Brain and Language **76,** 202–212 (2001)
doi:10.1006/brln.2000.2397, available online at http://www.idealibrary.com on IDEAL®

# NOTES AND DISCUSSION

## Sometimes a Noun Is Just a Noun: Comments on Bird, Howard, and Franklin (2000)

Kevin Shapiro and Alfonso Caramazza

*Harvard University*

Published online January 18, 2001

Bird, Howard, and Franklin (2000) have proposed a semantic-conceptual explanation of grammatical category-specific deficits that attributes impairments in noun and verb processing to two distinct mechanisms. According to their account, apparent deficits in verb production are not category specific, but rather result from the lower imageability of verbs compared to concrete nouns. Noun deficits are said to result from differences in the distribution of semantic feature types such that damage to sensory features results in disproportionate impairments in naming nouns, especially animate nouns, compared to verbs. However, this hypothesis, which we call the ''extended sensory/functional theory'' (ESFT), fails on several counts. First, the assumption that representations of living things are more heavily freighted with sensory features than are those of nonliving objects does not have any reliable empirical basis. Second, the ESFT incorrectly predicts associations between deficits in processing sensory features and living things or functional features and nonliving things. Finally, there are numerous cases of patients with grammatical category-specific deficits that do not seem to be consistent with damage at the semantic level. All of this suggests that the ESFT is not a useful model for considering grammatical (or semantic) category-specific deficits. 

*Key Words:* category-specific deficits; nouns; verbs; sensory/functional theory.

Among the hallmarks of clinical neuropsychology are category-specific deficits, in which patients are unable to name or reason about particular categories of words (nouns, verbs, or function words) or objects (animals, artifacts, or foods) while knowledge about other, unaffected categories is broadly intact. When the category in question corresponds to a set of related objects, it seems only reasonable to assume that naming difficulties arise at the level of meaning or semantics, prior to the stages in lexical access at which information about word form and syntactic function becomes available. By contrast, there is more controversy as to the level(s) at which deficits restricted to categories relevant only in the domain of language, like nouns and verbs, might originate.

Bates, Chen, Tzeng, Li, and Opie (1991) have distinguished three broad classes of explanations for observed dissociations between noun and verb processing: grammatical explanations, semantic-conceptual explanations, and lexical explanations.

The writing of this article was supported in part by NIH Grant DC04542. We thank Albert Costa for his helpful comments.

Address correspondence and reprint requests to Alfonso Caramazza, Cognitive Neuropsychology Laboratory, Department of Psychology, Harvard University, William James Hall, Room 940, 33 Kirkland Street, Cambridge, MA 02138. Fax: (617) 496-6262. E-mail: caram@wjh.harvard.edu.



0093-934X/01 $35.00

The first group of hypotheses is centered around the correlation, observed in many patients with so-called agrammatic or Broca's aphasia, between an inability to produce fluent speech and a specific difficulty in retrieving main verbs (Miceli, Silveri, Villa, & Caramazza,1984). Many models of speech production assume that verbs play a crucial role in syntactic processing, specifying which noun arguments can occur in a sentence and how they are arranged (Bock, 1987; Garrett, 1988). Consequently, it is possible that a breakdown in processing the argument structures of sentences in agrammatism can lead to observed deficits in retrieving main verbs or vice versa (Saffran, 1982). Such ''grammatical'' explanations for category-specific deficits may yield important insights into patterns of verb production in nonfluent patients, but generally they are not equipped to account for selective noun deficits or naming deficits in fluent aphasic patients.

Semantic-conceptual explanations for grammatical category-specific deficits hinge upon the different sorts of meaning associated with nouns and verbs—that is, the idea that nouns prototypically refer to concrete objects, while prototypical verbs express reportable actions. Accounts in this class essentially reduce grammatical categories to semantic categories, assuming that mental representations of most nouns are localized in brain regions that also subserve the processing of more general semantic knowledge about concrete properties of objects—possibly in regions that have input from ''sensory association'' areas, like the inferior temporal lobe. By the same token, representations of verbs should be subserved by regions important for knowledge about actions, perhaps somewhere in the frontal cortex near motor/premotor areas. Grammatical class-specific deficits, which may not really be based on grammatical class at all, arise by dint of focal damage to these patches of neural tissue (Damasio & Tranel, 1993).

