Slipping on superlemmas

Multi-word lexical items in speech production*

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Only relatively recently have theories of speech production concerned themselves with the part idioms and other multi-word lexical items (MLIs) play in the processes of speech production. Two theories of speech production which attempt to account for the accessing of idioms in speech production are those of Cutting and Bock (1997) and superlemma theory (Sprenger, 2003; Sprenger, Levelt, & Kempen, 2006). Much of the data supporting theories of speech production comes either from time course experiments or from slips of the tongue (Bock & Levelt, 1994). The latter are of two kinds: experimentally induced (Baars, 1992) or naturally observed (Fromkin, 1980). Cutting and Bock use experimentally induced speech errors while Sprenger et al. use time course experiments. The missing data type that has a bearing on speech production involving MLIs is that of naturally occurring slips. In this study the impact of data taken from naturally observed slips involving English and Dutch MLIs are brought to bear on these theories. The data are taken initially from a corpus of just over 1000 naturally observed English slips involving MLIs (the Tuggy corpus). Our argument proceeds as follows. First we show that slips occur independent of whether or not there are MLIs involved. In other words, speech production proceeds in certain of its aspects as though there were no MLI present. We illustrate these slips from the Tuggy data. Second we investigate the predictions of superlemma theory. Superlemma theory (Sprenger et al., 2006) accounts for the selection of MLIs and how their properties enter processes of speech production. It predicts certain activation patterns dependent on a MLI being selected. Each such pattern might give rise to slips of the tongue. This set of predictions is tested against the Tuggy data. Each of the predicted activation patterns yields a significant number of slips. These findings are therefore compatible with a view of MLIs as single units in so far as their activation by lexical concepts goes. However, the theory also predicts that some slips are likely not to occur. We confirm that such slips are not present in the data. These findings are further corroborated by reference a second smaller dataset of slips involving Dutch MLIs

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(the Kempen corpus). We then use slips involving irreversible binomials to distinguish between the predictions of superlemma theory which are supported by slips involving irreversible binomials and the Cutting and Bock model's predictions for slips involving these MLIs which are not.

Phrasal lexical items[1] (PLIs) and compounds as lexical units

Observations of slips of the tongue have suggested that all and only linguistic units are involved in slips. This being so, "slips may involve units that vary in size from phonetic features, through phonemes, clusters, syllables, morphemes, words, phrases, and even clauses" (Dell & Reich, 1980, p. 274). They may therefore not involve the random exchanges of phoneme sequences across indeterminate stretches of discourse; no slips invert the order of large sequences of syllables or words. Levelt (1989, pp. 186–187) notes that "speakers have, over and above a stock of words, stocks of phrases and idioms. … We will assume that idiomatic collocations are entries in the mental lexicon". We will term such items "phrasal lexical items" (PLIs).[2] However, PLIs have played little part in theories of speech production until recently (Levelt, 1989, p. 187).[3]

PLIs have been extensively studied as linguistic units.[4] Their linguistic properties can thus be noted. The review below is based on the literature. The reason for doing so in the scope of this study is that any of these properties may be a factor in speech production involving PLIs. Since PLIs are lexical items we will concentrate on their idiosyncrasies. PLIs may have idiosyncratic phonological representations (Aijmer, 1996, pp. 14–15). For example, some PLIs with negatives conventionally have the negative contracted as in *Don't rock the boat*, cf. *Do not rock the boat*. Some have idiosyncratic intonation contours. For example, the formula *Dinner's ready* is often given with the call tune contour (Ladd, 1978).[5]

PLIs may have idiosyncratic phrase structural properties.[6] They must contain a lexicalized constituent; one where the lexical content of the constituent is given in the lexical entry of the PLI. For example, in the *let alone* construction discussed by (Fillmore, Kay, & O'Connor, 1988), the words *let alone* are lexicalized constituents of the construction. Some PLIs contain single words (bound words) that occur only within a PLI. For example, *take umbrage at* contains the word *umbrage* that cannot occur freely, and occurs in no other PLI (Moon, 1998a, p. 21). Some PLIs contain slots in their syntactic representation which require to be filled with other constituents but which are not filled in the representation of the item in the lexicon. For example, in the PLI *take NP to task*, the NP is an obligatory complement of the verb that must be filled for the phase to be used grammatically but the lexical content of the NP is not given in the lexical entry of the PLI (Lyons, 1969).

Some of these slots may be restricted in arbitrary ways. For example, some empty argument positions must be filled with animate or human NPs when that is not a semantic requirement of the verb of which the NP is a subject or complement, i.e., not the result of the selection properties of the verb (Chomsky, 1996, p. 54). For example, the object of *take* in *take NP for a ride* must be human. The subject of *blow hot and cold* must be human. Other types of slot restrictions might cover pronominal and anaphor antecedent relations. For example, the NP in *get NP's goat* cannot be co-referential with the subject of *get*.

Some PLIs have optional constituents that may or may not be used. They are part of what the speaker knows when s/he knows the PLI but their use is optional. For example, in the English PLI *breathe one's last breath* the final noun is optional; speakers can and do just say *breathe one's last*. Note that optional constituents are not adjuncts that may be added freely. The form of words is particular and is part of what native speakers know of the PLI. In some PLIs there appears to be more than one lexical item capable of functioning in the same position. To *be in a bad mood* is equivalent to *being in a bad temper*. It seems that *mood* and *temper* function as alternatives as last noun in this PLI. But there are no other possible nouns here that are known as part of knowing the PLI.[7] These two thus constitute a selection set. Selection sets only occur where the PLI is semantically and pragmatically equivalent regardless of which member of the set is used.

Some PLIs will take freely inserted adjunct constituents, what Abeillé (1995, p. 19) calls "the optional insertion of free modifiers". Others will not. For example, one can get annoyed or get very annoyed but one cannot conventionally modify the dismissive PLI *Get lost!* to *Get very lost!* in this way, although the insertion of an expletive is possible as it is with many such dismissive PLIs, e.g., the British vernacular English *Sling your hook*.[8]

PLIs have greater or lesser degrees of syntactic flexibility under movement, supposing a theory of syntax that allows movement. Nunberg, Sag, & Wasow (1994) suggest that the degree of frozenness may have to do with the degree of semantic compositionality. Classically, the PLI *kick the bucket* will not passivize.[9] However, as Abeillé (1995, p. 18) suggests, it is an empirical matter as to what an individual PLI will undergo. She asserts (Abeillé, 1995, p. 18) that "[f]rozenness is the exceptional case". In the case of both modifiability and flexibility, note needs to be taken of those facts which are part of the speaker's knowledge of the properties of the PLI and the speaker's ability to break these constraints for humorous or rhetorical effect in what Meľčuk (1995) terms "'artistic' deformation". Part of the effect is to be found in the speaker's knowledge of the conventional constraints on PLIs.

Some PLIs are restricted collocations (RCs). For example, if one wishes to use a bus as a means of public transport, one is said to catch the bus and then get on the bus. One does not trap the bus or get in the bus. RCs involve the preferential

selection of word combinations where such combinations are partly arbitrary. They may also be idiomatic, i.e. not semantically compositional. *Catching the bus* is, in some sense idiomatic but *getting on the bus* could be seen quite literally to be placing one's feet on the floor of the bus or oneself on its seats. *To the best of one's abilities* is what English speakers say rather than *at the best of one's abilities*. In terms of their semantic properties neither preposition is preferable. Both create semantically well-formed and appropriate compositional meanings in this construction. Yet one is lexicalized as a RC. The other is not. Cowie (1998, p. 16) points out these restrictions are between lexemes and not word forms.[10]

Occasionally, a PLI is syntactically ill-formed. For example, *by and large* is ill-formed because a preposition and an adjective are coordinated.[11]

The following semantic properties seem significant for understanding PLIs. If the meaning of the whole PLI is a compositional function of the meaning of its constituent parts then it is fully compositional. Thus PLIs with this property will have all the possible meanings available from the semantic interpretation of the senses of their constituents. For example, the checkout farewell *Have a nice day* is fully compositional but is a PLI. A lexical item which is non-compositional, i.e., in which the meaning of the whole is not a predictable semantic function of its constituents words is idiomatic. However, a PLI may be partially compositional when it does not have all the possible readings that the phrase has as a freely generated structure. For example, a political party could be a social occasion that is political, but in its lexicalized form it is an organization which functions to select and have elected members of a legislature. This is one of the possible compositional meanings of *political party*, but only one, given that *party* is polysemous. It is thus selectively compositional. This appears to be an independent property of some PLIs.

In some PLIs one of the words has an idiomatic sense, that is, a sense that it does not have elsewhere. For example, in *foot the bill* the word *foot* has a specialized meaning it has only in this PLI (Moon, 1998a, p. 21).[12] However, in some PLIs more than one word has a sense that it has only in the PLI. For example, a *red herring* is neither *red* nor a *herring*, i.e., both words have senses they have nowhere else except in construction within this PLI (Weinreich, 1969).

It is important in the discussion of the semantic properties of PLIs clearly to differentiate these from the syntactic properties of the same PLI. The work of Mel'čuk, as exemplified in work such as Mel'čuk (1995, 1998) makes it clear that PLIs can, in many cases, be seen as mapping semantic predicates idiosyncratically onto verbs or prepositions for individual arguments. So, using Mel'čuk's examples, the business of *carrying out* the action on a complement with the head noun *support*, the conventional verb is *lend*, while *carrying out* resistance is lexicalized as *put up*. Here the heads of phrase appear to be semantically specialized while their complements have their normal meaning. In the case of subjects and verbs, similar

specializations can be found. Nights fall, war rages, silence reigns. Here again the verbs appear to be specialized. Such collocatory specialization also appears with adjectives and their head nouns. There are *heavy smokers, artesian wells*, and *rancid butter*. Here the head is semantically unspecialized while the adjunct is specialized. All these are RCs.

The functional properties of PLIs, those relating to conditions of use, also yield sources of idiosyncrasy. A formula is a PLI with contextually restricted conditions of use. For example, *I'm sorry* is a PLI which is used to offer an apology. Speech act theory provides examples of formulae and subclassifications of types of usage conditions. However this is just a beginning. Every small-scale ritual tends to be accompanied by formulae: cabin crew on aeroplanes use them, *What would you like to drink, Sir/Madam?* Flight crew use them: *This is your captain speaking*. Various taxonomies are mentioned in the literature on PLIs, all of them being relatively arbitrary.

It is sometimes thought that all formulae are propositional, but this is not so. Many formulae are VPs or Vbars. So, for example, in sport announcer talk (Ferguson, 1983) the subject position is usually unlexicalized, as are the tense and aspect. For example, in the PLI *take a brilliant catch*, any fielder in a cricket game could be the subject.[13] The formula is normally in the present tense in play-by-play commentary but in colour commentary it might be in the past or have perfective aspect as commentators recall the event.[14] The fact that such formulae require subjects is a syntactic and not a lexical fact. But the function of a particular formula may be highly restricted, e.g., *move to the free throw line*.

There are probably as many functional taxonomies as one cares to make up and their level of generality is various. Gläser (1986), for example, has 15 subtypes including greetings, farewells, congratulations, well-wishings, warnings etc. Aijmer (1996) concentrates on four: thanks, apologies, requests and offers, and discourse markers. Other categories include proverbs and gambits. Proverbs are PLIs which are used to provide (moral or folkloric) support for an argument or action by reference to a generalized proposition (Cram, 1983). The study of proverbs has its own field in folklore studies, paremiology (Mieder, 1993). Gambits are PLIs used as a conversational marker peg for changing direction, indicating agreement and so on (Keller, 1981). They are PLIs which act as discourse markers.

