'Our striking results demonstrate …': Persuasion and the growth of academic hype

Ken Hyland & Feng (Kevin) Jiang

1   Introduction

Academics today are working in a time of intense competition. There are now more scholars writing than ever before, more journals, more papers, more publishers and more authors writing in a language which is not their native tongue. There are, in fact, perhaps eight million academics working in 17,000 universities around the world seeking to publish in English-language journals each year (UNESCO, 2017). One of the largest journal publishers, Elsevier, for example, reported over two million articles submitted and one billion read in 2019 (Page, 2020). Fifty years ago the university was a more sedate environment with fewer academics, more leisurely publication practices and a culture which valued reflection (e.g. Becher & Trowler, 2001). The explosion of publishing since then, of course, is fuelled by intensive audit regimes where individuals are measured by the length of their resumes. Metrics, financial rewards and career prospects have come to overwhelm and dominate the lives of academics across the planet, creating greater pressure, more explicit incentives and fiercer competition to publish.

It would be surprising if these stresses did not encourage academics to more actively promote the significance of their work. In this paper we examine this possibility; exploring how, and to what extent, academics rhetorically 'sell' their studies. We do this by examining authors use of hyperbolic and promotional language to glamorise, publicize, embellish and/ or exaggerate aspects of their research – a phenomenon Millar et al (2019) refer to as 'hype'. Specifically, we address the following questions:

1. To what extent do authors of academic papers hype their research?
2. What are the most common hyping devices in different disciplines?
3. What aspects of research does this language target?
4. Has the extent of this changed during the last 50 years and in which fields?

2. The rhetorical promotion of research

Academics have always presented their research in a favourable light, projecting a shared professional context in which their ideas make sense and appear persuasive. Novel interpretations and interesting results have to be situated in what the discipline knows and accepts, so writers must carve a recognisable niche for themselves. In this way their work has more chance of being published, cited and used. As a result, scientists routinely conceal contingent factors, downplaying the role of social allegiance, self-interest and power to depict a disinterested, inductive, democratic and goal-directed activity (e.g. Gilbert & Mulkay, 1984). More rhetorically, some 30 years ago Faiclough (1993) referred to the 'marketisation' of research and Hyland (1999) spoke of authors 'boosting' statements to strengthen their claims. These examples from our corpus[1] give some idea of this:

1) Our **striking** results **demonstrate** that longitudinal scaling of all long bones is **clearly** isometric throughout elongation. (Biology)

2) Drawing on an **exceptionally high-quality** longitudinal data source, this article provides **important contributions** to understanding variation in family behavior.

(Sociology)

3) ..the instrument opens up **new** avenues to researchers who wish to study how specific properties of the ideal L2 self. (Applied Linguistics)

Given the increasing pressure on academics to publish and with more than 3 million new peer reviewed articles issued each year (Johnson, et al, 2018), the promotion of research findings may be increasing. Certainly, academic life was less competitive in the 1960s where our story begins. The UK, for example, had only 14 universities compared to 130 today and Pergamon, now part of the Elsevier empire, had 40 academic titles compared with the 2,500 Elsevier publishes today. Publishing was a means for scholars to share their research beyond their immediate acquaintances and was largely disseminated by non-profit learned societies and the generosity of sponsors. Increased government funding following the second world war

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[1] Hypes are bolded in the examples, with the discipline in parenthesis. Examples are from the 2015 corpus unless the year is specified.

accelerated the expansion and professionalisation of the research community transforming publishing into a way of generating income (e.g., Fyfe et al, 2017). A key phenomenon of this change has been the division of labor into teaching and research, and the growing importance of publications as career-defining tokens of prestige for academics (Clark, 1987). These increasing pressures have transformed academic life over the last 50 years, not only fueling the scramble to publish, but also encouraging the rhetorical promotion of results and professional visibility itself.

Several studies, for example, have observed the emergence of 'a news-oriented text schema' designed to promote the authors' research results in Physics (Swales & Najjar, 1987), biology (Berkenkotter & Huckin, 1995), and computer science (Shehzad, 2010). Martin and Leon Perez (2014) found writers in both health sciences and political sciences often underscore the contribution of their research in article introductions by stressing their main findings. This promotion of results has developed to accommodate researchers who, swamped by the explosion of scientific information, read for bottom-line relevance to their own work. It is, however, also a feature of articles in the humanities. Here writers have been observed to explicitly highlight the novel contribution of their work in literary studies (Lindeburg, 2004) and applied linguistics (Wang & Yang, 2015).

But while such promotional strategies have become commonplace, we are more specifically concerned with the role of hyperbolic language itself: the use of words which impose subjective value on claims to embellish results and promote the merits of studies. The effect of such devices can be seen if we remove the boldface items from these examples:

(4) **Crucially**, fields permit some forms of capital to be converted into other forms....

(Sociology)

(5) This **powerful** algorithm has **successfully** been applied to a wide variety of problems

(Elec Engineering)

Some scientists believe that such hyping practices have reached a level where objectivity has been replaced by sensationalism and manufactured excitement (e.g. Rinaldi, 2012; Scott &

Jones, 2017). By exaggerating the importance of findings, writers are seen to undermine the impartiality of science, fuel scepticism and alienate readers (e.g. Horgan, 2015; Master & Resnik, 2012). The editor of *Cell Biology International*, for example, bemoaned an increase in 'drama words' such as *drastic decrease, new and exciting evidence* and *remarkable effect* which he believed had turned science into a 'theatrical business' (Wheatley, 2014: 14).

These vague feelings of unease have been confirmed by several studies suggesting such words are increasing. Thus, Fraser and Martin (2009), for example, found a significant increase in 21 'biased' adjectives' such as *important, critical* and *original* in clinical research journals between 1985 and 2005. The rise of hyperbole in medical journals has been vividly illustrated by Vinkers, Tijdink and Otte (2015), who found that the frequency of 25 positive-sounding words such as *novel, amazing, innovative and unprecedented* increased almost nine-fold in the titles and abstracts of papers published in PubMed between 1974 and 2014. In biology Hyland and Jiang (2019) report an increase in the boosters *show, must* and *know* in biology over the last 50 years, forms which ensure readers are aware of the strength of results. They also note a rise in *essential* with an extraposed *to-clause* or followed by *for*, which express judgments of extreme importance or necessity.

