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Changes in research abstracts: past tense, third person, passive and negatives

Research abstracts are an increasingly important aspect of research articles in all knowledge fields, summarising the full paper and encouraging readers to access it. Graetz (1985) suggests that four main features contribute to this purpose: the use of past tense, third person, passive, and the non-use of negatives, although this claim has never been confirmed. In this paper we set out to explore the extent to which these forms are used in the abstracts of four disciplines, the functions they perform and how their frequency has changed over the past 30 years. Drawing on a corpus of 6,000 abstracts taken from the top 10 journals in each of four disciplines at three distinct time periods, we found high but decreasing frequencies of past tense and passives, an increasing number of third person forms, and more than one negation every two texts. We also noted a remarkable decrease of past tense and passives in the hard sciences and an increase in applied linguistics, with sociologists making greater use of negation. These results suggest that abstracts have developed a distinctive argumentative style, rhetorically linked to both their communicative function, and to the changing social contexts in which academic writing is produced and consumed.

Keywords: research abstracts; past tense; third person; passive; negatives

1. Introduction

Research abstracts play an increasingly important role in knowledge production and distribution in the academy. Readers are faced with an ever-growing tsunami of scientific literature and so depend on abstracts to filter what they read and help them decide what is relevant and worth their attention. Abstracts are often readers' first encounter with a research article and, together with titles, are likely to influence their decisions to continue to the full paper or go elsewhere. So, while abstracts have been seen as a "distillation" (Swales, 1990:179), a "crystallization" (Salager-Mayer, 1990: 367), or a "summary" (Kaplan et al, 1994: 405) of the main text, Huckin (2001) sees them as "screening devices", helping readers decide whether to read the article and creating a road-map for those who intend to do so (p.93). The abstract, then, is essentially a promotional genre, distinct from the research paper in terms of its spatial location, rhetorical purpose and reading context, where writers seek to "hook the reader" and gain their attention (Hyland & Tse, 2005).

This promotional aspect gives research abstracts particular rhetorical importance since writers must employ this limited space to foreground the main claims of the paper and demonstrate that they have something worthwhile to say (Hyland, 2004; Jiang & Hyland, 2017). Abstracts need to evaluate prior work and be accessible for busy readers skimming for bottom-line relevance (Swales & Feak, 2009). For this reason, and the fact that they are a manageable length for analysis, abstracts have been a staple of linguistic research.

In one of the earliest accounts describing the linguistic features writers used to accomplish this rhetorical purpose, Graetz (1985, p. 125) argued that:

> "The abstract is characterized by the use of past tense, third person, passive, and the non-use of negatives".

This description of these four features has been echoed by others working in the field, most notably Biber, et al. (2021), Swales (1990), Tarone, et al. (1981) and Webber (2004). These claims have also found their way into pedagogic materials which novice writers may depend on for rhetorical advice. Empirical evidence, however, remains thin, so much so that that Swales (2019) has noted, that Graetz's "claim has been left unconfirmed or disconfirmed" (p.79). This is a serious oversight given the importance

of abstracts and the fact these features are often assumed to be routine features of research writing.

This study, therefore, seeks to investigate this impression by examining the occurrence and use of past tense, third person, passive, and negatives in research article abstracts. We seek to reveal the form, function, extent and distribution of these features and how they have changed across time and disciplines. We believe the results will add to current knowledge about both the repertoire of rhetorical resources which writers deploy in producing effective abstracts (Hyland, 2004; Omidian et al., 2008) and of the use of metadiscourse in academic persuasion (Gillaerts & van de Velde, 2010; Jiang & Hyland, 2017). To contextualise our study, we first review what is known about the four features, taking examples from our corpus. In our examples, past tense is bolded, third person underlined, passive italicised and negation bolded and underlined. Discipline and year are marked in brackets.

2. Past tense, third person, passive, and negatives: a literature review

Past tense, of course, is commonly used "when describing or discussing events that happened or were completed in the past" (Beason & Lester, 2012, p. 72). Yet choices are also influenced by writer intentions (e.g. Conrad, 2010), with the past strongly associated with verbs denoting activities, especially physical movements and speech acts, and the present with those expressing mental and logical states (Biber et al., 2021). The choice of past is also influenced by the rhetorical context. Salager-Mayer (1992), for instance, found the past to be the most frequent tense in medical abstracts, while Reid (2000, p. 283) notes that in many other disciplines it is usually used to present the research itself, its methods or results:

> (1) Measurements of joint work and power **were** determined using inverse dynamics analysis based on ground reaction force and high-speed video recordings of tammar wallabies as they **decelerated** and **accelerated** while hopping over a force platform on level ground. (Biology, 2005)
>
> (2) They **interpreted** the reflexive in a null context sloppily, indicating the constraints of the minimal processing cost of RT.
>
> (Applied Linguistics, 2005)

The complex influences on the choice of past tense suggest that it is not only a grammatical option but a considered rhetorical choice concerning how to report research claims in a way readers find familiar, plausible and persuasive. Its use allows writers to highlight how readers should understand research activities and claims and how they should attend to the argument (e.g., when Parsons **derived** action theory from Durkheim's sociology, he also **argued** with Durkheim, **disputed** his claims…).

Personal pronouns also help to engage readers in academic writing. According to Beason and Lester (2012), pronouns are used where the reference is unknown or fairly general, and for specific clause-binding functions. The most typical third person pronoun in academic writing seems to be *it* used non-referentially as a "dummy pronoun" (Biber et al. 2021, p.331). As shown here, it is most often used to refer to definite entities in the preceding text (3), to mark anticipatory subjects (4) or to present subjects in cleft constructions (5):

(3) Blockchain is a technology devised as the fundamental technology of Bitcoin. It allows reliability to be ensured in a decentralized manner…
(Engineering, 2020)

(4) It is important to incorporate class differences when addressing the social and the political dynamics of sexual orientation. (Sociology, 2005)

(5) It is a context that resembles some of the patterns of ordinary conversation. (Applied Linguistics, 2005)

When pointing to prior discourse, *it* creates a cohesive tie and works to increase the intelligibility of text. *It* can also allow writers to express a stance and foreground the evaluative meanings as the starting point of the message while concealing the source of this attitude with an impersonal subject (Hyland & Tse, 2005). At the same time, it allows the relatively long and heavy element to be shifted towards the end of the sentence, thereby assisting readers' processing of 'new' information.