We have outlined the linguistic properties of PLIs at some length because theories of speech production which assume that PLIs play a role in speech production are subject to Cutler's observation (Cutler, 1980, p. 67) that "[t]here appears to be a kind of Murphy's Law of speech errors that states: There is no component or stage in the production of a sentence but an error can occur there". We take this to mean that slips of the tongue can occur at all and only linguistic levels and effect all and only linguistic units. That being the case, any of the properties of PLIs that

we have outlined above may play a role in slips of the tongue involving PLIs. We will show later that this is the case.

By contrast with the properties of PLIs, the properties of compounds as lexical items are dealt with extensively in the basic literature in morphology (e.g., Marchand, 1969; Spencer, 1991). For our purposes we suppose that compounds are structurally binary, that their constituents are words, and that all existing compounds have a degree of semantic idiosyncrasy (Badecker, 2001; Kuiper, 1999), i.e., they are idiomatic. For example, speakers of English know more about a hard disk than just that is a disk which is hard and more about a truck driver than that (s)he is someone who drives a truck since not all those who drive trucks are truckdrivers.

Accessing the phrasal lexicon

A psycholinguistic theory about the processes that underly the production of MLIs must always also be a theory about the structure of the so-called *mental lexicon*. The mental lexicon is — among other things — a repository of the words (or morphemes) that form the building blocks of spoken utterances. According to Levelt (1989), the lexicon can be seen as an essential mediator between conceptualization on the one hand and grammatical and phonological encoding on the other. MLIs as a unit of processing must somehow be accommodated into this network of representations. Because theories of language production differ with respect to the exact structure of the lexicon (e.g., Dell, 1986; Levelt, 1989; Levelt, Roelofs & Meyer, 1999), these differences are reflected in the different theories of how MLIs are represented and processed by the speaker.

In terms of language production research, MLIs can be considered rather large units of processing, because they can extend across multiple words and phrases. MLIs as production units have not been studied in great detail. However, there do exist two models of MLI production that each have tried to reconcile the idiosyncrasies of MLIs with state-of-the-art language production theories. Both models are essentially *hybrid* models (Stemberger, 1995, p. 174) that try to explain how a unitary meaning representation for a complete MLI can translate into various degrees of lexical and syntactic flexibility. We will now briefly discuss these models and the experimental evidence which supports them.

PLI production models

Both idiom production and idiom comprehension theories have to solve the paradox inherent in idiomatic language use: we say things that, in a strict sense, we do not mean, but this usually does not confuse our listeners (Sprenger, 2003, p. 80). However, production and comprehension theories face different problems: the

speaker has to choose words that do not refer to the concept s/he intends, whereas the listener has to deal with two competing interpretations (i.e., a literal and a figurative one). Both problems must be solved by the same network of representations. This section discusses and compares two models of the representation of idioms within the mental lexicon, those of Cutting and Bock (1997), Sprenger (2003) and Sprenger et al. (2006).

Cutting and Bock's (1997) model is based on experimentally elicited speech errors combining two different idioms, or idiom blends. Blends in general are viewed as the result of two competing speech plans that interfere with one another. Sprenger et al.'s (2006) model is based upon error-free production of idioms and literal phrases, where reaction times were measured. Both theories argue idioms have their own lexical entry that refers to a lexical concept. However, this lexical entry involves the same single word representations that are used in literal speech. For example, the production of the idiom *skating on thin ice* refers to a dangerous situation, which in its idiomatic reading has nothing to do with sports or winter. Nonetheless, the idiom's representation does contain representations of the words *skate*, *thin* and *ice*. Words can thus be accessed either via their own lexical concept or via the idiom representation.

Both models agree on these aspects of idiom representation. They differ, however, in another aspect, that of the idiom's syntactic representation.

Cutting and Bock (1997)

To explore the syntactic and semantic components of idioms and the factors that constrain idiom errors, Cutting and Bock performed three experiments involving induced idiom errors. The motivation to employ a controlled error-elicitation procedure is their belief that "idiom blends occur too rarely in spontaneous speech to reveal much about how idioms are represented and processed in production" (Cutting & Bock, 1997, p. 59).

To explore the representational factors that constrain idiom errors, in particular of their meaning and syntax, Cutting and Bock focused on idiom blends. They assumed that constraints on idiom errors might reflect fundamental features of the idiom representation. If idioms are lexicalised phrases without internal syntactic and semantic structure, then the structure and literal meaning of competing idioms should not affect production (p. 59). On the other hand, if the representation of an idiom consists of both structure and meaning, then idioms blends involving PLIs are expected to respect the structures and meanings of the competitors. In the experiments, speakers were presented with two alternative production targets and were asked to reproduce only one of them while under time pressure. Cutting and Bock's three different experiments varied the features of the phrases involved.

The results of the first experiment show that idioms with identical syntactic structures are more likely to blend than those with different syntactic structures, and idioms from pairs with similar figurative meanings are more slowly reproduced than idioms from pairs with different meanings. Furthermore, 93% of the substituted words are of the same grammatical class as the word that they replaced, which suggests that production is sensitive to an idiom's internal syntactic properties. Cutting and Bock conclude that idiomatic representations include syntactic information and that they obey a grammatical class constraint. The production of idiomatic blends is sensitive to both internal syntactic structure and to the figurative meaning of the idioms involved.

The second experiment investigated whether the literal meaning of an idiom is active during its production. If idiom production is independent of literal meaning, then there should be no influence of an idiom's literal meaning on the production of idiom errors. If, however, the literal meaning does play a role in the use of an idiom, there is likely to be some interference from the literal-meaning similarity in the production of errors.

The results of this experiment show that literal-meaning similarity between an idiom and a literal phrase (e.g., *hold your tongue* and *grab your lip*) produces as many errors as does figurative-meaning similarity between two idioms (e.g., *hold your tongue* and *button your lip*). The majority of the errors occur on content words and almost all blends obey the grammatical class constraint. Furthermore, the figurative phrases are produced faster than the literal phrases. Cutting and Bock conclude that these findings provide evidence that the literal meaning of an idiom is active during its production.

The third experiment tested the idiom decomposition hypothesis (Nunberg, 1978), i.e., whether decomposable idioms are syntactically more flexible than non-decomposable ones. Decomposable idioms are those in which individual parts are thought to contribute meaning to the whole, making them syntactically flexible and modifiable (e.g., *The strings that John was able to pull seemed to be the right ones for getting the job*). Since the decomposable idioms may be less rigidly encoded in the lexicon than non-decomposable ones, the former (e.g. *hold your tongue*) are predicted to be more susceptible to the production of idiom blends than the latter (e.g. *chew the fat*).

Contrary to findings in language comprehension (Gibbs, Nayak, & Cutting, 1989), the predicted differences in error rates did not materialise. This suggests that the lexical representations of decomposable and non-decomposable idioms are the same when they enter the production process, and that the components of decomposable and non-decomposable idioms are accessed similarly during production. Figure 1 gives Cutting and Bock's resulting production model. It offers an explicit framework for explaining how the production of idioms proceeds. Idioms

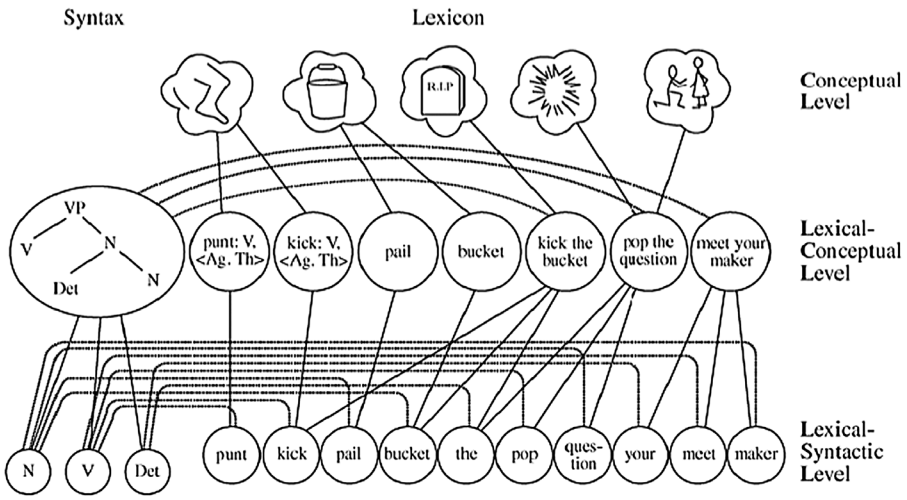

Figure 1. Cutting and Bock model for the activation of idioms.

are assumed to be compositional. They are phrases with internal syntactic and semantic components, rather than lexicalised chunks comparable to large single words. The model distinguishes between syntax and the lexicon; the syntax consists of a set of rules that create a structural frame with grammatically categorised slots while the lexicon consists of interconnected nodes for linguistic units such as concepts, words, morphemes, phonemes, as well as idioms. Idioms are represented in the lexicon as wholes, by their own lexical-concept nodes. In addition to their connections with the general conceptual system, lexical-concept nodes are associated with syntactic representations. In the case of idioms, the lexical-concept node is associated with a phrasal node (e.g., a verb phrase), not with a single grammatical category (e.g., a verb); the idiom thus retains structural information in its lexical representation. An idiom's lexical-concept node is also associated with lexical nodes that correspond to its component parts. Hence, the representation of an idiom like *kick the bucket* is associated with a phrasal node in the syntactic part of the system, as well as with the individual lexical entries *kick*, *the* and *bucket*.

According to Cutting and Bock this model predicts that the increase in error production in idiom pairs with the same figurative meaning can be interpreted as a consequence of competing similar conceptual representations, which create more competition than dissimilar conceptual representations. Likewise, the increase in error production that occurs when the idiom is paired with a semantically similar but literal phrase is taken to be the result of the association of the lexical-conceptual level of two words with similar literal meanings (e.g., *pail* and *bucket*). Their model also accounts for the increase in blending errors for idioms that have the same syntactic form; these idioms share the same syntactic representation.

Superlemma theory (Sprenger et al., 2006)

Cutting and Bock's hybrid model of idiom production is largely based on experimentally induced speech error data. However, a theory of idiom representation can also be complemented with data that show the pathway of activation during normal speech production. To this end Sprenger et al. performed two sets of experiments. The first set tested the predictions of Cutting and Bock's model, namely are fixed expressions in the mental lexicon composed of individual lemmas, and if so, are these lemmas the same ones that are involved in the production of a literal phrase? The second set of experiments investigated whether the literal word meanings of the constituent words of an idiom also become active during idiom production.