Last, there is a class of explanations which posit that lexical representations for words include features that specify their form class, or grammatical category, separate from features relating to phonology or semantics. Grammatical category information relating to nouns and verbs may be stored in different cortical areas, which can be damaged selectively following stroke or other trauma (Miceli et al., 1984, 1988; Caramazza & Hillis, 1991; Hillis & Caramazza, 1995). Lexical explanations of this sort do not depend on an association of grammatical class-specific deficits with either global syntactic difficulties (as with grammatical explanations) or problems with certain semantic categories of words (as with semantic-conceptual explanations). As a consequence, certain lexical explanations appear to be best equipped to explain cases of category-specific deficits in which the patients are fluent, or have apparently intact semantic knowledge, or both. Nevertheless, the difficulty of accounting for some such deficits by reference to semantics has not dissuaded many researchers from suggesting that all deficits that seem to be specific to one grammatical category are in fact based in the semantic system.

Bird, Howard, and Franklin (2000) propose a two-pronged semantic-conceptual account that attributes verb deficits and noun deficits to two distinct mechanisms. In fact, they regard the former as largely illusory: What appear to be deficits in verb production are not class-specific but rather are epiphenomena of the lower imageability of verbs, on average, compared to concrete nouns. Presumably, if we were to devise a naming test in which noun and verb targets were matched for imageability (as well as frequency, length, and other relevant factors), we should never find a patient significantly better at naming the nouns: as Bird and colleagues write, ''we would even go so far as to claim that true 'verb deficits' do not exist, when imageability differences between verbs and nouns are taken into account'' (p. 304). This claim is ostensibly corroborated by the naming performance of three ''verb deficit'' patients described in the article (IB, JM, and TJ), whose difficulties at producing verbs rela-

tive to nouns in confrontational picture-naming tasks are not replicated in other tasks, such as naming to definition, where noun and verb targets are matched for imageability.

Observed deficits in noun production, by contrast, are said to arise from differences in the distribution of semantic feature types. According to this explanation, the naming of nouns representing concrete objects relies more heavily on sensory features than the naming of actions, whose semantic representations are more heavily weighted with functional features. Within the category of nouns, living things depend more heavily on sensory features than do nonliving things. Therefore, damage to areas of the brain where primarily sensory features are encoded should adversely affect the naming of concrete nouns, and especially animate concrete nouns, while verb production should appear to be spared in comparison. In support of such a model, the authors present data from three ''verb spared'' patients (JS, ML, and NT), who are described as being impaired at naming living things compared to nonliving things and at retrieving sensory information about target items in a definition task.

The main theoretical assumptions behind the semantic-conceptual hypothesis put forward by Bird and colleagues are (1) that conceptual knowledge is organized in the brain in a way that distinguishes between information derived from the senses (vision, audition, olfaction, etc.), on the one hand, and functional information, on the other; and (2) that certain classes of concepts (e.g., living things and artifacts) rely more heavily on one type of information than the other. These two assumptions lie at the core of a family of related accounts, collectively dubbed the sensory/functional theory (SFT) by Caramazza and Shelton (1998), that were originally proposed to account for differences in the abilities of some aphasic patients to name living compared to nonliving things (Allport, 1985; Gainotti & Silveri, 1996; Hart & Gordon, 1992; Shallice, 1988; Silveri & Gainotti, 1988; Warrington & McCarthy, 1983, 1987; Warrington & Shallice, 1984). According to the variant proposed by Bird and colleagues, which we will call the ''extended sensory/functional theory'' (ESFT) for ease of reference, animates are regarded as the most prototypical (i.e., highly sensory-loaded) nouns. Therefore, any deficit in noun naming compared to verb naming should be accompanied by relatively greater difficulties naming living items compared to nonliving items.

In order to determine whether this and other predictions of the ESFT are likely to be correct, we need to examine more closely the theory's three basic tenets. The first concerns the architecture of the cognitive system: The ESFT assumes that the distribution of sensory and functional information is such that representations of living things include a much higher proportion of sensory information than do representations of nonliving things. These in turn must include more sensory information than do representations of actions. This assumption is obviously shared by other versions of the SFT, though a crucial problem in comparing various formulations of the model is that there is a good deal of ambiguity in what kind of information counts as functional. Bird and coworkers seem to understand the latter to include knowledge about the function of an object as well as other nonsensory information (for instance, where something is found).[1] As we shall see, however, other authors have defined functional features more strictly (e.g., Farah & McClelland, 1991).