Other third person pronouns, particularly *he* and *she*, can also be found in academic writing, largely when writers refer to other researchers, as in examples (6) and (7).

(6) The paper presents the key concepts, goals and achievements of Latour's approach and analyzes the way his framework relates to - or confronts – Bourdieu's sociology. (Applied Linguistics, 2005)

(7) Our data do not, however, support <u>his</u> hypothesis that the supraorbital region is bent more during incision than during mastication.(Biology, 1990)

The use of third-person pronouns here is a key interpersonal element of citation, relating writers and their research to others in the discipline and creating a research space for themselves (Hyland, 1999). By expressing an interest in, or admiration for, others' research in this way, writers can potentially mitigate possible criticism of their work (Kuo, 1999; Myers, 1989).

The passive is another feature that is socially conditioned by disciplinary communities (Leong, 2020; Tarone et al., 1981). Despite an increased use of active voice in academic writing (Banks, 2017; Seoane, 2006), the use of passives enables writers to achieve a more thing-oriented expression of knowledge and appear relatively objective, bringing attention to technical aspects of a particular scientific procedure and the natural world itself rather than the author. This representation of knowledge is valued in much scientific writing (Leong, 2020), although to varying degrees, with the number of passives in research writing varies from 20–26% for medical papers (Amdur, Kirwan, & Morris, 2010) to 30% for articles across scientific disciplines (Banks, 2017).

Biber et al. (2021) suggest that passives typically involve a restructuring of the clause, comprising either a long passive, where the agent is expressed in a *by*-phrase (8), and a short passive, where the agent is omitted (9). Seoane (2013) argues that both types function as information packaging devices, with the former backgrounding the subject "from the forefront of the clause" and the latter foregrounding or topicalising the object, which "involves promotion of a non-agent to subject and topic position" (p.78). But whichever way is used, passives tend to convey an abstract, informational and impersonal style, to help persuade readers of the validity of scientific claims without the explicit intrusion of an acting scientist.

(8) This daily variation in microglial synaptic phagocytosis *was abrogated by global REV-ERB alpha deletion.* (Biology, 2020)

(9) Several phenomena of scale predication, topicalization, and aspect/time structuration, *are accounted for* in terms of topoi.

(Applied Linguistics, 1990)

Much has been written about passives in academic writing, and according to the research, they essentially allow writers to present information as an objective generalisation rather than an individual claim, strengthening an argument in fields that value objectivity.

Negation, as a phenomenon of semantic opposition, is the final feature we examine. This expresses "the opposite of something or an absence of something" (Sinclair et al., 2017, p. 648). There are two main forms in which negation is indicted in texts: affixal and non-affixal (Tottie, 1991). The former, also referred to as morphological negation (Dahl, 2010), is marked by the presence of a negative affix (e.g. *non-*, *dis-*, *un-*). The latter, also known as clausal negation (Biber et al., 2021), is achieved by either negating the lexical verb or auxiliary (10), or by negating non-verbal constituents (11). Thus the entire proposition is denied or rejected, with the negative scope extending from the negative form to the end of the clause. Clausal negation represents what Miestamo (2005) calls 'standard negation' (see Dahl, 2010) and expresses a negative statement more directly (Biber et al., 2021; Tottie, 1991).

(10) Exogenous catalase does **not** affect ROS in mitochondrion-rich EMCs. (Biology, 2005)

(11) It **cannot** be completely explained either by the accent based theory nor by the syllable based theory of consonant gemination. (Applied Linguistics, 2005)

As can be seen above, negation projects a world in which users anticipate a likely critical response, and perhaps relatedly, scholars have shown that they are twice as common in speech as in writing (Biber et al., 2021; Tottie, 1991). It does, however, play an important role in shaping academic arguments. For Jiang and Hyland (2022), negation concerns the writer's efforts to present a view in opposition to what might be widely assumed, thus carving out a novel space and distinguish his or her position from that of others.

Following Hyland's (2005) view of metadiscourse, Jiang and Hyland suggest that in the interactive component, negation is found where authors seek to progress the argument by marking contrastive, additive and consequential relations, either between parts of the text or by highlighting a possibly unexpected connection (12) and (13).

(12) **Neither** relative income **nor** education level is a clear predictor of the degree of involvement in housework. (Sociology, 2005)

(13) Anteroposterior browridge thickness is correlated with neural-orbital disjunction among anthropoid primates, but **not** among prosimians. (Biology, 1990)

In the interactional dimension, on the other hand, negation focuses on the participants and displays the writer's persona and a tenor consistent with disciplinary norms. Here negation acts in a context of modality and affect, contributing to the writer's evaluation of material through hedging, boosting and attitude (14) and (15).

(14) However, **few** studies have ever considered the consequences of these methodological differences. (Applied Linguistics, 2020)

(15) The inspection time and the restoration time are either zero or fixed, and the production facility **never** breaks down. (Engineering, 1990)

In sum, past tense, third person, passive, and negatives reveal the varied ways that writers comment on their unfolding text while "anticipating readers' expectations and responses to participate in a virtual dialogue" (Hyland, 2009, p. 111). These are features which contribute to writers being able to demonstrate their contribution to their field and develop an appropriate relationship with their readers (Hyland, 2014). Therefore, those writing English for research and publication purposes may benefit from a better understanding of abstracts and the relationship between language and disciplinary context. It is our goal in this paper to bolster an awareness of this rhetorical connection between writing to context in order to provide a stronger foundation for both research into writing and the improvement of writing itself. By relating practice to disciplinary and diachronic contexts, we reveal how linguistic choices respond to changes of discipline and over time.

