Title of the manuscript: Surprise Markers in Applied Linguistics Research Articles: A Diachronic Perspective

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Surprise Markers in Applied Linguistics Research Articles: A Diachronic Perspective

Abstract

This paper reports on a corpus-based study of linguistic expressions of surprise (i.e., a type of attitude markers functioning as metadiscourse) in 160 applied linguistics research articles that were published in two periods of time separated by 30 years. Unlike previous research on metadiscourse, this study took a frame semantics perspective on surprise as a knowledge emotion and adopted a fine-grained, frame-based analytical framework to examine diachronic trends in the use of surprise markers and their co-occurrence with other types of metadiscourse (i.e., boosters, hedges, and self-mentions). Binary logistic regressions revealed that compared with research articles published earlier, those published more recently were 2.16 times more likely to express surprises triggered by prior knowledge, 2.37 times more likely to express surprises without providing an explanation, and 2.28 times more likely to indicate surprises without resolving them. These results can be explained in terms of the heuristic nature of surprise and the escalating pressure on academics to promote their research strategically.

1. Introduction

The past decade has witnessed a burgeoning interest in examining academic discourse from a diachronic perspective. Studies have been conducted to investigate how various language features in general (e.g., Biber & Gray, 2016; Hyland & Jiang, 2017; Seone, 2013) and metadiscourse in particular (e.g., Gillaerts & van de Velde, 2010; Hyland & Jiang, 2016, 2018) have changed over time. Hyland and Jiang (2017), for example, examined the use of 10 key language features of informality (e.g., first-person pronouns, unattended anaphoric pronouns, split infinitives, and sentence final prepositions) in research articles (RA) from two hard and two soft disciplines and observed a noticeable increase in the incidence of some of the target features in the two hard disciplines over a 50-year period. Drawing on the same corpus of RAs but focusing on stance features (i.e., hedges, boosters, attitude markers, and self-mentions), Hyland and Jiang (2016) found that the frequencies of attitude markers fell markedly in the two soft disciplines, remained unchanged in one hard discipline, and rose dramatically in the other hard discipline over the 50-year span. In another study of metadiscourse, Gillaerts and van de Velde (2010) reported a significant drop in the frequency of boosters and attitude markers and a slight increase in the use of hedges in the abstracts of RAs published in *Journal of Pragmatics* over a period of three decades. These and similar studies have provided strong evidence of how academic discourse has evolved shifting conventions to respond to major developments in the larger academic and social contexts, such as the changing nature of academic publishing, the expanding readership of scholarly publications, the prevalence of institutional appraisal systems, and new research practices (Hyland & Jiang, 2018).

While they are revealing and important in their own right, extant diachronic studies tended to examine linguistic features of interest at an aggregate level. As an illustration, various types of metadiscoursal resources for conveying attitudes were typically lumped together in the analysis and examined in isolation from other types of metadiscourse, for example, hedges and boosters. Consequently, it is not clear whether the observed shifts in the aggregated frequencies of attitude markers are true of all types of attitudes or only some of them. Nor is it clear how the expression of a particular type of attitudes interacts with other metadiscoursal resources. Has a certain type of attitudes been boosted or hedged more often in recent years than before? Are academic writers nowadays more likely to use self-mentions with certain attitude markers than their counterparts in the past? Answers to such questions have the potential to shed light on more subtle diachronic changes in academic discourse and knowledge-making practices. This paper reports on a corpus-based study that set out to address questions of this nature by drawing on frame semantics and integrating conceptually related information into a more fine-grained analytical framework. Specifically, our study examined the linguistic expressions of surprise (hereafter surprise markers) in applied linguistics RAs across a span of 30 years, using an analytical framework developed by Hu and Chen (2019). We focused on surprise markers because previous research has shown that surprise as a knowledge emotion is involved in the construction of scientific knowledge (Chen & Hu, 2020; Hu & Chen, 2019).

2. Previous research

2.1. Diachronic changes in the use of metadiscourse

As surprise markers are often treated as one type of metadiscourse (Hyland, 2005a), it is instructive to review extant diachronic research on metadiscourse. Although examining diachronic changes in the use of metadiscourse in academic writing is a rather recent endeavor, studies along this line have made many noteworthy observations. In one of the early studies on changing patterns of metadiscourse in academic writing, Taavitsainen (2000) identified a general trend in the use of "metadiscursive comments" that marked "a change from detached to more involved writing" (p.203) in early English medical writing (1375-1550). As an illustration, the observed increase in the use of hedges over time functioned to "lend a more personal tone to the text" (p.203). Examining texts from the same discipline but published in a much later historical period (1810-1995), Salager-Meyer and Defives (1998) observed a different trend. Focusing on four types of hedges – shields (i.e., traditional hedges), passive voice (i.e., agentless passive constructions), approximators (i.e., fuzzy expressions of degree, quantity, frequency, and time), and emotionally charged intensifiers (e.g., *extremely interesting*), the researchers detected no significant difference in the frequencies of hedges as a whole between papers published in the 19th and the 20th century, but they did find that papers published in the second period employed significantly more passive-voice constructions and shields but much fewer approximators and emotionally charged intensifiers than their counterparts in the first period did. They attributed these differences to the changing readership of medical papers in the two historical periods: Medical discourse in the 20th century was "no longer directed at the well-educated gentleman [sic] but at a specialized physician" (Salager-Meyer & Defives, 1998, p.157).