[1] In their instructions to students asked to rate definitions of objects on a sensory/functional scale, Bird et al. characterized functional information as including ''details which are not derived from the senses if one were presented with the object out of context and had never heard of it before: knowledge about habitat, country of origin or where the object or animal can normally be found, what the object or animal is used for, in the case of animals, what its habits and nature are like, and general [sic], what we might call 'encyclopaedic' information'' (p. 289). Others have called this sort of information ''associative'' (as opposed to, e.g., ''physical,'' as in Hodges, Patterson, Graham, & Dawson, 1996),

Second, the ESFT necessarily presupposes that the distribution of conceptual knowledge described above is adequate to account for observed differences in the recognition and naming of living things and nonliving things by aphasic patients. Difficulties retrieving names of living things should be traceable to damaged representation of sensory features, while damage to functional features should result in a relatively greater inability to name nonliving things. Conversely, patients with deficits in naming living things should present with problems reasoning about sensory features even of nonliving things, and likewise patients with inanimate naming deficits should have impaired functional knowledge about living things (whatever this might mean). These are, again, claims entailed by the original SFT.

The third assumption, unique to the ESFT, is that the same distribution of conceptual knowledge can account for observed deficits in producing concrete nouns. Since the conceptual representations of both living and nonliving things, which correspond to nouns, include a greater proportion of sensory information than do representations of actions, which correspond to verbs, damage to sensory features should have the effect of making nouns in general relatively more difficult to name than verbs.

It is our intention here to show that each of these three pillars of the ESFT is fundamentally unsound and that as a consequence this hypothesis about the nature of semantic and grammatical category deficits is unsupportable. In doing so, we hope also to draw attention to the pitfalls of drawing sweeping inferences about the organization of lexical and conceptual knowledge from patterns of weakly associated deficits.

Let us begin by asking whether there is evidence to support the contention that conceptual representations of living things include a greater proportion of sensory information than do representations of nonliving things. Farah and McClelland (1991) sought empirical support for this claim, which had been presented purely as conjecture in earlier versions of the SFT (Warrington & McCarthy, 1983, 1987; Warrington & Shallice, 1984), by asking normal subjects to underline visual and functional descriptors in written definitions of living and nonliving things. In apparent agreement with the predictions of the theory, Farah and McClelland found that the ratio of visual to functional properties underlined by their subjects was much higher for living things (7.7:1) than for nonliving things (1.4:1).

However, as Caramazza and Shelton (1998) have observed, the utility of this result is seriously compromised by the actual instructions given to subjects in the study. Specifically, functional features were defined as ''words describing what the item does or what it is for'' (p. 342), a definition that accords with a strict understanding of function but is virtually inapplicable to features of living beings. Caramazza and Shelton argue that this instruction therefore contains a built-in category bias inasmuch as it excludes many important nonsensory features of animals, like where they are found, what they eat, or whether they are friendly to humans. When Caramazza and Shelton attempted to repeat Farah and McClelland's study, with instructions to underline all nonsensory features (rather than just those pertaining strictly to function), they obtained ratios of sensory to nonsensory properties of 2.9:2.5 for living things and 2.2:2.3 for nonliving things.

Indeed, studies subsequent to Farah and McClelland (1991) that have utilized a more realistic assessment of nonsensory knowledge have uniformly found little difference in the ratios of sensory to nonsensory features for living and nonliving items

---

or have regarded it as belonging to several distinct categories (see for example McRae, de Sa, & Seidenberg, 1997, whose feature categories for conceptual representations include, inter alia, ''information related to a situation in which it takes part'' and ''people's related cognitions''). To simplify matters from this point forward we refer to all of these feature types as ''nonsensory'' or ''nonperceptual.''

(McRae, de Sa, & Seidenberg, 1997; Hodges, Patterson, Graham, & Dawson, 1996).[2] Moreover, at least two studies have shown that when subjects are asked to generate spontaneous lists of features for given words, they produce nearly as many functional features (by Farah and McClelland's definition) as sensory features for both living things and nonliving things (Garrard, Lambon Ralph, Hodges & Patterson, in press; McRae & Cree, in press). Even Bird and her coworkers themselves were unable to observe any significant differences when normal subjects' definitions of names for animals and artifacts were scored by independent raters on a 7-point sensory-functional scale, in which nonperceptual information was counted as functional. The average definition of an animal received a rating of 4.03 ($SD = 1.77$), while definitions of artifacts were rated on average 3.70 ($SD = 1.74$), a score of 7 representing an ''entirely sensory'' definition.

Apparently, then, empirical tests have so far failed to corroborate the assumptions of the ESFT (and related theories) with regard to the semantic features of living and nonliving things. On the other hand, even if we disregard the available evidence and simply imagine that the distribution of semantic features conforms to the theory, it is not clear that the ESFT can account *in principle* for the core features of semantic category-specific deficits.