3. Data and analysis

To investigate these four linguistic features across disciplines over time, we built three corpora, taking abstracts from journal articles published by the same 10 journals in four disciplines at three periods over the past 30 years: 1990, 2005 and 2020. The fact that journals come and go, that they undergo topic splitting and specialisation, and that they are replaced by new ones over time, places some constraints on diachronic research

(Hyland & Jiang, 2019). We sought, however, to select long-standing journals at the top of their respective fields with high 2020 impact factors, indicating their enduring, or emerging, prominence. Additionally, to provide a broadly representative picture of research writing in both hard and soft sciences (Becher & Trowler, 2001), and perhaps also make comparisons with research article practices where relevant, we selected papers from applied linguistics, sociology, electronic engineering and biology.

We downloaded 150 abstracts, half co-authored and half single authored, from each of the 10 top ranked journals in each discipline, and to ensure a random sampling, we took the first 75 abstracts of each type of authorship in alphabetical order of their titles. Overall, the corpus consists of 500 abstracts from each discipline from each year, totalling 6,000 abstracts of almost one million words. Table 1 shows the characteristics of the corpus. We note an increase in the length of abstracts over the period, especially in sociology and biology, and this change of length may be related to the growing importance of abstracts with the advent of digital communication.

Table 1 Total words at each period in the corpus of research abstracts

Discipline	**1990**	**2005**	**2020**
Sociology	65,796	75,814	83,419
Applied Linguistics	75,153	74,968	77,623
Engineering	72,448	79,583	85,062
Biology	85,525	94,014	107,276
Overall	**298,922**	**304,379**	**353,380**

Third person, passive, and negatives can be easily identified through a corpus word-search. Thus using *AntConc* (Anthony, 2019), we searched the items in the list of each feature, which we derived from the related literature (Biber et al., 2021; Carter et al., 2011; Sinclair et al., 2017). The list is provided in Appendix 1. The search for past tense is less straightforward and involved part-of-speech tagging the corpus using the Stanford Tagger (Santorini, 1990) and then conducting a regular expression search (\w+_VBD). After these machine searches, we manually checked each concordance to ensure that the retrieved instance was what we were looking for. Both authors worked independently and manually coded examples, achieving an inter-rater agreement of 98% on past tense, 98% on third person, 97% on passive, and 97% on negatives before

resolving disagreements. To determine statistical significances, the log-likelihood (*LL*) test was run using Rayson's log-likelihood spreadsheet (Rayson, 2016), and effect size for the log-likelihood test (*%DIFF*) was also calculated according to Gabrielatos (2018).

4. Distribution of the four textual features: An overview

Overall, we identified 12,976 cases of past tense, 8,040 cases of third person, 17,906 cases of passives, and 4,621 cases of negation in the corpus. Thus, of the four features, passives and past tense are most common in abstracts, with about 18.72 and 13.56 cases per 1000 words respectively. In addition, the frequency of negation, which amounts to more than one in every two texts, is probably sufficient to contradict Graetz's impression that negatives are not used in abstracts. This is often used to refute prior work and open a space for the current study. The results indicate that overall in research abstracts, the process of gaining attention and acceptance for the importance of a study involves persuading peers to see things in a certain way using past tense and passives.

We also analysed the distribution of the four features in research abstracts over time (see Table 2). The substantial rise in the length of abstracts (Table 1) may lead us to assume that more words provide writers with more opportunities to use these forms. However, negation, passives and past tense show a significant decrease of 24.4%, 18.8% and 2.0% respectively. This perhaps represents a growing desire to present information in a more affirmative manner with active agents and present relevance. This allows writers to engage more immediately with readers, to grab their attention at the outset with an arresting directness and sense of immediacy which may encourage them to explore the text.

Table 2 Distribution of target forms in abstracts over time (per 1000 words)

	1990		**2005**		**2020**		***LL***	***%DIFF***	***p***
	raw	**per 1000**	**raw**	**per 1000**	**raw**	**per 1000**			
Past tense	4095	13.70	4138	13.59	4743	13.42	36.55	-12.09	<0.001
Third person	2254	7.54	2663	8.75	3123	8.84	33.23	-14.68	<0.001
Passives	6201	20.74	5753	18.90	5952	16.84	131.78	23.16	<0.001
Negation	1614	5.40	1565	5.14	1442	4.08	59.96	32.35	<0.001

Interestingly, some of these changes are also found in research articles. Seoane (2013), for example, reports a reduced use of passives in articles in recent decades, although Gross et al (2002), examining 600 ten-line passages from articles in various sciences, argue that the use of an "objective" style, such as passive voice, personal pronouns and dummy subjects, have remained more or less steady between 1900 and 1995, reaching 'a point of evolutionary stability' (p.163). In abstracts, however, we see authors seeking greater visibility by highlighting an active agent with first person subjects (16). At the same time, because past tense often serves to present methods and results, writers seem to be placing less emphasis on how a study is conducted and what is found and more on why the research is significant by using present and perfect tenses (17):

(16) In this study, ***we*** aim to improve the methods currently used to find Borrelia in human blood, and identified two opportunities for optimization. (Biology, 2020)

(17) With reference to Schatzki, ***the paper emphasizes*** the role of explicit rules for practical accountability thus conceived. Such a normative perspective upon practice, we argue, ***complements*** existing theories of practice both conceptually as well as methodologically. (Sociology, 2020)

In contrast to the decline of these three features, the use of third person has risen by 9.32%. *It*, as a dummy pronoun, constitutes the main form, and is increasingly used to encapsulate specific information in the prior discourse (18) or represent anticipatory subject (19).

(18) <u>It</u> suggests that the latter details are not part of the communicative repertoires of most participants. (Applied Linguistics, 2020)

(19) <u>it</u> is difficult to accurately estimate a rotor-speed input that covers a wide range of operating conditions and modal frequencies. (Engineering, 2020)

This rhetorical use of dummy *it* assists the flow of information and improves the readability of a message, while projecting the writer's evaluation of the unfolding proposition. In previous work, we also found an increased use in research articles (Hyland & Jiang, 2018), pointing to writers' concern with establishing an interpretive frame for material while establishing a connected flow of ideas.

