

Experimental Pragmatics

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Summary While both pragmatic theory and experimental investigations of language using psycholinguistic methods have been well-established subfields in the language sciences for a long time, the field of Experimental Pragmatics, where such methods are applied to pragmatic phenomena, has only fully taken shape since the early 2000's. By now, however, it has become a major and lively area of ongoing research, with dedicated conferences, workshops, and collaborative grant projects, bringing together researchers with linguistic, psychological, and computational approaches across disciplines. Its scope includes virtually all meaning-related phenomena in natural language comprehension and production, with a particular focus on what inferences utterances give rise to that go beyond what is literally expressed by the linguistic material.

One general area that has been explored in great depth consists of investigations of various 'ingredients' of meaning. A major aim has been to develop experimental methodologies to help classify various aspects of meaning, such as implicatures and presuppositions as compared to basic truth-conditional meaning, and to capture their properties more thoroughly using more extensive empirical data. The study of scalar implicatures (e.g., the inference that some, but not all students left based on the sentence *Some students left.*) has served as a catalyst of sorts in this area, and they constitute one of the most well-studied phenomena in Experimental Pragmatics to date. But much recent work has expanded the general approach to other aspects of meaning, including presuppositions and conventional implicatures, but also other aspects of non-literal meaning such as irony, metonymy and metaphors.

The study of reference constitutes another core area of research in Experimental Pragmatics, and has a more extensive history of precursors in psycholinguistics proper. Reference resolution commonly requires drawing inferences beyond what is conventionally conveyed by the linguistic material at issue as well: the key con-

cern is how comprehenders grasp the referential intentions of a speaker based on the referential expressions used in a given context, as well as how the speaker chooses an appropriate expression in the first place. Pronouns, demonstratives, and definite descriptions are crucial expressions of interest, with special attention to their relation to both intra- and extra-linguistic context. Furthermore, one key line of research is concerned with speakers' and listeners' capacity to keep track of both their own private perspective and the shared perspective of the interlocutors in actual interaction.

Given the rapid ongoing growth in the field, there is a large number of additional topical areas that cannot all be mentioned here, but the final section of the article briefly mentions further current and future areas of research.

Keywords implicatures, presuppositions, conventional implicatures, reference, pronouns, demonstratives, psycholinguistics, experimental linguistics

1. The Experimental Turn in Pragmatics

Broadly construed, pragmatics is concerned with the study of language use. More specifically, it investigates how the overall message conveyed by a given utterance relates to the literal meaning of the sentence uttered. In large part, it thus deals with enrichments of literal meaning, which are crucially related to the context of the utterance. However, just where the line between semantics, which is concerned with literal meaning, and pragmatics should be drawn remains controversial, as some contextual information would seem to be a prerequisite for establishing literal meaning in the first place (e.g. in resolving the reference of a deictic expression). A similarly fraught question is to what extent pragmatic inferences draw on language-specific knowledge vs. more general cognitive mechanisms. These questions form an underlying current for work in the field.

Historically speaking, the field of pragmatics originated in the philosophy of language, in particular in the school of thought of ordinary language philosophy and the late Wittgenstein's dictum that 'meaning is use.' Foundational work in modern pragmatics, such as that by Paul Grice, established the basic division between semantics and pragmatics, with distinct roles for conventionally encoded, truth-conditional literal meaning on the one hand and general pragmatic principles coming into play in language use on the other hand.

Given the origins of the field, pragmatics started out as an 'arm-chair' discipline, with corresponding methodological and empirical limitations. At the same time, it also did not involve much formalization, particularly in comparison to formal semantics as developed within theoretical linguistics starting in the 1970's.

Indeed, the common notion of the ‘pragmatic wastebasket’ used to be prevalent in linguistics, alluding to the practice of essentially labeling meaning-related issues that resisted formalization as pragmatic, thus categorizing them as ill-understood and relating to the context in murky ways. Recent decades have seen a fairly dramatic shift in both of these regards: formal tools - both familiar ones from semantics and others adapted from other fields - have introduced formal rigor into many areas of pragmatics, and the use of experimental methods from psycholinguistics has begun to greatly expand the empirical foundations of the field. The present article focuses on this latter development.

From an abstract conceptual perspective, the application of experimental tools to the study of phenomena of language use may seem like an obvious choice - it simply amounts to systematically studying language use with a core scientific approach. And despite the relatively recent development of Experimental Pragmatics as a subfield, it has already greatly enriched the overall field of pragmatics, by providing new empirical underpinnings for pragmatic theorizing, by making it possible to test ever more intricate theoretical proposals, and last but not least, by raising new questions about the cognitive processes involved in pragmatic inferencing. The remainder of this article will focus on some major areas of work in Experimental Pragmatics as illustrative case studies: The main focus is the study of various ‘ingredients’ of the overall conveyed meaning of an utterance, illustrated in particular by work on implicatures and presuppositions. The experimental study of reference resolution is also surveyed briefly. The final section briefly mentions further areas of ongoing research and directions for future work.

