations of variables are explored.

One derived property that results from dividing the database in this manner is that of proximity. Database items that share more features with the given context *gopro* will appear in more subcontexts and will therefore have a higher likelihood of influencing the probability that *gopro* will be assigned a given conjugation. Gang effects also fall out of this architecture. Groups of similar items that display the same behavior will increase their probability of influencing the given context.

Heterogeneity is another important property of AML. It suggests that an item cannot be chosen as an analog if there are other items with a different behavior that fall between the given context and the proposed analogy. Calculating heterogeneity involves determining disagreements. A disagreement occurs when a member of a subcontext has a different behavior than another member of the same subcontext.

For example, *compro*, 'I buy', and *apro*, 'I open', share a stem-final /pr/, but they belong to different conjugations. As a result they constitute a disagreement. Under certain conditions, the analogical influence of the members of a subcontext that contains disagreements will be reduced or eliminated.

ITALIAN DATABASE

As mentioned above, AML always makes predictions on the basis of a database of instances. Therefore, it was important to design a database that is representative of what might exist in the mental lexicon of an Italian speaker. Psycholinguistic experimentation has shown that high frequency words are accessed more rapidly than low frequency words (e.g., Allen, McNeal, & Kvak, 1992; Scarborough, Cortese, & Scarborough, 1977). In addition, high frequency items are less subject to error than low frequency items (e.g., MacKay, 1982). This suggests that frequent forms are more readily available and, therefore, more likely to be selected as analogs.

Therefore, the 976 most common Italian verbs (Bortolini, Tagliavini, & Zampolli, 1971) comprised the data set. This number was chosen because in simulations of other linguistic phenomena, a data set of several hundred items was found to be sufficient to simulate native speaker intuitions. Only one instance of each of the 976 types identified was included in the database. Token frequency was not encoded. This is consistent with Bybee's (2001) observation that type frequency is more relevant to productivity than token frequency. In S&C's study, determining the conjugational class of a nonce word is an exercise in productivity.

In S&C's study, the test subjects were presented *io* and *noi* inflectional forms in the present tense and asked to produce past participles. In order to accurately perform a simulation of their study, it was necessary to build two databases. One contained the *noi* forms of all 976 verbs. The other contained the *io* forms of each verb. However, 9 of the verbs² have two *io* forms. Therefore, each variant form was included which resulted in 985 items in the *io* database. The phonemes of the last three syllables of each *io* or *noi* form (minus the tense/person suffixes *-iamo* and *-o*) were included in the database. For example:

2. <i>supplico</i>	"I beg"	===#===#SU##PPLI#K#=#
<i>preoccupiamo</i>	"we worry"	#PRE#===#O#=#KKU#P#=#

Hash marks indicate the first and last element in a syllable, the absence of a syllable nucleus, and the final phoneme of the stem. The equal sign serves as space marker to align each syllable and does not count as a variable.

SIMULATION

All 81³ of S&C's nonce words were encoded in the same manner as the database items. AML's algorithm was then used to predict which past participial suffix would be chosen for each nonce word: 1st conjugation *-ato*, 2nd conjugation *-uto*, 3rd conjugation *-ito*, or an irregular past participle. Nonce words that the subjects were presented in the *io* or *noi* form were tested against the corresponding *io* or *noi* database.

² *Comparire, divertire, eseguire, inghiottire, mentire, nutrire, partire, possedere, and ripartire.*

³ S&C's study originally contained 82 test items, but one was accidentally omitted from their testing materials.

TABLE 3
Comparison of S&C's findings and AML Predictions

Response type	Condition							
	1st conj. <i>-ato</i>		2nd conj. <i>-uto</i>		3rd conj. <i>-ito</i>		Irregular	
	S&C	AML	S&C	AML	S&C	AML	S&C	AML
Similar to irreg. 2nd conj.	59	38	7	6	3	1	31	55
Similar to irreg. 3rd conj.	71	29	4	2	4	14	21	56
Similar to reg. 2nd conj.	54	45	38	36	1	8	8	6
Similar to reg. 3rd conj.	62	63	1	3	35	26	1	8
No similarity	90	82	4	2	4	7	2	9

Note. The two most frequent responses in each condition are highlighted in boldface.

Table 3 shows the percentage of S&C's test subjects who chose the past participle in each category. It also indicates the probability calculated by AML that each past participial suffix would be applied. The top two responses in each condition are highlighted in boldface.

The AML simulation mirrors the responses of S&C's subjects quite closely ($r = .838$, $p < .01$, two-tailed). In each category, the two conjugations that have the highest chance of applying are the conjugation that the nonce items rhymed with, that is, the expected conjugation, and the default first conjugation. Second, for the items that do not resemble any Italian verb, the first conjugation was overwhelmingly predicted. Third, the probability that the first conjugation will apply is high in all of the classes of nonce words. In contrast, the probability of a second or third conjugation applying to an item that is not similar to a second or third conjugation verb is quite low.