Although the use of these four features has changed in different directions, we see a rhetorical investment on the part of writers to deploy textual resources to build solidarity with readers and strengthen the persuasiveness of their abstracts. We now elaborate the changes in each linguistic feature by discipline.

5. Past tense

Past tense, as we have noted, is used to report results and the insights gained from research, generally referring to a particular study (e.g. Swales, 1990; Prinz & Arnbjörnsdóttir, 2021). As Table 3 shows, however, changes in the use of past tense were not uniform across our four disciplines, with only applied linguistics showing a significant increase against decreases in the other three fields.

Table 3 Disciplinary distribution of past tense across time

	1990		**2005**		**2020**		*LL*	*%DIFF*	*p*
	raw	per 1000	raw	per 1000	raw	per 1000			
Applied Linguistics	499	6.6	576	7.7	905	11.7	106.3	-43.1	<0.001
Sociology	713	10.8	689	9.1	806	9.7	5.0	12.2	<0.001
Biology	2300	26.9	2478	26.4	2625	24.5	10.9	9.9	<0.001
Engineering	583	8.1	395	6.6	407	4.8	66.1	68.2	<0.01
Total	4095	13.7	4138	13.6	4743	13.4	36.6	-12.1	<0.001

Clearly, biologists have consistently made the most use of past tense verbs in abstracts over the period, taking advantage of the form to report the claims and findings of their analyses in a direct and unadorned way:

(20) Additionally, the enzyme **showed** low ability to hydrolyse sucrose. (Biology, 1990)

(21) Northern blot analysis **revealed** some tissue-specific differences in PKINI transcript levels, the lowest **were detected** in leaves and the highest in stolons. (Biology, 2005)

Applied linguists, however, have dramatically increased their use of past tense, thus limiting their claims to the current study and so signalling the distinctiveness of their contribution:

(20) Our results **revealed** asymmetric and correlated proficiency levels including in the students' native languages (L1s). Their multilingual proficiencies **were** also affected by factors such as age variables and associated with aspects of L1 attitudes. (Applied Linguistics, 2020)

(21) The results **showed** listeners with more experience in ELF settings **reached** the highest score in the test, while participants with specialist knowledge **were** unable to profit from it. The participants' English language skills **played** a rather subordinate role.

(Applied Linguistics, 2020)

The use of present tense is also common in abstracts, however, indicating writers' efforts to emphasize the generalizability of their claims beyond the current study as indicated by Salager-Meyer (1992):

(22) The proposed method ***reduces*** the size of the training data set compared with the traditional TI method. Simulation results ***show*** that the recovery performance of the proposed algorithm**…..** (Engineering, 2020)

(23) The results ***show*** that 35.7% of COVID-19 subjects ***have*** specific antiviral IgA at the ocular level, persisting till 48 days post disease onset. Most of the IgA positive subjects ***present*** mild symptoms. The collected data **indicate** a prolonged persistence of ... (Biology, 2020)

Tense choice therefore indicates the stance taken by the writer and past is a choice indicating greater specificity and a reluctance to claim beyond the confines of the present paper.

Turning to the actual past tense verbs used in the corpus, copular outnumbered lexical verbs in all fields in the 2020 papers (Table 4). Biology and engineering make greater use of copular verbs than the two soft disciplines, perhaps because of more cases of passives in the hard sciences (see next section).

Table 4 Most common verbs in past tense and their proportions in 2020 corpus

Applied linguistics		**Sociology**		**Biology**		**Engineering**	
verbs	**Per 1000**	**verbs**	**Per 1000**	**verbs**	**Per 1000**	**verbs**	**Per 1000**
was	2.23	was	1.61	was	6.27	was	1.28
were	2.22	were	1.44	were	5.88	were	1.22
found	0.30	found	0.24	showed	1.00	used	0.12
revealed	0.24	identified	0.22	found	0.61	demonstrated	0.11
used	0.23	revealed	0.16	revealed	0.55	applied	0.08
showed	0.21	showed	0.14	observed	0.51	observed	0.08
analyzed	0.19	examined	0.13	identified	0.46	developed	0.07
developed	0.17	indicated	0.11	indicated	0.30	improved	0.07
examined	0.17	observed	0.10	exhibited	0.29	showed	0.07
applied	0.13	suggested	0.10	suggested	0.27	analyzed	0.06

There are broad similarities across the disciplines with strong preferences for lexical verbs denoting what Hyland (2004) calls *research* acts which represent experimental activities or actions carried out in the real world. They generally occur either in statements of findings (24) or procedures (25):

(24) Results **showed** a significant positive relationship between workplace spirituality and workplace identity, as well as LTO and workplace identity. (Sociology, 2020)

(25) This study **developed** a local oscillator (LO) with low phase noise and low power consumption. (Engineering, 2020)

There are no *cognition verbs* in the top 10, presumably because abstracts largely attempt to present a brief picture of key results, methods or significance, rather than assumptions or theories. The *discourse* verb ‘suggest’ occurs in the sociology and biology lists and we also found considerable cases of ‘discuss’ and ‘report’ in these fields:

(26) Moral panic', I **suggest**, is an unsatisfactory form of moral language which may adversely affect the media's ability to handle moral issues seriously. (Sociology, 2020)

(27) Here, we **report** the localization and characterization of BHKp23. (Biology, 2020)

There are disciplinary differences among the 10 most common verbs in past tense, however, with *used*, *developed* and *applied* only in the two applied disciplines of applied linguistics and engineering with *identified*, *suggested* and *indicated* in the two more 'pure' fields, which deal more with theories and ideas than practical applications. These are verbs which help writers in applied disciplines build arguments which emphasise the real-world value of their procedures or outcomes rather than on theoretical claims. They therefore strengthen the practical importance of the research:

(28) The method can be **applied** to other machining processes.