Many studies conducted by scientists, however, are impressionistic and ad hoc, restricted to a few items noticed by the researchers as 'favourite examples' (Wheatley, 2014). These are then either restricted to abstracts and titles (Vinkers, Tijdink & Otte, 2015) or arbitrarily weighted according to their supposed 'impact' (Fraser & Martin, 2009). More rigorous methodologies have been adopted by applied linguists, so that Millar, Salager-Meyer and Budgell (2019), for example, manually annotated a small corpus of Randomised Control Trials (RTCs) for hyping items. RTCs are employed to measure the effectiveness of new treatments in medical research, yet the authors found 6.7 occurrences of hype words per-paper, or 2.0 per 1000 words. These mainly occurred in method and discussion sections to emphasise the expertise of the authors or the strength of the study design. Millar et al. (2019) argue that this focus on selling the research rather than its actual significance, can impose

'judgments on readers that might undermine objective and disinterested evaluation of new knowledge' (ibid p149). In a follow-up interview study with seven authors, Millar, Budgell and Salager-Meyer (2020) found that motives for hyping related to external editorial intervention, linguistic ability and replication of conventionalised discourse, underlined by pressure to publish and writing instruction.

In a recent study of hype in the 200 most highly cited scientific papers dealing with the Covid19 virus, Hyland and Jiang (2021) examined 400 candidate hype terms and found 35.9 items per 10,000 words. This was not only significantly more cases than in a reference corpus from the same fields, but the results showed a significant increase in hyping each month of the study (January to July 2020). The authors believe that the feverish atmosphere of intense, high-stakes competition to understand the virus and discover a vaccine for its control, encouraged a rush by researchers to promote their results. In this study we employ the same inventory of hyping terms, but use them to determine what changes have occurred in a wider range of disciplines, in a larger corpus of texts and over a longer period of time.

3. Corpora and methods

To trace changes of hyping practice in research articles over the past 50 years we created three corpora, taking research articles from the same five journals in four disciplines spaced evenly at 25-year intervals over 50 years: 1965, 1990 and 2015. The fact that journals come and go, become more specialised or change direction over time places some constraints on diachronic research. This meant making some compromises in compiling the corpus, but we selected robust journals at the top of their respective fields (as defined by the Thompson-Reuters categories) and with a long history.

We selected journals from disciplines which offered a cross-section of academic practice, representing both the hard and soft sciences: applied linguistics, sociology, electrical engineering and biology. From each of these four fields we took six papers at random from each of the five journals which had achieved the top ranking according to their 5-year impact

factor in 2015. Two journals, *TESOL Quarterly* and *Foreign Language Annals*, began only in 1967 and so papers were chosen from issues in that year. Single and co-authored papers were chosen in equal numbers. Overall, the corpus comprises 30 articles from each discipline from each year, 360 papers of 2.2 million words in total. Table 2 shows the composition of the corpus and the massive increase in the length of articles over the period:

Table 1 Corpora by discipline and word length

Discipline	1965	1990	2015	Change (%)
Applied linguistics	110,832	145,712	237,452	**114.2**
Biology	244,706	240,255	237,998	**-2.7**
Elec engineering	92,062	124,631	235,681	**156.0**
Sociology	149,788	205,238	262,203	**75.0**
Totals	**597,388**	**715,836**	**973,334**	**62.9**

Having created the corpus we then compiled a list of hyperbolic items. This is a potentially open set and different genres, registers and writer purposes are likely to contain different items, so that articles in tabloid journalism, for instance, are likely to differ from those in political speeches. We attempted to be as inclusive as possible in published academic genres.

First we included the categories of boosters and positively marked attitude markers from Hyland's (2005) stance framework. **Boosters** are epistemic devices which express conviction, seeking to assert claims categorically and shut down alternative voices (*demonstrate, show, clearly*). **Positive attitude markers**, on the other hand, indicate the writer's affective perspectives and include evaluations and personal feelings towards content (*interestingly, fascinating*) or on the communication itself (*honestly, to be frank*). Together these devices convey a writer's personal assessments and comment on either the truth or the value of arguments to express a conviction in claims. This list was supplemented by reference to the literature on this issue, such as those referred to as "positive words" (Vinkers et al, 2015), "superlatives" (McCarthy, 2015) and "hyperbolic terms" (Millar et al, 2019). We also scanned other sources for a wider inclusion of candidate items, such as the *Oxford*

Thesaurus of English (Waite, 2009) and corpus-generated wordlists such as the Academic Word List (Coxhead, 2000) and the Academic Vocabulary List (Gardner & Davis, 2013). This procedure produced a list of about 400 hype items.

We then searched the corpora for these items using *AntConc* (Anthony, 2019), and manually examined each concordance to exclude items that were not performing a hyping function. For example, the word *major* was excluded in contexts like (6), where it refers to an important component of something, but seen as hyping when used to modify a claim as in (7):

(6) Each lesson consisted of three **major** sections:…   (AL)

(7) This reformulation of the role of strategic competence constitutes a **major** advance. (AL)

Similarly, words such as *important* and *definitive* were ignored in the negative (not important/ no definitive conclusion) (see Fraser & Martin, 2009) and *significant* was rejected when used as a statistical measure. Both authors worked independently and achieved a high inter-rater agreement ($\kappa > .08$) before resolving disagreements.

At this point we lemmatised our results, that is, we grouped together inflected or variant forms of the same word to their base or dictionary form (i.e. shows, showed, showing = show). Only where different forms are likely to carry different meanings did we retain variants (e.g. increase/increasingly and high/highly were retained). To answer Research Question 3, concerning the aspects most hyped by these items, we adopted a modified version of the categories proposed by Millar, Salager-Meyer and Budgell (2019), dropping the category of *Research Conclusions* as being too difficult to distinguish from Research Primacy. The categories we used are: *Broad Research Area*, *Specific Research Topic*, *Authors' Prior Research*, *Research Methods*, *Research Outcome* and *Research Primacy*.

Cases of every search item were coded into categories of hyping expressions and aspects of hyped research using *MAXQDA*, a commercial qualitative data analysis tool (VERBI, 2020). Both authors worked independently on a 10% sample of cases of each search item and

achieved a high inter-rater agreement on hyping items (κ > .087) and categorisation of hyped targets (κ > .085) before resolving disagreements.

4 How much hyping is there in academic papers?

Overall, we identified 15,088 cases of hype in the 2015 corpus, averaging about 125.7 cases per paper and 155.0 cases per 10,000 words. The scale of hyping research may be surprising and suggests a widespread recognition of the competitive nature of contemporary academic publishing. Underlying these figures is perhaps a hint of anxiety and the sense that writers must promote their work to ensure their voice is heard in the growing cacophony of papers. While writer-reader interactions have been widely identified in the literature as a means to establish a writer's credibility, enhance reader engagement, and strengthen research claims (e.g Hyland, 2005), the presence of hype now seems to be part of the rhetorical apparatus of many authors.

Hype also appears to be increasing. Table 2 shows a massive rise of 93.8% since 1965, doubling the number of items per paper. Even when adjusted for the large increase in the length of papers, this remains a significant growth of 18.9% (*LL*=156.93, *%DIFF*=-15.91, *p*<0.001). Most of the rise seems to have occurred in the second period, coinciding with the explosion of academic publishing and the consolidation of the accountability culture which measures the performance of academics in terms of their output (e.g. Johnson et al., 2018).