As we mentioned above, the ESFT predicts that patients with impaired sensory knowledge should also be impaired in tasks that require knowledge about living things. As it turns out, this is not always the case: two articles, by Coltheart et al. (1998) and Lambon Ralph, Howard, Nightingale, and Ellis (1998), have shown that at least some patients with difficulties in processing visual attributes of objects do *not* also show evidence of impaired knowledge of living things. Moreover, several recent studies have described patients with category-specific deficits for living things who are equally impaired with visual and functional attributes of living things and equally unimpaired with both attribute types of nonliving things (Laiacona, Barbarotto, & Capitani, 1993; Laiacona, Capitani, & Barbarotto, 1997; Caramazza & Shelton, 1998). This result is inconsistent with the claim that the deficit for living things results from damage to sensory knowledge.

Finally, Caramazza and Shelton (1998) have noted that SFT models have difficulties accounting for dissociations within the categories of living things and artifacts, for instance, an impairment in naming animals alongside relatively spared naming of fruits and vegetables (Hart & Gordon, 1992; Caramazza & Shelton, 1998).[3] To the extent that semantic representations of both animals and ''living inanimates'' are loaded with sensory features, we would expect deficits with these categories always to co-occur. Bird and colleagues address this problem by ''[a]ssuming that food items or living inanimates fall midway between the other categories in terms of their relative weighting of sensory and functional features'' (p. 249) and thus that knowledge about living inanimate items might be spared relative to knowledge of animals if there is only mild damage to the semantic subsystem that encodes sensory features. But this assumption is entirely ad hoc, and the authors make no apparent attempt to provide it with a rationale not driven by the requirements of the theory under consideration. More crucially, it is difficult to see how such a feature gradient can account for

[2] Two of these studies (McRae et al., 1997; Hodges et al., 1996) are in fact cited by Bird and colleagues, and their results are averaged with those of the Farah and McClelland article to obtain estimated mean sensory/functional ratios for living and nonliving things—despite the plain inequivalency in method between the three experiments.

[3] In Bird et al. (2000) and elsewhere, the term ''animate'' is used as a synonym for ''living thing.'' To avoid confusion between this definition and the alternative notion of animacy as applying only to living things that breathe or move (viz., animals), we restrict our usage to the unambiguous terms ''living,'' ''nonliving,'' ''animal,'' and ''artifact.''

patients who are able to name both artifacts and animals, but who cannot name fruits and vegetables (Hart, Berndt, & Caramazza, 1985; Farah & Wallace, 1992).

The ESFT does not fare any better when we consider whether it is adequate to explain all observed grammatical category specific deficits or at least specific deficits in noun processing. To be sure, there are some cases where such deficits may in fact be attributable to semantic factors, as Bird and colleagues postulate. One case in point is DM, described by Breedin, Saffran, and Coslett (1994), who presented with a clear ''reverse concreteness effect'': DM performed poorly on tests of semantic knowledge that relied on an ability to identify perceptual properties of objects, an impairment that might account for his superiority at producing abstract over concrete words and even perhaps an advantage for verbs over nouns. Patient RG, reported by Marshall and coworkers (Marshall, Chiat, Robson, & Pring, 1996; Marshall, Pring, Chiat, & Robson, 1996), showed similar difficulties with perceptual features of nouns coupled with an overall advantage for naming verbs compared to nouns.

At the same time, there are numerous reports in the literature of patients whose deficits in noun or verb production cannot readily be accommodated by the ESFT or indeed by any semantic-conceptual explanation of grammatical category-specific deficits, including the imageability account of verb deficits offered by Bird and colleagues. Perhaps the most striking examples in this vein are descriptions of patients with grammatical category-specific deficits restricted to only one modality of output (Caramazza & Hillis, 1991; Hillis & Caramazza, 1995; Rapp & Caramazza, 1997, 1998). The fact that these patients were all able to produce verbs in either written or spoken form, but not both, suggests that the locus of the grammatical class effect in these cases is at the lexical, not the semantic, level.

Bird and colleagues attempt to confront this problem by suggesting that a basic semantic disorder may have different types of expression in different output modalities or in production as opposed to comprehension. However, the study they cite in support of this position (Gainotti, Silveri, Daniele, & Giustolisi, 1995) does not necessarily contradict the hypothesis of a deficit at the lexical level, as is claimed.

Gainotti and colleagues (1995) refer to the cases of two patients with verb deficits due to degenerative disease, GG and RA, who were first reported by Daniele, Silveri, Giustolisi, and Gainotti (1993). One of these patients, RA, had a verb deficit confined to writing that later emerged in oral production. Gainotti et al. attribute this pattern to disruption at the semantic level because they consider it ''unlikely that during the progression of a disease the same pattern of deficit may develop independently with the same characteristics in different lexical modalities'' (Gainotti et al. (1995), p. 251). Whether this is assessment is fair or not, it certainly does not seem much more likely, a priori, that damage at the semantic level should affect naming in only one modality of output, a possibility for which neither Gainotti et al. (1995) nor Bird et al. (2000) offer any plausible mechanism. It is perhaps just as probable that damage originally compromising stored orthographic representations later spread to affect phonological word forms and still later semantic-conceptual knowledge.