(Engineering, 2020)

(29) The study **used** a collaborative learning strategy as well as translanguaging to enhance students' understanding.

(Applied Linguistics, 2020)

Pure disciplines, on the other hand, tend to build knowledge incrementally so that "each new piece of the jigsaw has to be identified and fitted in to what is already there" (Becher, 1987, p. 56). This involves making such links, and the relevance of results to the discipline, more central:

(30) Sequence analyses **identified** possible adaptation strategies by the organism to cope with cold environments. (Biology, 2020)

(31) Results **indicated** significant positive relationship between workplace spirituality and workplace identity, as well as LTO and workplace identity.

(Sociology, 2020)

Past tense, then, can serve to highlight the salience of aspects of the current research and relate them to the expectations of readers.

6. Passive voice

Passives have long been seen as a distinguishing feature of scientific writing, marking a sense of scientific objectivity and observance of established procedures (Amdur et al., 2010; Biber et al., 2021). This helps account for the predominance of copular verbs in biology and engineering. We did, however, observe a significant decrease in the use of passives in the hard sciences (see Table 5). This trend aligns with the findings of Banks (2017) and Seoane (2013) in scientific research writing.

Table 5 Distribution of passives across time and disciplines

	1990		**2005**		**2020**		*LL*	*%DIFF*	*p*
	raw	per 1000	raw	per 1000	raw	per 1000			
Applied Linguistics	988	13.14	1051	14.02	1143	14.72	6.84	-10.73	<0.01
Sociology	857	13.02	1071	14.13	1251	15.00	10.22	-13.17	<0.01
Biology	2391	27.96	2085	22.18	1949	18.17	200.87	53.88	<0.001
Engineering	2088	28.82	1506	25.27	1657	19.48	142.97	47.95	<0.001
Total	6201	20.74	5753	18.9	5952	16.84	131.78	23.16	<0.001

While passives express an abstract, informational and objective style, writers are often advised to avoid them as "pedantic, long-winded, impersonal and tedious" (Seoane, 2013, p. 75). Thus Lebrun cautions scientific writers to "beware of the passive voice" (2007, p. 47), and *Nature* journals advises authors "to write in the active voice"[1]. This change may, at leas in part, be a result of the movement towards "scientific translation for the laity" (Gläser, 1995, p. 180), or more simply, 'knowledge exchange' and the growing imperative to make scientific writing more accessible to a wider audience, especially those whose taxes fund such research. Table 5 suggests that these admonishments have had some effect, at least in the ways that scientists write their abstracts, with significant falls in both engineering and biology. Hyland and Jiang (2016) found significant increases in the use of the first person in these two disciplines.

Passives, however, can help "organise or emphasise information" (Seoane, 2013, p. 75), as in (32) and (33):

(32) At steady-state, RNF41 ubiquitination facilitates interactions with ER-associated proteins and degradation machinery to control Clec9A levels. However, Clec9A interactions *are altered* following dead cell uptake to favor antigen presentation. (Biology, 2020)

(33) The deep learning-based forecasting and classification networks *are constructed* based on the Long Short-Term Memory networks to

[1] https://www.nature.com/nature-portfolio/for-authors/write

investigate long- and short term features in PEV behaviors. The data-driven structure of our proposed method enables us to observe and preserve the correlation between PEV travel data parameters.

(Engineering, 2020)

In (32), the passive creates a cohesive tie between the two sentences by making the rheme of the first the theme of the second, highlighting the *Clec9A interactions* which are changed during a process. Similarly, the engineering writer in (33) accentuates the methodological approach using a long noun phrase with a passive, downplaying the scientist's roles in the experiment and then commenting on the efficacy of such a solution. Thus the connected flow of ideas and foregrounding of procedures allows these writers to create arguments which may be more accessible and coherent to non-experts, assisting the wider dissemination of knowledge and helping writers gain a wider readership for their work (Hyland & Jiang, 2019).

The use of the passive in the softer fields, however, has shown a slight rise. This may be related to an increase in the use of quantitative methods and approaches representing something of a growing 'scientism' in soft disciplines (e.g. Franssen & Wouters, 2019; Hyland & Jiang, 2019). We can see this empirical change in the verbs used in passive form in those fields. In the 2020 corpus, *used* (6.5%), *analysed* (5.7%) and *conducted* (5.2%) were the most common verbs in applied linguistics and *conducted* (5.5%), *analysed* (5.0%) and *performed* (4.2%) in sociology. These verbs assist writers in supporting their arguments with research data and quasi-experimental investigation as in examples (34) and (35):

(34) Data collected through in-depth interviews with 35 university students *were analysed* in an inductive way. (Applied Linguistics, 2020)

(35) Descriptive statistics *were computed*, and one-way between-groups ANOVAs *were performed*. (Sociology, 2020)

These research-oriented verbs imply a very different epistemological orientation to representing research activities than cognitive verbs such as (36), for example:

(36) We ***consider*** her extended example of drag as sharing the impersonatory character of gender and as allegorizing the melancholic character of heterosexual gender identity. We ***comment*** on her interest in

a theatrical politics that may make trouble for gender. Finally we ***consider*** the theoretical burden that these ideas attempt to carry. (Sociology, 2020)

7. Third person

The use of *it* has been extensively studied as the most frequent third person pronoun in academic writing (c.f. Biber et al., 2021). The value of this linguistic feature is that it behaves like a grammatical subject by pushing the actual subject further into the sentence in a process known as 'extraposition' (e.g., Collins, 1994). This allows writers to conform to the pattern of end-weighting by shifting long and complicated chunks of information to the end of the clause and to present 'new' information at the end of the sentence where readers are likely to find it easier to process. At the same time, however, extraposition offers writers a means of initializing their perspective on what follows (e.g. Dong & Jiang, 2019), thematizing attitudinal meanings as an explicit proposition at the outset of the clause while concealing the source of this attitude with an impersonal subject (Herriman, 2000), as indicated in the following example:

(37) <u>It</u> is argued that theory and practice need not be seen as separate activities, and that diversity is an inevitable consequence of the interdisciplinary nature of Applied linguistics.(Applied Linguistics, 1990)

(38) <u>It</u> is proposed that the significant differences in the composition of the two fungal communities mirror the existence of a seral fungal succession paralleling the aging of the alder communities.