Table 2 Frequency of hype items across the 50 years

	1965	1990	2015	Change (%)
raw	7,787	10,654	15,088	93.8
per paper	64.9	88.8	125.7	93.8
per 10,000	130.4	148.8	155.0	18.9

In terms of disciplinary changes, Figure 1 reveals an upward trend across all four of our target disciplines, with the hard sciences rising most dramatically to reach the levels found in the social science fields. The graph shows that hyping has been relatively constant, and consistently high, in applied linguistics and sociology over the entire 50 years, with

sociologists remaining the most frequent users of the feature. Electrical engineering has reached the level of applied linguistics in its use of hyping devices by a steady 45 degree climb over 50 years. Biology, however, rose rapidly to match levels in applied linguistics in the 25 years to 1990, becoming a highly rhetorical discipline, reflecting the distinctive ways that Biology pursues and argues problems and understands the scientific endeavor (e.g. Chargaff, 1974).
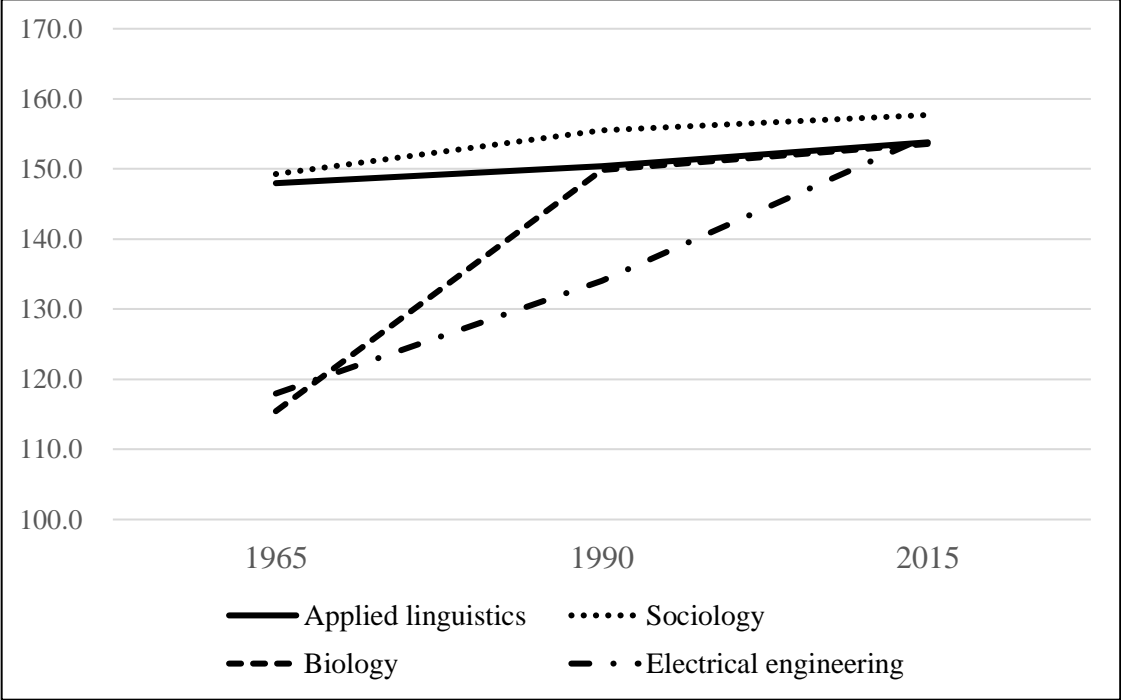

Figure 1 Change of rhetorical hype over time by discipline (per 10,000 words)

Although Figure 1 offers a clear visual representation of these disciplinary changes, a more detailed picture can be seen in Table 3 which shows the raw and normed frequency changes together with the *log likelihood* and *effect size* statistics. As can be seen, both the changes in electrical engineering and biology are significant. These remarkable disciplinary changes in the hard science fields are hard to account for but are doubtless related to the increasing pressure on academics to make their work visible and useful to others. As we have noted, a climate of managerialism and accountability in academia requires all researchers to make a name for themselves through a regular output of published works which are frequently cited and seen as authoritative.

Table 3   Distribution of hype items over 50 years by field (raw and normed frequency)

		1965	1990	2015	*LL*	*%DIFF*	*p*
applied linguistics	raw	1640	2191	3652	1.7	-3.8	>0.05
	per 10,000	148.0	150.4	153.8			
sociology	raw	2236	3192	4135	4.4	-5.3	<0.05
	per 10,000	149.3	155.5	157.7			
biology	raw	2825	3600	3655	130.9	-24.8	<0.001
	per 10,000	115.4	149.8	153.6			
engineering	raw	1086	1671	3646	64.5	-23.7	<0.001
	per 10,000	118.0	134.1	154.7			

Understandably constrained by conventions of objectivity and empirical impartiality, science authors were previously hesitant to taint the persuasiveness of established practices with promotional language. Writers in these two fields have not, however, been slow to employ hype features in response to this changing context. There are also aspects of the disciplines themselves which encourage these changes.

Engineers, for example, seek optimal solutions to problems where there is no formal way to find the best answer, forcing them to make judgments and provide explanations to justify their choices. The thinking which identifies a particular solution therefore requires careful rhetorical structuring (Robinson,1998). Weedon (2019) also highlights the importance of rhetorical decision-making in support of engineering judgements. Arguments are not only the application of individual ability to apply technical knowledge, but also a capacity to rhetorically establish common cause with readers. The invisibility of engineering rhetoric has increasingly become more explicit.

Biology has been influenced by other considerations which dispose it towards the use of hype. It is, as many observers have noted, a distinctive science, relying more on descriptive methods and 'beautiful models' than either physics or chemistry (Kellenberger, 1989). It is partly distinctive as a result of its subject matter, which allows less abstraction and certainty than other sciences, but also because of its personalities, who have tended to assume greater importance than in other hard sciences, both inside and outside the discipline (Judson, 1995;

Watson, 1968). Darwin, Bragg, Pauling, Luria, and Crick are among the most well-known academics of any field. Halloran (1984) has argued that this is the result of an entrepreneurial spirit in the discipline, a notion of scientific knowledge as private property which originated with Watson and Crick's seminal 1953 paper which simultaneously offered a model of DNA and a model of the scientist. The proclivity for hype in Biology might therefore be seen as an indication of a disciplinary ethos which emphasises proprietary rights to claims.

5   What are the most common hyping expressions?

Table 4 presents the most frequently occurring items used to promote research in these corpora (lemmatised to show the canonical form). Words in the 2015 top 20 and not in the 1965 list are bolded and those which are disciplinary specific are shaded.