Even in patients with degenerative diseases we must be able to account in a principled way for the deficit observed at any given stage. In other words, while changes in a patient's performance over time are of course of great interest, we are still faced with the task of explaining how the momentary abnormalities in a patient's neural circuitry—unstable though they may be—might give rise to specific disruptions in the ability to produce certain kinds of words. One might argue that RA's deficit was apparent only in writing at early stages of the disease because written naming is a more difficult task than spoken naming. However, this explanation would hardly be adequate for a patient like HW (Caramazza & Hillis, 1991), whose problems with verbs were restricted to oral production in several different tasks conducted over

numerous testing sessions. In theory, such a pattern of performance could be explained by a ''two-hit'' hypothesis, that is, by positing a selective disruption of modality-specific (but not category-specific) lexical representations along with damage at the semantic level. At the same time, it is hard to see how to reconcile the hypothesis that there is any damage at the semantic level with the observation that HW's spoken production of verbs was not merely relatively unimpaired, but virtually flawless: HW made no semantic errors in oral verb naming, compared to a 63% error rate in written naming. Likewise, patient SJD (Caramazza & Hillis, 1991), who made errors on 50% of responses in one written verb naming task, did not make any errors in the spoken version of the same task.

Even if Bird et al. were somehow able to explain some modality-specific deficits by invoking the possibility that underlying semantic problems may have different manifestations in different modalities, they would still face problems accounting for patient EBA (Hillis & Caramazza, 1995), who produced more errors on nouns than verbs in spoken output tasks, but showed greater impairment for verbs than nouns in written word comprehension and lexical decision tasks. This case poses formidable obstacles for both the imageability account of verb deficits and the ESFT with regard to noun deficits inasmuch as EBA presents with *both* kinds of deficits in different modalities.

Perhaps recognizing the limitations of hypotheses that locate the source of selective noun and verb deficits in the semantic system, Gainotti and coworkers (1995) suggest that modality specific impairments might also be explained by the anatomical and functional disconnection of semantic representations from their lexical counterparts. As Rapp and Caramazza (1997) have discussed, this hypothesis is indistinguishable from that of damage at the level of lexical representations—so long as one assumes (as Gainotti and colleagues do) that the semantic system is organized in a way that at least partially mirrors the distinction between nouns and verbs. Thus, for example, if the semantic features of action words are represented primarily in anterior brain regions, while those of words for objects are represented in more posterior regions, a deficit in producing spoken verbs in response to pictures of actions might result from either a disconnection between anterior regions and the area where lexical-phonological representations are stored or a disruption at the level of the lexical representations themselves.

It is not so clear, however, that a disconnection account can be made to accommodate the type of model that Bird and colleagues have proposed, especially with respect to patients who are impaired with verbs. (Indeed, Bird et al. do not pursue such an explanation, postulating damage only at the semantic level itself.) This is because, according to their hypothesis, verb deficits arise not from damage to specific semantic feature types, but rather from mild to moderate damage diffused throughout the semantic system. Verbs are said to be more difficult to retrieve when the system is lesioned in such a way because they generally have fewer semantic features than nouns (this, according to Bird et al., is what is meant by low ''imageability''), not because they are selectively disrupted. We are therefore unable to say *what* would have to be disconnected from a given lexicon in order to engender a modality-specific verb naming effect, unless it is the entire semantic system.

Bird and colleagues do consider the possibility that deficits in verb naming might result from damage specifically to functional features of words. However, they are led to abandon this line of reasoning in part by the results of a statistical model, which showed that verb deficits co-occur with impaired naming of nonliving objects only when functional features are almost obliterated. Why their model should depend on such a co-occurrence in the first place is somewhat unclear: the authors themselves acknowledge that the putative link between verbs and nonliving things is not explic-

itly supported by any empirical evidence. Bird et al. cite the case of Sacchet and Humphreys's (1992) patient CW, who had a category-specific deficit for artifacts and whose speech sample ''shows a marked lack of verbs'' (p. 255); this is at least not inconsistent with the postulated association. On the other hand, patient JJ (Hillis & Caramazza, 1991), who presented with an impairment in naming nonanimals compared to animals, did not appear to show any difficulty whatsoever with verbs and was able to provide very articulate definitions of animal names.[4] The ESFT does not appear to be adequate to account for JJ's performance, since it holds that any damage sufficient to impair the naming of nonliving objects should impair verb production in even greater proportions.

