22

Conclusions: Competition across time

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Research on competing motivations has proceeded along two separate branches. The first, with an older academic pedigree, focuses on language change and typology. This branch has emphasized general motivations (often indicated by capitalization) such as Easiness, Faithfulness, Bias, or Harmony. The second branch has developed within psycholinguistics, where the focus has been on competition between specific linguistic forms in real time. Although these two branches may seem unrelated, they are in fact closely intertwined. This relation is articulated most clearly by the theory of usage-based linguistics which views the general motivations as background pressures biasing the specific online competitions. The current volume has been devoted to the exploration and integration of both of these two branches. In this chapter, I will argue that, in order to understand the relations between these two types of competition we need to elaborate the theory of timeframe integration. We need to understand how processes organized on very different timeframes compete and cooperate to determine language processing in the present moment and its long-term cognitive and social consequences.

22.1 Competition and Systems Theory

Competition is fundamental to biological processes. Darwin (1859) showed how the evolution of the species emerges from the competition between organisms for survival and reproduction. The three basic principles underlying evolution are proliferation, competition, and selection. Proliferation generates organismic variation through mutation and sexual recombination. Organisms then compete for resources or rewards such as food, shelter, and the opportunity to reproduce. Finally, selection involves the ways in which strong and successful organisms produce offspring that also survive and reproduce.

In order to achieve proliferation, systems rely on the recombination of smaller parts. For biological evolution, the parts are the genes. For the brain, the parts are

neuronal structures working in competition. In his seminal article on the architecture of complexity, Simon (1962) emphasized the idea that cognitive processes were partially decomposable into elementary information processes or modules. Minsky (1985) pursued this idea by characterizing the mind as a society of interacting smaller processes. Both Simon and Minsky believed that people could solve large problems by combining smaller pieces in various ways. For Simon, creativity arose from the proliferation of these combinations and the subsequent imposition of mental selection of the best outcomes. Current models of cognition such as ACT-R continue on the pathway outlined by Simon and Minsky, but with increasing emphasis on links between cognition and the brain (Anderson 2007).

Aware of the limits of reductionism, Simon (1962) emphasized that complex systems were only partially decomposable. Dressler, Libben, and Korecky-Kröll (this volume) raise this same concern regarding reductionism in their discussion of competing motivations. Indeed, work in the physical, biological, and social sciences has underscored the limits of reductionism and the importance of emergent patterns of organization on higher levels (Kontopoulos 1993). The basic principles here can be nicely illustrated by considering the four levels of emergent structure during protein folding (MacWhinney 2010). The primary structure of the protein is determined by the sequence of amino acids generated by copying sequences from RNA; the secondary structure involves coils and folds created by hydrogen bonding across the amino acid chain; the tertiary structure emerges from hydrophobic reactions and disulfide bridges across secondary structures; and the quaternary structure derives from the aggregation of polypeptide subunits based on the ternary structures. In this partially decomposable emergent system, each level involves a configuration of components from lower levels, but the biochemical constraints operative on each level are unique to that level and only operate once that level has emerged during the process of folding. I will argue that these principles of partial decomposability and level-specific constraints apply with even greater force to the study of language, where the interactions between levels and timeframes are so intense. Reduction of language to simple composition of single building blocks is clearly impossible. Instead, we need to understand how complex levels such as syntax or discourse build upon lower-level structures, while still responding to level-internal pressures and constraints. In the terms of Dressler et al. (this volume), the issue for language study is figuring out how much weight preferences from higher levels have upon choices at lower levels. In the end, this is a matter of measuring the strength of competing motivations and the ways in which they mesh.

Functionalist accounts such as the Competition Model (MacWhinney 2012) view forms as competing for the expression of communicative functions or motivations. Across time, variation within both individuals and speech communities creates a proliferation of forms, and selection then determines which of these forms should survive in which communicative niches. As MacWhinney, Bates, and Kliegl (1984) noted, "the forms of natural languages are created, governed, constrained, acquired and used in the service of communicative functions." Bates and MacWhinney (1982) dissected this position into three separate claims. The first is that language change across generations is controlled by communicative function; the second is that

language acquisition in the child is shaped by communicative function; and the third is that language form in real-time conversations is controlled by communicative function. Back in 1982, it was not clear how to test or elaborate these claims and their interactions. However, ongoing advances in our understanding of the neural and social underpinnings of language now allow us to trace these interconnections in much finer detail.

To understand the linkages between processing, acquisition, and language change, we need to supplement current functionalist theories in two ways. First, we need theories that describe the mechanics of competition within individual timeframes in detail. Second, we need to understand how motivations arising from contrasting timeframes interact to impact these competitions.

22.2 The mechanics of competition

Linguistic theories often stop short of specifying the actual way in which forms compete. For example, Halliday's (2004) Systemic Function Grammar (SFG) describes in admirable detail an array of communicative options, but fails to take the additional step of showing how those options cooperate and compete during processing. Sociolinguistic accounts (Maling 2006) based on Variable Rule Analysis (Kay 1978), as well as Optimality Theory (Kager 1999) take the analyses a step further by quantifying or ranking the strengths of specific competitive processes. Psycholinguistic models such as Parallel Distributed Processing (1986) or the Unified Competition Model (MacWhinney 2012) advance the discussion still further by proposing specific mechanisms of competition that align with what we know about processing on the neuronal level (Pulvermüller 2003; Rosenbaum, 2014).

Competing forms express underlying communicative motivations in differential ways, linked to alternative timeframes. Consider the example of German pronouns for referring to the hearer (Helmbrecht, this volume). In Middle High German, the 2PL pronoun *ihr* was used as an honorific when referring to a hearer of higher social status. In the seventeenth century the 3SG pronouns *er* and *sie* entered as more marked honorifics. In the eighteenth century, yet a fourth level of politeness was added by using 3PL pronouns for the honored hearers. Each of these shifts was motivated by a complex set of motives, including the basic need to express deference (Brown and Levinson 1987), emulation of the French court by other royal courts, influences from bilingual speakers, and imitation of the royal courts by other segments of society. Contravening these pressures for differential marking were pressures for economy of reference that eventually led to the collapse of the earlier four-level system to the two-level system of modern German. Across these centuries, fundamental social changes in Europe led to marked modulations in the strengths of the underlying motives. Apart from the social changes, there were processing motives linked to the complexity of multiple honorific levels and perceived changes in the fashionableness of new markings, once they had become widely diffused outside the court.

Other formal competitions may be responsive to very different motives. For example, relative clause extraposition (RCE) is influenced by processing motives

such as clause length and intervening material length, as well as communicative motives such as definiteness, restrictiveness, previous mention, and presentational focus (Francis and Michaelis, this volume; Hawkins, this volume; Strunk, this volume). The forms of language arise from the complex interaction of these underlying motives, as discussed in every chapter in the current volume. In much of this literature, there is an emphasis on a basic competition between the motivations of Easiness and Faithfulness. It is true that many competitions can be viewed through this bipolar lens. However, there are other major motivation groups such as Politeness, Prestige, Social Solidarity, Paradigmatic Harmony, Bias, Retrievability, and Identifiability that have impacts throughout language. Moreover, these general motives are further expressed in complex and nuanced ways thoughout language and communication. In fact, the competing motivations underlying language are as complex and varied as human life itself.