2. Aspects of Meaning

While participants in natural discourse will generally perceive the overall conveyed meaning of a given utterance as a monolithic whole, there is broad consensus in the theoretical literature that it is in fact a conglomerate of various different aspects of meaning, which exhibit different properties. Pinpointing the relevant properties and developing diagnoses for them to then draw conclusions about what relevant classes there might be constitutes the core challenge in this area, and the contribution of experimental approaches has proven to be particularly fruitful for this endeavor. To set the stage for more detailed discussion of various aspects of meaning, consider the following toy example from a relatively traditional perspective:

- (1) Context: A whispering to his seat neighbor B at a conference talk.
A: Is the talk over soon?
B: Some of the damn semanticists are already heading to the bar again.
- (2) Sketch of key components of meaning of B’s utterance:

Literal Meaning: A (not necessarily proper) subset of the semanticists is heading to the bar.

Conversational Implicature (context-specific): B does not know for sure whether or not the talk is over soon but it seems likely that it is.

Scalar Implicature: Not all semanticists are heading to the bar.

Presupposition: Some semanticists had headed to the bar before.

Conventional Implicature / expressive meaning: B does not hold the semanticists in high regard and/or is annoyed by their going to the bar

The literal meaning is the product of a compositional semantic computation that puts the core of the conventional, lexical meanings of the expressions used together based on the syntactic structure (see Chierchia & McConnell-Ginet, 1990; Heim & Kratzer, 1998; Elbourne, 2011; Zimmermann & Sternefeld, 2013; Jacobson, 2014, for textbook introductions). But much more than literal meaning is part of the overall message. First, while not answering A's question directly, B's response conversationally implicates that the talk is likely over soon. This implicature is entirely dependent on the specific context of use, and is by no means generally associated with any of the expressions used in the sentence. In contrast, a more general case of a conversational implicature, namely a scalar implicature, is invoked by the use of *some*, which quite generally gives rise to a 'not-all' implicature. Similarly, the expression *again* can be held responsible for introducing the notion that there was a previous event of semanticists heading to the bar, which does not feature as a prominent part of the main point of utterance, but rather is backgrounded, connecting the present main point with prior discourse - a presupposition. Finally, the expressive *damn* contributes some disdain or negative attitude on B's part towards the semanticists and their behavior, though articulating this contribution more precisely is rather challenging.

In light of this toy example, we can flesh out the general questions raised above further: why should we consider these various contributions to the overall meaning as belonging to different categories? What are the categories to begin with? What properties come with each category? How do the various contributions relate to one another? Further important questions arise if we consider the actual cognitive processes involved in comprehension: How are the different aspects of meaning combined to give rise to the impression of one overall conveyed meaning? What is the relative time-course of the various contributions being considered? In the following, we will illustrate how recent and ongoing work has begun to address these questions.

2.1 Implicatures

The notion of implicature was introduced in seminal work by Paul Grice (Grice, 1975), in order to reconcile an approach to literal meaning based on logic with observations about common phenomena in language use that seemed *prima facie* at odds with this. The fundamental distinction to account for these aspects at two distinct levels is that between sentence meaning and speaker meaning. The foundation of Grice's approach to speaker meaning is to see discourse participants as rational agents engaging in cooperative behavior. Grice posits four maxims that guide cooperative behavior: Be truthful (Quality), be informative (Quantity), be relevant (Relevance) and avoid being obscure, ambiguous, overly lengthy and disorderly (Manner). These maxims interact with one another to give rise to what a given hearer takes a given speaker to implicate by way of the utterance made.

For example, in (1) Relevance and Quality are involved in the conversational implicature that the talk is likely over soon. The most relevant and direct answer would be a plain 'yes' or 'no.' In order to reconcile the fact that B provided a different response with the assumption of cooperativity, A concludes that other maxims must have influenced B's response choice. Quality requires speakers to both be truthful and have sufficient evidence, thus A will infer that B does not know the answer, or at least not for sure, but that semanticists heading to the bar is relevant to the question, presumably by indicating that the talk is over soon. Similarly, the notion that not all semanticists are heading to the bar arises through the interplay of Quality and Quantity. There is an alternative, logically stronger statement where *some* is replaced with *all* (its scalar alternative; Horn, 1972), which would have been favored by Quantity. The fact that B chose not to utter this alternative can plausibly be explained by considering Quality, i.e., assuming that B knew the stronger statement to be false (or at least lacked evidence for it being true). This leads to the inference that B does not endorse the stronger statement, which - given further assumptions about B's informedness and authority on the matter - can be strengthened to the inference that it is indeed false.