More recently, in a series of studies on diachronic changes in the use of metadiscourse in a corpus of 360 RAs sampled across three distinctive time periods (1965, 1985, and 2015) from four disciplines (i.e., applied linguistics, sociology, electrical engineering, and biology), Hyland and Jiang (2016, 2017, 2018) have observed different and complex patterns between the soft and the hard disciplines. For example, applied linguistics showed a decline in the use of self-mentions (i.e., first-person pronouns), whereas the other three disciplines all saw a marked increase (Hyland & Jiang, 2017). Similarly, hedges decreased markedly in applied linguistics (36%) and sociology (21%) but increased slightly in biology (14%) and electrical engineering (8%); boosters fell dramatically in applied linguistics (38%), sociology (35%), and biology (32%) but rose by 15% in electrical engineering (Hyland & Jiang, 2016). In a related study, Hyland and Jiang (2018) investigated the use of interactive and interactional metadiscourse in the same corpus of RAs. Interactive metadiscourse (i.e., transitions, frame markers, endophoric markers, evidentials, and code glosses) is "concerned with ways of organising discourse and reflect the writer's assessment of what needs to be made explicit to guide readers to what should be recovered from the text' (p.20). Interactional metadiscourse (i.e., hedges, boosters, attitude markers, engagement markers, and self-mentions), on the other hand, "concerns the writer's efforts to control the level of personality in a text and establish a suitable relationship to his or her data, arguments and audience, marking the

degree of intimacy, the extent of reader involvement and the expression of attitude and commitments" (p.20). Hyland and Jiang found that although the overall instances of metadiscourse aggregated over the disciplines saw a statistically significant increase over the 50-year span, interactive and interactional metadiscourse exhibited opposite patterns of change. The former showed a significant increase, whereas the latter underwent a significant decrease. When examined more closely, the different subtypes of metadiscourse exhibited complex trends over time and for the different disciplines.

Three points can be made about the diachronic studies on metadiscourse reviewed above. First, they have collectively demonstrated that examining historical trends in the use of various metadiscoursal features in academic discourse is a productive line of research that has offered valuable insights into how larger sociocultural and disciplinary forces have shaped the way academic writers interact with their readers when they disseminate their research. Second, although various types of metadiscourse are often grouped, according to their interpersonal or textual functions, into larger categories (e.g., interactive vs. interactional metadiscourse) and examined as such, little attention has been given to the interrelationships among the subcategories within a larger category, for example, the co-occurrence, or lack thereof, of attitude markers with self-mentions, hedges and/or boosters. Arguably, research along this line can help develop a richer and more nuanced understanding of how a combination of various metadiscoursal resources has been exploited strategically over time to achieve whatever goals deemed important by academic writers. Third, diachronic patterns of metadiscourse use observed at a more general level (e.g., interactional metadiscourse) can obscure complex and inconsistent patterns at a more micro level (e.g., various subtypes of interactional metadiscourse). The same can be said about hedges or attitude markers as a catch-all category. As demonstrated by Salager-Meyer and Defives (1998), different types of hedges can show different, even opposing, diachronic trends. Similarly, different types of attitudes (e.g., importance, interest, and surprise) may have exhibited widely differing patterns of incidence in academic discourse over time. The existence of complex trends at micro levels points to the need to develop more fine-grained analytical frameworks. In this regard, frame semantics offers some useful conceptual apparatus for constructing such fine-grained frameworks.

2.2. Frame semantics and the Surprise frame

Frame semantics is a theory of cognitive semantics developed by Fillmore (1975, 1976, 1982). It proposes a model of language understanding in which a linguistic item serves as a node that evokes a knowledge structure essential to its understanding. This "structured background of experiences, beliefs, or practices" (Fillmore & Atkins, 1992, p.76) is called a semantic frame. Such a frame consists of a collection of facts that specify the "characteristic features, attributes, and functions" of the object denoted by a linguistic item as well as "its characteristic interactions with things necessarily or typically associated with it" (Allan, 2016, p.55). The linguistic item in question is referred to as a frame-evoking lexical unit, and the "things necessarily or typically associated with it" are termed frame elements.

According to Ruppenhofer, Ellsworth, Petruck, Johnson, and Scheffczyk (2016), there are two types of frame elements: core frame elements, which are necessary components of a semantic frame, and non-core frame elements, which are peripheral and may be shared by many different semantic frames. As an illustration, the Stimulus_focus semantic frame can be evoked by *surprising*, as in the example below[1]:

(1) [Stimulus The upbeat account of the firm's local fortunes] may be regarded as [Degree somewhat] *SURPRISING*[Target] [Circumstance given the fact that IBM Eastern Europe has not announced the conclusion of any major contracts so far this year].

In this sentence, *The upbeat account of the firm's local fortunes,* as a core element of the Stimulus_focus frame, is the Stimulus that invokes the Target, that is, the emotion of surprise. Degree (instantiated by *somewhat*) and Circumstance (instantiated by *given that ... this year*) are two non-core frame elements.

A key characteristic of frame semantics that distinguishes it from other theories of lexical semantics is that frame knowledge is encyclopedic in nature and external to a particular language. According to Fillmore and Baker (2010), our frame knowledge results from our embodied experiences of "being human" and "living on the earth" (p.314) as well as our culturally bound and discourse community-defined experiences. In other words, frames are "cognitive structures that are context- and culture-dependent" (Ungerer & Schmid, 2006, p.219) and capture "institutional understandings of what takes place in particular communicative events" (Paltridge, 1997, p.51). Therefore, how a frame is typically evoked and represented in a particular genre reflects the discourse community's shared understanding of acceptable ways of achieving a certain social or communicative goal (Hyland, 2008; Miller, 1984; Swales, 1990). For this reason, although frame semantics started as a theory of lexical semantics, it provides a useful tool for discourse analysis as well. This compatibility of frame semantics with genre analysis can be seen in Steen's (2011) definition of a genre as "a type of complex knowledge schema that individual users have at their disposal to engage in discourse" (p.25).