There are still other reported patterns of aphasic performance that call into question the explanatory adequacy of the ESFT/imageability account. As we have seen, Bird and colleagues propose that noun/verb differences for ''verb spared'' patients should disappear when the nouns and verbs used in a task are equivalent with respect to sensory features (e.g., when the items are not pictureable).[5] However, patient JR (Shapiro, Shelton, & Caramazza, 2000), who fits Bird's ''verb spared'' profile, did not show any effect of concreteness or imageability in his naming of object pictures. JR was much better at producing verbs than nouns in both confrontation naming and sentence generation tasks and seemed to have marked difficulty using nouns in different syntactic contexts. Strikingly, in a task that required him to complete semantically empty sentence frames (like ''This is a . . .'' or ''Every day, they . . .'') with morphologically appropriate forms of supplied pseudowords, JR had problems producing pseudowords used as nouns compared to the same pseudowords used as verbs. Given that a pseudoword like *wug* is unlikely to have any stored sensory features, and almost certainly none that pertain to nouns rather than verbs (or the other way around), it is hard to see how JR's inability to produce specifically nominal pseudowords can be reconciled with the ESFT.

We have seen that the three fundamental claims of the ESFT do not hold up to careful scrutiny. First, the assumption that representations of living things are more heavily freighted with sensory features than are those of artifacts does not have any reliable empirical grounding, calling into question the entire enterprise of modeling semantic and grammatical category-specific deficits in terms of the differential distribution of sensory and functional features. Even if we were to ignore this problem, however, we would still be faced with the fact that the ESFT incorrectly predicts associations between deficits in processing sensory features and living things or functional features and nonliving things. Finally, there are numerous cases of patients with grammatical category-specific deficits that defy explanation under semantic-conceptual models, including one patient with noun and verb deficits restricted to different modalities and another whose problems with nouns extend to words with no discernible semantic content. All of this suggests that the ESFT is not a particularly useful model for considering grammatical (or semantic) category-specific deficits.

This is not to say that semantic-conceptual explanations in general, and sensory/

[4] Even JJ's inaccurate definitions of inanimate objects were syntactically well formed and evinced no sign of difficulties with verbs. For example, he described a bench as follows: ''A device you sit on, about 12 inches high with 4 legs. It revolves you around while sitting. Can be made of metal or wood.''

[5] It should be noted that the patients described by Bird et al. as ''verb spared'' do not, for the most part, display deficits in noun production (ML is a possible exception). Bird and colleagues claim that true deficits in noun production are ''rare'' (p. 304), though in fact such deficits are extensively documented in the literature (Miceli et al., 1984, 1988; Zingeser & Berndt, 1988, 1990; Bates et al., 1991; Daniele et al., 1992, 1993, 1994; Miozzo et al., 1994; De Renzi & di Pellegrino, 1995; Rapp & Caramazza, 1997, 1998; Damasio & Tranel, 1993; Silveri & di Betta, 1997; Robinson, Rossor, & Cipolotti, 1999; Shapiro, Shelton & Caramazza, 2000).

functional theories in particular, have no place in accounting for deficits in noun or verb naming. It is possible that a similar hypothesis might explain *some* cases of grammatical category specific deficits (if not, perhaps, those cases described in the paper). It would appear, however, that Bird and colleagues do not confine themselves to this limited claim:

> We believe that these data point to a single cause for the relative difficulties in retrieval of both grammatical and semantic categories *for the patients assessed here.* We have proposed the [sic] inanimate/animate distinction is in part due to weighting of functional and sensory information and in part due to the semantic representations of animate items' [sic] having features with a greater tendency to overlap or 'cluster.' If our assertion is true, *this entails that supposed 'grammatical class' effects arise at the level of semantics and not at a lexical level.* (p. 301; emphasis added)

Unfortunately, the authors do not offer us any clue as to how they might justify the logical leap from accounting for the constellation of deficits observed in their patients to proposing that ''supposed'' grammatical class effects arise at the level of semantics in other patients described in the literature, many of whom present with markedly different patterns of impairment. As an alternative, we suggest the possibility, indeed the probability, that there is no single account adequate to explain all instances of noun and verb deficits in aphasia. Rather, it is likely that deficits in some patients [like DM (Breedin et al., 1994) and RG (Marshall et al., 1996a, 1996b)] may arise at the semantic-conceptual level, while for others [like JR (Shapiro et al., 2000) and EBA (Hillis & Caramazza, 1995)] impairments in retrieving nouns and verbs may be more truly categorical in nature. Still other patients may present with verb retrieval deficits that stem from problems in constructing sentences. We are apt only to confuse matters by trying to shoehorn the diverse range of phenomena described as category-specific deficits into one explanatory rubric.