In the case of Italian, the first conjugation emerges as the default because its members are numerically superior and not as phonologically cohesive as those of the other conjugations. They are distributed throughout phonological space, while second and third conjugation stems contain many gangs of phonologically similar items. Unless a nonce word falls close to one of these gangs, the chances are that it will fall in a neighborhood of first conjugation items and receive the most analogical pull from words belonging to the default class.

Of course, the percentages resulting from the simulation and S&C's study do not coincide exactly. There may be two reasons for this. First, human performance on any sort of linguistic task always involves a degree of variability. It is entirely possible that a replication of S&C's study would yield somewhat different results. Second, the simulation could have been tweaked in a number of different ways to produce more similar results; the database could have been expanded; different variables could have been included or excluded; or a different analogical algorithm, other than AML, could have been applied. Nevertheless, such tweaking was not necessary since the purpose of the study is merely to demonstrate that a single-route approach can account for the general tendencies S&C found and that a dual-route model is not warranted.

Analogical Modeling of Language also mirrors the frequency effects to a large degree. Say and Clahsen expected nonce items resembling high frequency verbs to be more prone to adopt the conjugation of the word(s) they rhyme with when compared with low frequency items. However, frequency effects were only observed for regular second and third conjugation items, and not for irregular second conjugation nonce words. Analogical Modeling of Language reproduced the frequency effects for the regular items (see Table 4). However, it also predicted frequency effects for the irregular items. While this finding is not in accordance with the subjects' re-

TABLE 4
Comparison of S&C's Findings and AML's Predictions by Frequency^a

Condition	Frequency	1st conj.		2nd conj.		3rd conj.		Irregular	
		S&C	AML	S&C	AML	S&C	AML	S&C	AML
2nd conj. irregular	High	60	28	11	4	1	0	28	68
	Low	57	51	3	8	6	3	34	38
2nd conj. regular	High	43	27	45	54	2	13	10	6
	Low	65	71	31	20	1	3	4	6
3rd conj. regular	High	55	50	2	4	41	44	2	1
	Low	69	76	1	2	30	7	1	15

^a From S&C, 2001, Table 10.

Note. The two most frequent responses in each condition are highlighted in boldface.

sponses, it is actually the outcome that S&C predicted and were obliged to account for when it did not emerge as expected. Again, these differences may be due to subject variability or simulation factors. Further insight on this question will only be brought to light when further research is carried out.

CONCLUSIONS

Say and Clahsen discovered a dissociation between first versus second and third conjugation stems in their nonce word probe into Italian conjugations. This finding does indeed lend credence to the idea that the first conjugation is the default; however, it in no way demonstrates the existence of a rule that appends the theme vowel to first conjugation stems. Moreover, the fact that their results were also obtained via AML's single-route model casts doubt on the assumption that a dissociation necessarily implies differential processing mechanisms—an assumption which is increasingly questioned (cf. Juola & Plunkett, 1998; Paap, 1997). It also demonstrates the ability of a single-route model to determine the default.

Of course, Pinker and Prasada (1993) claim that single-route models would be unable to learn a default unless it were the numerically superior class. In the case of Italian, the first conjugation is indeed the most common, and the present study is not able to disprove their assumption. Nevertheless, Arabic has a default plural which is much less frequent than the nondefault plurals. A number of different single-route models have succeeded at modeling the Arabic plural (Nakisa, Plunkett, & Hahn, 1998; Plunkett & Nakisa, 1997).

In like manner, German has a low type frequency default plural, yet several single-route simulations, which do not explicitly differentiate between the default class and other classes, are shown to outperform a dual-route simulation (Nakisa & Hahn, 1996). In addition, the German default *-s* is thought to apply in a variety of different cases: proper names, acronyms, foreign words, and so on. Hahn and Nakisa (2000) present a study which demonstrates that the productivity of the *-s* plural varies widely when applied to different types of alleged default cases. Rule application of *-s* is simply unable to explain such variability. As far as default and type frequency is concerned, Plunkett and Marchman (1991) sum the issue up nicely by suggesting that the important factor in determining the default is not the size of the default class, but the fact that the members of the default tend to be spread throughout contextual space. Nondefault classes, on the other hand, are usually more consistent in that they contain significant gangs of members that share traits. Such is the case of Italian where gangs of similar items are found in the second and third conjugations.

It is unfortunate that the outcome of the AML simulation is negative evidence. Since both a single- and a dual-route model are able to account for the same data, the present study does not help to determine the superiority of one model over the other. Nevertheless, it does demonstrate the ability of a single-route model to account for dissociations and to determine the default class.

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