Despite the conceptual affordances that frame semantics offers to discourse analysis, academic genres have rarely been examined from a frame-based perspective. Paltridge (1997), one of the few attempts to apply frame semantics to the analysis of academic texts, focused on the macro structure of RAs by identifying the core characteristics of a genre prototype. Other more recent studies that analyzed academic writing from a frame-based perspective (e.g., Faber et al., 2006; L'Homme & Robichaud, 2014) aimed to extract discipline-specific frames that could account for the knowledge structure of a specific scientific domain. These studies were not discursively but ontologically oriented and had little to say about the potential of frame semantics to reflect genre-specific cognition. To date, only Hu and Chen (2019) have explored how a specific semantic frame is instantiated in academic writing. This study characterized all the surprise markers in a corpus of 320 RAs in terms of seven conceptually

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[1] This example is taken from FrameNet, a human- and machine-readable database built on the principles of frame semantics. The annotation in this paper follows the convention adopted in FrameNet.

related frames and their associated frame elements found in FrameNet. Based on the conceptual overlap identified among the seven surprise-related frames and a close analysis of the most frequently occurring frame elements in the corpus, a Surprise frame was generalized for the academic genre of RAs. This frame consisted of three core frame elements: Trigger (i.e., what is surprising), Explanation (i.e., why the Trigger is surprising), and Resolution (i.e., how the surprise is resolved). In addition, there were two peripheral frame elements: Degree (i.e., how surprising the Trigger is) and Experiencer (i.e., who is surprised). The Surprise frame incorporated Tutin's (2015) "surprise routine," which starts with an expectation, is followed by the violation of the expectation, and then ends with a resolution.

The Surprise frame, briefly described above, has several conceptual advantages. First, it has extended the purview of semantic frames beyond the sentence level by identifying frame elements, for example, Explanation and Resolution, which take extra-sentential positions. Such conceptual extensions make it feasible to apply frame semantics to discourse analysis and understand how the expression of surprise as a knowledge emotion (Silvia, 2009) is involved in the construction of scientific knowledge. Second, it addresses one of the issues identified above in extant research on metadiscourse, namely the lack of fine-grained analytical frameworks to capture complex patterns of metadiscourse use (e.g., use of attitude markers) at a more micro level, by providing a conceptually more concise and coherent frame-based analysis of one type of attitude, that is, surprise as a cognitive emotion. Third, the Surprise frame also overcomes the problem of examining one type of metadiscourse in isolation from another by integrating related metadiscoursal resources into a single frame. For example, the interrelationships of hedges and boosters with the attitude of surprise are captured by the frame element of Degree, in that surprise can be mitigated through hedges and intensified through boosters. Similarly, self-mentions are related to surprise markers by the frame element of Experiencer.

Drawing on the Surprise frame, this study set out to explore if there have been systematic diachronic changes in the use of surprise markers in a corpus of applied linguistics RAs. Specifically, the study was guided by the following research questions:

1. Has the use of surprise markers in a sample of RAs in applied linguistics changed over a span of 30 years?

2. Has the use of the five frame elements of the Surprise frame changed over the same time span?

3. Method

3.1. The corpus

To answer the research questions, we compiled a 1-million-word corpus of 160 full-length empirical RAs randomly sampled from four prestigious journals in applied linguistics (i.e., *Applied Linguistics*, *Modern Language Journal*, *TESOL Quarterly*, and *Language Learning*). These RAs were published in two 5-year periods (1981 to 1985 and 2011 to 2015) that were 30 years apart. Table 1 summarizes the descriptive information about the corpus. As indicated by the average numbers of words, there was a massive increase (i.e., about 69%) in the length of the RAs from the first period to the second one. This

trend is consistent with those reported in previous research (e.g., Hyland & Jiang, 2016, 2017, 2018).

Table 1 Descriptive information on the corpus

Measure	1981-1985	2011-2015	Total
Number of RAs	80	80	160
Total number of words	366,927	622,257	989,184
Average words/RA	4,587	7,778	6,182

3.2. The analytical framework

The Surprise frame developed by Hu and Chen (2019) was adopted as the analytical framework in this study. Minor modifications were made to the frame to make it more concise and pertinent to the present study. While all the five frame elements were kept unchanged, a few subcategories were modified. When defining the subcategories of the frame elements, our major consideration was the distinction between "new information" and "prior knowledge". In the present study, "new information" refers to anything that can only be known after a study begins, including characteristics of participants, properties of research instruments and research findings, while "prior knowledge" designates anything that is known before a study begins, such as existing theories, research context, and findings from previous research. Centering our definitions of the subcategories on this distinction was both necessary and potentially revealing because surprise as a knowledge emotion (Silvia, 2009) is centrally concerned with the gap between new information and expectations based on prior knowledge (Meyer et al., 1997).