## REFERENCES


Allport, D. (1985). Distributed memory, modular subsystems and dysphasia. In S. Newman & R. Epstein (Eds.), *Current perspectives in dysphasia.* Edinburgh, UK: Churchill–Livingstone.

Bates, E., Chen, S., Tzeng, O., Li, P., & Opie, M. (1991). The noun–verb problem in Chinese. *Brain and Language,* **41,** 203–233.

Bird, H., Howard, D., & Franklin, S. (2000). Why is a verb like an inanimate object? Grammatical category and semantic category deficits. *Brain and Language,* **72,** 246–309.

Bock, K. (1987). An effect of the accessibility of word forms on sentence structures. *Journal of Memory and Language,* **26,** 119–137.

Breedin, S., Saffran, E., & Coslett, H. (1994). Reversal of the concreteness effect in a patient with semantic dementia. *Cognitive Neuropsychology,* **11,** 617–660.

Caramazza, A., & Hillis, A. (1991). Lexical organization of nouns and verbs in the brain. *Nature,* **349,** 788–790.

Caramazza, A., & Shelton, J. (1998). Domain-specific knowledge systems in the brain: The animate-inanimate distinction. *Journal of Cognitive Neuroscience,* **10,** 1–34.

Coltheart, M., Ingris, L., Cupples, L., Michie, P., Bates, A., & Budd, B. (1998). A semantic subsystem specific to the storage of information about the visual attributes of animate and inanimate objects. *Neurocase,* **4,** 353–370.

Damasio, A., & Tranel, D. (1993). Nouns and verbs are retrieved with differently distributed neural systems. *Proceedings of the National Academy of Sciences of the United States of America,* **90,** 4957–4960.

Daniele, A., Giustolisi, L., Silveri, M., & Gainotti, G. (1992). Anatomo-functional correlations in patients with category-specific deficits for grammatical word classes. *Journal of Clinical and Experimental Neuropsychology,* **14,** 396.

Daniele, A., Silveri, M., Giustolisi, L., & Gainotti, G. (1993). Category-specific deficits for grammatical classes of words: Evidence for possible anatomical correlates. *Italian Journal of Neurological Science,* **14,** 87–94.

Daniele, A., Giustolisi, L., Silveri, M., Colosimo, C., & Gainotti, G. (1994). Evidence for a possible neuroanatomical basis for lexical processing of nouns and verbs. *Neuropsychologia,* **32,** 1325–1341.

Farah, M., & McClelland, J. (1991). A computational model of semantic memory impairment: Modality specificity and emergent category specificity. *Journal of Experimental Psychology: General,* **120,** 339–357.

Farah, M., & Wallace, M. (1992). Semantically-bounded anomia: Implications for the neural implementation of naming. *Neuropsychologia,* **30,** 609–621.

Gainotti, G., & Silveri, M. (1996). Cognitive and anatomical locus of lesion in a patient with a category-specific semantic impairment for living beings. *Cognitive Neuropsychology,* **13,** 357–389.

Gainotti, G., Silveri, M., Daniele, A., & Giustolisi, L. (1995). Neuroanatomical correlates of category-specific semantic disorders: A critical survey. *Memory,* **3,** 247–264.

Garrard, P., Lambon Ralph, M., Hodges, J., & Patterson, K. (in press). Prototypicality, distinctiveness and intercorrelation: Analyses of the semantic attributes of living and nonliving concepts. *Cognitive Neuropsychology.*

Garrett, M. (1988). Processes in language production. In F. Newmeyer et al. (Eds.), *Language: Psychological and biological aspects. Linguistics: The Cambridge survey,* Vol. 3. Cambridge, UK: Cambridge Univ. Press.

Hart, J., Berndt, R., & Caramazza, A. (1985). Category-specific naming deficit following cerebral infarction. *Nature,* **316,** 439–440.

Hart, J., & Gordon, B. (1992). Neural subsystems for object knowledge. *Nature,* **359,** 60–64.

Hillis, A., & Caramazza, A. (1991). Category-specific naming and comprehension impairment: A double dissociation. *Brain,* **114,** 2081–2094.

Hillis, A., & Caramazza, A. (1995). Representation of grammatical categories of words in the brain. *Journal of Cognitive Neuroscience,* **7,** 396–407.

