Explicit and Implicit Prosody in Sentence Processing

Studies in Honor of Janet Dean Fodor
The goal of this series is to bring evidence from many psychological domains to the classic questions of linguistic theory. The fundamental question from which the others flow is: What is the mental representation of grammar? Evidence from all aspects of language are relevant. How is the grammar acquired? How is language produced and comprehended? How is the grammar instantiated in the brain and how does language breakdown occur in cases of brain damage? How does second language acquisition and processing differ from first language acquisition and processing? A satisfactory theory of language calls for articulated connections or interfaces between grammar and other psychological domains. The series presents volumes that both develop theoretical proposals in each of these areas and present the empirical evidence needed to evaluate them.

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Studies in Honor of Janet Dean Fodor
To Janet with love
# Contents

**Introduction**  .................................................................................................................. 1  
Lyn Frazier and Edward Gibson

**Part I  Explicit Prosody**

**Extraposition and Prosodic Monsters in German**  ........................................... 11  
Caroline Féry

**Prosodic Realizations of Information Focus in French**  ................................. 39  
Claire Beyssade, Barbara Hemforth, Jean-Marie Marandin and Cristel Portes

**Clefting, Parallelism, and Focus in Ellipsis Sentences**  ................................. 63  
Katy Carlson

**The Effect of Phonological Encoding on Word Duration: Selection Takes Time**  85  
Duane G Watson, Andrés Buxó-Lugo and Dominique C Simmons

**Prosody and Intention Recognition**  ................................................................. 99  
Michael K. Tanenhaus, Chigusa Kurumada and Meredith Brown

**Prosody, Performance, and Cognitive Skill: Evidence from Individual Differences**  119  
Fernanda Ferreira and Hossein Karimi

**Processing, Prosody, and Optional to** ........................................................... 133  
Thomas Wasow, Roger Levy, Robin Melnick, Hanzhi Zhu and Tom Juzek
Part II  Implicit Prosody

The Roles of Phonology in Silent Reading: A Selective Review ............... 161
Charles Clifton

Empirical Investigations of Implicit Prosody ........................................ 177
Mara Breen

How Prosody Constrains First-Pass Parsing During Reading .............. 193
Markus Bader

Prominence in Relative Clause Attachment: Evidence from Prosodic Priming ............................................................... 217
Sun-Ah Jun and Jason Bishop

The Interplay of Visual and Prosodic Information in the Attachment Preferences of Semantically Shallow Relative Clauses ........ 241
Eva M. Fernández and Irina A. Sekerina

The Implicit Prosody of Corrective Contrast Primes Appropriately Intonated Probes (for Some Readers) ...................... 263
Shari R. Speer and Anouschka Foltz

Inner Voice Experiences During Processing of Direct and Indirect Speech ............................................................. 287
Bo Yao and Christoph Scheepers
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Introduction

Lyn Frazier and Edward Gibson

A group of prominent psycholinguists of various persuasions eagerly responded to a call for papers to honor Janet Dean Fodor, our beloved mentor, colleague, and friend. Those papers appear here. Janet has made numerous important contributions to the field of psycholinguistics. In the area of adult language processing, she is perhaps best known for her work on implicit prosody, but she has also contributed to our understanding of gap-filling, syntactic reanalysis, and cross-language processing (see Ferreira this volume for a fuller description). In the area of language acquisition, Janet has worked on parameter setting models, and the role of parsing in acquisition among other more specific topics. She was also the visionary behind the CUNY Conference on Human Sentence Processing, which meets annually and not necessarily in New York. It is difficult to exaggerate the role that this conference has had on organizing the field of psycholinguistics as a community involving linguists, psychologists, and computer scientists. It would not be an overstatement to claim that this community exists largely because of Janet, her vision, and her sustained efforts to make that vision a reality.