In what follows, we define and illustrate the various subcategories of the revised Surprise frame (see Figure 1). Four types of Experiencers can be identified. If a surprise marker is used with *we, I* or *the author(s)*, the Experiencer is classified as "author" (see Example 2). This category captures the interaction between surprise markers and another type of interactional metadiscourse, that is, self-mentions. When a surprise marker describes the feeling of a research participant, the Experiencer is categorized as "participant" (Example 3). All other explicitly stated Experiencers are referred to as "others" (Example 4). When no Experiencer is explicitly mentioned, he or she is "implied" (Example 5). As Hu and Chen (2019) pointed out, "these unstated experiencers were, by implication, the RA authors and, in many cases, their intended readers as well because the latter were expected to share the former's emotive reactions" (p.165).

(2) What pleased and *SURPRISED*[Target] [[Experiencer]me], though, was that the write-before-you-read exercise seemed to result in more than simple comprehension. (A1-40)

(3) [[Experiencer]Some students] were *SURPRISED*[Target] when they were called out to take the SVE a second time. (A1-69)

(4) One of the few exceptions to this negative pattern is [[Experiencer]Bailer et al.] (2014), who found the KAG of 10 Brazilian EFL teachers *BETTER THAN EXPECTED*[Target]. (A2-34)

(5) And very *STRIKING*[Target] were the revisions that took place almost simultaneously with the

rereading and that were recorded with such a sense of urgency that the first version was not crossed out until a later rereading. (A1-38)
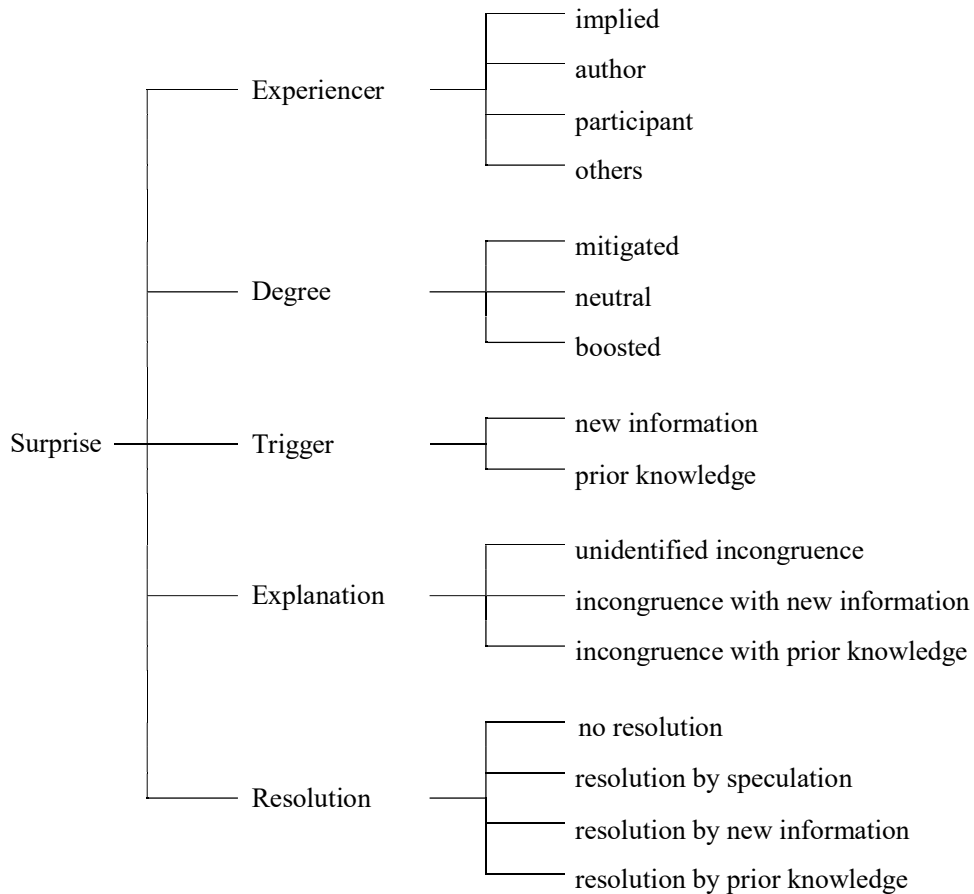

Figure 1 The revised Surprise frame

Degree of surprisingness has three subcategories: "boosted" if a surprise is intensified by a booster (Example 6); "mitigated" if a surprise is hedged (Example 7); and "neutral" if neither a booster nor a hedge is used with the surprise marker (Example 8). These subcategories capture the co-occurrence of surprise markers and boosters/hedges, two other types of interactional metadiscourse.

(6) And [$_{Degree}$very] *STRIKING*^{Target} were the revisions that took place almost simultaneously with the rereading and that were recorded with such a sense of urgency that the first version was not crossed out until a later rereading. (A1-38)

(7) It [$_{Degree}$seems] *SURPRISING*^{Target} that mode and person/number are both apparently impervious to monitoring, or perhaps it should be said, to more intensified monitoring. (A1-48)

(8) *SURPRISINGLY*^{Target}, the results of the meaning recognition test were generally higher than the correctly recognized word forms. (A2-75)

As the frame element that evokes the emotive response of surprise, a Trigger is characterized as

either "new information" (Example 9) or "prior knowledge" (Example 10).

(9) [$_{Trigger}$Our finding that there was overall no strong learning effect across the three sessions in the perception tasks] is perhaps *SURPRISING*^{Target}. (A2-60)

(10) [$_{Trigger}$That such widespread conversational phenomena should be ignored in the teaching of vocabulary] is *ASTONISHING*^{Target}. (A1-07)

Explanations of why something is surprising are also centrally concerned with the distinction between new information and prior knowledge. When a violated expectation is based on something already known before one's study, the Explanation is "incongruence with prior knowledge" (Example 11). By contrast, if the incongruence is between a Trigger and a piece of new information obtained in one's study, the Explanation is "incongruence with new information" (Example 12). When no Explanation is given explicitly, it is a case of "unidentified incongruence" (Example 13).