(Biology, 1990).

Despite the value of the structure in building textual coherence, however, it has often been seen as non-referential, dummy and empty (Biber et al., 2021; Carter et al., 2011), merely filling space in a sentence without contributing to its meaning (Beason & Lester, 2012). In this study, we see a decline in the use of *it* in this way in our corpus of abstracts, perhaps to increase the accessibility of the argument to a wider audience of non-scientists. Table 6 shows a decrease in the normed frequency of *it* by 47.17% over the 30 years.

Table 6 Distribution of third person in the corpora across time

	1990		2005		2020	
	raw	**per 1000**	**raw**	**per 1000**	**raw**	**per 1000**
their	591	1.98	708	2.33	983	2.78
it	697	2.33	672	2.21	749	2.12
its	333	1.11	499	1.64	563	1.59
they	309	1.03	400	1.31	392	1.11
his	123	0.41	140	0.46	156	0.44
them	102	0.34	133	0.44	152	0.43
he	65	0.22	54	0.18	58	0.16
her	22	0.07	33	0.11	38	0.11
she	8	0.03	16	0.05	18	0.05
him	4	0.01	8	0.03	14	0.04
Total	**2254**	**7.54**	**2663**	**8.75**	**3123**	**8.84**

Juxtaposed to the decrease in *it*, we found a significant increase in the use of *their*, which is now the most frequent pronoun in our corpus. *Their* refers to a concrete individual person or thing and allows writers to establish a cohesive link between current and prior information. In (39), for example, *their* both creates a connection with earlier material and indicates the focus of the paper is the struggle of multilinguals in society, and in (40), *their* clearly points to seabass as the topic of the biological research.

(39) The reported opening of spaces for meaningful multilingual and contextualized voices carries useful lessons for those actors who might find their work settings limiting their agency and power.

(Applied Linguistics, 2020)

(40) Successfully adapted seabass displayed standard behavior; their blood osmolality was maintained almost constant after the freshwater challenge, attesting to their efficient hyperosmoregulation. (Biology, 2005)

This frequent use of *their* also suggests research papers are largely concerned with collective rather than individual subjects, represented by *its*, *his* or *her*. Although the plural pronoun is increasingly found in general use to refer to a single person of unspecified gender to avoid gender bias, we saw no examples of this in our texts.

In the applied linguistics 2020 corpus, moreover, *their* most frequently collocated with *functions* (9 times), *meanings* (7) and *interpretations* (6) while in sociology with *work* (10), *children* (9) and *health* (8) and in biology with *activity* (9), *capacity* (9) and *development* (6).

> (43) A key factor in explaining topic-open-endedness early in the life of a new sign language is the nature of the linguistic symbols, the words, and the human ability to extend their meanings.
>
> (Applied Linguistics, 2020)
>
> (44) This article examines how professionals employed in professional organizations make sense of the disruption of their work.
>
> (Sociology, 2020)
>
> (45) We used the transparent larva of zebrafish to image CNS neurons and their activity in response to colored visual stimuli. (Biology, 2020)

These collocations of *their* provide some indication of the principal themes and interests of research in these fields: language use, people in society and biological organisms. It is also interesting to note the pronouns *she, her* and *him* increasing in research abstracts while *he* and *his* are falling. These forms are mainly used in the soft knowledge fields (Table 7).

Table 7 Distribution of third person pronouns by discipline over time (per 1000 words)

	Linguistics			**Sociology**			**Biology**			**Engineering**		
	1990	**2005**	**2020**	**1990**	**2005**	**2020**	**1990**	**2005**	**2020**	**1990**	**2005**	**2020**
their	1.33	2.61	3.81	3.34	3.53	4.24	1.57	2.11	2.21	1.89	0.92	1.13
it	2.85	2.77	2.31	2.01	2.19	1.67	1.08	1.04	1.02	3.62	3.32	2.90
its	0.84	1.88	2.01	1.60	1.56	1.45	0.61	1.45	1.60	1.56	1.36	1.34
they	1.22	1.64	1.71	1.49	1.70	1.75	0.69	0.84	0.66	0.83	0.60	0.49
his	0.33	0.32	0.30	1.14	1.28	1.51	0.22	0.01	0.00	0.06	0.06	0.08
them	0.27	0.53	0.55	0.50	0.62	0.68	0.19	0.21	0.27	0.46	0.18	0.27
he	0.21	0.13	0.08	0.61	0.56	0.60	0.08	0.02	0.00	0.03	0.02	0.02

her	0.12	0.13	0.14	0.15	0.25	0.31	0.02	0.01	0.01	0.01	0.00	0.00
she	0.09	0.09	0.09	0.02	0.12	0.13	0.00	0.00	0.00	0.00	0.00	0.00
him	0.01	0.01	0.01	0.03	0.09	0.16	0.01	0.00	0.00	0.00	0.00	0.00

Table 7 shows that singular pronouns are fairly infrequent overall and extremely rare in the hard sciences. *His, he* and *her* stand out with a higher frequency in sociology. While this discipline deals with human, rather than inanimate subjects, the concordances indicate that these forms mainly refer to cited authors rather than to research topics:

(41) Soren Kierkegaard is widely read in the disciplinary spheres of philosophy and theology. However, the sociological resonance of some of his work has been overlooked. (Sociology, 2020)

(42) In her groundbreaking scholarship on intimacy and economy, Viviana Zelizer coined the concept of relational work, or efforts in matching social relations with economic transactions and media of exchange. (Sociology, 2020)

The frequent use of singular pronouns to cite others points to the more extensive refencing in the discursive fields to build a shared context for interpretation and also to preferred pattern of single authorship in that field. It may also be, as Atkinson (1999) argues, that the use of third-person coupled with past tense suggests a more narrative texture in academic prose and the possibility of a shift towards a more narrative style in abstract writing in these soft disciplines.