The theoretical framework Grice initiated most certainly was not intended as a psychological account of actual mental processes, but merely as an abstract, rational explanation of communicative behavior (see Geurts & Rubio-Fernández, 2015, for recent discussion). However, just what cognitive processes are involved in utterance comprehension, and specifically in construing speaker meaning as pragmatically enriched by implicatures, constitutes a perfectly good, and closely related, research question in its own right - one that has been central to Experimental Pragmatics as a field from the early 2000's on. Scalar implicatures, such as the 'not all' implicature commonly associated with *some*-utterances, have been the main focus in this area. The key theoretical controversy has been about whether or not drawing im-

plicature inferences is an effortful and time-consuming process in cognitive terms. Defaultists, most prominently [Levinson \(2000\)](#), have argued that highly systematic, or ‘generalized’ implicatures (and in particular scalar ones, which arguably do not depend on specific aspects of the context) are so strongly associated with the triggering expression that they have the status of a default inference that is automatically and immediately associated with the relevant expressions in actual processing. Another theoretical perspective that is often associated with similar processing expectations is Grammaticism, i.e., the view that scalar implicatures are derived through covert exhaustivity operators akin to *only* at the level of Logical Form ([Chierchia, 2004](#)), but note that - for better or for worse - this theory on its own is not inherently linked to any particular processing predictions. On the other side of the debate is the Gricean (and Neo-Gricean) camp, including derivative theoretical approaches such as Relevance Theory ([Sperber & Wilson, 1995](#)), which proposes that there is a cognitively effortful process of implicature computation reflecting classical Gricean reasoning that is associated with corresponding processing delays.

Seminal work by Ira Noveck and colleagues ([Noveck & Posada, 2003](#); [Bott & Noveck, 2004](#)) provided initial experimental evidence that implicature interpretations of *some* (=‘some but not all’) arise later than literal (= ‘some and possibly all’) interpretations. To illustrate briefly, [Bott & Noveck \(2004\)](#) asked participants to provide truth-value judgments for sentences such as *Some elephants are mammals*, and found that subjects took longer to respond ‘false’ - as an implicature interpretation would require (since all elephants are mammals) - than to respond ‘true’ (which is possible given the literal meaning of *some*). In a similar vein, [Breheny et al. \(2006\)](#) found evidence for delays associated with implicature interpretations in self-paced reading for both *some* and disjunction (where the implicature gives rise to an exclusive interpretation). [Chevallier et al. \(2008\)](#) directly applied the paradigm from [Bott & Noveck \(2004\)](#) to disjunction, with parallel results. Even more fine-grained time-course evidence from the visual world paradigm (where eye movements relative to visually presented scenes are recorded while linguistic stimuli are played back auditorily; [Tanenhaus et al., 1995](#)) was first reported by [Huang & Snedeker \(2009, 2011\)](#). More recently, [Bott et al. \(2012\)](#) looked at speed-accuracy tradeoffs with implicatures, yielding more subtle behavioral evidence for delays in implicature computation.

However, there also are visual world eyetracking studies that find implicature interpretations to be available immediately, without a delay, such as [Grodner et al. \(2010\)](#) and [Breheny et al. \(2013\)](#). In other related work, [Degen & Tanenhaus \(2016\)](#) investigate contextual factors that modulate the availability of implicatures and affect the time course of implicature interpretations, which the authors argue to support a constraint based approach. Another relevant line of work that has been argued to show rapid integration of implicature inferences in online processing has

looked at the role of informativity expectations in reference resolution, where use of contrastive adjectives has been shown to more or less immediately influence the choice between otherwise compatible referents (e.g. Sedivy, 2003). A further, and somewhat different approach to assessing the time-course of implicature vs. literal interpretations has been taken by Schwarz et al. (2015), which investigates the time course of acceptance judgments in a picture matching task. Schwarz et al. (2015) find that pictures compatible with the implicature are accepted more quickly than ones that are only compatible with literal meaning, and Schwarz et al. (to appear) use eye movement data from a visual world variant of this approach to show that even when subjects accept a literal picture, they go through a stage of considering the implicature interpretation. While on the whole, studies in this area have yielded significant progress, this continues to be a very lively area of ongoing research and theoretical controversies. Given the seemingly divergent sets of results, it is clear that a broader perspective is needed which incorporates both various contextual factors affecting the availability of implicatures in online processing as well as the precise timing thereof.

Another important line of work, which indeed preceded the above adult processing work at least in part, has looked at implicatures in language acquisition. The basic tenet of this work has been that children tend to respond more literally than adults. For example, Noveck (2000), Guasti et al. (2005), and Chierchia et al. (2004), find that children respond based on literal interpretations of *some* more often than adults. Another related line of work has looked at literal interpretations of disjunction in children (see Crain, 2008, for an accessible illustration). Overall, the empirical situation seems more clear-cut here than in the adult processing literature: researchers robustly find children's behavior to be more logical than adults. Much of the literature is thus concerned with explaining this finding. One common interpretation is to conclude that children are unable to go through the steps of Gricean reasoning necessary to derive an implicature. But various other explanations have been offered as well that allude to differences in how children relate to the discourse context and what general cognitive resources they bring to the process. For example, various authors argue that a more convincing explanation can be provided in terms of task effects and contextual factors, given that the observed effects happen at various ages and with such systematic variability (see, e.g., Papafragou & Tantalou, 2004; Gualmini et al., 2008). Another variation along these lines, raised by Katsos & Bishop (2011), is that children are more tolerant in accepting literal interpretations in the relevant experimental tasks. A more resource oriented proposal has been argued for by Barner et al. (2011), among others, which concludes that children do not have access to the relevant alternatives for specific scales in the same way as adults.

