26 Formulaic Language in an Emergentist Framework

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1. Introduction

The human brain is a veritable hodgepodge of ad hoc assemblages of the old, the borrowed, and the new, gerrymandered in response to millennia of internal and external forces. It follows that human cognition has unfolded, over evolutionary time, out of disparate fragments: emotion, movement programs, very old instincts, multiple memory systems, visual patterning and many uses of sound, all in constant, intimate interplay with harsh contingencies of the environment. Experience with natural language, especially following brain damage, suggests that language may also be viewed as a conglomerate of many disparate structural types. This viewpoint is supported by observing persons with aphasia. In moderate to severe language deficit, certain definable "subsets" of language are preserved, sometimes with dramatically normal skill, while others are impaired (Hughlings Jackson, 1874b; Lum and Ellis, 1994; Van Lancker, 1975, 1988). Observations in the speech and language clinic inspire the whimsical notion that a Rube Goldberg machine model might lend itself to more veridical descriptions of human language than other approaches.

Multiple examples of anomalous structural formations fall into the category of formulaic language (Van Lancker, 1973; Van Lancker Sidtis, 2006, 2008a): conversational speech formulas, idioms, expletives, schemas, proverbs, lexical bundles, collocations, and other kinds of fixed conventional expressions comprise a major component of speaker–listener performance (Fillmore, 1979; Pawley and Syder, 1983; Van Lancker Sidtis, 2004). The size of the repertory is difficult to capture: numerical estimates range from more than 25,000 (in the Wheel of Fortune computation; Jackendoff, 1997) to as many as 300,000 (K. Kuiper, personal communication, 2013). Discourse analyses reveal that formulaic expressions – known, holistic material – make up about 25% of ordinary discourse, ranging from 15% to 50% depending on topic and speaker (Van Lancker Sidtis and Rallon, 2004). Casual inquiries as well as formal surveys indicate that speakers endorse familiarity and knowledge of a preponderance of utterances presented to them (Van Lancker Sidtis and Rallon, 2004; Van Lancker Sidtis, Kougentakis, Cameron, Falconer, and J. Sidtis, 2012; Van Lancker Sidtis, Cameron, and Sidtis, 2013).

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Formulaic language has recently received benefit of scrutiny from a broad range of disciplines. Much of the impetus arose from discourse or corpus studies (Altenberg, 1998; Moon, 1998a, 1998b; Sinclair, 1987) and from studies of second language learning (Cowie, 1992). Discourse revealed a considerable presence of fixed expressions, while teachers of a second or third language discovered a special challenge in conveying speech formulas and idioms to their students (Ellis, 1996; Biber, 2009). This increase in scholarly activity has led to insights about important differences between formulaic and novel (or productive) language as viewed from several linguistic perspectives: language evolution in biology, child language development, second language acquisition, neurolinguistics, and psycholinguistics. As described in this chapter, learning, emotion, motor programs, and memory mechanisms all operate in different ways for formulaic as contrasted with novel language processes. The unique characteristics of formulaic expressions distinguish them from novel expressions in acquisition, normal pragmatic use, mental representation, and underlying brain function. These characteristics arise from the contribution of multiple cognitive and neurological systems, seen as underlying use of formulaic expressions. It is a goal of this chapter to account for formulaic language in terms of these various neurological and psychological systems.

2. Characteristics of Formulaic Language

Formulaic expressions differ from novel or productive ones in numerous ways. Most often mentioned are their unique structural characteristics. Converging evidence suggests that formulaic expressions are acquired and used as coherent units with stereotyped lexical configuration, specific prosodic details, and conventionalized meanings, which include inherent affective and attitudinal connotations along with strong relations to social context. An important feature is that people know these expressions: they know the complex details of their shape, meaning, and use. The items are internalized *in toto* in a canonical form, or formuleme,[1] in the same sense that the stem of a verb is known, along with its possible derived forms. The relative status of the formuleme to the formulaic expression is analogous to lexeme(lemma)/word, morpheme/morph or phoneme/phone. This knowledge, or storage in memory of a canonical form, is characteristic of formulaic expressions (also called "superlemmas"; Kuiper, Van Egmond, Kempen, and Sprenger, 2007) and has been compared to knowledge of words (lexemes).

By definition, novel expressions are newly created by assembling lexical items through application of grammatical rules or reference to grammatical constructions. Formulemes take the notion of construction a step further by specifying not only the structural shape but also the exact lexical entries, their order, prosodic characteristics (which may include specific features of articulation and voice quality), and intonational contour. While various lexical items can appear in a grammatical construction, which is a pairing of form and content, the essential quality of a formulaic expression is that the precise words are fixed. Construction grammar encompasses abstract argument structures of many kinds, in order to describe, for example, clausal expression in language (Goldberg, 2006). In contrast, formulaic expressions are superficially fixed. Interestingly, it is mentioned in the construction grammar literature that idioms form the ultimate example of a construction in the sense of a total pairing of sound and meaning. A hybrid form is the schema, in which at least one open slot is mandatorily present in an otherwise fixed expression, as in "*I can _____ with one hand tied behind my back*" (Van Lancker Sidtis, Kougentakis, Cameron, Falconer, and Sidtis, 2012; Van Lancker Sidtis, Cameron, and Sidtis, 2013). These utterance types are related to the category "snowclones" (Pullum, 2004), which allow for controlled variability on a thematic base, as "*She is a few cards short of a deck; She is one sheep short of a sweater*" (Silverstein, 1987). However, the focus of construction grammatical analyses is newly created expressions, where actual words are not necessarily or typically fixed. In contrast, in a formulaic expression, semantic replacement of words comprising the formuleme (the known canonical form), as in "*She has him nibbling out of her hand*," signals creative or humorous effect, non-native production, or other digression from well-formedness.

Viewed in a certain way, language naturally yields objects with emergent properties. Five words, *boy*, *likes*, *girl*, *the*, *the*, dynamically produce a grammatical form, a sentence or a statement, when the words are placed in order and given any number of prosodic shapes: *The boy likes the girl*. But novel sentences are flexible and composed, so that a possible version is *The girl likes the boy* and a very broad set of options obtain. Formulaic expressions take the notion of emergent property much further. The combination of words *eating*, *of*, *out*, *her*, *she*, *has*, *hand*, *him*, when ordered a certain way, yields a specific, unique idiom, which has uniquely emergent characteristics with respect to form, meaning, use, and memory characteristics. The form is fixed. The expression is stereotypically known as *She has him eating out her hand*, and any changes (adding *really* or *always*) must simply ensure that the canonical form is recoverable (Kuiper, 2009). Form includes a stereotyped prosodic contour or "phonological coherence" (Lin, 2010). Meanings are complex and usually nonliteral. In the example above, the expression has nothing whatever to do with hands or eating, but denotes a certain sociopolitical relationship, and contains connotations of subservience, domination, and compliance, tinged with embarrassment and defiance. Use is similarly complex, as the appropriate situation for applying this expression will require considerable inferencing. Finally, as mentioned above, and most importantly, these expressions are known. They are personally familiar. None of these qualities inhere necessarily in novel expressions, although they certainly CAN occur.

In views that resemble the modern ones, Katz (1973), Bolinger (1976, 1977), and Fillmore, Kay, and O'Connor (1988) identified idiomaticity as a property to be distinguished from compositionality. The psychologist Lounsbury (1963) used the terms "ad hoc" and "familiar and employed as a whole unit" to distinguish two essential different processes of speech production, stating that "their psychological statuses in the structure of actual speaking behavior may be quite different" (p. 561). This dichotomy has more recently been labeled (Sinclair, 1991; Erman and Warren, 2000) as the *idiom principle* and the *open choice principle*. This duality corresponds to organizational principles posited in a variety of neural systems (Mishkin, Malamut, and Bachevalier, 1984; Hughlings Jackson, 1874b; Graybiel, 2008; Bates and Goodman, 1999; Koestler, 1967), referred to, for example, as analytic/synthetic or sequential/holistic.

Psychological studies consistently revealed reliable, gross performance differences between formulaic and novel exemplars, attesting to the holistic structure of the formulaic expressions in the speaker's competence. It was shown that subjects could recall individual words from novel expressions more successfully than the same words presented in formulaic expressions (Horowitz and Manelis, 1973; Osgood and Housain, 1974), or they performed a judgment task more rapidly to the formulaic than the novel expression (Pickens and Pollio, 1979; Swinney and Cutler, 1979; Jiang and Nekrasova, 2007; Conklin and Schmitt, 2008; Libben and Titone, 2008). These effects of patterns on recognition performance have been shown more extensively in the visual modality (Pomeranz, Sager, and Stoever, 1977; Poljac, de-Wit, and Wagemans, 2012). Following James (1885), Bousfield (1953), and Miller (1956), Simon's (1974) article describing memory processes gave credence to the concept of "chunks" as units of processing, which are such that when people are asked to remember and recall a spoken list of items, the number of recallable items is nearly the same for syllables, words, compound words, and idiomatic phrases. This finding was replicated for Chinese (Simon, Zhang, Zang, and Peng, 1989). Early studies revealed differences in pronunciation and perception between matched novel and formulaic exemplars (Lieberman, 1963; Van Lancker, Canter, and Terbeek, 1981). More recently, a study investigating the intelligibility of formulaic and novel utterances in a condition of masked auditory presentation revealed a dramatic superiority for formulaic expressions, indicating that these are known to native speakers and therefore have a much lower threshold for recognizability in a listening challenge (Rammell, Pisoni, and Van Lancker Sidtis, 2013). As will be elaborated in this chapter, there is strong evidence of specialized modes of learning by children and adults, as well as of dedicated roles of procedural and declarative memory, in acquisition and use of the repertory of formulaic expressions. It has also been shown that cerebral damage and dysfunction have selective effects on use and recognition of formulaic expressions.