The handmaiden of competition is cooperation. As Du Bois (this volume) and Bates and MacWhinney (1982) have pointed out, humans have a great many ideas that they would love to express all at once. But language only allows us to say one thing at a time. One way in which language addresses this problem is by allowing motives to form coalitions. For Bates and MacWhinney (1982) the possible solutions to competition were: (1) peaceful coexistence, (2) divide-the-spoils, and (3) winner-take-all. We can illustrate these solutions by looking at subject marking in English. In the unmarked active transitive clause, the subject expresses a coalition of motives including agency, perspective, givenness, and topicality. This construction represents a *peaceful coexistence* or coalition between the motives, because they all point in the same direction. Peaceful coexistence arises from natural patterns of cooccurence in the real world. For example, the properties of solidity, boundary, and firmness tend to cooccur for objects. Animals tend to have cooccuring features of agency, movement, warmth, directed attention, and so on. The category of definiteness involves a peaceful coexistence based on uniqueness determined by relations such as class membership (*the first door*), unique geographical feature (*the Sahara*), object owned (*the University of Colorado*), and so on.

When speakers of a language choose to emphasize one of the features in a peaceful coalition over others, the coalition can break down, creating a *divide-the-spoils* solution. For example, English uses the passive construction as a way of dividing the spoils between the topic/perspective that wins the main prizes of subject position and agreement and the agent that is awarded the "consolation prize" of placement in a by-clause. An alternative to the divide-the-spoils approach is the *winner-take-all* solution. For English transitive verbs, this solution gives rise to the truncated passive. In that solution, the agent is not expressed at all. Moravcsik refers to the winner-take-all strategy as involving *override*, because one motivation overrides others. In addition, she and Malchukov (this volume) note that competition can be resolved through the strategy of *blocking* in which both motives fail to achieve mapping to surface forms. The Competition Model work has never considered the effects of *blocking*, because it is difficult to use as stimuli forms that do not occur.

22.3 Timeframes and meshing

We can illustrate the meshing of timeframes by looking at the great astronomical clocks or *horologs* in the Gothic city hall clock towers of Europe such as Lund, Prague, and Strasbourg. These clocks display the time in minutes, hours, days, and months, while also displaying the positions of the sun, moon, and the stars of the zodiac. Coordination of these displays is controlled by a central periodic oscillation that produces changes in the long-term positioning of the various dials through wheels that mesh in complex, but accurate ratios.

Timeframe meshing in human language is more complicated and more flexible than meshing in clocks. In language, meshing involves four different major systems: dynamic neural processing, memory storage, social interaction, and environmental changes. Within each of these major systems there are scores of additional timeframes that must all be coordinated to have their effects at the moment of speaking. Let us now take a closer look at each of these four major systems.

22.3.1 *Processing wheels*

Like the heart, the brain has central timekeepers or rhythms produced by neural assemblies sensitive to hormonal control (Buzsaki 2006). Such timekeepers can then control the iterative loops (Feldman 2006) involved in walking, breathing, or speaking. In speech, the basic iterative rhythm involves the repetitive production of syllables lasting about 150 ms each (Massaro 1975). The output of this basic wheel is modified by inputs from other wheels. For example, there is a wheel grounded in the lexicon that imposes syllabic stress. This second wheel operates not at the timeframe of the syllable, but at the slightly longer timeframe of the metrical foot. It must coordinate with syllabic rhythm in order to properly impact motor output. In this case, one wheel meshes with another, not because they are both driven by gears, but because the slower wheel becomes dynamically entrained across development by the faster wheel (Iverson and Thelen 1999). As in the rhythms controlling the beating of the heart, there are neural feedback mechanisms that can modify rhythms to respond to stress, relaxation, or sleep.

22.3.2 *Memory wheels*

Linkage across timeframes also depends on memory. In order to understand how this works, it will help to take a detour into the simpler world of the honeybee. Menzel (1999) explains how honeybee cognition relies on five memory phases, each involving different cellular processes, different timeframes, and different environmental challenges. The first phase is early short-term memory (eSTM). When foraging within a single patch of flowers of the same type, bees are able to maintain attention on a pollen source through activity within an activated neural ensemble (Edelman 1987; Pulvermüller 2003) without consolidation. In the second phase of late short-term memory (lSTM), synthesis of the PKA protein kinase begins to solidify the active circuit. The third phase of middle-term memory (MTM) spans a timeframe of hours and involves the formation of covalent modifications in the

synapses between neurons. During these first three timeframes, bees have not yet returned to the hive, but are still processing flowers encountered during a single foraging bout. The fourth phase of memory consolidation relies on the formation of early long-term memories (eLTM) through the action of NO and PKC1. This type of consolidation is important, because it allows the bee to return to remembered pollen sources even after a trip back to the hive. The fifth phase of consolidation in late long-term memory (lLTM) operates across a timeframe of over three days, using PKC2 protein synthesis for even more permanent memories. Thus, each of the five phases of memory consolidation is responsive to the nature of the memory that must be retained to allow the bee to continue successful foraging.

This linkage of memory to ecological tasks is not unique to bees. We find the same five memory mechanisms operating across these timeframes in humans. For humans, there are additional mechanisms that support even more complex consolidation into cortical structures over longer timeframes for increasingly complex memories (Koechlin and Summerfield 2007). Many of these additional mechanisms rely on links between the hippocampus and the cortex (McClelland et al. 1995; Wittenberg et al. 2002), including episodic storage in the medial temporal lobes (Daselaar et al. 2004). Links between the hippocampus and auditory cortex also support our ability to pick up sequential and distributional statistical patterns (Thiessen and Erickson 2014).

Patterns that reveal themselves more slowly across longer timeframes, such as words, constructions, or social rules require more comparison across input exemplars (Ellis et al. 2014). Once a basic set of patterns has been stored in memory, new higher-level patterns can emerge through processes of generalization and association. Understanding how generalizations arise across multiple domains and timeframes is a fundamental task for the theory of child language development (MacWhinney 2014).

22.3.3 *Social wheels*

Bees also engage in communication to locate pollen sources (von Frisch 1962). However, what the bee finally encodes is not the information conveyed in these dances, but the actual nature and location of the pollen source. For humans, the details of the many spatiotemporal processes driving communicative interactions are of great importance in themselves. Children learn to be responsive to syllables, words, collocations, gestures, turn-taking patterns, proxemics, and other patterns during conversation. The long-term memories incorporating these patterns can be viewed as collections of social memes (Mesoudi et al. 2006). For these patterns, the Darwinian processes of proliferation, competition, and selection operate across spatiotemporal frames involving specific social interactions, which must then be further synchronized with the requirements of memory and processing.

22.3.4 *Environmental wheels*

Because so many aspects of our environment are shaped by human structures and interactions, it is often difficult to see how the long-term changes in the natural

environment produce impacts on language. In the extreme, forces such as glaciation, global warming, desertification, hurricanes, epidemics, or famine can lead to extinctions of whole language groups. However, the power of these natural forces is no greater than that of the forces of war, genocide, migration, and slavery brought about by man upon man.