Lexical access during idiom production. Sprenger et al. (2006) first set of experiments tests Cutting and Bock's model's predictions for error-free speech production within a reaction time paradigm. If the simple lemmas involved in idiom production are the same ones as those involved in the production of compositional phrases, then it is expected that these lemmas could be activated by means of priming. Priming is known to be able to activate the representation of a word and to speed up access and consequently production. For example, priming *road* in the phrase *clean the road* by means of the word *road* itself is expected to result in shorter production latencies than priming with an unrelated word (p. 165). Similarly, if simple lemmas are involved in idiom production, then a similar effect of identity priming is expected to be found for the production of the idiom *hit the road* as well. However, in their experiment, Sprenger et al. predicted a stronger facilitation from the identity prime in the case of idioms, because hearing the word *road* activates the lemma *road*, which in turn activates the proposed lexical entry for *hit the road*. Consequently, all lemmas that belong to the idiom will become more active, and therefore easier to access. In contrast, the priming effect of a literal phrase, *clean the road*, was expected to be smaller, because there is no common lexical entry that binds the word *clean* to *road.* Thus, production of the word *clean* cannot profit from spreading activation.

These predictions were supported by the results of a cued-recall experiment, in which participants produced idiomatic and literal phrases in response to visually presented stimuli. Priming occurred for both types of phrases, but was stronger in the case of idioms. The authors conclude that the individual words that constitute an idiom are accessed separately during production, and that they are bound together by a common representation in the mental lexicon that enables spreading activation to all its component parts.

A second experiment used a cloze procedure to show that the production of a PLI can be primed by means of words that are semantically related to one of its constituent words, supporting the hypothesis that PLIs activate individual lemmas

that are not unique to the PLI. Thus, an individual lemma in the mental lexicon can be activated either from its own lexical concept node or from an idiom of which it forms a constituent.

A third experiment employed a reversal of the second. Here participants who were embarked on the production of an idiom with a cloze gap, were asked to read out loud a visually presented word which was semantically related or unrelated to the target word in the PLI. Significant priming effects showed that even when used within the context of an idiom, individual words activate their own semantic network. That is, a speaker who produced the idiom *get out of hand* will also activate the literal word meaning of the word *hand*.

Sprenger et al. conclude that the three experiments confirm the hybrid model of idiom representation as formulated by Cutting and Bock (1997): idioms are both unitary and compositional, be it at different levels of processing. Idioms have a unitary idiomatic concept that points to individual lemmas that together constitute the idiom, but which are not exclusively bound to an idiomatic meaning. In, for example, the idiom *he hit the road,* 'he left', the same lemma *road* is active as in the production of the literal phrase *he cleaned the road*. It is the source of activation of the lemma *hand* that differs in the two cases. Boosting the activation of *road* with an identity prime influences the activation of all the remaining elements of the idiom *he hit the road*, as opposed to only one of the elements of the literal phrase (Sprenger et al., 2006).

So far, Sprenger et al. and Cutting & Bock agree. However, Sprenger et al. argue that Cutting and Bock's model is underspecified with respect to its syntactic processing assumptions. Since syntactic idiosyncrasies are one of the defining features of idioms, as we indicated earlier, Sprenger et al. provide an alternative model of idiom production that specifies the way by which the syntactic information of an idiom is activated and which is given in Figure 2. In this model, each idiomatic expression is assumed to be represented in the lexicon by a lemma of its own, called a superlemma (SL). These SLs represent the syntactic properties of idiomatic expressions including, presumably, all of the potential syntactic idiosyncrasies described earlier (Sprenger et al., 2006). An idiom is represented by only one lexical concept (e.g., the lexical concept of *kick the bucket* is DIE). The activation of this concept will result in the activation of its SL *kick the bucket*. Co-activated SLs are assumed to compete in the same way in their lexical selection as co-activated Ls. The probability of the target SL being selected from the mental lexicon is according to Luce's ratio, the ratio of the SL's degree of activation and the total activation of all Ls (both SL and simple Ls) in the lexicon. The syntactic constraints that are associated with an idiom become available to the production system with the selection of a SL. The selected SL fixates the set of simple Ls that are to be selected in the subsequent processing steps, again based on Luce's ratio.

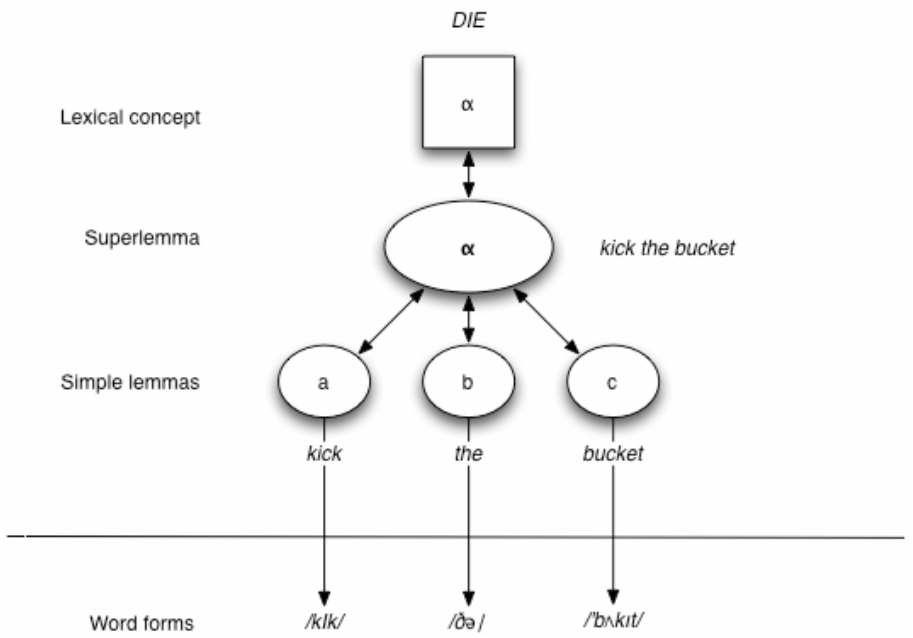

Figure 2. Diagrammatic representation of superlemma activation.

SLs specify the grammatical and syntactic relations between the actual lemmas involved in the idiom, which can be characterised as a (phrasal) function over some set of simple lemmas.

Cutting and Bock (1997) versus superlemma theory

Both Cutting & Bock's and Sprenger's models predict that idioms have their own lexical entry in terms of a lexical concept, which is somehow linked to the simple lemmas that make up the idiom. The data of both sets of experiments, one involving elicited idiom blends and the other the reproduction of idiomatic phrases, provide evidence that idioms are both compositional and non-compositional at the same time, at different levels of processing. However, the SL model differs from the Cutting and Bock model in one aspect: the way in which the syntactic representation of an idiom is theorised. Cutting and Bock assume that idiomatic concepts activate phrasal frames that are not bound to specific lemma representations (Sprenger et al., 2006). They provide a phrase structure with open slots that can be filled with the simple lemmas that are activated by the idiom's lexical concept node. Sprenger et al. argue that this is straightforward in the case of a phrasal VP frame with open slots for only a noun and a verb like *kick the bucket*, but when an idiom contains two NPs, it is unclear how the system knows in which slots these NPs are to be

inserted. Since Cutting and Bock's phrasal frame is an abstract syntactic structure that is blind to the relationship between concepts and active lemmas, there is no way for the production system to know what the speaker intended. For example, for the idiom *to be a wolf in sheep's clothing*, the nouns *wolf* and *sheep* could be inserted in either one of the open noun slots, making *a wolf in sheep's clothing* and *a sheep in wolf's clothing* equally likely (Sprenger et al., 2006, p. 177). We will show later that there are significant predictions here for naturally occurring slips of the tongue.

Additional syntactic constraints must be assumed to account for this position marking within the phrasal frame approach of Cutting and Bock. It is also not clear how Cutting and Bock would account for the many kinds of syntactic idiosyncrasies we outlined earlier. Cutting and Bock's phrasal frames appear to be general phrase structural frames. While most idioms have syntactic representations of this kind, they also have many other properties which would not necessarily fit comfortably in a generalized frame.[15]

With SL theory, these problems do not arise. The syntactic relationships and constraints that characterise an idiom are directly applied to the lemmas involved; no additional operation is required. Hence, the SL model offers a theoretical alternative for the Cutting and Bock model and entails a more precise description of idiom representation by spelling out its syntactic nature in more detail. Also, the superlemma model can more easily be accomodated with a model of the mental lexicon that serves both production and comprehension needs at the same time (Sprenger et al., 2006).

The corpora of naturally occurring slips involving PLIs

Our test of the models of speech production outlined above uses two new datasets of naturally observed slips of the tongue: one is an English dataset, the Tuggy dataset, and one a Dutch dataset, the Kempen dataset. We will not rehearse here the problematic nature of naturally observed slips but see Cutler (1982) and Stemberger (1992). Suffice it to say that naturally observed slips can play a useful role testing the theories outlined above, regardless of any selectional arbitrariness in the manner in which they became a member of the dataset as is suggested by Stemberger (1992).

The data used in the studies of Cutting and Bock, and Sprenger et al. are explicitly restricted to idiomatic PLIs. The data sets outlined and utilised below are not as restricted. They include non-idiomatic restricted collocations and, in a few cases, compounds.[16] In this respect these datasets provide richer testing for the hybrid models outlined above.

There is reason to suppose that compounds might be subject to the same kinds of representation and activation as PLIs. For example Badecker (2001, p. 363)

provides experimental evidence on the production of compounds that the activation of compounds must involve "an intermediate representation between the conceptual/semantic representation and lexeme, i.e., the lemma". This sounds rather like the superlemma representation but for compounds. We will later suggest reasons why non-idiomatic PLIs may also have superlemma representations.

The Tuggy dataset

The Tuggy dataset is probably the largest existing naturally observed collection of slips of the tongue involving MLIs. With about 1000 observations, this set bypasses the caveat of Cutting and Bock given earlier that "idiom blends occur too rarely in spontaneous speech to reveal much about how idioms are represented and processed in production".

The data were collected by David Tuggy of the Summer Institute of Linguistics. The initial data set consisted of speech errors of many kinds but the majority involved MLIs since this was Tuggy's main interest.

The data had been coded as it was collected by Tuggy for later analysis. The relevant fields used were:

a. the slip
b. the slip in its verbal context
c. guesses as to its target(s) gained from context and inferred speaker's intent
d. analysis as to type of slip
e. comments including if the slip was written or made by non-native speakers
f. domain such as 'travel'
g. who produced the slip
h. date of the observation

Not all data were coded for the (e)–(f) parameters.

Size of data set

The initial data set consisted of 1820 data items. After coding and deletion of slips not clearly related to the production of MLIs, the data set for analysis was reduced to 1008.

MPI coding

The data were imported into a Filemaker PRO database for further analysis. Three layouts were constructed. The first contained all the data in the Tuggy fields and no others. The second contained all the Tuggy fields and further fields as follows:

a. Search domain equivalence. Here the question was whether the targets of either word or phrasal blends had a close semantic or pragmatic relationship such as near synonymy or polarity.
b. Output grammar. Here the question was whether a slip was syntactically well-formed or not. The basis of the distinction was whether the phrase structure was a possible English phrase structure given the words of the slip. Where word blends leading to possible but non-existing words were involved, appropriate inflections were taken as a diagnostic.
c. Output lexis. Here the question was whether the slip created well-formed word(s) or not, and whether it created existing words or not.
d. Overlap. This field was to be coded only if there was a phrasal blend involved. It was coded as 'yes' if there was a word or superlemma common to the two targets.
e. Three sets of fields followed for analysis of the error type.
    i. was devoted to substitutions, and indicated the slip, target and domain (lexical phrasal, phonological, other) as well as an analysis as to relationships between the slip and the target (lexical, phonological, semantic, other)
    ii. was devoted to lexical or phrasal blends and indicated the slip, targets and domain. If the blend was phrasal it was coded for whether the phrases were restricted collocations or idioms. Word blends remained in the data set only if they were within a MLI.
    iii. was devoted to other possible analyses including other substitution possibilities, exchanges, perseverations or anticipatory slips, additions, deletions, truncations or omissions, morphological or phonologically-based slips.
f. A notes section allowed coders to list comments of any kind. *Novel uses* (usually as indicated by Tuggy's analysis), were noted. *Complex* slips that involved more that one mechanism (rather than just alternative analyses) were noted. *Syntax errors*, such as agreement errors, were noted where these were errors which might occur normally and did not involve MLIs. If two freely generated expressions, i.e., non-MLIs, appeared to have been blended, this was noted as an *alternative blend*. Data regarded as not being relevant for the analysis of slips involving MLIs were noted as *delete record*.[17]

The data were initially coded in 1999 over a three month period by four coders.