3. Emotional and Connotational Meanings

The role of emotional meaning in language has received more attention in psychological than in linguistic approaches (Van Lancker, 2008b). Panksepp (2008) has argued for the importance of affective content in all of verbal interaction. This perspective tracks well with formulaic expressions. With respect to their meaning, like many birds, formulaic expressions have natural coloration. Emotional and attitudinal nuances are woven into their meaning. Unlike newly created expressions, which require selected lexical items or prosodic cues in order to convey explicit feeling, idioms, proverbs, conversational speech formulas, and expletives inherently incorporate a broad palette of attitudinal stances and emotional nuances (Palm, 1995). Take any idiom: *She's got him eating out of her hand* carries varying gradations of scorn, envy, and condescension; *He's at the end of his rope* conveys worry, fear, exasperation, and concern. The case is similar for conversational speech formulas: *Have a nice day* is cheery and friendly (even if insincere); *You've got to be kidding* contains incredulity, disapproval, and a whiff of mild shock. In contrast, novel sentences such as *The cat is sleeping in the stairwell*, or *Many master's students study in the library*, as such, do not reveal a clearly delineated place in a semantic differential grid (Osgood, Suci, and Tannenbaum, 1957). Of course, adjectives and loaded emotional nouns or verbs carrying intense affective meaning, perhaps with prosodic emphasis, when formulated in novel utterances, such as "In a single blow, his captor decapitated him," will accomplish the task of converging strong connotational meaning, but lexical selection and other strategies are involved. This is not so in the case of formulaic expressions: evaluative, affective, and attitudinal meanings inhere in the expression.[2]

Given that formulaic expressions are tinged throughout with emotional and attitudinal nuances, it is natural to propose that the brain mechanisms modulating emotions will play a special role in their acquisition and use. Studies in the use of formulaic expressions support this proposal. The fact that these expressions are familiar (in the sense of personally known) can be demonstrated anecdotally in any group of (native speaker) listeners, who invariably produce a knowing smile on hearing an exemplar (see Baudouin, Gilibert, Sansone, and Tiberghien, 2000). This formulaic expression-specific response suggests the engagement of cognitive systems that differ from those processing novel expressions. These include systems supporting processing of familiarity and emotion, represented in the basal ganglia and in the right hemisphere (Van Lancker, 1991; Panksepp, 1998, 2003; Robinson, 1987). Procedural memory systems, posited to be represented in the basal ganglia (Mishkin, Malamut, and Bachevalier, 1984; Graybiel, 1998, 2005; Marsden, 1982), enable the motor gesture incorporating the produced expression. Current proposals describe proceduralization for structurally frequent propositional utterance types (Ullman, 2004; Lieberman, 1963, 2002); this depiction is supported by preservation of syntactic structures in Alzheimer's disease (Kempler and Zelinski, 1994). Further, studies reviewed below indicate a selective impairment of formulaic expressions with preservation of propositional sentence types in basal ganglia disease. Declarative and episodic memory processes for storage of the expression, maintaining the very large repertory of formulemes, as has been claimed for words or listemes, have been associated with parietal (Hyvärinen, 1982a, 1982b; Fair, 1988, 1992; Simons and Mayes, 2008; Wagner, Shannon, Kahn, and Buckner, 2005) and temporal lobe (Ullman, 2004) function.

Use of formulaic expressions in conversation, cartoons, newspapers, magazines, movies, and everywhere else in the media provides incontrovertible evidence for the theory of mind, the presumption that others have a mind with thoughts, desires, and intentions related to one's own (Baron-Cohen, 2001; Stone, Baron-Cohen, and Knight, 1998). Daily examples are countless. A cartoon by Barsotti of a (caricatured) king opening a gift, with the caption "Why, this is fit for me!"[3] derives its humor almost entirely (the drawing is charming) from the presumption that readers know the exact expression "fit for a king" as a nonliteral hyperbole; the literal context for a well-known nonliteral expression is the source of the humor. Cartoons in New Yorker magazines throughout the years utilize this trope: a formulaic expression with nonliteral meaning and use, assumed to be universally known, is drawn and placed in a literal or otherwise pragmatically inappropriate context. Perusal of newspaper story headings reveals the same practice: use or slight distortion of a formulaic expression to attract the reader, all implying knowledge of a vast repertory of formulemes by the journalist and by the public.

4. Usage Data: How Are Formulaic Expressions Acquired?

There has been very little fieldwork targeting natural acquisition and use of formulaic expressions in children or adults. Jay (1992) performed casual observations of the use of expletives by college students in common surroundings, such as cafes. Use of expletives during meetings of a health care team on a psychiatric ward revealed interesting influences of context (Gallahorn, 1971). Hain (1951) spent three years documenting use of proverbs in daily social contexts in a small town, chronicling the proverb, the context in which it was uttered, and an explanation of its meaning in that context. Another study revealed that speech formulas are sometimes transmitted through elicited imitation, as in parents to children during a Halloween walk through the neighborhood (Gleason and Weintraub, 1976).

Many more comprehension studies have been performed. It has been proposed that children gradually acquire formulaic expressions throughout childhood (Nippold, 1998; Kempler, Van Lancker, Marchman, and Bates, 1999), but the mechanisms – in what ways this process differs from acquisition of grammar – are not understood, and the relationship of comprehension to competent use has not been examined. Previous studies suggest that the maturational schedules for formulaic and novel language differ, with grammar being in place at an earlier time, while formulaic language continues to be acquired into adolescence. A study of 250 children between the ages of 3 and 19 years, using a picture-matching response, revealed that competence for formulaic language comprehension barely begins at age eight and is not completed until after age 15 (Kempler et al., 1999). At the same time, the role or influence of frequency of exposure remains uncertain. As mentioned above, acquisition of a formulaic expression includes details of stereotyped form, connotational meanings, and social-contextual relations, and the entire expression must be uploaded with these specifications. From the ages of 3 to 15, a very large number of these multi-word units are acquired, one by one. Given the number that must be acquired, frequent exposure to all expressions is unlikely. Some must be very rapidly taken in.

Reuterskiöld and Van Lancker Sidtis (2013) proposed a model of formulaic expression acquisition derived from notions of a one-trial learning. An anecdote of a personal observation illustrates this proposal. A child of approximately eight years of age was observed in the cafeteria of the Monterey Bay Aquarium carrying his tray to the tables overlooking the dramatic Monterey Bay, which could be seen through an expansive wall of glass. Several family members, adults and children, were moving along with him in the group. As the boy prepared to take a place at a table commanding a spectacular view, one of the older males said to the boy: *Look! You have the best seat in the house!* The boy's expression became pensive, and he said softly: *House. Best seat in the house. House*. In the one-trial learning model, the boy's response could be said to reflect awareness that the word "house" was being used in a non-standard way. It is proposed that anomalous usage, as well as affective content, stimulates cerebral arousal and leads to rapid assimilation of the utterance, the meaning of which was obvious when context was considered. That is, the evaluative, affective, and connotative strength of the utterance, accompanied by a readjustment of the nonliteral meaning to accord with the context, gave this utterance a special status, and, according to our theory, resulted in rapid acquisition.

The Reuterskiöld and Van Lancker Sidtis (2013) study explored the proposal that the forms, meanings, and contextual relations of idioms are stored effectively in memory following one-time exposure in a naturalistic context. Retention of idioms was compared with matched novel (newly created, grammatical) utterances. The hypothesis was that idioms, because of their inherent holistic, affective, nonliteral, and social characteristics, are acquired differently and more rapidly than novel utterances. Two age groups of typically developing girls, 8–9- and 12–14-year-olds, were engaged in craft activities with two experimenters. During naturalistic, casual conversational exchanges, the participants were exposed to 12 low-frequency idioms and 12 matched novel expressions. Following the exposure period, recognition performance of the exposed idioms

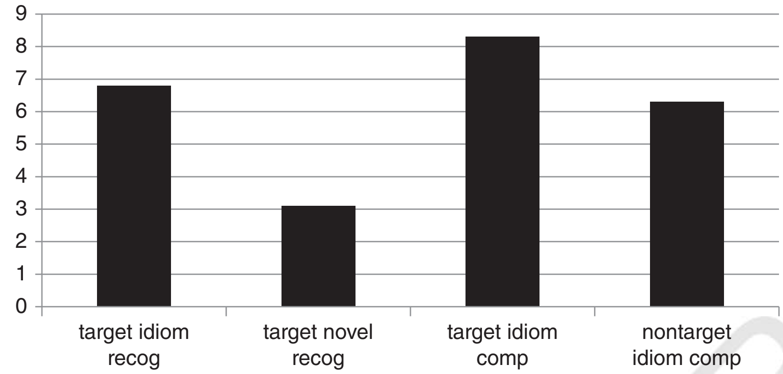

Figure 26.1. Performance of 14 children aged 8–14 on recognizing (*recog*) low-frequency idioms and novel expressions following one-time exposure in a naturalistic setting, and comprehending (*comp*) target exposed idioms and non-target non-exposed idioms. Total correct is indicated on the ordinate

was compared with matched novel expressions; comprehension of target and non-target idiom meanings was also probed. Participants in both age groups recognized significantly more target idioms than novel expressions following one-time exposure and scored higher on comprehension of target idioms than non-target idioms (Figure 26.1). This result is consistent with evidence from the adult literature indicating that formulaic language and novel language are acquired, stored, and processed differently (Van Lancker Sidtis, 2010), with formulaic expressions being acquired more rapidly.