22.4 Why study timeframes

The reader may ask whether it is really important for linguists to understand the meshing of timeframes. There are three answers to this question. The first is that failure to appreciate timeframe meshing can lead to the generation of unproductive debates. This problem is particularly acute for the theory of Competing Motivations, because the global motivations impacting output are not unitary pressures, but rather complex interactions across many wheels for processing, memory, and social interaction. Without understanding how motivations impact wheels across timeframes, we cannot understand how global motivations like Faithfulness and Easiness get cashed out in detail. The second answer is that the audio and video data we record from language production arise from the meshing of all these wheels. In order to detect the effects of these processing, memory, and social forces, we need to pull them apart statistically and analytically by detecting patterns in their combined effects on the output. This is the empirical approach of the Competition Model and variationist analysis (Poplack and Cacoullos 2014), as well as the major lesson to be derived from the chapters in this book. The third reason for wanting to understand the meshing of timeframes is to advance the scientific content of interactions across Linguistics, Biology, Psychology, and Sociology. In this chapter, my goals for timeframe analysis are more modest. Here, I will simply focus on considering how the findings presented in this volume can be interpreted in terms of the theory of timeframe meshing.

Online meshing takes in motives or pressures from across at least ten major functional domains of competition or *arenas*. These ten arenas include: word production, word comprehension, sentence production, sentence comprehension, language acquisition, diachronic change, interactional maintenance, encounter structure, group membership, and phylogenetic change. We will focus our attention here on the first six of these arenas, saying only a little about the next three, and nothing about phylogenetic change (but see MacWhinney 2008a).

22.5 Word production

Word production is the first functional arena we will examine. We have already described the 150 ms timeframe during which single syllables are articulated and the way in which wheels operating on other timeframes mesh into this syllabic backbone. This involves the meshing of word-level patterns into a sequence of motor commands being formulated in motor cortex. There are even more rapid timeframes at the output end of speech production that involve the tuning of articulatory gestures by the cerebellum and basal ganglia.

Those timeframes are important for understanding the competition between Faithfulness and Easiness. Faithfulness requires a close match between the output and the target form in long-term memory. On the level of specific articulatory gestures, as modulated by the cerebellum, Faithfulness attempts to hit articulatory targets (MacNeilage 1998) or end points as accurately as possible. To implement Faithfulness across the board, the speaker must increase attentional control and monitoring at both the lexical and articulatory levels (Roelofs 2011). However, attention is a limited good. So, increased Faithfulness to one aspect of communication, such as articulation, could come at the expense of reduced attention to some other aspect of behavior, such as monitoring for appropriate conversational sequencing or paying attention to where one is walking. Competing with Faithfulness is the motivation of Easiness that seeks to minimize effort in production. Easiness leads to all manners of assimilations and deletions, both within and between words. During speech, it can be implemented in a general manner by reducing attention. These reductions in attention can then impact individual wheels operating on lexical selection, tongue position, and so on. However, similar effects may arise instead from the long-term storage of reduced forms for frequent collocations, rather than from online processing at the moment (Bybee and Beckner 2014). The application of Easiness is facilitated by the fact that speech is so redundant that the listener can still extract the message despite omissions and assimilations. In this sense, the shape of language represents a long-term memetic adaptation to the competing demands of Easiness and Faithfulness during language usage (Regier et al. 2014).

Direct competitions arise not from the global motivations, but from specific forms that compete tightly for similar ecological niches. Consider the case of the production of *flaste* as a blend between *flavor* and *taste* (Stemberger 1985). Here, the speaker is trying to describe the flavor and taste of a type of ice cream. Both lexical items become activated at the same time, in part because they reside in the same area of the lexical map. Normal lexical processing works in a winner-take-all fashion to choose a single best matching item. However, in this particular case, the competition is not resolved in time and both elements manage to activate gestures in the output articulatory buffer, resulting in *flaste* as a blend error. In this way, various speech error phenomena, including exchanges, anticipations, perseverations, and omissions arise from failures to control lexical competition and activation. For example, Pouplier and Goldstein (2010) showed how competition operates up to the last minute in the production of consonantal anticipations. Pfeiffer (this volume) shows that corrections are sensitive to the shape of the construction in which they are embedded. In German, prepositions are tightly linked to their nouns through case and gender. Therefore, prepositional phrases constitute a unit of production. When the nouns in these prepositional phrases are corrected for semantic reasons, then the whole prepositional phrase must be retraced. English repairs, on the other hand, are far less likely to require retracing of the preposition. Through fine-grained analyses of this type, we can see how lexical competition shines a flashlight on the structures involved during the speech production process.

Current theories view lexical items as structured into *gangs* based on semantic similarity (Armstrong and Plaut 2008) and *cohorts* based on phonological similarity

(Norris 1994). The theory of self-organizing feature maps (SOFM) (Kohonen 2001) links these gangs to specific neighborhoods in the local neural topography. Analogy arises from the extension of local patterns to neighboring items and competition arises between similar items in the neighborhood. There is evidence that the brain uses this system of topological organization across all types of cortical areas, ranging from tonotopic organization in auditory cortex (Wessinger et al. 1997) to the detailed somatotopic body maps located in motor cortex (Hauk et al. 2004).

As in the case of articulatory processing, there are neuronal events at very quick timeframes that shape the overall outcome of lexical access. The basic speed of neuronal firing is in the order of 2–7 ms. If we consider that it takes perhaps 150 ms to activate a lexical item, then at least a dozen connections could be firing during this period. Some of these firings will be incomplete, some will require summation, and some will involve connections from distant cortical areas that will take somewhat longer to transmit impulses, but there is clearly time for a rich variety of interactions between items and patterns, particularly within tightly organized lexical areas. Much of the competition occurring within lexical fields involves inhibition. Inhibitory processes operate not only within gangs, but also between larger areas. Inhibition plays a major role in controlling language selection in bilinguals (Prior and MacWhinney 2010) and there are also fundamental processes of competition, cooperation, and inhibition that operate between the two cerebral cortices (Gazzaniga 1970).

Another major source of competition during production involves the coordination of gesture and speech. Just as prosody must integrate itself temporally into the 150 ms wheel of syllable production, gesture must integrate itself into the peaks and valleys of prosody. Some gestures are planned to coincide with lexical stresses; others are intended to align with pauses. McNeill (2005) and others believe that this synchronization between language and gesture occurs because both forms of expression arise from shared "growing points" within the fundamental system of embodied cognition (MacWhinney 2008b).