Hodges, J., Patterson, K., Graham, N., & Dawson, K. (1996). Naming and knowing in dementia of Alzheimer's type. *Brain and Language,* **54,** 302–325.

Laiacona, M., Barbarotto, R., & Capitani, E. (1993). Perceptual and associative knowledge in category specific impairment of semantic memory: A study of two cases. *Cortex,* **29,** 727–740.

Laiacona, M., Capitani, E., & Barbarotto, R. (1997). Semantic category dissociations: A longitudinal study of two cases. *Cortex,* **33,** 441–461.

Lambon Ralph, M., Howard, D., Nightingale, G., & Ellis, A. (1998). Are living and non-living category-specific deficits causally linked to impaired perceptual or associative knowledge? Evidence from a category-specific double dissociation. *Neurocase,* **4,** 311–338.

Marshall, J., Pring, T., Chiat, S., & Robson, J. (1996a). Calling a salad a federation: An investigation of semantic jargon. Part 1—Nouns. *Journal of Neurolinguistics,* **9,** 237–250.

Marshall, J., Chiat, S., Robson, J., & Pring, T. (1996b). Calling a salad a federation: An investigation of semantic jargon. Part 2—Verbs. *Journal of Neurolinguistics,* **9,** 251–260.

McRae, K., de Sa, V., & Seidenberg, M. (1997). On the nature and scope of featural representations for word meaning. *Journal of Experimental Psychology: General,* **126,** 99–130.

McRae, K., & Cree, G. (in press). Factors underlying category-specific semantic deficits. In E. Forde & G. Humphreys (Eds.), *Category specificity in brain and mind.* East Sussex, UK: Psychology Press.

Miceli, G., Silveri, M., Villa, G., & Caramazza, A. (1984). On the basis for the agrammatic's difficulty in producing main verbs. *Cortex,* **20,** 207–220.

Miceli, G., Silveri, M., Nocentini, U., & Caramazza, A. (1988). Patterns of dissociation in comprehension and production of nouns and verbs. *Aphasiology,* **2,** 351–358.

Miozzo, A., Soardi, M., & Cappa, S. (1994). Pure anomia with spared action naming due to a left temporal lesion. *Neuropsychologia,* **32,** 1101–1109.

Moss, H., Tyler, L., Durrant-Peatfield, M., & Bunn, E. (1998). Two eyes of a see-through: Impaired and intact semantic knowledge in a case of selective deficit for living things. *Neurocase,* **4,** 291–310.

Rapp, B., & Caramazza, A. (1997). The modality-specific organization of grammatical categories: Evidence from impaired spoken and written sentence production. *Brain and Language,* **56,** 248–286.

Rapp, B., & Caramazza, A. (1998). A case of selective difficulty in writing verbs. *Neurocase,* **4,** 127–140.

Robinson, G., Rossor, M., & Cipolotti, L. (1999). Selective sparing of verb naming in a case of severe Alzheimer's disease. *Cortex,* **35,** 443–450.

Sacchet, C., & Humphreys, G. (1992). Calling a squirrel a squirrel but a coanoe a wigwam: A category-specific deficit for artefactual objects and body parts. *Cognitive Neuropsychology,* **9,** 73–86.

Saffran, E. (1982). Neuropsychological approaches to the study of language. *British Journal of Psychology,* **73,** 317–337.

Shallice, T. (1988). Specialisation within the semantic system. *Cognitive Neuropsychology,* **5,** 133–142.

Shapiro, K., Shelton, J., & Caramazza, A. (2000). Grammatical class in lexical production and morphological processing: Evidence from a case of fluent aphasia. *Cognitive Neuropsychology,* **17,** 665–682.

Silveri, M., & di Betta, A. (1997). Noun-verb dissociations in brain-damaged patients: Further evidence. *Neurocase,* **3,** 477–488.

Silveri, M., & Gainotti, G. (1988). Interaction between vision and language in category-specific impairment. *Cognitive Neuropsychology,* **5,** 677–709.

Warrington, E., & McCarthy, R. (1983). Category specific access dysphasia. *Brain,* **106,** 859–878.

Warrington, E., & McCarthy, R. (1987). Categories of knowledge: Further fractionations of an attempted integration. *Brain,* **110,** 1273–1296.

Warrington, E., & Shallice, T. (1984). Category specific semantic impairments. *Brain,* **107,** 829–854.

Zingeser, L., & Berndt, R. (1988). Grammatical class and context effects in a case of pure anomia: Implications for models of language production. *Cognitive Neuropsychology,* **5,** 473–516.

Zingeser, L., & Berndt, R. (1990). Retrieval of nouns and verbs in agrammatism and aphasia. *Brain and Language,* **39,** 14–32.