Table 4   Most common hyping lemmas in 2015 (per 10,000 words & % of total)

Applied linguistics			Sociology			Biology			Engineering		
items	freq	%	items	freq	%	items	freq	%	items	freq	%
important	12.7	8.3	important	10.1	4.9	important	7.9	5.1	new	7.8	5.0
very	7.5	4.9	significant	9.0	4.1	very	6.5	4.2	very	5.6	3.6
significant	7.0	4.6	very	6.4	3.4	significant	5.9	3.9	important	4.5	2.9
new	**6.8**	**4.4**	**new**	**5.3**	3.4	potential	5.9	3.8	significant	3.9	2.6
clear	5.1	3.3	clear	4.5	2.5	new	4.8	3.1	main	3.7	2.4
positive	4.3	2.8	**strong**	**4.1**	**2.5**	high	4.7	3.1	original	3.6	2.3
effective	3.5	2.2	best	4.0	2.0	strong	3.7	2.4	high	3.3	2.1
main	3.5	2.2	potential	4.0	1.8	highly	3.5	2.3	useful	3.2	2.1
strong	**3.2**	**2.1**	really	3.7	1.6	clear	3.4	2.2	complete	2.9	1.9
potential	3.0	2.0	positive	2.9	1.6	major	3.4	2.2	necessary	2.8	1.8
useful	3.0	1.9	substantial	2.7	1.5	contribute	3.2	2.1	**unique**	**2.8**	**1.8**
highly	2.9	1.9	close	2.6	1.5	effective	2.6	1.7	best	2.5	1.6
critical	**2.7**	**1.8**	highly	2.5	1.5	essential	2.6	1.7	positive	2.5	1.6
value	2.7	1.8	**distinct**	**2.4**	**1.4**	**best**	**2.4**	**1.6**	full	2.4	1.5
contribute	**2.6**	**1.7**	value	2.4	1.3	complete	2.4	1.6	clear	2.1	1.3
full	2.5	1.6	**central**	**2.3**	**1.2**	distinct	2.1	1.4	effective	2.0	1.3
always	2.1	1.4	always	2.3	1.1	fully	2.1	1.4	potential	2.0	1.3
original	**2.1**	**1.4**	main	2.2	1.0	**interesting**	**2.1**	**1.3**	crucial	1.9	1.2
really	2.1	1.4	high	2.1	0.9	**novel**	**2.1**	**1.3**	salient	1.9	1.2
successful	1.9	1.2	**robust**	**1.9**	**0.8**	original	2.0	1.3	**ensure**	**1.9**	**1.2**

It is interesting to see that the top four most frequent items are very similar in all four disciplines and the top five are identical in applied linguistics and sociology. *Important, very,*

new and *significant* are the most favoured means of establishing the prominence of work. But while there was considerable overlap across the disciplines, with the top 80 slots in 2015 filled by only 38 different items, just eight were shared by two disciplines and 16 were found in only one. Those hypes specific to the top 20 of a particular discipline are shaded in Table 4. As can be seen, the hard knowledge fields had the highest frequency of unique items, with five in biology and four in electrical engineering. These examples (8-11) provide an idea of how some of these distinctive items were used.

(8) **Interestingly**, both the autonomous and nonautonomous effects on tissue size were rescued by depletion of Dally. (Bio)

(9) On grounds of parsimony alone, this **novel** hypothesis therefore deserves to be taken seriously. (Bio)

(10) Low-rank tensor decompositions provide redundancy that results in **strong uniqueness** that is further improved in the presence of coupling or additional constraints. (EE)

(11) We devise a **crucial** criterion, which concentrates on the comparison and quantification of the granules vis-à-vis the original interval data. (EE)

The items bolded in Table 4 are those which have emerged more recently, and these are most frequent in the soft knowledge fields. Here hyping has had a longer history of prominence and presumably new items are needed to replace those which have lost their impact over the years.

(12) The objectification of linguistic practices is a **critical** component of a folk theory of language. (AL)

(13) Supported by the think-aloud protocols, we also provide **strong** statistical evidence for… (AL)

(14) This paper is the **first** to **demonstrate** this effect and it is an **important** start to a **new** avenue of research. (Soc)

(15) We have developed a **robust** framework for the analysis of private interests in this sector. (Soc)

In general, the items in the lists illustrate that the expression of strong evaluation involves both a statement of personal judgement and an appeal to shared values. Hype is therefore interpersonal; it requires writers to draw on their knowledge of what is prized by the community and how best to appeal to this. From the items in Table 4 we identified four broad categories of value which writers seemed to be promoting in their papers:

- Certainty (concerns strength or importance – *significant, important, strong, crucial*)
- Contribution (refers to immediate value or use – *necessary, essential, effective, useful*)
- Novelty (stresses originality and inventiveness – *first, timely, novel, new, unique*)
- Potential (comments on possible future value – *promising, potential, apparent*)

We can see that the items highlighted in examples 8-11 and 12-15 relate to a clear assurance of importance, stress the benefits of the research, or confirm its novelty.

The top three items in each discipline are declarations of certainty and these comprise the majority of items overall, impressing on readers the value of what is being discussed and seeking to coax agreement from them that the research is significant:

(16) As desegregation policy recedes, it is **crucial** to understand the impact of new institutional arrangements.   (Soc)

(17) Note that our procedure is more **powerful** than simply counting the number of neurons that would reach a certain significance level separately for each q or [q,k].   (Bio)

The function which occurs next most frequently in the top 20 is the contribution the study is claimed to make to understanding or overcoming a given problem, particularly in the hard sciences. Here we find items which assert the current benefits of the research, as here:

(18) The adaptive approach is **very effective** in terms of static error and smoothness of both actuators.   (EE)

(19) The **robust** classification of single-unit spike trains **indeed shows** that the activity resembled a prototypical firing pattern specific to …..   (Bio)

The remaining two areas which writers address to hype their research concern novelty and potential. Clearly, the originality of research is at a premium in a context where academics

are searching for ideas to trump others thus establishing their reputations and furthering their careers (20 & 21), although often it is the potentiality of this impact, rather than its confirmed value, which is the most that can be claimed for it (22 & 23):

(20) We propose a **new** closed loop architecture that tries to suppress VCO non-linearity without using a high gain analog loop filter. (EE)

(21) These data are **uniquely** designed to provide **ground-breaking** insights into family processes. (Soc)

(22) The linear mixing model is a **promising** solution for this scenario as well. (EE)

(23) It is **clear** that association data provides **potential** insights in the organization of the mental lexicon. (AL)

Academics, driven by an appraisal culture which depends on producing impactful research that will be published, noticed and cited, thus seem eager to promote the value of their work. As we noted in section 3 above, moreover, they do this in two main ways: the use of ***boosters***, to stress the categorical nature of claims and so increase their impact (24 & 25), and ***positive attitude markers***, which indicate an affective take on what is being said (26 & 27):

(24) This conversion is **always** a site of struggle. (AL)

(25) Probabilistic graphical models are **extremely useful** for making the conditional dependence in a statistical model explicit. (EE)

(26) It is quite **remarkable** that we found equivalent time scales in our data for which internal neuronal dynamics was probably the **major** contributor. (Bio)

(27) Particularly **intriguing** is the fact that terpene emission appears to mitigate abiotic stress. (Bio)

Table 5 shows how items in these categories have changed over the 50 year period. It can be seen that boosting has increased in all disciplines, most dramatically in Biology which has risen by nearly 30%. The most radical changes, however, have been in the use of attitude markers. The small declines in applied linguistics and sociology are not statistically significant, but huge rises in both biology (by 37%) and electrical engineering (by 46%)

suggest that scientists have revised previous cautions concerning the expression of attitude. They are now far more comfortable about tagging claims with their affective perspectives and strengthening their statements with expressions of affect.