8. Negatives

The final feature which Graetz (1985) proposed as characterising research abstracts is the non-use of negatives. As we noted in Section 2, negation represents the writer's intervention at certain points to contrast a perspective with assumed reader expectations to create a space for his or her work. We also noted that negation can perform interactive, or cohesive, functions and interactional ones, conveying modality and affect. Table 8 shows that we found a decrease of 24.4% in the overall frequency of negation over the 30 years in these abstracts, with both interactive and interactional uses declining.

Table 8 Distribution of metadiscourse uses of negation across time (per 1000 words)

Dimensions	1990	2005	2020	% change	*LL*	*% DIFF*	*p*
Interactive	**3.4**	**3.0**	**2.7**	-21.1	27.6	26.7	<0.0001
Consequence	2.3	1.8	1.4	-41.1	80.1	69.6	<0.0001
Addition	0.6	0.6	0.7	19.3	5.1	-16.2	<0.05
Comparison	0.6	0.6	0.7	19.6	5.2	-16.4	<0.05
Interactional	**1.2**	**1.3**	**1.4**	17.0	6.1	-14.5	<0.05
Hedging	0.6	0.7	0.7	20.0	5.5	-16.7	<0.05
Boosting	0.1	0.1	0.1	-53.9	8.6	116.7	<0.01
Affect	0.5	0.5	0.6	33.3	6.9	-25.0	<0.01
Total	**5.40**	**5.14**	**4.08**	**-24.44**	**59.96**	**32.35**	**<0.001**

Negation related to boosting and consequence show the heaviest falls, by 53.9% and 41.1% respectively. *Boosters* enable writers to "emphasise the force of propositions and display commitment to statements, thereby asserting the writer's conviction and restricting the negotiating space available to the reader" (Hyland, 2014, p. 10). Negation plays a role here by both strengthening a proposition and adding a stylistic variation with some impact as in (46) and (47).

(46) However, glutamate receptor cluster formation has **never** been examined in Drosophila DLG mutants. (Biology, 2005)

(47) As such, managers can **no** longer rely on conventional well-established solution methods. (Engineering, 1990)

However, this boosting use of negation fell by over half in the 30 years, perhaps because it appears rather over-assertive, which may be counter-productive when persuading sceptical readers.

After boosters, the use of negation to present *consequence* saw the largest fall. Consequence, of course, expresses a relationship between elements and the use of negation here signals how a writer presents the absence of a positive result or a lack of a significant connection. Thus (48) expresses the lack of a significant connection while (49) refutes a causal relation between research result and a previously assumed theory.

(48) The results do **not** support the hypothesis. (Biology, 1990)

(49) The skeletal elements from Florida do **not** suggest that the disease changed dramatically following contact with Europeans. (Biology, 1990)

However, our data show a clear preference for the expression of the positive marking of consequences, although negation of course remains useful when highlighting what others have not found.

In contrast to Gillaerts and van de Velde's (2010) findings that interactional metadiscourse had declined in abstracts, all the other functions we examined increased over the period with negation associated with affect (up 33.3%), hedging (20.0%), comparison (19.6%) and addition (19.3%). *Affective* negation indicates the author's adverse assessment of something and is often used to a create a research gap to situate the current study (50). *Hedging* negation serves to weaken a categorical statement, either to indicate the state of knowledge on a topic or out of respect for the potentially opposing views (51).

(50) However, **little** or **no** empirical justification is offered by researchers in support of its employment.. (Applied Linguistics, 2020)

(51) The battery could offer a solution to this problem, but the purpose may **not** be served completely ... (Engineering, 2020)

Comparison and *addition* are resources which guide readers through a text in a way which highlights the writer's preferred presentation of material, and negation here contributes to a persuasive flow of information. Accompanying comparison, negation both marks contrast with another idea while emphasising a preference for one:

(52) Hospitality experiences create a halo effect of patient goodwill, while medical excellence and patient safety do **not**. (Sociology, 2020)

Additive negation, on the other hand, builds an argument in which the statements are seen to be closely related or built one on another:

(53) Reducing losses of the latter **not** only improves return on investment but also reduces the required cooling effort and potentially enables higher power densities. (Engineering, 2020)

Disciplinary variations in the use of negation concern very small frequencies, especially in the hard sciences, and only a fall in interactive forms in applied linguistics and a rise in sociology show any marked change. Table 9 presents the findings.

Table 9 Functional distribution of negation across disciplines (per 1000 words)

Functions	App Linguistics			Sociology			Biology			Engineering		
	1990	2005	2020	1990	2005	2020	1990	2005	2020	1990	2005	2020
Interactive	**1.9**	**1.1**	**0.7**	**0.8**	**1.2**	**1.4**	**0.7**	**0.9**	**0.9**	**0.1**	**0.1**	**0.2**
Consequence	1.3	0.5	0.2	0.2	0.5	0.7	0.3	0.5	0.6	0.0	0.0	0.1
Addition	0.3	0.3	0.3	0.3	0.4	0.4	0.1	0.1	0.1	0.1	0.1	0.1
Comparison	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.0	0.0	0.0
Interactional	**0.5**	**0.5**	**0.4**	**0.6**	**0.8**	**0.9**	**0.7**	**0.5**	**0.5**	**0.2**	**0.1**	**0.1**
Hedging	0.2	0.3	0.3	0.3	0.3	0.4	0.2	0.3	0.3	0.1	0.1	0.1
Boosting	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.0	0.0	0.1	0.0	0.0
Affect	0.2	0.1	0.0	0.1	0.3	0.3	0.4	0.2	0.2	0.0	0.0	0.1

Sociology texts showed a significant increase of negation in both interactive (LL=12.06, p<0.001) and interactional (LL=5.41, p<0.05) dimensions. There has been some criticism that sociology has lost touch with all but the most dedicated insiders and is unable to effectively communicate with a wider audience (Billig, 2013; Hyland & Jiang, 2021). It may, therefore, be that writers see the use of negation as a means to achieve what Erikson believed was the focus of sociological writing, arguing it should:

> "convey ideas and information with enough clarity to be easily understood outside the narrow precincts of the discipline and yet with sufficient precision to allow for careful inspection and evaluation within it" (Erikson, 2008, p. 404).