Initially a set of 50 slips was coded by all four coders. After discussion and re-coding together to reconcile differences, a further set of 200 were coded this way and variation was reduced to a low level. The targets noted by Tuggy were normally used.

Thereafter the four coders each coded 400 more slips. These were allocated in sets of one hundred seriatim through the remaining 1600 slips.

The coding was checked in 2003 for the following factors:

1. consistency across the coders,
2. deletion from the dataset for analysis of:
   cases marked for deletion,
   cases marked as novel use,
   cases marked as 'complex',
   cases marked as syntax errors,
   cases noted by Tuggy as involving non-native speakers,
   cases which did not clearly involve an MLI, such as word blends where the word was not a constituent of an MLI,
   cases of written slips.

Coding was further altered or augmented when:

1. there seemed to be an additional plausible analysis which was not given in the initial analysis,
2. a plausible MLI had not been recognised as a potential target.

Checking was done twice. First, all the data analyses were examined datum by datum. Second, the data were sorted parameter by parameter and the search parameter was checked for consistency of application. For example, the search for whether the output was lexically well-formed was checked in one run. The criterion for this was whether the output was phonologically and/or morphologically a possible word.

Coding was finally rechecked in 2004 for mechanical errors.

The Kempen data set of Dutch slips involving MLIs

This corpus of about 180 slips of the tongue was collected by Gerard Kempen of the University of Leiden and the Max Planck Institut für Psycholinguistik.[18]

Testing the models

We now employ a deductive technique to test the speech production theories of both Cutting and Bock, and superlemma theory. Both theories make predictions about the way in which spreading activation involving idioms might give rise to slips of the tongue. Recall that slips of the tongue are predicted to occur when more than one possible course of action presents itself during the activation of nodes

which are in association with one another. Recall also that normally the monitor component of Levelt's speech production model filters out any malformed utterance before it is articulated (Levelt, 1989, pp. 13–14). However, occasionally the monitor slips up resulting in slips of the tongue.

What slips are therefore predicted to occur as a result of the activation patterns when MLIs are activated in speech production? First we would expect all the types of slip which occur in case no MLI were activated also to occur when a MLI *is* activated. This is because, as far as their linguistic properties are concerned, MLIs are associated with a lexical concept, with a sequence of constituent lemmas each of which is, in turn, associated with a lexical concept; each of which also has morphological and phonological structure as an independently occurring lemma in the mental lexicon. Thus we expect to find at all the relevant levels of linguistic representation and all the kinds of slips which have been previously identified namely anticipations, perseverations, exchanges, deletions, insertions and blends. The relevant data are to be found in Tables 1–18.

We would also expect to find a second set of slips which occur because an MLI has been activated. When a lexical concept associated with a superlemma is activated, different kinds of slip become possible. First, when a superlemma and a lemma both associated with related lexical concepts compete, this competition can give rise to substitution slips where the lemma is substituted for one of the constituent lemmas of the superlemma. Second, two superlemmas may be associated with related lexical concepts giving rise to substitutions and phrasal blends. Third, leak back from a constituent lemma of a superlemma can activate a related lemma which can substitute into the superlemma. Fourth, leak back from a constituent lemma of one MLI to a second MLI of which it is also a constituent can give rise to substitutions and blends involving the second superlemma. Finally, it is possible that a compositionally constructed phrase can activate a superlemma associated with the compositional lexical concept of the completed phrase giving rise to blends or perseverations. Slips resulting from these activation patterns are documented in Tables 19–25.

We will interrogate the Tuggy data to see if the predicted slips occur in reasonable numbers. Common to both theories to be tested is the hypothesis of the duality of structure we mentioned above. MLIs are both single units in having a single lexical concept, and decomposable units which consist of independently occurring words. We have, for the most part, given only a sample of the available instances. Not all are clear cases. In a number of instances more than one analysis is plausible. Our aim therefore is to see whether the predicted slips occur in the databases we interrogate. We make no claims about the frequency of occurrence of the MLIs we find in these slips. Searches for frequencies of PLIs are fraught with problems. See (Altenberg, 1998; Moon, 1998b). Nor do we make predictions as to the frequency

of occurrence of the slips in our data (although we will draw a few tentative conclusions on general frequencies later). The set of predictions relating to the unitary and compositional nature of MLIs do not require such predictions. Furthermore the models we are testing make no predictions about the frequency of slips arising from the activation patterns resulting from the activation of an MLI.

Slips involving the activation of lemmas

All the slips in this section are predicted to occur by both Cutting and Bock and superlemma theory on the basis of the hypothesis that MLIs consists of the lemmas they consist of and regardless of whether those lemmas are constituents of an MLI. In all these cases, they are constituents of an MLA but the slips are predicted to occur regardless of that fact. We show that the normal taxonomy of slips is represented. In this section we present data in the following way. Unit levels are presented from largest to smallest: phrasal, lexical, morphological, phonological. Slip types are in the following order: anticipations, perseverations, exchanges, deletions, insertions, malapropisms, blends, and finally a table showing slips involving bound words. The significance of these slips should be clear. Since bound words occur only within MLIs any slip involving them solely as words is of interest.

General slip type: Anticipation slips (Tables 1–3)

Table 1. Lexical Anticipations

Nr.	Slip	Anticipation	Target
55	as business as usual	*as* … as	–
440	the end-all and end-all	*end* … end	be

Table 2. Morphological Anticipation

Nr.	Slip	Anticipation	Target
88	at the tops of your lungs	-s	top
920	both in the literative and figurative sense	-ative	-al

Table 3. Phonological Anticipation

Nr.	Slip	Anticipation	Target
22	adorish and cherish your wives	ish	–

General slip type: Perseveration slips (Table 4)

Table 4. Lexical Perseveration

Nr.	Slip	Perseveration	Target
147	bent way back bentwards	… bent	back
1033	never say never die	… never	–

General slip type: Exchanges (Tables 5–7)

Table 5. Phrasal Exchanges

Nr.	Slip	Exchange	Target
1330	rubbing it in our noses	rubbing it in our noses	rubbing our noses in it
1456	stand something to gain	stand something to gain	stand to gain something

Table 6. Lexical Exchanges

Nr.	Slip	Exchange	Target
702	head with the chicken cut off	head … chicken …	chicken … head …
730	hitch your star to his wagon	… star … wagon	…wagon … star
1054	nose up your finger	nose … finger	finger … nose
1756	which hand breads my butter	… breads … butter	… butters … bread
1104	on the outlook	outlook	look out
1460	start on us	on us	us on

Table 7. Phonological Metatheses

Nr.	Slip	Exchange	Target
1211	preceive to be the case	preceive	perceive[19]
551	freath of bresh air	freath … bresh	breath … fresh

General slip type: Deletions (Tables 8–11)

Table 8. Phrasal Deletions

Nr.	Slip	Deletion location	Target
150	best of mice and men	the best — of mice and men	the best laid plans of mice and men
606	get twisted	get — twisted	get my arm twisted
640	going in a handbasket	going — in	going to hell in a hand-basket
	that's just the iceberg	just … the iceberg	the tip of the iceberg

Table 9. Lexical Deletions

Nr.	Slip	Deletion location	Target
477	fall from	fall — from	falls out from
932	long short of it	long — short	long and short
1745	what the world!	what … the world	what in the world

Table 10. Morphological Deletions

Nr.	Slip	Deletion location	Target
380	don't do anything rational	…rational	irrational
592	get our head together	head…	heads
664	guilt conscience	guilt…	guilty

Table 11. Phonological Deletions

Nr.	Slip	Deletion location	Target
30	alieve the anxiety	alieve…	alleviate
434	eke out[20]	…eke	leak
734	hold on like your life ends on it	…ends	depends
812	irratial behavior	irra…tial	irrational
1285	where we can reet you	/t/…	/tch/

General slip type: Insertion slips (Tables 12–16)

Table 12. Phrasal Insertions

Nr.	Slip	Insertion	Target
167	bite the hand of the ox that feeds you	of the ox	bite the hand that feeds you

Table 13. Lexical Insertion[21]

Nr.	Slip	Insertion	Target
330	curious as to know why	as	curious to know why
449	every periodical time	periodical	every time
558	from the groundwork up	groundwork	ground
725	hit me home	hit me home	hit home
733	hold down the fort	hold down the fort	hold the fort

Table 14. Morphological Insertion

Nr.	Slip	Insertion	Target
352	deserve you right	de-	serves
397	down-to-earthy	-y	earth

619	getting his heads together	-s	head
800	initional phases	-on-	initial
974	many a times	-s	time

Table 15. Phonological Insertion

Nr.	Slip	Insertion	Target
579	get growing in this branch	/r/	going
877	last-grasp[22]	/r/	gasp
983	a memoriable occasion[23]	/i/	memorable

Table 16. Malapropisms

Nr.	Slip	Insertion	Target
122	be the brunt of the jokes	brunt	butt
340	dead balloon	dead	lead
392	down in the grumps	grumps	dumps
497	feel under the water	water	weather
533	fly off your rocket	rocket	rocker

General slip type: Lexical blends

Word blends are expected to occur when a word within a PLI activates a related word. Such blends occur.

Table 17. Lexical Blends

No	Context	Word blend	Target 1	Target 2
258	There's always a chancibility that they will …	chancibility	chance	possibility
626	The prognosis is pretty glim	glim	gloomy	grim
741	horms of locusts	horms	hordes	swarms
765	He does this impressionation of Mr. Shawver	impressionation	impersonation	impression

The types of slips exemplified above show that utterances containing MLIs can be the source of the same kinds of slips as are found in utterances that do not contain MLIs. This in turn shows that MLIs are simply phrases consisting of words (and further phrases) and, as such, are subject to predictable errors of execution. This is very clear when we look at slips involving bound words. One might expect that such words would not be involved in slips of the tongue since they are not words in the Bloomfieldian sense of being minimum free forms. However, slips involving such manqué words do occur.

Table 18. Slips Involving Bound Words

Nr.	Substitution		Blend		
	Slip	**Target**	**Slip**	**Target 1**	**Target 2**
424	eyesight	sight	be within eyesight	be within *earshot*	eyesight
715			here, there and *yon*	here and there	*hither* and *yon*
731			hither, to and *fro*	*hither* and *yon*, *hither* and *thither*	to and *fro*
1335	havoc	*roughshod*	run havoc	wreak havoc	run *roughshod* over
1375			sets her off on her *dander*	sets her off	gets her *dander* up
1389	*kaboodle*	match	the whole shooting *kaboodle*	the whole shooting match	the whole kit and *kaboodle*
1662	unbeknowingst	*unbeknownst*			

All cases are grammatical in that none of the insertions or blends misrecognizes the syntactic category of the bound word. Its meaning may also be recognized. In slip 424 the speaker appears to know that being within earshot is very much the same kind of thing as being within sight of something but has to do with hearing, even though *earshot* only exists within the PLI *be within earshot*. Even the morphology of a stem within a bound word is identified in slip 1662 when a permissible affix is added to *know*.