Table 5 Change of hyping markers across time (per 10,000 words & % change)

Markers	Applied linguistics						Sociology					
	1965	1990	2015	%	*LL*	*p*	1965	1990	2015	%	*LL*	*p*
boosting	68.3	71.5	78.7	15.2	11.03	<0.001	70.2	78.4	80.3	14.4	12.85	<0.001
attitude	79.7	78.9	75.1	-5.8	2.07	>0.05	79.1	77.1	77.4	-2.1	0.34	>0.05
total	**148.0**	**150.4**	**153.8**	**3.9**	**1.68**	**>0.05**	**149.3**	**155.5**	**157.7**	**5.6**	**4.40**	**<0.05**
	Biology						Electrical engineering					
	1965	1990	2015	%	*LL*	*p*	1965	1990	2015	%	*LL*	*p*
boosting	59.6	75.2	77.1	29.4	54.24	<0.001	64.7	70.4	76.8	18.7	13.55	<0.001
attitude	55.8	74.6	76.5	36.9	77.97	<0.001	53.3	63.7	77.9	46.3	60.00	<0.001
total	**115.4**	**149.8**	**153.6**	**33.0**	**130.93**	**<0.001**	**118.0**	**134.1**	**154.7**	**31.1**	**64.47**	**<0.001**

Interestingly, the period recording the greatest rise was 1965-1990 in biology, a period which saw the establishment of molecular biology, a major branch of the discipline, and a period of intense research and institutional expansion for the discipline (Kellenberger, 1989). Electrical engineering, in contrast saw a bigger increase in the use of positive attitude markers after 1990 as the applied sciences increasingly embraced the competitive academic world of publication, sponsorship and commercial partnerships.

6   What aspects of research are most hyped?

In addition to the specific items and rhetorical functions of hypes, we need to consider the broad functional categories which these target. We therefore followed a slightly modified version of Millar et al.'s (2019) classification to determine which aspects hypes served to embellish.

 i.   Broad Research Area: the general field of study which the hype targets

 ii.   Specific Research Topic: the particular area under investigation

 iii.   Authors' Prior Research: related research conducted by the text author

 iv.   Research Method: the study design or conduct of the study

 v.   Research Outcome: the results or interpretations of the study

 vi.   Research Primacy: the research assigned as superior in some way.

The categories, to some extent, correspond with the IMRD (Introduction, Methods, Research, Discussion) structure of the conventional science research paper. Millar et al. (2019), for example, found that hypes of both broad and specific research topics mainly occurred in the introduction to establish the centrality of the topic and the purpose of the research; the authors' prior research was mainly found in the discussion; hypes related to research methods were in the methods and discussion sections; and those boosting research outcomes and primacy mainly in the discussion. Figure 2 shows that hypes in all areas have increased, although this rise was minimal in those related to the *broad research area*.
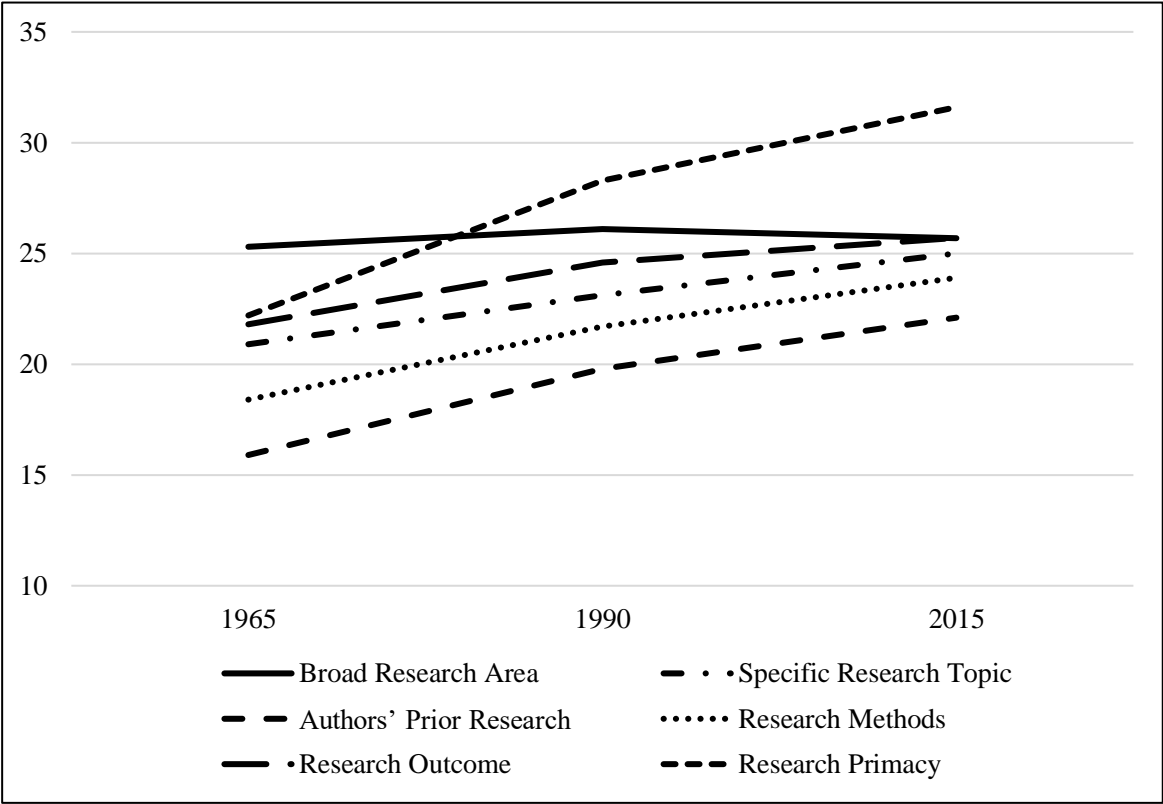

Figure 2 Change of Hyped targets in the corpus across the years (per 10,000 words)

The *broad research area* concerns the general topic of the paper and is often used to claim centrality for the research in the Introduction. In 1965 this comprised the most hyped category in the corpus, but most academics now work in fairly well-established areas of disciplinary inquiry which presumably require little additional effort to promote. While not claiming novelty for the area, it is often incumbent on authors to re-establish its centrality, as here:

(28) An **essential** aspect of successful lecture delivery and comprehension both for native and non-native speakers is the identification of important points (+ 6 refs).   (AL)

(29) This area has attracted **significant** attention worldwide and researchers have studied networked systems from different perspectives.   (EE)

(30) Reflexivity responses are not only **increasingly central** to contemporary life, however, but also, we suggest, to ways of engaging with and managing deceit...   (Soc)

We see in these examples writers encouraging readers to accept that the domain they have identified offers a significant or worthwhile area to traverse.