As the field of experimental research on implicature has been emerging and

expanding over recent years, various other theoretical and empirical issues have gained importance. One key theoretical issue that has attracted a fair amount of experimental investigation concerns so-called local implicatures, i.e., implicature-type strengthening in the scope of embedding expressions. These have been argued to make a strong case for grammatical approaches to implicatures (Chierchia, 2004; Chierchia et al., 2012). The outcome of experimental work in this area has been somewhat mixed, with some arguing against the existence of embedded implicatures (Geurts & Poussoulous, 2009) and others finding evidence in their favor (Clifton & Dube, 2010; Chemla & Spector, 2011), but the theoretical literature contains rather compelling arguments in their favor (Chierchia et al., 2012; Sauerland, 2014).

Another important recent development in experimental work has begun to expand empirical coverage by looking at a broader variety of triggers. For example, Doran et al. (2012) investigate a broad range of implicatures and further shed light on speakers' capacity to access sentence and speaker meaning independently by utilizing a 'Literal Lucy' speaker. They find considerable variation in implicature interpretation rates across triggers which for the most part does not align neatly with any existing classification of implicature types. In a similar vein, van Tiel et al. (2014) consider a wide range of scalar terms, including a large number of scalar adjectives, and assess the relative frequency of implicature responses in light of two factors: availability of scalar alternatives (measured by association strength, grammatical class, word frequencies, and semantic relatedness) and distinctness of scale mates (operationalized as semantic distance and boundedness). They only find the second factor to significantly correlate with implicature rates. Yet another novel empirical approach is pursued by Degen (2015), who collected judgments on implicature strength for naturally occurring examples from a web-based corpus. The results suggest that implicature strength varies greatly based on linguistic factors, such as partitive forms and the nature of the quantificational determiner, and thereby provide a potential challenge to the notion that implicatures occur with scalar expressions as the general norm.

In sum, experimental work on implicatures has played a pivotal role in the nascent field of Experimental Pragmatics, and the increasingly rich body of work in this area has allowed for considerable progress both in theoretical terms and with respect to our understanding of the mental processes involved in drawing implicature inferences. At the same time, many new questions have arisen from this work, which call for more in-depth exploration. Furthermore, the expansion of experimental methods to various types of implicatures and implicature triggers is only in its beginnings.

2.2 Presuppositions

The notion of presupposition goes back to Frege (1892) and gained initial prominence in the modern literature through Strawson (1950). The latter argued that sentences with definite descriptions, such as *The King of France is bald* are neither true nor false, given that there is no (present) king of France (in contrast to Russell (1905), who proposed that such statements are simply false). While details in the analysis of definites themselves remains controversial (see Ostertag, 1998; Reimer & Bezuidenhout, 2004, for recent collections), it soon transpired in the linguistic literature that there is a host of expressions that exhibit similar properties. The two key properties typically assumed to hold of such ‘presupposition triggers’ are a) that the presupposed information is (usually) already taken for granted by the discourse participants (or at least backgrounded) and b) that it is not affected by a variety of embedding operators. Take the example of the contribution of *again* to the overall conveyed meaning of (1): it conveys that there was a previous time where some of the semanticists headed to the bar, but this is by no means the main point of the utterance, and rather something already mutually assumed by the interlocutors. This is reflected in the fact that one cannot directly challenge this aspect of the message, e.g., by just saying *No*. Instead more elaborate means are required, such as *Hey, wait a minute - I didn’t know the semanticists had headed to the bar before!* (Shannon, 1976; von Stechow, 2004). Turning to the second property, consider variations of the original sentence in various embedding environments:

- (3) a. If some of the semanticists are already heading to the bar again, it must be over soon.
- b. Are some of the semanticists already heading to the bar again?
- c. Probably some of the semanticists are already heading to the bar again.

None of these variations convey that some semanticists are in fact heading to the bar - (3a) merely considers that case as a possibility, (3b) explicitly requests information on whether this is the case, and (3c) merely claims this to be likely - but they all still convey the presupposition that semanticists headed to the bar at some point before. This is the phenomenon of ‘presupposition projection’, which has been at the core of theoretical debates in this area (see Schlenker, 2011a,b, for an introduction to recent approaches). The central challenge is to account for how presuppositions interact with both their intra-sentential and extra-sentential (as well as extra-linguistic) context, as projection does not always arise and sometimes gives rise to modulated versions of the presupposition (e.g., in the form of a conditional; Heim, 1983).