Production involves far more than lexical access and articulation. To produce complex words and sentences, we must figure out how to combine lexical items. Dual-route models of morphological processing of the type formulated by MacWhinney (1978) or Pinker (1999) are based on a competition between rote and combination. To study this competition, Stemberger and MacWhinney (1986) used resistance to induced speech errors to show that high frequency regulars such as *wanted* are more often produced by rote than lower frequency regulars like *spliced*. Because both rote and combination produce the same outcome, we cannot know which pathway is operative in a given case. It is possible that advances in neuroimaging such as MEG, ECoG, or NIRS may eventually allow us to trace these effects, but we already know that both routes are possible and that speakers rely on one route for some trials and the other route for other trials, depending on additional factors, such as previous lexical priming. Psychologists refer to competitions of this type as "horse races" in which two or more processes are operating in parallel and the faster one wins (Ratcliff et al. 1999). These basic facts regarding alternative brain pathways,

horse races, and the cooperative and competitive nature of language processing are incompatible with grammatical formulations that view language processing as algorithmic, deterministic, and strictly modular. It is this underlying processing indeterminacy that gives rise to the conclusion (Sapir 1921) that "all grammars leak."

The competition between rote and combination is reflected historically in the forces that determine the order of derivational and inflectional morphemes. As Dressler et al. (this volume) note, affix order is governed by a principle of relatedness: Derivational markers are closer to the stem than inflectional markers both positionally and conceptually. This tendency can be seen as a consequence of the tendency for derived forms to be encoded by rote (lexicalization) rather than combination. Forms that are retrieved by rote can then be treated as units for further inflectional processing, whereas trying to insert inflectional markings into already unitized rote forms would be difficult. In terms of processing and memory, derivational forms can be retrieved as wholes, because their shape is seldom altered by syntactic combination. Because derivational forms are stored by rote, they are then exposed to memetic forces for phonological changes and semantic drift.

Mondorf's analysis (this volume) of the competition between the synthetic comparative (e.g. *fuller*) and the analytic comparative (e.g. *more full*) in English provides detailed evidence regarding the competition between rote and combination. Synthetic forms are more likely to be stored and produced by rote, whereas analytic forms are most likely to be produced by combination. Mondorf (2009a) shows how competition between these two form types is influenced by twenty-six factors or motives. In general, there is a preference for the synthetic form when the stem is short and there are few additional factors complicating processing. This preference could reflect the fact that, in the race against combination, rote retrieval will win as long as the target form is high in frequency. If processing is slowed down by additional factors, then there will be more time for the analytic comparative to win out in the competition.

Mondorf notes that the analytic operator *more* can also function as a quantifier and the synthetic suffix *-er* can also function as an agentive suffix. She suggests that these ambiguities should diminish the validity of these cues, as analyzed by the Competition Model. A similar point was raised by Pelham (2011) in regard to the difficulties that ambiguities cause to children learning English pronouns. However, ambiguity will only have this effect if alternative readings arise in actual sentence processing. In the case of the comparative, the theory of item-based processing (MacWhinney 1975a) holds that the comparative reading is only activated if the head is an adjective. During processing, there can be a brief moment of uncertainty regarding the identity of the head in processing of sequences such as *more heavy armour*, but once attachment is resolved, the cue itself is completely reliable.

Haspelmath (this volume) considers another consequence of the horse race between rote and combination. This is the competition between marking and zero marking. Typically, zero marking applies to highly frequent unmarked categories such as Singular or Subject. It also arises in patterns such as differential object marking (DOM) (Malchukov 2008a). In all of these cases, zero marking expresses Easiness without sacrificing Faithfulness, as long as the contrasting cases are marked.

Haspelmath (this volume) notes that the preference of zero marking for high frequency items can occasionally be reversed under the pressure of analogy, which is the motive that Malchukov calls *Harmony*. To derive a fuller understanding of the competition between Easiness, Faithfulness, and Harmony, we will need to dig more deeply into the psycholinguistics of lexical competition. Specifically, we need to contrast analytic lexical combination (*more happy*), inflectional combination (*runs*), compositional compounding (*cherry pie*), non-compositional compounding (*blackboard*), derivational combination (*happier*, *feathers*), morphological rote with analogical or minor rule support (*bend-bent*, *send-sent*), and full rote (*went*). These various levels of analyticity involve not just the competition between rote, analogy, and combination (MacWhinney 1975b), but also the contrast between combinations of free and bound morphemes, transparent and opaque semantics (Plaut and Gonnerman 2000). We can better understand the full range of competitions by linking each of these pressures to the neurological mechanisms that support real-time production.

Pursuing his examination of the role of systematicity and analogy, Haspelmath notes that lexical classes are grounded on semantic and syntactic contrasts, rather than frequency information. He says that there is something "very natural" about these divisions, but that "we do not know what it is." Let me suggest that this pervasive feature of human language arises from the way in which the lexicon is structured in the cortex during development. For example, the DevLex model of the child's lexical acquisition (Li et al. 2007) shows how lexical groups emerge in self-organizing maps (Kohonen 2001) by detecting correlated regularities (Burgess and Lund 1997) in syntactic combination and semantic features. This form of organization is important because it allows distant connections from frontal areas to connect accurately to the correct part of speech and grammatical class areas in lexical space. Essentially, the brain provides mechanisms for the support of lexical field organization that function in parallel for both semantic classes and grammatical classes.

22.6 Word recognition

Word recognition relies on a basic auditory wheel that is synchronized to the same 150 ms timeframe as the articulatory wheels that produce chains of syllables (Massaro 1987). As in word production, lexical items compete during recognition in terms of gangs and cohorts. However, during perception, there is no requirement for lexical items to trigger events in the motor cortex. Instead, the impact of word recognition and sentence comprehension is to trigger interpretations in mental model space. During this process, comprehension involves motivations that are analogous to Faithfulness and Easiness in production. In recognition, the basic competition is between the Faithfulness achieved by focusing on bottom-up activation and the constructive Easiness achieved by relying on top-down information. Speed-readers rely on top-down information and minimize reliance on bottom-up information. If they use this balance carefully and strategically, they can still achieve good comprehension in less time than those who focus on the bottom-up information provided by individual words. Sentence processing shows similar effects.

Beginning second language learners find that they spend so much time focusing on individual lexical items that they sometimes miss the overall message of a sentence. As they learn to integrate top-down processes with bottom-up information, their processing improves (Presson et al. 2013).

Word recognition is fundamentally easier than word production. This difference reflects the fact that recognition is easier than recall. In the case of recognition, there are usually enough intersecting cues in the input to determine a unique winning word. Exceptions occur under conditions of noise. In production, we often fail to recall names or words that we would easily recognize. This is because recall involves the smooth generation and utilization of cues to separate out a winning word from its competitors.