While rule-governed or grammatical construction-based language may be acquired by frequent exposure to many variants of the morphogrammatical structure of interest, results from our studies suggest that formulaic expressions take their place in linguistic competence according to a very different process. As illustrated in the "Monterey Bay Aquarium" anecdote above and borne out by the study by Reuterskiöld and Van Lancker Sidtis (2013), formulaic expressions may operate more like one-trial learning processing, such as flashbulb memories or imprinting (Rauschecker and Marler, 1987; Brown and Kulik, 1977; Horn, 1985; Christianson, 1992; Gold, 1985; for review see Kreiman and Sidtis, 2011: ch. 6). Repetition and frequent exposure may not be necessary factors, given the anomalous nature of formulaic utterances. The properties of nonliteral meanings, a unique relationship to context, and intrinsic connotations and nuances likely more acutely engage motivation, emotional, and memory systems of the brain. Social salience has been described as a key feature in language learning (Merriman, 1999; Tomasello, 1995); Snow (1999) proposed pragmatic precocity – involvement in the social context – in young children as a key impetus to the development of language. This process is likely heightened for acquisition of formulaic expressions, representing an extreme example of item-based learning, as has been proposed for child language acquisition (MacWhinney, 2004).

It is well known that many expressions in child language learning first occur as unitary utterances, which later evolve into grammatically composed utterances (e.g., Locke, 1997; Peters, 1977, 1983). Thus the existence of two modes of language learning, configurational and analytic, has been proposed to account for the earliest developmental stages. Key roles of chunking and memorial processes in child language learning are highlighted in the emergentist framework (MacWhinney, 2005). In the dual-process model, it is proposed that these two disparate modes of learning continue throughout maturation, with formulaic language being acquired according to holistic processes, which are less well understood (Van Lancker Sidtis, 2012b). Pragmatic functions have been associated with the right hemisphere in adults, and the unitary characteristic of the utterance is compatible with the pattern recognition preferences of the right hemisphere.

5. Second Language Learning

Second language learners encounter special challenges in the acquisition and appropriate use of formulaic expressions. It is likely that age and brain maturation factors lead to acquisition of much of the second language, including formulaic expressions, into declarative, rather than procedural, implicit memory processes (Ullman, 2008; Clahsen and Felser, 2006a, 2006b). Formulaic expression "errors" from speech samples of non-native speakers may involve distortion in prosodic form, as in *blind spot*, where native pronunciation places the accent on the first word, or *I wouldn't want to be in his shoes like that*, where the formuleme places the accent on *his* (this deviation is accompanied by an error in lexical choice – adding *like that*). Non-native errors differ essentially from errors documented from native speakers (Kuiper, Van Egmond, Kempen, and Sprenger, 2007; Nooteboom, 2011; Cutting and Bock, 1997). Other examples are *on the other fence* (for *on the fence*), *it really didn't sink* (target unknown), *thanks God* (intrusive *s*), *not off my head* (for *not off the top of my head*), *I got into their goat* (for *I got their goat*), *We have risen up to the occasion* (extraneous word *up)*, *They are selling like little cakes* (*little* replacing *hot*), *I wanted to get it out of my chest* (for *off my chest*); *it was because I wanted to take someone off of my chest* (for *get someone off my back*). A psychiatrist of native Italian background, worried about an error in a grant proposal, stated *I hope I didn't shoot myself in the head* (for *shoot myself in the foot*). These examples reflect the fact that "well-formed" formulaic expressions have fixed, stereotyped shapes with respect to prosody and lexical sequencing and that a small change in lexical configuration, unless done intentionally for humorous or creative effect, signals a non-native production.

Many examples of inappropriate usage with respect to connotations and context also occur, but these are more difficult to document and describe. In an actual example, a male non-native speaker of English was asked by a fellow airplane passenger to stop kicking her seat. After the third such request, the non-native speaker twice repeated the expression *Hold your horses*. While this expression may be said to fit the occasion overall semantically, its usage is inappropriate and odd in the specific context. These kinds of deviations are often heard during interviews on radio and television. For example, recently, in a radio interview, a Pakistani spokesman described a spate of violent attacks by political opposition in his country, concluding that "the prison breakout is just the *icing on the cake*."[4] Here the word selection and order for the idiom is correct, but the nuances fail, missing an expected favorable connotation. While grammatical competence in second language speakers may be fully adequate to the speaking demands and approaches native ability, use of formulaic expressions falls short. Numerous books, pamphlets, and learning workbooks have been written to assist the second language learner with idioms and other formulaic expressions. Yet very little research exists to date to document and quantify formulaic language usage in second language learning, or to establish the effects of age and conditions of second language acquisition on this kind of competence. Much more study of discourse is needed to better understand the different learning processes between formulaic and novel language. The state of affairs is similar for child acquisition: anecdotal reports about formulaic errors in children are numerous but systematic collections and analyses of such phenomena are few.

Some experimental studies have been done in the laboratory to probe processing differences in second language learning. Jiang and Nekrasova (2007) used an on-line grammaticality judgment task to compare subjects' reaction times to formulaic, non-formulaic, and ungrammatical sequences presented visually on the computer screen. Participants were college-age native and non-native speakers of English. Shorter reaction times were seen for formulaic than non-formulaic sequences for both study groups, suggesting, as in previous studies, that formulaic expressions are stored and processed as unitary forms. A related study measuring eye movements revealed differences between native and non-native speakers in processing formulaic expressions (Underwood, Schmitt, and Galpin, 2004). Eye movements by native speakers included fewer and shorter fixations during processing of idiomatic expressions, while non-native speakers showed no advantage for formulaic over novel expressions. The finding for an advantage in eye-tracking time for formulaic expressions was supported by later studies (Conklin and Schmitt, 2008; Siyanova-Chanturia, Conklin, and Schmitt, 2011).

6. Familiarity and Memory

As an object of study, familiarity has hovered at the periphery of legitimate scientific research. Therefore, a key feature of formulaic expressions – that people know them – has been only sparsely and indirectly examined. In the dual process proposal, formulaic expressions, because of their affective content and social salience, become personally relevant (familiar) through a rapid uptake process. Familiarity, emotion, and memory are highly related in psychological performance (Stephens, 1988). These properties combine synergistically with social context to create a very large repertory of formulaic expressions in normal native language competence. This very large number, with all the semantic, usage, and social connotations, are held in memory. Recent speech studies point to retention in episodic memory of incidental and surface (sound, words, and structure) features of verbal material (Goldinger, 1996; Gurevich, Johnson, and Goldberg, 2010; Luka and Choi, 2012). Our studies suggest that this natural ability is foregrounded and exploited to the fullest in acquisition and storage of formulaic expressions.

In our studies of formulaic language, subjects endorse knowledge of any selected subset of the huge repertory that they are exposed to; knowledge is demonstrated through memory tasks probing recognition (correctly identifying whether an utterance is novel or formulaic) and recall (correctly filling in the blank of a formulaic expression) (Van Lancker and Rallon, 2004). This knowledge, according to our surveys, remains constant across generations (Van Lancker Sidtis, Cameron, and Sidtis, 2013). Related to the proposal for grammatical constructions underlying newly created sentences, it must be concluded that memory systems in humans include a capacity for storing and accessing a very large number of utterances that are fixed and stereotyped. All of this information on many thousands of utterances is stored in memory and managed by, as is posited here, a right-hemisphere-subcortical system in the brain.

Procedural memory – memory for actions and gestures – has important representation in the subcortical systems of the brain (Ullman, 2005; Graybiel, 2005). Gestures become routinized or automatized by being adapted in the motor systems of the basal ganglia. Evidence from persons with neurological disease leads to a model of the basal ganglia as playing a large role in organizing, initiating, monitoring, and executing motor gestures, such as arm movement, gait, and motor speech. In Parkinson's disease, for example, speech is impaired in fluency, rate, and articulation. These deficits are seen more prominently in spontaneous speech than in reading or repetition, which indicates that when the motor control system of the basal ganglia is provided with an external model, its production burden is lessened (Sidtis, Rogers, Godier, Tagliati, and Sidtis, 2010). An important component of this function of the basal ganglia is organizing material into unitary structures or chunks (Graybiel, 1998). These properties have led to the notion that formulaic expressions are produced with major representation in the basal ganglia using procedure memory functions, in line with recent models of brain organization for language (e.g., Ullman, 2004, 2008). From our analyses of speech obtained from persons who have suffered unilateral cerebral stroke, it appears that declarative storage of formulaic expressions is represented in the right hemisphere and motor action is instantiated through basal ganglia processes. It is from these kinds of evidence that we propose a significant role for a right-hemisphere-subcortical system in declarative and procedural memory processes in the production of formulaic expressions.