Generally speaking, the predominant theoretical approach in the literature, going back to Karttunen (1974) and Stalnaker (1973) understands presuppositions to

impose constraints on the contexts in which a sentence can be uttered felicitously (with more intricate projection phenomena accounted for by a notion of ‘local’ contexts). Ongoing theoretical debates concern both the source and status of presuppositions. Concerning the former, most of the classical work in linguistics had assumed presuppositions to be encoded conventionally in the lexical entries of the relevant expressions, but various recent proposals have revived a pragmatic view (going back to [Stalnaker, 1973, 1974](#)) that (at least some) presuppositions can be conversationally derived ([Simons, 2001](#); [Abusch, 2010](#); [Romoli, 2014](#)). With respect to the latter, there is a question as to whether or not the notion that presupposed content needs to be taken for granted by the interlocutors can generally be maintained in light of well-known counter-examples involving accommodation ([Lewis, 1979](#)). Alternatively, one could think of them as simply backgrounded information, and even that could be a status that’s subject to their relation to the context, e.g., in terms of the question under discussion ([Tonhauser et al., 2013](#)).

While initial pursuits to experimentally investigate presuppositions lagged behind work on implicatures, there now is a substantial and constantly growing body of experimental work on presuppositions addressing a wide range of issues and phenomena. Two recent studies relate to Strawson’s original point about the presuppositions of definites. [Abrusán & Szendrői \(2013\)](#) report a truth-value judgment study investigating the effects of topicality and verifiability on speakers’ willingness to judge sentences with non-referential definites as plain false (rather than truth-value-less) based on factors such as verifiability and topic-hood ([Reinhart, 1981](#); [Laserson, 1995](#); [von Stechow, 2004](#)). In a forced-choice task with ‘can’t say’ as a third option, they found that subjects were generally quite willing to judge affirmative versions as ‘false’, independent of the manipulated factors. However, in negated versions, both the topicality and verifiability manipulations significantly increased the proportion of ‘true’ judgments, suggesting that these factors affect speakers’ disposition to assign a truth-value. [Schwarz \(2016b\)](#) takes a different approach to the same issue by measuring reaction times in a binary truth-value judgment task, and finds that with definite descriptions, subjects are slower to respond ‘false’ when no individual has the property described by the noun phrase (relative to when the main predicate is false), in contrast to indefinite controls. This suggests that even plain false judgments can reflect presupposition failure in the way that the judgment is reached.

Given the extensive body of work on the time course of implicature processing as well as the theoretical debates about the source of presuppositions, it is natural to investigate the time course of accessing presupposed content as well. Overall, there is mounting evidence that presuppositions are available rapidly during online processing. One set of pertinent results comes from reading studies, which vary whether or not a given presupposition is supported by, or at least consistent with,

the context and then look for corresponding slow-downs upon encountering the trigger based on the inconsistency of the presupposition and the context (Schwarz, 2007; Tiemann et al., 2011, 2015). Extending this approach to eyetracking during reading, Schwarz & Tiemann (2016) look at German *wieder* ('again') and find delays in early processing measures on the verb following *wieder*. Another line of work has employed the visual world eye tracking paradigm, with early results by Craig Chambers and colleagues (see Chambers & Juan (2005) on *another* and Chambers & Juan (2008) on *return*.), both finding immediate eye movement effects attributable to the respective presuppositions. More recently Romoli et al. (2015) and Schwarz (2015b) compare the presupposition of *also* to the asserted component of *only*. The results from these studies also indicate immediate availability of presupposed material. Altogether, these results are most naturally compatible with accounts that assume presupposed content is encoded conventionally, though they could also be a reflection of rapid pragmatic effects.

A considerable amount of experimental work has aimed to clarify the basic empirical patterns involved in projection. For example, there is disagreement in the theoretical literature on whether a presupposition trigger in the consequent of a conditional gives rise to a conditional or non-conditional presupposition for the overall sentence. Both types of interpretations appear to be attested, but theories differ in terms of which one they see as basic. Romoli et al. (2011) provide a first experimental exploration of this topic using a covered box picture matching task (Huang et al., 2013) and argue their results to favor accounts that predict a conditional presupposition as the basic one. Relatedly, Chemla & Schlenker (2012) test presupposition triggers in conditionals, disjunctions, and *unless*-sentences. In an inference judgment task, they find that subjects more strongly endorse inferences corresponding to a conditional inference, compared to a non-conditional one, regardless of where the presupposition trigger appears.

Another important topic involving projection concerns the availability of so-called local interpretations, where presuppositions embedded under an operator whose scope they would normally escape are interpreted relative to the operator (e.g., *The king of France is not bald - because there is no king of France!*). Such readings had long been considered to be dispreferred in the theoretical literature, and this was recently supported experimentally by Chemla & Bott (2013), who used a truth value judgment task with sentences such as (4) and measured reaction times for subjects' responses.

- (4) Zoologists don't realize that elephants are reptiles.

The factive verb *realize* presupposes the truth of its complement clause. But a local interpretation has that inference negated as part of the asserted content (\approx 'It is not the case that [elephants are reptiles and Zoologists believe that they are]'). The

sentence should then be judged true, whereas it would be false on a global reading. Both types of responses are frequently given by subjects, but the ‘true’ responses take significantly longer than ‘false’ responses (see Romoli & Schwarz, 2015, for comparable results for *stop* in a covered box picture matching task).