(11) Perhaps *SURPRISINGLY*^{Target}, [$_{Explanation}$given the variation in how early language learning programmes are implemented across European countries (Edelenbos et al. 2006)], rather little is known about how the amount of input and teacher's language proficiency may influence children's foreign language skills. (A2-25)

(12) [$_{Explanation}$For somebody who is so strongly in favor of promoting the dialect and regards it as part of the patrimony of his people], such lack of dialect use during the interview may seem *SURPRISING*^{Target}. (A2-19)

(13) Also, despite the *STRIKING*^{Target} uniformity in the developmental profile of different learners, there are variations in the overall course of development that learners follow. (A1-12)

When an expressed surprise is not resolved, it is a case of "no resolution" (Example 14). When a Resolution is presented, it can take the form of "resolution by new information" (Example 15), "resolution by prior knowledge" (Example 16) or "resolution by speculation" (Example 17), that is, by putting forward a new hypothesis.

(14) Given the centrality of materials in a very wide range of language teaching situations, it is somewhat *SURPRISING*^{Target} that there has not been more empirical classroom-based research on the role(s) that materials play in the totality of processes of language teaching and learning that comprises classroom interaction. (A2-40)

(15) Since it is widely assumed that linguistic context is relevant for the interpretation of utterances, the fact that the presence of context in this instance actually reduced judged intelligibility is *SURPRISING*^{Target}. … [$_{Resolution}$In retrospect, it appears that these two utterances may not have included contextual information relevant to the interpretation of the deviant utterance; the context was in some cases useless and perhaps even potentially confusing]. (A1-59)

(16) A possible explanation of this somewhat *SURPRISING*^{Target} result is that, as Rosa and O'Neill (1999) suggested, [$_{Resolution}$different types of instruction led to qualitatively different input processing, with more explicit instruction triggering concept-driven (top_ down) processing and less explicit instruction promoting data-driven (bottom-up) processing]. (A2-69)

(17) Another reason for this *SURPRISING*[Target] finding might be [Resolution that beginners might not have been aware of both readings for both pseudo-homophonic and homographic words whereas the intermediate participants likely were]. (A2-68)

3.3. Data coding and analysis

A list of 83 surprise markers was compiled with reference to *Roget's International Thesaurus* (Kipfer, 2010) and WordNet (Fellbaum, 1998). These surprise markers were synonyms and antonyms of *surprise* (included in the list as well) and all their derivative forms. The comprehensive list was then used to query the corpus of RAs to identify all the surprise markers. The identified surprise markers were coded using the revised Surprise frame presented in the preceding section. To establish the reliability of the coding, a graduate student of applied linguistics was invited to serve as a second coder and given a training session, in which the Surprise frame with its various categories and subcategories were clearly defined and illustrated with examples. Then, the invited coder and the first author of this paper coded 5% of the corpus independently, compared their coding results, and resolved all disagreements through discussion. This process was repeated for another 5% of the corpus. When the two coders calibrated their interpretations of the analytical framework sufficiently, they independently coded a third 5% of the RAs. Cohen's kappa values obtained from this final round of coding exercise indicated very good inter-coder reliability (Landis & Koch, 1977): .85 (Degree), .70 (Experiencer), .65 (Trigger), .65 (Explanation), and .71 (Resolution). Given the robust inter-coder reliability statistics, the first author coded all the remaining RAs independently.

To answer our research questions, we conducted inferential statistical analyses. The selection of statistical methods was based on the patterns of distribution of surprise markers in our corpus. A preliminary examination of the data revealed that surprise markers did not occur in 38.75% ($n = 62$) of the RAs in our corpus. Of those RAs that did employ surprise markers, many used only a single surprise marker, and, where two or more surprise markers appeared in the same RA, they often referred to the same trigger event. These distributional characteristics ruled out the use of inferential statistics (e.g., ANOVA and multiple regression) that require a continuous dependent variable measured as raw frequencies or, more frequently, normalized frequencies (typically adopted in corpus studies to control for the varying lengths of texts). Rather, a binominal measure (i.e., use or non-use of surprise markers in an RA) would better capture the patterns of distribution of surprise markers in our corpus. For this reason, the dependent variables were coded as dichotomous variables (i.e., presence or absence of particular types of frame elements in this study), and no normalization was necessary to control for the varying lengths of the RAs. Given our binominal measures, we chose binary logistical regression as our method of analysis. A binary logistical regression can determine whether a continuous or categorical independent variable (i.e., the two periods of publication time in this study) can significantly predict a binominal dependent variable. Apart from statistical significance, it provides multiple effect size measures: Cox and Snell's R^2, Nagelkerke's adjusted R^2, and odds ratio. The first two statistics indicate

the proportion of variance in the outcome variable that is explained by the predictor variable, and the last one is the ratio of the odds of an event occurring compared to another one. An odds ratio indicates a positive relationship if it is greater than 1 but a negative relationship when it is smaller than 1. For ease of interpretation, the first time period (1981-1985) was set as the reference category in all the binary logistical regressions. Because multiple statistical tests were run for the subcategories of each frame element, the Bonferroni correction was applied to adjust the alpha and control Type I error.