The frequencies of hypes in different categories, with the exception of *research primacy*, now cluster in a narrow band between 22 and 26 cases per 10,000 words (see Table 6 for details). The *specific topic of research* and *research outcomes* have increased the least over the 50 year period, rising by 19.6% and 17.9% respectively per 10,000 words, although these are statistically significant increases. The main reason why these areas have not shown more dramatic rises is that they are aspects of the argument where authors have traditionally placed considerable emphasis.

Table 6 disciplinary distribution of hype items across the period (raw & normed frequency)

		1965	1990	2015	% change	*LL*	*%DIFF*	*p*
Broad Area	raw	1509	1865	2505	66.0	0.3	-1.9	>0.05
	per 10,000	25.3	26.1	25.7	1.6			
Specific Topic	raw	1250	1657	2434	94.7	26.7	-16.3	<0.001
	per 10,000	20.9	23.1	25.0	19.6			
Authors' Research	raw	952	1420	2147	125.5	72.5	-27.8	<0.001
	per 10,000	15.9	19.8	22.1	39.0			
Research Methods	raw	1099	1556	2331	112.1	53.3	-23.1	<0.001
	per 10,000	18.4	21.7	23.9	29.9			
Research Outcome	raw	1300	1763	2501	92.4	23.9	-15.3	<0.001
	per 10,000	21.8	24.6	25.7	17.9			
Research Primacy	raw	1327	2023	3072	131.5	119.2	-29.6	<0.001
	per 10,000	22.2	28.3	31.6	42.3			

Hyping the *specific research topic*, for instance, allows writers to establish the significance of their research and specify the gap they seek to fill within the broader research area. It therefore both helps to encourage readers' acceptance of the value of the research they are doing and promotes their own expertise in the area.

(31) Fundamental-cause theory would **greatly** benefit from **greater** attention to racial/ethnic disparities in health, rather than socioeconomic disparities.   (Soc)

(32) The study of very advanced L2 learners offers the **best** insights into the factors affecting the degree of foreign accent in L2 speech.   (AL)

(33) Growth control is **essential** in industrial biotechnology and **fundamental** research of this kind could pave the way to **novel** types of antimicrobial strategies.   (EE)

The specialist audiences who are likely to read papers are unlikely to need to be shown the importance of a topic, but there is sufficiently high frequency of hypes to ensure readers are left in no doubt of the value of what it offers.

The relatively small increase in hyping *research outcomes* might also be explained by the fact that writers have always done this. It is here that writers seek to underline the importance of their findings and the weight of their interpretations. This is often achieved by the use of adverbs and adjectives to impart a personal take on the results, highlighting how the reader should understand what is presented and ensuring they fully understand its significance:

(34) **Remarkably**, the reduced size of the wing primordium observed in hypomorphic alleles of dpp is restored when combined with brk mutants.   (Bio)

(35) This study **shows clearly** that among Italian English bilinguals in Australia, the effect of enhanced ease of processing does not operate.   (AL)

(36) **Strikingly**, these data **demonstrate** that the consistent emphasis given to the genetic elements of the racial contrasts may be a distraction from....   (Soc)

(37) **Notably**, only these neoavian relationships remained unresolvable in whole-genome sequence analyses.   (Bio)

The terms *striking, notable,* and *remarkable* are examples of what Wheatley (2014) calls 'Drama Words' which invoke a sense of theatre. They add a hyperbolic dimension to the text in order to convey the unmistakable significance of the result and underline the main conclusion for the reader.

Larger rises in hype can be seen in the categories of *research methods* (29.9%) and *author's prior research* (39%) (Fig 2). Neither category seems to have been regarded as particularly worthy of promotion to the same extent as other types in 1965, but rapidly emerged to become significantly more hyped in 1990, then more gradually to 2015. Although *research methods* are generally considered to be the most expository, factual and least overtly persuasive part of research articles (e.g. Samraj, 2016), our data show that academics consistently use hypes to establish that their approach is valid, robust and, often, original:

(38) This methodological approach has ensured comparability and replicability of results and has **contributed considerably to** building confidence in the validity of the ideal L2 self.   (AL)

(39) This error correction has a **substantial** positive impact on the similarity of a contagion to its immediate predecessor.   (Soc)

(40) We propose a **new** closed loop architecture that tries to suppress VCO non-linearity without using a high gain analog loop filter.   (EE)

(41) To **facilitate** rapid development of recommendations, we performed a **novel systematic** prioritization of outcomes by the ongoing SSC guideline 2020 work and expert input.. (Bio)

The need to hype methodology in this way is perhaps partly due to the emerging range of available options, but is also due to a competitive climate which encourages innovative research designs and places pressure on writers to demonstrate rigor.

The *author's prior research* has increased 39% in hyping, underlining both the cumulative nature of academic research and the reputation-building efforts of its authors. As scholarly publication becomes more specialised, more collaborative and more

important for promotion and tenure, self-citation plays a more visible role in published research. Hyland and Jiang (2018), for instance, found a large increase in self-citations over the past 50 years, although this increase was tempered by a huge rise in citations overall, so that self-citation has fallen as a proportion of all citations. Despite this, researchers seem determined to promote their previous work through links to it, as here:

(42) Our earlier work *importantly expanded* upon previous research by employing DI models to test how interactions between species pairs within communities influence diversity (Bio)

(43) Our recent study *highlighted* the *importance* of this approach in low-income households in the Mid-West (Soc)

(44) This study **strongly** endorses our previous work **confirming** the **effectiveness** of this methodology. (AL)

Self-citation is particularly heavy among authors who have a long history of engagement in an area (Pichappan & Sarasvady 2002) and increases as scholars move through their careers and publish more research (Chang 2006). While this does not imply more hyping of this prior work, it makes it available for such promotion.