Various other issues in presupposition projection have seen recent experimental advances as well. Chemla (2009) spear-headed the investigation of presupposition triggers in quantified sentences and the readings that they give rise to. He reports results from an inferential judgment paradigm suggesting that quantifiers vary in terms of the strength of the presupposition (e.g., whether it is universal, existential, or somewhere in-between), in a way that is not predicted by any of the main theories on the market. Similarly, Tiemann (2014) reports reading time evidence for variation between existential vs. universal presuppositions for existential and universal quantifiers. More recently, Zehr et al. (2015) argue based on a picture matching task that even a single quantifier, *none*, can exhibit both existential and universal readings (in addition to a local accommodation reading).

Much current work on presuppositions is concerned with the apparent need to differentiate different types of presupposition triggers, with various proposals for fleshing out the distinctions between them, such as lexical vs. resolution triggers (Zeevat, 1992), soft vs. hard triggers (Abusch, 2002, 2010; Romoli, 2014), strong vs. weak triggers (Glanzberg, 2005), and ones that entail their presupposition vs. ones that don’t (Sudo, 2012). Some of these have seen some initial experimental investigations. Cummins et al. (2013) and Amaral & Cummins (2015) build on Zeevat’s notion and argue that resolution triggers are compatible with ‘Yes, although...’ continuations that directly contradict the presupposition (e.g., *Did Brian lose his wallet again? Yes, although he never lost it before.*), whereas lexical triggers are not. While their results also align, by and large, with the hard vs. soft distinction, other work suggests that the relevant trigger differences may not be as clear-cut as the literature suggest. Jayez et al. (2015) argue that, contra Abusch (2010), hard triggers allow for accommodation in the antecedent of conditionals once the context is controlled for properly, and Singh et al. (2015) argue that hard triggers like *too* can be accommodated globally as long as this is plausible in context. Schwarz (2014) compares the time course for processing soft vs. hard triggers in the visual world paradigm, without any differences emerging that might have been expected if soft triggers are conversationally derived. In another line of work, Romoli & Schwarz (2015) and Schwarz et al. (2015) investigate the analysis of soft triggers as scalar implicatures proposed by Romoli (2014) by directly comparing the soft trigger *stop* under negation to strong scalar items under negation, and ultimately find differences that challenge a unified view. Two further studies do report differences between triggers along the lines of potential theoretical distinctions. Domaneschi et al. (2013) take the weak vs. strong distinction from Glanzberg

(2005), arguing that certain triggers require accommodation in non-supporting contexts while others are only optionally accommodated (for another relevant result, see [Tiemann et al., 2015](#)). This difference is borne out in their experiments where subjects are exposed to short narrative texts and are later queried about various inferences introduced by different presupposition triggers. They find that the two types of triggers indeed differ in terms of how present the inferences they introduce are when answering questions about the previously heard text, in that accuracy is overall much lower for weak triggers.

2.3 Conventional Implicatures

Of the major traditional aspects of meaning, conventional implicatures have seen the least amount of systematic experimental exploration. Their role in the traditional literature has also been somewhat varied. While Grice introduced the term in direct contrast to conversational implicatures, their distinction from presuppositions was not always clear (see, e.g., [Karttunen & Peters, 1979](#)). More recently, however, [Potts \(2005\)](#) firmly (re-)established them as a class of their own and proposed a multi-dimensional analysis, covering both expressives, such as *damn* in the example in (1), and various other expressions and constructions, e.g., appositive nominals and relative clauses. One of the central claims of his analysis was that they are invariably speaker-oriented, i.e., unlike presuppositions, they always make their contribution at the global level of the entire sentence. However, [Amaral et al. \(2008\)](#) argued that non-speaker oriented interpretations exist and are more prevalent than expected on that type of account. In a series of experiments and corpus studies, [Harris & Potts \(2009b\)](#) and [Harris & Potts \(2009a\)](#) investigate the conditions under which such readings become available. Another aspect of conventional implicatures is that they introduce information that has been argued to be strictly separate from the main point of the utterance in question. [Syrett et al. \(2014\)](#) investigate this aspect in appositives by looking at both truth value judgments and reaction times. They find an interesting effect of linguistic context, in that the contribution of sentence final appositives (which are assumed to contribute a conventional implicature) apparently can become part of the at-issue content, in contrast with sentence initial or medial ones. Further experimental and cross-linguistic investigations are in order to assess the nature and variation in types of projective content in natural language more thoroughly, and the area of conventional implicatures in general will benefit from more extensive experimental approaches.