4. Results and discussion

4.1. Surprise markers: A brief overview

A total of 66 different surprise markers occurred 224 times in our corpus. Notably, seven surprise markers (i.e., *striking, remarkably, unusual, surprising, unexpected, surprisingly*, and *remarkable*) each occurred 10 times or more and accounted for 45.54% of all instances of surprise markers in our dataset. A binary logistical regression did not find a statistically significant relationship between the presence/absence of surprise markers in an RA and the time period in which it was published, $B = 0.624$, $p = 0.055$, Nagelkerke $R^2 = 0.031$, odds ratio (OR) = 1.867. This means that time of publication could not reliably predict the presence or absence of surprise markers in the RAs examined in this study. Since previous research reported significant declines in the use of attitude markers as a catch-all category in both RA abstracts (Gillaerts & van de Velde, 2010) and RAs (Hyland & Jiang, 2018) in applied linguistics, this finding confirmed our initial concern that different types of attitudes may show different patterns of change. Given the contradictory findings of this study and the previous ones, we speculate that diachronic changes in the use of attitude markers may have as much to do with their unique affective content as with their general metadiscoursal functions. This hypothesis can be tested by conducting fine-grained analyses of different types of attitudes, such as "importance," "interest," and "confusion", over the same time span.

4.2. Experiencer and Degree: Interaction of surprise markers with other types of metadiscourse

A close look at the various types of Experiencers revealed how the use of surprise markers interacted with that of self-mentions. Most surprise markers were used in a "source-oriented" manner (Tutin, 2015), without explicitly identifying the Experiencers. Implied Experiencers ($n = 186$) occurred for 83.04% of the 224 surprise markers identified in the RAs. Only in 5.80% ($n = 13$) of the cases were authors explicitly presented as Experiencers. These patterns led us to hypothesize that when expressing attitudes in RAs, academic writers would focus more on what invoked their affective reactions than who experienced them. This hypothesis could be tested with other attitude markers (e.g., markers of importance, confusion, and interest) in further research.

Binary logistical regressions run on the Experiencer data showed that time of publication did not reliably predict the presence/absence of any of the four subcategories: $B = 0.504$, $p = 0.114$, Nagelkerke $R^2 = 0.021$, OR = 1.655 for implied Experiencers; $B = 0.432$, $p = 0.516$, Nagelkerke $R^2 = .007$, OR =

1.541 for authors as Experiencers; $B = 0.600$, $p = 0.354$, Nagelkerke $R^2 = 0.014$, OR $= 1.822$ for participants as Experiencers; $B = 0.000$, $p = 1.000$, Nagelkerke $R^2 = 0.000$, OR $= 1.000$ for others as Experiencers. This meant that RAs published in the two periods of time did not differ in the use of self-mentions to express surprises. This result was inconsistent with Hyland and Jiang's (2016, 2018) finding that frequencies of self-mentions dropped considerably in applied linguistics RAs in the past 50 years. While our result should be taken with caution because there were only a small number of self-mentions used with surprise markers in our corpus, it did not obviate but underscore the need to study the interplay between different types of metadiscourse in academic discourse.

Similar to the results reported above for Experiencers, most surprise markers ($n = 176$) did not co-occur with the frame element of Degree. Specifically, only 12.50% ($n = 28$) of the surprise markers were mitigated, and 8.93% ($n = 20$) were boosted. That 78.57% of the surprise markers were neutral in Degree might be taken to suggest that for the attitude of surprise in academic discourse, what matters heuristically is the invocation of the emotion rather than its intensity. As in the case of Experiencers, binary logistical regressions did not find statistically significant associations between time of publication and any of the Degree subcategories, $B = 0.325$, $p = 0.324$, Nagelkerke $R^2 = 0.008$, OR $=$ 1.385 for neutral Degree; $B = 0.670$, $p = 0.109$, Nagelkerke $R^2 = .027$, OR $= 1.954$ for mitigated Degree; $B = -0.361$, $p = 0.465$, Nagelkerke $R^2 = 0.007$, OR $= 0.697$ for boosted Degree. In other words, when used together with surprise markers, boosters and hedges did not show significant changes in their presence/absence over the time span covered in this study. These results again revealed diachronic trends in the use of boosters and hedges that were different from those reported in previous research. For example, Gillaerts and van de Velde (2010) and Hyland and Jiang (2018) both found marked declines in the use of these two types of interactional metadiscourse in social sciences. Needless to say, these discrepancies should not be taken as suggesting that either our study or the previous research got it wrong. Rather, what our findings made clear was that the trends reported in the previous studies could not be observed when hedges and boosters co-occurred with surprise markers in RAs. One reason for the inconsistent findings of the previous studies and the present one could be the rather low proportions of surprise markers used with a Degree modifier.

4.3. Core frame elements: Trigger, Explanation, and Resolution

Prior knowledge and new information triggered 28.57% ($n = 64$) and 71.43% ($n = 160$) of the surprise markers, respectively. No statistically significant relationship existed for surprises triggered by new information, $B = 0.051$, $p = 0.874$, Nagelkerke $R^2 = 0.000$, OR $= 1.052$. However, a significant association was found between time of publication and expression of surprises triggered by prior knowledge, $B = 0.769$, $p = 0.022$, Nagelkerke $R^2 = 0.045$, OR $= 2.157$. As indicated by the odds ratio, RAs published in the more recent time period were 2.16 times more likely to express surprises triggered by prior knowledge, compared with those published in the earlier period.