7. Neurological Foundations

As mentioned above, aphasic speech contains preserved fragments of expressive language, including exclamations and expletives, greetings, counting, days of the week and other serial speech, fixed expressions of many kinds, and memorized verbal material. Given the many examplars, the retained spoken forms differ radically across patients, except for a few constant observations: yes, no, counting, conversational speech formulas, and expletives. Following J. Hughlings Jackson's (l874a, 1874b) extensive clinical descriptions, a traditional perspective referred to these phenomena somewhat dismissively as *automatic speech* or *nonpropositional speech*, constituting verbal bits and pieces that were hardly considered part of human language (Critchley, 1970). Thus these phenomena were long ignored as nonrevealing about language structure and process. The more modern view of formulaic language provides a satisfying explanation for these observations: so-called *nonpropositional speech* represents competence for the very large repertory of formulemes, expressions that are learned in a special way with unique linguistic properties and are stored and processed differently from novel, grammatical language.

Studies comparing proportions of formulaic expressions in unilateral brain damage have shown striking differences between right and left hemispheres (Van Lancker and Postman, 2006). Left cerebral hemisphere damage was associated with abnormally high proportions of formulaic language (Blanken, 1991). Persons with mild expressive aphasia and those with fluent aphasia but poor comprehension also reveal an abnormal proportion of formulaic expressions in their speech. Observations in left hemisphere damage lead to the inference that an intact right hemisphere contributes to production of formulaic expressions (Graves and Landis, 1985). This proposal is compatible with current models of hemispheric specialization; it is generally accepted that the right hemisphere is superior at processing configurations and patterns (Benowitz, Finkelstein, Levine, and Moya, 1990; Bever, 1975; Van Lancker, 1975, 1997; Sidtis, J., 1980).

Persons with hyperexpression of formulaic language can delude interlocutors: they utilize conversational expressions deftly and copiously, giving the impression that they are communicating. The speech of an adult diagnosed with transcortical sensory aphasia comprised up to 60% of formulaic expressions (Sidtis, Canterucci, and Katsnelson, 2009). With his other preserved linguistic ability, repetition, his fluent, socially based speech often misled interlocutors into assuming normal communicative skills. Nonetheless, this individual was afflicted with profound aphasia, with severely deficient naming, comprehension, reading, and writing. His ability to produce newly created sentences to communicate semantically based information was severely impaired. This imbalance in competence for novel and formulaic utterances is seen across the aphasias and over recovery periods for patients. Examination of speech from aphasic patients undergoing rehabilitation often reveals that the quantity of speech increases, but that a large proportion is formulaic.

The communicative picture is very different in right hemisphere damage. In studies of persons suffering from stroke, persons with right hemisphere damage were seen to use speech that was pathologically deficient in formulaic expressions, containing about 16% (normal speakers' values are about 25%). It is well known that a stroke in the right cerebral hemisphere does not usually cause language deficit. Persons with right hemisphere damage generally retain grammatical, phonological, and semantic competence. For this reason, these individuals seldom undergo language testing and they are not diagnosed with a linguistic deficit. Nonetheless, the paucity of formulaic expressions following right hemisphere damage can negatively affect their communicative abilities, resulting in deficient conversational interaction.

It is only in recent years that speech–language practitioners have become aware of right hemisphere communicative deficits (Brownell, Gardner, Prather, and Martino, 1995; Van Lancker, 1997). Many of the elements belonging to language use, or the pragmatics of language, are deficient: maintaining topic and theme, conversational turn-taking, recognizing when speaker's meaning overrides linguistic meaning in utterances (as in indirect requests, sarcasm, and idiomatic expressions), processing humor, and appropriately using social expressions. When recalling the natural properties of formulaic language described above, it follows that the right hemisphere, so adept at the pragmatic component of language, would play a major role in the use of formulas. Conversely, as a sequela of pragnosia (deficits in pragmatics of communication), persons with right hemisphere damage have been shown to produce significantly fewer formulaic expressions in their spontaneous speech (Van Lancker Sidtis, 2004; Van Lancker Sidtis and Postman, 2006) (see Figure 26.2).

To better understand the role of the right hemisphere in the processing of formulaic expressions, it is useful to remember, as mentioned previously in this chapter, that preferential affective, familiar, and configurational processing has been attributed to this hemisphere. Numerous studies assign emotional processing to the right hemisphere,

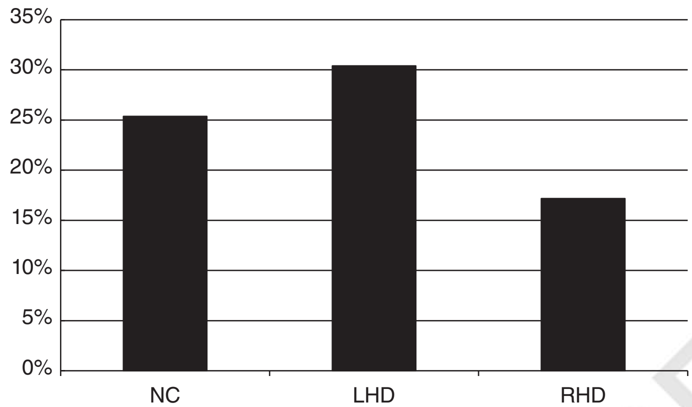

Figure 26.2. Proportions of words in formulaic expressions in the spontaneous speech of persons with left hemisphere damage (LHD), right hemisphere damage (RHD), and normal control (NC) (Van Lancker Sidtis and Postman, 2006)

while others have noted the specialized tendency to process familiar phenomena (Cutting, 1990; Silva, Leong, and Wine, 1993; for review, see Van Lancker, 1991). Since unitary structure, affective connotations, and personal familiarity are key features of formulaic expressions, it is not surprising that persons with left hemisphere damage produce a significantly larger proportion, while the speech (otherwise intact) of persons with right hemisphere damage is characterized by a significant paucity of formulaic expression.

7.1 Contribution of subcortical structures

The first evidence that subcortical nuclei contribute significantly to the production of formulaic language appeared in a paper by Illes (1989), describing the speech of persons with Parkinson's disease as impoverished in formulaic expressions. Parkinson's disease is caused by dysfunctionality of the basal ganglia due to insufficient infusion of dopamine to the structures that enable and facilitate movement. A later case study (Speedie, Wertman, Ta'ir, and Heilman (1993) described a religious individual who, following a stroke to the basal ganglia, was no longer was able to say his daily prayers. Additional support for a subcortical role in formulaic language arose from studies by Van Lancker, Pachana, Cummings, and Sidtis (2006; see also Van Lancker and Cummings, 1999). A psychiatric nurse with no language (phonology, syntax, or semantics) problems showed considerable linguistic awareness when stating that she no longer knew the "little expressions" to use in social settings. Quantitative measures of her speech confirmed a significant impoverishment of formulaic expressions in her spontaneous speech. In the companion case study, quantitative analysis of pre- and post-morbid speech revealed a significant decline in proportion of formulaic expressions following the basal ganglia injury (Sidtis, Canterucci, and Katsnelson, 2009).

Further studies of persons with Parkinson's disease lent support to the proposal that subcortical structures play an important role in production of formulaic language. Persons with Parkinson's disease have significantly fewer formulaic expressions than healthy speakers, and their proportion of formulaic language may diminish with progression and severity of the disease (Rogers, Sidtis, and Sidtis, 2009). Studies of basal ganglia function reveal its important role in configuring holistic and routinized gestures (Graybiel, 1998; Lieberman, 2002). This should not be surprising, as a range of procedurally based processes are impacted by the subcortical disturbances in Parkinson's disease. Formulaic expressions are produced as a single verbal gesture, which leads to the proposal that procedural motor processes of the basal ganglia may be highly involved in their production.

For understanding brain structures underlying use of formulaic language, Alzheimer's disease is of great interest. Alzheimer's disease affects the cortical layers but leaves basal ganglia intact until late in the disease progression. Neurologically, Alzheimer's disease presents with cortical degeneration of the temporal and parietal lobes that gradually progresses frontally. Individuals afflicted with Alzheimer's disease suffer cognitive and language impairments that continuously decline as the disease progresses (Davis and Maclagan, 2010). Syntactic structures remain relatively intact, while meaning deteriorates (Kempler and Zelinski, 1994; Altmann and McClung, 2008). Alzheimer speech is often described as "empty," with predominance of high frequency, general terms (*thing*, *stuff*). While comprehension of formulaic expressions is impaired very early in the course of the disease (Kempler, Van Lancker, and Read, 1988), production of formulaic expressions remains intact until very late.