These slips strongly suggest that MLIs may be normal phrases in so far as speech production processes are concerned, since even the bound words in them are subject to slips of predictable kinds. This corroborates the findings of Nooteboom (1999, p. 4) that "the very fact that we find both lexical and phonological errors in stock phrases, and that the kinds of errors are not different from those we find in free expressions, convincingly shows that much computation is going on, both on the grammatical and phonological level in preparing stock phrases for articulation."

An additional prediction of the hypotheses we are exploring is that the relative frequency of the different types of lemma-based slip as between those occurring in free expressions and in and around MLIs would be more or less the same.[24] There are two major reasons why the data at hand make such a comparison difficult. Other corpora of slips of the tongue than ours do not usually distinguish those utterances which contain MLIs from those which do not. They would need to be recoded for that purpose as Nooteboom (1999) has done with his Dutch corpus. Second, when an utterance contains an MLI, analyses become available which

are not available when the utterance consists only of free expressions. We will see below that when an utterance contains an MLI, this leads to many cases where alternative analyses present themselves. Frequently there is no way to resolve this ambiguity and thus comparison between slips in utterances of the two different types becomes problematic.

MLIs and slippage

MLIs are, however, not just phrases. They are lexicalized and as such we suppose, along with Cutting and Bock, and Sprenger et al., that they are activated as a result of the activation of a single lexical concept. We will use superlemma theory to demonstrate this, since this model makes clear predictions about the ways in which activation might facilitate the making of slips of the tongue. The activation patterns involving superlemmas, as we suggested earlier, are predicted to produce a number of different types of slip of the tongue. Two major sources of competition are predicted to occur. More than one lexical concept may be activated, resulting in competition between their respective lemmas or superlemmas. Furthermore, the selection of a superlemma may activate a competitor through leak back between lemmas and their individual lexical concept. Superlemma theory predicts that such slips will occur. It will be shown that the resulting theoretically predicted taxonomy of slips is exemplified by sets of actual slips in the Tuggy data set.

The organisation in this data presentation is different from that in the previous section because here we are using the activation of a superlemma as the motivating activation for the slip.[25]

Type 1 slips. Type 1 slips are the result of both a superlemma and an individual word lemma being activated by related lexical concept nodes. This can result in

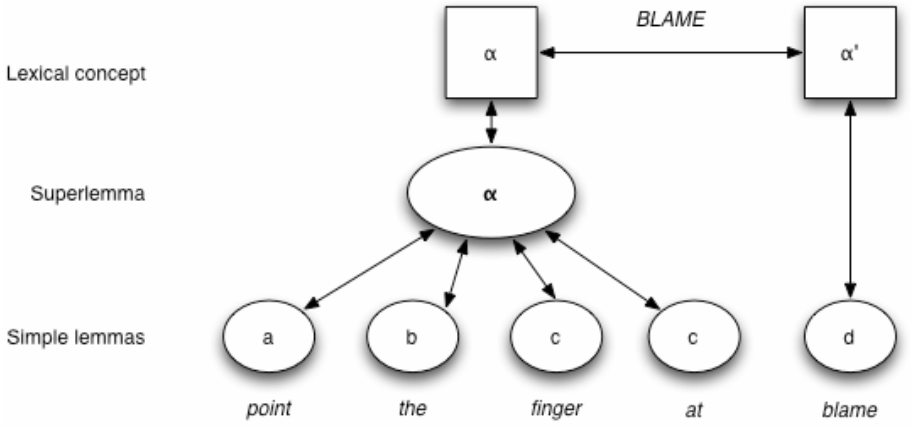

Figure 3. Joint activation of a superlemma and a lemma from related lexical concept nodes.

substitutions of single words by near synonyms of the MLI. These are the clear cases.[26]

The activation pattern that is responsible for slips of this kind can be seen in Figure 3.

Table 19 shows a set of slips that have the predicted insertion of a single word near synonym of a superlemma into the body of the superlemma.

Table 19. Type 1 Slips

Nr.	PLI with slip	Insertion	Target
171	blame the finger at	blame	point
277	coast on your laurels	coast	rest
651	green behind the ears	green	wet
913	like furious	furious	crazy
977	matter of frank	frank	fact
1047	no time soon	soon	flat

Type 2 slips. Type 2 slips are predicted to occur when two related lexical concepts both activate superlemmas. When that happens there are two possible outcomes: either the two superlemmas will be blended in some way, or a constituent lemma from one superlemma will be substituted for a lemma in the other superlemma. The predicted activation pattern responsible such slips is shown in Figure 4.

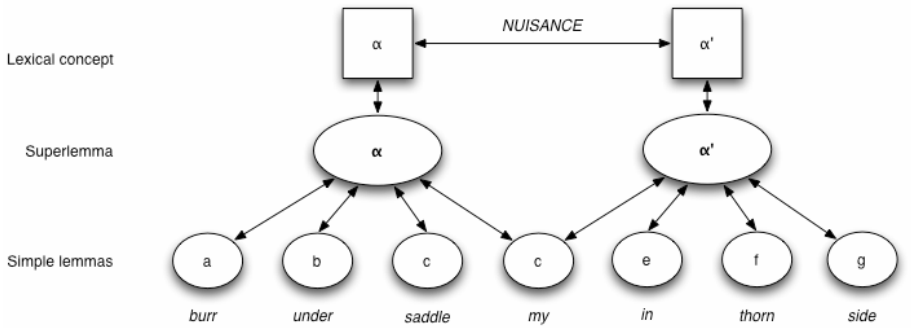

Figure 4. Joint activation of two superlemmas from related lexical concept nodes.

Table 20 shows slips where blending of two superlemmas appears to have taken place. The source lexical concepts are near synonyms or functionally related, such as both being greetings. The alternative analysis of a substitution is also shown.

Type 3 slips. When a superlemma is activated, its constituent lemmas are consequently activated as well. Since leak back to each constituent lemma's lexical concept is possible, this leak back can, in turn, activate other lemmas with closely related lexical concepts. This situation is shown diagrammatically in Figure 5.

Table 20. Type 2 Slips

Nr.	Blend slip	Substitution		Blend	
		Slip	Target	Target SL1	Target SL2
1554	take NP under her hand	under	in	take NP under her wing	take NP in hand
1559	talks to my heart-strings	talks	tugs	talks to my heart	tugs at my heart-strings
1563	tell the whole picture	picture	story	tell the whole story	give the whole picture
1578	by the seat of my tail	tail	pants	by the seat of my pants	by the tail
1595	at this time of hour	hour	day	at this time of day	at this hour of the day
1597	be a thorn in my saddle	saddle	side	be a thorn in my side	be a burr under my saddle

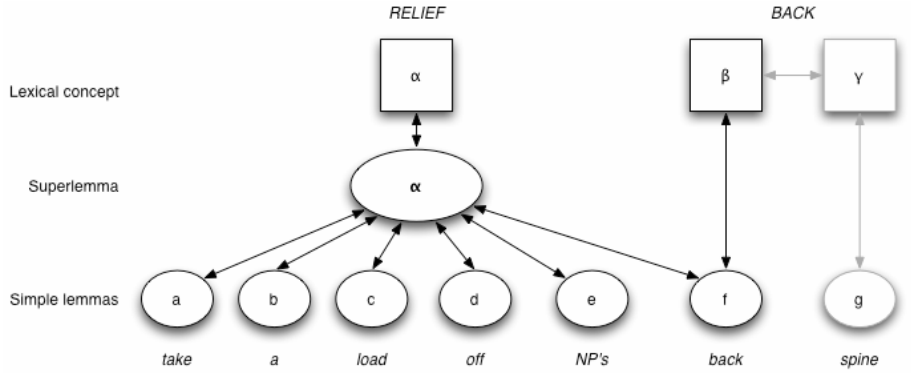

Figure 5. Activation of an lemma 2 via leak back from a constituent lemma 1 of a superlemma.

When that happens, substitution slips can again be in evidence. Here the diagnostic property is that the 'intruder' lemma has a lexical concept related not to the whole MLI but to one of the lemmas in the MLI.

This activation pattern gives rise to a number of slips with the predicted property, namely a close relationship between the lexical concept of the intruder and that of one of the lemmas of the source superlemma into which it has been substituted. Such slips are shown in Table 21.

Table 21. Type 3 Slips

Nr.	PLI with slip	Substitution	Target
81	at each other's necks	necks	throats
238	can't put my foot on it	foot	finger

264	chicken with its hair cut off	hair	head
516	fingernail sketch	fingernail	thumbnail
654	grope with the issues	grope	grapple
926	load off my spine	spine	back

Type 4 slips. For these slips, the activation of a constituent lemma of a superlemma will activate other superlemmas of which it is also a constituent lemma. Activation of this type of slip is not by means of the lexical concept of a second superlemma but directly because the two superlemma share a constituent lemma. We are thereby assuming that all lemmas that are constituents of a superlemma allow for these associated superlemmas to be activated. Such an activation pattern is illustrated in Figure 6.

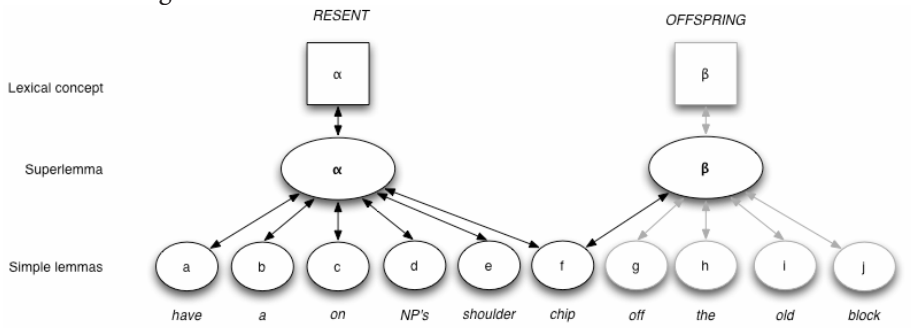

Figure 6. Activation of a superlemma 2 by means of leak back activation of a constituent lemma common to superlemma 1 and superlemma2 where the lexical concept node of the lemma and superlemma 2 are not related.

Again, slips with the predicted property are in evidence in the data set. As with type 3 slips, some of these will be substitutions of lemmas of the second MLI into the first; others will be blends of the two superlemmas. Again, it is an open question for some of these cases whether they are substitutions or blends. Nothing follows from this analytic ambiguity for our test of the superlemma theory, since both are predicted to result from activation pattern 4.

Type 4 substitutions and blends are to be found in Table 22.