These results were puzzling at first blush because there did not seem to be any apparent reason

why academics today are more likely to be surprised by things already known than their counterparts were 30 years ago. In view of previous research showing that the linguistic expression of emotions is "inherently strategic, persuasive, interactional, and other-directed" (Caffi & Janney, 1994, p. 329; Hyland & Jiang, 2018), we examined surprises triggered by prior knowledge in relation to types of Resolutions. Of the 64 instances of surprise invoked by prior knowledge, only the following two were resolved:

(18) [Experiencer Schlesinger] (1968) was *SURPRISED*^Target to learn [Trigger that his subjects performed about as well on sentences that were structurally complex as on those that were less complex]. [Resolution In discussion with them he discovered that they were using lexical meanings to understand sentences and sometimes they were not even sure that a sentence was grammatically correct]. (A1-06)

(19) It is [Resolution for this reason] that, *SURPRISINGLY*^Target, [Trigger "misunderstandings are not frequent in ELF interactions,"] according to Seidlhofer (2004, p.218). (A2-16)

As attested to by their rare occurrences, these were two special cases: Example 17 described the surprise of another researcher, and in Example 18 the Trigger was a citation from a previous article. Clearly, surprises triggered by prior knowledge were not meant to be resolved. The question then arises as to why the academic writers bothered to express such surprises in the first place. A close analysis of text containing such surprises revealed that the surprise markers in question were mainly deployed to provide justifications for one's study. Such text typically appeared in the introductory part of an RA and often identified research gaps (Swales & Feak, 2004) in an emphatic manner, as illustrated by Example 19:

(20) [Explanation Given the centrality of materials in a very wide range of language teaching situations], it is somewhat *SURPRISING*^Target [Trigger that there has not been more empirical classroom-based research on the role(s) that materials play in the totality of processes of language teaching and learning that comprises classroom interaction]. (A2-40)

In this example, the observation that *there has not been more empirical classroom-based research on the role(s) that materials play* was perceived to be incongruent with *the centrality of materials in a very wide range of language teaching situations*, and therefore was *surprising*. Thus, juxtaposing a research gap and "the assumed shared understandings of community readers" (Hyland & Jiang, 2018, p.26) effectively highlighted the unexpectedness of the research gap and provided a strong justification for the author's new study. Seen in this light, the significantly more frequent expression of surprises triggered by prior knowledge to justify one's own research endeavors in the more recent RAs seemed to stem from the escalating competition among academics to publish in high-impact journals and attract more readers. This competition has made it increasingly necessary to promote one's own research strategically (Fairclough, 2013; Mautner, 2010; Wang & Yang, 2015).

As regards the subcategories of Explanation, incongruence with prior knowledge ($n = 36$) and with new information ($n = 21$) were provided as Explanations for 25.45% of the surprise markers, whereas

sources of incongruence were unidentified for the remainder ($n = 167$). Binary logistic regressions revealed that time of publication was a statistically significant predictor of unidentified incongruence ($B = 0.864$, $p = 0.008$, Nagelkerke $R^2 = 0.059$, OR = 2.371), though no such relationship was found for the other two types of Explanations ($B = 0.000$, $p = 1.000$, Nagelkerke $R^2 = 0.000$, OR = 1.000 for incongruence with prior knowledge; $B = 0.599$, $p = 0.154$, Nagelkerke $R^2 = 0.021$, OR = 1.821 for incongruence with new information). RAs published more recently were 2.37 times more likely to express surprises without giving any Explanation. These results were unexpected. As Silvia (2009) points out, surprise motivates "learning, thinking, and exploring, actions that foster the growth of knowledge" (p.49). Similarly, Gross (2010, p.5) notes that "surprising effects of experiments can be seen as the motor force for producing new knowledge since surprises help scientists become aware of their own ignorance." Given the heuristic nature of surprise as a knowledge emotion, one would expect most surprise markers to be used in such a way that the types of incongruence causing the emotion of surprise were explicitly identified for the generation of new knowledge, as illustrated by Example 21.

> (21) [Trigger That a large percentage of students from both groups believed their writing skills to have improved significantly] was an *UNEXPECTED*Target finding, [Explanation particularly since the data demonstrated otherwise]. … How does one explain the control group's significant increase in errors coupled with its faulty assessment that indeed the opposite had transpired? [Resolution The answer may be that the feedback which they received was faulty, incomplete, or ineffective….].
> (A1-51)

This, however, was not the case most of the time. What could have contributed to the observed patterns of Explanation? Why was the tendency to leave the sources of incongruence unidentified stronger in the more recent period?

A qualitative analysis of the instances of unidentified incongruence in the more recent RAs suggested that the rhetorical, rather than heuristic, functions of surprise markers were responsible for the observed patterns. The following two example was representative:

> (22) [Degree The most] *STRIKING*Target [Target insight] to emerge from the interviews is that, during the periods of intense and sustained motivation, learning Swedish was not just important, but became an all-consuming preoccupation around which all other activities in the participants' lives had to be accommodated. (A2-07)

In this example, the expression of surprise did not end with the resolution of the incongruence invoking the surprise and, hence, new knowledge, because no such incongruence was identified. Rather, it was intended to affect the opinion or response of the target audiences strategically and led them to make a positive assessment of the novelty, value, and contributions of the author's research. Consequently, such a use of surprise markers meets Martín and León Pérez's (2014) definition of "persuasive promotional rhetoric" (p.1). This is understandable because, as Hyland (1999) points out, "academic writers do not only need to make the results of their research public, but also persuasive, and their success in gaining acceptance for their work is at least partly dependent on the strategic manipulation

of various rhetorical and interactive features" (p.341). The onslaught of academic marketization and neoliberal accountability (Fairclough, 2013; Mautner, 2010) has been escalating the pressure on academics to promote their research strategically (Wang & Yang, 2015). Thus, "it is not so much the *amount* of news value that is remarkable in today's scientific journal arguments as it is the *promoting of it*" (Berkenkotter & Huckin, 1995, p. 43).