Clinical personnel describe how persons with Alzheimer's disease use traditional greetings (*hello, nice to see you again*), leave-taking phrases (*good bye*, *have a good day*), and other formulaic expressions, which emerge intact despite profoundly impaired semantic and cognitive systems. As one example, at an Alzheimer's disease clinic, a patient with advanced dementia of the Alzheimer's type was being evaluated. He could not provide any information about himself due to profound cognitive impairment, and so instead communication with the neurologist was conducted entirely with his wife. At one point in the session the patient belched and immediately said *Excuse me*. When the session was over, he used several leave-taking phrases and expressions of thanks. These were uttered with correct prosody, lexical sequences, and articulation. A highly literate individual with Alzheimer's disease produced lengthy, memorized quotes from poetry and prose long after cognitive abilities were disabled (Hoblitzelle, 2008). Although these observations are common, quantitative measures were not available until recently.

In our laboratory, two studies of formulaic language in Alzheimer speech were conducted. In the first, transcripts of spontaneous speech samples from persons diagnosed with Alzheimer's disease and samples from age- and education-comparable healthy-control participants were analyzed using previously published methods (Van Lancker and Rallon, 2004). To compare measures in these samples with those from previous studies, word frequencies for nouns, verbs, and adjectives, and syntactic structures were quantified. Formulaic expressions are identified by two independent raters and categorized (Bridges and Van Lancker Sidtis, 2013). In line with earlier studies, individuals with Alzheimer's disease also used significantly fewer low-frequency lexical items, but they did not differ in use of complex syntactic structures (see Figure 26.3). The proportions of words in formulaic expressions in each target speech sample were calculated. The new finding was that persons with Alzheimer's disease used significantly more words in formulas than healthy controls.

In the second study, speech samples obtained from persons with Alzheimer's and Parkinson's diseases were compared by means of a structured conversational interview,

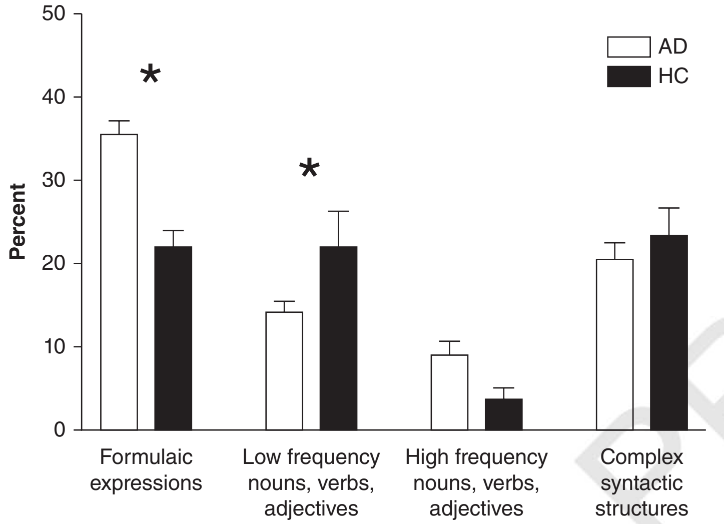

Figure 26.3. Alzheimer and healthy control (HC) participants' results for formulaic expressions, low- and high-frequency nouns, and complex syntactic structures. Findings for nouns and syntax match typical results for Alzheimer speech

followed by administration of the formal protocol testing of their abilities to produce and comprehend formulaic expressions using an instrument called the Northridge Evaluation of Formulas, Idioms and Proverbs in Social Settings (NEFIPSS; Hall, 1996). Again, persons with Alzheimer's disease had significantly greater proportions of formulaic language than normal speakers, and a trend toward more formulaic language than the Parkinson group (Rogers, Sidtis, and Sidtis, 2009).

Given their different sites of neurological impairment, it was anticipated that the Parkinson and Alzheimer groups would differ on the production as compared with the comprehension protocols. The Parkinson's group revealed relatively intact knowledge of formulaic expressions (80% correct responses), while the Alzheimer group performed poorly (67%). Comprehension of formulaic expressions in a group of Alzheimer participants had revealed deficits in an earlier study (Kempler, Van Lancker, and Read, 1988). These results suggest complementary profiles in these diseases regarding formulaic language. Alzheimer subjects are able to produce the expressions but do not have good knowledge of their meanings, while the Parkinson groups use fewer of the expressions but show appropriate knowledge of their meanings. Distortions of formulaic expressions were seen only in the Alzheimer group, likely reflecting their cortical dysfunction; an example is *If I can't say anything pleasant*, *just keep quiet* (Bridges and Van Lancker Sidtis, 2013). This profile reflects the proposal for neurological substrates underlying formulaic language expression: cortical-meaning dysfunction in Alzheimer's disease featuring intact basal ganglia, subcortical-gestural dysfunction in Parkinson's disease with relatively intact cortical function (see Van Lancker Sidtis, 2012b for review; Figure 26.4).

The role of the subcortical nuclei in the processing of formulaic language was further supported by studies of recited speech in persons with Parkinson's disease. In this format, recited speech included nursery rhymes (Humpty Dumpty), known prayers

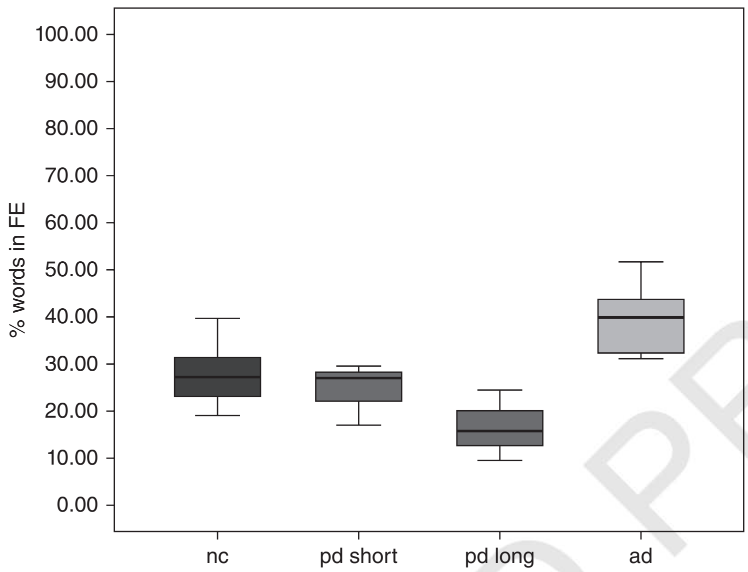

Figure 26.4. Proportions of formulaic expressions (FE) in spontaneous speech of Alzheimer's and Parkinson's disease (shorter or longer times since diagnosis)

(self-selected by subjects), and the Pledge of Allegiance. Persons with Parkinson's disease with and without deep brain stimulation were studied, and compared with healthy control speakers. Deep brain stimulation (DBS) – insertion of chronically stimulating electrodes into a selected nucleus of the basal ganglia – is a currently prevalent treatment for the movement disorders accompanying Parkinson's disease, but its effects on speech are not well known. Study participants divided into four groups: Parkinson's disease without DBS, Parkinson's disease with DBS turned ON, Parkinson's disease with DBS turned OFF, and healthy participants produced recited speech, which was recorded and analyzed. Results indicated that, overall, participants with Parkinson's disease showed significantly deficient production of recited speech in the DBS OFF state compared to normal speakers, while the DBS ON and PD (without DBS) groups showed intermediate performance (Figure 26.5). Together with results obtained from analyzing spontaneous speech of Parkinson's disease subjects, where a significant reduction in proportion of formulaic language compared with matched controls was found, these results provide considerable support for a role of subcortical systems in formulaic language (Bridges, Van Lancker Sidtis, and J. Sidtis, 2013).

8. Summary

Formulaic expressions, such as idioms, are unarguably emergent, in that they rise to an existence beyond their constituent parts, displaying entirely new, non-derived meanings and usage characteristics. Surveys and rating scales have demonstrated knowledge of a very large repertory of these expressions in the average speaker. Viewed in this framework, a viable model of language must include grammatically generated as well