The category which recoded the greatest increase and which is now the most hyped of all is the *primacy given to the research*. These hypes promote the research itself rather than the results. While they strengthen the reader's awareness of bottom-line outcomes, they also go beyond this to emphasise the wider importance of the study and the likely future value of pursuing this line of work. These examples are typical:

(45) This research **strongly** supports turning analytic attention to illegitimacy as a distinct area of inquiry with **far-reaching** implications. (Soc)

(46) This is the **first** study to **show** there are **significant** changes in the ratio-specific information **important** to insects across relevant temperature changes. (Bio)

(47) The analysis given in our paper …. is **important** for a variety of **potential** applications to microwave devices and systems. (EE)

In the cut-throat competitive world in which academics now work, it is important for researchers to encourage readers to see not only the results of a single study, but the benefit it may have for future work in the area.

7   What disciplinary variations are there in hyping functions?

We have seen that writers in different fields have increased their research hyping at different rates (Table 3), with different preferred forms (Table 4), and with different enthusiasm for expressing attitude. We can also see in Figure 3 that they take different stances on which areas of the paper to hype most.
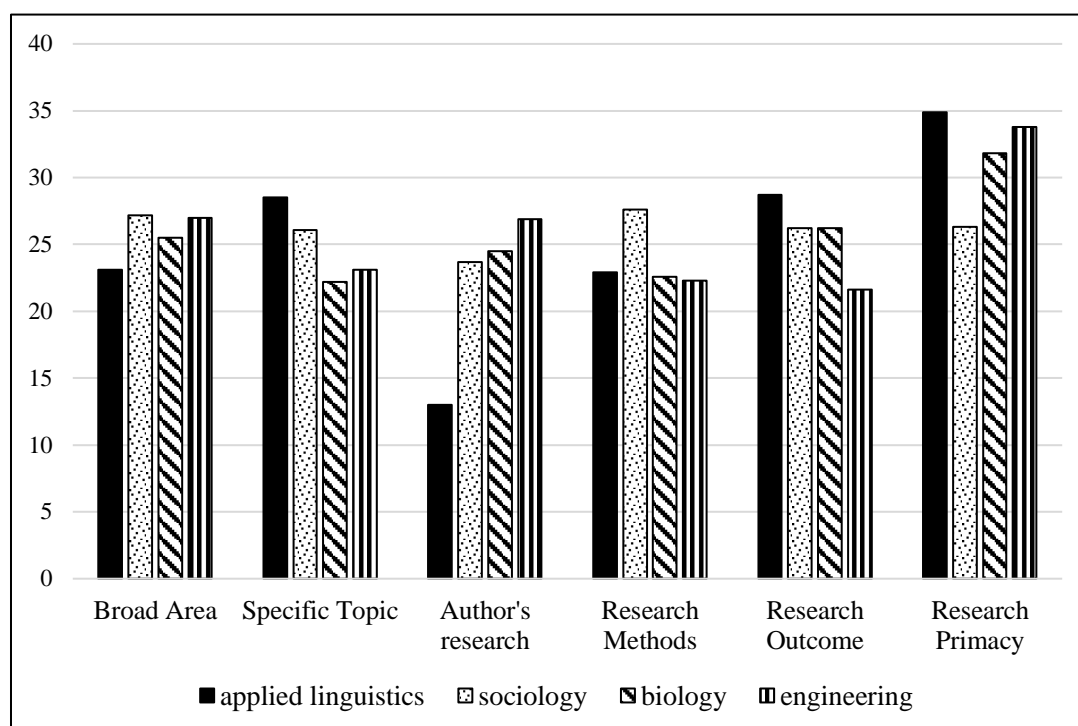

Figure 3   Hyped categories in 2015 by discipline (per 10,000 words)

As we noted above, *research primacy* was the most hyped category in 2015 and Figure 3 shows that this was particularly true in applied linguistics and electrical engineering, the two most applied disciplines in our corpora. We are cautious about proposing a single cause for this, but it is possible that the hyping of the value of the overall research project is a means of sending a message of relevance and importance to wider audiences, especially for the engineers, a majority of whom are involved in commercial applied work (Hughes et al, 2016).

(48) Order selection plays an **important** role in the performance of the final fusion results, and also presents an **effective** means to perform exploratory analysis of multimodal data. (EE)

(49) It is often a **great advantage** to group data into larger categories, and this analysis has identified a **convincing** framework for doing so. (AL)

Applied Linguistics also exceeded the other disciplines in hyping both *research outcomes* and the *specific research topic*. This may be because the field is relatively young compared with the other disciplines studied here and, to some extent, appeals to a more heterogeneous audience of teachers, theorists and researchers from a range of areas. Writers might therefore feel unable to make the same assumptions about readers' knowledge and so offer a stronger emphasis about both the outcomes (1) and the topic (2):

(50) The experimental investigation undertaken in this article **clearly demonstrates** the effects of modality on subjects responding on a grammaticality judgement task. (AL)

(51) The higher education literature on class participation provides **compelling** information on the factors that influence student participation in the university classroom. (AL)

Electrical engineers also heavily populate hypes in the *author's prior research* category. Engineering is one the highest self-citing disciplines (Public Policy Group, 2011) and writers are also enthusiastic hypers of their own previous work, creating a coherent narrative for university assessors, peers and the commercial interests who might make use of it.

(52) In our previous work, we **demonstrated** that SDA is capable of producing over 100 'IN [16] and of moving for over 50mu distance L151. (EE)

(53) This algorithm has been **shown** to be **extremely** effective in controlling the area of the weld pool in our previous study [19]. (EE)

Interestingly, applied linguists appear to be more reluctant than other writers to hype their previous work. This is perhaps because the discipline is relatively new and, emerging from the practical concerns of language instruction and learning in the late 1960s, has only recently

begun to establish a coherent literature. Thus, applied linguistics has become a more specialized discipline offering opportunities for researchers to occupy ever smaller niches each providing clear lines of inquiry and facilitating the hyping of *authors' prior research*. We can see in Table 7, for example, a 100% increase in applied linguists' activity in this category. Electrical engineering, too, has expanded over the past 50 years, moving into ever more commercially attractive applications. This helps explain the significant growth of hyping of their earlier work as researchers specialize in particular sub-fields such as power, control, electronics, instrumentation and so on.