22.7 Sentence comprehension

Sentence comprehension for spoken language operates within a timeframe of a few seconds. Although there is no fixed rhythmicity within this timeframe, there is a default framework for organizing comprehension in terms of the unit of the clause. Within this frame, comprehension is subject to the same competing pressures of Faithfulness, Easiness, and Harmony that we find at other timescales. Research in the Competition Model framework (<http://psyling.talkbank.org/UCM>) has analyzed sentence comprehension and production in terms of the competition between functions and forms. In production, functions compete for mapping to forms. In comprehension, forms compete for mapping to functions. Although these two processes work in opposite directions, they rely on a common set of form–function mappings and cue strengths. Because it is easier to control stimuli in comprehension experiments, there is more Competition Model work on sentence comprehension than on sentence production, although the model has been articulated for both processes. As in word recognition, sentence comprehension involves a competition between top-down processes that maximize Easiness and bottom-up processes that maximize Faithfulness. These motivations operate both cooperatively and competitively. Faithfulness works to link together lexical items into grammatical relations, based on item-based frames and higher-order constructions (MacWhinney 1975a, 1982, 1987, 2012). This is done on the basis of cues to attachment relations found in word order, morphological markers, and lexical semantics. For example, in the English sentence *the girl ate the apple*, the choice of *girl* as the agent is favored by the preverbal positioning cue, as well as the animacy cue. Listeners use these various cues to determine attachment, assign grammatical roles, and process anaphoric links between referents. Easiness or top-down processing can work to speed up bottom-up processing by forming biases and anticipations (Elman 1990) that may occasionally be contradicted by bottom-up information. When this happens, comprehension can involve slowdowns for ambiguity resolution or recovery from garden pathing.

In a given sentence, cues often yield alternative possible attachments and interpretations. To resolve these competitions, listeners rely on cue strength. In accord with Darwinian theory, the model holds that the strongest cues are the ones that have proven themselves most reliable in previous comprehension efforts. The

Competition Model views both first and second language acquisition as a process of learning these cues and setting their proper relative strengths. The timeframe of this learning extends over years, but the strengthening of individual cues occurs each time a sentence is processed. When the cues function correctly, each usage leads to a modest growth in strength, eventually producing proceduralization, fluency, and entrenchment (MacWhinney 2012). When the use of a cue leads to error, its strength is diminished and there can be a search for additional cues to resolve the competition. In this way, the fast moving timeframe of sentence comprehension meshes with the much slower process of setting cue strengths.

The principles of the Competition Model have been incorporated into a variety of other accounts, with additional mechanistic (MacDonald et al. 1994; Elman et al. 2005; O'Grady 2005) and neurolinguistic (Bornkessel-Schlesewsky and Schlesewsky, this volume) detail. In order to provide ways of comparing first and second language acquisition, the basic principles of the model have been reformulated in the Unified Competition Model (MacWhinney 2012). Nearly all of the chapters in this volume explore issues of relevance to the Competition Model. What is exciting is the way in which all this new data allows us to deepen our understanding of the linkage of competing motivations across divergent cue types and timeframes.

22.7.1 *Cues and biases*

The primary empirical claim in the Competition Model is that cue strength (as measured in sentence processing experiments) is a direct function of cue reliability (as measured from corpora). To achieve high cue strength, it is not enough for a cue to be merely frequent, rather it is more important that it be reliable and always point to the correct interpretation when it is present. Although a basic level of frequency is necessary for cue learning, the model holds that it is reliability and not frequency that is the determinant of strength or entrenchment. There are several additional factors that modify this basic relation between cue strength and reliability.

The most important limitations to the force of reliability stem from processing or *cue cost* factors, including ambiguity. When listeners are allowed to assign grammatical relations after the end of the sentence, we find an optimal pattern of cue integration based on reliability. However, when competition is measured online using ERP, crossmodal priming, joystick motions, or picture choice, a different pattern emerges. In this case, listeners depend on the most dominant cue in the language and attempt to assign that cue to one of the items in the clause.

A second major limitation relates to the Bias motivation triggered by perspective taking. In all languages studied so far, the first nominal functions as the default starting point or perspective for sentence interpretation (Bornkessel-Schlesewsky and Schlesewsky, this volume; MacWhinney, 1977, 2010; Gernsbacher 1990). The timeframe for perspective maintenance derives from higher-level top-down processes of discourse interpretation and integration, but it meshes with sentence level cues on the quicker timeframe needed to determine role assignment.

For sentence comprehension, Bornkessel-Schlesewsky and Schlesewsky (this volume) demonstrate the pervasiveness of the preference for assignment of an initial

nominal to the actor role. The Perspective Hypothesis (MacWhinney 1977) links this bias to the fact that people use the "starting points" of sentences to construct actions from their own human perspective. In a series of comprehension studies, Gernsbacher (1990) showed how pervasive this bias is in English. McDonald and MacWhinney (1995) were able to show that the establishment of a perspectival bias in a sentence persists across a longer timeframe than do more punctate cues such as implicit causality and pronominal coreference. MacWhinney and Pleh (1988) showed that perspective is temporally dominant, even in a language like Hungarian that makes strong use of case-marking and topic-marking. As long as we are dealing with SVO, SOV, and VSO languages, the application of the Perspective Hypothesis is fairly straightforward. Although VOS languages like Malagasy or Tagalog would seem to defy the linkage of perspective to the first nominal, we do not yet have published work evaluating how topic, perspective, and agency operate in processing terms in these languages.

The Competition Model analyzed the subject category as a coalition of the motives of agency, givenness, topic, and perspective. Bornkessel-Schlesewsky and Schlesewsky (this volume) show how such coalitions can be understood in terms of the theory of attractor networks. They then consider the important issue of the timeframe of the components of this coalition. The component with the most enduring timeframe is that of the human perspective. Consider the sentence, *the ball hit the boy*. The viewpoint of a boy is always more basically human than the viewpoint of a ball. However, if the previous discourse has been discussing its motions then *the ball* may be more topical. The most fast-moving timeframe is the one that determines agentive action. In this case, the action of hitting promotes the candidacy of *the ball* for subject. Well-constructed texts maintain a single topic as the perspective throughout, contradicting agency as necessary to trigger constructions such as the passive, the inverse, object fronting, or clefting. The Perspective Hypothesis views these shifts as causing increased processing load, and Bornkessel-Schlesewsky and Schlesewsky cite ERP studies by Hung and Schumacher (2012) confirming this claim. Bornkessel-Schlesewsky and Schlesewsky then proceed to argue that processing of the subject coalition utilizes the dorsal neural processing stream. This claim is in accord with the analysis of MacWhinney (2009), as well as that of Koechlin and Summerfield (2007). It is clear that agency is more local and initial than topic and perspective. However the details of the temporal, neural, and conceptual relation between topicality and perspective may require further analysis.

22.7.2 *Competition and the acquisition of grammar*

The Competition Model has also been used to account for the learning of grammatical patterns in various languages. Some of the most creative and convincing work in this area has come from workers in Leipzig, Manchester, and Liverpool. This group has emphasized the role of usage-based inputs to the child and the role of item-based constructions and formulas (Tomasello 2003a). Within this framework, Krajewski and Lieven (this volume) provide a clear summary of the Competition Model approach to grammatical development. They review a set of recent studies

using sentences with novel verbs in transitive sentences. Unlike earlier Competition Model studies, these new studies allow us to separate learning based on individual verbs from learning of more general constructions. This method tends to focus more on later stages of development, rather than the earlier development of the control of grammatical marking on the basis of item-based patterns. For example, Dabrowska and Tomasello (2008) taught Polish children a new verb that took an object in the instrumental case in one gender. They found that even 2-and-a-half-year olds were then able to mark new objects in another gender with the instrumental. But this learning is based on the single new verb that was taught and hence is only item-based, rather than construction-based. It is important to remember that individual verbs continue to behave in unique item-based ways even in adult sentence processing (Corrigan 1986; Trueswell and Tanenhaus 1994). From the viewpoint of the theory of timeframes, what is important about all of this work is the way in which it provides us with additional understanding of the quick acquisition of item-based patterns and the much slower acquisition of generalized constructions that are being abstracted in memory from collections of item-based patterns.