Type 5 slips. Here a superlemma is activated on the basis of a compositionally produced structure sharing semantic/pragmatic properties with an MLI. For this to happen the speaker is creating incrementally a structure that has a compositional meaning. At a particular point, this meaning is closely related to the lexical concept of an MLI that is consequently activated. Two kinds of slips can be expected: substitutions from the superlemma into the compositional structure, and whole or parts of the superlemmas being inserted into/onto the end of a compositional structure. The diagnostic property for such cases is that the superlemma and an

Table 22. Type 4 Slips

Nr.	Slip	Substitution		Blend	
		Slip	Target	Target SL1	Target SL2
163	go out for a bite of fresh air	bite	breath	go out for a bite (to eat)	go out for a breath of fresh air
213	burn that bridge	burn	cross	burn NP's bridges behind NP	cross that bridge when we come to it
266	have a chip on his block	block	shoulder	have a chip on his shoulder	be a chip off the old block
410	drive a stake between	stake	wedge	drive a stake into	drive a wedge between
848	keep your ear to the grind-stone	ear	nose	keep your ear to the ground	keep your nose to the grindstone
887	lay NP's cards on the line	line	table	lay NP's cards on the table	lay NP on the line
897	in the left blue yonder	left	wide	in the wide blue yonder	out in left field

earlier non-MLI structure share a similarity in meaning or pragmatic function. Cutting and Bock's experimentally induced slips contained such cases. Such cases are not common and their analytic status is doubtful, but there are a few possible cases in the data set as is shown in Table 23.

Table 23. Type 5 Slips

Nr.	Slip	Target 1 (compositional)	Target 2 (SL)
56	as conclusion	as a conclusion	in conclusion
1591	many things have hap-pened under the bridge	many things have hap-pened	much water has passed under the bridge
1732	wear NP on	wear NP	have NP on
127	beat me over a stick	beat me with a stick	beat me over the head
424	be within eyesight	eyesight	be within earshot

Word blends again

Further evidence for the bivalent nature of MLIs comes from word blends within MLIs. Sometimes the words that are blended are both members of a selection set. Blends of this kind are found in Table 24.

Table 24. Blends of Words From the Same Selection Set

No	Context	Word blend	Target 1	Target 2	PLI with selection set
547	Now that we've laid that foundwork, we can begin the discussion.	foundwork	groundwork	foundation	lay the groundwork/ foundation
1262	They're trying to railrod it through	railrod	railroad	ramrod	try to railroad/ramrod NP through
1346	[on edge of a cliff] I was scared stiffless!	stiffless	stiff	shitless	be scared stiff/shitless
1385	I just wanted to know for shirtain (suretain)	suretain	sure	certain	know for sure/certain
1782	withtract his statement of support	withtract	withdraw	retract	to withdraw/retract a statement

Here words are blended, but the source of the blended words come from the selection set made available by a single MLI.

A further set of word blends seems to have a similar etiology. In this case, the second target has a meaning relationship not with the word it blends with, but with the MLI in which that word is found. The source of such blends, we surmise, is activation pattern 1. See Table 25.

Table 25. Word Blends Deriving From a Meaning Relationship Between a Word and an MLI

No	Context	Word blend	Target 1	Target 2	PLI
397	a very down-to-earthy person	down-to-earthy	down-to-earth	earthy	down-to-earth
653	you get the grisp of it … a grasp on it	grisp	gist	grasp	get the gist of NP
658	ground to a pulver	pulver	powder	pulverise	grind to a powder
1349	Let's go scounge around for some food	scounge	scout	scrounge	scout around for

The Kempen data set

To test the predictions of superlemma theory against a single set of data (however large) made by one observer has obvious potential shortcomings. We therefore tested the major findings of the above analysis against a second (smaller) data set. Here the MLIs involved are Dutch. The data was collected by Gerard Kempen and involve one hundred and eighty naturally occurring slips.

To check the first set of predictions of superlemma theory, namely that MLIs consist of the words with the properties those words have as individual lexical items, we looked for MLI internal exchanges. These occur in some numbers, as is shown in Tables 26–29

Table 26. Phonological Exchanges

Nr.	Context	Slip	Target
1825	dat kost ons een lib uit het rijf 'that costs us a lib from the rife'	lib … rijf	rib … lijf 'rib … body
1830	uit de zuim duigen 'out your sum thuck'	zuim duigen	duim zuigen 'thumb suck'
1844	voetsers en fietsgangers 'feetsers and bike goers'	voetsers en fietsgangers	fietsers en voetgangers 'cyclists and pedestrians'

Morphological exchanges

None

Table 27. Lexical Exchanges

Nr.	Context	Slip	Target
1823	het twijfel van de voordeel 'the doubt of the advantage'	twijfel … voordeel	voordeel … twijfel 'advantage … doubt'
1833	je moet de beer niet verkopen voordat je de huid geschoten hebt 'you mustn't the bear sell before you the skin have shot'	beer … huid	huid … beer 'skin … bear'
1835	… van die mensen die de klepel horen luiden maar niet weten waar de klok hangt 'from people who the clapper hear sound but not know where the bell hangs'	klepel … klok	klok … klepel 'bell … clapper'
1840	dat neemt niet waar dat het weg is wat ik zeg 'that takes not true that it gone is what I say'	waar … weg	weg … waar 'away … true'
1857	maak me maar dood met een blije mus 'make me only dead with a happy sparrow'	…dood … blije	…blij … dode 'happy … dead'

Table 28. Phrasal Exchange

Nr.	Context	Slip	Target
1898	… dan gooien we het slot niet in de deur … '… then throw we the lock not in the door … '	het slot … de deur	de deur … het slot… 'the door … the lock'

These data again suggest that exchanges occur within an MLI.

The predictions of superlemma theory about the effect of MLIs on slips of the tongue are also borne out in the Kempen data as evidenced by the appearance of the same five types of predicted slip that appear in the Tuggy data as shown in Tables 30–34.

Table 29. Type 1 Slip: Joint Activation of a Superlemma and a Lemma with Related Lexical Concepts (activation pattern Figure 3)

Number	Slip blend	PLI	L	Target
1829	uit je duim verzinnen 'out your thumb make up'	uit je duim zuigen 'out your thumb suck'	verzinnen 'make up'	zuigen 'suck'
1931	zich ontvluchten aan… 'REFL escape at …'	zich onttrekken aan 'REFL withdraw from'	ontvluchten 'escape'	onttrekken 'withdraw (from)'
1932	zich gebeurt 'REFL happened'	zich afspeelt ' REFL proceed'	gebeurt 'happen'	afspeelt 'proceed'
1938	in het vooruitzicht geboden 'in the foresight bid'	in het vooruitzicht gesteld 'in the foresight placed'	geboden 'bid'	gesteld 'placed'
1963	ik acht het tot mijn taak 'I regard it to my task'	reken tot 'count to'	acht 'regard'	reken 'count'
1979	met zich teweegbrengt 'with REFL to way brings'	met zich meebrengt 'with REFL bring'	teweegbrengt 'to way brings'	meebrengt 'with bring'

Table 30. Type 2 Slip: Joint Activation of Two Superlemmas with Related Lexical Concepts (activation pattern in Fig 4).

Number	Blend/substitution slip	Target SL 1	Target SL 2
1828	voor de rug 'before the back'	voor de boeg 'before the bow'	achter de rug 'behind the back'
1837	dat valt me erg teleur 'that falls me very sorrow'	stelt me teleur 'puts me sorrow'	valt me tegen 'falls me against'
1849	er is geen touw op te trekken 'there is no rope up to pull'	geen touw aan vast te knopen 'no rope on fast to knot'	geen peil op te trekken 'no level on to pull'

1851	iemand de loef afsnijden 'someone the windward side off cut'	de pas afsnijden 'the step cut off'	de loef afsteken 'the windward side take away'
1858	zoekt slakken op laag water 'seek snails at low tide'	zoekt spijkers op laag water 'seek nails on low tide'	legt op alle slakken zout 'lays on all snails salt'
1882	dan loop je door de mand 'that runs you through the basket'	val je door de mand 'fall you through the basket'	loop je tegen de lamp 'run you against the lamp'

Table 31. Type 3 Slip: Activation of an L2 with a Related Lexical Concept Node to a Superlemma Constituent Lemma 1 (activation pattern in Fig 5).

Number	PLI slip	Slip	Target
1834	nieuws onder de horizon 'news under the horizon'	horizon 'horizon'	son 'sun'
1950	een knuppel acher de deur hebben 'a club behind the door have'	knuppel 'club'	stok 'stick'
1859	onder ogen bekeken 'under eyes examined'	bekeken 'examined'	gezien 'seen'
1864	op zo snel mogelijke termijn 'on as fast possible time	snel 'fast'	kort 'short'
1866	daar lukten ze niet in 'there managed they not in'	lukten 'managed'	slaagden 'succeeded'
1867	hij is daar in gelukt 'he is there in managed'	gelukt 'managed'	geslaagd 'succeeded'

Type 4 slips: activation of superlemma 2 through the activation of a constituent lemma common to both superlemma 1 and superlemma 2 where neither superlemma 1 or lemma are semantically/pragmatically related to superlemma 2 (activation pattern in Figure 6).

Table 32. Type 4 Slips

Number	Slip	Substitution		Blend	
		Slip	Target	Target 1	Target 2
1927	de kool en het sop sparen 'the cabbage and the suds save'	het sop 'the suds'	de geit 'the goat'	het sop is de kool niet waard 'the suds are the cabbage not worth'	de kool en de geit sparen 'the cabbage and the goat save'
1961	dat spoor loopt bijster 'that trail runs lost'	bijster 'lost'	dood 'dead'	dat spoor loopt dood 'that trail runs dead'	het spoor bijster zijn 'the trail lost be'

2000	ik had nog een peuletje te schillen met… 'I had still a peashell to peal with you'	peuletje 'peashell'	appeltje 'apple'	ik had nog een appeltje te schillen met 'I had still an apple to peal with '	het was een peulenschilletje 'it was a peashell'

Type 5 slip: a superlemma is activated on the basis of a compositionally produced structure which shares semantic/pragmatic properties with an superlemma.

Table 33. Type 5 Slips

Number	Slip	Target 1 (compositional)	Target 2 (SL)
1845	je beleeft heel wat mee 'you experience quite much with'	je beleeft heel wat 'you experience quite much	je maakt heel wat mee 'you make quite much with'
1901	zijn NP hebben REFL voorgedaan 'his NP have themselves demonstrated'	zijn NP geweest 'have NP been'	NP hebben zich voorgedaan 'NP have REFL demonstrated'
1907	geeft NP met zich mee 'gives NP with REFL with'	geeft NP 'give NP'	brengt NP met zich mee 'brings NP with REFL with'
1938	NP in het vooruitzicht geboden 'NP in the anticipation offered'	NP geboden 'NP offered'	NP in het vooruitzicht gesteld 'NP in the anticipation placed'
1983	worden wij geld uit de zak geklopt 'get/are we money from the pocket knocked'	worden wij benadeeld 'are we disadvanted'	wordt ons geld uit de zak geklopt 'is us money out the pocket knocked'

Negative predictions

An empirically vulnerable theory should not only yield predictions that corroborate the theory, but also negative predictions. In the case of superlemma theory, we can seek these by means of a property of the Levelt model. Each activation step in the Levelt model has a time course. We can think of this as a time penalty for the activation step. Since the model is essentially feed-forward, activation ceases to have an effect beyond a certain point because the execution of the speaker's intent has got beyond the point where further spreading activation of the original intent has any effect. Humans must speak in real time and real time speech is rapid. Figures 3–6 show that a small number of activation steps can create slips. However further additional steps may and in some cases must get beyond the point where

they give rise readily to execution errors. The more steps, the more likely further activation is to have no effect on the speech production process.