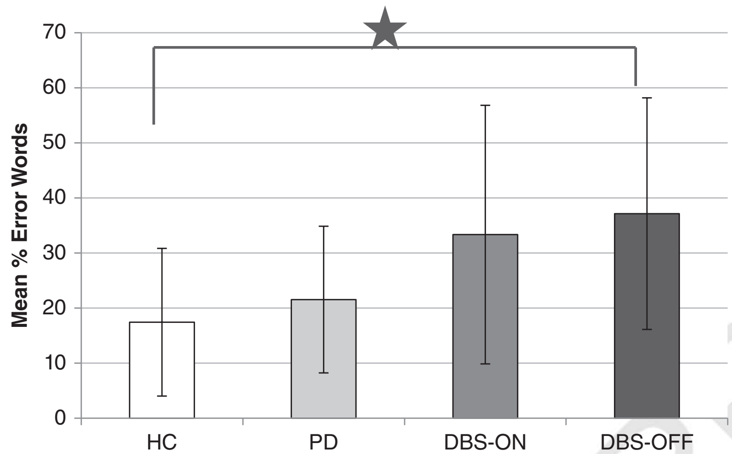

Figure 26.5. Performance on recited speech in Parkinson's disease (PD) without deep brain stimulation (DBS) and PD with DBS ON and OFF. Number of errors on recited items was quantified for each group and is given on the ordinate

as holistically stored and processed utterances. The characteristics of formulaic expressions lead to the conclusion that formulaic language draws significantly on a range of cerebral processes traditionally considered to belong to the domains of memory, emotion, vocal motor systems, arousal, learning, motivation, and cognition. These domains contribute to the acquisition and maintenance of formulaic expressions. Converging studies suggest that formulaic and novel language, respectively, are acquired, stored, and processed according to disparate psycholinguistic principles and dissociated cerebral processes. Neurolinguistic studies of persons with focal brain lesions, Parkinson's disease, and Alzheimer's disease support a dual-processing model of language, whereby novel language is processed in the left hemisphere, while formulaic language is modulated in large part by a right-hemisphere-subcortical system. Acquisition of formulaic expressions radically exploits social interaction and attentional processes in children, utilizing the holistic processing mode which functions parallel to the analytic mode. There is a distinct maturational period for such acquisition, separate from grammatical processes, which remains to be examined. In the adult, familiarity, emotional representation, memorial competence, and holistic processing operate as necessary and sufficient properties for the maintenance and use of formulaic expressions. These two modes, holistic and novel language processing, coexist at the earliest time during language development, have independent maturational trajectories, and continue in resourceful interplay into adult language use.

NOTES

1 Formuleme differs from listeme in referring only to formulaic expressions as defined here. Listeme refers to any sound–meaning pairing, including words, idioms, morphemes, acronyms, phrases, and so on.

2 Many so-called lexical bundles (Biber, 2009; Biber and Barbiere, 2007), such as "the extent to which," "in the meantime," and "over the course of" lack nonliteral and enhanced connotational meaning. Their status in the model presented here is unknown at this time.
3 See image at http://imgc.allpostersimages.com/images/P-473-488-90/61/6151/3HAG100Z/posters/charles-barsotti-why-this-is-fit-for-me-new-yorker-cartoon.jpg.
4 National Public Radio, USA, July 30, 2013.

REFERENCES

Altenberg, B. 1998. On the phraseology of spoken English: The evidence of recurrent word-combinations. In A. P. Cowie (ed.), *Phraseology*, pp. 101–124. Oxford: Clarendon Press.

Altmann, L. J. P. and J. S. McClung. 2008. Effects of semantic impairment on language use in Alzheimer's disease. *Seminars in Speech and Language* 29: 18–31.

Baron-Cohen, S. 2001. Theory of mind in normal development and autism. *Prisme* 34: 174–183.

Bates, E. and J. C. Goodman. 1999. On the emergence of grammar from the lexicon. In B. MacWhinney (ed.), *The Emergence of Language*, pp. 29–80. Mahwah, NJ: Lawrence Erlbaum.

Baudouin, J. Y., D. Gilibert, S. Sansone, and G. Tiberghien. 2000. When the smile is a cue to familiarity. *Memory* 8(5): 285–292.

Benowitz, L. I., S. Finkelstein, D. N. Levine, and K. Moya. 1990. The role of the right cerebral hemisphere in evaluating configurations. In C. B. Trevarthern (ed.), *Brain Circuits and Functions of the Mind*, pp. 320–333. Cambridge: Cambridge University Press.

Bever, T. G. 1975. Cerebral asymmetries in humans are due to the differentiation of two incompatible processes: Holistic and analytic. *Annals of the New York Academy of Science* 263: 251–262.

Biber, D. 2009. A corpus-driven approach to formulaic language in English. *International Journal of Corpus Linguistics* 14: 275–311.

Biber, D. and Barbieri, F. 2007. Lexical bundles in university spoken and written registers. *English for Specific Purposes* 26: 263–286.

Blanken, G. 1991. The functional basis of speech automatisms (recurring utterances). *Aphasiology* 5: 103–127.

Bolinger, D. 1976. Meaning and memory. *Forum Linguisticum* 1: 1–14.

Bolinger, D. 1977. Idioms have relations. *Forum Linguisticum* 2(2): 157–169.

Bousfield, W. A. 1953. The occurrence of clustering in recall of randomly arranged associates. *Journal of General Psychology* 49: 229–240.

Bridges, K. and D. Van Lancker Sidtis. 2013. Formulaic language in Alzheimer's disease. *Aphasiology* 27(7): 799–810.

Bridges, K. A., D. Van Lancker Sidtis, and J. J. Sidtis. 2013. The role of subcortical structures in recited speech: Studies in Parkinson's disease. *Journal of Neurolinguistics* 26: 591–601.

Brown, R. and Kulik, J. 1977. Flashbulb memories. *Cognition* 5: 73–93.

Brownell, H. H., H. Gardner, P. Prather, and G. Martino. 1995. Language, communication, and the right hemisphere. In H. S. Kirshner (ed.), *Handbook of Neurological Speech and Language Disorders*, pp. 325–349. Neurological Disease and Therapy 33. New York: Marcel Dekker.

Christianson, S.-Å. 1992. Do flashbulb memories differ from other types of emotional memories? In E. Winograd and U. Neisser (eds.), *Affect and Accuracy in Recall: Studies of "Flashbulb Memories,"* pp. 191–211. Cambridge: Cambridge University Press.

Clahsen, H. and H. Felser. 2006a. Grammatical processing in language learning. *Applied Psycholinguistics* 27: 3–42.

Clahsen, H. and H. Felser. 2006b. How native-like is non-native language processing? *Trends in Cognitive Sciences* 10: 564–570.

Conklin, K. and N. Schmitt, 2008. Formulaic sequences: Are they processed more quickly than nonformulaic language by native and nonnative speakers? *Applied Linguistics* 29: 72–89.

Cowie, A. P. 1992. Multiword lexical units and communicative language teaching. In P. Arnaud and H. Bejoint (eds.), *Vocabulary* *and Applied Linguistics*, pp. 1–12. London: Macmillan.

Critchley, M. 1970. *Aphasiology and Other Aspects of Language*. London: Edward Arnold.

Cutting, J. 1990. *The Right Cerebral Hemisphere and Psychiatric Disorders*. Oxford: Oxford University Press.

Cutting, J. C. and K. Bock. 1997. That's the way the cookie bounces: Syntactic and semantic components of experimentally elicited idiom blends. *Memory and Cognition* 25(1): 57–71.

Davis, B. H. and M. Maclagan. 2010. Pauses, fillers, placeholder, and formulaicity in Alzheimer's discourse: Gluing relationships as impairment increases. In N. Amiridze, B. H. Davis, and U. M. Maclagan (eds.), *Fillers, Pauses, and Placeholders*, pp. 189–216. Amsterdam: John Benjamins.

Ellis, N. C. 1996. Sequencing in SLA: Phonological memory, chunking and points of order. *Studies in Second Language Acquisition* 18: 91–126.

Erman, B. and B. Warren. 2000. The idiom principle and the open choice principle. *Text* 20(1): 29–62.

Fair, C. M. 1988. *Memory and Central Nervous Organization*. New York: Paragon House.

Fair, C. M. 1992. *Cortical Memory Functions*. Boston: Birkhäuser.

Fillmore, C. 1979. On fluency. In C. J. Fillmore, D. Kempler, and W. S.-Y. Wang (eds.), *Individual Differences in Language Ability and Language Behavior*, pp. 85–102. London: Academic Press.

Fillmore, C., P. Kay, and M. O'Connor. 1988. Regularity and idiomaticity in grammatical constructions: The case of "let alone." *Language* 64: 501–538.

Gallahorn, G. E. 1971. The use of taboo words by psychiatric ward personnel. *Psychiatry* 34: 309–321.

Gleason, J. B. and S. Weintraub. 1976 . The acquisition of routines n child language. *Language in Society* 5: 129–139.

Gold, P. E. 1985. A proposed neurobiological basis for regulating memory storage for significant events. In E. Winograd and U. Neisser (eds.), *Affect and Accuracy in Recall: Studies of "Flashbulb Memories,"* pp. 141–161. Cambridge: Cambridge University Press.

Goldberg, A. 2006. *Constructions at Work: The Nature of Generalization in Language*. Oxford: Oxford University Press.

Goldinger, S. D. 1996. Words and voices: Episodic traces in spoken word identification and recognition memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 22(5): 1166–1183.

Graves, R. and T. Landis. 1985. Hemispheric control of speech expression in aphasia. *Archives of Neurology* 42: 249–251.

Graybiel, A. M. 1998. The basal ganglia and chunking of action repertoires. *Neurobiology of Learning and Memory* 70: 119–136.

Graybiel, A. M. 2005. The basal ganglia: Learning new tricks and loving it. *Current Opinion in Neurobiology* 15: 638–644.

Graybiel, A. M 2008. Habits, rituals, and the evaluative brain. *Annual Review of Neuroscience* 31: 359–387.

Gurevich, O., M. A. Johnson, and A. E. Goldberg. 2010. Incidental verbatim memory for language. *Language and Cognition* 2–1: 45–78.