Rowland, Noble, and Chan (this volume) provide further detail on this issue by examining the competition for object and recipient roles in dative constructions in English, Welsh, and Cantonese. MacWhinney (in press) shows how constructions operate in terms of a hierarchy with item-based patterns at the lowest level, functional constructions at the mid-level, and global patterns at the highest level of generality. These three levels correspond naturally to three developmental timeframes with item-based patterns being acquired quickly and more general constructions being slower to form. There is little dispute about the existence of these contrasting levels of generalization (Goldberg, 2006; Kemp et al. 2007). However, the details of these developments are not yet well quantified. The studies by Rowland et al. (this volume) are quite important in that regard. They show how competition between constructions slows initial acquisition in English and Cantonese. In Welsh, where there is no such competition, datives are acquired earlier. These findings are in accord with the Competition Model analysis, as well as Slobin's (1973) one-form/one-function principle which holds that acquisition is facilitated when the child can map a form directly and simply to a single function, but delayed when the mapping is more complex and ambiguous. In terms of the theory of timeframe meshing, this suggests that delays in acquisition will arise as the child strives to acquire additional cues to sort out and control the details of the competition.

22.8 Sentence production

For sentence production, the speaker relies on the same system of cues and weights that support comprehension. This insures that the speaker marks functions in a way that can be accurately decoded by the listener. To achieve this linkage, comprehension and performance must refer to a core representational format for phonology (Hickok 2009), lexicon (Li et al., 2007), syntax (Kempen 2014), and pragmatics (Haiman, this volume). Unlike the competence component of generative theory (Chomsky 1975), the Competition Model views this shared format as composed of

a relatively simple set of linked form–function mappings or constructions (Goldberg 2006). The fundamental difference between production and comprehension is that production maps functions to forms, whereas comprehension maps forms to functions. Thus, sentence production involves recall, whereas sentence comprehension involves recognition. Just as word production is more difficult than word recognition, sentence production is more difficult that sentence comprehension. In production, one must make a series of careful choices regarding conjugation, declension, and complex sentence patterns. Some of these decisions must be made well in advance, even when the speaker has not fully formulated (Levelt 1989) the complete form of the utterance. Because of this, the motivation of Easiness plays a greater role in sentence production than sentence comprehension.

Three chapters in this volume explore ways in which forms compete during production. These chapters focus specifically on how competing motivations determine the positioning of relative clauses. Looking at 1,300 sentences from the Tübingen Treebank of Written German, Strunk (this volume) finds that relative clause extraposition (RCE) to the end of the sentence is favored by four factors: long relative clauses, absence of any intervening DP, minimal amounts of intervening material, and indefiniteness of the head. In an acceptability judgment study, Strunk finds that the presence of a demonstrative modifier, such as *derjenige* 'that one' on the head can increase the acceptability of clauses that have been extraposed across long distances.

In a second chapter on this topic, Francis and Michaelis (this volume) also find that RCE increases when extraposed clauses are longer, when the subject noun is indefinite, when the predicate is presentational or passive, and when the predicate is accessible from prior discourse context. This patterning indicates that RCE is functioning very much like a presentational construction. Using stepwise logistic regression, Francis and Michaelis show that each of these four factors makes an independent contribution. Moreover, the model based on a complete integration of the factors is nearly a perfect fit to the data. Interestingly, there are times when this smooth cue integration breaks down. Francis and Michaelis note that one of the instances that violated the cue prediction model was this marginally acceptable spoken production: *The best singer is this Olaf Bergh that I've seen.* Here, the RCE of *that I've seen* seems to be functioning more as a real afterthought, than as a presentational construction.

This type of complete cue integration described by Francis and Michaelis is comparable numerically to the high levels of model fit reported from Competition Model studies of cue integration (McDonald and MacWhinney 1989) for case role assignment. Such clear and stable results emphasize the extent to which the language processor is able to integrate patterns from contrasting timeframes online. Although these cues derive from somewhat different timeframes, they must all be available at the time when the head noun is produced, so that the speaker can produce either RCE or non-RCE at the transition between the subject and the predicate. In effect, production models must be structured to allow for online cue integration from these contrasting timeframes.

In a third chapter dealing with competition in production, Hawkins (this volume) shows how a wide range of typological patterns can be understood in terms of competing motivations. The fundamental constructs of this analysis align very closely with those from the Competition Model, while extending that analysis in important ways to typological data. Like O'Grady (2005) and MacWhinney (1987), Hawkins argues that the processor attempts to minimize cue cost by forming phrasal attachments as soon as possible. This principle accounts for the preference for short intervening domains in RCE observed by Strunk, Francis and Michaelis, and Hawkins (1994). It also explains how competing prepositional phrases are ordered in relation to the main verb, why languages attempt to place prepositions close to the verb and nouns to which they relate, what forms of center embedding are most generally tolerated, and the competition of direct objects and oblique arguments for positioning near the verb. However, the process of minimizing domains is not the only motivation in sentence production. Hawkins also considers the preference for placing fillers before gaps, showing that this motivation is stronger than the motivation for minimizing domains, when the two are in competition. This results in a preference for placing the relative clause after the head noun in OV languages like Hungarian or Persian. Further exploring the relative strength of competing motivations, Hawkins shows how a semantically based principle of placing the Agent before the Patient can compete with the motivation of consistency of case marking. Following Primus (1999), he shows how languages that have been described as OVS or OSV are really functioning not to prepose Patient before Agent, but to prepose Absolutive before Ergative, because this reduces the load on working memory. Despite this advantage for ordering Absolutive first, the fact that most ergative languages place the Ergative first indicates that the Bias motivation for marking the thematic role of agency is inherently stronger than the Harmony motivation for marking case (Malchukov, this volume), in accord with the analyses of Bornkessel-Schlesewsky and Schlesewsky (this volume) and MacWhinney (1977).

Optimality Theory—as represented in this volume by chapters from Malchukov and Lamers and De Hoop—provides another framework for analyzing preferences and competition. Lamers and De Hoop find a relatively higher level of object fronting in the elicited production of sentences with unaccusative psych verbs in Dutch such as *bevallen* 'to please' as opposed to causative psych verbs such as *overtuigen* 'to convince.' In order to produce utterances that begin with animate nouns as their starting point (MacWhinney 1977), Dutch speakers can either use passives or OVS word order. However, passivization is not possible for the unaccusatives. This means that, instead of using the consolation prize of the passive, Dutch speakers must resort to the consolation prize of OVS ordering for the unaccusatives. As a result, the strengths of OVS and passivization are reversed for the unaccusative psych verbs compared to the causative psych verbs. This leaves open the question of why the unaccusatives do not allow passivization. To account for this, Lamers and De Hoop note that the subjects of causative psych verbs such as *overtuigen* 'to convince' are more agent-like than the subjects of unaccusative psych verbs such as *bevallen* 'to please.' This effect seems to be centered in the implicit causality relations (McDonald and MacWhinney 1995) of the verb. With a verb such

as *convince*, there is an animate object that undergoes a psychological change of state or knowledge, whereas with a verb such as *please*, the animate object barely changes psychological state. It is the activity of this change of mental state that qualifies the object of the causative psych verb for passivization. This analysis shows how case role and word order cue configurations are determined first by the semantics of individual verbs, and then by the semantics of larger verb groups (MacWhinney, in press).