If we now look at the activation patterns in Figures 3–6, the extra activation which is hypothesised to be responsible for slip types 1–4 involves one or two additional activation steps from the direct route from the lexical concept, through the superlemma, to its constituent lemmas. Consider the activation patterns 1 and 2. These require competition between a target lexical concept and another related lexical concept; one lexical concept node activates another related lexical concept node which consequently activates its superlemma and constituent lemmas. Type 3 presupposes a leak back activation to the lexical concept node of one of the constituent nodes and a consequent activation of a lexical concept node related to that second node. Here, the number of activation steps creating the competition responsible for the slip is two. In the case of activation pattern 4, the activation of superlemma 2 is a direct consequence of its sharing a constituent with superlemma1. Only two additional activation steps are required. Since activation spreads in a variety of ways, as we have indicated, some activation patterns are expected to take too long to be implemented and thus do not find their way into slips. Consider, therefore, the activation pattern in Figure 7.

This activation pattern contains the three additional activation steps which would be needed to yield a slip. The hypothetical possibility would be that the activation of the PLI *done to a turn*, meaning literally or metaphorically 'well cooked', has its constituent lemma *turn* activating the PLI *go about*, the term for turning a ship or aircraft around. This could hypothetically yield substitutions such as *go to a turn* and *done about a turn* and the blend *go about a turn* all of which are

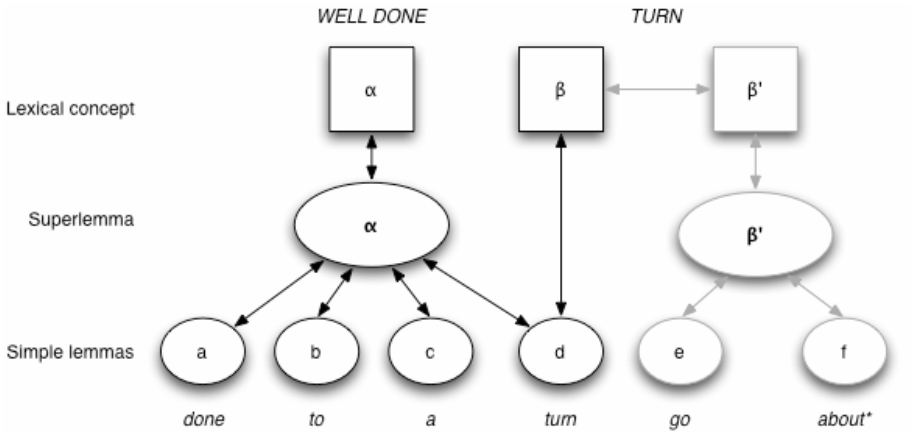

Figure 7. Activation of a superlemma 2 by means of leak back activation of a constituent lemma of superlemma 1 and superlemma 2 where the lexical concept node of the lemma and superlemma 2 are related.

well-formed. We predict that such slips are unlikely to occur. No slips with the predicted diagnostic properties were found in the Tuggy or Kempen data. Longer activation patterns than this can be contemplated. We predict also that these activation patterns are unlikely to give rise to slips.

Cutting and Bock vs superlemma theory

We now turn again to the differences between Cutting and Bock's theory and superlemma theory. As Sprenger et al. (2006) point out, and as mentioned earlier, Cutting and Bock's theory makes different predictions from superlemma theory since the syntactic frame which Cutting and Bock's model activates is a generalised one rather than the superlemma specifically associated with a single MLI. Specifically, Cutting and Bock appear to have no way to prevent the exchange of nouns in an MLI which has two nouns as constituents since the syntactic frames of MLIs are activated independently of individual words or MLIs. Thus the predictions of these two theories should be testable against the predictions each makes about slips of the tongue. They will be tested here against data involving irreversible binomials (IBs). Irreversible binomials such as *heart and soul* and *tooth and claw* (Malkiel, 1959) under Cutting and Bock's analysis would be associated with coordinate conjoined phrase markers involving two coordinated bare NPs without reference to the order in which the two nouns come since that order is an arbitrary idiosyncrasy (and therefore not to be found in the syntactic frames accessed in Cutting and Bock's account) whereas superlemma theory would predict that the irreversible nature of binomials would be one of the syntactic idiosyncrasies listed in the superlemma of each such item. Thus superlemma theory predicts that any slip involving an IB would be unlikely to exchange the order of the nouns whereas Cutting and Bock would predict that this is possible or likely.

Neither the Tuggy data nor the Kempen data contains an exchange involving nouns within an irreversible binomial. Furthermore, where there are substitutions in an irreversible binomial or blends of two irreversible binomials, the order of the nominals is not reversed in either data set. So, for example, the slip *It's not written down in black and ink* contains a substitution of *ink* for *white* without a reversal of the normal order, that being *black and white.* The slip *by and far* (not listed in any table but a datum in the Tuggy corpus), being a blend of *by and large* and *near and far,* maintains both conjuncts that appear in the slip in their canonical positions. Note there is no reason why this should be so if the access to syntactic information in the model for the activation of MLIs is to some item neutral representation of coordinated conjoined structures involving bare NPs.[27]

Inter-observer reliability

We have used two data sets as evidence for superlemma theory: the Tuggy and Kempen corpora and their analyses. We have shown that the kinds of data that are predicted by superlemma theory appear in both data sets. To gain a measure of the comparability of the two sets of data we took the analytic categories in Table 34 which were used to gather the data in the earlier tables and examined them for a measure of inter-observer reliability and analytic consistency. Note that these percentages are to be interpreted as follows. In the case of category 1, in the Tuggy corpus 56.35% of the data could be plausibly analysed as being a phrasal blend while in the Kempen corpus 58.59% of the data could be so analysed.

Table 34. Analytic Categories in the Two Corpora. (Note that percentages do not add up to 100% since many tokens are of more than one type.)

		Data set percentages	
	Analytic category	**Tuggy**	**Kempen**
1	phrasal blend	56.35	58.89
2	word blend	9.33	12.78
3	word blend resulting in possible words	7.84	11.67
4	word blend resulting in impossible words	1.49	0.56
5	word blend resulting in existing words	1.39	3.89
6	word blend resulting in non-existing words	7.94	8.89
7	word blends from same semantic/pragmatic search space	7.24	11.67
8	word blends from different semantic/pragmatic search space	2.08	1.11
9	lexical substitutions	71.73	68.89
10	phrasal substitution	1.49	0.56
11	both substitution and phrasal blend analyses plausible	21.92	46.67
12	phrasal blend analysis only	6.05	6.11
13	phrasal blend from same semantic/pragmatic search space	48.41	57.22
14	phrasal blend from different semantic/pragmatic search space	7.94	2.22
15	syntactically well-formed phrasal blends	50.40	55.56
16	ungrammatical phrasal blends	5.95	3.89
17	phrasal blends whose targets were both idioms	24.31	9.44
18	phrasal blends whose targets were both RCs	17.66	40.00
19	phrasal blends which did not have matching targets	12.90	10.00
20	complex	2.98	6.11
21	insertion, no blend	3.77	7.78
22	exchange, no blend	2.58	10.56
23	deletion, no blend	1.98	1.11
24	insertion & blend	10.91	12.22
25	substitution, no blend	30.75	15.00
26	intra-idiom	34.33	29.44

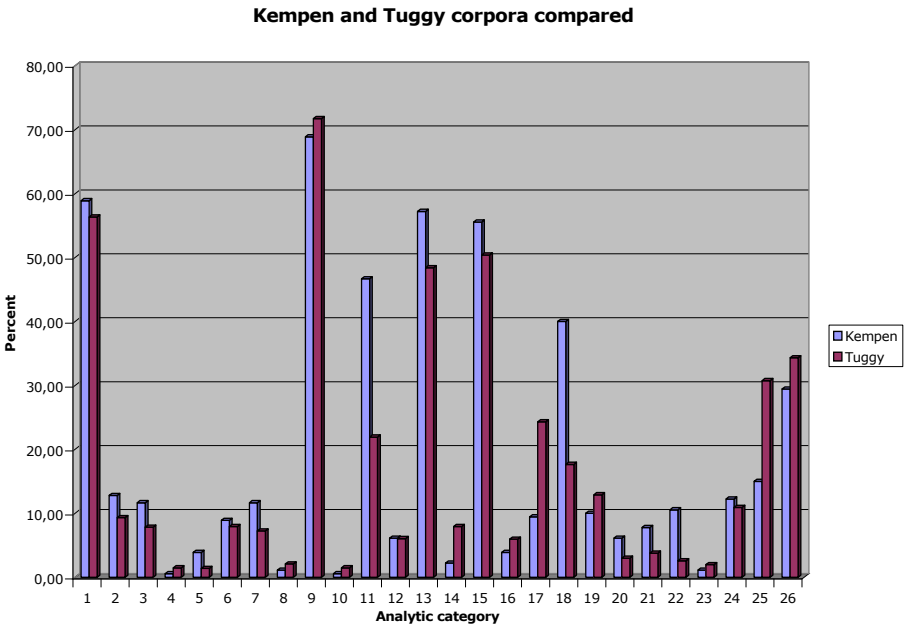

Figure 8. The analysis of the Tuggy and Kempen data compared.

Figure 8 shows profiles of the two sets suggesting a high degree of inter-observer reliability and a high degree of consistency among the coders.

Given the differences in the size of the two data sets, the fact that they were collected by two different observers and analyzed by different coders shows a high degree of consistency in the patterns of analysis.

Discussion

So far we have largely ignored the frequency properties of the data. There are various possible constraints on slips that may be deduced from the figures in Table 34 and 35.

First Table 34 (rows 13 and 14) shows that slips involving MLIs have a strong tendency to involve competition from MLIs within the same semantic/pragmatic domain, as was the case with the findings of Cutting and Bock mentioned earlier. This is not surprising given the hypothesis that MLIs are unitary at the level of their lexical concept and at the superlemma level. By way of comparison, word blends within MLIs in Tuggy and Kempen data (Table 34 rows 7 and 8) also heavily favour lemmas having lexical concepts from the same semantic/pragmatic domain. This in line with the observation of Fay (1982, p. 163).[28]

Second, the output constraint on slips to the effect that these are normally

Table 35. Numbers of Clear Cases of Slip Types in the Two Slips Corpora

Slip type and activation pattern	Tuggy	Kempen
Type 1. Joint activation of a superlemma and a lemma from related lexical concept nodes	36	17
Type 2. Joint activation of two superlemmas from related lexical concept nodes	528	97
Type 3. Activation of a lemma 2 via leak back from a constituent lemma 1 of a superlemma	306	49
Type 4. Activation of a superlemma 2 by means of leak back activation of a constituent lemma common to superlemma 1 and superlemma 2 where the lexical concept node of the lemma and superlemma 2 are not related	69	4
Type 5. Activation of a superlemma on the basis of a compositionally produced phrase	8	7

well-formed (Nooteboom, 1969, p. 130) is also borne out in our data sets (Table 34, rows 15 and 16). By 'well-formed' we mean that the syntactic structure of the slip is a possible syntactic structure of English or of Dutch. We do not mean that the idiosyncratic subcategorization properties of heads are always respected. In this sense MLI blends are well formed in 90% of cases. By way of comparison, word blends within MLIs in the two data sets are well formed in 86% of cases. There are no arbitrary word fragment substitutions and no substitutions of word fragments from across word boundaries in the data.