The use of negation can assist sociologists to better express social issues more clearly, allowing readers with non-specialist knowledge to see explicitly what cannot be assumed from the text. It is a means of helping them recover the writer's intended meaning:

(54) Nonviolent protests have been at the center of minority interest advocacy for nearly a century ….. While groups organize and demonstrate in a peaceful manner, there is **no** guarantee that onlookers will perceive them as such. (Sociology, 2020)

(55) However, **neither** economic development **nor** marketization at the province level is a significant predictor of postmaterialist work values. (Sociology, 2020)

In applied linguistics, on the other hand, there were significant, but small, falls, particularly in negating consequences and affect. We have discussed the possible reasons for the decline of negation above, but where it is used by applied linguists, it tends to help open a research space for their own work by challenging accepted positions or prior work:

(56) They do not apply as easily to requests, however, in that they do not account for differences in force created by the negative in both languages. (Applied Linguistics, 1990)

(57) This paper demonstrates that it is not an appropriate description of the phonetic correlates of the harmony system. (Applied Linguistics, 1990)

9. Conclusion

While keywords, and often highlights, are now widely used by journals to aid searches, abstracts remain the key means by which writers can package their paper to succinctly promote its relevance and interest to peers. More than a summary, the abstract helps situate new work in the old and advertise it to potential readers. [A1][A2]These purposes help account for a certain systematised appearance, and we have investigated Graetz's (1985) claim that four major features characterise the genre. Our results indicate that she was broadly correct in her description, with particularly high, but falling, frequencies of past tense and passives, an increasing number of third person forms, particularly *it* and *their*, and relatively low, and declining, use of negation. The fact that, on average, there was at least one example of a negative in every two texts, however, tends to contradict Graetz's claim that negatives are not used in abstracts.

Graetz's observations have been influential, however, and together offer us some insights into how discourse is managed and academic interaction is constructed in this

genre. The commonly held view that the abstract is "a summary of the longer texts with maximum efficiency, clarity, and economy" (Swales & Feak, 2009, p.x3) often restricts analyses to moves and lexical strings. However, we see from the changes we have reported here both the contextual embeddedness of abstracts and their role as a genre with a distinct purpose. The shifting nature of these four features indicates a move towards pointing readers to the agency of researchers and beyond the results of the current study to its wider significance. These are, moreover, changes which do not always coincide with those of their accompanying articles which are sometimes seen as conforming more strictly to norms of scientific objectivity (e.g. Gross et al., 2002).

Overall, however, articles and abstracts exist in a similar academic environment and many of the changes reflect the disciplinary variations found in journal articles (e.g. Hyland & Jiang, 2019). What appears to be important for writers is to appeal to readers from outside their disciplinary 'tribes' (Becher & Trowler, 2001), of sociology or biology. Following institutional demands for wider knowledge transfer while ensuring they do so from within the boundaries of their disciplinary culture. In doing so, they continue to recognise and replicate the field's beliefs and knowledge structures in their writing to ensure their work is noticed and hopefully, cited and made use of, by peers. The linguistic features identified by Graetz and which we have focused on in this study suggest aspects of these disciplinary assumptions and indicate how individuals make use of them to position themselves within their communities in such limited textual space of the abstract.

The explosion of published research, the ease of accessing literature online, the pressures on authors to be visible and cited, and the imperative to ensure work reaches a wider audience of sponsors, institutional evaluators and an interested lay public has resulted in rhetorical change. These factors may help account for the falling use of past tense and passives in the hard sciences, suggesting a greater sensitivity to accessibility and generalisability of research findings to a larger population. In the soft disciplines studied, however, applied linguists have significantly increased their use of past tense and passives while both sociologists and applied linguists have replaced *its* with *their* as their preferred third person form. Sociologists also seem to be making greater use of negation in abstracts, especially to express (non)consequence of prior work as a way of opening a space for an individual contribution.

Overall, our work suggests that abstracts are a not just a bland reflection of the full article, but have developed their own argumentative style, rhetorically linked to their communicative function and considerable changes in the social contexts in which academic writing is produced and consumed. Nor are these changes of merely abstract interest to discourse analysts. How texts are written to engage and hook readers is intimately connected to the marketisation of academic discourse and the promotional nature of research, a development we should be critically aware of. How abstracts are now written also contributes to the growing literature on the disciplinary differences of academic writing and how knowledge is differently constructed in different fields. Such understandings, of course, feed into the genre knowledge essential to those whose careers depend on writing, and reading, the papers which influence their fields.

We recognise that the study has clear pedagogical implications for those working in English for Academic Purposes (EAP) and English for Research and Publication Purposes (ERPP) contexts. The need to condense their research into 150 words often presents students and novice writers with a considerable challenge, despite the wealth of literature and reference materials on the topic. The findings presented here offer teachers a way to exploit a 'bottom-up' inductive approach in contrast to the commonly used 'top-down' genre structure models. The focus on these features and the functions they serve can help guide students through a consciousness-raising exploration of abstracts. This teacher-supported, data-driven learning process can both stimulate students' curiosity and encourage them to actively engage with these features of language to become better writers.

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Appendix 1

(1) Third person

their	his	she
it	them	him
its	he	
they	her	

(2) Passives

is, are, was, were (+done)

(3) Negation

barely	nobody	nothing
little	never	seldom
few	no one	rarely
not	neither	hardly
no	none	scarcely
nowhere	nor	