Hain, M. 1951. *Sprichwort und Volkssprache*. Giessen: Wilhelm Schmitz Verlag. English version: A. Tachler (trans.), in D. Sidtis and S. Mohr (eds.), *Formulaic Language in the Field* (to appear). Copyright.

Hall, E. 1996. Northridge Evaluation of Formulas, Idioms and Proverbs in Social Situations (NEFIPPS). Northridge, CA: Copyright. Unpublished protocol.

Hoblitzelle, O. A. 2008. *Ten thousand joys and ten thousand sorrows*. New York: Penguin Group.

Horn, G. 1985. *Memory, imprinting and the brain*. Oxford Psychology Series No. 10. Oxford, Clarendon Press.

Horowitz, L.M., and Manelis, L. 1973. Recognition and cued recall of idioms and phrases. *Journal of Experimental Psychology* 100: 291–296.

Hughlings Jackson, J. (1874b. On affections of speech from disease of the brain. In: Taylor, J. (ed.), *Selected Writings of John Hughlings Jackson*. Vol. 2:,1878–9/1932, pp. (155–204. Hodder and Stoughton, London, (1932. Originally in *Brain* 1 (1878/79) 304–330; *Brain* 2 (1879–80) 203–222 and 323–356; also Reprinted in *Brain* 38, (1915).

Hyvärinen, J. 1982a. *The Parietal Cortex of Monkey and Man*. Berlin: Springer-Verlag.

Hyvärinen, J. 1982b. Posterior parietal lobe of the primate brain. *Physiological Reviews* 62(3): 1060–1129.

Illes, J. 1989. Neurolinguistic features of spontaneous language production dissociate three forms of neurodegenerative disease: Alzheimer's, Huntington's, and Parkinson's. *Brain and Language* 37: 628–642.

Jackendoff, R. 1997. *The Architecture of the Language Faculty*. Linguistic Inquiry Monograph 28. Boston, MA: MIT Press.

James, W. (1895. The knowing of things together. *Psychological Review* 2(2): 105–124.

Jay, T. B. 1992. *Cursing in America*. Philadelphia, PA: John Benjamins.

Jiang, N. and T. M. Nekrasova, 2007. The processing of formulaic sequences by second language speakers. *Modern Language Journal* 91(3): 433–445.

Katz, J. J. 1973. Compositionality, idiomaticity, and lexical substitution. In S. Anderson and P. Kiparsky (eds.), *A Festchrift for Morris Halle*, pp. 357–376. New York: Holt, Rinehart and Winston.

Kempler, D., D. Van Lancker, V. Marchman, and E. Bates. 1999. Idiom comprehension in children and adults with unilateral brain damage. *Developmental Neuropsychology* 15(3): 327–349.

Kempler, D., D. Van Lancker, and S. Read. 1988. Proverb and idiom comprehension in Alzheimer disease. *Alzheimer Disease and Associated Disorders* 2(1): 38–49.

Kempler, D. and E. M. Zelinski. 1994. Language in dementia and normal aging. In F. A. Huppert, C. Brayne, and D. W. O'Connor (eds.), *Dementia and Normal Aging*, pp. 331–365. Cambridge: Cambridge University Press.

Koestler, A. 1967. *The Ghost in the Machine*. London: Hutchinson.

Kreiman, J. and D. Sidtis. 2011. *Foundations of Voice Studies: Interdisciplinary Approaches to Voice Production and Perception*. Oxford: Wiley-Blackwell.

Kuiper, K. 2009. *Formulaic Genres*. Basingstoke: Palgrave Macmillan.

Kuiper, K., M. Van Egmond, G. Kempen, and S. Sprenger. 2007. Slipping on superlemmas: Multi-word lexical items in speech production. *Mental Lexicon* 2(3): 313–357.

Libben, M. R. and D. Titone. 2008. The multidetermined nature of idiom processing. *Memory and Cognition* 36: 1103–1121.

Lieberman, P. 1963. Some effects of semantic and grammatical context on the production and perception of speech. *Language and Speech* 6: 172–187.

Lieberman, P. 2002. *Human Language and Our Reptilian Brain: The Subcortical Bases of Speech, Syntax, and Thought*. Cambridge, MA: Harvard University Press.

Lin, P. M. S. 2010. The phonology of formulaic sequences: A review. In D. Wood (ed.), *Perspectives on Formulaic Language: Acquisition and Communication*, pp. 174–193. London: Continuum.

Locke, J. L. 1997. A theory of neurolinguistic development. *Brain and Language* 58: 265–326.

Lounsbury, F. G. 1963. Linguistics and psychology. In Sigmund Koch (ed.), *Psychology: A Study of a Science*. New York: McGraw-Hill, pp. 552–582. (Reprinted as Bobbs-Merrill Reprint Series in the Social Sciences A-322.)

Luka, B. J. and H. Choi. 2012. Dynamic grammar in adults: Incidental learning of natural syntactic structures extends over 48 h. *Journal of Memory and Language* 66: 345–360.

Lum, C. C. and A. W. Ellis. 1994. Is "nonpropositional" speech preserved in aphasia? *Brain and Language* 46: 368–391.

MacWhinney, B. 2004. A multiple process solution to the logical problem of language acquisition. *Journal of Child Language* 31(4): 883–914.

MacWhinney, B. 2005. A unified model of language acquisition. In J. Kroll and A. De Groot (eds.), *Handbook of Bilingualism: Psycholinguistic Approaches*, pp. 49–57. Oxford: Oxford University Press.

Marsden, C. D. 1982. The mysterious motor function of the basal ganglia: The Robert Wartenberg lecture. *Neurology* 32: 514–539.

Merriman, W. E. 1999. Competition, attention, and young children's lexical processing. In B. MacWhinney (ed.), *The Emergence of Language*, pp. 331–358. Mahwah, NJ: Lawrence Erlbaum.

Miller, G. A. 1956. The magic number seven plus or minus two: Some limits to our perspective for processing information. *Psychological Review* 63: 81–87.

Mishkin, M., B. Malamut, and J. Bachevalier. 1984. Memories and habits: Two neural systems. In G. Lynch, J. L. McGaugh, and N. M. Weinberger (eds.), *Neurobiology of Learning and Memory*. New York: Guilford Press.

Moon, R. E. 1998a. *Fixed Expressions and Idioms in English: A Corpus-based Approach*. Oxford: Clarendon Press.

Moon, R. E. 1998b. Frequencies and forms of phrasal lexemes in English. In A. P. Cowie (ed.), *Phraseology*, pp. 79–100. Oxford: Clarendon Press.

Nippold, M. A. 1998. *Later Language Development: The School-age and Adolescent Years*. 2nd ed. Austin, TX: ProEd.

Nooteboom, S. 2011. Self-monitoring for speech errors in novel phrases and phrasal lexical items. *Yearbook of Phraseology* 2011: 1–16.

Osgood, C. E. and R. Housain. 1974. Salience of the word as a unit in the perception of language. *Perception and Psychophysics* 15: 168–192.

Osgood, C. E., G. Suci, and P. Tannenbaum. 1957. *The Measurement of Meaning*. Urbana: University of Illinois Press.

Palm, C. 1995. *Phraseologie: Eine Einführung*. Tübingen: Gunter Narr Verlag.

Panksepp, J. 1998. *Affective Neuroscience: The Foundations of Human and Animal Emotions*. New York: Oxford University Press.

Panksepp, J. 2003. At the interface of affective, behavioral and cognitive neurosciences: Decoding the emotional feelings of the brain. *Brain and Cognition* 52: 4–14.

Panksepp, J. 2008. The power of the word may reside in the power of affect. *Integrative Psychological and Behavioral Science* 43: 47–55.

Pawley, A. and F. H. Syder. 1983. Two puzzles for linguistic theory: Nativelike selection and nativelike fluency. In J. C. Richards and R. Schmidt (eds.), *Language and Communication*, pp. 191–226. London: Longman.

Peters, A. 1977. Language learning strategies: Does the whole equal the sum of the parts? *Language* 55: 560–573.

Peters, A. 1983. *The Units of Language*. Cambridge: Cambridge University Press.

Pickens, J. D. and H. R. Pollio. 1979. Patterns of figurative language competence in adult speakers. *Psychological Research* 40: 299–313.

Poljac, E., L. de-Wit, and J. Wagemans. 2012. Perceptual wholes can reduce the conscious accessibility of their parts. *Cognition* 123: 308–312.

Pomerantz, J, R., L.C. Sager, and R. J. Stoever. 1977. Perception of wholes and of their component parts: Some configural superiority effects. *Journal of Experimental Psychology: Human Perception and Performance* 3(3): 422–435.

Pullum, G. K. 2004. Snowclones: Lexicographical dating to the second. *Language Log*, January 16. http://itre.cis.upenn.edu/~myl/languagelog/archives/000350.html. Accessed August 7, 2013.

Rammell, C. S., D. B. Pisoni, and D. Van Lancker Sidtis. 2013. Perception of formulaic and novel utterances under acoustic degradation: Evidence for a unitary memory trace. Paper presented at Midwestern Cognitive Science Conference, Columbus, OH, May 18.