2.4 Additional directions

With the general approach of utilizing experimental tools to provide fine-grained assessments of the properties of different types of meaning becoming more established, there have been various extensions to additional phenomena and aspects of meaning, many of which relate directly to investigations of implicatures, both in terms of methodology and theoretical approaches. For example, Tieu et al. (2014) report acquisition data on the interpretation of plurality inferences, which they argue to support an analysis in terms of implicatures. Other case studies have been used to argue against implicature based analyses: Chemla & Bott (2014) look at free choice inferences in disjunctions, which some theoretical approaches have analyzed as implicatures, and argue that the behavioral patterns they give rise to instead make them look more similar to presuppositions. Similarly, an acquisition study by Tieu et al. (2015) finds that children display adult-like behavior on free choice inferences before doing so for implicatures. More recently, Singh et al. (forthcoming) present acquisition data on conjunctive interpretations of disjunctions, both unembedded and under *every*, and argue for a scalar implicature based account while assuming differences in how children compute implicatures.

There are various other semantic phenomena studied with similar methods. Kriz & Chemla (2015) investigate homogeneity effects with plural definite descriptions, and distill the implications for different theoretical approaches, e.g., based on presuppositions, implicatures, or supervaluations. They also explore further useful methodological variations, including judgments whether a given statement is ‘completely true’, ‘completely false’, or neither. Furthermore, Cremers & Chemla (2016) and Cremers et al. (forthcoming) investigate exhaustive readings of questions, in adult language and acquisition respectively. More broadly, other important aspects of non-literal meaning include irony, metonymy and metaphor, all of which have seen substantial experimental investigation (e.g. Glucksberg, 2001, 2003; Frisson, 2009; Schumacher, 2014; Spotorno & Noveck, 2014).

In another line of work on differentiating properties of various aspects of meaning, Onea & Beaver (2011) and Destruel et al. (2015) investigate the exhaustive inference of exclusive *only*, clefts, and focus (also see Velleman et al., 2011, for other triggers), with a forced choice task offering different sentence continuations, similar to that by Cummins et al. (2013) mentioned above. They find that *Yes*... continuations inconsistent with the exclusive inference are more compatible with clefts than with exclusive *only* sentences, and explain this in terms of the status of the exhaustive inference, which is *at-issue* in the latter but not in the former, and thus is more or less likely to be targeted by *Yes* and *No*. These methodologies, as well as the approaches discussed in this section in general, provide a rich and versatile tool-kit for studying all kinds of aspects of meaning in greater empirical detail,

and substantial growth can be expected in this area in the near future.

3. Reference

Another major area of research in Experimental Pragmatics is concerned with the resolution of referential expressions. In a sense, many issues arising in this domain are quite parallel to those discussed above for various types of inferences that utterances can give rise to, just at the level of reference to individuals. Referential expressions quite standardly do not provide sufficient information for the hearer to figure out based on literal meaning alone just who the speaker intended to refer to. Pronouns are, of course, a case in point *par excellence*. It is rather the exception than the norm that the use of a pronoun can be resolved unambiguously. But even definite (or demonstrative) descriptions, which have the potential to contain more information, are very commonly underinformative. But despite occasional failures in communication, it seems as if interlocutors are by and large not only successful at conveying reference, but furthermore entirely unaware that anything could have gone wrong. They thus must rely on shared principles for resolving reference which likely draw both on knowledge of the language in question, and specifically the resources it provides in terms of available referential expressions, and of more general assumptions about how information from the context and the communicative situation can inform reference resolution. Naturally, many core issues in this area lend themselves to experimental investigation, and the interpretation of pronouns in particular has long been a topic extensively studied in psycholinguistics, with much work preceding any notion of a (sub-)field of ‘Experimental Pragmatics.’ The frame of the present article does not permit any detailed consideration of this entire literature (for a recent collection of work in this area, see [Gibson & Pearlmutter, 2011](#)). Instead, only a brief sketch of some key themes and prominent topics as they relate to the current state of the field of Experimental Pragmatics is provided.

One line of work investigates, and in many ways confirms the basic tenets of, the predictions of Centering Theory ([Grosz, 1977](#); [Grosz et al., 1995](#)). The Givenness Hierarchy ([Gundel et al., 1993](#)) has been tested experimentally in similar ways. A central aspect of both of these is that there is an inverse relationship between the complexity of referring forms and the salience of the referents, with more reduced forms picking out more salient referents. For example, repeated proper names tend to give rise to a penalty in processing (in contrast with pronouns, [Gordon et al., 1999](#)), and topical antecedents for pronouns are better than non-topical ones. Unsurprisingly, the specific resources a particular language has for expressing reference are important for how the details of a given referential system play out, and specific forms can be associated with particular requirements on their potential an-

tecedents. For example, German d-series pronouns (e.g., *der* vs. regular pronoun *er*) have been argued to exhibit a strong preference for non-topical antecedents, whereas regular pronouns prefer topical ones (Bosch et al., 2007). Not all contrasts between forms map straightforwardly to a unidimensional salience hierarchy, however. Kaiser & Trueswell (2008) investigate Finnish pronouns and demonstratives, and argue for a form-specific approach based on findings suggesting that factors such as the syntactic role and linear position of the antecedent affect these forms in different ways. Another comparison between pronouns and demonstratives suggesting a more complex set of factors affecting choices between different forms was conducted by Brown-Schmidt et al. (2005), who compare pronouns and demonstratives in English and find that the latter are preferably used for composites of previously mentioned entities (such as a cup and a saucer that were put together in an experimental task). While all of the studies just mentioned are concerned with the comprehension of referential expressions, another important question is how choices between alternative expressions are made in production. While it is commonly assumed that contextual factors affect production and comprehension symmetrically, recent work comparing the two directly (Kehler et al., 2008; Hannah Rohde & Kehler, 2014) argues that certain factors, such as semantic biases from the context, influence the two in very different ways.