Most of the papers in this volume were first presented at a workshop held in Janet’s honor in Amherst in May 2013. Taken jointly the papers present a glimpse of the state of the art concerning prosody, both explicit and implicit, in sentence processing. Only a few decades ago, it was unclear whether there were rules governing prosody. Lehiste’s (1973) pioneering empirical work simply tried to ascertain whether various types of syntactic ambiguities could be prosodically disambiguated. By the time of Nespor and Vogel’s (1986) seminal study of prosodic disambiguation, the notion of a hierarchy of prosodic phrases (the “prosodic hierarchy”) was becoming established, in large part due to them, and in their book an explicit
phonological theory of prosodic phrasing was offered which actually predicted in advance which syntactic structures could be disambiguated prosodically. They tested the theory in Italian and the results strongly supported the theory. Today it is generally assumed that there are rules governing prosody though they are often stated in terms of violable phonological constraints, essentially with a default that the prosody reflects the syntax (Match constraints) when no higher ranked constraint countermands the syntactic constituency (see Féry this volume, Selkirk 2011).

With respect to the role of prosody in silent reading (“implicit prosody”), Janet proposed that prosodic preferences for equal-sized prosodic units, or for the default prosody of the language, might influence the syntactic analysis readers assign. Focusing on relative clause attachment ambiguities, the idea was that conditions favoring a prosodic boundary before the relative clause would favor high attachment, since the prosodic boundary serves to close off the current—lowest—phrase, thereby leaving higher attachment as the only option. Bader (1998, this volume) also argued for the existence of implicit prosody. He showed that readers assume function words are unstressed and this in turn can determine the preferred syntactic analysis of an ambiguous sentence. Before these proposals, there were various investigations of the role of phonology in silent reading (see Clifton, this volume), but they concerned the role of phonology in lexical access or in maintaining a sentence representation in memory long enough to permit further processing of it, such as drawing nonlinguistic inferences from it. What is different about the implicit prosody hypothesis is that the prosodic representation at the phrase and sentence level is hypothesized to play a causal role in syntactic processing.

The current volume examines grammatical issues (Féry, Bessayde, et al., Ferreira and Karimi), processing issues (most chapters), and brain representation (Yao and Scheepers) concerning explicit and implicit prosody. Féry (this volume) investigates extraposition in German and argues that it is constrained by prosody. Avoidance of an ungrammatical prosody, “prosodic monsters,” forces extraposition to take place under predictable circumstances. Beyssade, Hemforth, Marandin and Portes (this volume) investigate the prosody of answers to broad focus and narrow focus (“partial”) questions in French. They show that two prosodic properties, Nuclear Pitch Accent and an Initial Rise on the resolving/answering constituent are in play: both properties may be present in the answer to a narrow focus question, or only one of the properties may be present. They suggest that the Initial Rise marks a constituent with any of a number of discourse roles, including answering a narrow focus question, whereas the Nuclear Pitch Accent marks a discourse update, and as a consequence the two prosodic properties may co-occur. These studies illustrate just how closely connected prosody and intonation are to other systems of language, be it phonology and syntax, as in Féry’s study, or pragmatics, as in Beyssade et al’s chapter.

Carlson (this volume) examines focus in the semantic sense, i.e., where a focused constituent introduces semantic alternatives (Rooth 1992). She investigates whether focus conveyed by clefts and by other means such as a pitch accent behave alike in processing. In self-paced reading and auditory questionnaire studies of English, she shows that empirically they do behave similarly with respect to their effects on interpretation of ambiguous sentences. What is striking is that the particular
means used to convey the contrast does not seem to matter, e.g., in Carlson’s study. This is reminiscent of Cutler and Fodor (1979), where comparable effects are found for prosodically conveyed and for semantically conveyed focus (though see also, Drenhaus et al. 2010 for evidence that the focus introduced by clefts, pitch accent, and only differ semantically.)

Ferreira and Karimi (this volume) highlight the important issue of how one analyzes empirical data concerning duration and pauses. Since the durational properties of an utterance reflect both the prosodic phrasing assigned to the utterance and any planning/performance pauses, it is essential to separate the two if we are to properly evaluate linguistic and psycholinguistic accounts of prosody. Ferreira and Karimi’s own approach is to investigate individual differences in working memory, inhibitory control, and lexical difficulty. They show that individuals with less capacity are more likely to produce sentence internal breaks—at positions unexpected according to prosodic theory. (See Jun and Bishop, this volume, for additional discussion of individual differences.)