Third, MLI blends do not form existing MLIs. Word blends within MLIs gave rise to existing words in 18% of cases (Table 34 rows 3 and 4).[29] We may conjecture why this might be. It could be that the chances of a phrasal blend resulting in an existing MLI by accident may be slight given the additional syntactic complexity of MLIs over that of words and the large number of MLIs in a native speaker's lexicon. It may also be that the monitor checks that the output of a syntactic structure is syntactically well-formed, rather than that an existing MLI has been produced. By contrast, it checks the lexical output for the presence of existing words. It is plausible that this would be the case. Utterances in which there are non-existing but possible words are likely to be meaningless whereas utterances containing novel grammatical phrases are not necessarily meaningless.

Fourth, the slips show a preference for the activation of two MLIs with related lexical concepts rather than a MLI and a single lemma with related lexical concepts (Table 35, types 1 and 2) . This suggests that speech production processes may be sensitive to whether or not a lexical concept is related to a superlemma or just a lemma. Slips appear to be more likely where two related lexical concepts are both associated with a superlemma. Otherwise we would expect the number of cases of type 1 and 2 slips to be closer.[30]

Fifth, we have not taken much notice so far of the distinction between idioms and restricted collocations. Recall that idioms have idiosyncratic semantic representations leading to their being listed with their own lexical concept node. The question can now be asked if restricted collocations have their own lexical concept node. On the one hand, since restricted collocations are semantically compositional, one might expect them not to have individual lexical concept nodes. However the Levelt model of speech production assumes that synonyms have individual lexical concept nodes even though their semantic representations might be regarded as identical (Levelt, 1989, p. 213). It is also assumed that morphologically complex words with (perhaps partially) compositional readings have their own lexical concept nodes. The consequence of supposing that restricted collocations have their own lexical concept node and thus associated superlemmas is that they are subject to the same kinds of slips as idioms because they have lexical entries with a single lexical concept node but also a superlemma representation. The analyses in Table 34 show that restricted collocations blend with other restricted collocations and that they also blend with idioms. Furthermore, it might be predicted on the basis of Cutler's adaptation of Murphy's law cited earlier, that slips would be sensitive to whether or not the MLIs that are activated are compositional in meaning. Our data show that blends involving MLIs have a clear preference for competitors that share the same compositional property, i.e. either idiom with idiom or restricted collocation with restricted collocation. Only 26% of blends do not have matching targets in terms of whether they are compositional or not. This suggests that lexical concept nodes of MLIs may contain information as to whether they are associated with superlemmas that are compositional or not. Certainly, it is knowledge which native speakers have. This is also in line with the outcomes of the analysis of semantic decomposability which Sprenger et al. (2006) conducted. The outcome of this analysis was that "the extent to which idioms … were decomposable, did not affect the size of the priming effect" (Sprenger et al., 2006, p. 178) although it did explain some of the variance on the data (Sprenger et al., 2006).

If we proceed down this road, where then is the difference between a restricted collocation and an idiom indicated in the superlemma activation model? A parallel can be found with morphologically complex words. Many of these have distributional idiosyncrasies, but some have reasonably compositional meanings. For example, *hesitation* is 'the act of hesitating'. Others do not, for example *direct* vs *direction*. Morphologically complex words do not have superlemma representations so, if they have some indication of their compositionality, then that must be noted in either their lemma or lexical concept node. It seems likely that information about a word's compositionality will be stored in its lexical concept node since it is idiosyncratic information about a word's lexical concept. A prediction would

therefore be that morphologically complex words that are idiomatic are more likely to blend with like words as is the case with MLI blends. We assume, therefore, that the idiomaticity of an MLI will be indicated in its lexical concept node. That seems the only way to account for the strong preferences of MLIs to blend with MLIs that have the same compositional property.

Conclusion

It has been shown that the hypotheses of both Cutting & Bock (1997) and Sprenger et al. (2006) are confirmed in that PLIs are unitary at the point where a single lexical concept activates a superlemma and they are compositional at the point where a superlemma activates its constituent lemmas. The predictions of superlemma theory are borne out by the types of natural slips that are predicted to occur as a result of a set of activation patterns involving superlemmas. Such slips occur in considerable numbers. Furthermore, targets from closely related lexical concepts are preferred for slips. Although both these theories restrict themselves to idioms, it appears that they can also account naturally for restricted collocations. The observed preference for matching the compositionality characteristics of competitors suggests that speech production is sensitive to the compositionality of the MLIs being accessed. From the analysis of slips involving irreversible binomials, it also appears that superlemma theory makes better predictions than the theory of Cutting and Bock.

Notes

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1. We distinguish PLIs from compounds on the basis that compounds are words while PLIs are phrases, although the distinction is sometimes not clear. See Kuiper (1999). Together compounds and PLIs form the set of multiword lexical items (MLIs).

2. Terminology construction in the domain of phraseology is endlessly creative (Wray & Perkins, 2000). We follow Jackendoff (2002) in supposing that, besides words, a large range of phrases are also stored in the mental lexicon. Hence our term.

3. See, for example, (Burger, 2003; Moon, 1998a; Wray, 2002).

4. But note that Cohen (1980, p. 158), for example, observes that PLIs "are presumably programmed in larger chunks, giving rise historically to transpositions of whole words, as, for example, in Dutch *hart onder de riem steken* versus *riem onder het hart steken*, which have both become acceptable for expressing the same intention".

5. The call tune has pragmatic import, perhaps in and of itself. Without the call tune, *Dinner's ready* is just a statement without the additional import that those within hearing should come and sit up at the dinner table. Without the call tune, *Dinner's ready* may not be a lexicalised expression at all no more than is *The elephant's ready*. How the association between the sequence of words and the tune are handled in a theory of MLIs is not relevant to the case to be made in this paper but it is an interesting question. The relationship is typically idiosyncratic. For example, not all formulaic requests to sit up at a dinner table are made with the call tune. When the butler says, "Dinner is served." that is not conventionally said with the call tune.

6. These are significant for a comparison between SL theory and the proposals of Cutting and Bock since these two theories differ in how they account for the syntactic idiosyncrasies of MLIs.

7. A reviewer suggests that *way* is another alternate noun for this MLI. This raises the interesting question of whether *being in a bad mood* and *being in a bad way* are essentially different forms of the same MLI or two different MLIs. We think they are the latter. *Being in a bad way* might be a state one is in after being involved in a serious motor accident. This is quite different from being in a bad mood or temper.

8. Nicolas (1995) proposes that all internal modification is, semantically, modification of the PLI within which the modifier is inserted.

9. Such judgments are normative and there are always contexts in which an expression which is conventionally considered frozen may be unfrozen for particular effect (Mel'čuk, 1995, p. 211; Naciscione, 2001). The degree to which an MLI may be deformed, is subject to a recoverability condition, i.e. the deformation must not be such that the standard form of the MLI is no longer accessible from the phrasal lexicon (Kuiper, 2007). Exactly what the constraints on recoverability are remain to be investigated.

10. Howarth (1998, p.44ff) and Mel'čuk (1998) give an interesting and sophisticated account of RCs. Note too that while for psycholinguists, the terms *lexeme* and *word form* are normally synonymous, this is not the case for linguists for whom a lexeme denotes an abstract word independent of the various (grammatical) word forms such as inflected forms which it might take (Spencer, 1991, p. 45). Thus for psycholinguists *lexeme* and *word form* are to be distinguished from *lemma*.

11. An anonymous reviewer has suggested that this MLI is not syntactically ill-formed because it exists as an MLI. This is a category error. From the fact that a lexical item exists it does not follow that it is well-formed. Borrowed words, for example, may not always follow the phonotactics

of the language into which they are borrowed. The onset cluster of the third syllable of *wiener-schnitzel* is not a native cluster. The fact that the word exists in English does not change the phonotactics of English. *By and large* is not well formed syntactically because the rules of co ordination of English do not permit it and no freely created construction would permit a preposition to be coordinated with an adjective.

12. Nicolas (1995, p. 234) supposes that RCs are always unilaterally idiomatic.

13. Catching the ball on the full from the batsman's bat in cricket has the same result as in baseball; namely the player at bat is out.

14. Play-by-play commentary is commentary which follows the game as it happens. Colour commentary is usually restricted to period when there is no play in the game such as in football when there has been a stoppage in play.

15. Given the findings of Smith & Wheeldon (2001) a further plausible way to test the predictions of the two competing theories would be to employ priming based on syntactic idiosyncrasies which are shared among a set of MLIs. For example do irreversable binomials prime other irreversible binomials? Given the number of blends involving irreversible binomials in the Tuggy data (around 50) that seems plausible. Do MLIs that do not permit the insertion of free modifiers prime other such MLIs?

16. It should be noted that it is not always clear whether two nouns or two nouns and an adjective which have been lexicalised are phrases, i.e. N bars, or compounds (Kuiper, 1999).

17. This coding system was devised by Koenraad Kuiper, Simone Sprenger and Gabriella Vigliocco at the Max Planck Institut für Psycholinguistik.

18. These data were coded by a native speaker of Dutch in 2003–4 on the basis of the coding model provided by the Tuggy data and after experience with checking the coding of the Tuggy data.

19. Nooteboom (personal communication, March 29, 2006) has pointed out to us that this could also be a morphological substitution where the prefix *per-* is substituted for *pre-*.

20. There seems to be no monosyllable starting with a vowel in the utterance to provide a source for this deletion.

21. Some of these insertions are also plausibly analysed as insertions into an MLI. For example *everytime* is closely related to *periodically*.

22. Nooteboom (personal communication, March 29, 2006) suggests that this case can also be analysed as a lexical substitution.

23. Nooteboom (personal communication, March 29, 2006) notes that this case can also be analysed as a word blend.

24. We are grateful to Sieb Nooteboom for this suggestion. It is a line of enquiry which seems worth pursuing.

25. Manfred Bierwisch has suggested (personal communication, November 7, 2006) that these slips are different in kind from the kind of serial ordering slips that we find in the data in the preceding section.

26. Note that it is sometimes difficult to tell just what the source of the competition between the lemma in the target MLI and its intruder is in an individual case. It may be that the competition is between two superlemmas with related concepts (type 2 activation), but where only one word from the competitor superlemma is substituted.

27. That is not, of course, to say that lexical exchanges do not take place within MLIs. They do. But they are infrequent in irreversibles where one would expect them to be quite common given that there is no semantic reason for the conjuncts not to be exchanged.

28. An anonymous reviewer indicates that it is impossible to interpret this figure in the absence of knowing what chance would be. That may be so but we currently have no way of knowing what chance would be in the absence of knowledge of the number of MLIs in a native speaker's lexicon and how many of them are related by way of their lexical concepts with other MLIs, and thus the theoretical chances of hitting any MLI as a target, let alone two with related lexical concepts. In theory, if one knew how many MLIs there were in the mental lexicon of the speaker producing the slip and how many of these were semantically or pragmatically related then a calculation as to chance might be possible. It is possible to conjecture, however, that, given that the acquisition of lexical items is subject to synonymy avoidance (Clark, 1993, p. 92) and that many lexical items do not have polarity equivalents, the chances of two MLIs with related lexical concepts being selected at random will be low.

29. This situation is like that in footnote 28.

30. Again, this is just an observation. In the absence of clear knowledge of what chance would be, it can only be that.

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