Turning to referential expressions beyond pronouns and demonstratives, a fair amount of experimental work has been carried out on related phenomena concerning reference with definite descriptions. One line of prominent early findings focused on acquisition, finding that children are more prone than adults to use a definite even when there is more than one individual meeting the relevant description in the context (Maratsos, 1976, and also see Schaeffer & Matthewson 2005 for an example of more recent work). Much early work in adult language processing focused on cases of so-called bridging, where a definite has not been introduced explicitly but directly relates back to something else in the context. In an early study, Haviland & Clark (1974) compared contexts that required a bridging inference (e.g., mentioning picnic supplies) with ones where some entity (e.g., beer) was mentioned explicitly, and found longer reading times on a subsequent presentation of a definite (e.g., *the beer*). O'Brien et al. (1988) showed, however, that prior mention of a referent is not necessary if the context is sufficiently specific: the definite *the knife* was read more slowly when the antecedent was more general (*a weapon*) than when it directly matched the noun phrase (*a knife*), but only when the context involved a general verb such as *assault*, and not when it involved *stab*, which is more closely associated with knives. Burkhardt (2005) (and subsequent work) used ERP-studies to identify neural correlates of bridging by looking at definites such as *the conductor* in contexts with an explicit antecedent, a bridging antecedent (*a concert*), and no antecedent. Intriguingly, the bridged cases display neural hallmarks of

both new and old information (in the form of a reduced N400 hundred effect, followed by a P600 effect). In another related vein of work, the visual world paradigm has utilized definite descriptions in critical parts of the sentences, thus contributing to the study of their use in referring. For example, typical stimulus types involve instructions for clicking on one of several presented pictures, with the crucial material introduced in the context of the instructional phrase *Click on the [NP]*. Work within this paradigm has revealed a variety of context-related factors affecting reference resolution that also interact with parsing decisions both in adults and children (see, e.g. Sedivy et al., 1999; Hurewitz et al., 2000; Sedivy, 2003; Chambers et al., 2002, among many others).

Yet another related area of research takes a more interactive perspective by looking at conversations between two people who jointly have to manipulate some set of objects. Crucially, the experimental setup occludes some of the objects from one of the interlocutors, thus implementing a distinction between common or shared ground (including the objects visible to both) and privileged ground (including objects only visible to one). Once again, definite descriptions are used as part of the instructions, and the identity of the referents crucially depends on whether the listener is considering only their own perspective or the shared perspective at a given point in time (e.g., by using *the tall cup* in a context where there is a relatively tall cup in the shared ground, but also an even taller cup in the privileged ground). A central question in this area turns on how easily listeners can keep track of the shared ground, and to what extent they may, at least initially, be tempted to include privileged ground objects as candidates for referents when following instructions uttered by the speaker. While some visual world studies provide clear evidence for the general ability to quickly focus on the shared ground (e.g., Nadig & Sedivy, 2002; Hanna et al., 2003; Heller et al., 2008), other studies report delays in homing in on the referent of the definite as interpreted relative to the common ground (Keysar et al., 2000, 2003, and subsequent work).

4. Other Current Topics & Future Directions

The field of Experimental Pragmatics is continuing to grow quite rapidly. There are many areas of ongoing research that could not be discussed here for reasons of space, and the range of issues that could be investigated as part of the overall enterprise is naturally even greater. To give but a few examples, the impact of prosody on meaning, the processes involved in assessing quantificational statements, the interpretation of numerals (modified and bare), the interpretation of vagueness, and the role of context in a variety of phenomena, e.g., degree constructions and quantificational domain restriction, all have seen recent advances through experimental investigations. In bringing together formal insights from formal semantics

and pragmatics and psycholinguistic models of linguistic processing, work in this area in general integrates the study of natural language meaning into the cognitive sciences ever more deeply. In addition to expanding experimental approaches to further linguistic phenomena, future directions include broader cross-linguistic investigations and comparisons, as well as more comprehensive comparisons between different populations, e.g., to individuals with language-related disorders. The advance of ever more sophisticated psycho- and neurolinguistic methodologies furthermore will ultimately allow deeper insights into the neural basis of the relevant phenomena. On the whole, Experimental Pragmatics has already proven to have great potential to open up new perspectives on key semantic and pragmatic phenomena, but existing work constitutes only the beginnings of a much broader enterprise, the bulk of whose work still lies ahead.

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