22.8.1 *Production, typology, and language change*

When we move from synchronic studies of sentence production to studies of typology and language change, we cross a major divide in our thinking about competing motivations. Synchronic studies can observe competition in progress at the moment, whereas diachronic studies must assume that changes emerge from the variation inherent in synchronic competitions. It is at the moment of sentence production that a speaker will drop an ending, level a paradigm, or forge a new construction. However, we can use our understanding of forces operative in the moment to illuminate the past. There is nothing radical about this assumption—it is the same assumption upon which Evolutionary Biology (Darwin 1859), Astronomy, and Geology (Hutton 1788) are based. Evolutionary Biologists, such as Darwin, are confronted with a pattern of distribution of species at a given moment in geological time and space and must reason back from this pattern to an understanding of the forces governing this distribution. Astronomers can access historical depth by comparing images derived from alternative distances in the cosmos. They can reason back from these snapshots across time to an understanding of the forces and patterns generating these images and changes. Geologists have access to present patterns of deposition, erosion, and orogeny, as well as the relatively complete record of the past available from rock exposures and drill cores. By considering detailed records of the moment of speaking across time, language scientists have access to similar data. Like astronomers, geologists, and evolutionary biologists, they must use these data to figure out how diverse processes mesh across time.

The emergence of differential object marking (DOM) (Malchukov 2008a) can be viewed as an illustration of the meshing of online pressures into the slower diachronic timeframe. For example, languages like Turkish and Hebrew may mark the direct object when it is highly prominent in terms of its definiteness. Over time, this marking can extend to other types of prominent objects, as in Spanish. In these developments, Harmony comes to dominate over Easiness. Eventually, the marking can extend to all objects and become no longer differential, as in Hungarian.

Hughes and Allen's (this volume) study of subject omission in child language provides an useful window on how synchronic pressures can lead to diachronic changes. They show that young English-speaking children tend to omit subjects when these are highly accessible (MacWhinney and Bates 1978). Hyams (2011), Ariel (1990) and others have noted similar effects of accessibility in adult pro-drop languages such as Italian or Chinese. In effect, the same pressures for dropping subjects that operate in adult Italian can be seen in both child English and highly

informal conversational English. More generally, across languages and constructions, we can often first see the effects of pressures for Easiness in child language and informal adult conversation.

Malchukov (this volume) argues that variations in alignment preferences across constructions may arise from the competition between the motivations of Bias and Harmony. Malchukov's Bias motivation includes a cluster of motivations impacting alignments between role relationships across constructions. In particular, he notes that imperatives tend to prefer accusative alignment, whereas nominalizations show a preference for ergative alignment. Malchukov argues that Harmony modifies this construction-specific biases. Like Cristofaro (this volume) and Newmeyer (this volume), he stresses the extent to which alternative resolutions of these Bias pressures arise from complex interactions of constructional types in a language at a given point in its historical development. For ergative languages, one solution to the competition between Bias and Harmony is to ignore ergative Harmony and to shift entirely to accusative marking for imperatives. Another is to retain absolutive agreement in imperatives, while losing ergative agreement. Yet another solution prohibits expression of the ergative A in an imperative, while allowing expression of the absolutive A. Malchukov's analyses show how the competition between Bias and Harmony is filtered out into finer detail against a backdrop of other features of the language such as case marking and agreement details.

Harmony can also exert a pressure toward reinterpretation of "peaceful coexistence" relations. Cristofaro (this volume) notes how the topic marker in !Xun is being reinterpreted as a subject marker. As Bates and MacWhinney (1982) and many others have noted, the high correlation between topic, givenness, perspective, and agency produces systems in which markings express all of these functions at once, but with differential emphasis in alternative competing constructions. As Dressler et al. (this volume) note, systems of interdependent motivations of this type are "the most problematic ones to identify and classify." They are also the most likely targets for reinterpretation across generations. Over time, a marking that is narrowly identified with one of these functions in the interlocking system can be reinterpreted as marking another motivation in the set (MacWhinney 1989). These readjustments are the linguistic equivalents of changes in Evolutionary Biology in which new forms arise to interpret old forms and new functions are first interpreted by old forms.

In another illustration of this process of reinterpretation, Cristofaro shows how markers of O(bject) can arise from the reinterpretation of verbs like *take*, whereas markers of A(gent) arise from the reinterpretation of deictics. For both alignment systems and number marking, Cristofaro shows how changes in the grammar can arise from the reinterpretation and grammaticalization of particular morphemes. This position is further supported by Newmeyer's (this volume) analysis of competing patterns for preposition-stranding and aux-inversion in English. In such cases of reinterpretation, it often happens that only parts of a construction move to the new configuration, leaving other parts in the old state. In general, such cases of reinterpretation to maximize Harmony provide good illustrations of the operations of competition and selection (MacWhinney 1989).

Competing motivations operating across diverse timeframes also impact the selection of more lexically limited grammatical constructions. Ariel (this volume)

examines the competitions of lexicalized forms for marking disjunction. The choice between the marking of disjunction with *or* as opposed to more specific constructions such as *or else*, *or something like that*, and *perhaps* depends on the extent to which the speaker wants to favor Faithfulness over Easiness. An even more extreme case of favoring Easiness over Faithfulness arises in cases where the conjunction is omitted altogether, leaving it to the listener to infer a disjunction. As Ariel points out, the development of these systems over time is governed by both Faithfulness and Easiness. The use of old forms for new functions initially supports Easiness over Faithfulness. However, over time, these new functions for old forms give rise to their own new forms, eventually increasing Faithfulness. A good example of a change of this type that may be in progress involves the reduction in English of the phrase *or something like that* to merely *or something*.

22.9 Interactional pressures

When people engage in conversations, they find themselves subjected to a wide variety of interactional pressures. They are supposed to be relevant, brief, and helpful (Grice 1975); they should follow rules of conversational sequencing (Schegloff 2007); they should take their listeners perspective by implementing recipient design (Garfinkel 1967); they should follow and appreciate the communications of the other person; and they should maintain topic flow and relevance (Halliday and Hasan 1976). As Augustine (1952) put it, they should "delight, inform, and persuade." To keep all of these balls in the air, speakers make use of a wide variety of conversational devices such as tempo change, prosodic variation, overlap, pausing, gesture, and proxemics, as well as linguistic devices for perspective shifting (MacWhinney 2008b), politeness, sarcasm (Haiman, this volume), denial, and agreement. These various interactional pressures and motives can arise from either long-term influences, such as years of experience with a marriage partner, or short-term experiences, such as coming to realize that a new acquaintance stutters or likes Jazz (Goodwin 1994).