Rauschecker, J. P. and P. Marler (eds.). 1987. *Imprinting and Cortical Plasticity*. New York: John Wiley and Sons.

Reuterskiöld, C. and D. Van Lancker Sidtis. 2013. Retention of idioms following one-time exposure. *Child Language Teaching and Therapy* 29(2): 216–228.

Robinson, B. W. 1987. Limbic influences on human speech. *Annals of the New York Academy of Sciences* 280(1976): 761–771.

Rogers, T., D. Sidtis, and J. Sidtis. 2009. Formulaic language in Alzheimer and Parkinson speech. Poster presented at the Academy of Aphasia 47th Annual Meeting, Boston, October 18–22.

Sidtis, D., G. Canterucci, and D. Katsnelson. 2009. Effects of neurological damage on production of formulaic language. *Clinical Linguistics and Phonetics* 23(4): 270–284.

Sidtis, D., T. Rogers, V. Godier, M. Tagliati, and J. J. Sidtis. 2010. Voice and fluency changes as a function of speech task and deep brain stimulation. *Journal of Speech Language and Hearing Research* 53(5): 1–11.

Sidtis, J. J. 1980. On the nature of the cortical function underlying right hemisphere auditory perception. *Neuropsychologia* 18(3): 321–330.

Silva, J. A., G. B. Leong, and D. B. Wine. 1993. Misidentification delusions, facial misrecognition, and right brain injury. *Canadian Journal of Psychiatry* 38(4): 239–241.

Silverstein, A. 1987. Canonical list of fulldeckisms. http://herbison.com/canon/fulldeck.html. Accessed August 4, 2013.

Simon, H. A. 1974. How big is a chunk? *Science* 183: 482–488.

Simon, H. A., W. Zhang, W. Zang, and R. Peng. 1989. STM capacity for Chinese words and idioms with visual and auditory presentations. In H. A. Simon (ed.), *Models of Thought*, vol. 2, pp. 68–75. New Haven, CT/London: Yale University Press.

Simons, J. S. and A. R. Mayes. 2008. What is the parietal lobe contribution to human memory? Editorial. *Neuropsychologia* 46: 1739–1742.

Sinclair, J. M. 1987. Collocation: A progress report. In R. Steele and T. Threadgold (eds.), *Language Topics: Essays in Honour of Michael Halliday*, vol. 2, pp. 319–331. Amsterdam: John Benjamins.

Sinclair, J. M. 1991. *Corpus, Concordance, Collocation*. Oxford: Oxford University Press.

Siyanova-Chanturia, A., K. Conklin, and N. Schmitt. 2011. Adding more fuel to the fire: An eye-tracking study of idiom processing by native and non-native speakers. *Second Language Research* 27(2): 251–272.

Snow, C. E. 1999. Social perspectives on the emergence of language. In B. MacWhinney (ed.). *The Emergence of Language*, pp. 257–276. Mahwah, NJ: Lawrence Erlbaum.

Speedie, L .J., E. Wertman, J. Ta'ir, and K. M. Heilman. 1993. Disruption of automatic speech following a right basal ganglia lesion. *Neurology* 43(9): 1768–1774.

Stephens, L. L. 1988. The role of memory in the relationship between affect and familiarity. *Cognition and Emotion* 2: 333–349.

Stone, V., S. Baron-Cohen, and K. Knight. 1998. Frontal lobe contributions to theory of mind. *Journal of Cognitive Neuroscience* 10(5): 640–656.

Swinney, D. and A. Cutler. 1979. The access and processing of idiomatic expressions. *Journal of Verbal Learning and Verbal Behavior* 18: 523–534.

Tomasello, M. 1995. Joint attention as social cognition. In C. Moore and P. J. Dunham (eds.), *Joint Attention: Its Origins and Role in Development*, pp. 103–130. Hillsdale, NJ: Lawrence Erlbaum Associates.

Ullman, M. T. 2004. Contributions of memory circuits to language: the declarative/procedural model. *Cognition* 92: 231–270.

Ullman, M. T. 2005. A cognitive neuroscience perspective on second language acquisition: The declarative/procedural model. In C. Sanz (ed.), *Mind and Context in Adults Second Language Acquisition: Methods, Theory, and Practice*, pp. 141–178. Washington, DC: Georgetown University Press.

Ullman, M. T. 2008. The role of memory systems in disorders of language. In B. Stemmer and H. A. Whitaker (eds.). *Handbook of the Neuroscience of Language*, pp. 189–198. New York: Academic Press.

Underwood, G., N. Schmitt, and A. Galpin. 2004. The eyes have it: An eye-movement study into the processing of formulaic sequences. In N. Schmitt (ed.), *Formulaic Sequences*, pp. 155–172. Amsterdam: John Benjamins.

Van Lancker, D. 1973. Language lateralization and grammars. In John Kimball (ed.), *Studies in Syntax and Semantics*, vol. 2, pp. 197–204. New York: Academic Press.

Van Lancker, D. 1975. Heterogeneity in language and speech: Neurolinguistic studies. *Working Papers in Phonetics* 29, UCLA, The Phonetics Laboratory: Los Angeles, CA. http://escholarship.org/uc/item/8zw4z7ch. Accessed July 16, 2014.

Van Lancker, D. 1988. Nonpropositional speech: Neurolinguistic studies. In Andrew Ellis (ed.), *Progress in the Psychology of Language*, pp. 49–118. Hillsdale, NJ: Lawrence Erlbaum.

Van Lancker, D. 1991. Personal relevance and the human right hemisphere. *Brain and Cognition* 17: 64–92.

Van Lancker, D. 1997. Rags to riches: Our increasing appreciation of cognitive and communicative abilities of the human right cerebral hemisphere. *Brain and Language* 57: 1–11.

Van Lancker, D., G. J. Canter, and D. Terbeek. 1981. Disambiguation of ditropic sentences: Acoustic and phonetic correlates. *Journal of Speech and Hearing Research* 24: 330–335.

Van Lancker, D. and J. L. Cummings. 1999. Expletives: Neurolinguistic and neurobehavioral inquiries into swearing. *Brain Research Reviews* 31: 81–104.

Van Lancker Sidtis, D. 2004. When novel sentences spoken or heard for the first time in the history of the universe are not enough: Toward a dual-process model of language. *International Journal of Language and Communication Disorders* 39(1): 1–44.

Van Lancker Sidtis, D. 2006. Where in the brain is nonliteral language? *Metaphor and Symbol* 21(4): 213–244.

Van Lancker Sidtis, D. 2008a. Formulaic and novel language in a "dual process" model of language competence: Evidence from surveys, speech samples, and schemata. In Roberta L. Corrigan, Edith A. Moravcsik, Hamid Ouali and Kathleen M. Wheatley (eds.), *Formulaic Language. Volume 2: Acquisition, Loss, Psychological Reality, Functional Explanations*, pp. 151–176. Amsterdam: John Benjamins.

Van Lancker Sidtis, D. 2008b. The relation of human language to human emotion. In B. Stemmer and H. H. Whitaker (eds.), *Handbook of the Neuroscience of Language*, pp. 199–207. New York: Academic Press.

Van Lancker Sidtis, D. 2010. Formulaic and novel expressions in mind and brain: Empirical studies and a dual process model of language competence. In J. Guendouzi, F. Loncke, and M. Williams (eds.). *The Handbook of Psycholinguistic and Cognitive Processes: Perspectives in Communication Disorders*, pp. 247–272. London: Psychology Press.

Van Lancker Sidtis, D. 2012a. Formulaic language and language disorders. *Annual Review of Applied Linguistics* 32: 62–80.

Van Lancker Sidtis, D. 2012b. Two track mind: Formulaic and novel language support a dual process model. In Miriam Faust (ed.), *Advances in the Neural Substrates of Language: Toward a Synthesis of Basic Science and Clinical Research*, pp. 342–367. Oxford: Wiley-Blackwell.

Van Lancker Sidtis, D., K. Cameron, and J. J. Sidtis. Submitted. The formulaic schema in the minds of two generations of native speakers.

Van Lancker Sidtis, D., K. Kougentakis, K. Cameron, C. Falconer, and J. J. Sidtis. 2012. "Down with ____": The schema as intermediary between formulaic and novel expressions. *International Journal of Phraseology* 3: 87–108.

Van Lancker Sidtis, D., N. Pachana, J. Cummings, and J. Sidtis. 2006. Dysprosodic speech following basal ganglia insult: Toward a conceptual framework for the study of the cerebral representation of prosody. *Brain and Language* 97: 135–153.

Van Lancker Sidtis, D. and W. A. Postman. 2006. Formulaic expressions in spontaneous speech of left- and right-hemisphere damaged subjects. *Aphasiology* 20(5): 411–426.

Van Lancker Sidtis, D. and G. Rallon. 2004. Tracking the incidence of formulaic expressions in everyday speech: Methods for classification and verification. *Language and Communication* 24: 207–240.

Wagner, A. D., B. J. Shannon, I. Kahn, and R. L. Buckner. 2005. Parietal lobe contributions to episodic memory retrieval. *Trends in Cognitive Sciences* 9: 445–453.