As for Resolution, a majority (61.16%, $n = 137$) of the expressed surprises were not resolved. Resolution by speculation, resolution by prior knowledge, and resolution by new information accounted for 25% ($n = 56$), 2.68% ($n = 6$), and 11.16% (n = 25) of the cases, respectively. Binary logistic regressions showed that time of publication significantly predicted non-resolution of expressed surprises ($B = 0.825$, $p = 0.011$, Nagelkerke $R^2 = 0.054$, OR = 2.281) but not the other three subcategories of Resolution ($B = 0.076$, $p = 0.845$, Nagelkerke $R^2 = 0.000$, OR = 1.079 for resolution by speculation; $B = 0.120$, $p = 0.807$, Nagelkerke $R^2 = 0.001$, OR = 1.127 for resolution by new information; $B = -1.661$, $p = 0.133$, Nagelkerke $R^2 = 0.028$, OR = 0.190 for resolution by prior knowledge). Specifically, RAs published more recently were 2.28 times more likely to leave expressed surprises unresolved than those published in the earlier period were. As we have seen earlier, the marked greater incidence of non-resolution in the more recent RAs can be explained by the strategic manipulation of surprises triggered by prior knowledge (Example 20) to position one's research in relation to previous work and the deployment of surprises triggered by new information to promote the significance and originality of one's findings (Example 22). These trends have intensified in today's academic world in response to major developments in the larger society. As Hyland (1999) insightfully puts it, "discoursal decisions are socially grounded." This is not to suggest that the heuristic function of surprise as a knowledge emotion will retreat completely from RAs. As demonstrated by our data, close to 40% of the expressed surprises were resolved in one way or another, leading to the construction of new scientific knowledge.

5. Conclusion

In this corpus-based study, we examined linguistic expressions of surprise as attitude markers in 160 applied linguistics RAs that were published in two 5-year periods separated by 30 years. To complement extant research that investigated attitude markers and other types of stance metadiscourse at an aggregate level, we took a frame semantics perspective on surprise as a knowledge emotion and adopted a fine-grained, frame-based analytical framework to examine diachronic changes in the use of surprise markers and their co-occurrence with other types of metadiscourse (i.e., boosters, hedges, and self-mentions). The diachronic trends that we have uncovered often differ from those reported in previous studies, underscoring the need to develop more fine-grained analytical frameworks and examine the interrelationships among different types of metadiscourse. Notably, we have found that RAs published more recently were 2.16 times more likely to express surprises triggered by prior knowledge, 2.37 times more likely to express surprises without providing an explanation, and 2.28 times more likely to indicate

surprises without resolving them, when compared with RAs published earlier. These results have been interpreted in terms of the heuristic function of surprise in knowledge making as well as the rhetorical functions that surprise markers can serve to promote one's research strategically in response to fundamental sociocultural developments and neoliberal pressure on academics to perform and deliver.

Our study has pedagogical implications for instruction in English for academic and research publication purposes. The findings reported above suggest that in such instruction surprise markers should be introduced to graduate students and novice academics as valuable resources that they can leverage to promote their research. In this regard, the surprise frame that we have refined in this study can be used as a heuristic to raise their awareness of the frame elements as epistemic and rhetorical resources for enhancing the enterprise of knowledge making and the persuasiveness of the resultant knowledge. Furthermore, graduate students and novice academics could also use the surprise frame to analyze surprise markers in the academic discourse of their disciplinary communities to uncover discipline-specific strategies for expressing surprises epistemically and rhetorically.

Our study has demonstrated the potential of a frame semantics-based approach to explore academic discourse in general and stance resources in particular. Future research can take a similar methodological approach to examine other types of knowledge emotions, for example, interest and confusion, to develop a fuller understanding of how different types of attitudes are instantiated in academic discourse to achieve various heuristic and rhetorical purposes. Interested researchers can also compare the expression of distinct attitudes/emotions to test our hypotheses that patterns of use exhibited by different attitude markers are a function of both their unique affective content and their general metadiscoursal functionality and that academic discourse focuses more on what invokes affective reactions than who experiences them. Additionally, further research may investigate the use of surprise markers from a cross-disciplinary perspective (Hu 7 Cao, 2015). As Hyland (1999) points out, academic discourse is necessarily "influenced by the broad inquiry patterns and knowledge structures of their disciplines" (p.362). A cross-disciplinary comparison of how surprise markers are used promises to uncover the influences of "fundamental disciplinary assumptions, epistemological characteristics of the research traditions involved, and historically evolving philosophies of science" (Hu & Chen, 2019, p.166) on the strategic expression of surprises in academic discourse. Last but not least, stratified sampling can be adopted in future research to ensure compatible distributions of different types of academic articles (e.g., review articles, qualitative studies, and quantitative studies) and other article-/author-level variables that may potentially impact the use of surprise markers. Such a sampling method is essential to developing an understanding of how these variables may mediate the expression of surprises for epistemic and rhetorical purposes.

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