As Bates and MacWhinney (1982) noted, these multidimensional motives must be packaged into the single linear stream of speech. Kaltenboeck and Heine (this volume) have explored ways in which these conversational pressures for linearization (Levelt 1981) lead people to include (paren)thetical material within utterances. These insertions constitute a separate domain of structure outside of the normal sentence grammar. The decision to resort to thetical insertion is motivated by attempts to express material that otherwise would not easily fit into sentence grammar. By providing sockets for such insertions in the form of structures such as tags, appositives, interjections, or dislocations, language is able to satisfy Faithfulness (or Expressivity) for multiple information streams.

Haiman (this volume) looks at the use of the device of repetition to express a wide variety of intentions, including intensification, symmetry, histrionics, plagiarism, agreement, and sarcasm. The forms Haiman discusses are not in direct competition, because they are formally distinct. The use of repetition to mark intensification involves simple lexical repetitions, such as *it was very very big* or *he climbed and*

climbed and climbed. On the other hand, twin forms such as *helter-skelter*, Khmer servant words forms such as *banti: bantoan* 'rush,' or parallel constructions such as *one went East, one went West* do not involve simple repetition alone, but specialized lexical or morphological devices that mark particular, specific pragmatic motives or functions. In the case of histrionic reduplications such as *tsk-tsk* or *unh-unh*, the material being repeated is lexically quite distinct from repetitions of adjectives or verbs, even if they may originally derive from content words. Moreover, languages may load additional cues, such as falsetto or high pitch, onto repeated ideophones in order to further clarify their special status. Together these divergences and added cues help the listener understand when reduplication is used for histrionic effect rather than intensification, symmetry, or some other possible motive.

22.10 Social pressures

Conversational encounters also incur a wide variety of social pressures, deriving from competing role commitments operating across very different timeframes. For example, our membership in a given racial or gender group is essentially permanent, whereas our allegiance to a particular current popular fashion trend may not last more than a few months. In between these extremes are the timeframes of our allegiance to social class, clubs, regions, family, and friends. The meshing of allegiances and identities across all of these timeframes has an ongoing impact on language usage and form. Our choice of vocabulary, slang, topics, and even language is determined by the status of our social relations to the people we meet. We can select particular linguistic options to emphasize solidarity, impose our power, or seek favors. All of these motivations, options, and pressures operate across diverse timeframes whose operation must mesh during the moment of speaking.

Looking at 207 languages in the WALS Atlas, Helmbrecht (this volume) shows how the competing motivations of Easiness, Politeness, and Prestige impact the structure of systems of second person pronouns. As we noted earlier, these motivations operate on very different timeframes. Easiness works online to favor the choice of pronouns against proper names and titles that are more difficult to select and articulate. Politeness motivations operate in terms of longer-term power relations that encourage the speaker to use terms of deference for the addressee and terms of effacement for themselves. Within a still longer timeframe, the motivation of Prestige operates to diffuse forms of polite address conceived in high society and the court to broader social circles. Across a timeframe of centuries, forms that developed first in Old Latin and the court of Charlemagne then diffused to other countries in Europe. Helmbrecht argues that this spread was motivated by bilinguals seeking to obtain Prestige by identifying themselves with the cultural elite.

22.11 Direct competition and timeframes

Newmeyer (this volume) presents a critique of functionalist theories that subscribe to what he calls "direct competition," such as the Emergent Grammar approach of Hopper (1988). These approaches are in accord with the notion being developed here

that what makes the whole system inherently adaptive and functional is the fact that motives from various timeframes must mesh at the moment of speaking. However, Hopper's account tends to minimize the role of consolidation in long-term memory. In that regard, Emergent Grammar differs fundamentally from the approach being developed here.

Newmeyer supports his critique of direct competition by citing several interesting problems in language change. The first is the competition between GEN-N (*Mary's book*) and N-GEN (*leg of the table*) forms of the possessive in English. Much like the choice between forms of the comparative (Mondorf, this volume), this competition is governed by a wide variety of cues. For example, GEN-N is used in *Riemann's Proof* with an animate possessor, but N-GEN is used in *the proof of the theorem* when the possessor is inanimate. Newmeyer believes that an analysis of the many cues and motives operative in the competition between these two constructions would be "unrevealing." On the contrary, it seems to me that it would be fascinating and instructive, as demonstrated by Mondorf's analysis of the competition for the comparative. This is not to deny the fact that many of these cues have become ossified and non-functional through the development of the language. Newmeyer's example of *Tuesday's lecture* is a good case in point. The use of GEN-N with this inanimate seems to be supported by a series of other constructions in the language such as *Tuesday's child is full of grace* or competition from *the lecture on Tuesday* as a non-possessive alternative.

Newmeyer presents another type of evidence regarding the operation of pressures from contrasting timeframes in his analysis of the loss of plural markings on forms such as *fish* and *deer*. These shortened forms originated in the hunting jargon of the elite which then spread to farmers and later to the general population. Newmeyer cites similarly "non-functional" developments in French, German, and Dutch. In all these developments, we see the operation of the slow timeframes of social diffusion for marking Prestige and other group membership motives. Newmeyer is convinced that these social motives should not be included in any reasonable grammatical analysis. However, if we view language as an adaptation situated within a widely divergent set of timeframes with their own unique motivations, then the whole system can be seen as coherent and functional.

Through his analysis of these complexities, Newmeyer reaches a conclusion that is very much in accord with the current analysis. He notes that the causation of cancer cannot be linked to some single overarching pressure. Smoking is certainly a high risk factor for cancer, but that risk can be further elevated through exposure to asbestos or radon or mitigated by consuming high-fiber foods. Exposure to asbestos can be a one-time event leading to long-term consequences, whereas exposure to radon is more likely to be an event occurring over years. Newmeyer warns against linking "statements in particular grammars with particular motivations." In the preceding pages, we have seen that simple one-to-one linkages in language are the exception, rather than the rule. Instead, what we have are remarkably complex linkages replete with reinterpretation of peaceful coexistence and divide the spoils solutions, always responsive to a menagerie of competing motivations operating across diverse timeframes. All of these pressures interact and mesh together in the

moment of speaking, emphasizing the ways in which language adapts to competing motivations.

22.12 Conclusions

Given the centrality of proliferation, competition, and selection in biological systems, and the fact that language is one of these systems, it is difficult to imagine how a theory of human language could be constructed without assigning a central place to competition. Just as Dobzhansky (1973) has declared that "nothing in biology makes sense except in the light of evolution," we can say that nothing in language makes sense except in the light of competition. The chapters in this book have shown how competition is driven by competing motives. Because we use language as the basic glue for our social lives, these competing motivations are as diverse as the many facets of human life and thought. Moreover, they are organized into processes that operate across widely divergent timeframes, ranging from milliseconds to centuries. We can study how these motivations combine and mesh by dissecting spoken interactions, analyzing language structures, following children and adults learning language, and tracing usage through corpora. The results of these analyses will eventually be expressed through models linking all of these forces to online language processing in the brain.