Table 7 disciplinary distribution of target focus across the period (per 10,000 words)

	Applied linguistics						Sociology					
	1965	**1990**	**2015**	**%**	*LL*	*p*	**1965**	**1990**	**2015**	**%**	*LL*	*p*
Broad Area	35.8	30.0	23.1	-35.5	42.85	<0.001	26.8	27.0	27.2	1.5	0.06	>0.05
Specific Topic	21.2	24.2	28.5	34.4	15.98	<0.001	24.1	25.7	26.1	8.3	1.51	>0.05
Authors Prior Research	6.5	11.3	13.0	100.0	32.09	<0.001	20.1	22.4	23.7	17.9	5.61	<0.01
Methods	10.1	17.7	22.9	126.7	73.58	<0.001	21.9	25.0	27.6	26.0	12.41	<0.001
Outcome	26.8	27.0	28.7	7.1	0.98	>0.05	24.0	25.3	26.2	9.2	1.83	>0.05
Primacy	32.9	34.2	34.9	6.1	0.89	>0.05	23.7	25.8	26.3	11.0	2.57	>0.05
	Biology						Electrical engineering					
	1965	**1990**	**2015**	**%**	*LL*	*p*	**1965**	**1990**	**2015**	**%**	*LL*	*p*
Broad Area	20.8	23.5	25.5	22.6	11.54	<0.001	21.9	24.8	27.0	23.3	6.95	<0.01
Specific Topic	19.5	21.6	22.2	13.8	4.22	<0.05	19.2	20.7	23.1	20.3	4.70	<0.05
Authors Prior Research	17.9	22.7	24.5	36.9	24.91	<0.001	15.3	20.1	26.9	75.8	41.13	<0.001
Methods	19.8	21.4	22.6	14.1	4.47	<0.01	19.0	21.7	22.3	17.4	3.45	>0.05
Outcome	18.9	24.7	26.2	38.6	28.66	<0.001	19.7	20.6	21.6	9.6	1.15	>0.05
Primacy	17.6	28.5	31.8	80.7	100.03	<0.001	19.2	24.9	33.8	76.0	51.88	<0.001

The hyping of *research methods* has also seen a tremendous increase among applied linguists of 126% as the procedures used to address problems have expanded with the growth of the discipline's status. This growth provides a confidence which "allows for readier acceptance of methodological innovation or appropriation" (Choi & Richards, 2016: 2), and also for authors to hype their own approaches:

(54) This approach offers a several **significant** advantages in this context. (AL)

(55) The method we use here places a necessarily **strong** emphasis on the empowerment of groups who have traditionally been seen as deficient. (AL)

The 2015 frequencies for hyping methods, however, are dominated by sociologists (Fig 3), whose activity in this category has risen significantly, establishing the reliability of their procedures in what has become a marketplace of possible options:

(56) By paying attention to such standard quality measures, we can **ensure** that we are drawing **strong** conclusions from our SGOF statistic. (Soc)

(57) This genetic approach is **fully** consistent with a phenomenological emphasis on actors' beliefs and perceptions. (Soc)

Finally, it is worth mentioning the considerable rise of hyping of *research primacy* in the hard sciences. While applied linguistics and electrical engineering exceed other fields in 2015, both biology and engineering, with over 75% rise, show the greatest increases (Table 7). This attempts to establish the prominence and value of the current work against alternative approaches to the same issue:

(58) The numerous advantages of a DSP based signal processing system over one based on sampled analogue techniques are **overwhelming**. (EE)

(59) Our model, which is essentially a charge-control model, provides a **superior** representation in terms of the physical operation. (EE)

(60) Our study **strongly** suggests that future work might **greatly** benefit from adopting a similar approach. (Bio)

(61) Due to the lack of success in using several conventional methods, a **more effective** recognition algorithm is proposed based on a **novel** statistical feature. (Bio)

Here we see writers taking a clear position on the preeminent value of their research against competing views, a stance which writers have seen as increasingly necessary during the past 50 years.

8   Conclusions

In this paper we have traced the use of hyperbolic language in four disciplines over the past 50 years. These features glamorise, publicize or exaggerate research, helping to invigorate text, personalise commentary, engage readers and boost aspects of a study, and we have found that they have increased by 19% when adjusted for the longer papers over the years. Readers are now likely to see twice as many hypes in every paper they read. We have also discovered that while hypes have increased in each of our four target disciplines, they have done so most markedly in the hard sciences, and particularly biology. We have also noted the most commonly used hypes, the greater willingness of authors to employ impactful expressions of positive attitude, the frequency of hypes to convey certainty and underline the contribution made by the work, and the considerable increases in hyping of research primacy, methods and the author's prior research.

It seems unlikely that the ideas claimed today are any more *remarkable, significant* or *groundbreaking* than those of 1965. This increase in hyping, then, suggests an authorial repositioning; a shift from traditional conventions of objectivity and an apparently neutral stance towards one's work, results and methods towards something more partial and explicitly rhetorical. Tracking these features in the same 20 journals across 50 years of publishing shows, once again, that academic writing is not static, fixed and uniform but dynamic, diverse and responsive to the social conditions which create it (e.g. Authors, 2019).

We have suggested that academics are driven by pressures to gain visibility through their publications and citations as much as by the desire to get their research accepted. The professional recognition that comes from successful publication and the impact their work has on others is vital to academics, who rank it higher than financial reward (e.g. Zhang, 2014). Rhetorically promoting their work through the use of hypes seems to play a role in this endeavour. Alongside the growing desire to share work more widely through blogging (Zou & Hyland, 2019), preprints (Johansson et al, 2018) and academic tweets (Thelwall,

2013), hypes help to emphasise the distinctiveness and value of authors' research in an increasingly competitive environment.

But while they may add to the readability and persuasiveness of an argument by clarifying the author's position, strengthening claims and enhancing interactivity, hypes can also undermine arguments and compromise the integrity of the information being presented. This may, in fact, bias readers' evaluations of new knowledge, so that Master and Resnik (2012), for example, have called for research that examines the relationships between hype and the trust the public invests in academic research. The impatience expressed by some editors towards the growing 'theatricality' of science (e.g. Wheatley, 2014) may spread to the funders and consumers of academic work. It might also be noted that these findings are based on papers in top indexed journals and so represent the 'hard case' of demonstrating hype: the sites where papers are most likely to be circumspectly written to gain acceptance by the most demanding editors. There are almost certainly many more papers in many more journals which are less rigorously checked and more vigorously hyped than our data show.

We recognise, of course, that there are limitations to our study. We have focused on only three time points and four disciplines, nor have we sought to confirm our interpretations through interviews with disciplinary readers on the impact of hypes. Elaboration here would be useful directions for future research. But in closing we would also like to stress (or hype) the significance of this study. This partly lies in its contribution to the literature on academic persuasion and disciplinary variation in rhetorical practices, particularly from a diachronic perspective. But in addition, these findings have wider implications, speaking to the social conditions within which academics work and the impact of these changes on writing. The most influential of these changes, of course, is the massive expansion of academic publishing and what it means for the careers of those who participate in it. The need to talk to external funders, commercial sponsors and other non-specialists is becoming more important and, with metrics-driven assessments dominating academic careers, the importance of talking up the value of one's research is now a professional imperative. Hype is part of researchers'

desire to get there first and to meet institutional demands for precedence, publication and citation. For the moment this shows little sign of abating.

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