Watson et al. (this volume) are also concerned with understanding word durations in natural production. They evaluate whether the lengthening of a discourse-focused word is due to difficulties in phonological encoding, by comparing results of a task where participants produced pairs of words against the predictions of a simple recurrent network applied to the same task. They found that both the network and the experimental participants experienced the most errors for word pairs at word onset in cases where initial fragments overlapped in two words and at points of word nonoverlap. They therefore propose that word lengthening may be partly a result of the phonological encoding system needing processing time. They discuss these effects in part in terms of uniform information density (Aylett and Turk 2004; Levy and Jaeger 2006), whereby speakers lengthen and shorten words to facilitate robust communication with listeners.

Wasow et al. (this volume) report a corpus investigation of a previously understudied phenomenon in English that they call the “do-be construction” (DBC). In line with earlier work on optional “that” that provided support for uniform information density (Jaeger 2010; Wasow et al. 2011), they found that factors that contribute to the processing difficulty of a DBC sentence increased the probability of the use of optional “to.” In addition, they found that “to,” which is almost always unstressed, sometimes serves to prevent two stressed syllables from appearing adjacent to one another (“stress clash”; Liberman and Prince 1977). An important theoretical consequence of this work is that the prosodic effects on lexical selection favor the interactivist view over a serial, modularist view of the lexical-selection and phonological-encoding stages of language production. These results provide support for a view of moment-by-moment language production as being crucially guided by considerations of communicative optimality (Levy and Jaeger 2006; Jaeger 2010).

Tanenhaus et al. (this volume) are concerned with mapping prosody onto intentions. The relevant intentions vary with the context of an utterance (e.g., the speaker’s goals) and the realization of prosodic contours varies across speakers, accents, and speech conditions. They propose that listeners map acoustic information
onto prosodic representations using (rational) probabilistic inference, in the form of generative models, which are updated on the fly based on the match between predictions and the input. They review some ongoing work, motivated by this framework, focusing on the “It looks like an X” construction, which, depending on the pitch contour and context, can be interpreted as “It looks like an X and it is” or “It looks like an X and it isn’t.” Using this construction, they show that pragmatic processing exhibits the pattern of adaptation effects that are expected if the mapping of speech onto intentions involves rational inference.

Turning to implicit prosody, Clifton (this volume) provides an elegant review of what’s known about the role of phonology in silent reading. Knowledge of the mapping of orthography onto phonology appears to be important in skilled reading, and this knowledge is applied very early in the process of recognizing words in isolation. The same is true when one is reading sentences and texts, and the creation of a phonological representation of a text is a critical determinant of eye movement patterns during reading. Phonological representations beyond the level of the individual word, including prosodic representations, also seem to play an important role in guiding parsing and in integrating discourse-level information.

Breen (this volume) follows with a history of Fodor’s implicit prosody hypothesis (Fodor 2002) and discusses a variety of studies which have demonstrated that implicit phrasing, accentuation, and rhythm play a role in syntactic parsing. Breen suggests that the field needs to explore more subtle aspects of implicit prosody, including its relationship to overt prosody, its interaction with other information sources, and how an implicit prosodic representation serves to assist a reader in understanding written language.

Bader (this volume) reports new studies showing that default assumptions about stress/accent play a role in implicit prosody. One involves a manipulation so that the reader places stress on the more distant potential head for an extraposed relative clause in German. These studies add to his earlier work showing that manipulating stress in the implicit prosody has effects on the syntactic analysis assigned. The work highlights some of the questions about how readers assign prosody during reading. Do they use a strategy of assigning whatever prosody/intonation they would assign to the sentence in the spoken language, or are there circumstances where readers assign some minimal prosody, e.g., postulating a prosodic phrase or pitch accent only where necessary, with the consequence that the absence of a boundary (triggered by the minimality assumption) might dictate a particular syntactic analysis?

Jun and Bishop (this volume) provide an overview of the work on implicit prosody and relative clause attachment. Janet Fodor’s work stimulated a large range of work on the role of prosody in processing relative clauses with more than one potential attachment site (The daughter of the colonel who was on the balcony..., Cuetos and Mitchell 1988). Jun and Bishop note that much of the research targeting the explicit prosody assigned to this structure uses the method of having participants read sentences out loud in the laboratory. The results of this method may not be representative of natural speech. Instead Jun and Bishop introduce an implicit priming method where ambiguous target sentences are preceded by three sentences with a prosodic boundary in a particular location. With silent primes, using the